ENGINEERING
TOMORROW

Danfoss
Field Service Guide

INSTALLATION AND OPERATION

Valves | Regulators | Controls | Sensors

www.ir.danfoss.com

Manual Stem Operation	
Valve Type	Turning Direction to Manually Open Valve
EVRA	Clockwise
EVRAT	Clockwise
ICS	Clockwise
ICLX	Counter-Clockwise
ICFO 20 for ICFE 20	Clockwise
ICFE 20H	Clockwise
ICFE 25	Counter-Clockwise
PM	Clockwise
PML	Clockwise
PMLX	Clockwise
GPLX	Counter-Clockwise

Equivalent mm	
mm	**inches**
5	3/16"
10	3/8"
15	1/2"
20	3/4"
25	1"
32	1¼"
40	1½"
50	2"
65	2½"
80	3"
100	4"
125	5"
150	6"
200	8"
250	10"
300	12"

Smartphone apps that make your job easier.

Industrial Refrigeration 2
(Spare Parts App)

Refrigerant Slider

Available on iOs and Android

Magnetic Tool
(Coil Tester)

Available on iOs

Contacts:

Technical Support
1-888-DANFOSS (1-888-326-3677)
Press 1 for Cooling; 2 for Technical Support,
3 for IR Technical support
Cooling.TS.IR.NA@Danfoss.com

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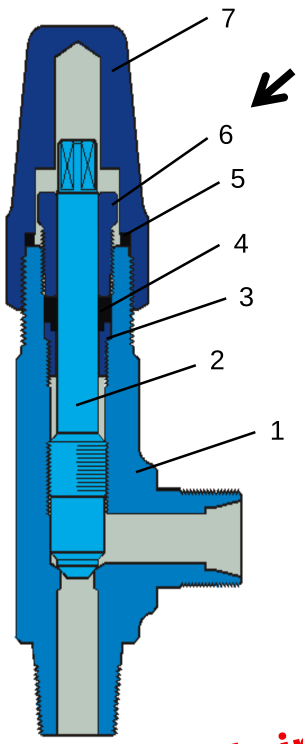
ENGINEERING
TOMORROW

Gauge/Purge/Needle Valves
Type SNV-ST

Gauge, Purge and Needle Valves Type SNV-ST



Packing nut (#6) can be tightened if there is leakage at stem but do not tighten over 14.8 ft-lb (20 Nm)

No ductile iron used!

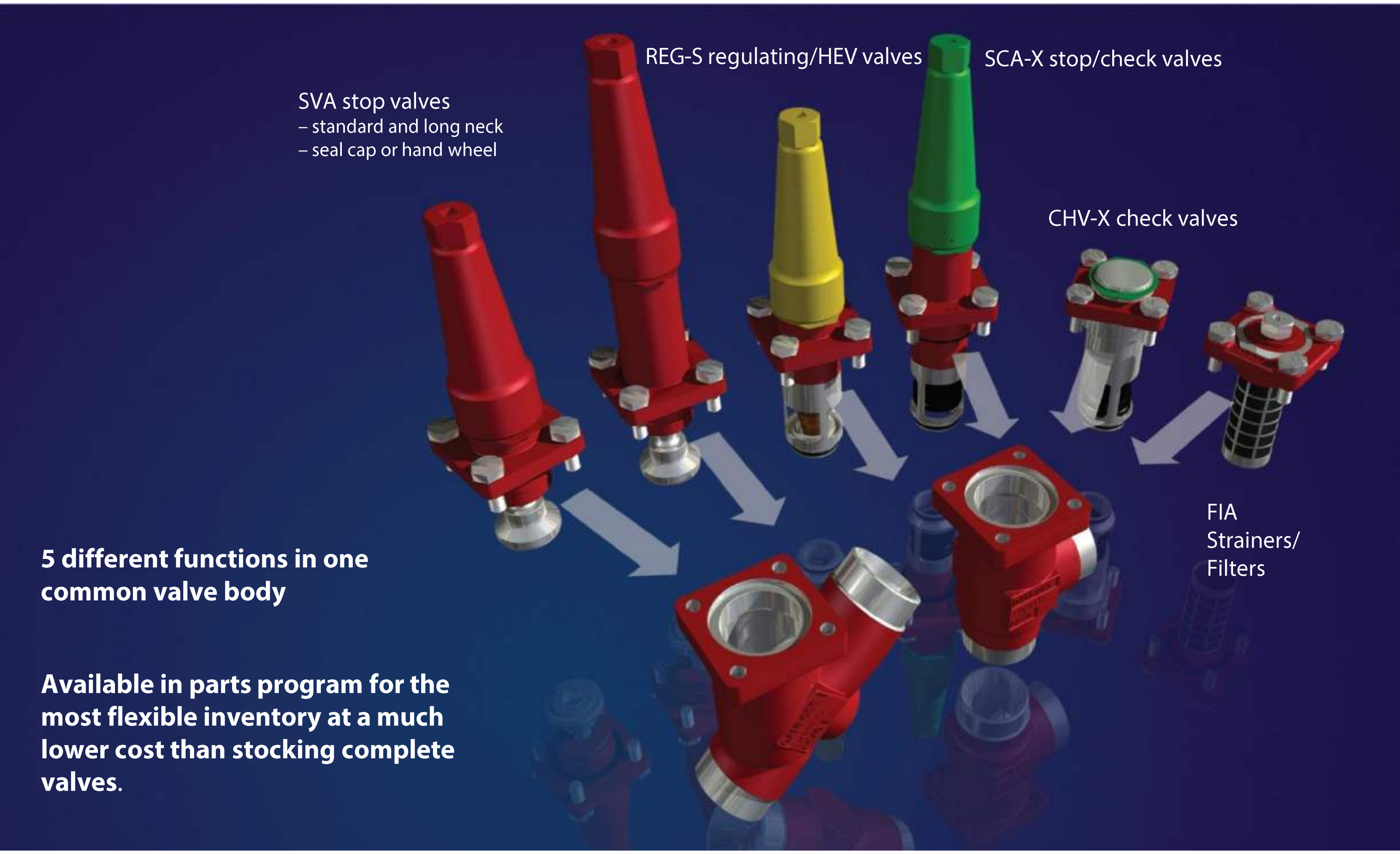
- Designed as service valves and as needle valves with metal to metal seating.
- Have non-removable stems, so they will not back out if over-turned
- No special flow direction required
- 754 psig max. operating pressure

No.	Part	Material
1	Housing	Steel
2	Spindle	Stainless steel
3	Locking ring	Steel
4	Sealing ring	Teflon
5	Seal cap gasket	Nylon
6	Gland nut	Steel
7	Seal cap	Steel

Common connection sizes and types:

Connection size and type		Type	Part No.
Bottom	Side		
1/4" MPT	1/4" FPT	SNV-ST 1/4" FPT - 1/4" MPT	148B3746
3/8" MPT	3/8" FPT	SNV-ST 3/8" FPT - 3/8" MPT	148B3747
1/2" MPT	3/8" FPT	SNV-ST 3/8" FPT - 1/2" MPT	148B4565
1/2" MPT	1/2" MPT	SNV-ST 1/2" MPT - 1/2" MPT	148B4564
1/4" FPT	1/4" FPT	SNV-ST 1/4" FPT - 1/4" FPT	148B4568
3/8" FPT	3/8" FPT	SNV-ST 3/8" FPT - 3/8" FPT	148B4572
1/4" MPT	1/4" FPT	SNV-ST LONG NECK (3.95")	148B4567
1/4" MPT	1/4" Flare	SNV-ST 1/4" Flare - 1/4" MPT	148B4566

SVL Flexline™ Platform



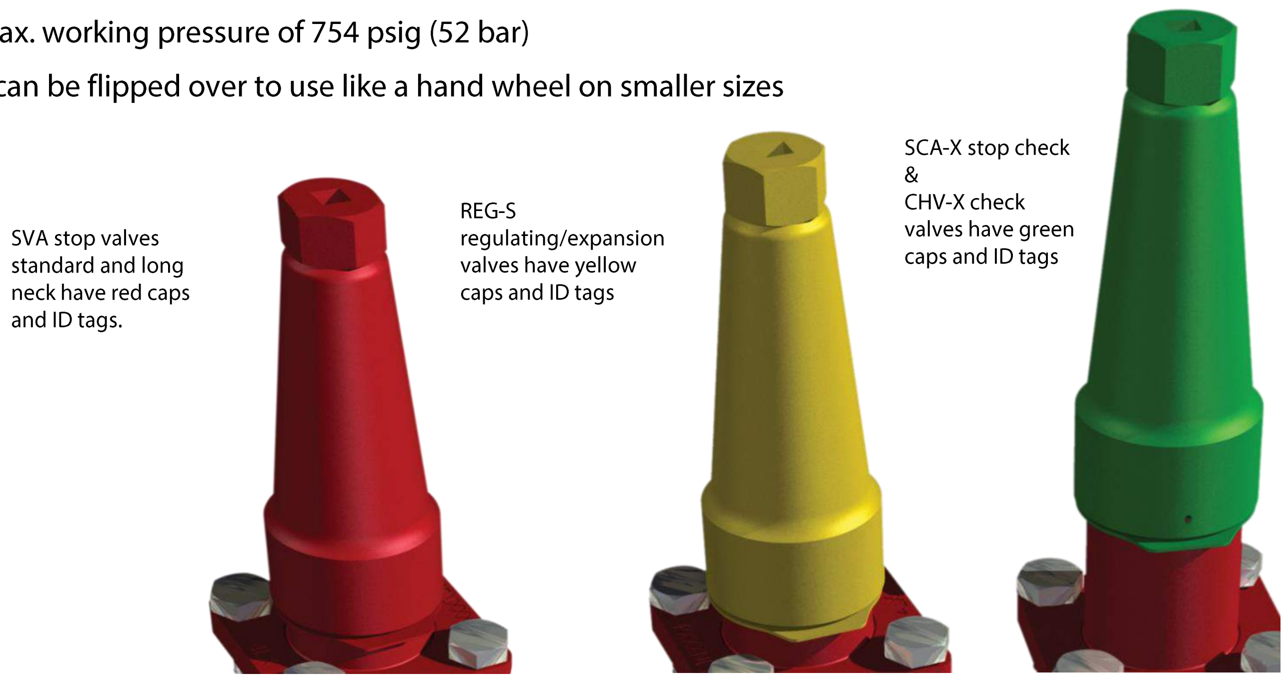
5 different functions in one common valve body

Available in parts program for the most flexible inventory at a much lower cost than stocking complete valves.

Stainless Steel SVL SS Flexline™ Valves

SVL Flexline™ Features

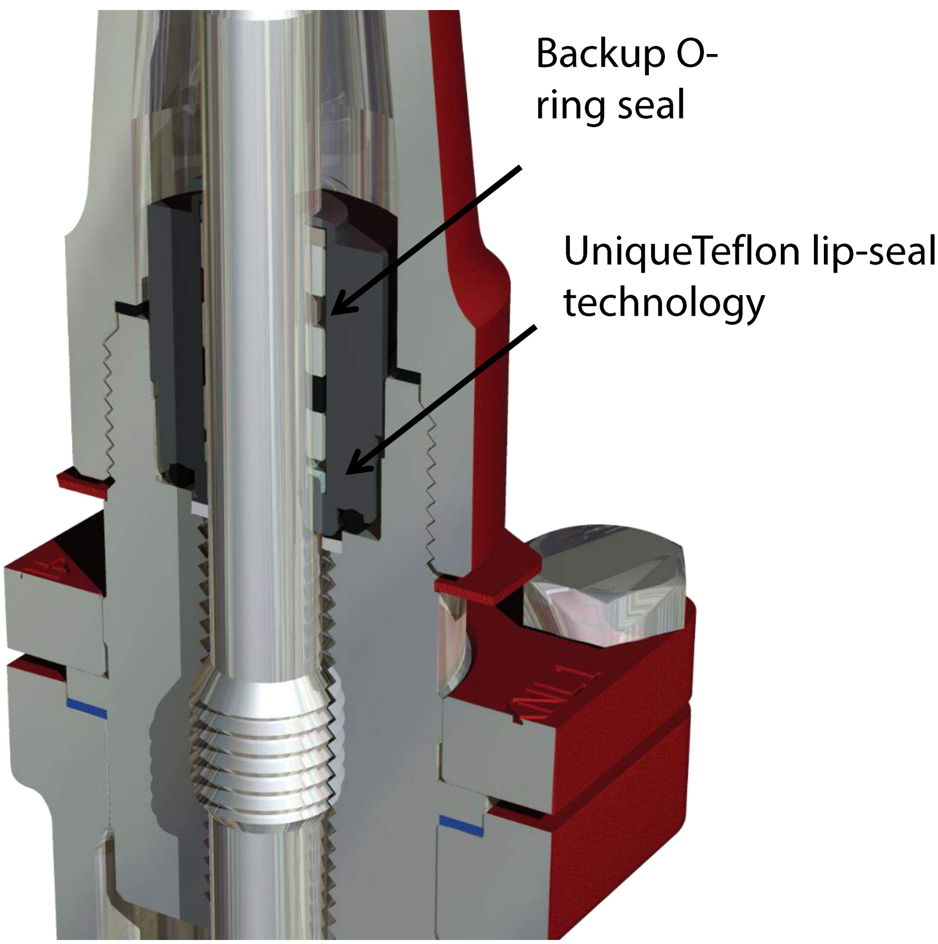
- Colored seal caps and ID tags for easy identification of valve function.
- Standard with stainless steel trim for easier and safer maintenance in the future
- Designed with low temperature steel for a compact yet extremely strong valve
    - Lighter weight compared to other valves on the market making them easier to install and lowers your freight costs
    - Large temperature range: –76 °F to 302 °F (–60 °C to 150 °C)
    - High max. working pressure of 754 psig (52 bar)
- Seal caps can be flipped over to use like a hand wheel on smaller sizes



Upgraded Packing Gland

- The new packing gland is designed to give a tight seal throughout the operating conditions covering all approved refrigerants.
- Designed for **safe operation**. The valve can be opened/closed without the need of a wrench to loosen the packing nut
- Packing gland can easily be changed out by back-seating valve.
- Standard for the whole SVL Flexline™ platform and easily replaces old SVA packing designs

Note: New packing gland can be used in old SVA valves



Stop Valve Sizes ½ to 8 in.

SVA-S:
The **S** stands for **S**tandard bonnet length

(sizes 2" to 8" are standard with longer bonnet)

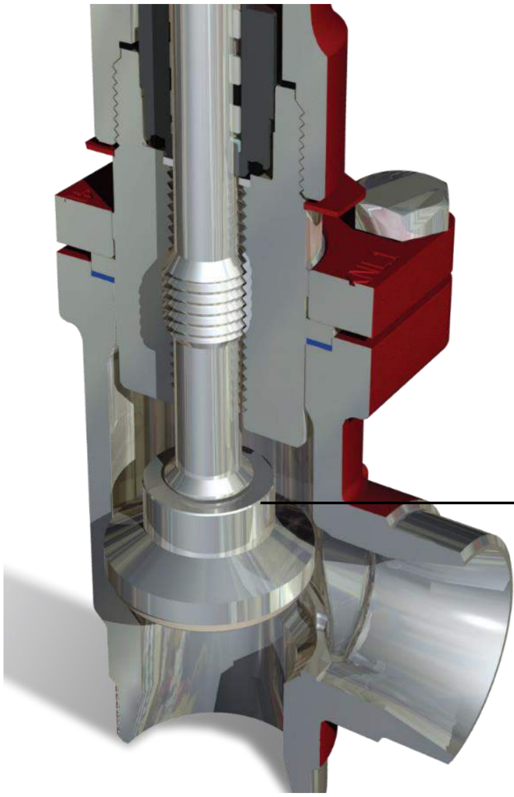
SVA-L:
The **L** stands for **L**onger bonnet length

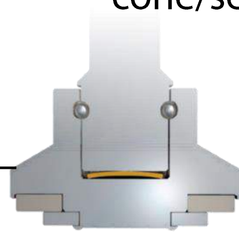
(insulation friendly)

Size		SVA-S	SVA-L
Inches	(mm)		
1/2"	(15)	X	X
3/4"	(20)	X	X
1"	(25)	X	X
1¼"	(32)	X	X
1½"	(40)	X	X
2"	(50)	X	
2½"	(65)	X	
3"	(80)	X	
4"	(100)	X	
5"	(125)	X	
6"	(150)	X	
8"	(200)	X	

Stop Valves are available in both Seal Cap and Hand Wheel.

SVA Stop Valve Features





Anti-spin cone/seat

A “securing function” has been added in order to effectively limit the cone spin during system vibration, thereby avoiding fatigue wear on the cone/seat assembly.

- Packing Glands can be changed out by back-seating valve
- Cone/seat can be replaced if bonnet is removed

Stop Valves Sizes 10 – 12 in.

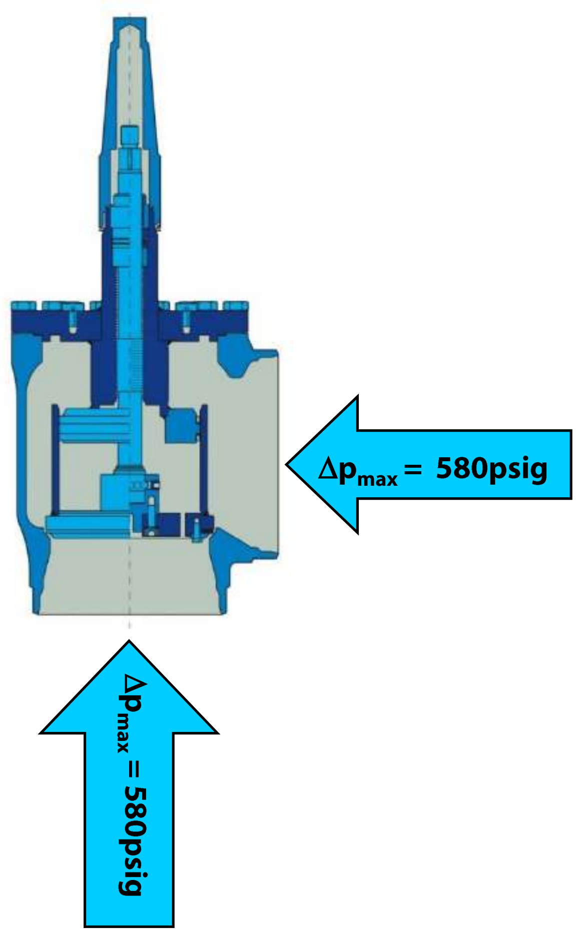
SVA-DH 250 – 300

SVA-DH has a balanced design so it is able to open with high differential pressures with limited torque

No bypass valve needed
for pre-opening equalization!

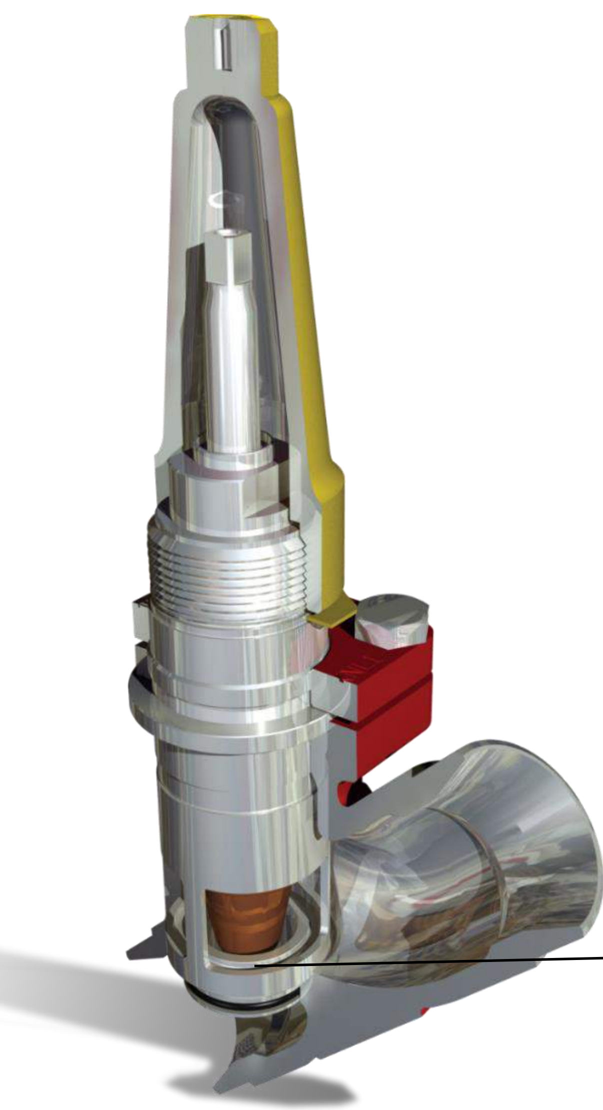
Max. working Δp is same as the max. working pressure of the valve which is 580 psig

Available in Angle configuration only.



REG-S regulating valves

REG-SA – A cone
REG-SB – B cone



Insert design for

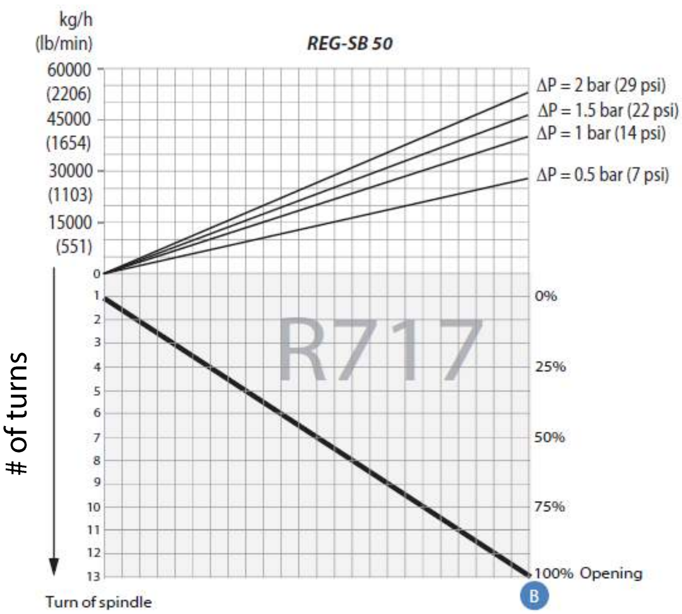
(sizes 1-1/2" and down)

Allows installation in the standard SVL Flexline™ housing.

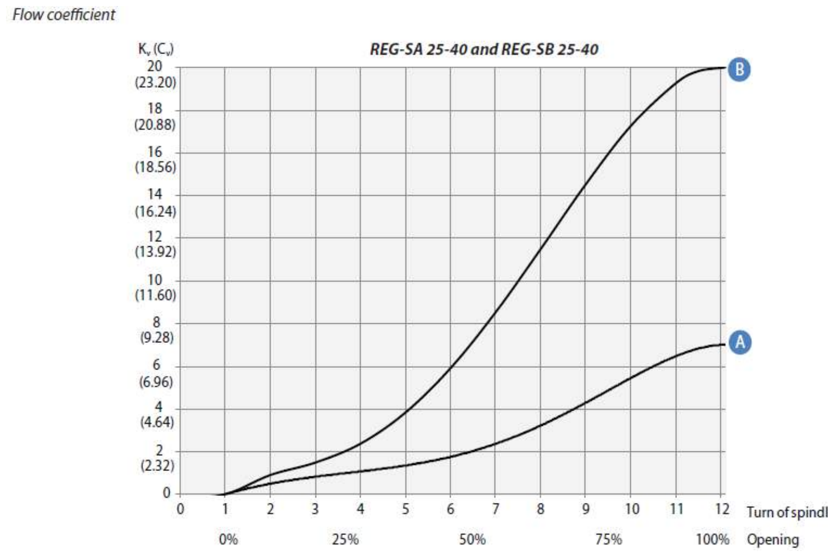
This cage must be screwed on tight to prevent damage when bonnet is installed in valve housing.

Number of Turns Setting Using Literature

Setting the hand expansion valve using flow rate

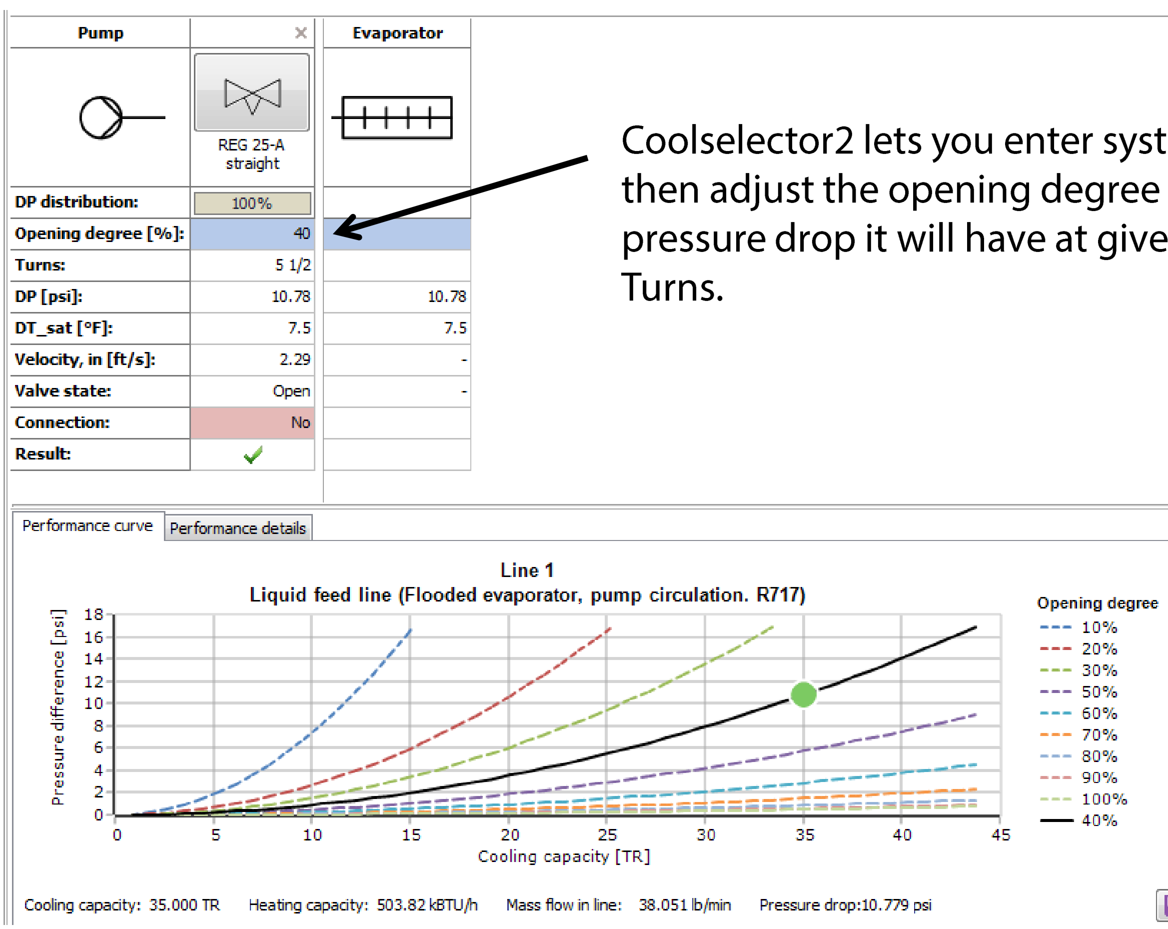


Setting the hand expansion valve using Cv value



Get your number of turns here..

Number of Turns Setting Using Coolselector®2



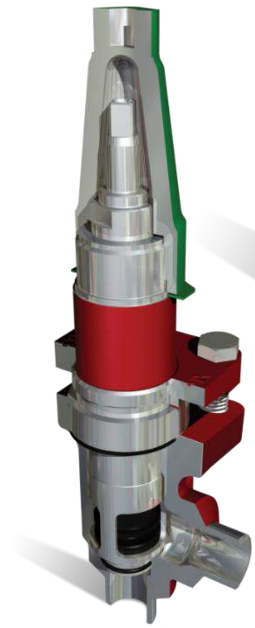
Coolselector2 lets you enter system conditions, then adjust the opening degree to see what pressure drop it will have at given number of Turns.

SCA-X Stop/Check valve
CHV-X & NRVA Check Valves

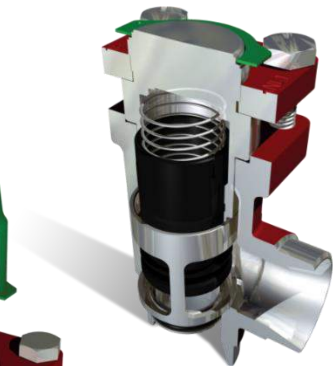
CHV-X Check & SCA-X Stop/Check Valves

- Available with ½″ to 5″ connections
- Angle and globe configuration
- Open with a low differential pressure of 0.58 psi
- 754 psig pressure rating for CO_2
- Non-chattering design with built-in damping chamber gives optimal protection during low loads and pulsations
- Uses same body as stop valves

SCA-X



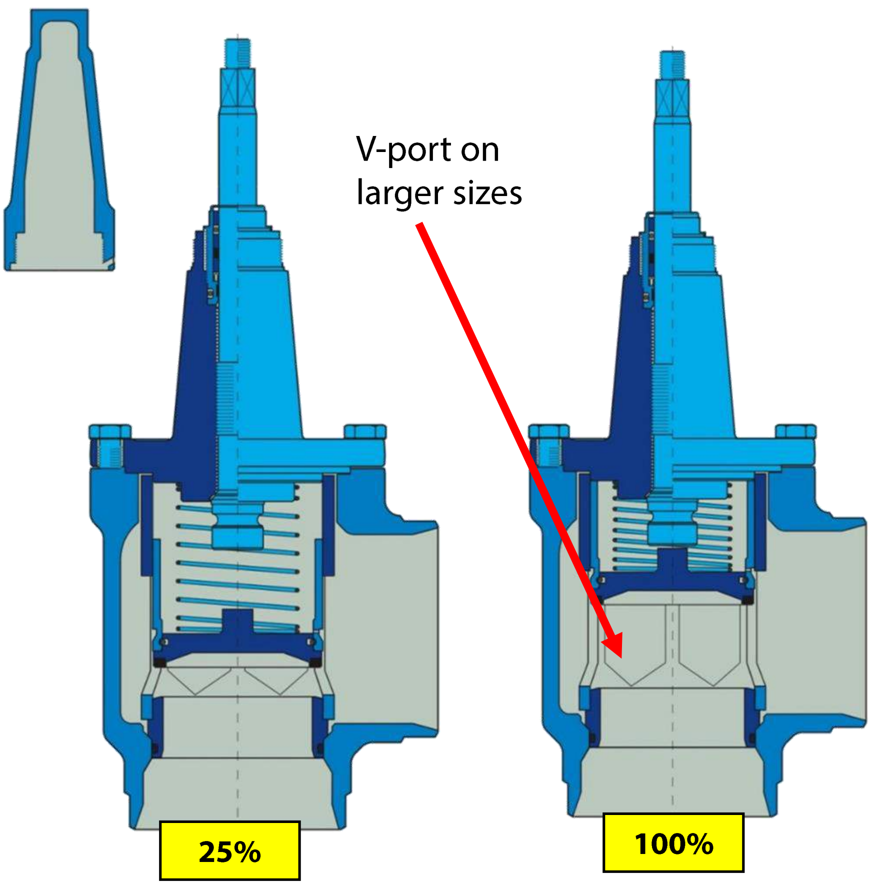
CHV-X

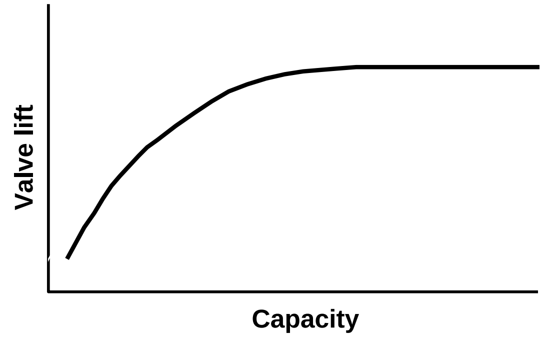


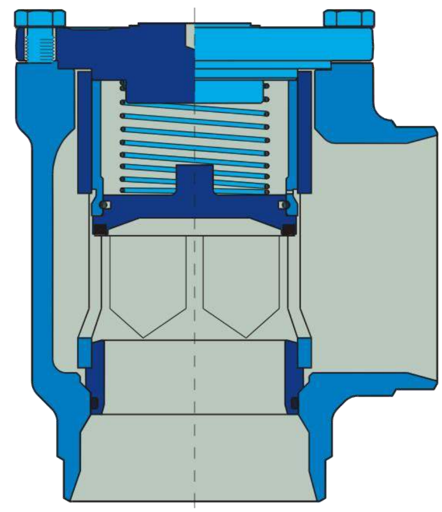
SCA-X Stop/Check Valves

- SCA-X valves can be backseated to change the packing gland while the system is under pressure
- Standard with extended bonnet for insulating
- Stainless steel bolts
- Vented seal cap for extra protection

CHV-X and SCA-X Cross-Sections







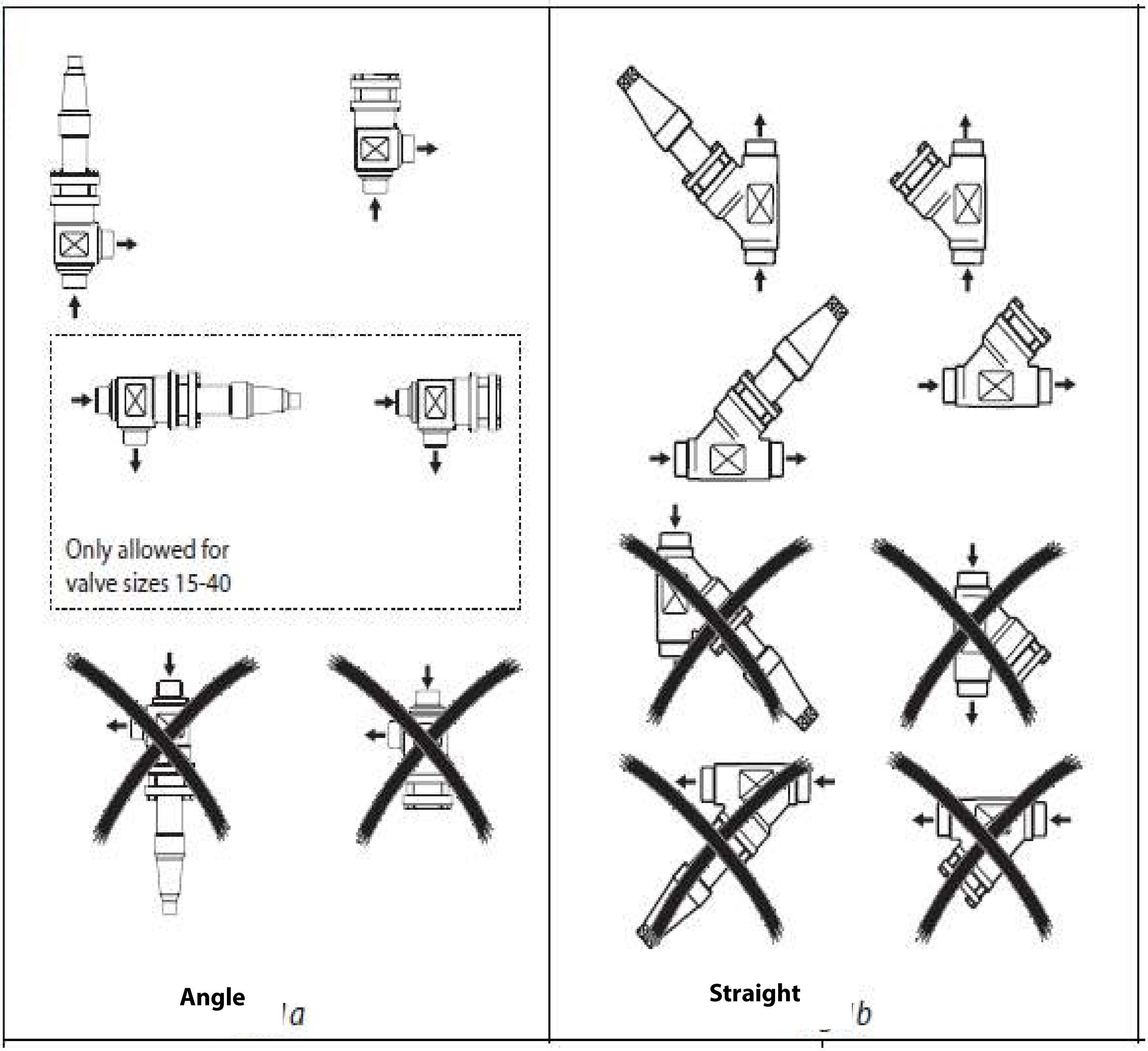
Technical Information – CHV-X & SCA-X

- Always size the valves according to the required capacity and not the line size
- A stronger springs (4.35 psi) are available for use where cold, thick oil or impurities are present.
- Come with RED primer and GREEN ID tags and GREEN seal cap on SCA-X.
- Old version of CHV and SCA valves came from the factory painted with a yellow primer. These valves used a special body on sizes 1-1/2" (size 40) and down so a new CHV-X/SCA-X bonnet will not fit.

ID ring located on the bonnet below the seal cap on SCA-X or on cover of CHV-X

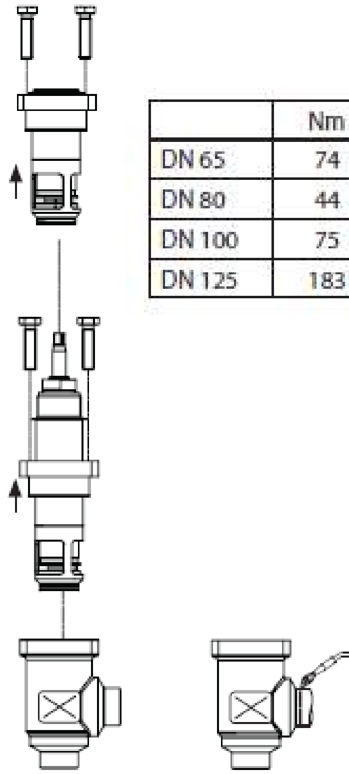
Installation of CHV-X & SCA-X

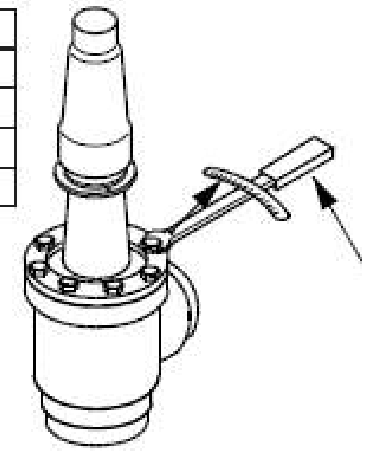
Mounting restrictions



Installation of CHV-X & SCA-X

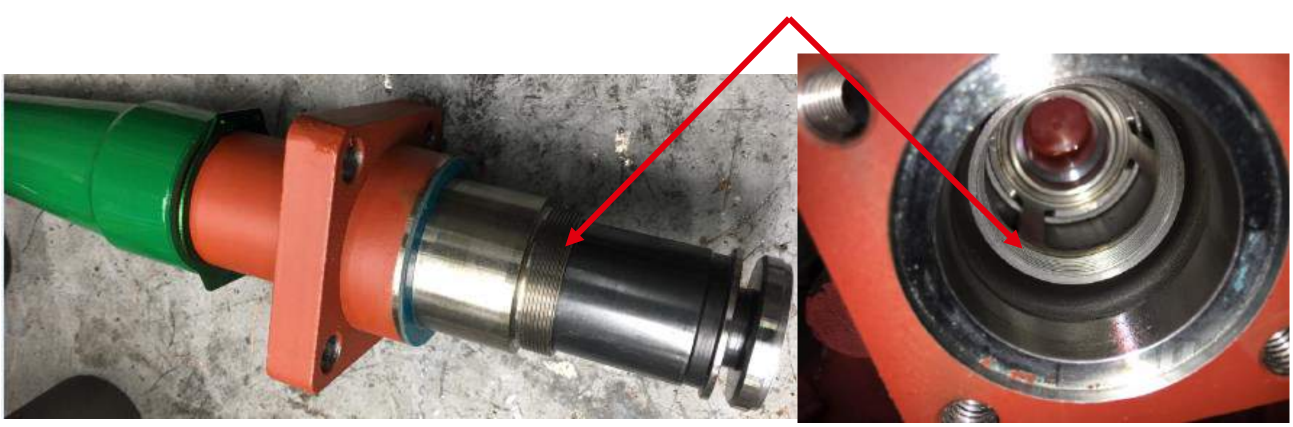
Valve bonnet needs removed to weld body into system.





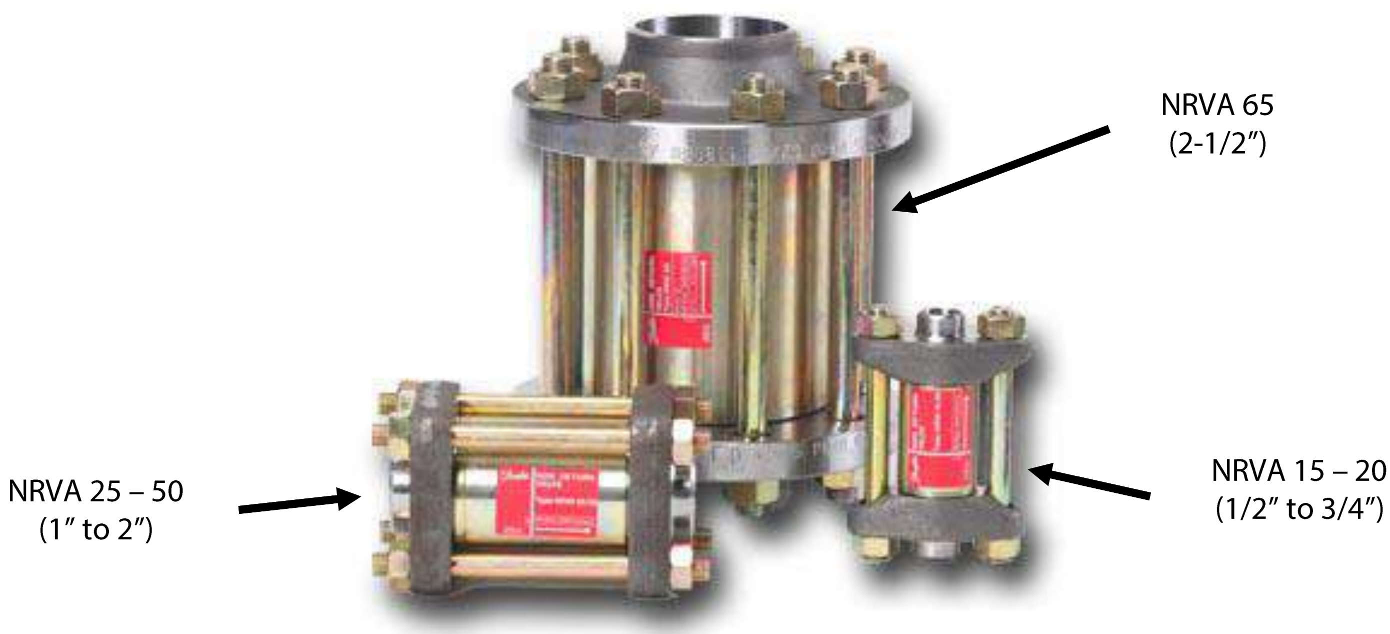
	Nm	Lb-feet
DN 65	74	54
DN 80	44	32
DN 100	75	53
DN 125	183	135

Warning: The valve seat cage/insert on the smaller SCA-X and also REG-S are screwed on the bonnet at the threads shown below. After the bonnet bolts are removed the bonnet should be pried straight out. The bonnet is only held in by the O-ring at the end of the valve seat cage/insert. If the bonnet is turned and removed by turning the bonnet out of the cage the cage will remain in the valve housing. This must be removed from valve housing and installed fully on bonnet prior to being put back together. If not threaded completely on when bonnet is installed it will damage the valve seat cage/insert.

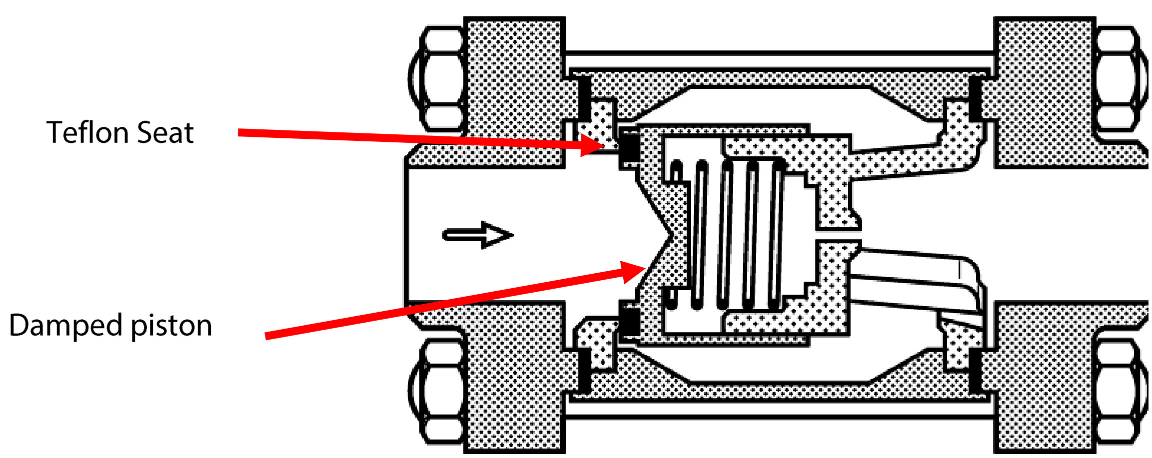


NRVA Flanged Check Valves

NRVA check valves are damped check valves for use in liquid lines, suction lines and discharge lines. They are available from 1/2" to 2-1/2".



NRVA Cut-Away



Technical Data - NRVA

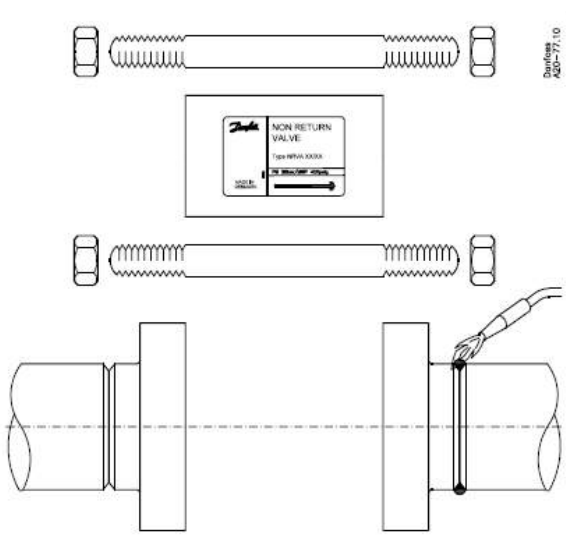
- Always size the valves according to the required capacity and not the line size
- NRVA check valves can be mounted in vertical or horizontal lines
- NRVA 15-20 (1/2”- 3/4”) bolts & nuts are ZnCr plated. NRVA 25-65 (1”- 2-1/2”) bolts and nuts are stainless steel.
- A stronger spring is available for all sizes of NRVA for use where cold, thick oil or impurities are present

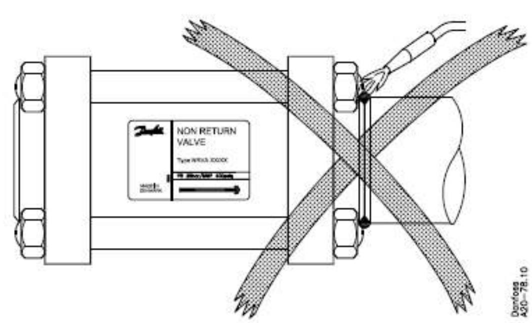
NRVA size	Min. Delta Pressure [PSI] *	
	Weak Spring	Strong Spring
NRVA 15-32 (1/2" to 1-1/4)	1.7	4.4
NRVA 40-65 (1-1/2" to 2-1/2)	1	5.8

* minimum pressure differential at which the valve is completely open.

Installation of NRVA

- Valve should be installed with the direction of flow as indicated by the arrow on the valve body.
- Flanges should be welded into the system while removed from the NRVA valve.





Strainers
Type FIA 15 to 300 *(1/2″ to 12″)*

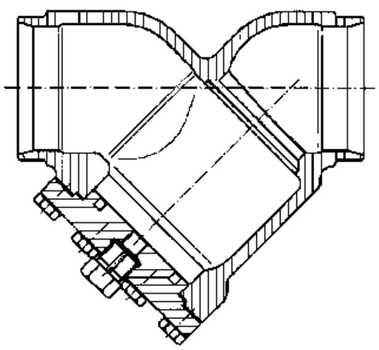
Strainers Type FIA Size 15-300 *(1/2" to 12")*

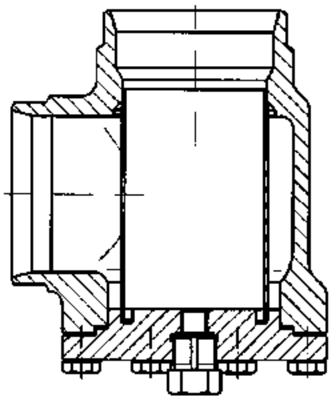
Features:

- -76 to +302 degF
- 754 PSIG rated
- Angle or Globe
- Stainless steel bolts

Purge valve connection in cover:

- Sizes 15 to 40 (1/2" to 1-1/2") is standard with ¼" NPT treaded connection in the Top Cover
- Sizes 50 to 300 (2" to 12") is standard with a G 1/2 treaded connection in the Top Cover. If ordering a complete FIA with element a ¼" NPT adapter will be included in the box just in case a purge valve needs mounted.

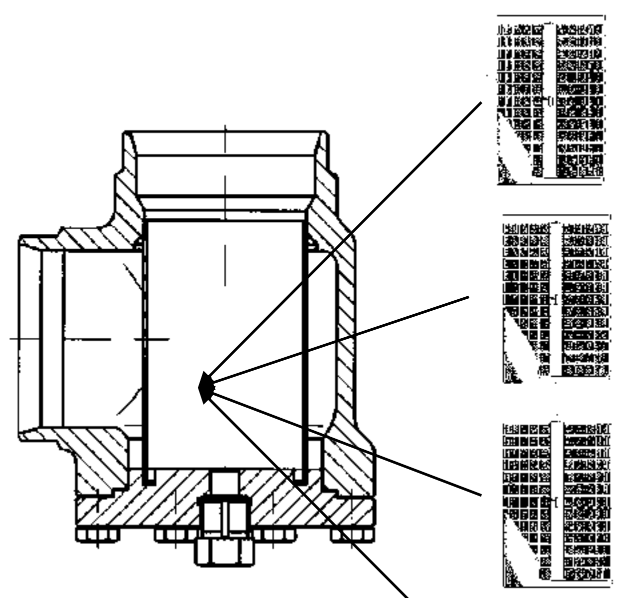




Adapter

Note: cover should be mounted in the downward position so dirt/debris can collect at bottom of strainer and easily be removed.

Danfoss recommends cleaning or replacement of the strainer insert when the **Δp** across valve is 7 psi or greater in the liquid line or 0.7 psi in a suction line. The max. permissible **Δp** is 15 psi.



100µ (150 mesh)

(size 15-50 only and recommended for use before pulse expansion valves type AKVA)

150µ (100 mesh)

Best protection for valves

250µ (72 mesh)

Protecting valves in suction lines where less pressure drop is required.

500µ (38 mesh)

Not for protecting valves and is used for other equipment like ahead of pumps etc.

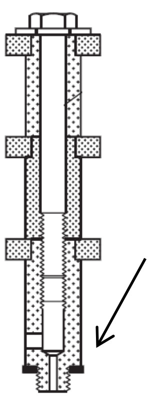
The micron size is stamped on the strainer insert.

FIA Strainer Accessories

Note: Start-up bag includes metal frame as shown and a standard insert will replace this after the start-up.

Filter Bags (50 µ) for Plant Start-up

FIA strainer Size		Part No.
Inches	(mm)	
2”	(50)	148H3150
2-1/2”	(65)	148H3151
3”	(80)	148H3152
4”	(100)	148H3153
5”	(125)	148H3154
6”	(150)	148H3155
8”	(200)	148H3156

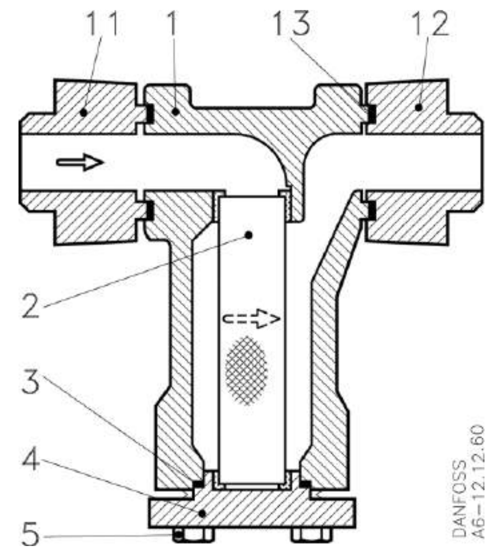


Screws into the inside of the FIA cover

Magnetic Inserts to remove metal

FIA strainer Size		Part No.
Inches	(mm)	
2-1/2” to 4”	(65 to 100)	148H3447
5” to 8”	(125 to 200)	148H3448

Close-Coupled Strainers Type
FA 15 and 20 (1/2" and 3/4")



- Stainless steel weave, mesh size 150µ (100 mesh)
- 406 psig Max. Working pressure

See EVRAT solenoid section for info on how to ID the FA strainer size

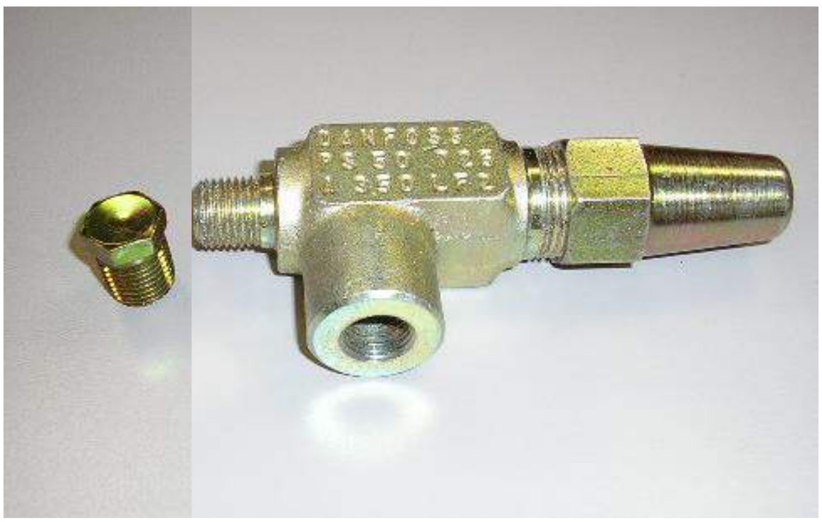
Close-Couple Strainers Type - FA 15 and 20

Strainer Size	Nom. Port Size	Will Directly Fit with Solenoid Valves Type/Size	Part No.
FA 15	1/2"	EVRA 3	006-0043
FA 15	1/2"	EVRA 10, EVRAT 10, EVRA 15, EVRAT 15	006-1012
FA 20	3/4"	EVRA 20, EVRAT 20, PM 5, PM 10, PM 15, PM 20	006-1013

FA Strainer Accessories

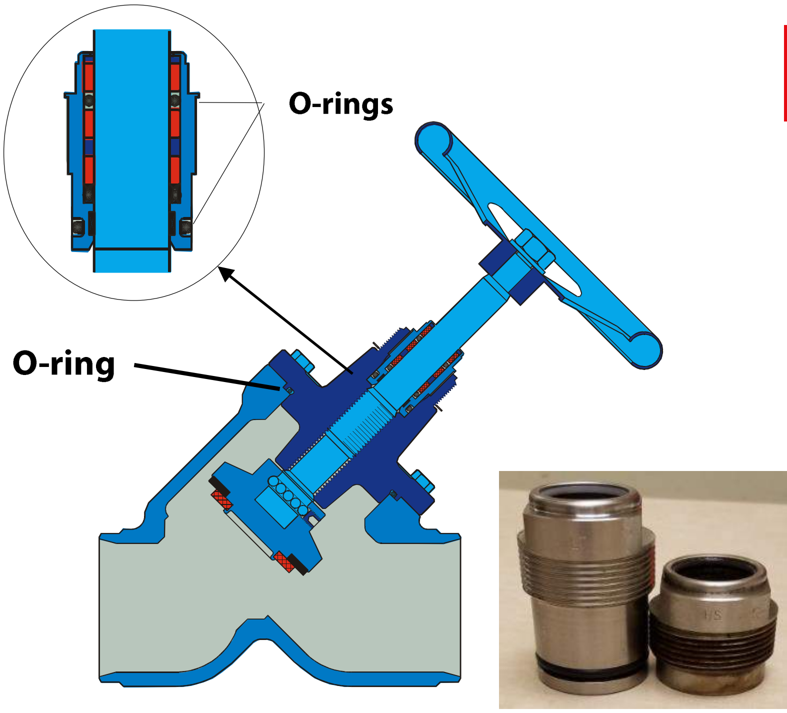
Purge valve drain kits

Purge Valve Kit	Description	Part No.
For use with FA 15 (1/2”)	Includes 1/4" gauge valve type SNV, FA cover with 1/4" NPT connection and plug	027X0151
For use with FA 20 (3/4”)	Includes 1/4" gauge valve type SNV, FA cover with 1/4" NPT connection and plug	027X0152



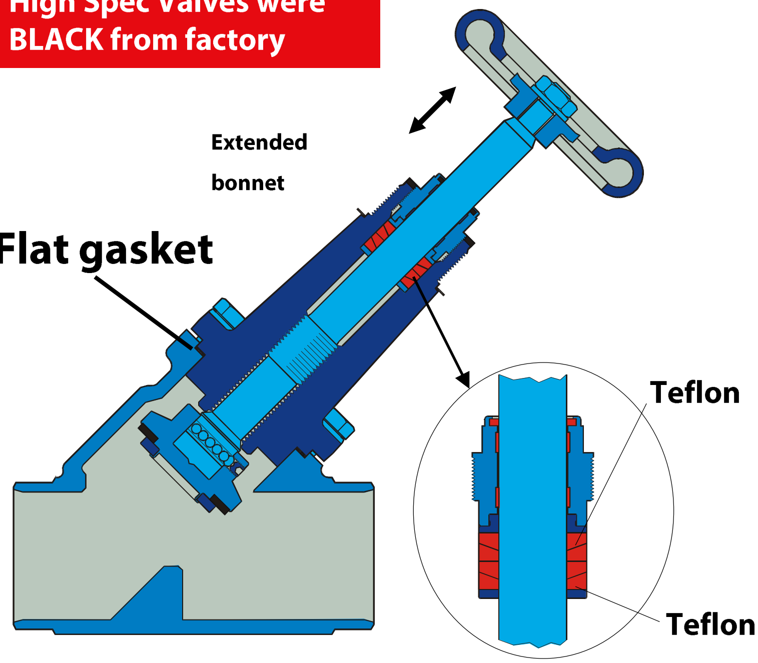
Previous Versions of SVA Stop Valves

SVA-ST (Standard)



SVA-HS (High Spec)

High Spec Valves were BLACK from factory



Note: Spare part kits for new SVA will work for old SVA

Backward Compatibility

Most of the SVL Flexline™ bonnets (top parts) are backward compatible with housings of the existing line components. The below table illustrates the compatibility.

Backwards compatible
Not backwards compatible

New SVL Flexline™	Size	Stop valves SVA-S/L	Stop Check valves SCA-X	Check valves CHV-X	Regulating valves REG-SA/SB	Filters FIA
Backwards compatibility	DN 6					
	DN 10					
	DN 15-20					
	DN 25-40					
	DN 50					
	DN 65					
	DN 80					
	DN 100					
	DN 125					
	DN 150					
	DN 200					
Existing SVA range		Stop valves SVA-ST/HS	Stop Check valves SCA	Check valves CHV	Regulating valves REG	Filters FIA

Note: There was a prior SVA version before SVA-ST manufactured prior to Jan. 2003 and the current SVA-S/L bonnets will not fit for these old valves for sizes 40 (1-1/2") and down but the repair kits will work on these.

Examples:

Compatible: Existing SVA-ST size 80:
Can be later exchanged into a SVA-S or SVA-L size 80 just by replacing the top part.
It will fit in the existing SVA-ST housing.

Non-compatible: Existing CHV size 15:
Can only be exchanged into a CHV-X size 15 by replacing the complete valve.
The top part will not fit into the existing CHV housing.

Spare Part Kits

Simple selection based on 3 types of kits:

- Inspection kits – Includes all gaskets and O-rings belonging to indicated valve types and size for both old and new versions
- Repair kits – Includes same parts as inspection kit and also includes a packing gland. Would not be relevant for FIA strainers or CHV/CHV-X check valves
- Overhaul kits – Includes same parts as Repair kit and parts that could be damaged or worn out for the indicated valve types and size

Note: complete valve bonnets are available up to 5" by ordering from the SVL parts program

Inspection Kits

Valve type	Size	Part No.
SVA-S/L/ST/LT - REG/SA/SB	6-10 (3/8")	148B6050
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X - FIA - CHV/X	15-20 (1/2" to 3/4")	148B6051
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X - FIA - CHV/X	25-40 (1" to 1-1/2")	148B6052
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X - FIA - CHV/X	50 (2")	148B6053
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X - FIA - CHV/X	65 (2-1/2")	148B6054
SVA-S/L/ST/LT/HS - SCA/X - FIA - CHV/X	80 (3")	148B6055
SVA-S/L/ST/LT/HS - SCA/X - FIA - CHV/X	100 (4")	148B6056
SVA-S/L/ST/LT/HS - SCA/X - FIA - CHV/X	125 (5")	148B6057
SVA-S/L/ST/LT/HS - FIA	150 (6")	148B6058
SVA-S/L/ST/LT/HS - FIA	200 (8")	148B6059

Repair Kits

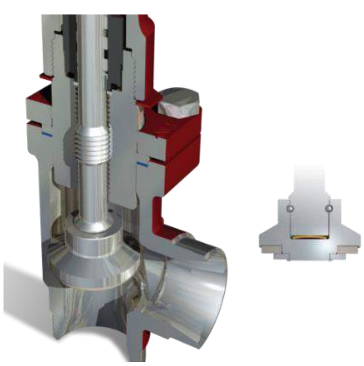
Valve type	Size	Part No.
SVA-S/L/ST/LT - REG/SA/SB	6-10 (3/8")	148B6060
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X	15-20 (1/2" to 3/4")	148B6061
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X	25-40 (1" to 1-1/2")	148B6062
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X	50 (2")	148B6063
SVA-S/L/ST/LT/HS - REG/SA/SB - SCA/X	65 (2-1/2")	148B6064
SVA-S/L/ST/LT/HS - SCA/X	80 (3")	148B6065
SVA-S/L/ST/LT/HS - SCA/X	100 (4")	148B6066
SVA-S/L/ST/LT/HS - SCA/X	125 (5")	148B6067
SVA-S/L/ST/LT/HS	150 (6")	148B6068
SVA-S/L/ST/LT/HS	200 (8")	148B6473

Repair kit is not relevant for the CHV and FIA due to the fact that there is no packing gland on these valves.

Please note! the packing gland in the repair kits is the same as used in the new SVL Flexline TM and are compatible and replaceable for the old SVA-HS, SVA-ST, SCA, REG.
However, when replacing the packing gland in SVA-ST, SVA-S/L, SVA-HS, REG-SA/B, REG, SCA-X and SCA the aluminum gasket is needed.

SVA Overhaul Kits

Valve type	Size	Part No.
SVA-S/L/ST/LT	6-10 (3/8")	148B6150
SVA-S/L/ST/LT/HS	15-20 (1/2" to 3/4")	148B6151
SVA-S/L/ST/LT/HS	25-40 (1" to 1-1/2")	148B6152
SVA-S/L/ST/LT/HS	50 (2")	148B6153
SVA-S/L/ST/LT/HS	65 (2-1/2")	148B6154
SVA-S/L/ST/LT/HS	80 (3")	148B6155
SVA-S/L/ST/LT/HS	100 (4")	148B6156
SVA-S/L/ST/LT/HS	125 (5")	148B6157
SVA-S/L/ST/LT/HS	150 (6")	148B6158
SVA-S/L/ST/LT/HS	200 (8")	148B6472

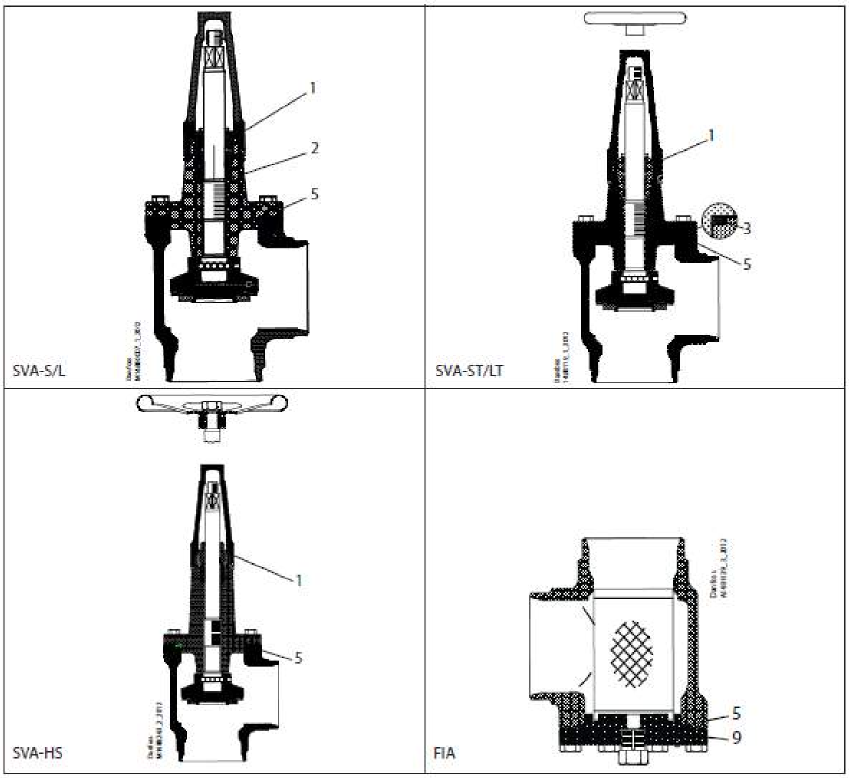


Please note! the disk spring between spindle and cone in the SVL stop and regulating valves is not part of this overhaul kit. In case a customer wants to do service where the spring disk is needed (relevant for the valves located at the discharge or economizer line), a complete bonnet from the part program can be ordered.

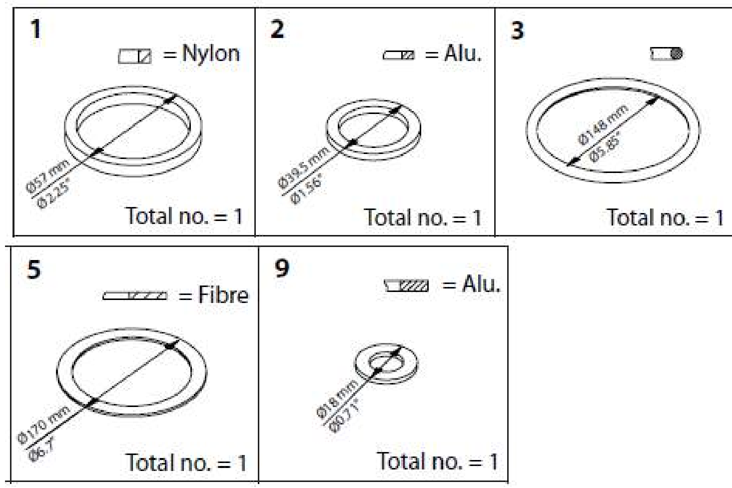
How Do You Identify Which Parts Should Be Used?

SVA-S/L, SVA-ST/LT, SVA-HS, FIA size 150

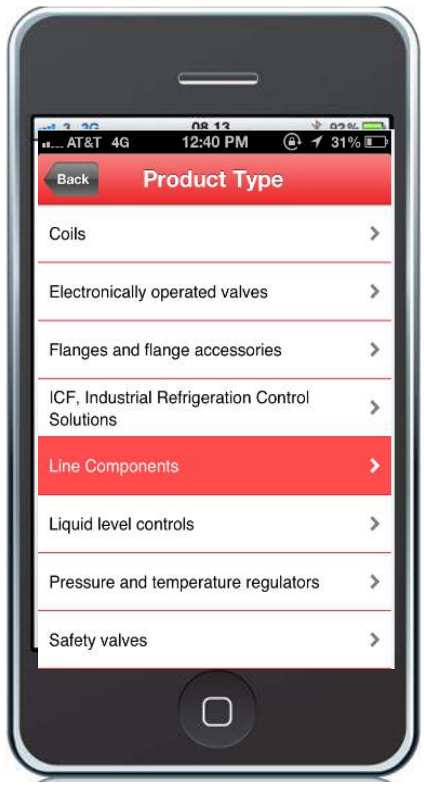
Inspection kit | Code number 148B6058

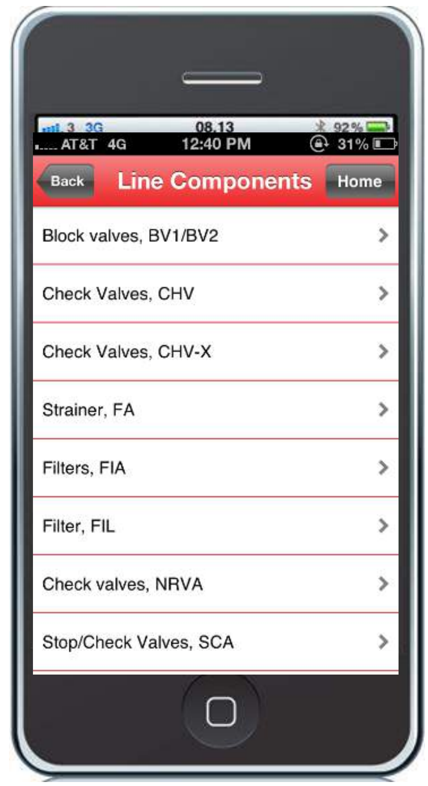


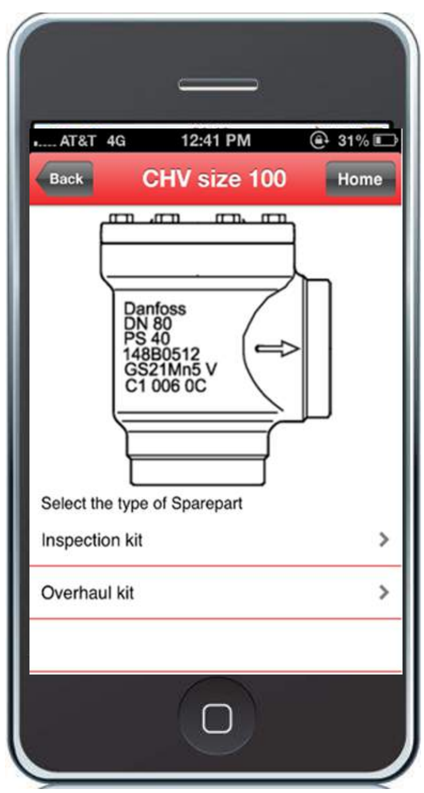
The sealing parts that need to be replaced can be recognized based on the dimensions of the parts shown on the included instruction or viewed from the spare parts App.

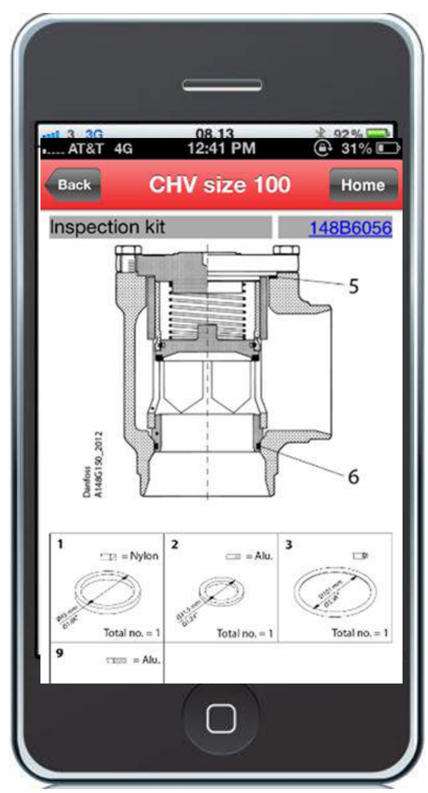


Danfoss IR App for Spare Parts









Danfoss IR App for Spare Parts

Clicking on the **underlined blue kit** number on the previous screen will generate a populated email with the information needed to purchase the component or kit.

Download the app today!

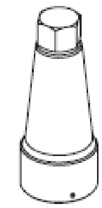
Android

iOS

Accessories

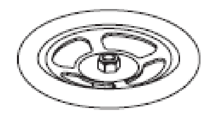
Seal Cap incl. Teflon gasket

- Same for old SVA platform and new SVL line



Handwheel

- Same for old SVA platform and new SVL line

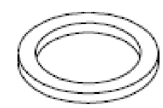


Standard and high pressure springs

- For most sizes of both old and new SCA/CHV and SCA-X/CHV-X

Flat gasket

- I-pack of 10pcs. For all SVL, old SCA/CHV and FIA for given size

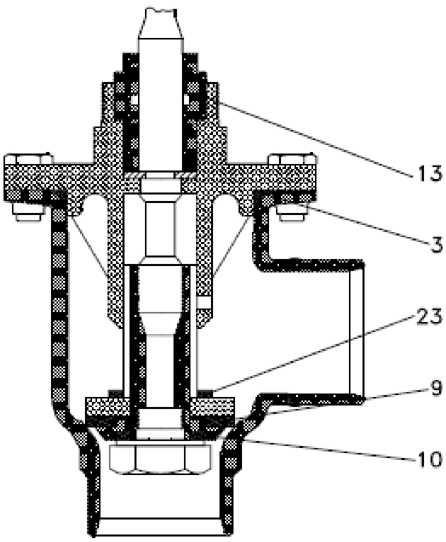


Grease for packing gland

Discontinued Danvalve Stop Valve Type SCV

Valve has a non-rising valve stem meaning the valve stem does NOT go in/out of the valve when the valve is closed/opened.

Note: only limited spare parts are still available



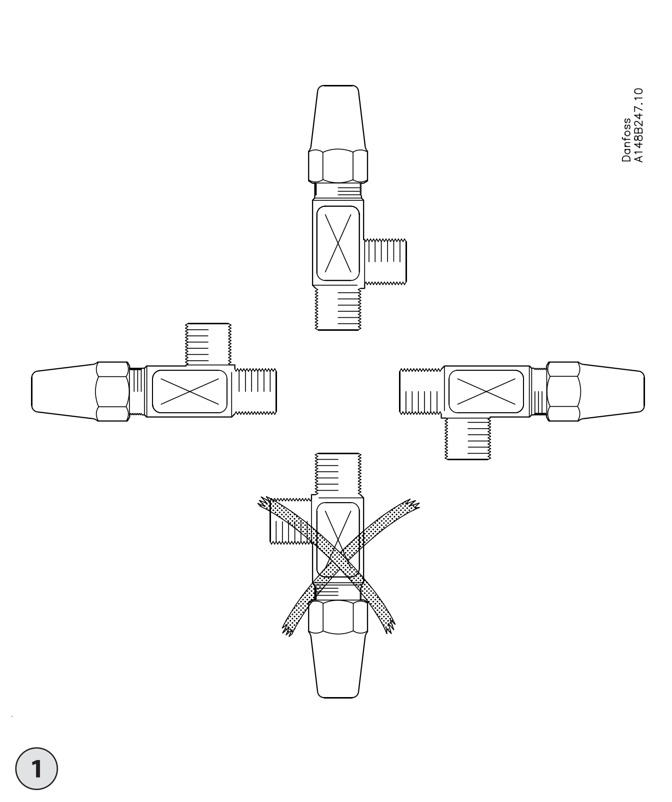
SCV 25 - 200

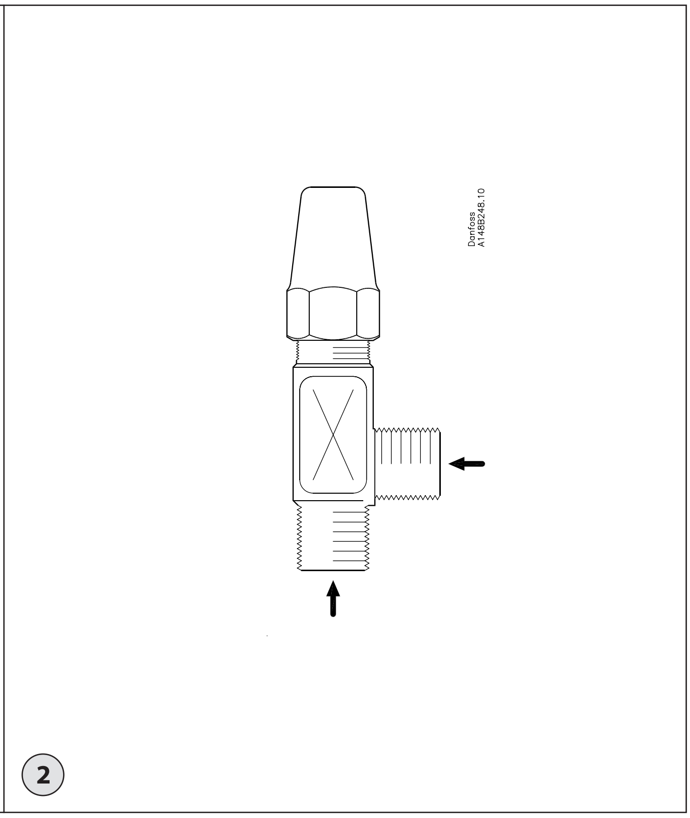
3 O-ring / gasket (only for size 125) for housing / bonnet
9 Gasket for cone
10 Gasket for cone
13 Packing gland incl. gaskets
23 Back sealing

Installation Guide

Gauge valve
Type SNV-ST, SNV-SS

148R9517





148R9517

ENGLISH

Installation

Refrigerants
Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2).
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
SNV: –60/+150°C (–76/+302°F)

Pressure range
SNV: The valves are designed for a max. working pressure of 52 bar g (754 psig).

Installation
The valve must be installed with the spindle vertically upwards or in horizontal position (fig. 1). Valves should be opened by hand according to sound engineering practice only by use of small spanners.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Recommended flow direction
Flow direction as indicated by the arrow (fig. 2). The force used to open and close the valve must not exceed the force of an ordinary handwheel.

The valve housing must be free from stresses (external loads) after installation.

SNV valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a threaded plug.

Identification
Precise identification of the valve is made via the stamping on the valve body.

Surface Treatment
SNV-ST is externally zinc-chromated and SNV-SS is made of stainless steel. The external surface of the valve housing can be further prevented against corrosion with a suitable protective coating.

Maintenance

SNV valves are assembled without the possibility to be disassembled. The spindle can in no way be unscrewed. This will protect the system from tampering.

Packing gland
If the packing gland is found to be leaking, there is a possibility to tighten it by carefully screwing with a wrench. Make sure not to apply very high force (max. 20 Nm)and we recommend turning the packing gland in steps and to check the leaking in between.

In cases of doubt, please contact Danfoss.

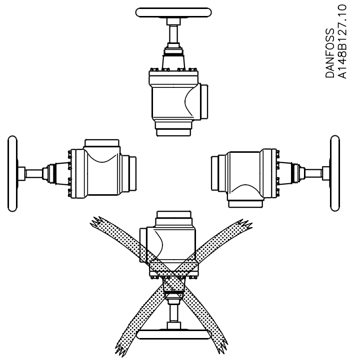
Installation Guide

Shut-off Valves

SVA-S/L 15-200

148R9549

Installation



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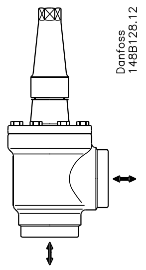

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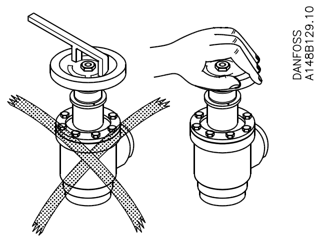

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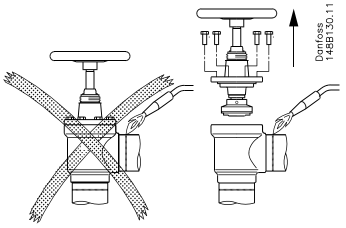

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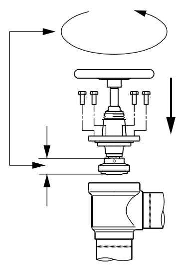
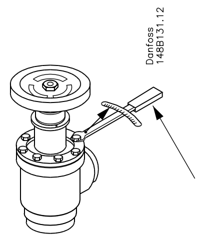


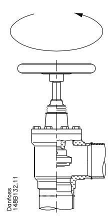
5a



5b

	Max. Nm	Max. LB-feet
DN 15-20	21	15
DN 25-32-40-50	44	32
DN 65	74	54
DN 80	44	32
DN 100	75	53
DN 125-150	183	135
DN 200	370	272

Maintenance



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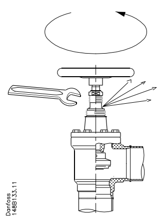

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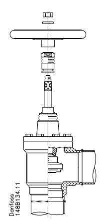

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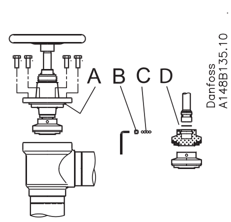
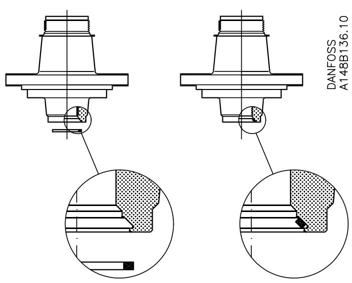


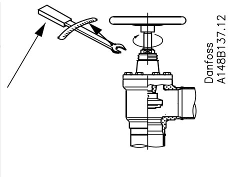
9

Only DN 80-200



10

	Max. Nm	Max. LB-feet
DN 15-20	50	37
DN 25-40	75	55
DN 50-65	95	70
DN 80-100	150	111
DN 125-150	250	184
DN 200	80	59



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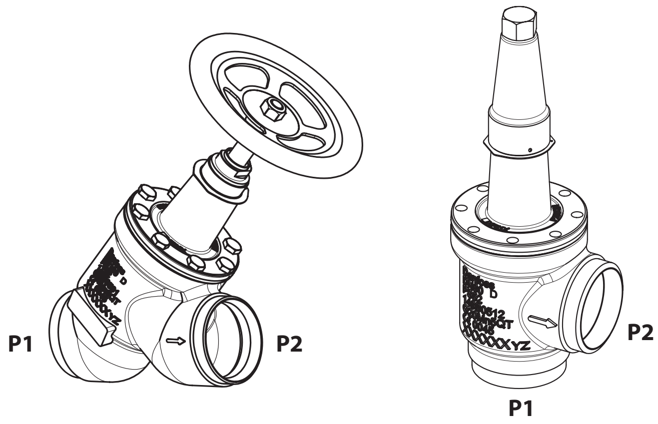


	Flow direction		
	P1 → P2	**P2 → P1**	**P2 → P1**
Valve size [DN]	Closing and opening pressure ΔP max. (P1-P2)	Closing pressure ΔP max. (P2-P1)	Opening pressure ΔP max. (P2-P1)
125	33 bar	52 bar	33 bar
150	21 bar	52 bar	21 bar
200	14 bar	52 bar	14 bar

12

DKRCI.PI.KD1.A7.ML | 520H5935 |

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717 (Ammonia), R744 (CO_2) and all flammable refrigerants.

The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Pressure and temperature range
SVA-S/L (DN 15-200) 52 bar (754 psi) at –60°C to +150°C (–76°F to +302°F),

Installation
The valve must be installed with the spindle vertically upwards or in horizontal position (fig. 1). Valves should be opened by hand without the use of tools or other devices (fig. 3). The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Attention!
SVA are shut-off valves and must always be either fully closed or fully open. Half open positions are not allowed.

Recommended flow direction
To achieve optimum flow conditions, the valve should be installed with the flow towards the valve cone as indicated by the arrow on the side of the valve body (fig. 2). Flow in the opposite direction is also acceptable (fig. 2), but slightly reduces the k_v- / C_v value.

Welding
The bonnet should be removed before welding (fig. 4) to prevent damage to the sealing parts in the packing gland and between the valve body and bonnet, as well as the teflon gasket in the valve seat. Only materials and welding methods, compa-tible with the valve housing material, must be welded to the valve housing. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the threads of the housing and the bonnet.

Removing the bonnet can be omitted provided that:
The temperature in the area between the valve body and bonnet during welding does not exceed +150°C/+302°F. This temperature depends on the welding method as well as on any cooling of the valve body during the welding itself. (Cooling can be ensured by, for example, wrapping a wet cloth around the valve body.) Make sure that no dirt, welding debris etc. get into the valve during the welding procedure.

Be careful not to damage the teflon cone ring.

The valve housing must be free from stresses (external loads) after installation.

Stop valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the cone has been fully screwed back towards the bonnet before it is replaced in the valve body (fig. 5a).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 5b).
Please note that the table (fig. 5b) containing maximum torque must be adhered to and **never exceeded**.

Colours and identification
The SVA valves are painted with a red oxide primer in the factory. Precise identification of the valve is made via the ID ring at the top of the bonnet, as well as by the stamping on the valve body. The external surface of the valve housing must be guarded against corrosion with a suitable protective coating after installation and assembly.

Protection of the ID ring when repainting the valve is recommended.

Maintenance

Packing gland
When performing service and mainte-nance, replace the complete packing gland only, which is available as a spare part. As a general rule, the packing gland must not be removed if there is internal pressure in the valve. However, if the following precautionary measures are taken, the packing gland can be removed with the valve still under pressure:

Backseating (fig. 6)
To backseat the valve, turn the spindle counter-clockwise until the valve is fully open.

Pressure equalization (fig. 7)
In some cases, pressure forms behind the packing gland. Hence a handwheel or similar should be fastened on top of the spindle while the pressure is equal-ized. The pressure can be equalized by slowly screwing out the gland.

Removal of packing gland (fig. 8)
Handwheel and packing gland can now be removed.

Dismantling the valve (fig. 9)
Do not remove the bonnet while the valve is still under pressure.

Check that the flat gasket (pos. A) has not been damaged.

- Check that the spindle is free of scratches and impact marks.
- If the teflon cone ring has been damaged, the whole cone assembly must be replaced.

Replacement of the cone (fig. 9)
Unscrew the cone screw (pos. B) with an Allen key.
SVA-S/L 15-40 .... 2.0 mm A/F
SVA-S/L 50-65 .... 2.5 mm A/F
SVA-S/L 80-100 .... 4 mm A/F
SVA-S/L 125-150 .... 5 mm A/F
SVA-S/L 200 .... 6 mm A/F

(An Allen key is included in the Danfoss Industrial Refrigeration gasket set).
To remove the balls compress the disk spring (pos. D) and remove the balls (pos. C).

Number of balls in pos. C:
SVA-S/L 10-20 .... 10 pcs.
SVA-S/L 25-65 .... 14 pcs.
SVA-S/L 80-200 .... 13 pcs.

The cone can then be removed. Place the new cone on the spindle and remember to place the disk spring (pos. D) between the spindle and the cone. Compress the the disk spring and replace the balls (pos. C). Refit the cone screw in again using Loctite No. 648. to ensure that the screw is properly fastened.

Replacement of backseat seal (fig. 10)
For sizes DN 80-200 only:
The valve backseat is a special teflon ring. If this is damaged, it must be replaced. Screw the spindle out of the bonnet. Carefully remove the original backseat seal and mount a new one in the angled contact surface directly inside the opening in the bonnet. Avoid folding and damage to the teflon ring, or damage to the contact surface at the top of the valve during assembly.

Assembly
Remove any dirt from the body before the valve is assembled. Check that the cone has been screwed back towards the bonnet before it is replaced in the valve body (fig. 5a).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 5b). Please note that the table (fig. 5b) containing maximum torque must be adhered to and **never exceeded**.

Tighten the packing gland with a torque wrench, to the values indicated in the table (fig. 11).

DN 125-200 only
Max permissible pressure difference for closing/opening according to EN12284 which is a part of EN378-1:
The table in fig. 12 states the maximum pressures at which the valves can be operated manually and tightness can be achieved.

Use only original Danfoss parts, including packing glands, sealing parts and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss. Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

148R9510

148R9510

Installation Guide

Shut-off valves
SVA-DH, SVA-DL 250-300

Installation

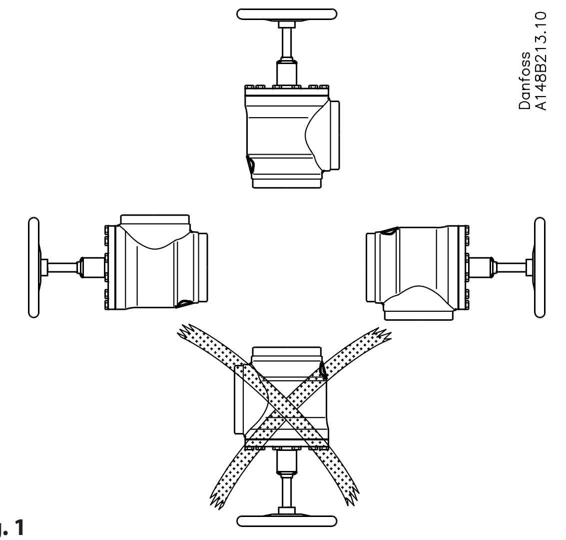


Fig. 1

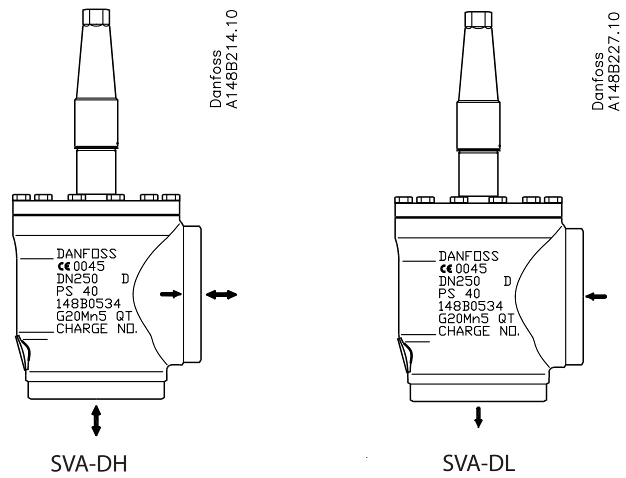


Fig. 2

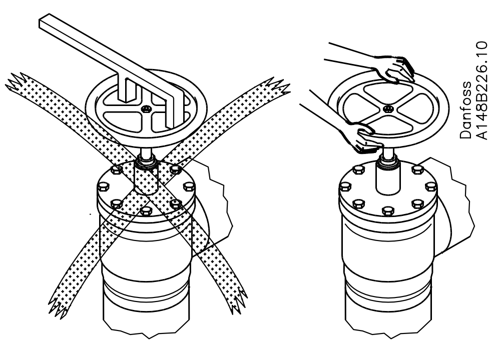


Fig. 3

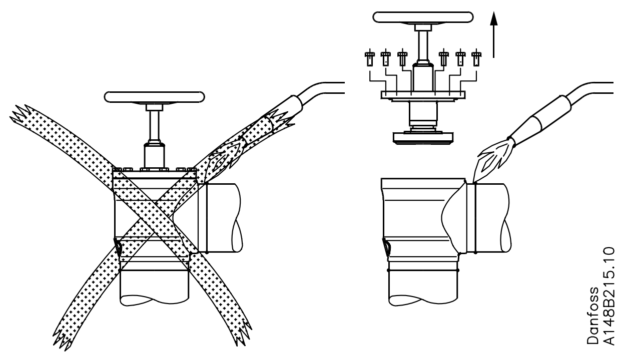


Fig. 4

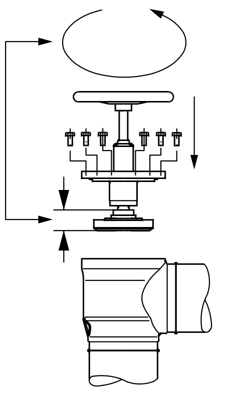


Fig. 5a

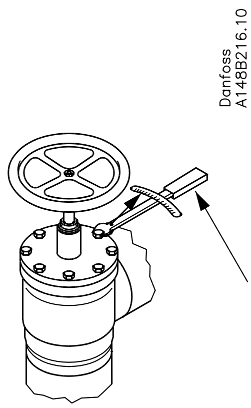


Fig. 5b

	Nm	LB-feet
DN 250-300	370	272

Maintenance

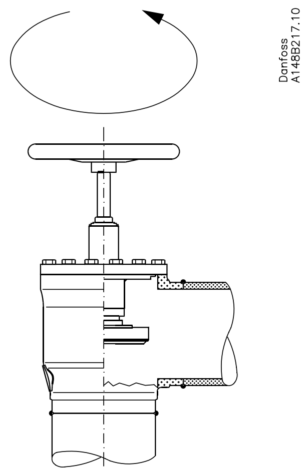


Fig. 6

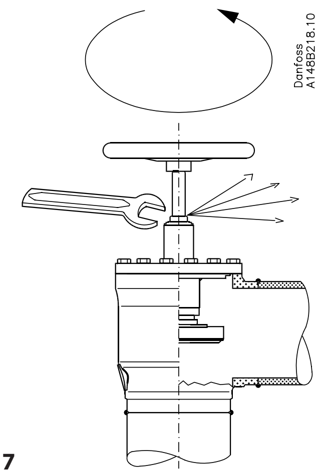


Fig. 7

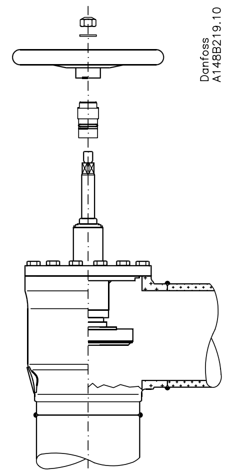
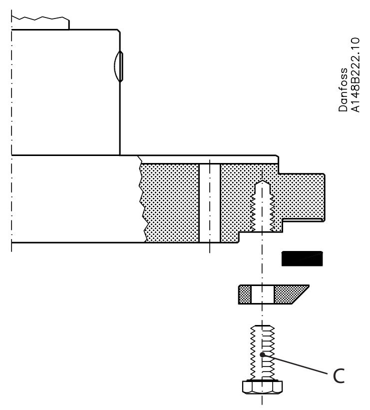


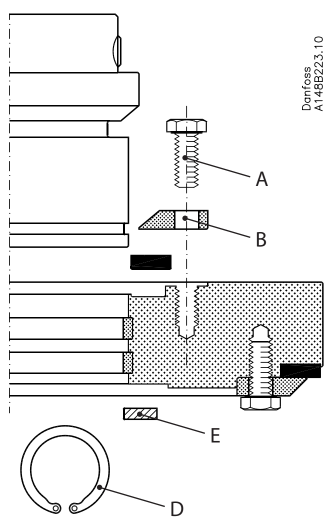
Fig. 8



SVA-DL, SVA-DH

Pos. C	Nm	LB-feet
DN 250-300	25	18

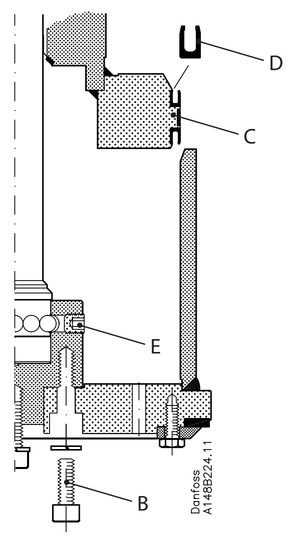
Fig. 9a



SVA-DL

Pos. A	Nm	LB-feet
DN 250-300	25	18

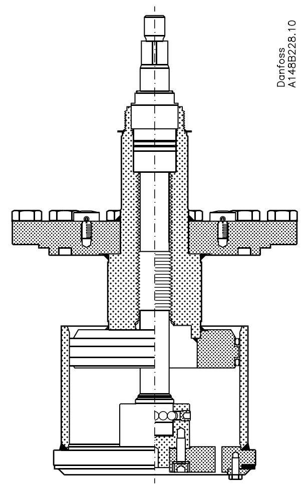
Fig. 9b



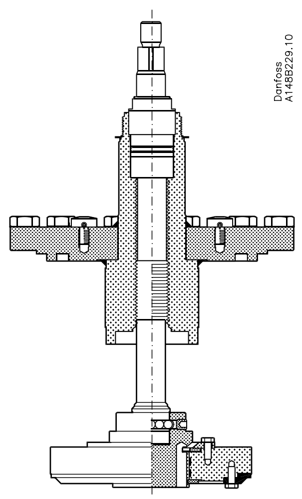
SVA-DH

Pos. B	Nm	LB-feet
DN 250-300	49	36

Fig. 9c

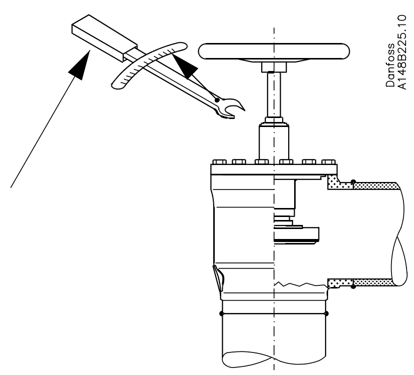


SVA-DH



SVA-DL

Fig. 10



	Nm	LB-feet
DN 250-300	80	60

Fig. 11

ENGLISH

Installation

Refrigerants
Applicable to HC, HCFC, HFC, R717 (Ammonia) and R744 (CO_2).
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
SVA-DL: –60/+150°C (–76/+302°F)
SVA-DH: –60/+150°C (–76/+302°F)

Pressure range
SVA-DL, SVA-DH:
40 bar (580 psi) at -60°C to +60°C (-76°F to +140°F)
36 bar (522 psi) at +60°C to +80°C (+140°F to +176°F)
32 bar (464 psi) at +80°C to +120°C (+176°F to +248°F)
28 bar (406 psi) at +120°C to +150°C (+248°F to +302°F)

The valves are designed for a max. working pressure of 40 bar g (580 psi g).

Installation (fig. 1)
The valve must be installed with the spindle vertically upwards or in horizontal position (fig. 1). Valves should be opened by hand without the use of tools or other devices (fig. 3). The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Recommended flow direction (fig. 2)
To achieve optimum flow conditions, the valve should be installed with the flow as indicated by the arrow (fig. 2) for SVA-DH. Flow in the opposite direction is also acceptable, but slightly reduces the k_v- / C_v value.

For SVA-DL, flow direction can only be from the side in order for the pressure relief to function.

Welding (fig. 4)
The bonnet should be removed before welding (fig. 4) to prevent damage to the O-rings in the packing gland and between the valve body and bonnet, as well as the teflon gasket in the valve seat. Only materials and welding methods, compatible with the valve housing material, must be welded to the valve housing.

The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the threads of the housing and the bonnet. Removing the bonnet can be omitted provided that:
The temperature in the area between the valve body and bonnet during welding does not exceed +150°C/+302°F. This temperature depends on the welding method as well as on any cooling of the valve body during the welding itself. (Cooling can be ensured by, for example, wrapping a wet cloth around the valve body.) Make sure that no dirt, welding debris etc. get into the valve during the welding procedure.

Be careful not to damage the teflon cone ring.

The valve housing must be free from stresses (external loads) after installation.

Stop valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly (fig. 5a)
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the cone has been fully screwed back towards the bonnet before it is replaced in the valve body (fig. 5a).

Tightening (fig. 5b)
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 5b).

Tightening of the bonnet should be performed according to sound mechanical practice.

Colours and identification
The SVA valves are painted with a red oxide primer in the factory. Precise identification of the valve is made via the ID ring at the top of the bonnet, as well as by the stamping on the valve body. The external surface of the valve housing must be prevented against corrosion with a suitable protective coating after installation and assembly.

Protection of the ID ring when repainting the valve is recommended.

Maintenance

Packing gland
When performing service and maintenance, replace the complete packing gland only, which is available as a spare part. As a general rule, the packing gland must not be removed if there is internal pressure in the valve.

However, if the following precautionary measures are taken, the packing gland can be removed with the valve still under pressure:

Backseating (fig. 6)
To backseat the valve, turn the spindle counter-clockwise until the valve is fully open.

Pressure equalization (fig. 7)
In some cases, pressure forms behind the packing gland. Hence a handwheel or similar should be fastened on top of the spindle while the pressure is equalized. The pressure can be equalized by slowly screwing out the gland.

Removal of packing gland
Handwheel and packing gland can now be removed.

Dismantling the valve
Do not remove the bonnet while the valve is still under pressure.

- Check that the top gasket has not been damaged.
- Check that the spindle is free of scratches and impact marks.
- If the teflon cone ring has been damaged, the cone assembly must be disassembled and the teflon renewed.

Replacement of the teflon seat (fig. 9a)
The Teflon seat can be renewed as shown in fig. 9a. The bolts, pos. C, are unscrewed and the tension ring can be removed. If the Teflon seat is moderately damaged, it can be turned around to use the fresh side (check).
If the Teflon ring is deformed or has very deep marks (> 1mm) it must be replaced for strength. When remounting the bolts on the tension ring, please refer to the torque table.

Replacement of pressure relief seat on SVA-DL (fig. 9b)
If the the SVA-DL has a leak over the pressure relief seat, this can be changed:
- Remove the retaining ring (Seeger circlip ring), pos. D, by using suitable tool.
- Pull the seat assembly off the spindle
- Remove bolts, pos. A
- Remove tension ring, pos. B.

Again the Teflon ring can be turned around if damages are moderate (moderate deforming or pressure marks < 0.8 mm). Otherwise the Teflon ring must be replaced.

- Put tension ring and bolts back in place and tighten bolts (pos. A) to the torque indicated.
- Check that the wear rings, pos. E, are intact and oil the rings before slowly and lightly placing the seat assembly on the spindle again.

- Refit the retaining ring, pos. D, in the spindle groove and check that the cone assembly refits on the spindle.

Replace U-sleeve seals or balls in SVA-DH (fig. 9c)
If the two U-sleeve seals are damaged or access is needed for the balls in the valve spindle - valve seat bearing:
- Rotate the spindle clockwise all the way down as for fully closed.
- Unscrew all the bolts in pos. B.
- Carefully remove the seat with the welded on cylinder.

Now there is access to the two U-sleeve seals (pos. C), the wear ring (pos. D), and the balls behind the set screw (pos. E).
The U-sleeve seals must be replaced by bending them slightly into an oval shape and carefully pull them off in an angle and pushing the new one from an angle. The wear ring, pos. D, must be undamaged, otherwise replace.
- Oil the U-sleeve seals, pos. C, and wear ring, pos. D
- Carefully refit the cone with cylinder and at the same time place one of the bolts in pos. B to control the position of the remaining six bolt holes.
- Rotate the cone ot get the holes aligned
- Refit also the center bolt and tighten.
- Check that the U-sleeve seals are in place and the wear ring is positioned before slowly moving the spindle upwards checking that the seals move into place over the bevel.

Replacement of backseat seal (fig. 10)
The valve backseat is a special teflon ring. If this is damaged, it must be replaced. Screw the spindle out of the bonnet. Carefully remove the original backseat seal and mount a new one in the angled contact surface directly inside the opening in the bonnet. Avoid folding and damage to the teflon ring, or damage to the contact surface at the top of the valve during assembly.

Assembly
Remove any dirt from the body before the valve is assembled. Resposition the valve cone on the SVA-DH bonnet as described above with consideration to the U-sleeve seal. Check that the cone has been screwed back towards the bonnet before it is replaced in the valve body (fig. 5a).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 5b). Tightening of the bonnet should be performed according to sound mechanical practice.

Tighten the packing gland with a torque wrench, to the values indicated in the table (fig. 11).

Use only original Danfoss parts, including packing glands, O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss.

Instructions

REG 15 - 65, REG-SS 15 - 40

148R9516

Installation

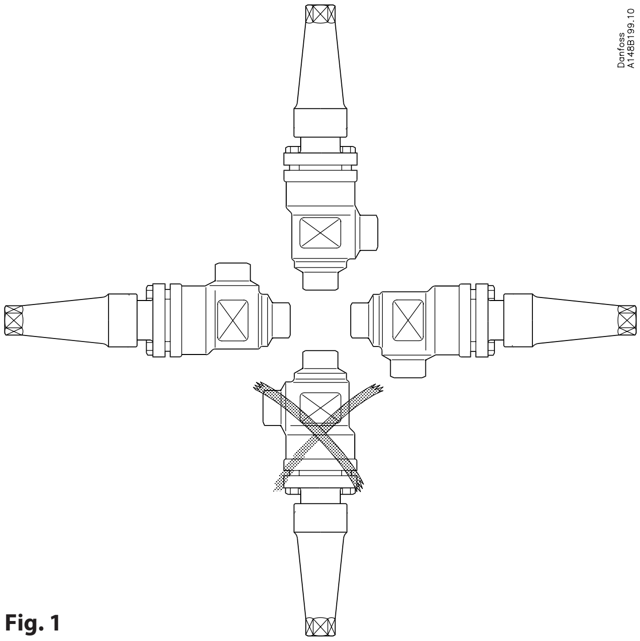


Fig. 1

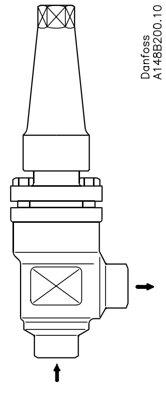


Fig. 2

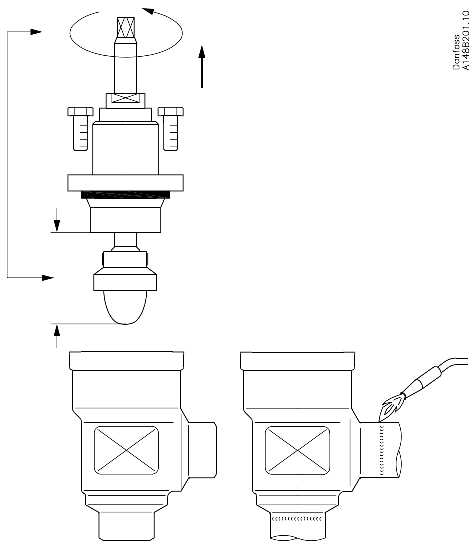
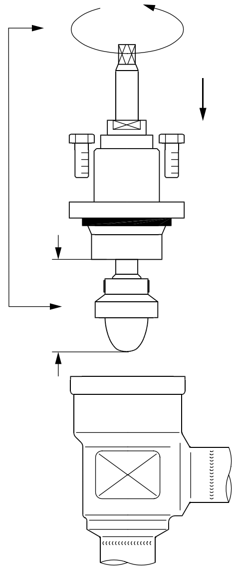
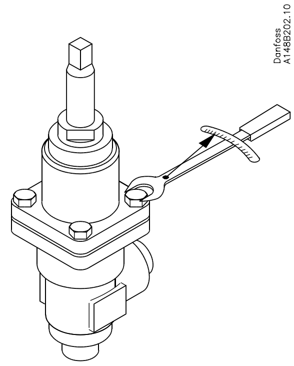


Fig. 3

	Nm	LB-feet
DN 15-25	22	16
DN 25-50	44	32
DN 65	75	53

Fig. 4

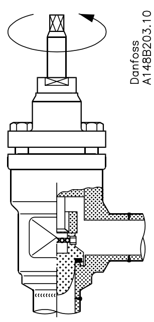


Fig. 5

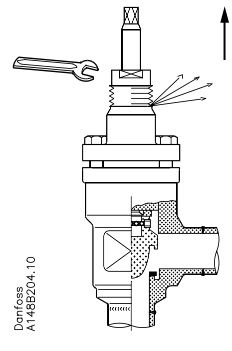


Fig. 6

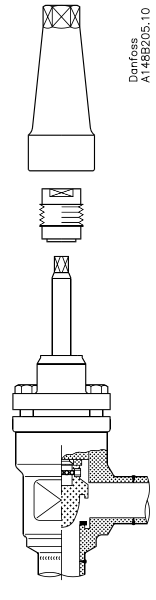
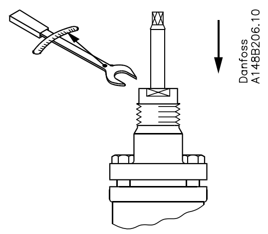


Fig. 7



	Nm	LB-feet
DN 15-25	50	37
DN 25-40	70	52
DN 50-65	60	45

Fig. 8

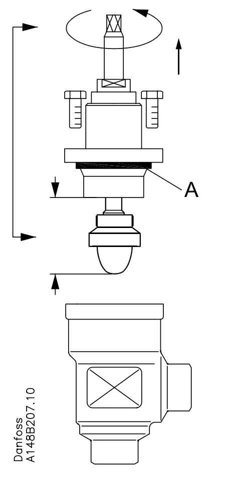


Fig. 9

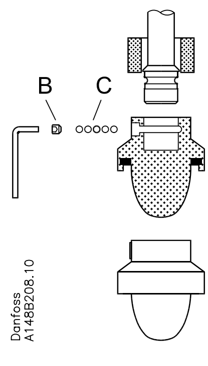


Fig. 10

ENGLISH

Installation

Refrigerants
Applicable to all common non-flammable refrigerants, including R717 and non-corrosive gases/liquids dependent on sealing material compatability.
Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
REG: –50/+150°C (–58/+302°F)
REG-SS: –60/+150°C (–76/+302°F)

Pressure range
The valves are designed for a max. working pressure of 40 bar g (580 psi g).

Installation
The valve must be installed with the spindle vertically upwards or in horizontal position (fig. 1). Valves should be opened by hand according to the guidelines in the datasheet. The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Recommended flow direction
Direct the flow towards the cone as indicated by the arrow placed on the valve housing (fig. 2). The force used to open and close the valve must not exceed the force of an ordinary handwheel.

Welding
The bonnet should be removed before welding (fig. 3) to prevent damage to the O-rings in the packing gland and between the valve body and bonnet, as well as the teflon gasket in the valve seat. Only materials and welding methods, compatible with the valve housing material, must be welded to the valve housing. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the threads of the housing and the bonnet.

Removing the bonnet can be omitted provided that:
The temperature in the area between the valve body and bonnet during welding does not exceed +150°C/+302°F. This temperature depends on the welding method as well as on any cooling of the valve body during the welding itself. (Cooling can be ensured by, for example, wrapping a wet cloth around the valve body.) Make sure that no dirt, welding debris etc. get into the valve during the welding procedure.

Be careful not to damage the teflon cone ring.

The valve housing must be free from stresses (external loads) after installation.

REG valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the cone has been fully screwed back towards the bonnet before it is replaced in the valve body (fig. 4).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 4).

Colours and identification
The REG valves are painted with a red oxide primer in the factory. Stainless steel valves are not painted. Precise identification of the valve is made via the ID ring at the top of the bonnet, as well as by the stamping on the valve body. The external surface of the valve housing must be prevented against corrosion with a suitable protective coating after installation and assembly.

Protection of the ID ring when repainting the valve is recommended.

Maintenance

Packing gland
When performing service and maintenance, replace the complete packing gland only, which is available as a spare part. As a general rule, the packing gland must not be removed if there is internal pressure in the valve. However, if the following precautionary measures are taken, the packing gland can be removed with the valve still under pressure:

Backseating (fig. 5)
To backseat the valve, turn the spindle counter-clockwise until the valve is fully open.

Pressure equalization (fig. 6)
In some cases, pressure forms behind the packing gland. Hence a handwheel or similar should be fastened on top of the spindle while the pressure is equalized. The pressure can be equalized by slowly screwing out the gland.

Removal of packing gland (fig. 7)
Cap and packing gland can now be removed.

Dismantling the valve
Do not remove the bonnet while the valve is still under pressure.
- Check that the O-ring (fig. 9, pos. A) has not been damaged.
- Check that the spindle is free of scratches and impact marks.
- If the teflon cone ring has been damaged, the whole cone assembly must be replaced.

Replacement of the cone (fig. 10)
Unscrew the cone screw (pos. B) with an Allen key.

REG 15-40	2.0 mm A/F
REG 50-65	2.5 mm A/F

(An Allen key is included in the Danfoss Industrial Refrigeration gasket set).
Remove the balls (pos. C).

Number of balls in fig. 10, pos. C:
REG with cone no. 4-5-6-7 .... 10 pcs.
REG with cone no. 8-9-10-11-12......... 14 pcs.

The cone can then be removed. Place the new cone on the spindle and replace the balls. Refit the cone screw in again using Loctite No. 648. to ensure that the screw is properly fastened.

Assembly
Remove any dirt from the body before the valve is assembled. Check that the cone has been screwed back towards the bonnet before it is replaced in the valve body (fig. 4).

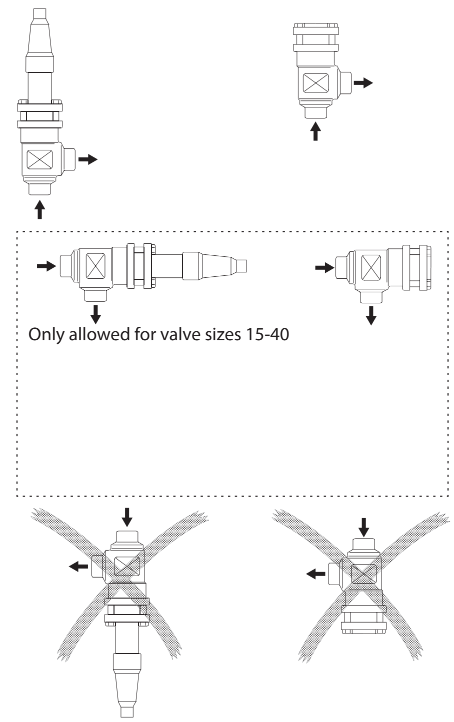
Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 4). Tighten the packing gland with a torque wrench, to the values indicated in the table (fig. 8).

Use only original Danfoss parts, including packing glands, O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

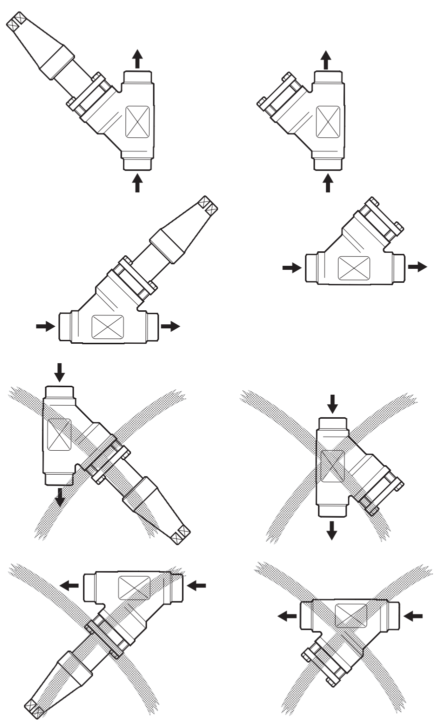
In cases of doubt, please contact Danfoss.

Check & stop valve / Check valves
SCA-X / CHV-X 15-125

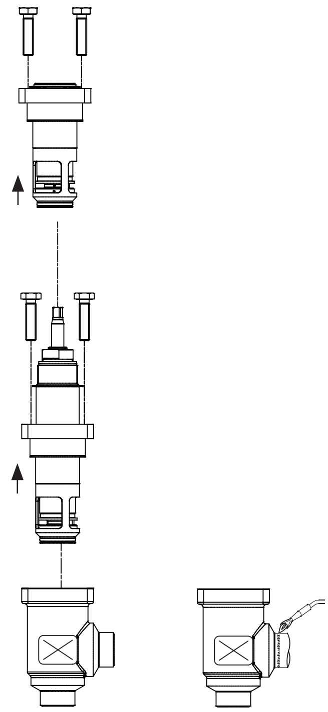
148R9550



1a



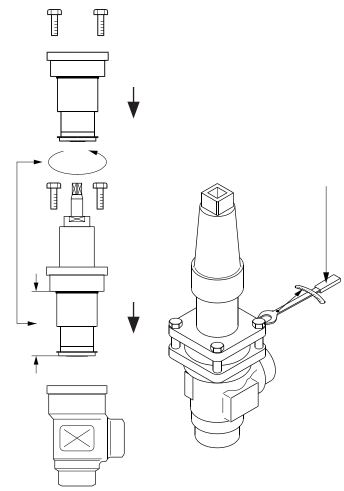
1b



2

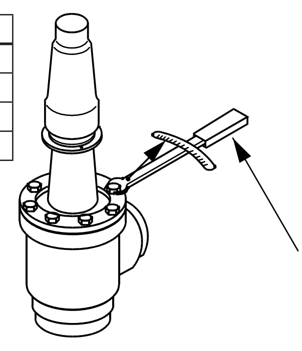
148R9550

	Nm	LB-feet
DN 15, 20	21	15
DN 25, 32, 40, 50	44	32

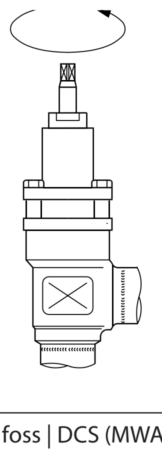


3

	Nm	Lb-feet
DN 65	74	54
DN 80	44	32
DN 100	75	53
DN 125	183	135

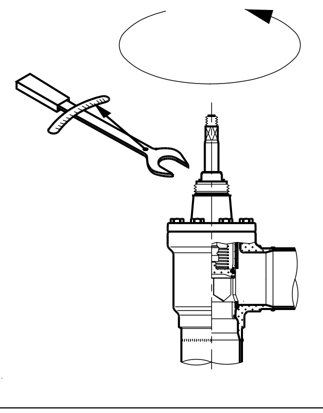


3a

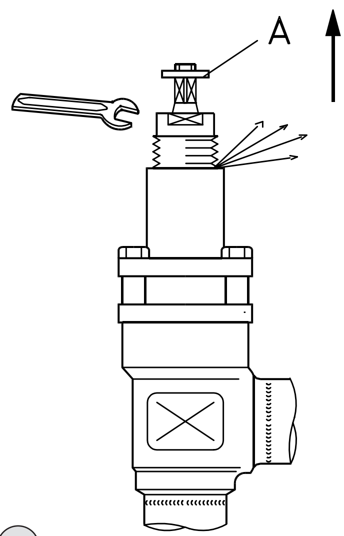


4

	Nm	LB-feet
DN 15-20	50	37
DN 25-40	75	55
DN 50-65	95	70
DN 80-100	150	111
DN 125	250	184



4a



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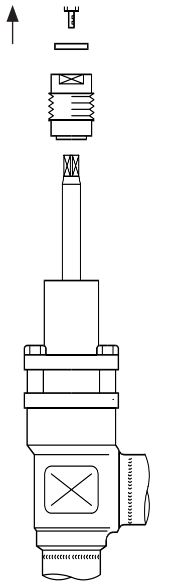
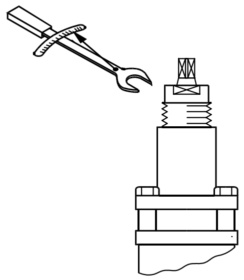


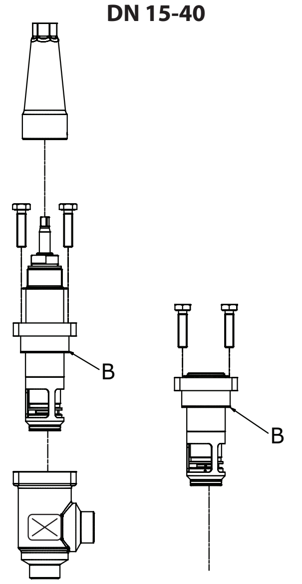
6

	Nm	LB-feet
DN 15, 20	50	37
DN 25, 32, 40	75	55



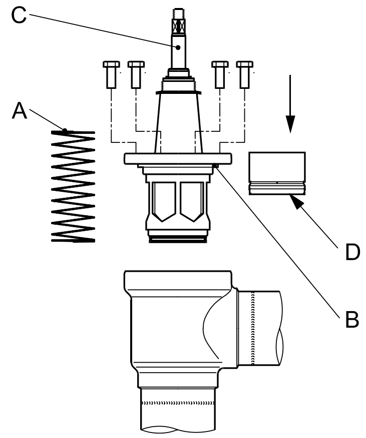
7

DN 15-40



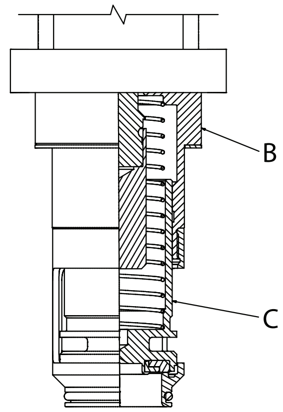
8a

DN 50-125

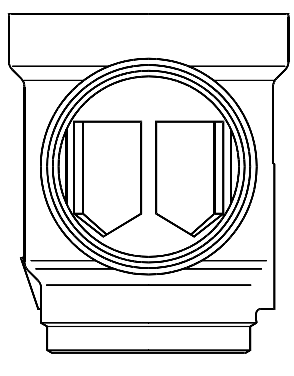


8b

DN 15-40

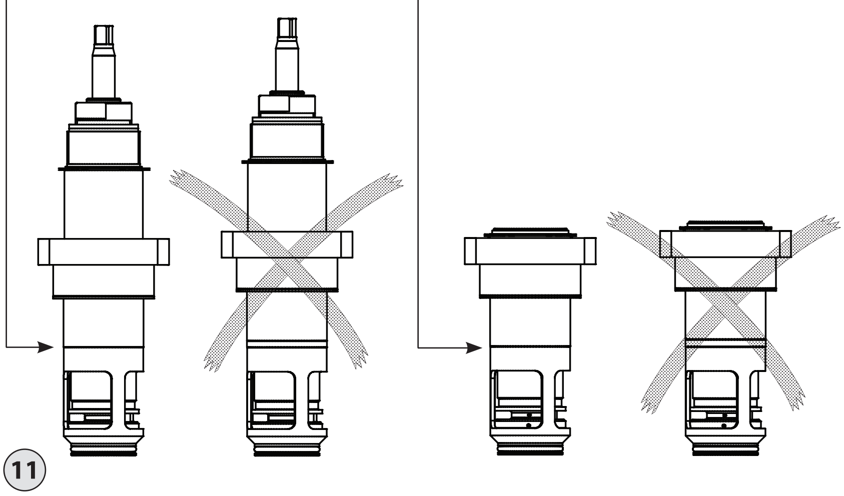


9



10

Ensure tight screw connection.



11

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717 (Ammonia), R744 (CO_2), Propane, Butane, Iso-Butane and Ethane.

The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+150°C (–76/+302°F)

Pressure range
52 bar (754 psi)

The valve must be installed with the spindle on top vertically upwards or in horizontal position (fig. 1). SCA-X valves should be opened by hand without the use of tools or other devices. The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Flow direction
Direct the flow towards the cone as indicated by an arrow on the valve housing (fig. 1).

Welding
The bonnet should be removed before welding (fig. 2) to prevent damage to the O-rings in the packing gland and the gasket between the valve body and bonnet, as well as the teflon gasket in the valve seat. Only materials and welding methods, compatible with the valve housing material, must be applied to the valve housing. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the threads of the housing and the bonnet.

Be careful not to damage the teflon cone ring.

The valve housing must be free from stresses (external loads) after installation.

Stop check valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the cone has been fully screwed back towards the bonnet before it is repositioned in the valve body (SCA DN 50-125) (fig. 3).

Important for the SCA-X valves:
Full capacity is only obtained when the spindle is screwed outward, "into bonnet", i.e. counterclockwise (fig. 3).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 3).

Please note that the table (fig. 3) containing maximum torque must be adhered to and **never exceeded**.

Important for SCA-X/CHV-X 50 - 125 valves: For optimal flow the insert must be installed as indicated in (fig. 10). Otherwise kv value will be below indicated in the technical brochure.

Colours and identification
The SCA-X and CHV-X valves are painted with a red primer in the factory. Precise identification of the valve is made via the green coloured ID ring at the top of the bonnet, as well as by the stamping on the valve body. The external surface of the valve housing must be protected against corrosion with a suitable protective coating after installation and assembly.

Protection of the name plate when repainting the valve is recommended.

Maintenance

Packing gland (only SCA-X types)
When performing service and maintenance, replace the complete packing gland only, which is available as a spare part. As a general rule, the packing gland must not be removed if there is internal pressure in the valve. However, if the following precautionary measures are taken, the packing gland can be removed with the valve still under pressure:

Backseating (fig. 4)
To backseat the valve, turn the spindle counterclockwise until the valve is fully open.

Pressure equalization (fig. 5)
In some cases, pressure forms behind the packing gland. Hence, a handwheel or a large washer (pos. A) should be fastened on top of the spindle while the pressure is equalized. The pressure can be equalized by slowly screwing out the gland.

Removal of packing gland (fig. 6)
Packing gland can now be removed.

Dismantling the valve (fig. 8)
Do not remove the bonnet while the valve is still under pressure.

DN 15-40 (fig. 8a):
- Check that the gasket (pos. B) has not been damaged.
- Check that the spindle is free of scratches and impact marks.
- If the teflon cone ring has been damaged, the whole cone assembly must be replaced.

DN 50-125 (fig. 8b):
- Check that the spring (pos. A) is intact.
- Check that the gasket (pos. B) has not been damaged.
- Check that the spindle (pos. C) is free of scratches and impact marks.
- If the teflon cone ring (pos. D) has been damaged, the whole cone assembly must be replaced.

Replacement of the cone (fig. 9)
DN 15-40:
O-ring (pos. C) prevents the cone from falling out. Pull the cone clear of the bonnet. Ensure that the spring is not lost in the process. Remove dirt, if any. Mount O-ring (pos. C) on cone. Mount spring and cone in bonnet.

Assembly
Remove dirt, if any, from pipes and housing before assembly. Important for the SCA-X valves: Full capacity is only obtained when the spindle is screwed outward, "into the bonnet", i.e. counterclockwise (fig. 3).

Note:
For SCA-X and CHV-X sizes DN 15-40 it is important to ensure that the lower and upper part of the insert is tightly screwed together (fig. 11) and that this screw connection is kept tight during repositioning of the cone in the housing.

Use a torque wrench to tighten the bonnet (fig. 3).

Tightening
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 3). Tighten the packing gland with a torque wrench, to the values indicated in the table (fig. 7).

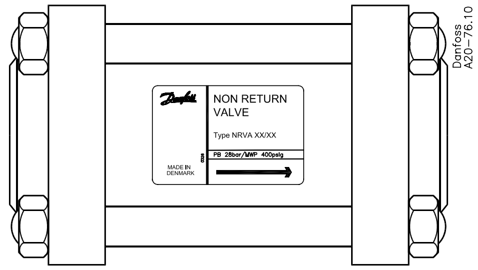
Use only original Danfoss parts, (including packing glands and gaskets) for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact your local Danfoss sales office.

027R9531

Installation Guide

Check valves NRVA



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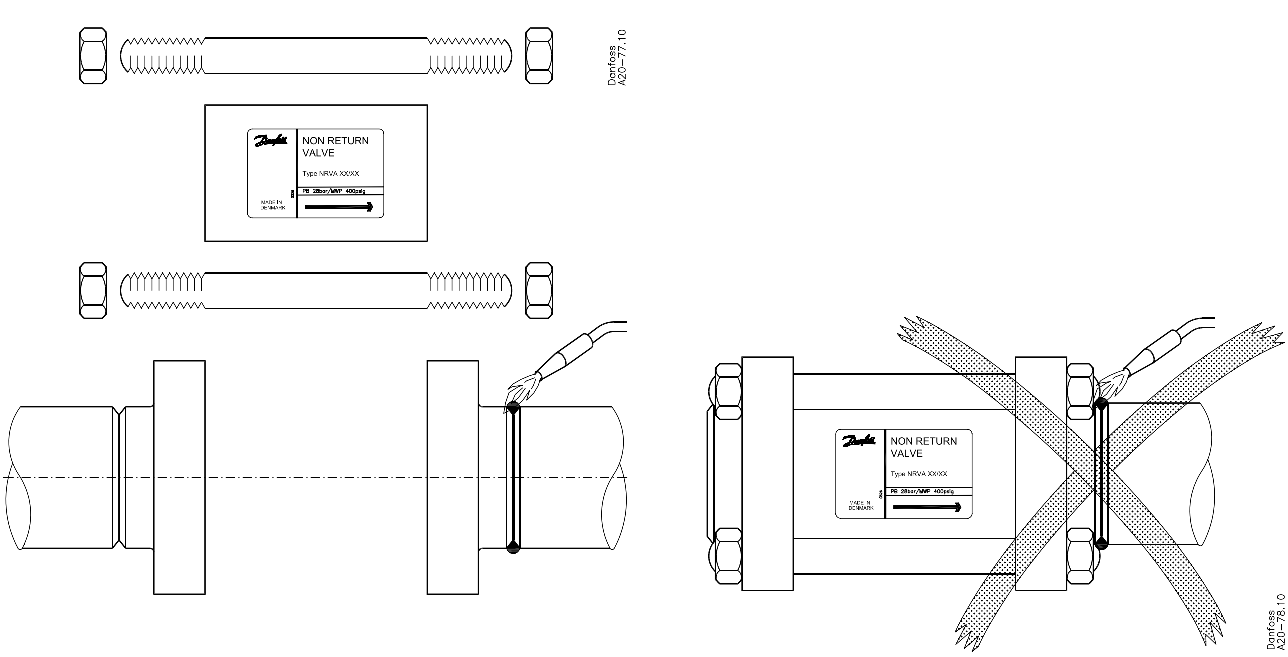

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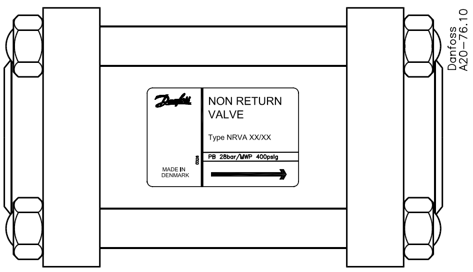


Type	Bolt	Nm	LB-Feet
NRVA 15-20	2 × M12	50	37
NRVA 25-32	4 × M12	70	52
NRVA 40-50	4 × M12	70	52
NRVA 65	8 × M16	100	74

3

027R9531

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC and R717 (Ammonia).
Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
NRVA: –50/+140°C (–58/+285°F)

Pressure range
NRVA: The valves are designed for a max. working pressure of 40 bar g (580 psi g).

Installation
The valve must be installed in the flow direction as indicated by the arrow on the valve housing (fig. 1).
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding
The internal parts should be removed before welding (fig. 2) to prevent damage to the gaskets, as well as the teflon gasket in the valve seat.
Only materials and welding methods, compatible with the flange material, must be welded to the flanges. The flanges should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Be careful not to damage the teflon on the cone.

The valve inclusive flanges must be free from stresses (external loads) after installation.

The valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. Both the inlet and outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly.

Tightening
Thighten the staybolts and nut with a torque wrench, to the values indicated in the table (fig. 3).

Surface protection
The external surface of the flanges must be prevented against corrosion with a suitable protective coating after installation and assembly.

Maintenance

Dismantling the valve
Do not remove the valve housing while the valve is still under pressure.

- Check that the gasket has not been damaged.
- Check that the cone is free of scratches and impact marks.
- If the teflon cone ring has been damaged, the whole cone assembly must be replaced.

Assembly
Remove any dirt from the body before the valve is assembled.

Tightening
Tighten the staybolts and nut with a torque wrench, to the values indicated in the table (fig. 3).

Use only original Danfoss parts, including gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss. Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

148R9551

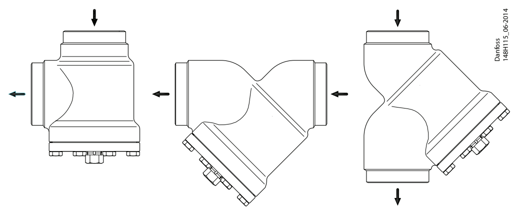
Installation guide

Strainer
FIA 15-200

148R9551

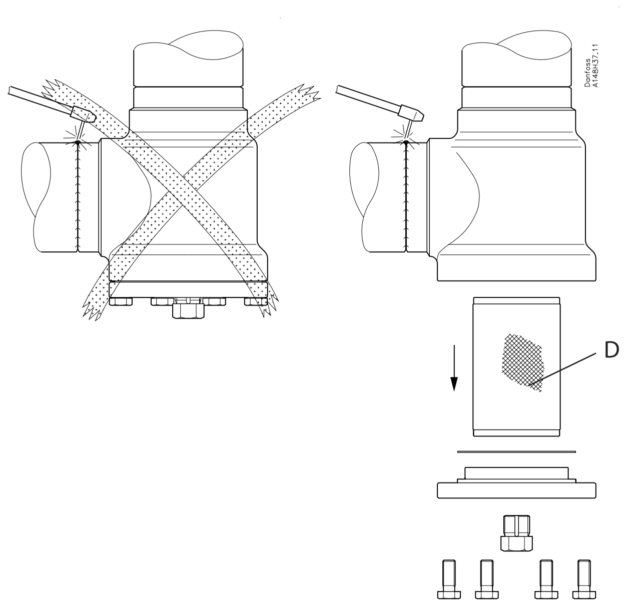
Installation

Note:
At delivery the strainer housing is not equipped with strainer insert or accessories.



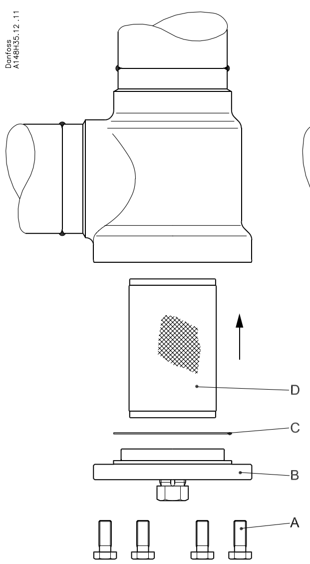
1

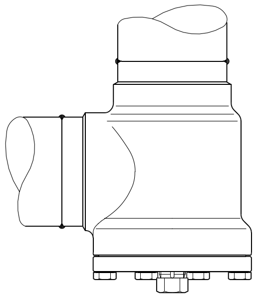
FIA 15-200



2

Maintenance



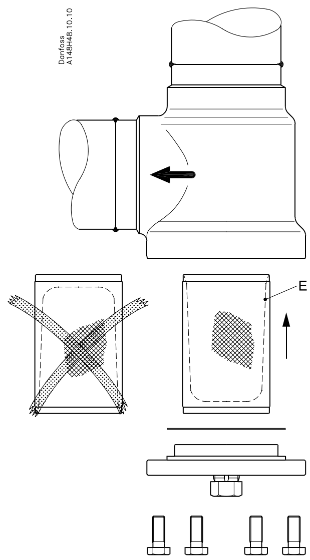


Max. torque

	Nm	LB-ft
DN 15-20	21	15
DN 25-32-40-50	44	32
DN 65	74	54
DN 80	44	32
DN 100	75	53
DN 125-150	183	135
DN 200-300	370	272

3

Filter bag
Flow direction



4

ENGLISH

Refrigerants
Applicable to HCFC, HFC, R717 (Ammonia), R744 (CO_2) and all flammable refrigerants.

The strainer is only recommended for use in closed circuits. For further information please contact your local Danfoss sales office.

Pressure and temperature range
–60/+150°C (–76/+302°F)

FIA 15-200:
The strainers are designed for a max. working pressure of 52 bar (754 psi g)

Installation

Note:
At delivery the strainer housing is not equipped with strainer insert or accessories

The strainer must be installed with the top cover downwards, and the flow must be directed towards the top cover as indicated by the arrow on the strainer housing (fig. 1). The strainer insert must be inserted after welding.

The strainer housing is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the strainer is protected from pressure transients like "liquid hammer" in the system.

Recommended flow direction
The strainer must be installed with the flow towards the top cover as indicated by the arrow on the side of the valve body (fig. 1). Flow in the opposite direction is not acceptable.

Welding
The top cover should be removed before welding (fig. 2) to prevent damage to the gasket between the strainer housing and top cover. Only materials and welding methods compatible with the valve housing material, must be applied to the valve housing.

Clean the strainer housing internally to remove welding debris at completion of welding and before the strainer is reassembled.

Removing the top cover can be omitted provided that:

The temperature in the area between the strainer housing and top cover during welding does not exceed +150°C/+302°F. This temperature depends on the welding method as well as on any cooling of the strainer housing during the welding itself.

(Cooling can be ensured by, for example, wrapping a wet cloth around the filter body). Make sure that no dirt, welding debris etc. get into the strainer during the welding procedure.
The strainer housing must be free from stresses (external loads) after installation.

Strainers must not be mounted in systems where the outlet side of the strainer is open to atmosphere. The outlet side of the strainer must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and strainer housing before assembly. Check that the strainer insert has the right size before it is inserted in the top cover and check that the gasket is undamaged.

Place the strainer insert (pos. D) from underneath. The insert has a slight force fit into the housing, no gaskets or O-rings are used.

If magnet inserts have been chosen as accessory, fit those on the top cover before replacing the cover.

Tightening
Tighten the top cover with a torque wrench, to the values indicated in the table (fig. 3).

Please note that the table (fig. 3) containing maximum torque must be adhered to and **never exceeded**.

If the drain valve has been chosen as accessory, the drain plug should be replaced by the drain valve.

Colours and identification
The FIA strainers are painted with a red oxide primer in the factory. Precise identification of the strainer is made via the ID plate on the top cover, as well as by the stamping on the strainer housing. The external surface of the strainer housing must be prevented against corrosion with a suitable protective coating after installation and assembly.

Be sure to protect the ID plate when repainting the strainer.

Maintenance

Mounting of accessory:
Filter bag (fig. 4)
A 50µ filter bag (pos. E), especially for commissioning of the plant, can replace the normal strainer insert.
Mount the filter bag (held in place by the filter holder) and be sure to place the filter bag correctly in the strainer as shown in fig. 4.
The flow must go into the filter bag cavity and out or else the bag will not function properly.

Dismantling the strainer (fig. 3)
Before servicing the strainer, isolate it from the system and remove all refrigerant by evacuation to zero pressure. Check for refrigerant pressure before unscrewing and removal of the top cover.
The strainer insert must be removed without any use of tools

Cleaning
Clean the strainer insert using an appropriate solvent by flushing and brushing. The use of strong acids cannot be recommended. The strainer insert must be wiped or blown dry before inspection. If the insert is damaged or the sediments cannot be removed, the strainer insert must be replaced.

Assembly
Remove any dirt from the housing before the strainer is assembled.

Replacement of gasket
Change the gasket for the top cover (pos. C) and drain plug.

Check that the strainer insert is correctly placed before remounting the top cover and bolts (pos. A).

Tightening (fig. 3)
Tighten the top cover bolts (pos. A) with a torque wrench according to the table in fig. 3

Use only original Danfoss parts (including gaskets) for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact your local Danfoss sales office.

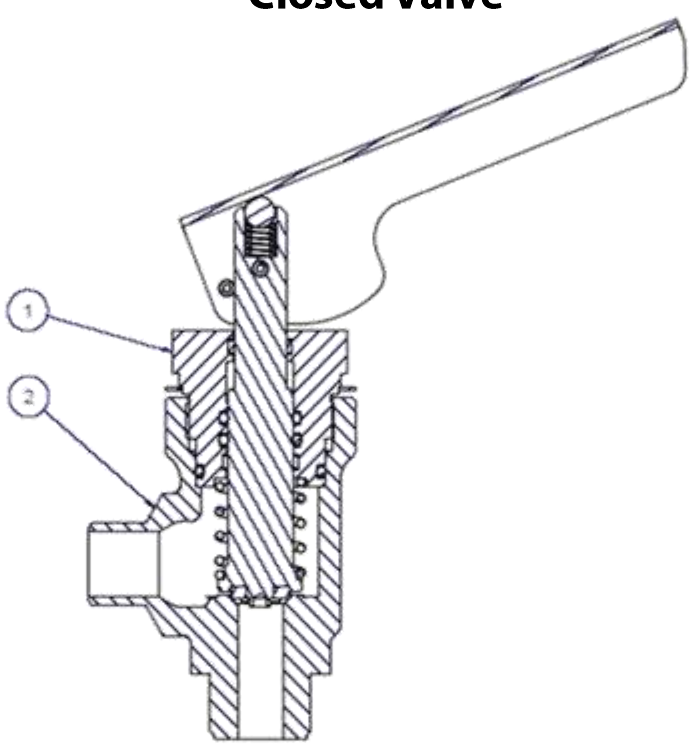
Quick Closing Oil Drain Valve
Type QDV

QDV – Features

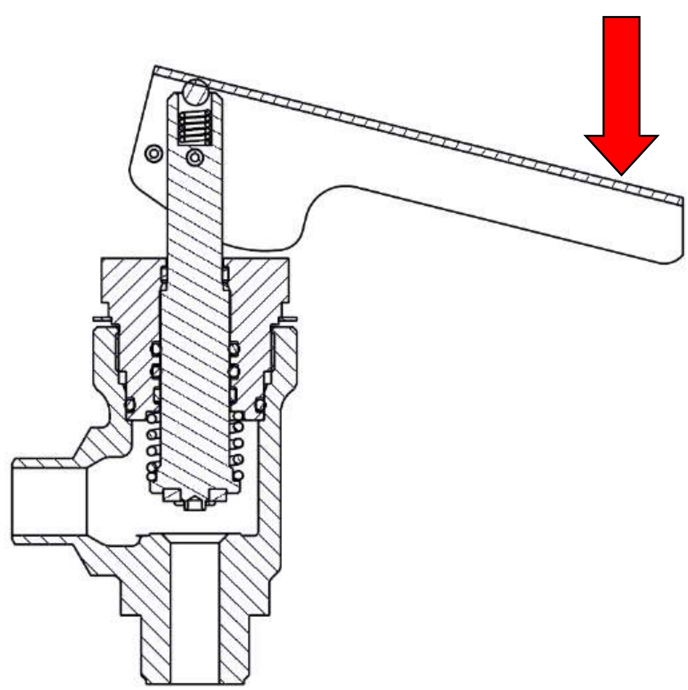
- QDV valve is for draining oil out of refrigeration systems.
- Spring return closing
- Has a safety valve function that opens the valve when pressure before the valve exceeds approximately 365 psig (25 bar) to avoid hydraulic pressure build-up.
- Valve handle can be rotated 360°
- Available with ½″ or ¾″ connections

QDV – Cut-Away

Closed Valve

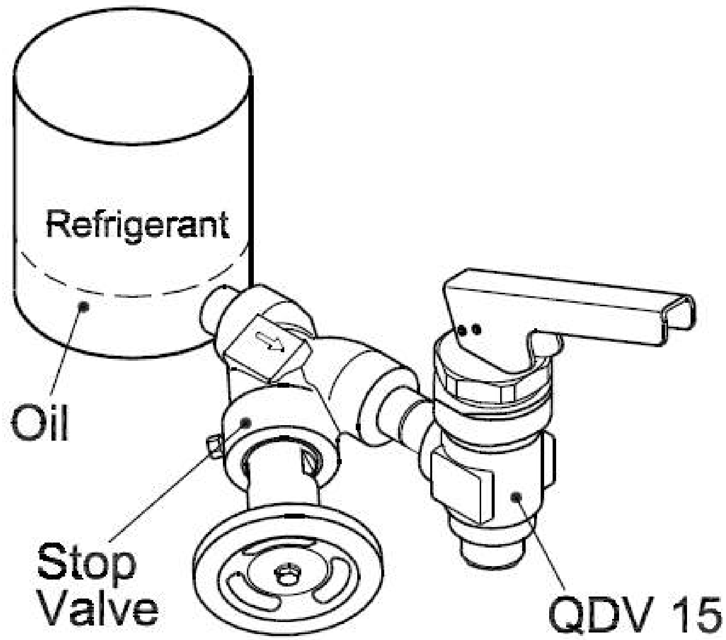


Opened Valve



Installing QDV Valve

It is recommended to always install a stop valve before the QDV!



QDV Valve Train

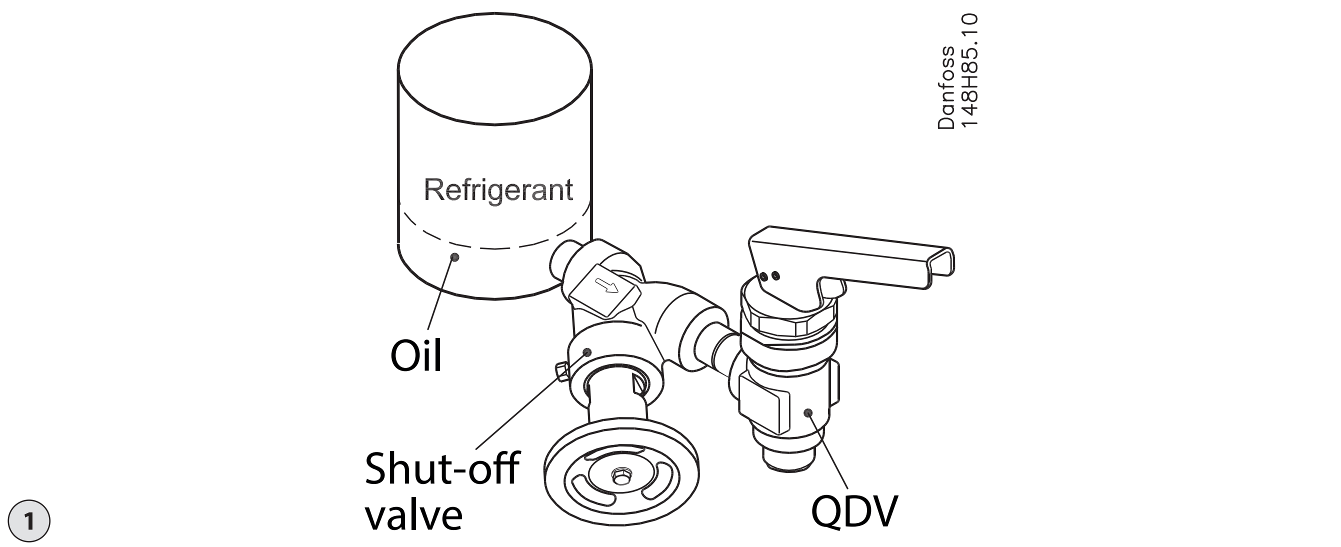
Male-NPT connection for mounting QDV

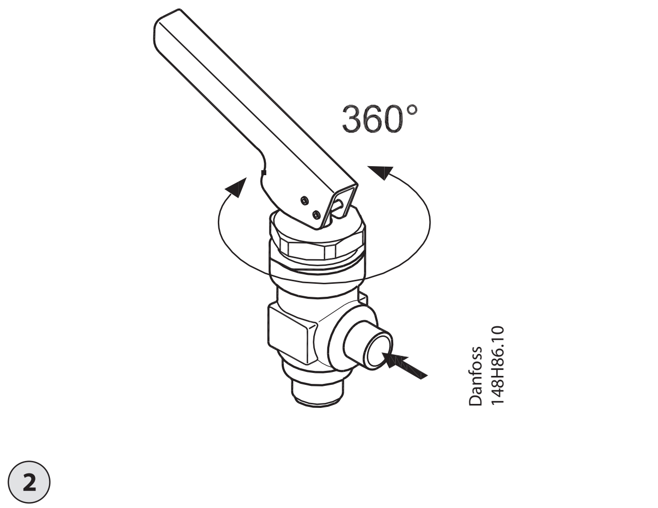
Will have a Socket-weld connection to connect to the system

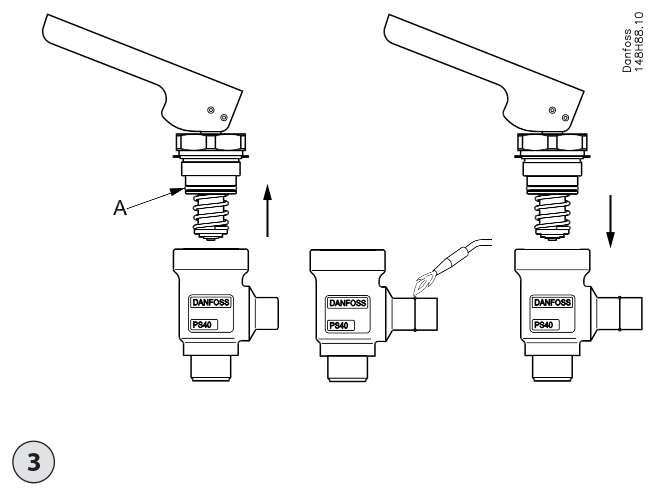
- QDV and special stop valve will be packaged in the same box (not threaded together)
- Stop valve must be installed on its side so the hand-wheel does not get in the way of the QDV handle

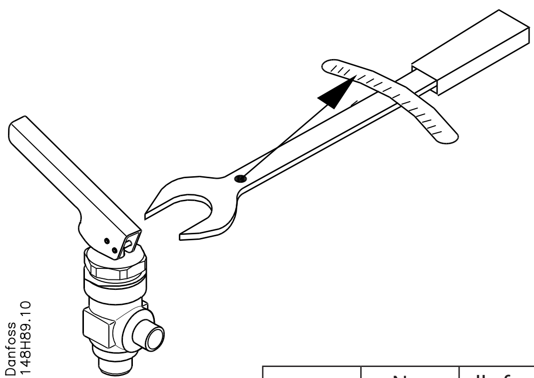
Shut-off valve
Type QDV 15

148R9540



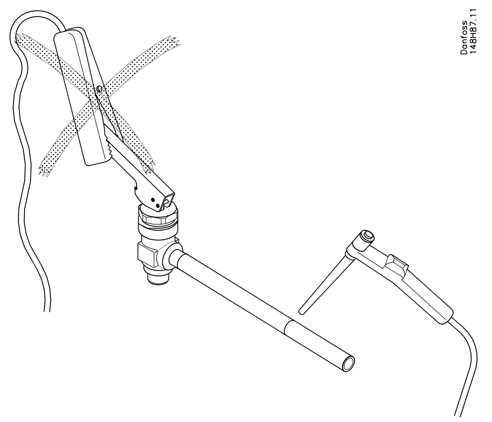






	Nm	lb-feet
QDV 15	50	37

4



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ENGLISH

Refrigerants:
Applicable to R717 (Ammonia).

Flammable hydrocarbons are not recommended. QDV is a backpressure dependent valve. The valve is only recommended for use in open circuits. For further information please contact Danfoss.

Temperature range:
QDV 15: –50/+150°C (–58/+302°F)

Pressure range:
The valves are designed for a max. working pressure of 40 bar g (580 psi g). In order to prevent hydraulic pressure building up between the stop valve and the QDV an integral relief device is included opening the valve slowly if the pressure exceeds 16 bar (232 psig).

Installation:
The valve must be installed after a stop valve with the spindle vertically upwards and with flow direction from the side branch (fig. 1).

If any tube or hose is mounted on the outlet of the QDV it has to be calculated to prevent backpressure building up when relieving. Blocking the outlet of the QDV will cause danger (hydraulic pressure building up).
An outlet hose of the same size as the outlet connection of the QDV valve must be used.

The handle can be turned 360° for optimizing operation position (fig. 2).
Valves should only be operated by hand without the use of tools or other devices.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Recommended flow direction:
The valve must be installed with flow direction from the side branch (fig. 2).

Welding:
The bonnet should be removed before welding (fig. 4) to prevent damage to the O-ring between the valve body and bonnet, as well as the Teflon cone ring in the valve seat.
Only materials and welding methods, compatible with the valve housing material, must be welded to the valve housing.
The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.
Avoid welding debris and dirt in the threads of the housing and the bonnet.
Removing the bonnet can be omitted provided that:
The temperature in the area between the valve body and bonnet during welding does not exceed +150°C/+302°F.
This temperature depends on the welding method as well as on any cooling of the valve body during the welding itself. (Cooling can be ensured by, for example, wrapping a wet cloth around the valve body.) Make sure that no dirt, welding debris etc. get into the valve during the welding procedure.
Be careful not to damage the Teflon cone ring. The valve housing must be free from stresses (external loads) after installation.

Fig. 5
Never use QDV or any other Danfoss product to get an earth connection for welding as it might cause damage to the product.

Assembly:
Remove welding debris and any dirt from pipes and valve body before assembly.
Check that the O-ring between the valve body and bonnet, as well as the Teflon cone ring in the valve seat is without marks or scratches.

Tightening:
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 4).

Colors and identification:
The QDV 15 valves are painted with a red oxide primer in the factory.
Precise identification of the valve is made via the ID ring at the top of the bonnet, as well as by the stamping on the valve body.
The external surface of the valve housing must be prevented against corrosion with a suitable protective coating after installation and assembly.
Protection of the ID ring when repainting the valve is recommended.

Maintenance

Dismantling the valve (fig. 3):
Do not remove the bonnet while the valve is still under pressure. Always close the stop valve before the QDV. Then proceed with activation of the QDV valve to make sure that it is not under pressure.
- Check that the O-ring (pos. A) has not been damaged.
- Check that the spindle is free of scratches and impact marks.
- Check that the Teflon cone ring is without marks or scratches.

Replacement of the O-ring between the bonnet and the valve body (fig. 4):
The QDV 15 is delivered with an extra O-ring. Remove the damaged O-ring (pos. A) from the bonnet and carefully install the new O-ring.

Assembly:
Remove any dirt from the body before the valve is assembled.
Check that the O-ring between the valve body and bonnet, as well as the Teflon gasket in the valve seat is without marks or scratches.

Tightening:
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 4).

Use only original Danfoss parts for replacement.
New parts must be made of certified materials applicable for the refrigerant used.

In cases of doubt, please contact Danfoss.

Danfoss accepts no responsibility for errors and omissions.
Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

A possible issue with our quick oil drain valves type QDV which may not fully close off during an oil draining process.

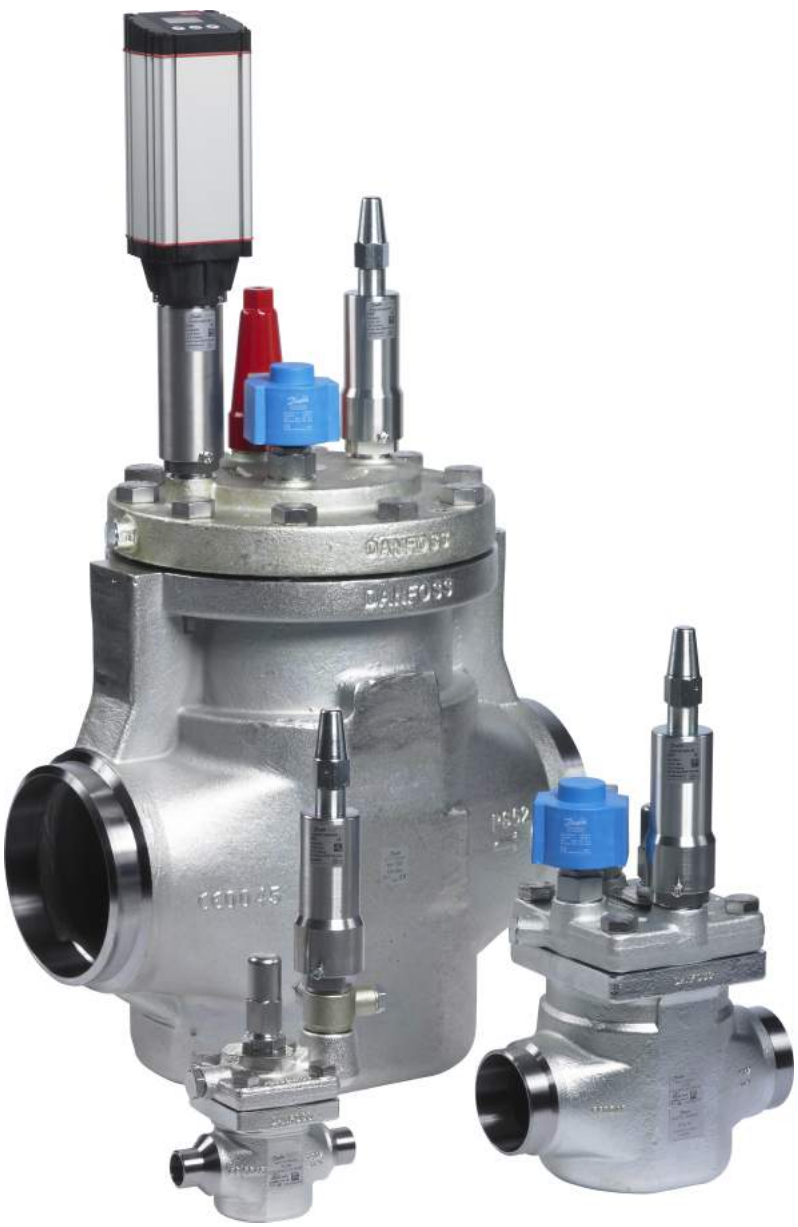
This may present itself when a drainage pipe is installed on the outlet of the valve which generates a back pressure to the valve such that the valve is unable to fully close. This will not present itself if there is no drainage pipe installed on the valve outlet. Max. back pressure 10 bar.

In applications where a QDV valve is installed in a system and is normally operating with an outlet pipe, please ensure that full safety precautions are taken when draining oil and make sure the inlet to the vessel is isolated during the oil draining process.

ENGINEERING
TOMORROW

Danfoss

Pressure Regulators - ICS and CVMD



ICS and PM Pilot Operated Valves

ICS 5 to 150
Direct weld steel body
Sizes 3/16" to 6" Port
Available with 1 or 3 pilot ports

PM 5 to 125
Flanged ductile iron body
Sizes 3/16" to 6" Port
Complete range discontinued Nov. 2015
Sold: 1979 to 2015

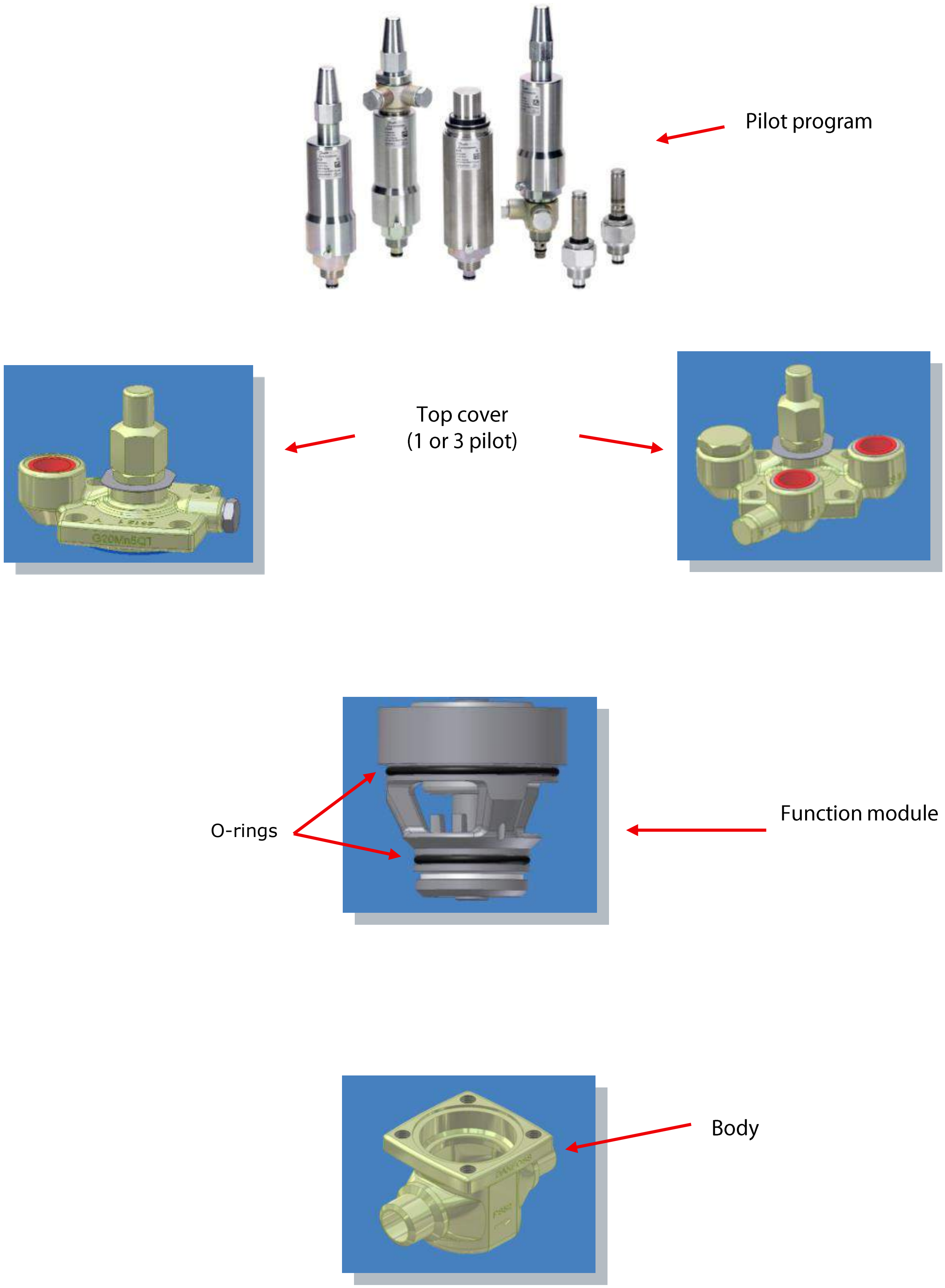
NOTE: ICS sizes 4", 5" and 6" are only available with 3 pilot top covers, but include 2 pilot plugs for applications where only 1 pilot is needed.

ICV – Industrial Control Valve Family

All wear surfaces are incorporated into exchangeable function modules that share the same ICV **direct weld** valve housing

Common valve body for all configurations

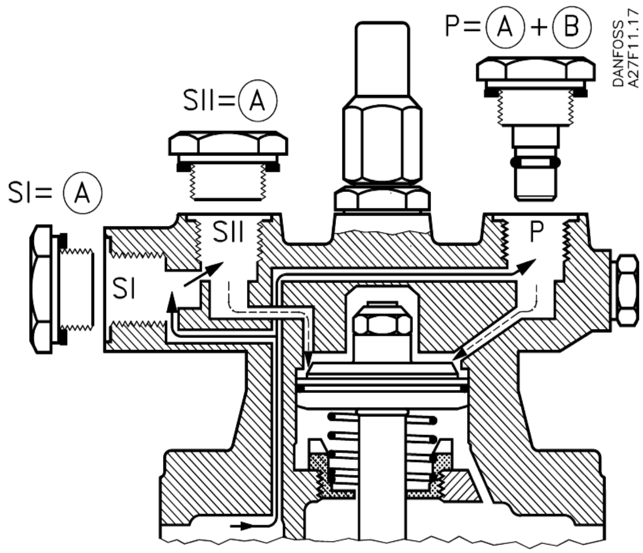
ICS Valve Concept



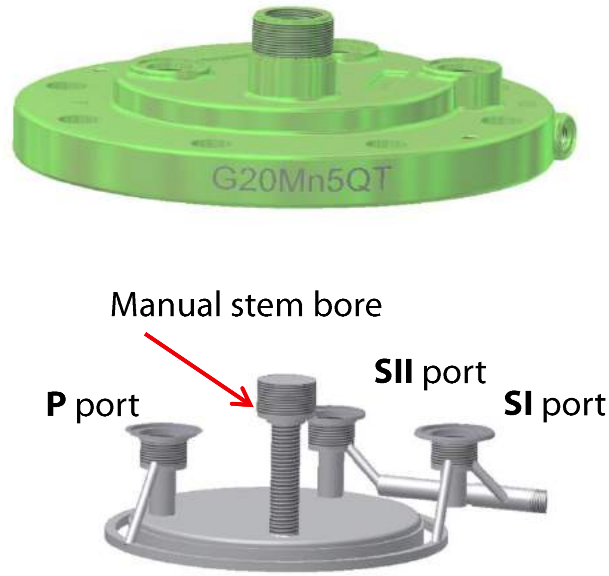
Function of ICS and PM Regulators

The principle of operation is the same for both ICS and PM valves

PM Valve



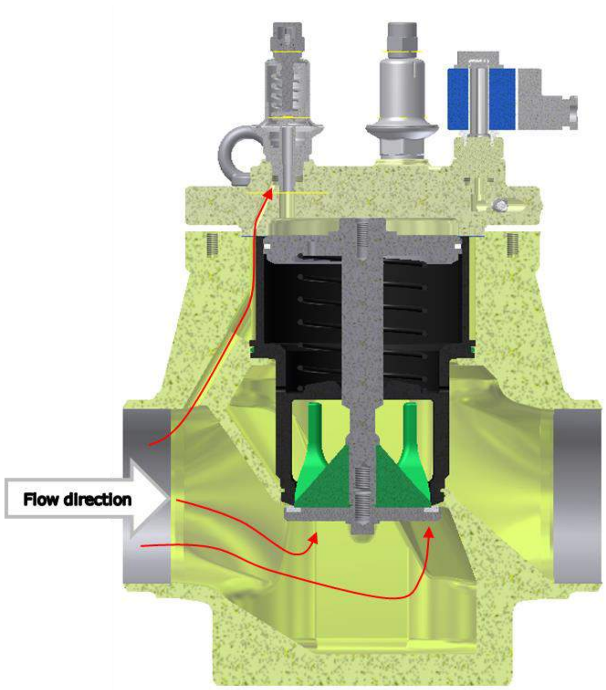
ICS Valve



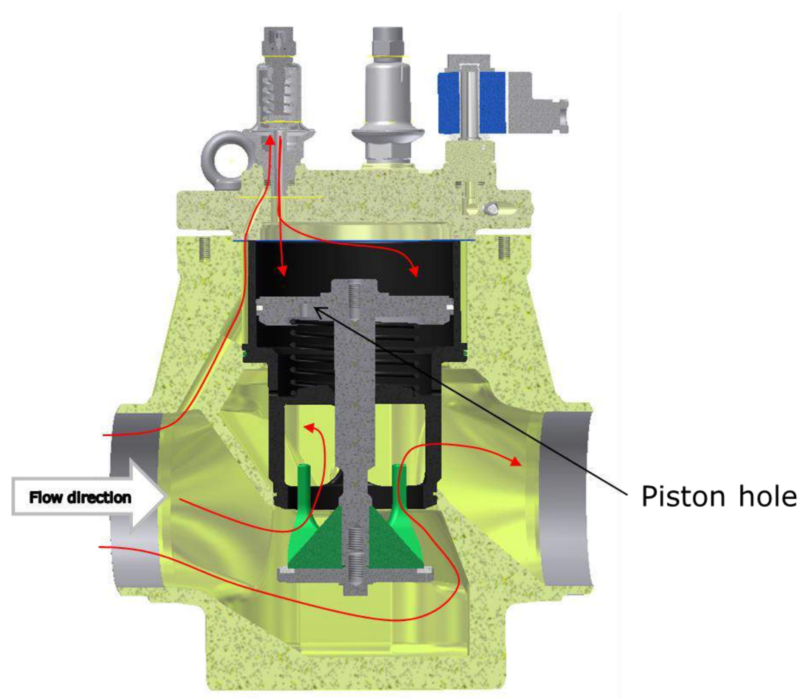
Valve starts to open at 1 psi differential pressure across valve and will be fully open with a differential pressure of about 2.9 psi.

ICS Cut-Away

ICS in closed position



ICS opening



Note: Top cover can be rotated without affecting the function of the valve and the gauge port **always** senses inlet pressure regardless of the top cover position

Pilot Valves for Regulators

EVM (NC), normally closed solenoid pilot
EVM (NO), normally open solenoid pilot
External connection

Old Version Pilots

CVP-LP, Inlet pressure pilot for LP side
CVP-HP, Inlet pressure pilot for HP side
CVP-XP, Inlet pressure pilot for very high pressure
CVPP-HP, Differential pressure pilot for HP side
CVC, Outlet pressure/Hot gas by-pass pilot
CVQ, Electronic temperature controlled pilot

New pilots are standard at the higher pressure rating

CVP, Inlet pressure pilot
CVPP, Differential pressure pilot
CVC, Outlet pressure/Hot gas by-pass pilot
CVE, Electronic controlled pilot

Previous Pressure Regulating Pilots

New Pressure Regulating Pilots

Inlet Pressure Regulating Pilots

CVP-L
CVP-M
CVP-H

Pilot flow in

Must have O-ring at tip and gasket
for sealing with cover

Pilot flow out

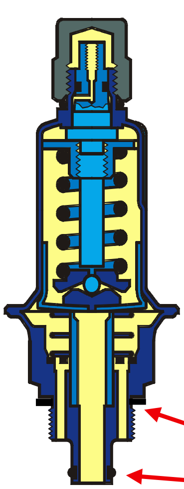
Adjustment for current Pilot Valves

Type	Range	Approx. Factory Setting	1 rev. turn*
CVP-L	19.5 in. Hg to 102 psig (-0.66 to 7 bar)	11.6 psig (0.8 bar)	14.5 psi (1 bar)
CVP-M	58 to 406 psig (4 to 28 bar)	174 psig (12 bar)	45 psi (3.1 bar)
CVP-H	363 to 754 psig (25 to 52 bar)	386 psig (26.6 bar)	20.3 psi

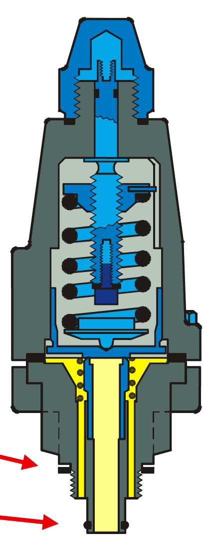
* one revolution increases the pressure by this amount

Prior CVP Valves

CVP - LP



CVP - HP



Gasket

O-ring

Adjustment

Discontinued Pilot Valve type/range	1 rev. turn*
CVP-LP range: 0 to 102 psig	14.5 psi
CVP-HP range: 20" to 102 psig	7 psi
CVP-HP range: 58 to 319 psig	20.3 psi
CVP-HP range: 58 to 406 psig	29 psi
CVP-XP range: 363 to 754 psig	119 psi

* one revolution increases the pressure by this amount

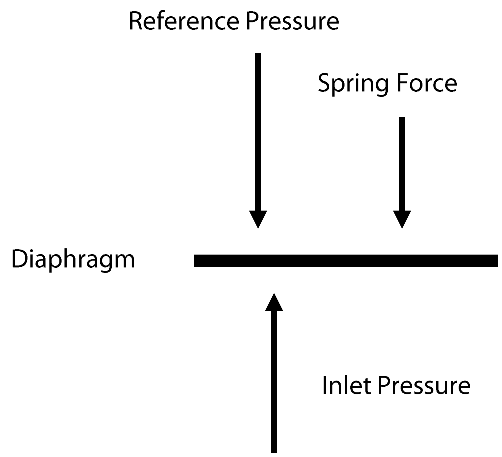
Differential Pressure Regulating Pilot

CVPP-L
CVPP-M

This can be loosened to turn and align the external connections with the customer supplied reference tubing that must be installed.

Connections on pilot are G ¼" thread (European) so ¼" FPT adapter (027B2062) and aluminum gasket should be used.

Working Principal



Adjustment for current Pilot Valves

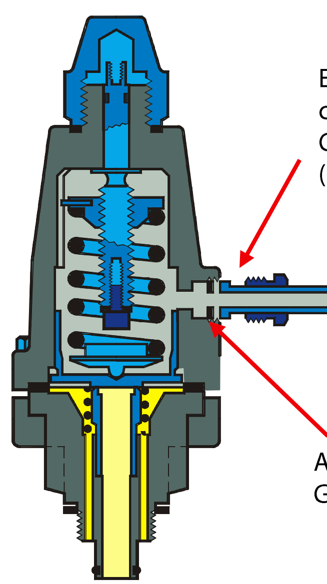
Type	Range	Approx. Factory Setting	1 rev. turn*
CVPP-L	19.5 in. Hg to 102 psig (-0.66 to 7 bar)	10.2 psig (0.7 bar)	14.5 psi (1 bar)
CVPP-M	58 to 406 psig (4 to 28 bar)	110 psig (7.6 bar)	45 psi (3.1 bar)

* one revolution increases the pressure by this amount

Prior CVPP-HP Valves

CVPP – HP Adjustment

Range	1 turn 360° Δ
19.5 in. Hg → 102 psi	6.5 psi
58 psi → 319 psi	20 psi

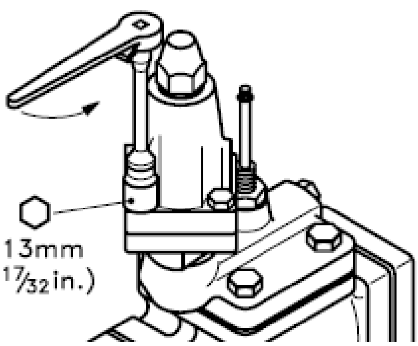


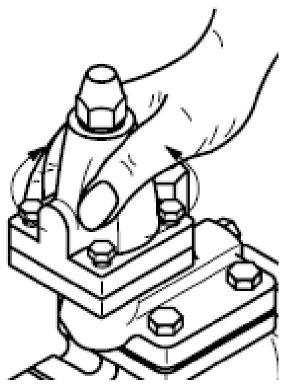
Ext. pressure connection G ¼" thread (European)

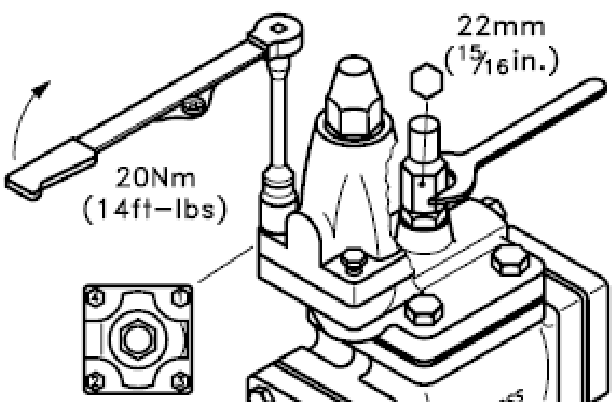
Aluminum Gasket

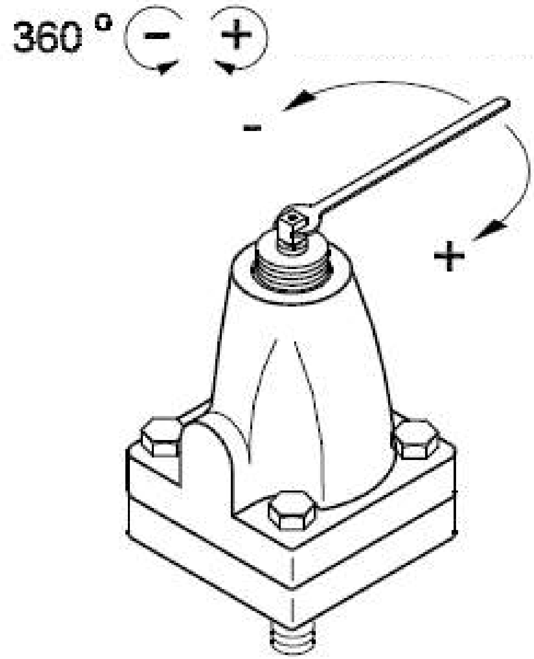
Differential Pressure Regulating Pilot CVPP-HP

The final position of CVPP-HP pilot can easily be changed by slightly loosening the 4 pilot bolts allowing the pilot to be turned to a different final position. This can give a better position for the external pilot connection.









Outlet Pressure Regulating Pilot

CVC function

Valve opens as the outlet pressure falls. Turning the setting spindle clockwise raises the opening pressure (outlet pressure).

CVC-L
CVC-M

Adjustment for current Pilot Valves

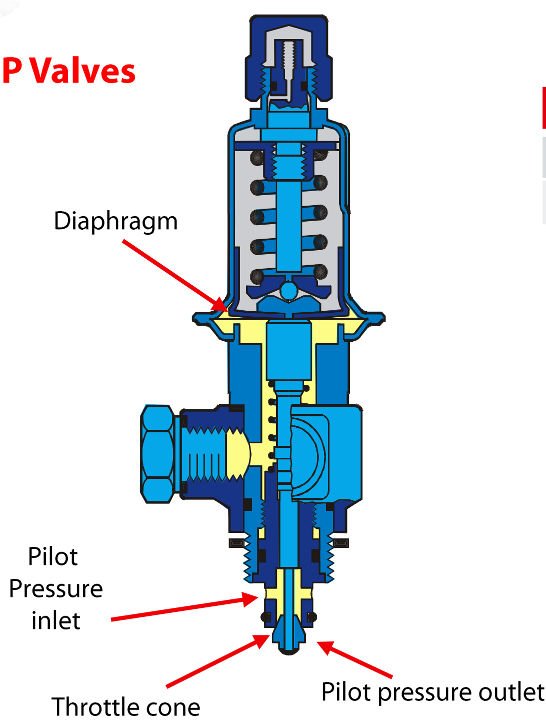
Type	Range	Approx. Factory Setting	1 rev. turn*
CVC-L	19.5 in. Hg to 102 psig (-0.66 to 7 bar)	11.6 psig (0.8 bar)	14.5 psi (1 bar)
CVC-M	58 to 406 psig (4 to 28 bar)	174 psig (12 bar)	45 psi (3.1 bar)

* 1 revolution increases the pressure by this amount

Both external pilot connections reference same pressure and 1 of them must be connected downstream of the valve. The other one is for an optional pressure gauge connection which references the valve outlet pressure where reference line is connected.

Note: Connections on pilot are G ¼" thread (European) so ¼" FPT adapter (027B2062) and aluminum gasket should be used which comes with assembled ICS valve or SNV-ST purge valve with adapter.

Prior CVC-LP/XP Valves



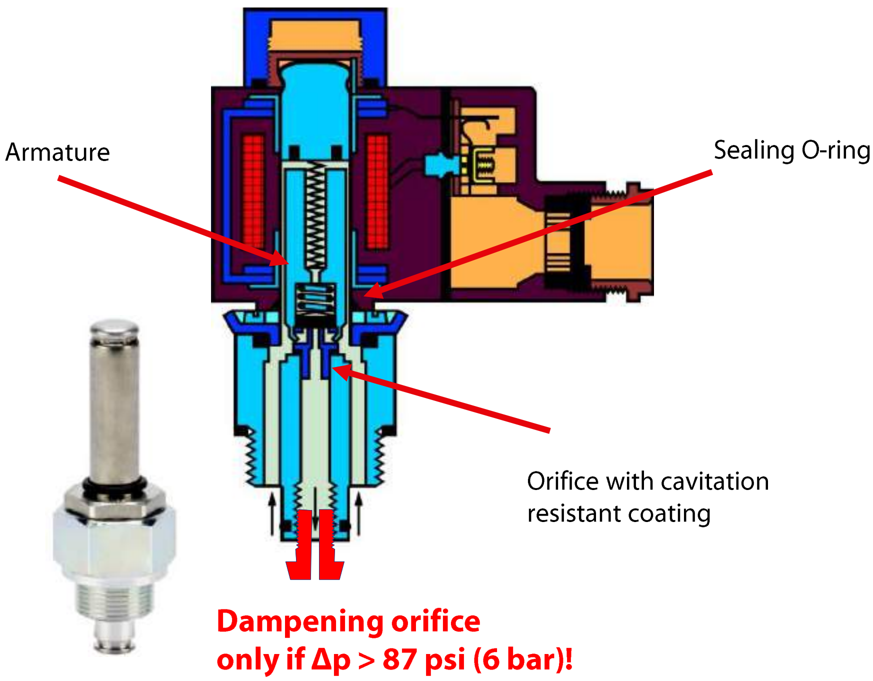
CVC – LP/XP Adjustment

Range	1 turn 360° Δ
13 in. Hg → 102 psig	21 psi
58 psi → 406 psig	43.5 psi

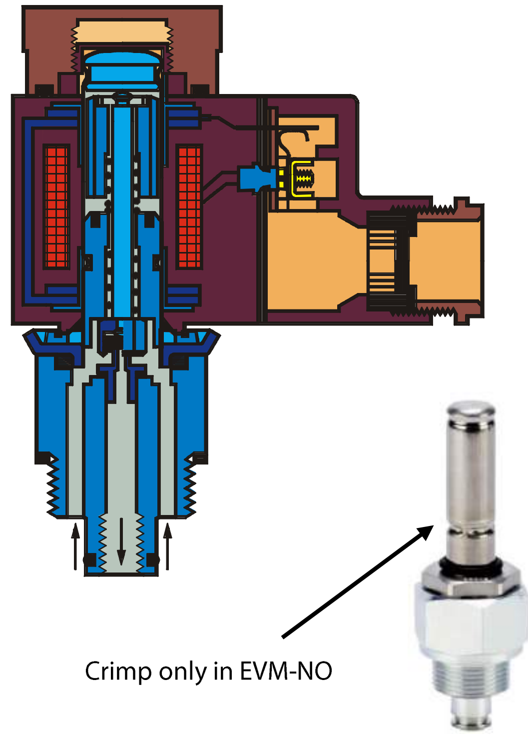
Note: Connections on pilot are G ¼" thread (European) so ¼" FPT adapter (027B2062) and aluminum gasket should be used.

Solenoid Pilots

EVM – NC
(Normally-closed)



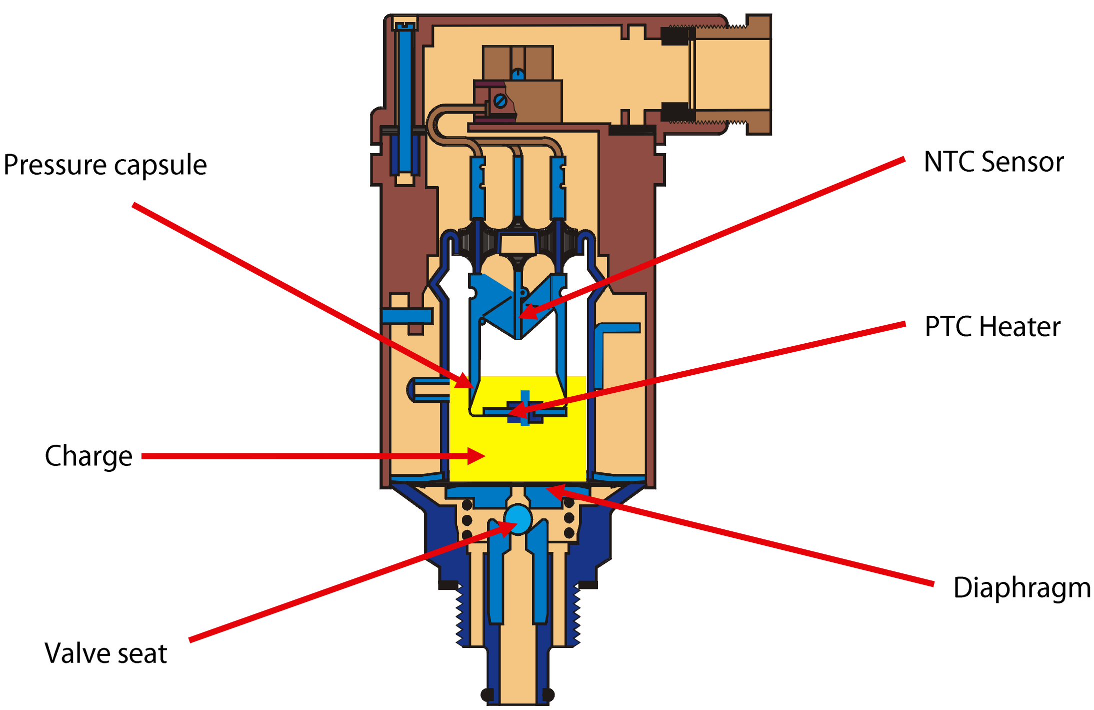
EVM – NO
(Normally-opened)



Electronic Regulating Pilot

Will be discontinued in the near future

CVQ



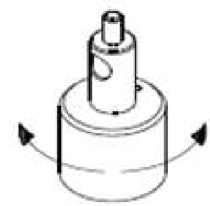
Note: CVQ pilots can only be mounted within a 23 degree angle from the vertically upward position.

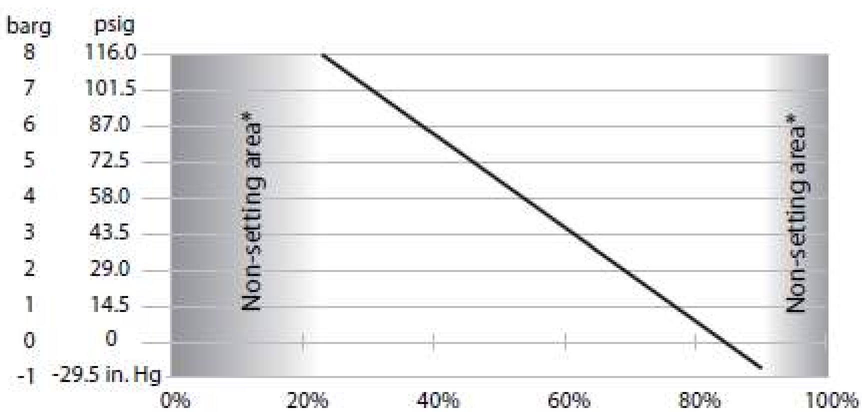
New CVE

Motorized Pilot Valve Plus ICAD 1200A for Inlet Pressure Regulation

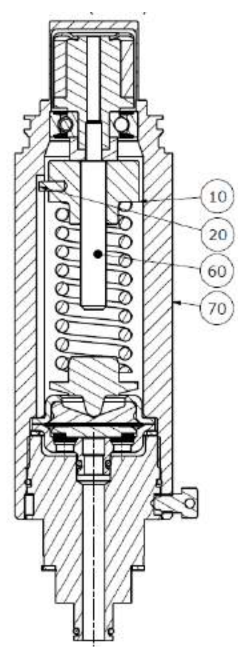
Specifications and features

- Max. working pressure: 754 psig (52bar)
- Regulation range:
  - 19 in Hg to 116 psi (-0.66 to 8 bar)
- Based on a motorized concept, which is well known in the market
- 4-20mA input signal, which can be operated directly from a PLC
- Fail-safe motorized valve by using a solenoid pilot in ICS for mechanical CVP pilot backup
- Fast and precise regulation
- Stainless steel housing





* These areas are dedicated regulation band for the pilot. It is recommended not to exceed the limits in above table



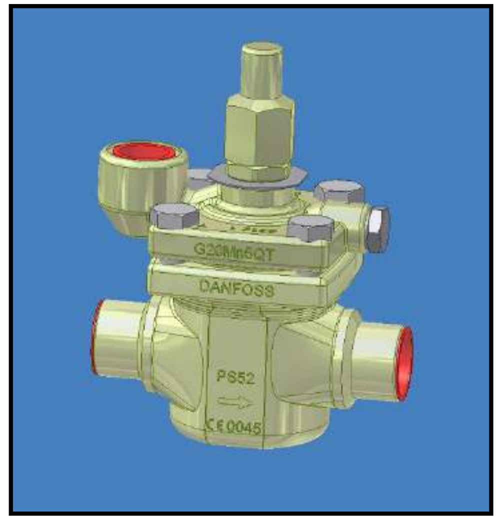
barg	-0.66	0	1	2	3	4	5	6	7	8
psig	19.5 in. Hg	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0
mA	18.3	17.1	15.9	14.7	13.5	12.3	11.1	9.9	8.7	7.5
ICAD reading %	90%	83%	75%	67%	60%	53%	45%	37%	30%	23%

ICS Sizes and Connections

Type	Valve Body size	Port Size	Standard Connection Sizes
ICS25-5	25	3/16″	¾″, 1″, 1-1/4″
ICS25-10		3/8″	
ICS25-15		½″	
ICS25-20		¾″	
ICS25-25		1″	
ICS32	32	1-1/4″	1-1/4″, 1-1/2″
ICS40	40	1-1/2″	1-1/2″, 2″
ICS50	50	2″	2″, 2-1/2″
ICS65	65	2-1/2″	2-1/2″, 3″
ICS80	80	3"	3"
ICS100	100	4"	4"
ICS125	125	5"	5"
ICS150	150	6"	6"

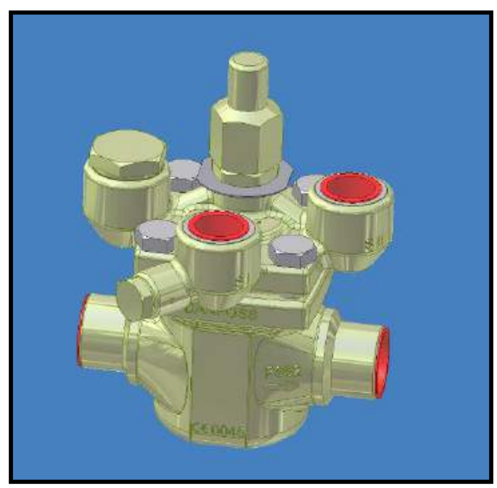
Note: ICS 50-40, ICS 50-32 and ICS 65-40 reduced port modules were created for the large ICF 50 and ICF 65 valve stations but currently complete assembled ICS vales are not available with these modules and they can only be made by ordering from the parts program.

Common Variations



1 Pilot Variations

- ICS Solenoid
- ICS-STD: Inlet Pressure Regulator
- ICS-O: Outlet Regulator
- ICS-L: Differential Regulator
- ICS-M: Motorized Regulator



3 Pilot Variations

- ICS-S: Inlet Pressure Regulator with Electric Shut-off
- ICS-B: Inlet Pressure Regulator with Forced Wide Opening
- ICS-D: Dual Pressure Regulator
- ICS-OS: Outlet Pressure Regulator with Electric Shut-off
- ICS-BL: Differential Pressure Regulator with Forced Wide Opening
- ICS-DM: Motorized Regulation with Mechanical CVP Pilot Backup

ICS - (size) – STD
Standard Inlet Pressure Regulator

Function

Inlet pressure is channeled through inlet passage to the CVP pilot. When the inlet pressure exceeds the set pressure, pilot allows flow to piston to modulate the valve

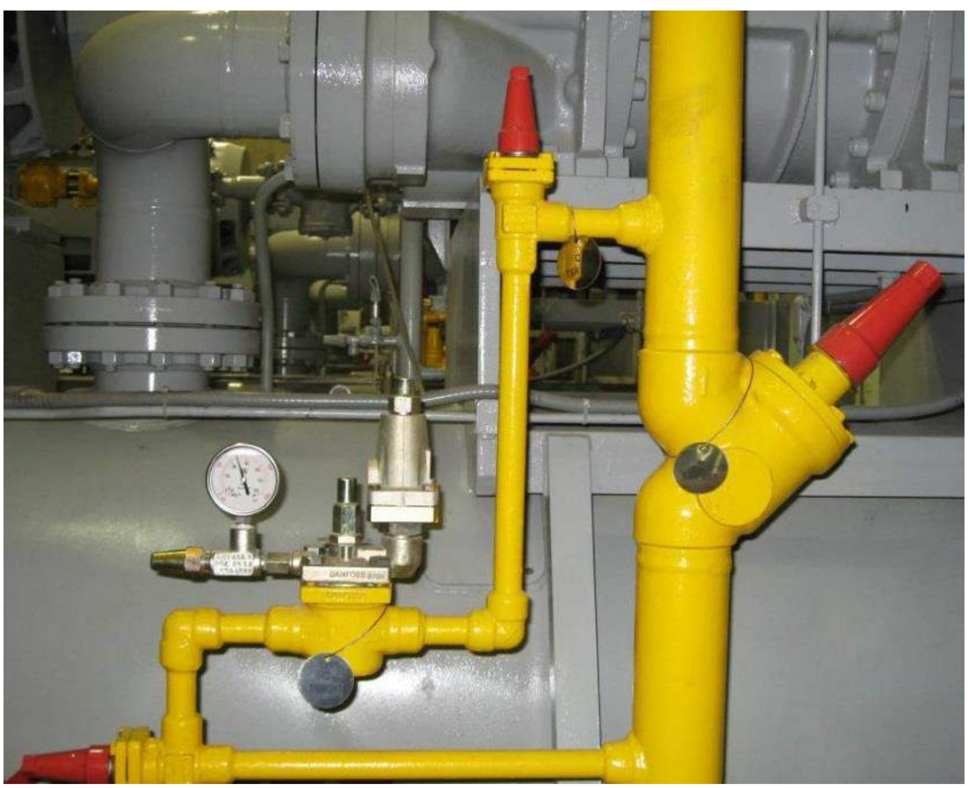
Applications

- Evaporator Pressure Regulation
- Defrost Relief Regulator.

(When used from low pressure to intermediate pressure don't forget to install a check valve downstream)

- Pump relief regulator
- Thermo-siphon relief regulator

Example of ICS25-20 STD used for Thermo-siphon relief regulator



Pressure Gauge Connection

Pressure Gage Connection
An inlet pressure connection is provided on all regulator bodies.

The internal thread of this connection is a straight metric type which makes a seal via an aluminum gasket.

The gage valve kit for the ICS p/n 148B4772 includes a standard ¼"MPTxFPT gauge valve and an adapter with a ¼" FPT outlet thread as shown in the picture.

Note: The top cover can be mounted in any direction and the pressure gauge connection will **<u>always</u>** read valve inlet pressure

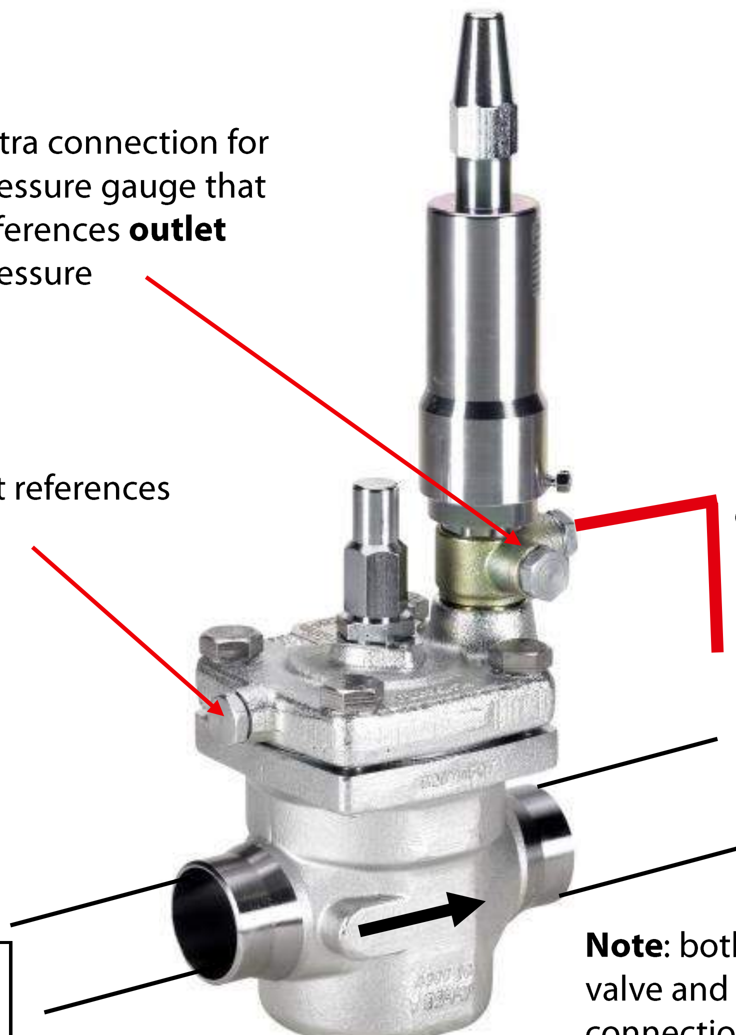
Thread in ICS cover is metric straight thread so and adapter including Aluminum gasket must be installed as shown.

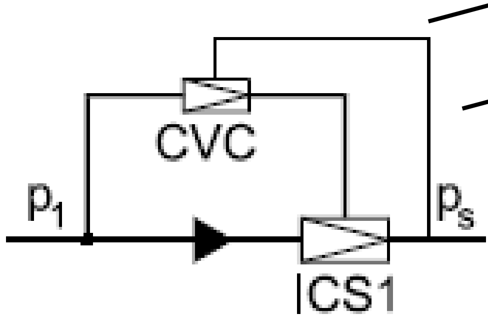
ICS - (size) – O
Outlet Pressure Regulator

Function
CVC pilot reads outlet pressure (via an external line provided by customer) downstream of the valve.

Valve opens and closes according to setting of CVC pilot.

CVC pilot is furnished with a second access port to get outlet pressure reading to a gauge. Both access ports sense the same pressure. Use same adapter that is used for ICS pressure gauge connection.





Note: both connections on pilot valve and pressure gauge connection on ICS are ¼" BSP straight thread so an adapter with aluminum gasket needs to be used to convert to ¼" FPT.

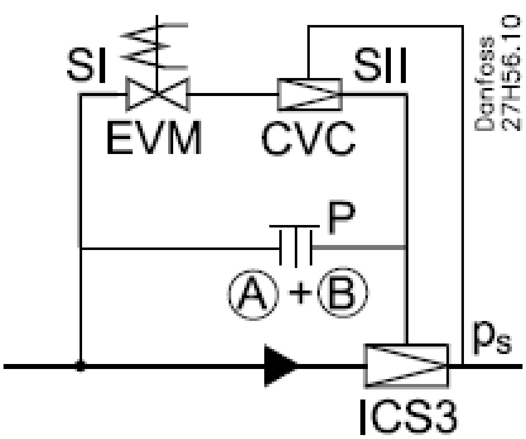
ICS - (size) – OS
Outlet Pressure Regulator with Electric Shut-Off

Function

When coil is energized, the valve will regulate according to the set pressure of CVC pilot which reads outlet pressure (via an external line provided by customer to downstream of valve). When the coil is de-energized, the valve will close.

CVC pilot is furnished with a second access port to get outlet pressure reading to a gauge. Both access ports sense the same pressure. Use same adapter as the ICS pressure gauge port.

External pilot
Reference line
Supplied by customer

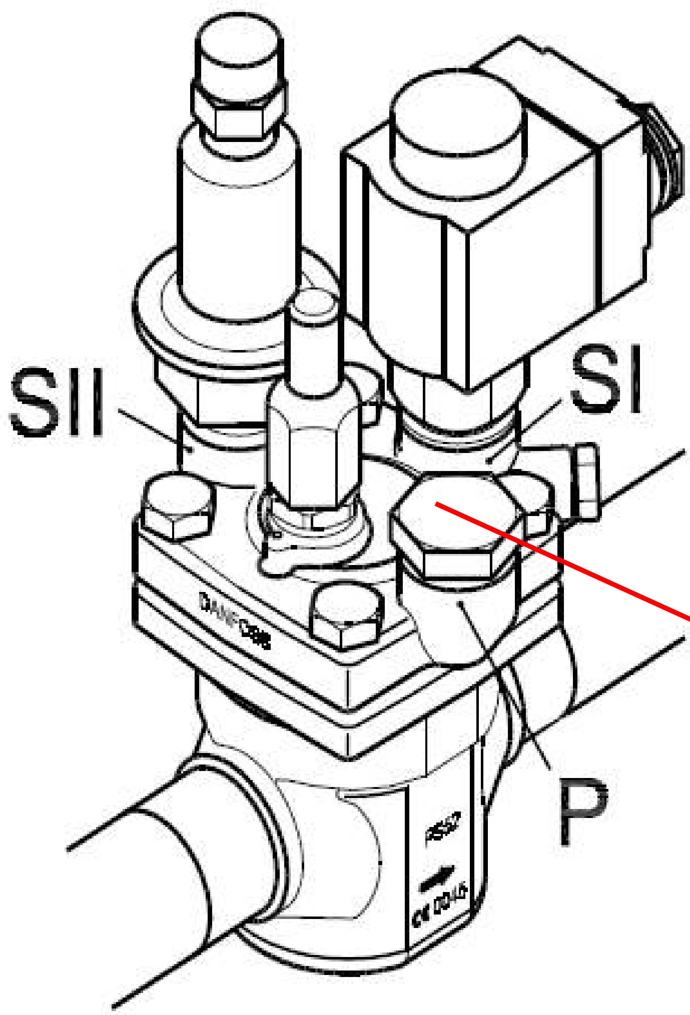


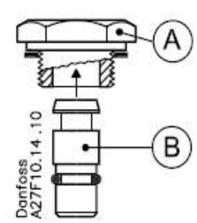
Pilot cap (A) & plug (B) in "P" port

Note: both connections on pilot valve and pressure gauge connection on ICS are ¼" BSP straight thread so an adapter with aluminum gasket needs to be used to convert to ¼" FPT.

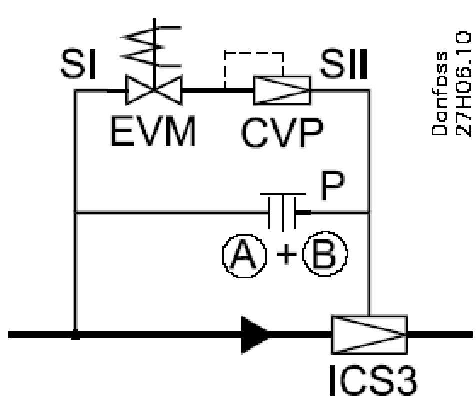
ICS - (size) - S
Inlet Pressure Regulator with Electric Shut-Off

Function
When coil is energized, the valve will regulate according to the set pressure. When the coil is de-energized, the valve will close.





Pilot cap A + Blanking plug B

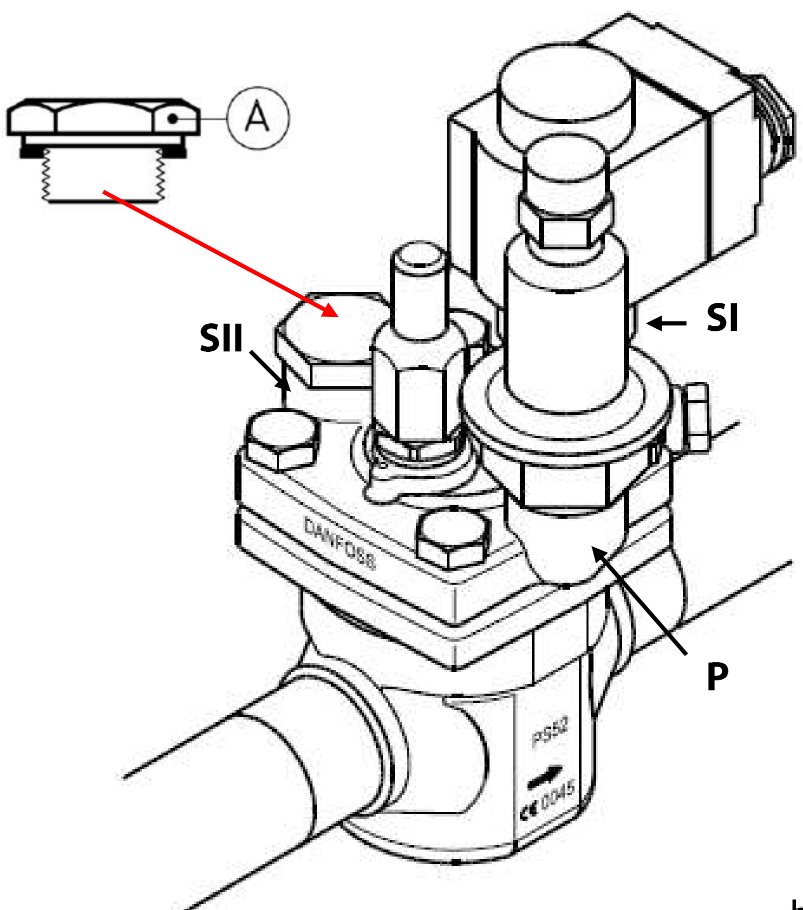


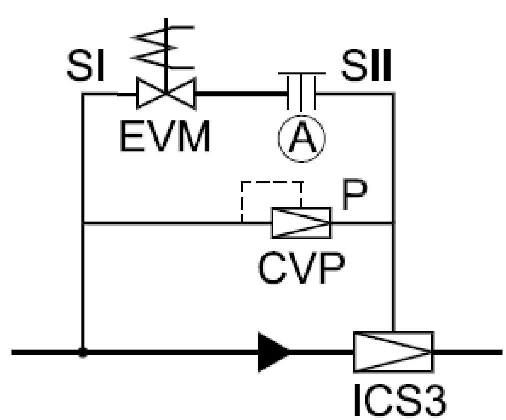
ICS - (size) - B

Inlet Pressure Regulator with Forced Wide Opening

Function

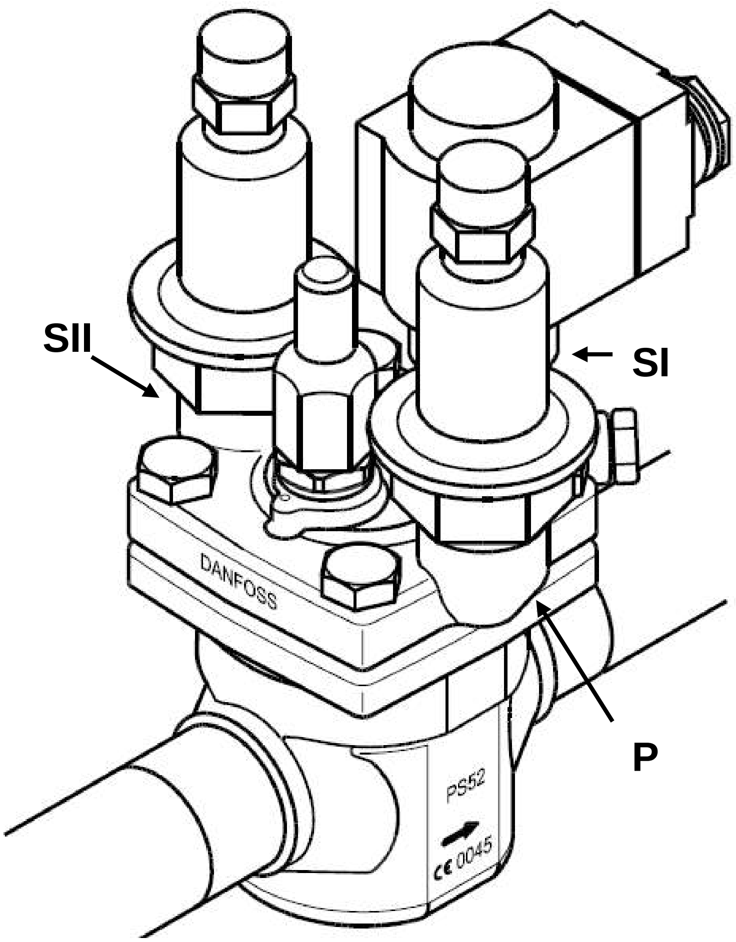
When coil is energized, the valve will allow full flow (forced wide-opening). When the coil is de-energized, the valve will regulate according to the set pressure.

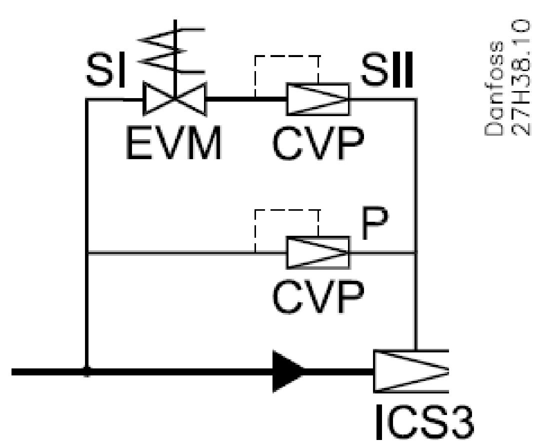




ICS - (size) - D
Dual Pressure Regulator

Function
When coil is energized, the valve will regulate according to the lower set pressure. When the coil is de-energized, the valve will regulate according to the higher set pressure which must be the pilot located in the P port.



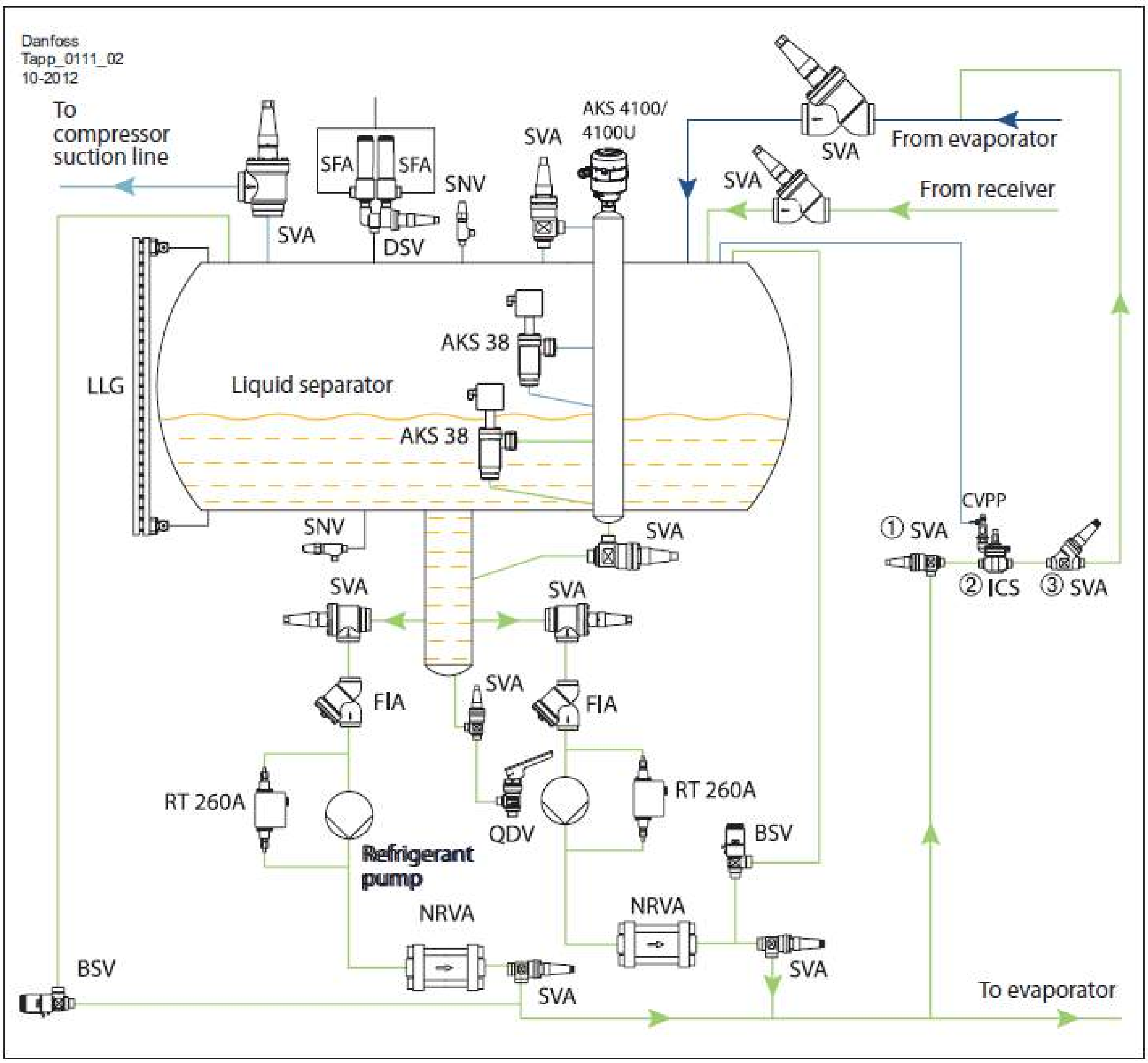


Note: The pilot in the P port must be the higher set pressure

ICS - (size) - L Application Example
Differential Pressure Regulator for Pump Pressure Control
Dual Pressure Regulator

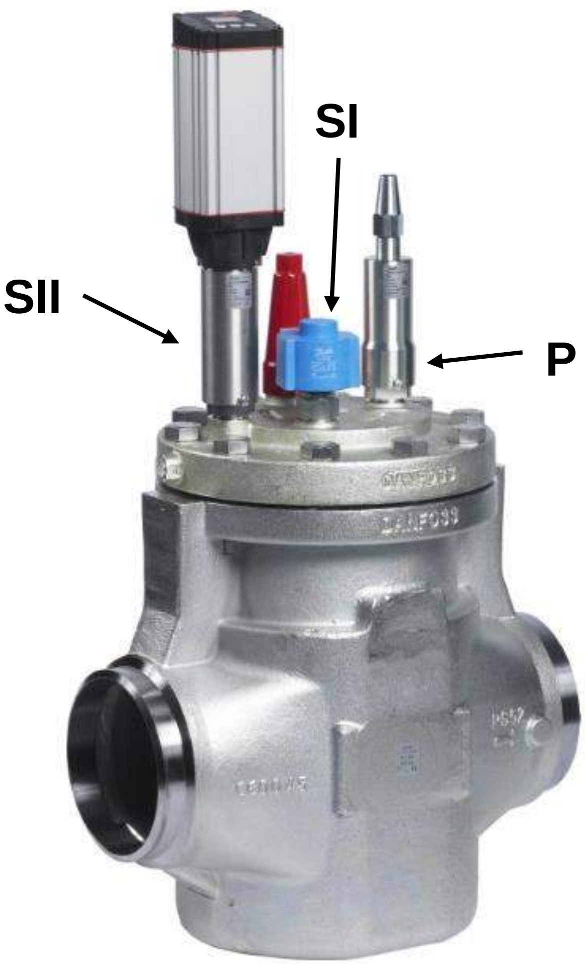
Function
Provides a stable pump pressure and recirculation ratio going to evaporators

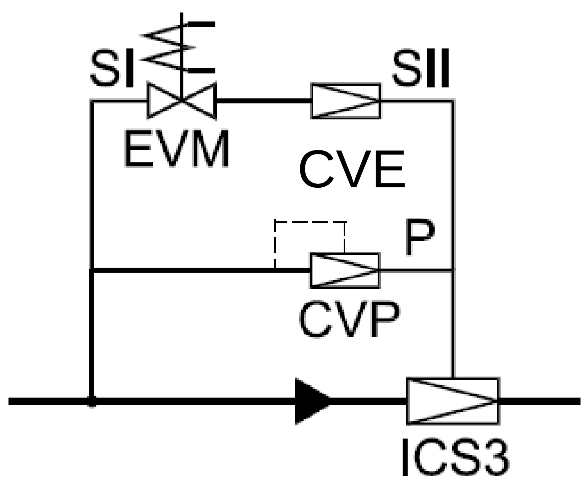
Note: external pilot reference line is supplied by customer which is usually installed downstream of valve. The connection on pilot is ¼" BSP straight thread so an adapter with aluminum gasket needs used to convert to ¼" FPT which is supplied with assembled valve.



ICS - (size) – DM Which Replaced Old JD Configuration
Electronic Regulator with Mechanical CVP pilot

Function
When coil is energized, the valve will be controlled by the electronic pilot. When the coil is de-energized, the valve will regulate according to the set pressure of the mechanical CVP pilot, which must be set higher than the operating range of the electronic regulating pilot.





ICS - (size) - OBS

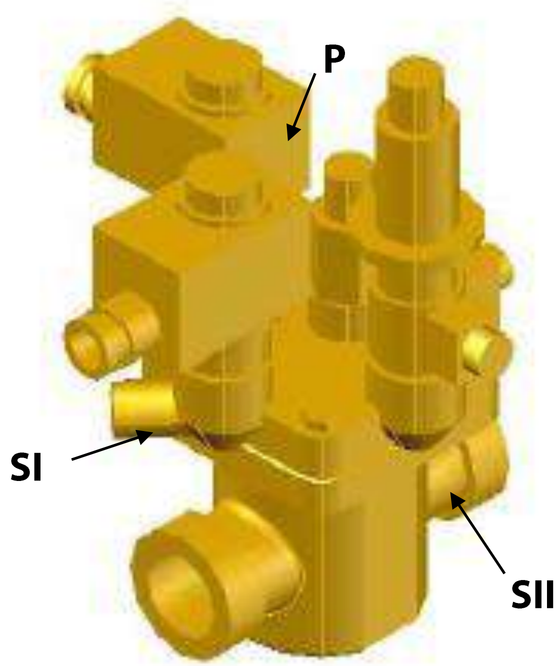
Outlet Pressure Regulator with Forced Wide-Open and Shut-Off Feature

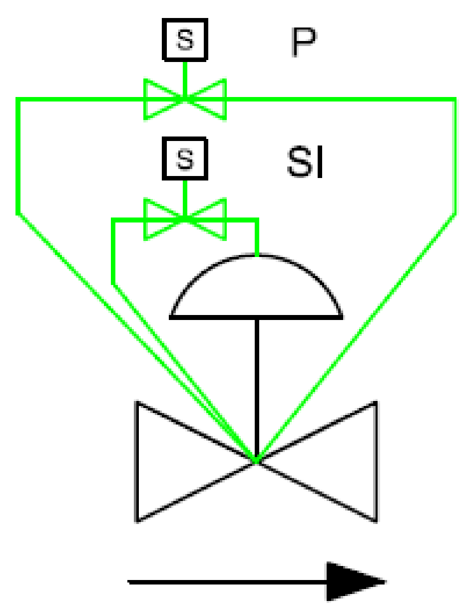
Function

When both solenoids are de-energized, no refrigerant will pass through the valve.

When the SI port solenoid is energized, refrigerant will pass through the valve according to the pressure set by the outlet pressure regulator (downstream of the valve).

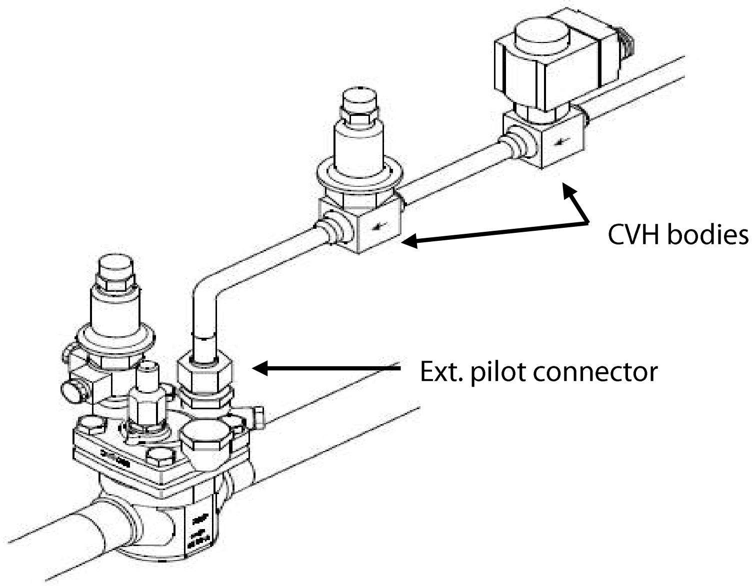
When the SI port solenoid is de-energized and the P port solenoid is energized, the valve will fully open.

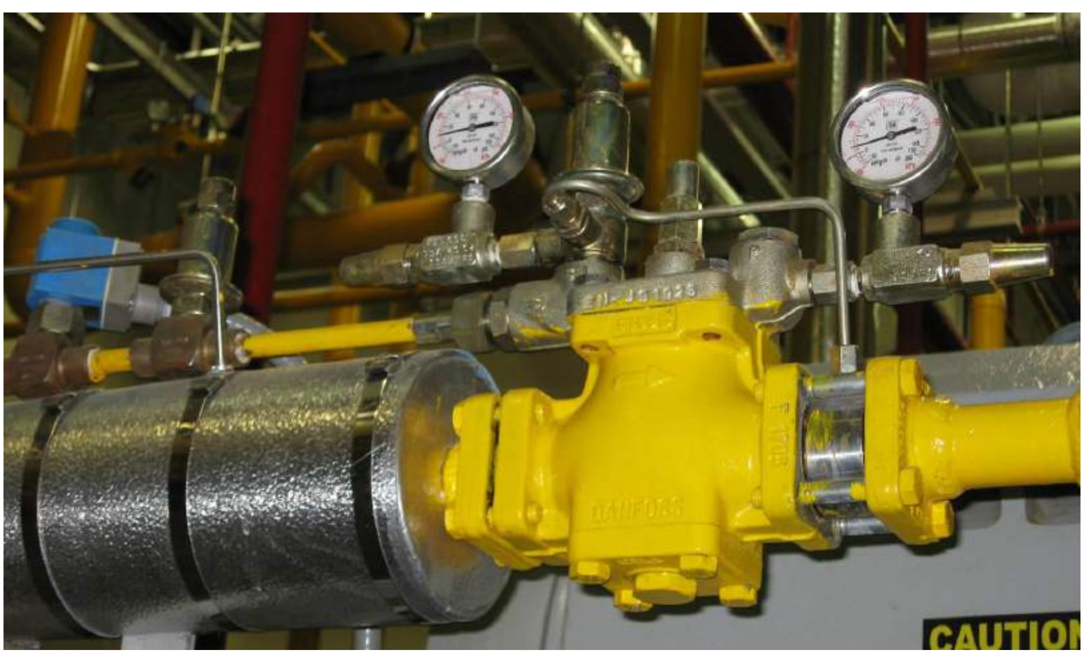




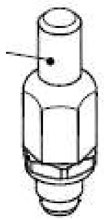
Applications with external pilots
Example of Inlet and Outlet Regulator with Forced Closing

Special applications may require the use of external pilots. In these applications, an external pilot connector and CVH bodies for pilot valves are used.



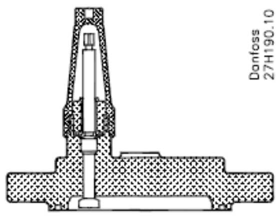


Operation of Manual Stem



ICS25 to 80

¾″ to 3″



ICS100 to 150

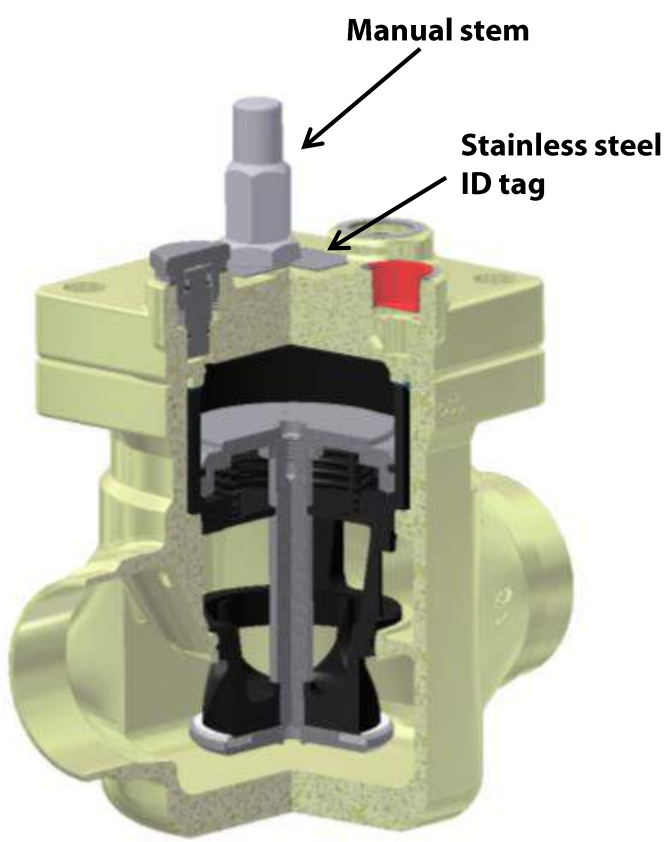
4″ to 6″

Automatic Mode:

- Spindle all the way out
  (Turn counter clockwise)

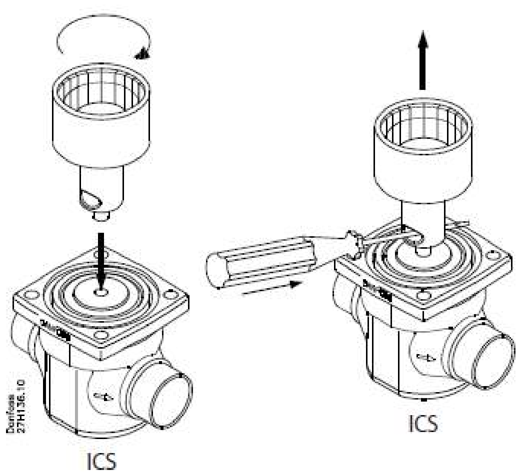
Manual Mode:

- Spindle all the way in
  (Turn clockwise)
- Important! During auto mode, spindle should be backseated. Be sure to replace cap

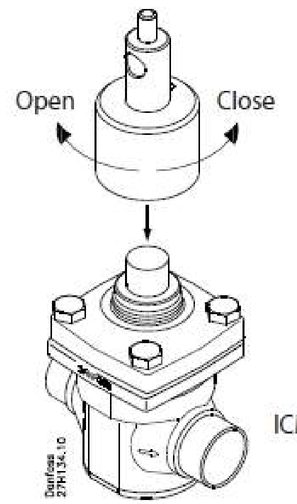


Multi-Function Tool

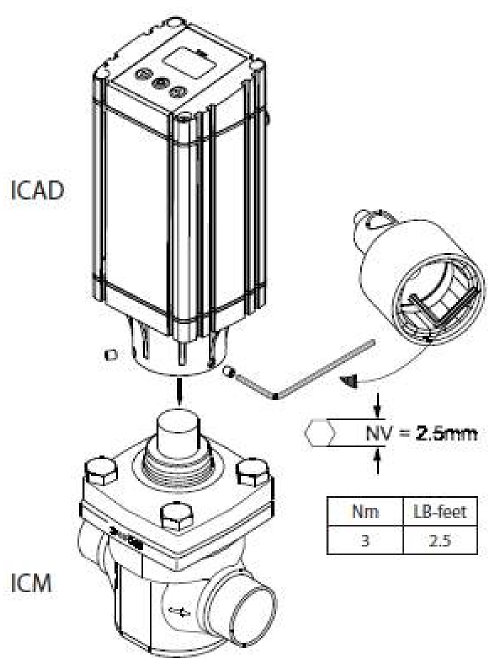
Removing the ICS function module



Manually open/close ICM w/o ICAD

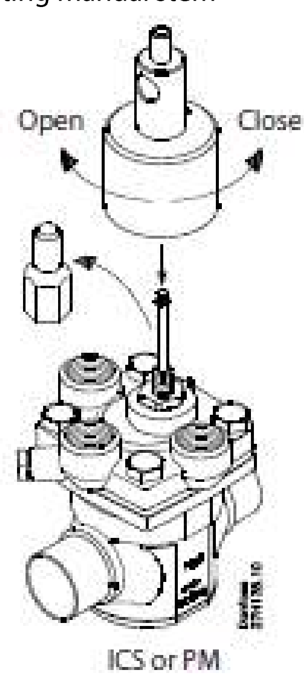


Mounting ICAD on ICM valve



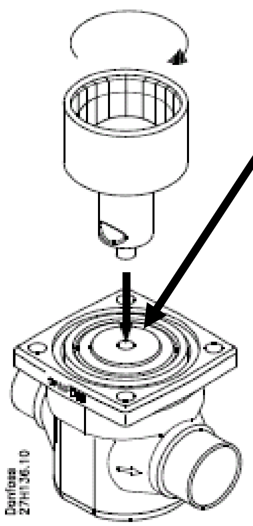
Nm	LB-feet
3	2.5

Operating manual stem

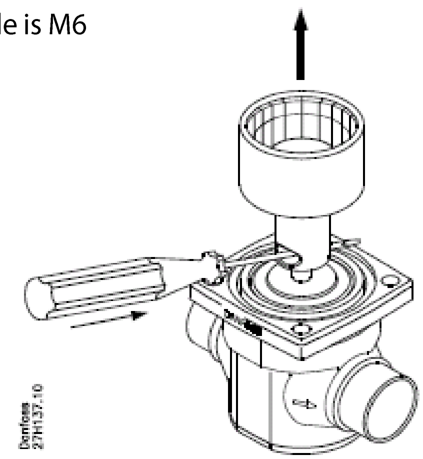


ICS Installation and Service

Important!
For ICS sizes 80 and down it is required to weld in the valve body **without** the function module installed.

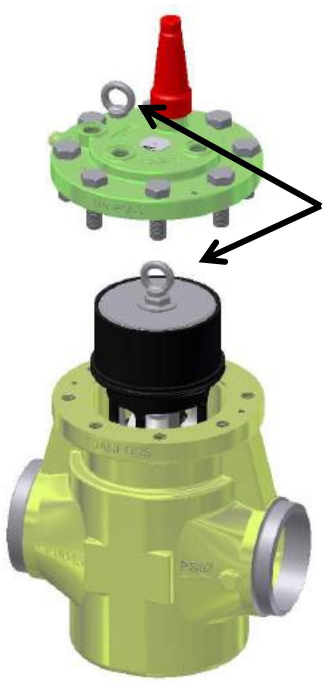


Thread in ICS module is M6



An eyebolt with M6 thread is included with every complete ICS valve or spare part function module for sizes 80 and down.

For ICS sizes, 100, 125 and 150 (4", 5" and 6") the complete valve can be welded into the system w/o disassembling and removing the function module.



If needing to remove the function module, the eyebolt can be used from the top cover

ICS Spare Parts

ICS Inspection kit (gasket set) – Includes all gaskets and O-rings.

Valve type	
ICS / ICM / ICLX	Inspection kit code number
Size	
25*	027H2218
32	027H3016
40	027H4014
50	027H5014
65 / 80	027H6016
100	027H7191
125	027H7194
150	027H7196

* ICS and ICM only

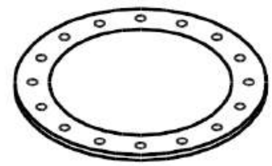
Repair Kit – Includes all gaskets, O-rings, **valve seat** and piston ring.

NOTE: Only ICS function modules manufactured after April, 2012 can be taken apart to replace the valve seat and piston ring

Valve type	
ICS / ICLX	Repair kit code number
Size	
25**	027H2219
32	027H3017
40	027H4015
50	027H5015
65 / 80	027H6017
100	027H7192
125	027H7204
150	027H7197

** ICS only

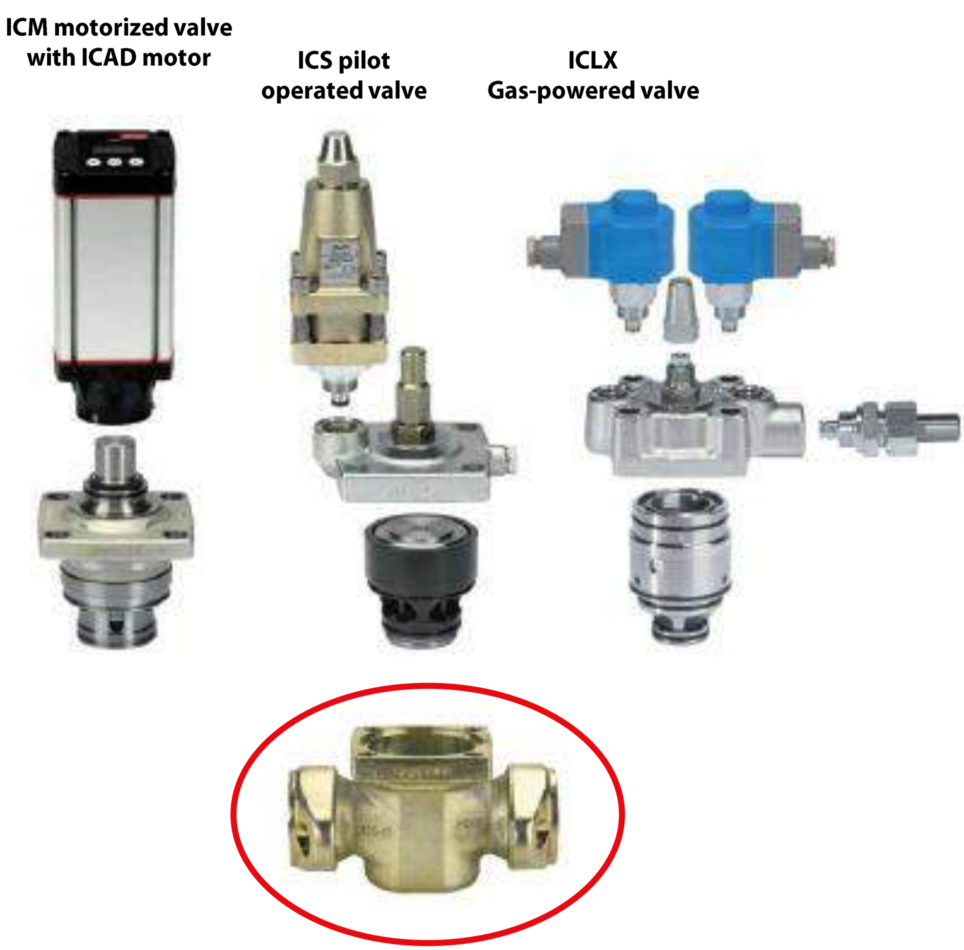
Replacement ICS Function module – Includes complete function module (all wear parts), top cover gasket and module O-rings.



Note: module size is marked on the piston

NEW Flanged ICV Valve Bodies
Can Upgrade the Following:

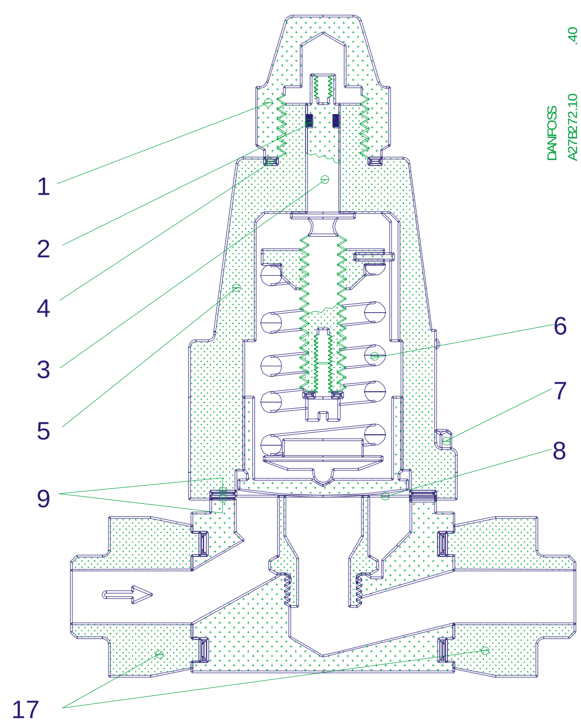
- Danfoss valves
  - PM Regulators or Solenoids
  - MEV/MRV motorized valves
  - PML/PMLX gas-powered valves
- Hansen valves
  - HS4A
  - HA4A
  - HMMR/HMMV
- R/S Parker valves
  - S4A
  - A4A



Common valve body for all configurations

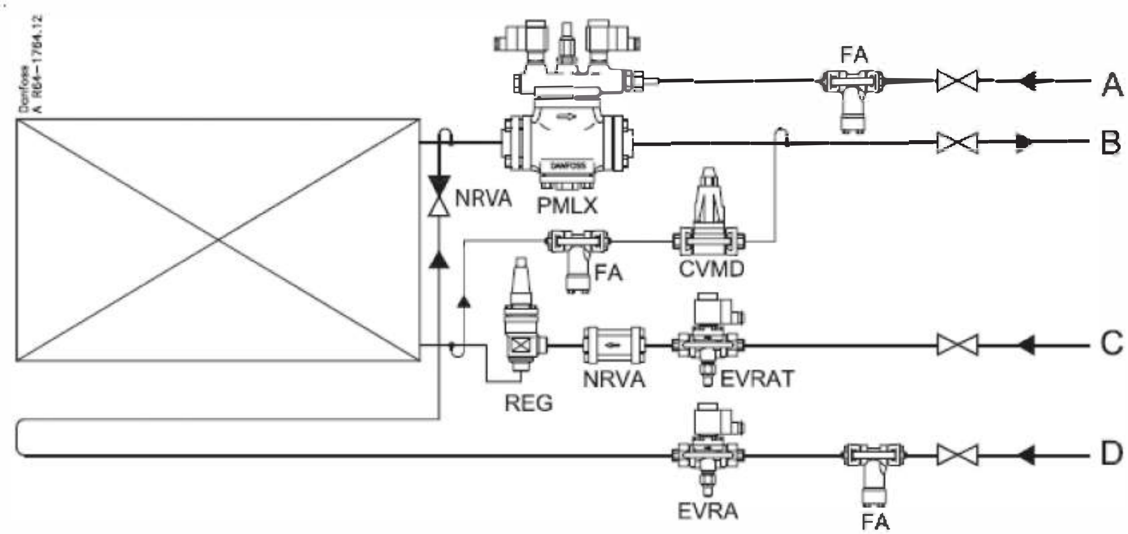
Small Regulators Type CVMD

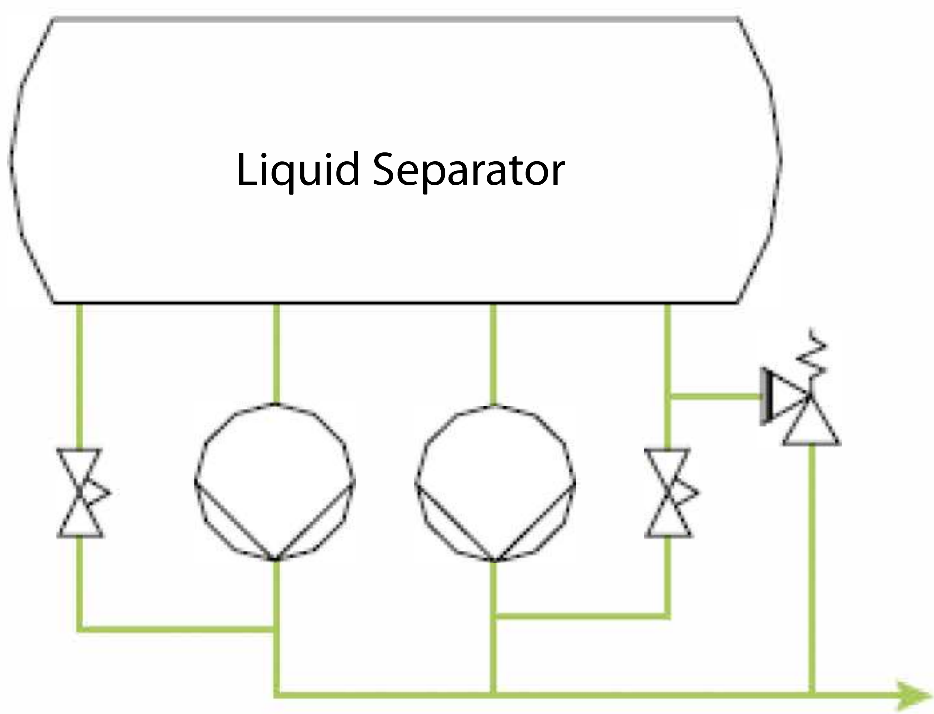
- Available with ½″ or ¾″ flanges
- Range: 0 to 102 psig



CVMD Application Examples

Hot gas defrosting of evaporator with pump circulation

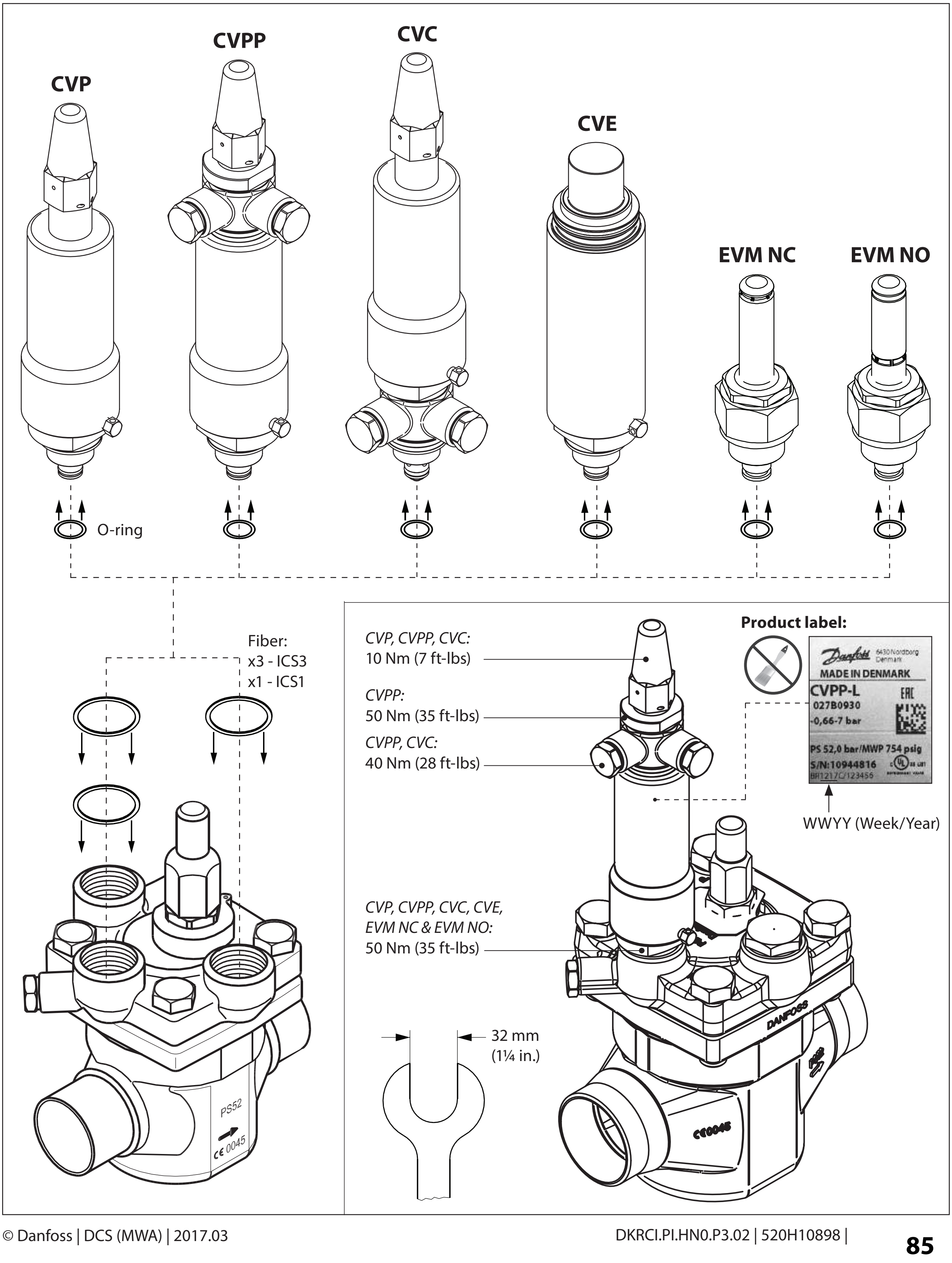




Installation guide

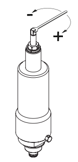
Pilot valves
CVP, CVPP, CVC, CVE and EVM

027R9594



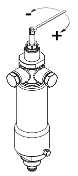
027R9594

CVP



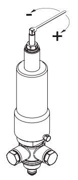
Range	Range	Factory setting	1 Rev (360°) ~
-0.66 → 7 bar	19.5 in Hg → 102 psig	~ 0.8 bar/11.6 psig	1 bar/ 14.5 psig
4 → 28 bar	58 → 406 psig	~ 12 bar/174 psig	3.1 bar/ 45 psig
25 → 52 bar	363 → 754 psig	~ 26.6 bar/386 psig	4.1 bar/ 59.5 psig

CVPP



Range	Range	Factory setting	1 Rev (360°) ~
-0.66 → 7 bar	19.5 in Hg → 102 psig	~ 0.7 bar/10.2 psig	1 bar/ 14.5 psig
4 → 28 bar	58 → 406 psig	~ 7.6 bar/110 psig	3.1 bar/ 45 psig

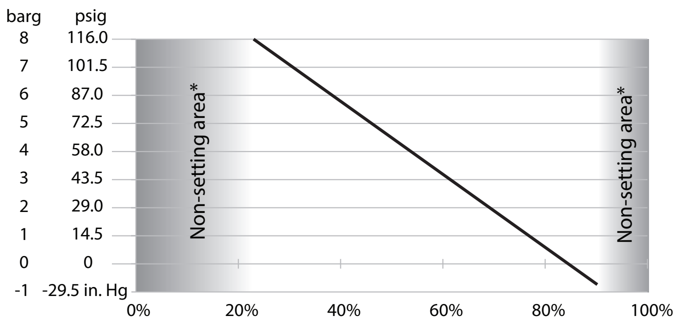
CVC



Range	Range	Factory setting	1 Rev (360°) ~
-0.66 → 7 bar	19.5 in Hg → 102 psig	~ 0.8 bar/11.6 psig	1 bar/ 14.5 psig
4 → 28 bar	58 → 406 psig	~ 12 bar/174 psig	3.1 bar/ 45 psig

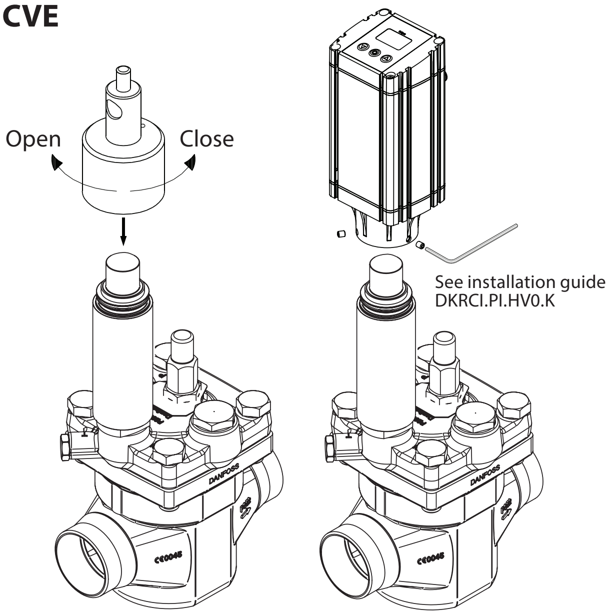
CVE Pressure setting (see DKRCI.PI.HVO.J for ICAD setup)

barg	-0.66	0	1	2	3	4	5	6	7	8
psig	19.5 in. Hg	0	14.5	29.0	43.5	58.0	72.5	87.0	101.5	116.0
mA	18.3	17.1	15.9	14.7	13.5	12.3	11.1	9.9	8.7	7.5
ICAD reading %	90%	83%	75%	67%	60%	53%	45%	37%	30%	23%

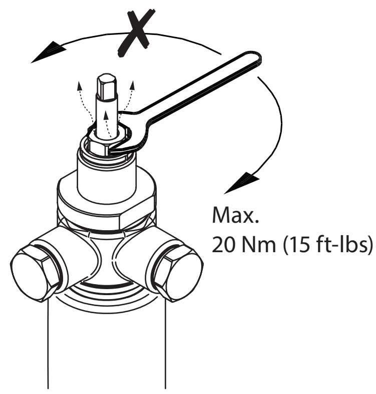


* These areas are dedicated regulation band for the pilot. It is recommended not to exceed the limits in above table

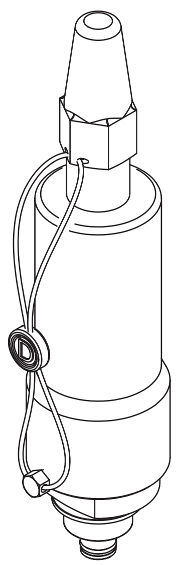
CVE



Packing gland leak tightening (CVP, CVPP & CVC)



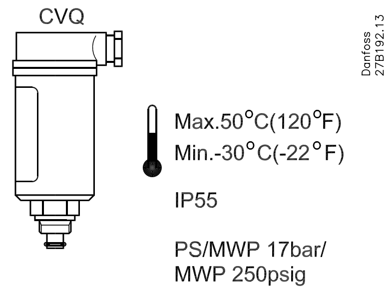
Valve sealing



Installation Guide

Pilot valve
CVQ

027R9626



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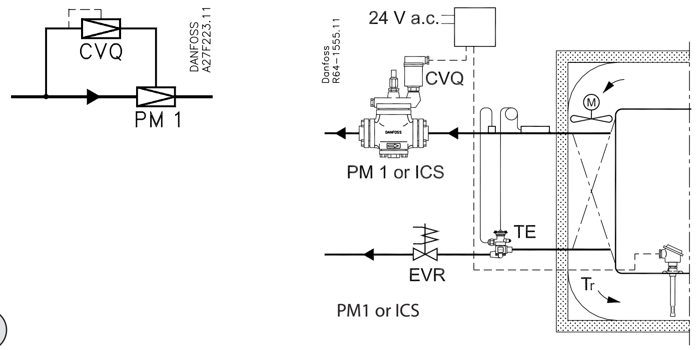

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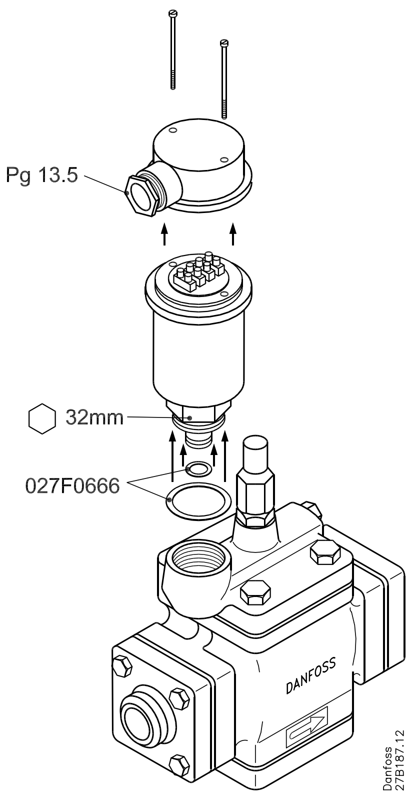

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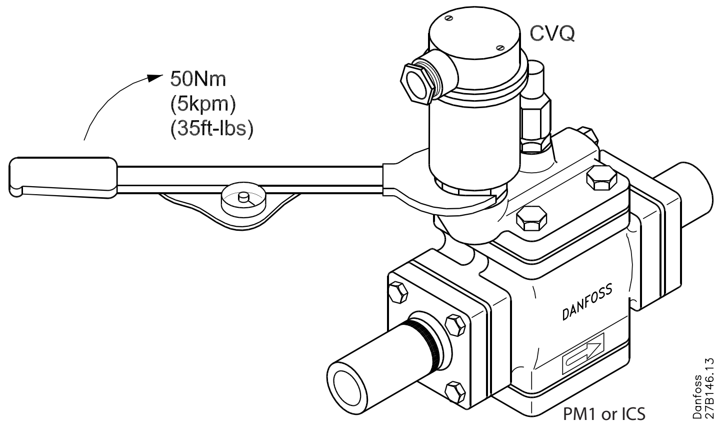

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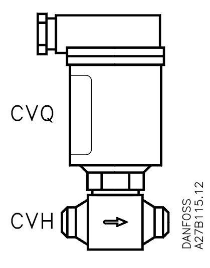

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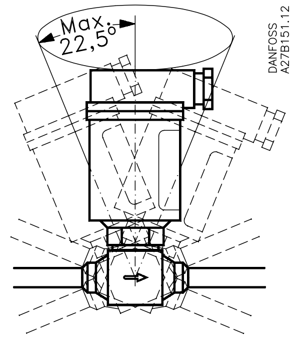


6

027R9626

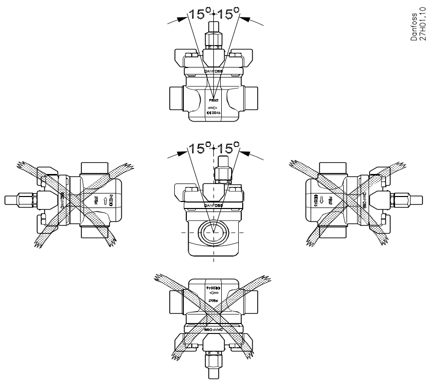
c UL us LISTED

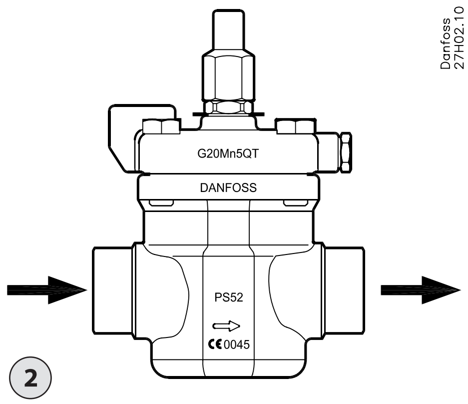
The following text is applicable to the UL listed products CVQ
Applicable to all common non-flammable refrigerants, including/excluding (+) R717 and to non-corrosive gases/liquids dependent on sealing material compatibility (++). The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. (+++).

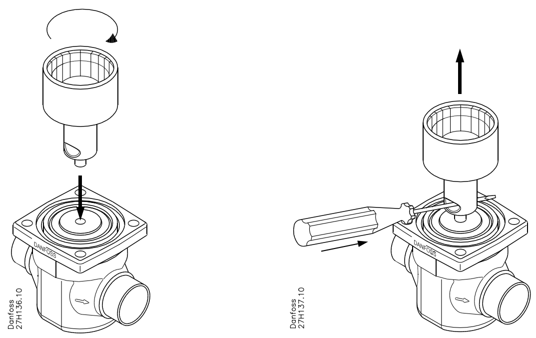
Installation Guide

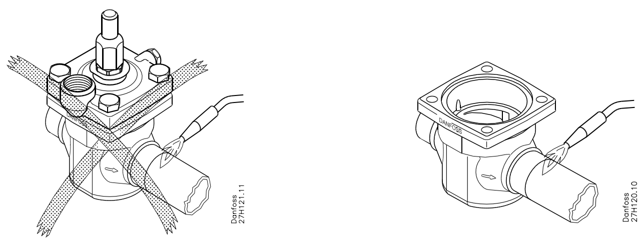
Pilot operated servo valve ICS 25-80

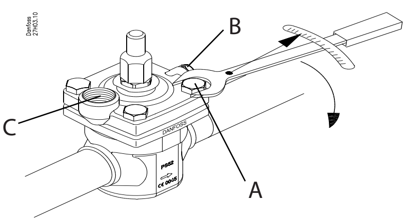
027R9775





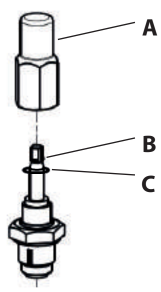


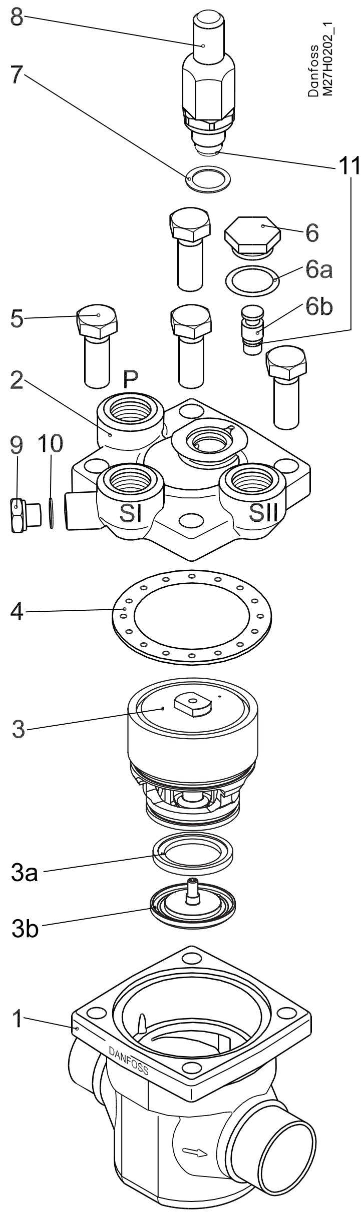




	Valve body size	Nm	ft lb
Pos. Rep. A	25	100	74
	32	120	88
	40	120	88
	50	140	103
	65	150	110
Pos. Rep. B	25	25	18
	32		
	40		
	50		
	65		
Pos. Rep. C	25	50	37
	32		
	40		
	50		
	65		

6





ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717(Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended.
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+120°C (–76/+248°F)

Pressure range
The valves are designed for a max. working pressure of 52 bar g (754 psi g).

Technical data
The ICS can be used in suction, liquid, hotgas and liquid/vapor lines. The ICS regulates the flow of the medium by modulation or on/off function, depending on the control impulse from the screwed on pilot valve or valves.

Regulating range
Dependent on the chosen type and combination of pilot valves.

Opening differential pressure (p)
The ICS main valve requires a minimum opening differential pressure of 0.07 bar (1 psi) to begin to open and 0.2 bar (3 psi) to be completely open.

The valve must be protected against back pressure. A check valve should be installed upstream of the ICS in installations where there is a risk of back pressure. Back pressure can affect the correct position of the piston ring.

Design (fig. 4)
1. Body
2. Top cover
3. Function module
3a Valve plate (Teflon) (available as spare part)
3b Washer plate
4. Gasket
5. Bolts
6. Plug
7. Gasket
8. Manual operating spindle
9. Plug
10. Gasket

Installation

The valve must be installed with the spindle in vertically upwards position (fig. 1).

The valve must be installed with the arrow in the direction of the flow and the top cover upwards (fig. 2). The top cover can be rotated 4 X 90° in relation to the valve body.
The valve is fitted with a spindle for manual opening. If an external pilot valve is used, the pilot line must be connected to the upper side of the main line so that any dirt and oil from the plant will not find its way into the pilot line.
If the ICS 1 is to be used as a solenoid valve in a liquid line, external control pressure cannot be recommended because it can cause liquid hammer.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 3, 4 and 5)
The top cover (fig. 4, pos. 2) and function module (fig. 4, pos. 3), must be removed before welding to prevent damage to o-rings and teflon (PTFE) in the function module and to avoid getting welding debris in the module.
The function module can be lifted out using a bolt size M6 or multi-function tool screwed into the threaded hole of the piston on the function module (fig. 3). Debris blocking the bolt hole will need cleaning.

Note: Remove all parts from the valve body before welding (as shown in fig. 5).

The internal surfaces and weld connections of the enclosed ICS/ICM valve have been applied with an anti-corrosion treatment.

In order to maintain the effectiveness of this anti-corrosion treatment, it is important to ensure that the valve is disassembled just prior to the welding / brazing process being undertaken.

In the event that the function modules are to be left disassembled for any length of time, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be welded to the valve body. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

The valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the o-rings are intact before replacing the function module. If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings. Check that the top gasket has not been damaged. If the surface has been damaged or the gasket has been bent, it must be replaced.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Colours and identification
The ICS valves are Zinc-Chromated from factory. The Zinc-Chromatization does not cover the welding connections. If further corrosion protection is required, the valves can be painted. Precise identification of the valve is made via the ID plate on the top cover.
The external surface of the valve housing must be protected against corrosion with a suitable top coating after installation involving welding and consequent assembly.
Protection of the ID plate when painting the valve is recommended.

Maintenance

Service
The ICS valves are easy to dismantle.
Do not open the valve while the valve is still under pressure.

Pressure relief can be done by carefully opening the manual operating spindle. Small grooves along the thread will release refrigerant into open air. This operation must only be done after providing the correct countermeasures under local legislation.
The function module can be lifted out using a bolt size M6 screwed into the threaded hole of the piston on the function module (fig. 3). Debris blocking the bolt hole will need cleaning.

Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged. A valve with a damaged o-ring might not modulate according to the specification.
- Check that the piston and cylinder is free of scratches and look for wear marks. If the wear is excessive the function module should be replaced to prevent false pilot signal around the piston ring.
- Check that the movement of the cylinder and valve seat is free and with low friction.
- If the teflon valve plate is damaged it must be replaced. It is available as spare part:

Type	Code number
ICS 25 repair kit	**027H2219**
ICS 32 repair kit	**027H3017**
ICS 40 repair kit	**027H4015**
ICS 50 repair kit	**027H5015**
ICS 65 repair kit	**027H6017**
ICS 80 repair kit	**027H6017**

For mounting instructions please see DKRCI.PI.HS0.D.

Assembly
Remove any dirt from the body before the valve is assembled. Check that all channels in the valve are not blocked by particles or similar.
If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Note:
Always pay attention to the spindle during operation of the manual opener (see fig 7)
1. Make sure that the C-clip (**C**) is positioned on the spindle (**B**) and is intact. A new C-clip is available in the inspection kit for the valve.
2. Pay attention to the C-clip reaching the top nut of the packing gland when turning the manual stem clockwise for opening the valve. **Never use excessive torque and stop turning when the C-clip gets in contact with the top nut.**
3. When turning the spindle (**B**) anticlockwise, for deactivation of the manual opener, to the top point, tighten the spindle further anticlockwise to 8 Nm (5.9 lb/ft) torque.
4. Remount the cap (**A**) and tighten it clockwise to 8 Nm (5.9 lb/ft) torque.

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.
In cases of doubt, please contact Danfoss.

Drawings are only for illustration, not for dimensioning or construction.

Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

C UL US LISTED

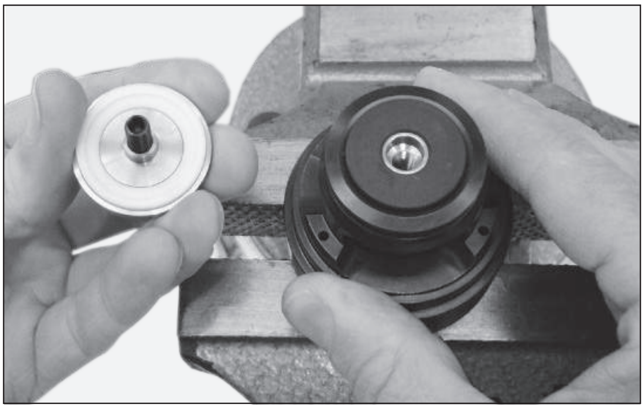
The following text is applicable to the UL listed products ICS 25-65
Applicable to all common non-flammable refrigerants, including/excluding (+) R717 and to non-corrosive gases/liquids dependent on sealing material compatibility (++). The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. (+++).

ICS 25-80
Replacing the Teflon seat in the function module

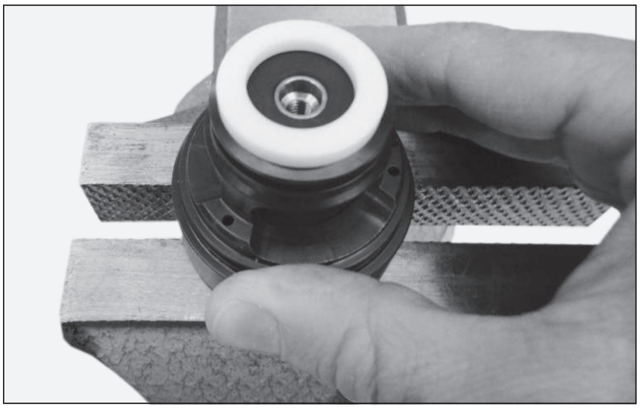
027R9888

1.
Turn the module upside down and secure in a screw vice, holding the module on the two flat sides (A).

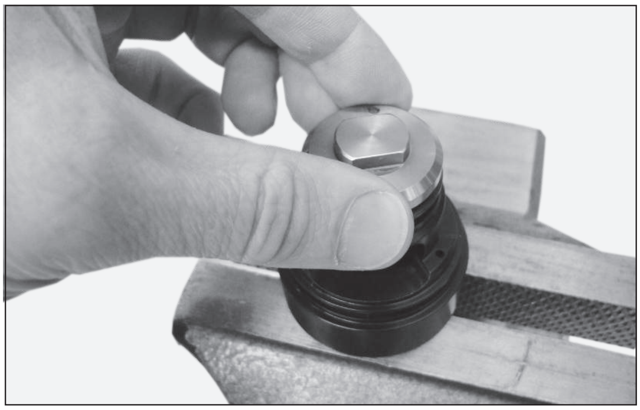
2.
Loosen the washer plate using a 13 mm (0.5 in.) spanner.



3.
Unscrew the washer plate while holding on to the module (the spring force will force the module to detach from the piston).



4.
Remove the old/worn Teflon seat from the washer plate. Mount the new Teflon seat on top of the regulating cone. Remember to place the Teflon seat with the flat surface facing up.



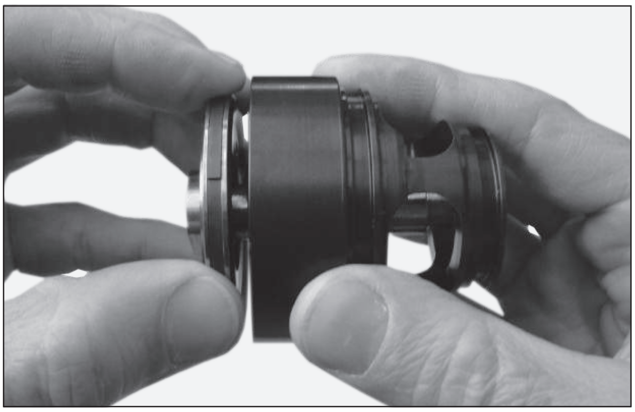
5.
Screw the washer plate back on to the module by hand. It is recommended to add thread lock liquid prior to assembly.

6.
Tighten the washer plate using a torque wrench.
ICS 25, 32 and 40 = 17 Nm (12 lb/ft)
ICS 50, 65 and 80 = 25 Nm (18 lb/ft)

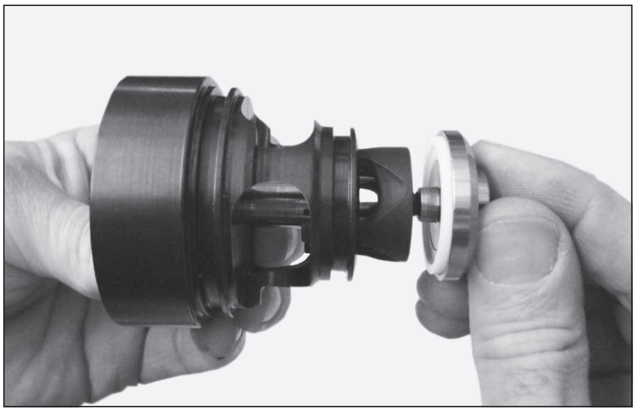
NOTE!
It is important to tighten the washer plate with the correct torque, otherwise the washer plate may become loose or get damaged!

027R9888

If the insert becomes detached from the piston, follow the procedure below.



1.
Place the spring in the module and insert the piston. Squeeze the piston ring while pressing the piston into the module.



2.
Hold the piston in place while mounting the regulating cone, Teflon plate and washer plate. Tighten the washer plate using the correct torque:
ICS 25, 32 and 40 = 17 Nm (12 lb/ft)
ICS 50, 65 and 80 = 25 Nm (18 lb/ft)

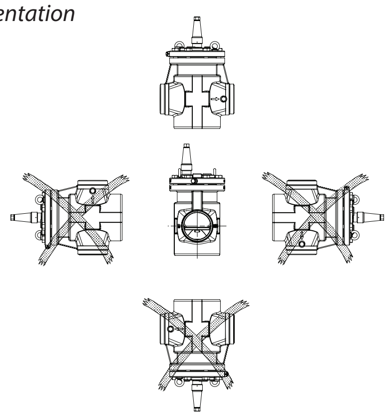
Installation Guide

Pilot operated servo valve
ICS 100-150

027R9793

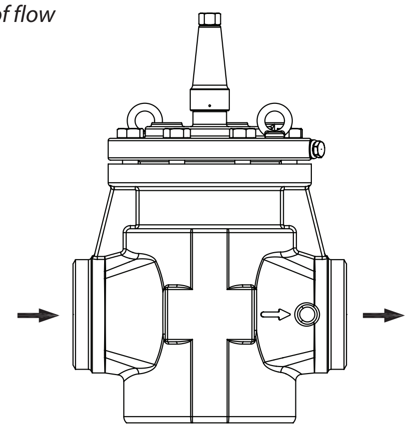
Installation

Mounting orientation



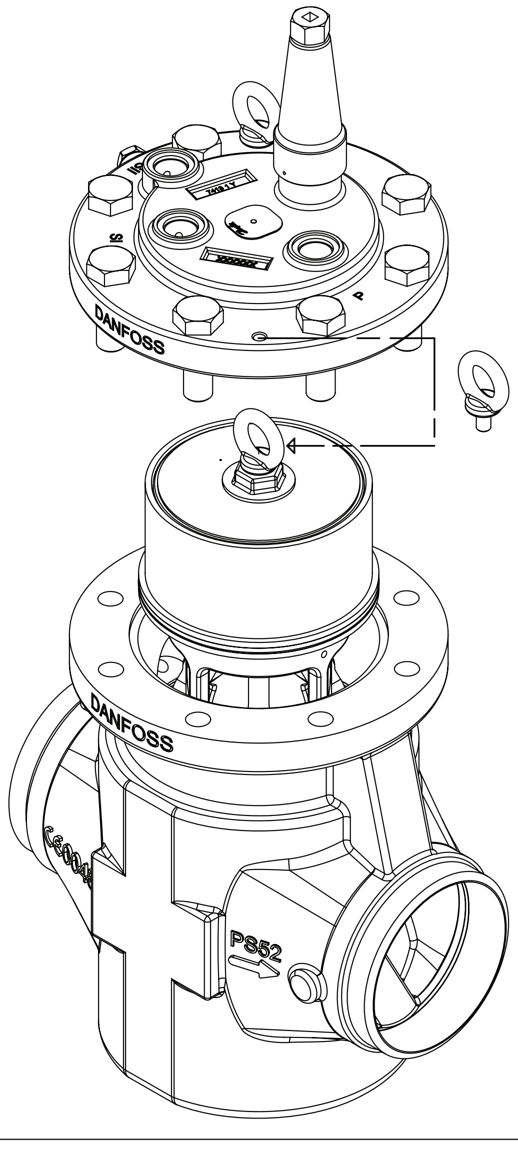
1

Direction of flow



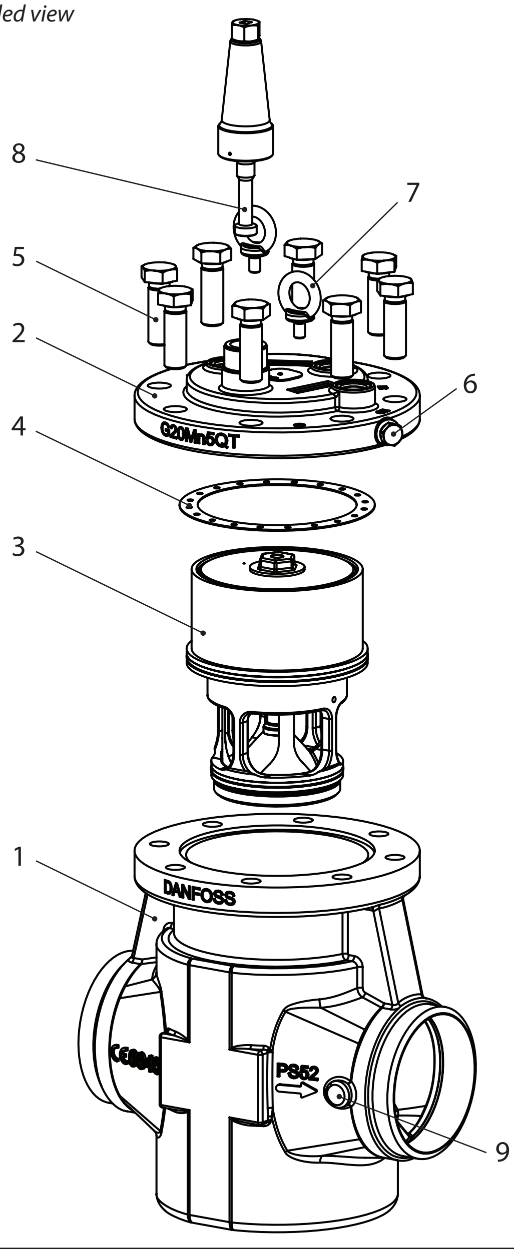
2

Removing function module with eyebolt



3

Exploded view

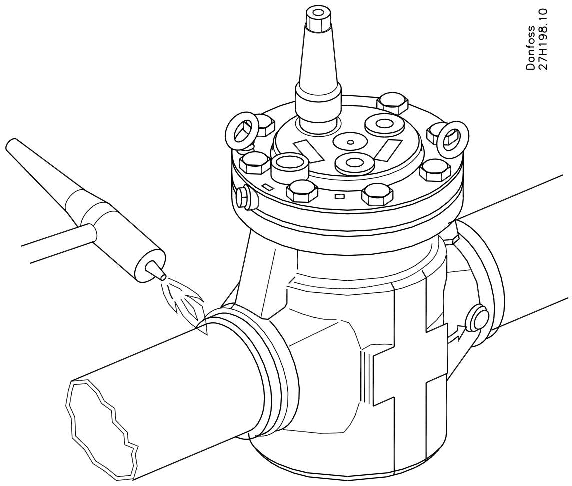


4

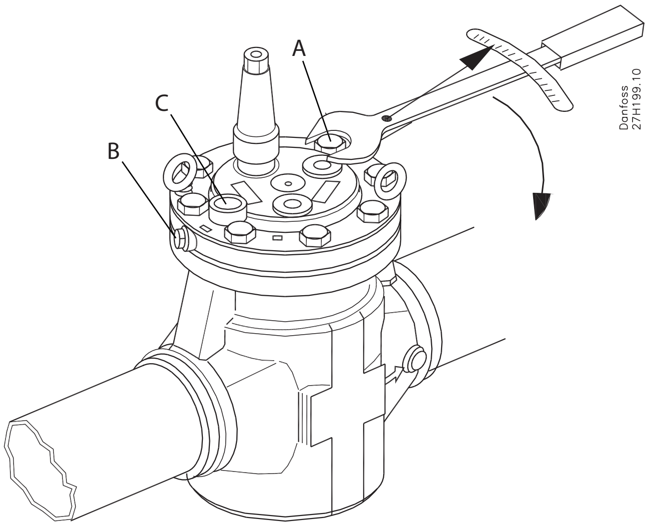
027R9793

Installation

Welding



Torque specification

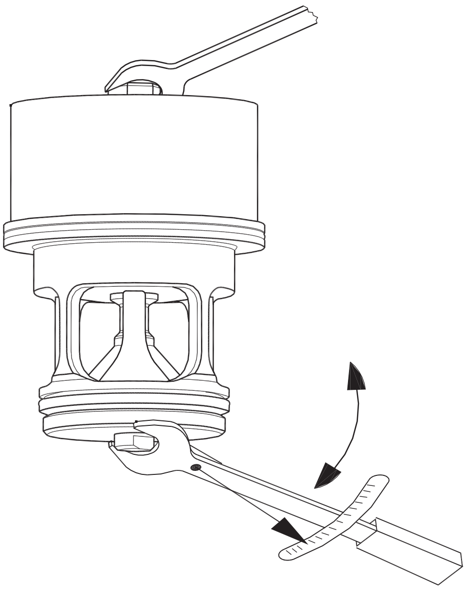


	Valve body size	Nm	ft lb
Pos. A	100-150	220	162
Pos. B	100-150	25	18
Pos. C	100-150	50	37

6

Maintenance

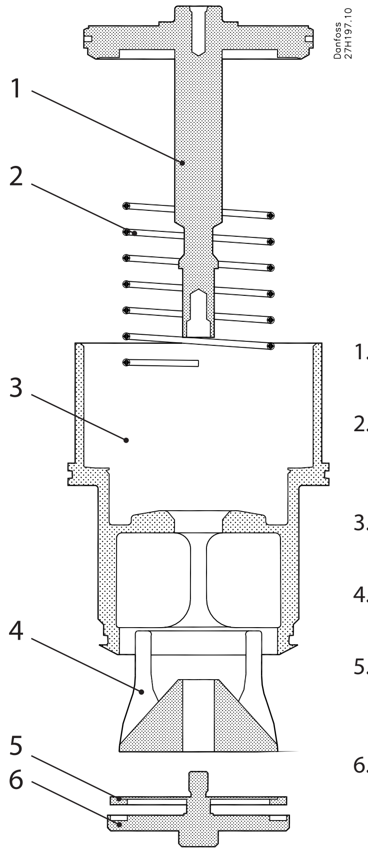
Module torque specification



ICS 100-150 = 80 Nm (59 ft lb / pés lb)

7

Exploded view of function module



1. Piston
2. Spring
3. Insert
4. Cone
5. Valve plate
6. Washer plate

8

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717 (Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended.
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+120°C (–76/+248°F)

Pressure range
The valves are designed for a max. working pressure of 52 bar g (754 psi g).

Technical data
The ICS can be used in suction, liquid, hotgas and liquid/vapor lines. The ICS regulates the flow of the media by modulation or on/off function, depending on the control impulse from the screwed on pilot valve or valves.

Regulating range
Dependent on the chosen type and combination of pilot valves.

Opening differential pressure (p)
The ICS main valve requires a minimum opening differential pressure of 0.07 bar (1 psi) to begin to open and 0.2 bar (2.9 psi) to be completely open.

The valve must be protected against back pressure. A check valve should be installed upstream of the ICS in installations where there is a risk of back pressure. Back pressure can affect the correct position of the piston ring.

Design (fig. 4)
1. Body
2. Top cover
3. Function module
4. Gasket
5. Bolts
6. Plug
7. Eye bolt
8. Manual operating spindle
9. $^3/_8$ NPT plug (available on certain valve bodies)

Installation

The valve must be installed with the manual opening in vertically upwards position (fig. 1).

The valve must be installed with the arrow in the direction of the flow and the top cover upwards (fig. 2). The top cover can be rotated in any direction.
The valve is fitted with a spindle for manual opening. The spindle can open the ICS 100-150 valves against a differential pressure of 10 bar (154 psi). If an external pilot valve is used, the pilot line must be connected to the upper side of the main line so that any dirt and oil from the plant will not find its way into the pilot line.
If the ICS is to be used as a solenoid valve in a liquid line, external control pressure cannot be recommended because it can cause liquid hammer.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.
It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 3, 4 and 5)
The valve can stay assembled during the welding process provided that the welding method is controlled and ensuring no welding debris.
The function module can be lifted out using a bolt size M10 or by using one of the eyebolts placed in the topcover (fig 4, pos. 7). Debris blocking the bolt hole will need to be removed.

The internal surfaces and weld connections of the enclosed ICS/ICM valve have been applied with an anti-corrosion treatment.

In the event that the function modules are to be left disassembled for any length of time, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be welded to the valve body. The valve should be cleaned internally to remove welding debris on completion of welding.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

The valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the o-rings are intact before installing the function module. If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings. Check that the top gasket has not been damaged. If the surface has been damaged or the gasket has been bent, it must be replaced.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Colours and identification
The ICS valves are Zinc-Chromated from factory. The Zinc-Chromatization does not cover the welding connections. If further corrosion protection is required, the valves can be painted. Precise identification of the valve is made via the ID plate on the top cover.
The external surface of the valve housing must be protected against corrosion with a suitable top coating after installation involving welding and consequent assembly.
Protection of the ID plate when painting the valve is recommended.

Maintenance

Service
The ICS 100-150 valves are easy to dismantle and can be serviced by using spare parts available from Danfoss.
Do not open the valve while the valve is still under pressure.
Pressure relief can be done by carefully opening the manual operating spindle. Because of small grooves along the thread on the spindle, refrigerant can be released into open air when operating the manual opener. This operation must only be done after providing the correct countermeasures under local legislation.

The function module can be lifted out using a bolt size M10 screwed into the threaded hole of the piston on the function module (fig. 3). Debris blocking the bolt hole will need to be removed.

The ICS 100-150 insert can be serviced by dismantling the insert. This is done by screwing off the washer plate fig 7 and removing the parts (fig 8). When reassembling the valve, Danfoss recommends to use Loctite 586 or similar on the thread of the washer plate.

Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged. A valve with a damaged o-ring might not modulate according to the specification.
- Check that the piston and cylinder is free of scratches and look for wear marks. If the wear is excessive the function module should be serviced or replaced to prevent false pilot signal.
- Check that the movement of the cylinder and valve seat is free and with low friction.
- If the teflon valve plate has been damaged the teflon valve plate should be replaced by using a Danfoss sparepart kit.

Assembly
Remove any dirt from the body before the valve is assembled. Check that all channels in the valve are not blocked by particles or similar.

If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss.

Drawings are only for illustration, not for dimensioning or construction.

Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

c UL us
LISTED

The following text is applicable to the UL listed products ICS 100-150
Applicable to all common non-flammable refrigerants, including/excluding (+) R717 and to non-corrosive gases/liquids dependent on sealing material compatibility (++). The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. (+++).

ENGINEERING
TOMORROW

Solenoid Valves

Solenoid Valve Types

Valve Type	Nom. Port Size Range	Connection Type	Operation
EVRA (Special Order)	1/8” to 1”	Flanged Body (Ductile Iron)	EVRA 3 (1/8”) is direct operated, all others are servo-operated
EVRAT (Standard Type)	3/8” to 3/4”	Flanged Body (Ductile Iron)	Assisted Lift (No pressure differential required to open valve)
ICS solenoid (Standard Type)	3/16” to 6”	Direct Weld and flanged Body (steel)	Servo-operated with EVM solenoid pilot
PM solenoid (Discontinued)	3/4” to 6”	Flanged Body (Ductile Iron)	Servo-operated with EVM solenoid pilot
ICSH solenoid (2 step Hot Gas)	3/16” to 3”	Direct Weld and Flanged Body (steel)	Servo-operated with two EVM solenoid pilots. 1 solenoid for opening about 20% of capacity and other for full capacity.

The solenoid types in RED text are special order or have been discontinued.

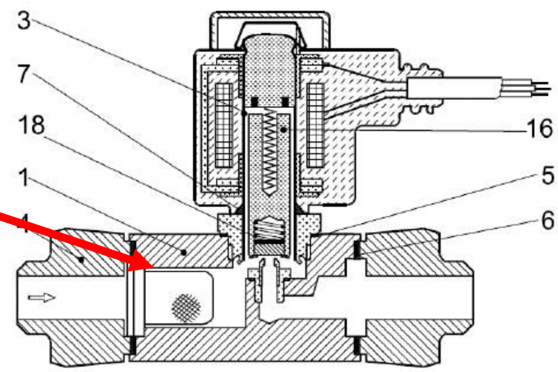
EVRA and EVRAT Solenoids

- Flanged Ductile Iron Body
- External strainers type FA can be close- coupled to the valves
- Valves are supplied with Zn-Chromate surface treatment
- Teflon seat
- Stainless Steel bolts

EVRA 3 (1/8" Port Size)

1. Direct Operated. No pressure differential required to open valve
2. Teflon Valve plate is fitted directly on the armature
3. When de-energized, the inlet pressure, spring force and the weight of the armature close the valve

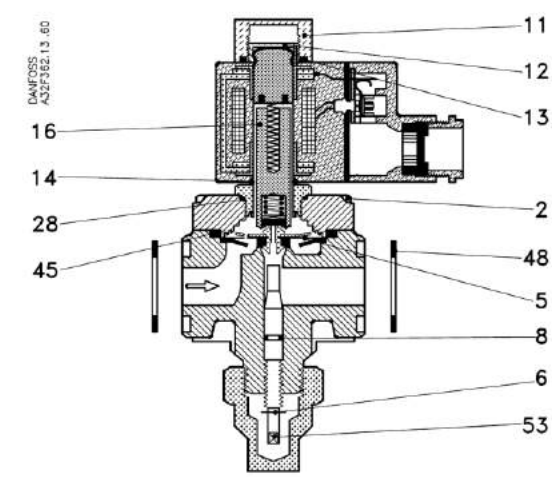
Built-in Strainer



NO manual stem

EVRA 10, 15 & 20 (3/8", 1/2" & 3/4")

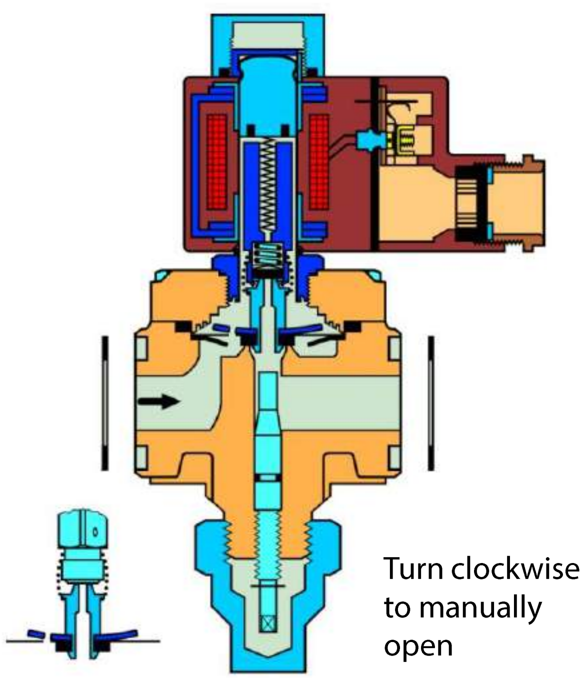
1. Manual Opening stem
2. Minimum differential pressure to fully open: 0.7 psi
3. When energized, the pilot orifice opens and relieves the pressure above the diaphragm. The pressure differential between inlet and outlet then forces the valve open



Turn clockwise to manually open

EVRAT 10, 15 & 20 (3/8", 1/2" & 3/4")

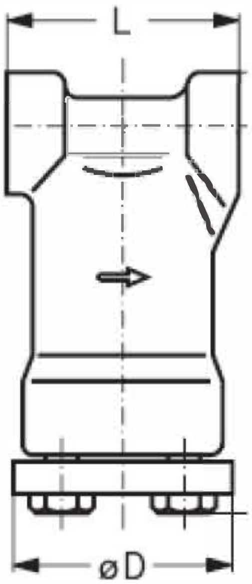
1. Valve is assisted lift (magnetic pull keeps the valve open).
2. No pressure differential required to open valve.
3. Ideal for drain lines or applications where differential pressure is not available.
4. Manual Opening stem

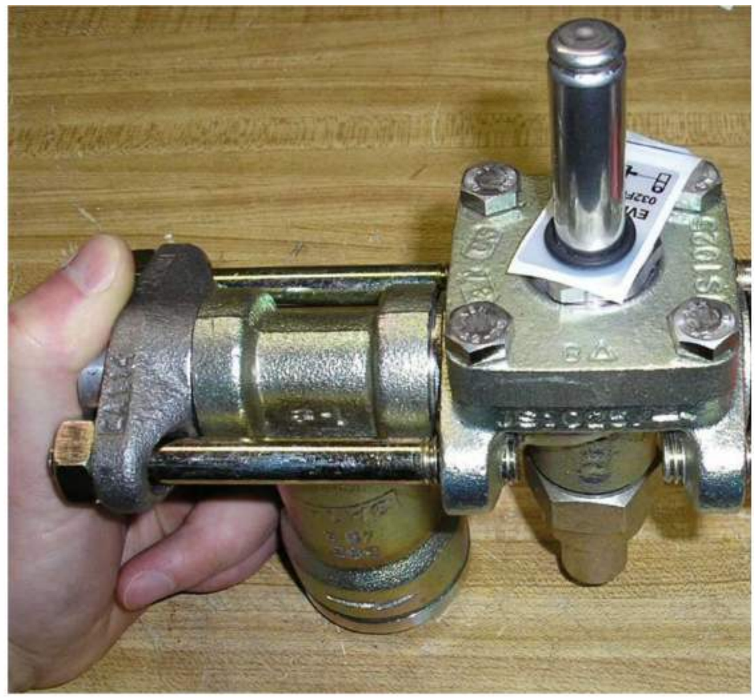


Assisted lift spring

FA Close-Couple Strainer for EVRA/T 3 to 20 (3/8" to 3/4")

1. Includes long bolts to close-couple to EVRA/T valves.
2. Ideal for small capacity evaporators

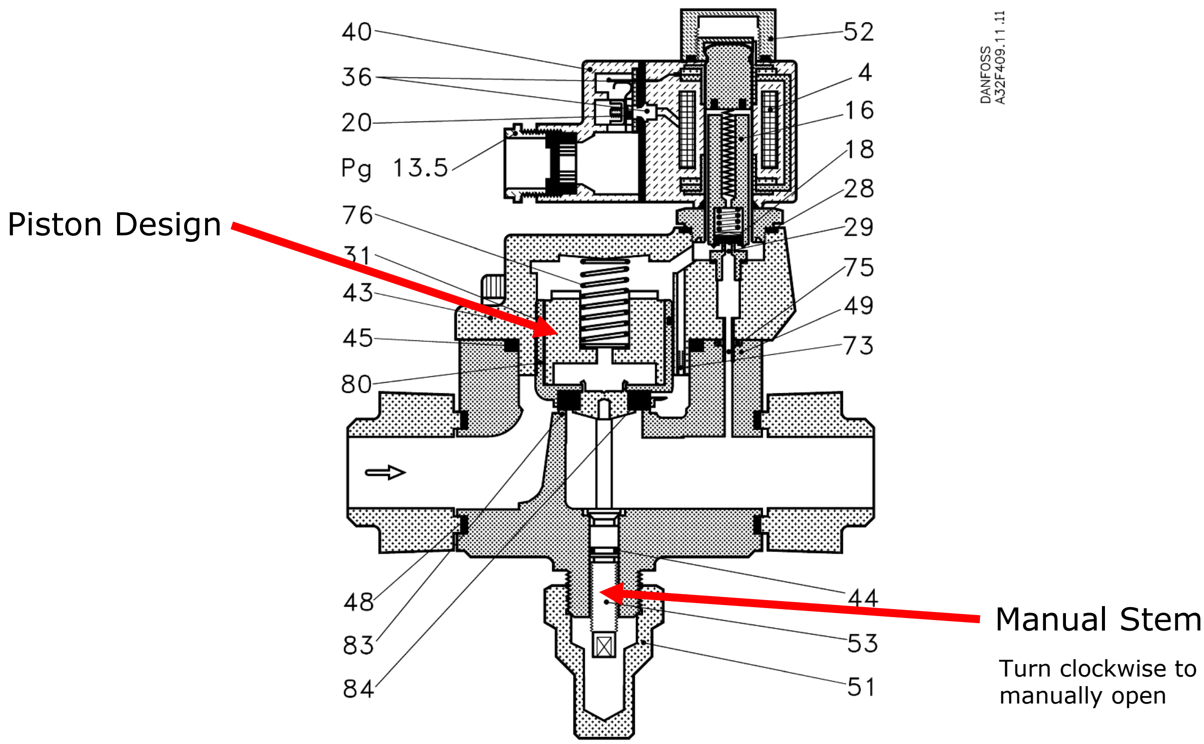




Strainer type	L		ØD	
	in.	mm	in.	mm
FA 15	2.1	54	2.0	51
FA 20	2.8	72	2.4	60

Valve Size	Nominal Port Size	C_V (K_V) Values*	Will directly connect with valves
FA 15	1/2"	3.8 (3.3)	Solenoid valve type EVRA 3
			Solenoid valves type EVRA 10, EVRAT 10, EVRA 15, EVRAT 15
			Thermostatic valves type TEA 20, TEAT 20, TEVA 20
FA 20	3/4"	8.0 (7.0)	Solenoid valves type EVRA 20, EVRAT 20
			Thermostatic valves type TEA 85, TEAT 85, TEVA 85

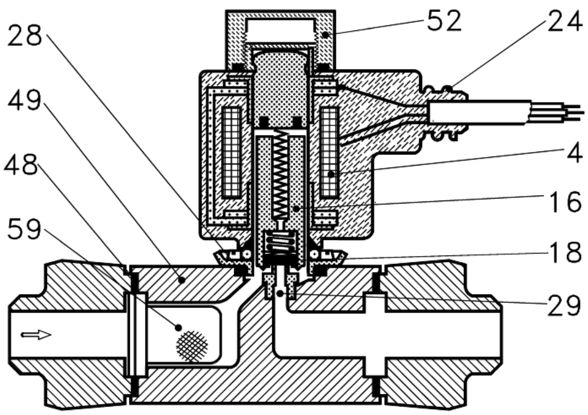
EVRA 25 (1" Port Size)



Minimum full opening differential pressure of 3.0 psi required

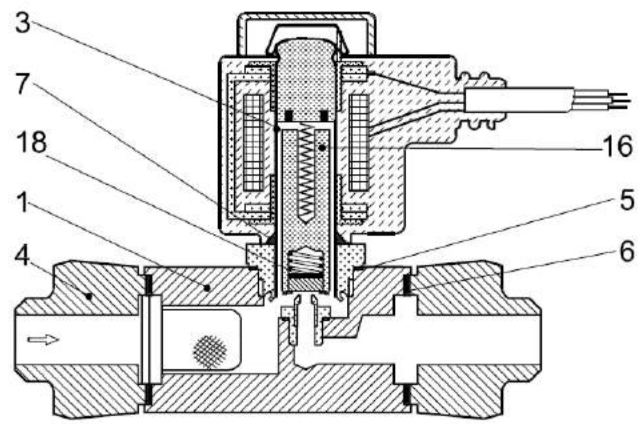
Old Design EVRA and EVRAT

Old Design



4 bold flanged armature tube

Current Design

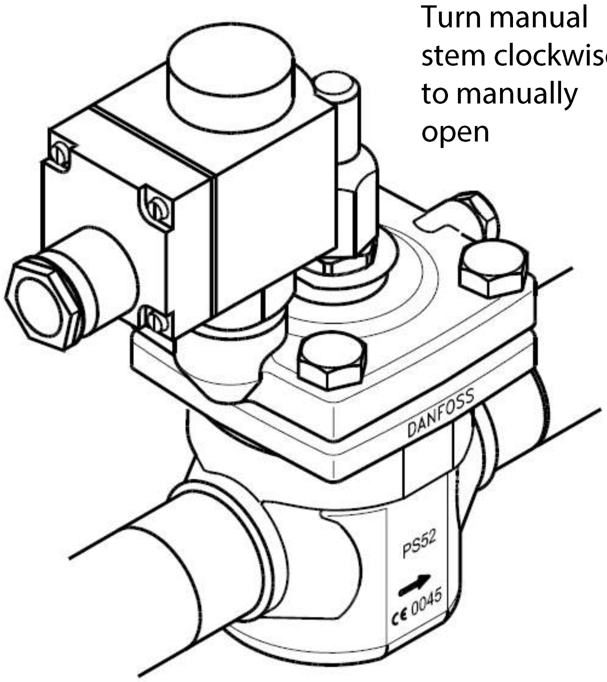


Armature tube has threaded end piece that screws directly in body

Change was made on all EVRA and EVRAT sizes around 1999 except for EVRA 3 which was changed shortly after.

ICS Solenoids (3/16" to 6" Port)

- Pilot operated solenoid valve
- Same valve as ICS regulators
- Direct weld steel body
- Valve starts to open at a differential pressure of 1 psi and will be fully open with about 2.9 psi
- ICS solenoid sizes 4, 5 and 6" will come with 3 pilot top covers with the extra pilots plugged.

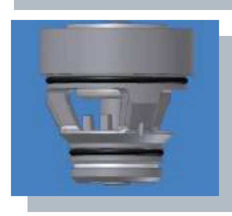


Turn manual stem clockwise to manually open

Note: Top cover can be rotated without affecting operation!

EVM solenoid pilot

1 pilot top cover



Function module

Valve body

Pilots in ICS Solenoids

EVM-NC

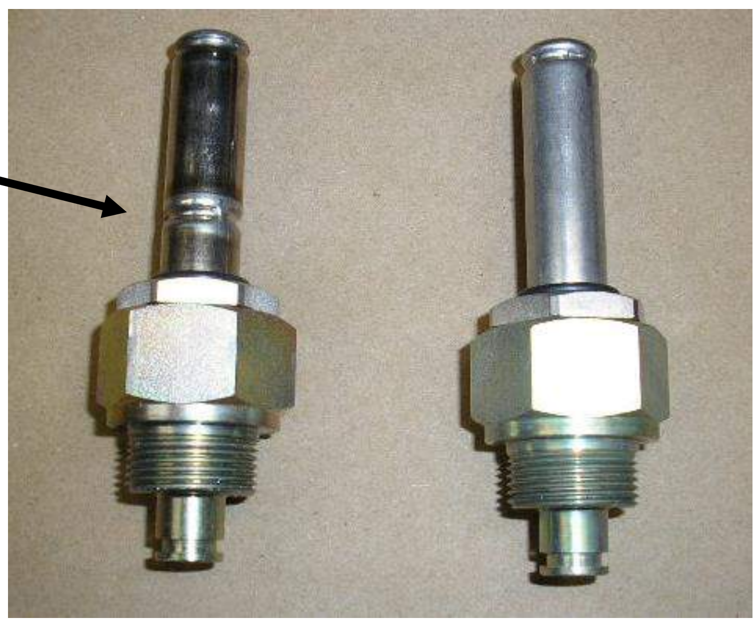
- Normally-closed pilot
  (de-energized coil will close valve)
- Most commonly used

EVM – NO

- Normally-open pilot (must energize coil to close valve)
- Mainly used on our gas-powered valves

EVM-NO **EVM-NC**

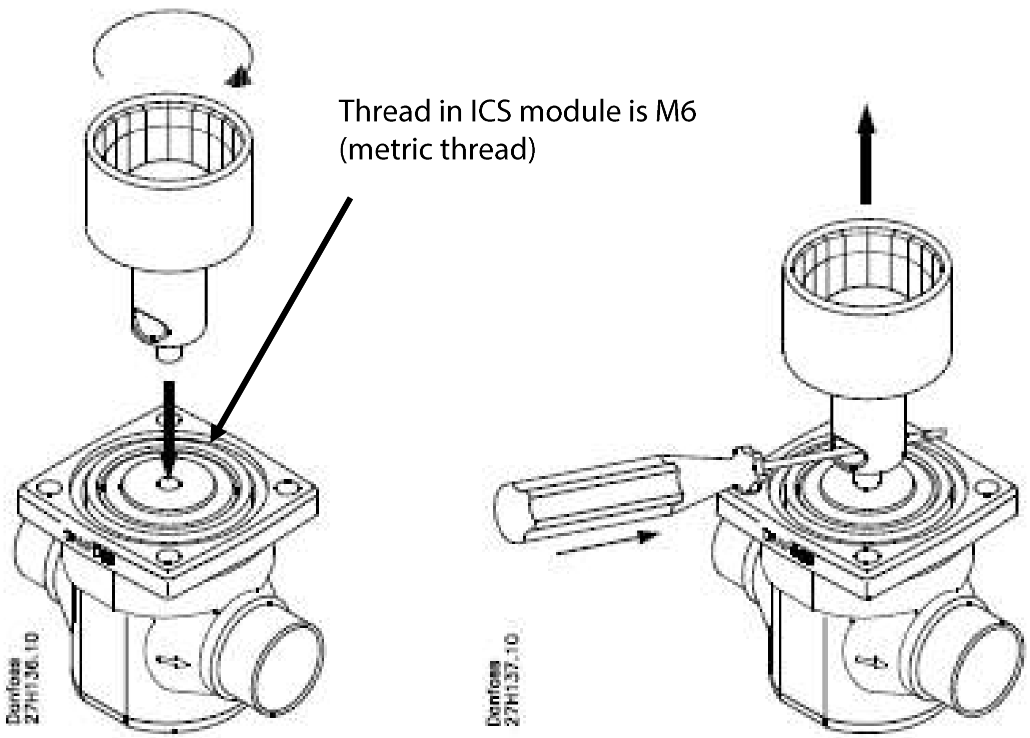
Crimp
(only in NO)



Installing ICS Valves Size 80 (3”) and Down

Important!
Prior to installation, it is required to weld in the valve body **without** the function module installed for ICS sizes 80 and down.

Use best practice procedures to weld body and clean after finished



ICSH Dual Position Solenoids (3/16" to 3" Port)

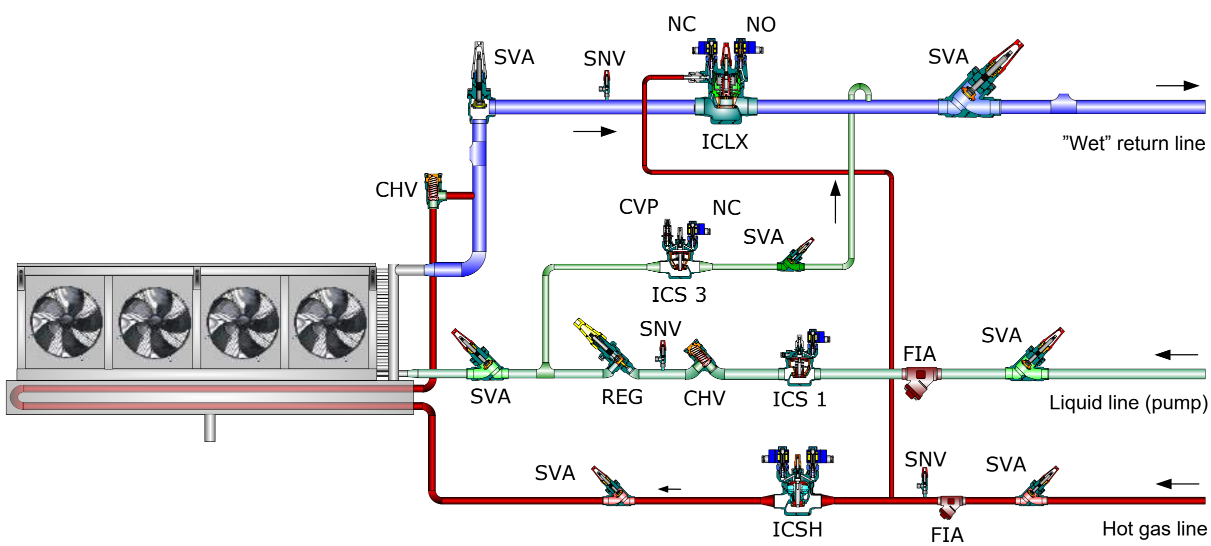
Dedicated for **safe hot gas injection**

ICSH Dual Position Solenoid Valve = Safe hot gas injection

Dedicated for the hot gas line, Danfoss ICSH ensures a safe and controlled, 2-step injection of hot gas into the evaporators during hot gas defrost.

For improved operational safety and to prevent negative pressure impact to your refrigeration system, it has been configured in such a way that it only opens fully (step-2) if the soft opening allowing approximately 20% of full flow (step-1) has been activated*.

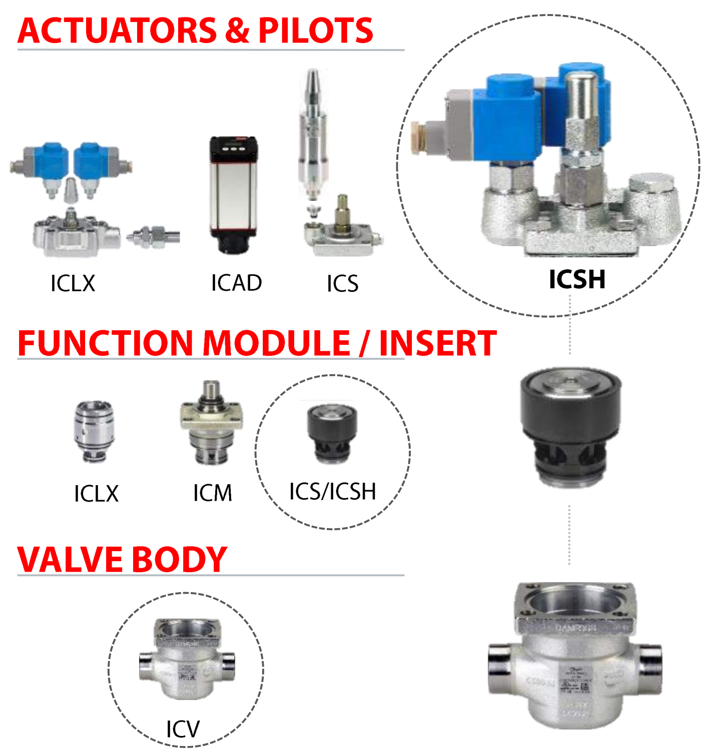
** Optional setting to make step-2 opening independent of step-1 opening is possible*



Solenoid Valve Types

ICSH is part of ICV Platform

- Huge flexibility and inter-changeability between components
- ICSH covers available up to size 80 (3″)
- ICSH uses the same function module and body as ICS solenoids.



Operation of the ICSH Dual Position Solenoid Valve

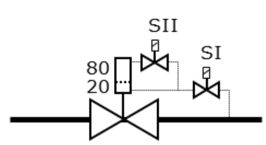
- ICSH top cover comes with 2 EVM normally closed solenoid pilots installed. Each solenoid pilot must be activated independently by PLC/controller to control the 2 different opening steps.

- For safe operation, the EVM solenoid pilots are configurated in series from factory as shown in **Configuration I**
  - **For step-1** the solenoid in SI port opens the ICSH partially to approx. 20% of full flow.
  - **For step-2**, the solenoid in SII port opens the ICSH fully only if step-1 is successfully activated (**safe operation**)

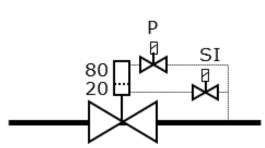
- Optional: If required, the EVM solenoid for step-2 can be installed in the parallel pilot port "P" making step-2 independent of step-1 as shown in **Configuration II**

Note: The SI, SII and P pilot port locations are cast in the ICSH top cover

Configuration I
Two step with **dependent**
second step (**safe operation)**



Configuration II
Two step with
independent second step



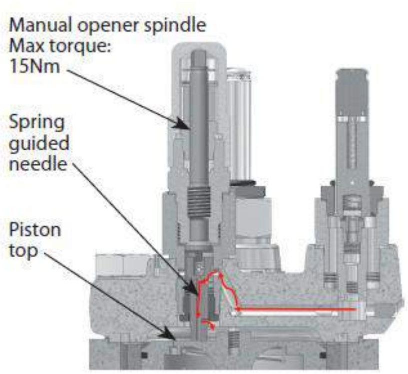
How the ICSH dual position solenoid valve works

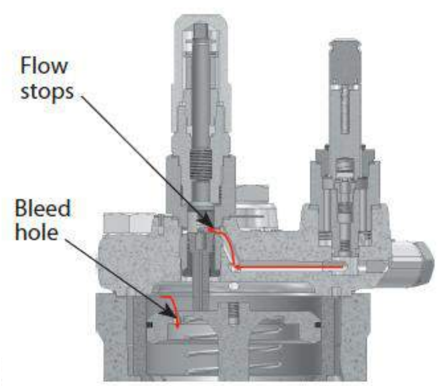
- When the solenoid pilot in SI is activated it will allow flow from P1 (inlet of valve) through the spring guided flow control needle to build up pressure on top of the piston and open the valve.

- When the valve opens the flow needle will drop down following the piston until it reaches its max movement which will block the flow through the needle and stop the valve from opening further.

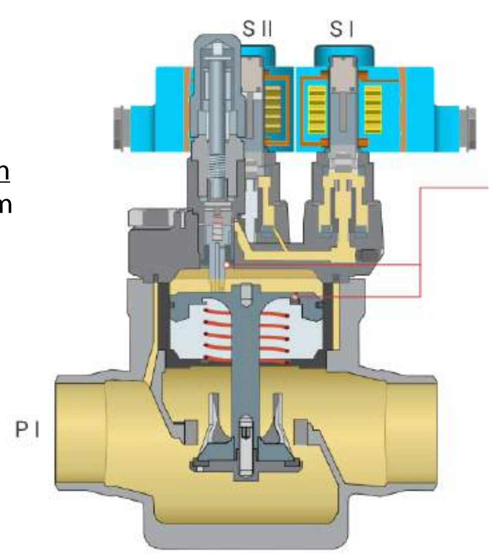
- The bleed hole in the top of the piston will allow the flow out of the chamber causing the valve to start to close and lift the flow needle up to allow more flow in and hold valve at part flow position.

- When the 2^{nd} step solenoid is activated it lets flow directly into the chamber opening the valve fully.





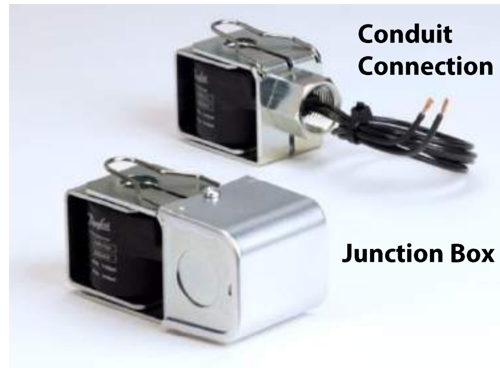
<u>Manual operation</u>
Turn Manual stem clockwise to manually open valve.



Coils

- All coils are clip-on and do not require any additional knobs or caps
- Easily mounted and removed with clip-on feature
- Available for AC or DC applications
- Several different electrical connections
  - Conduit connection (1/2”) with wire leads (NEMA 4)
  - Junction box (NEMA 2)
  - Coil with DIN connector (IP65~ NEMA4X)
  - Coil with terminal box (IP67 ~ NEMA6)

Note: we now list the max coil wattage on the blue coils where before we listed the nominal wattage which was lower. This was just a labeling change and the coil itself was not changed.

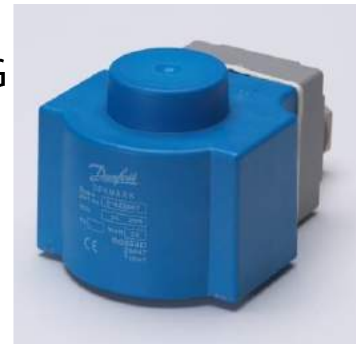


Coil w/ DIN plug

Coil with terminal box

Coil with Terminal Box

- 4 screws mounting the terminal box for a tight seal
- Cable entry is similar to DIN connector where you can run cable through hole and screw tight to seal or remove nut and have PG 13.5 thread at cable entry for conduit connection
- Terminal box is available with a built-in GREEN LED pilot light for indication of power



Inside view

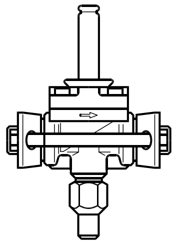
Can easily remove layers to best fit cable diameter

Installation Guide

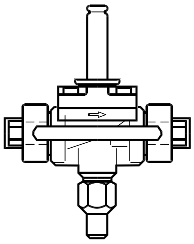
Solenoid valve
EVRAT 10, 15, 20

032R9669

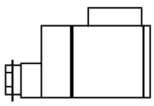
032R9669



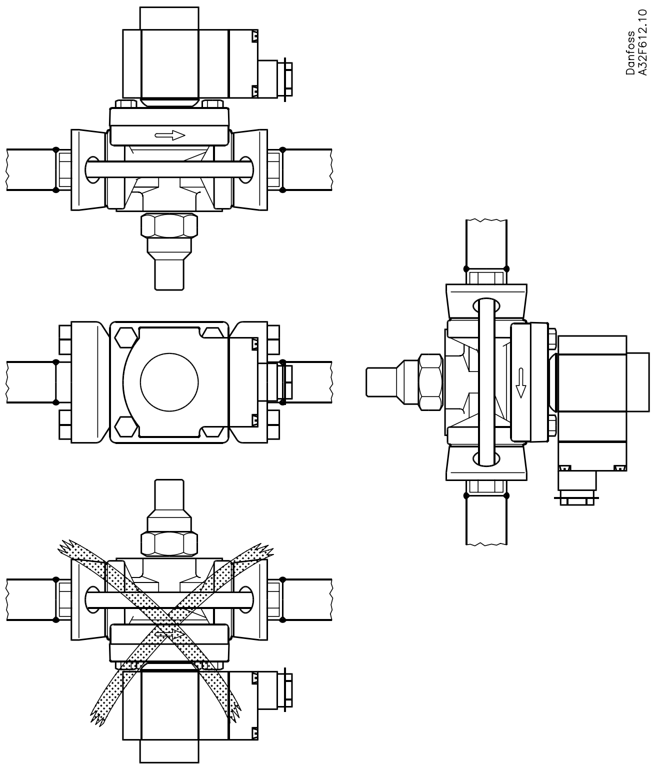
EVRAT 10

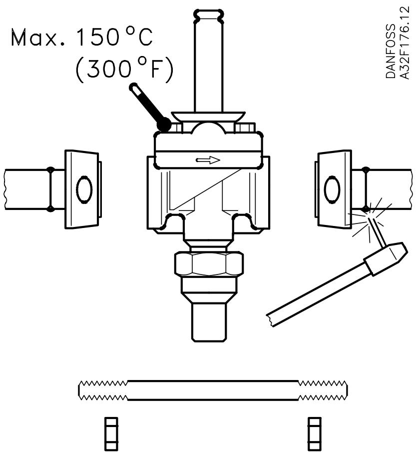


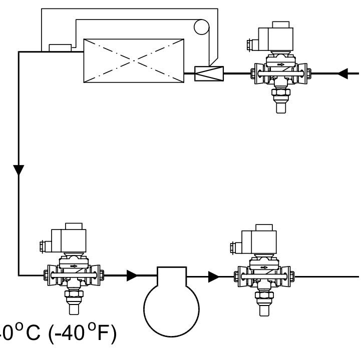
EVRAT 15, 20

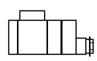


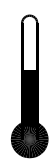
12 V a.c.



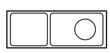




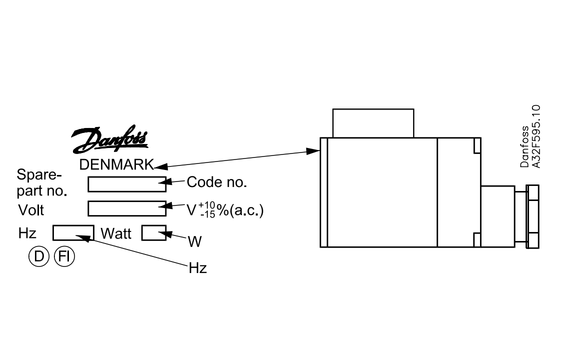
12 W d.c.  t max. 50 °C (120 °F)

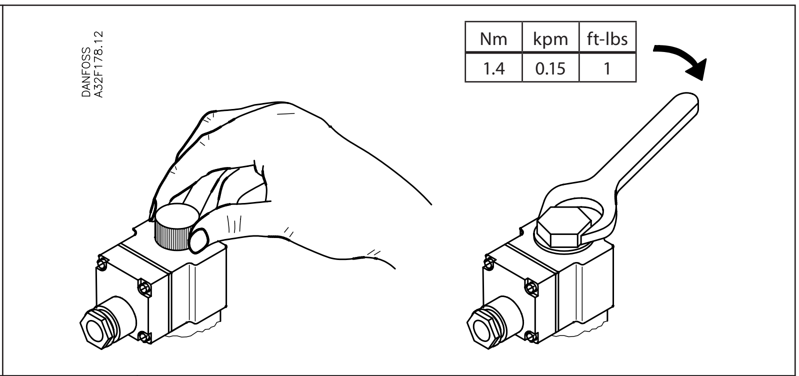
 t min. -40 °C (-40 °F)

Min. medium temperature: EVRAT -40 °C (-40 °F)
Max. medium temperature: EVRAT 105 °C (221 °F)
Max. working pressure: PB=28 bar/ MWP 405 psig

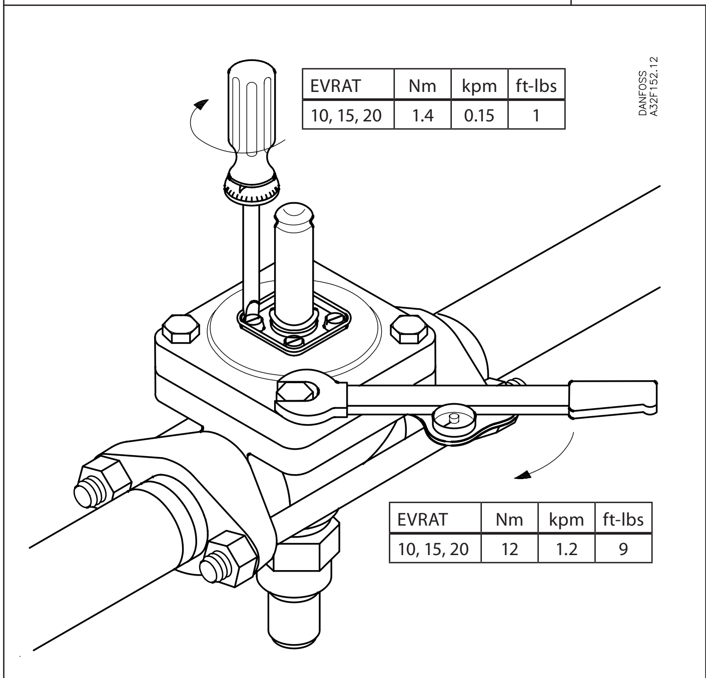
Max. opening diff. pressure (MOPD): →  21 bar (300psig)

Danfoss
A32F613.10



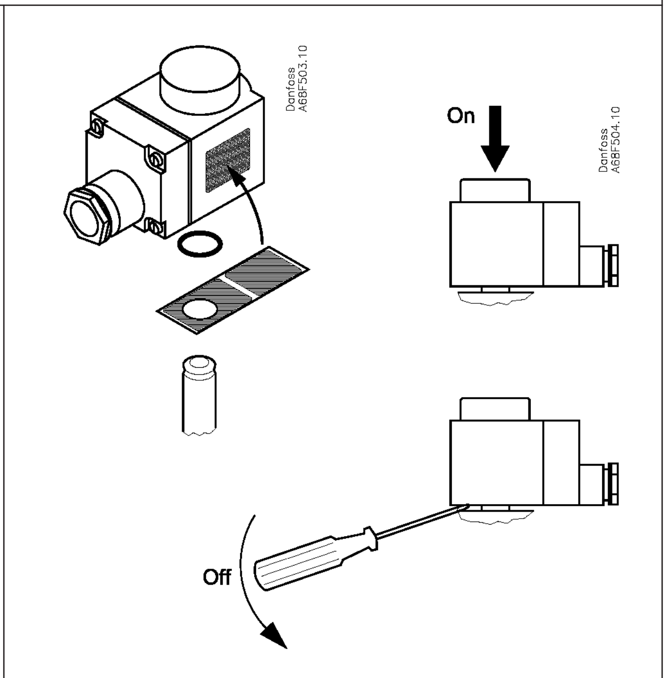


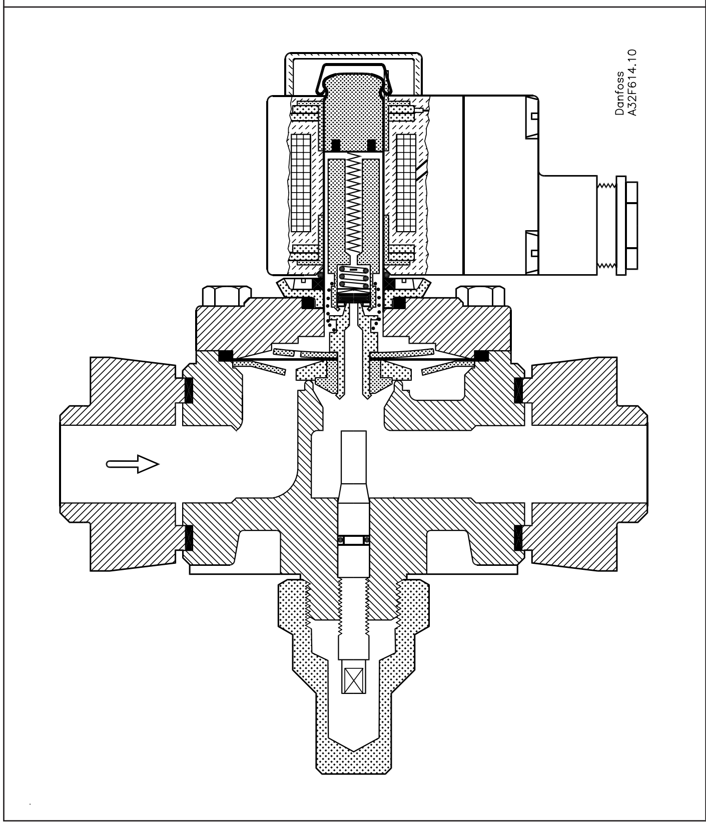
Nm	kpm	ft-lbs
1.4	0.15	1

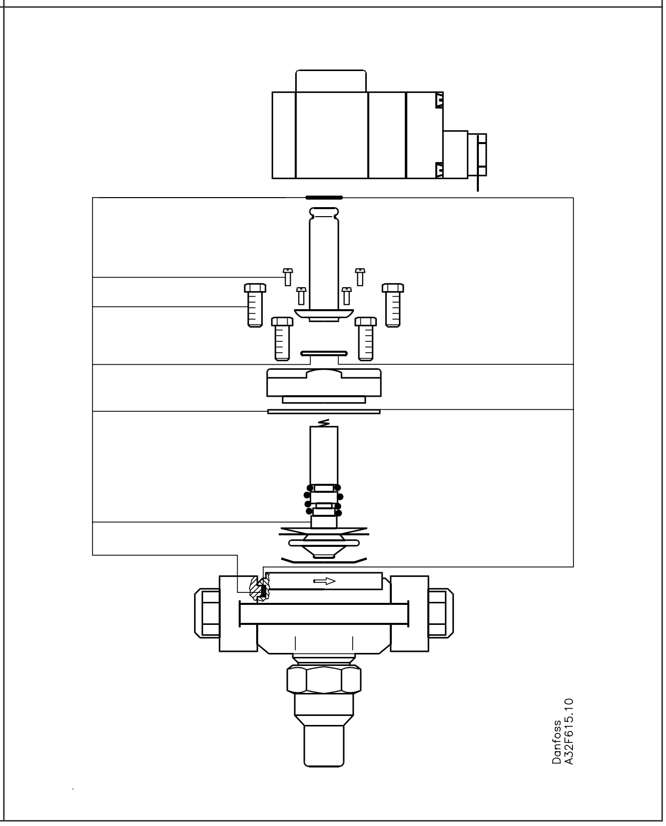


EVRAT	Nm	kpm	ft-lbs
10, 15, 20	1.4	0.15	1

EVRAT	Nm	kpm	ft-lbs
10, 15, 20	12	1.2	9





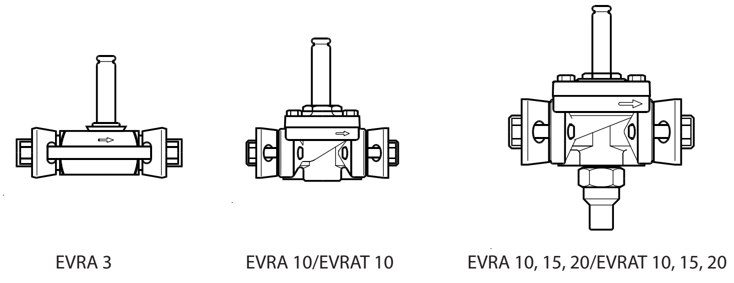


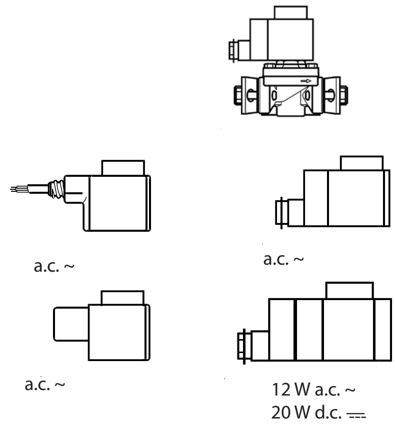
Installation Guide

EVRA 3 - 20 and EVRAT 10 - 20 Solenoid valves

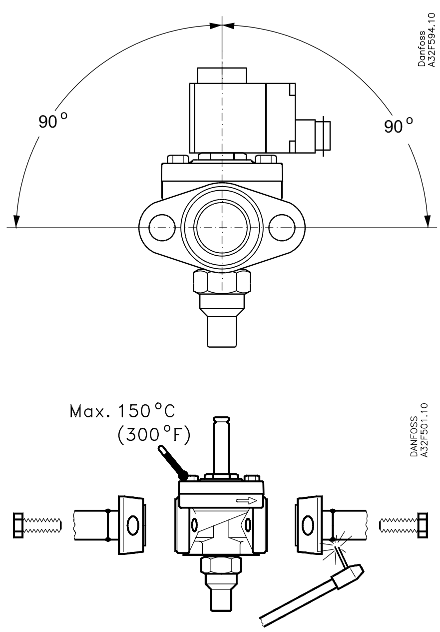
032R9519

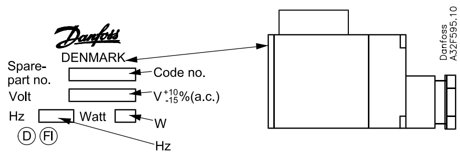
HCFC, HFC, R717 (Ammonia)

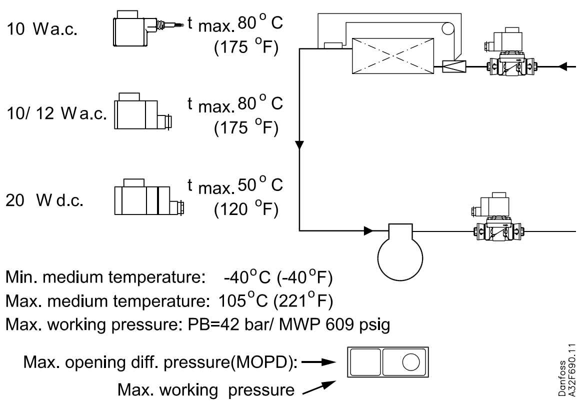




032R9519



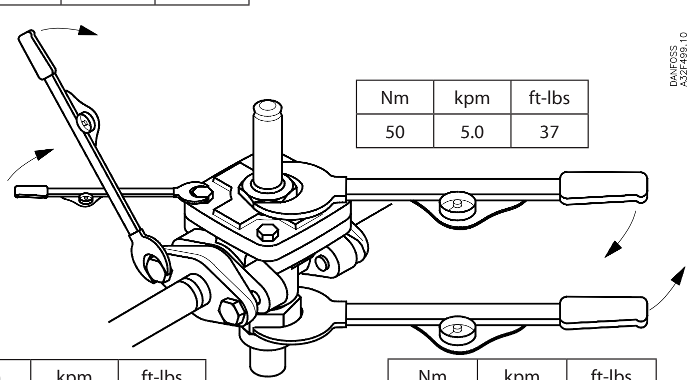




Min. medium temperature: -40°C (-40°F)
Max. medium temperature: 105°C (221°F)
Max. working pressure: PB=42 bar/ MWP 609 psig

Nm	kpm	ft-lbs
60	6.0	45.0

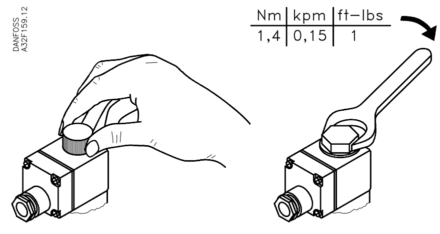
Nm	kpm	ft-lbs
50	5.0	37

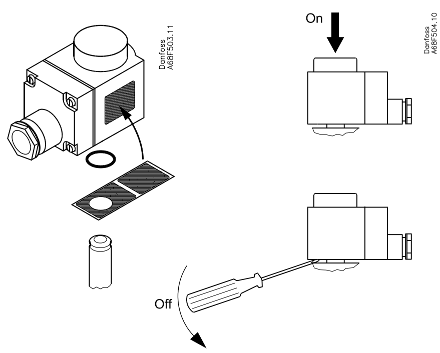


Nm	kpm	ft-lbs
20	2.0	15

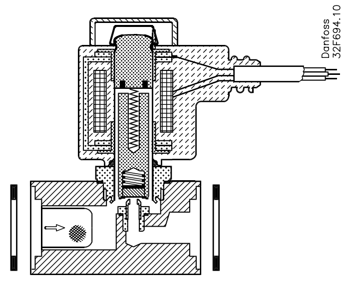
Nm	kpm	ft-lbs
30	3.0	22.5

Nm	kpm	ft-lbs
1,4	0,15	1

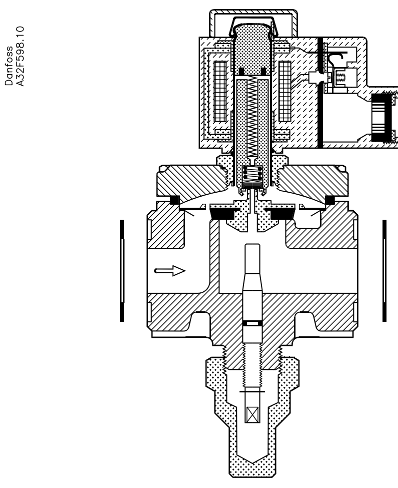




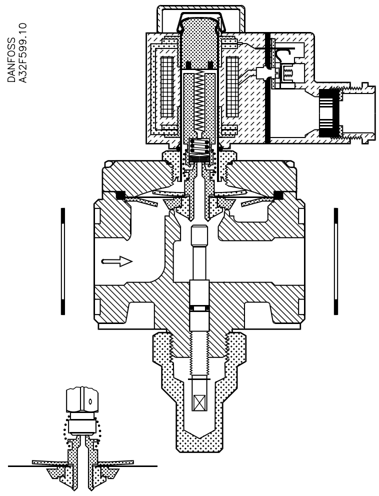
EVRA 3



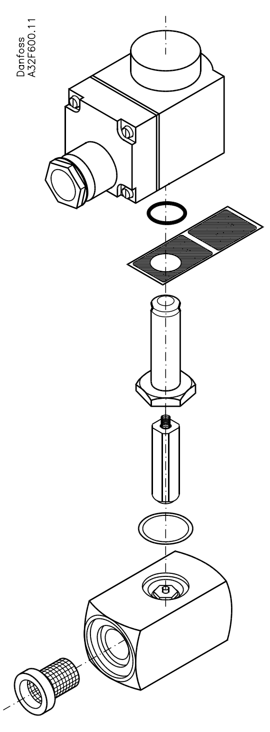
EVRA 10 - 20



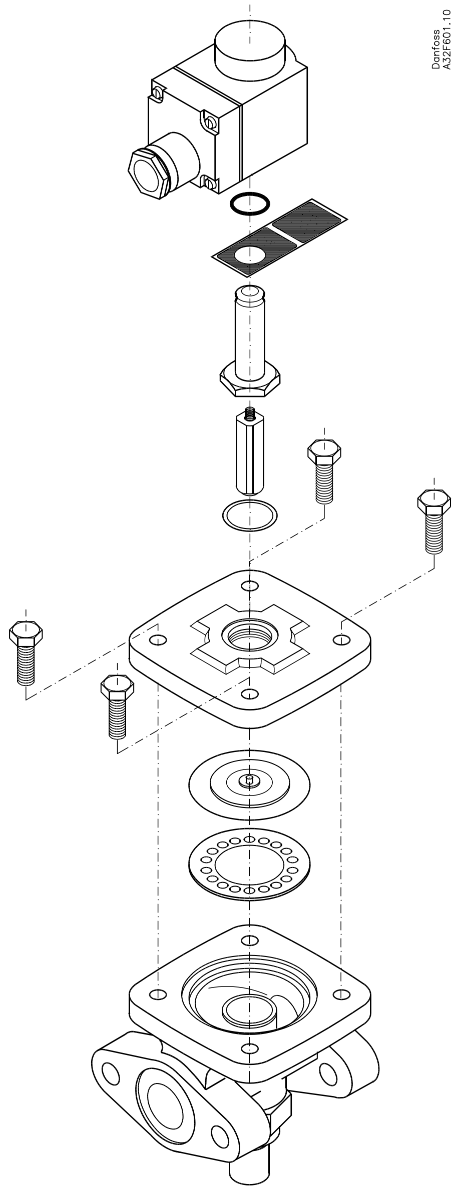
EVRAT 10 - 20



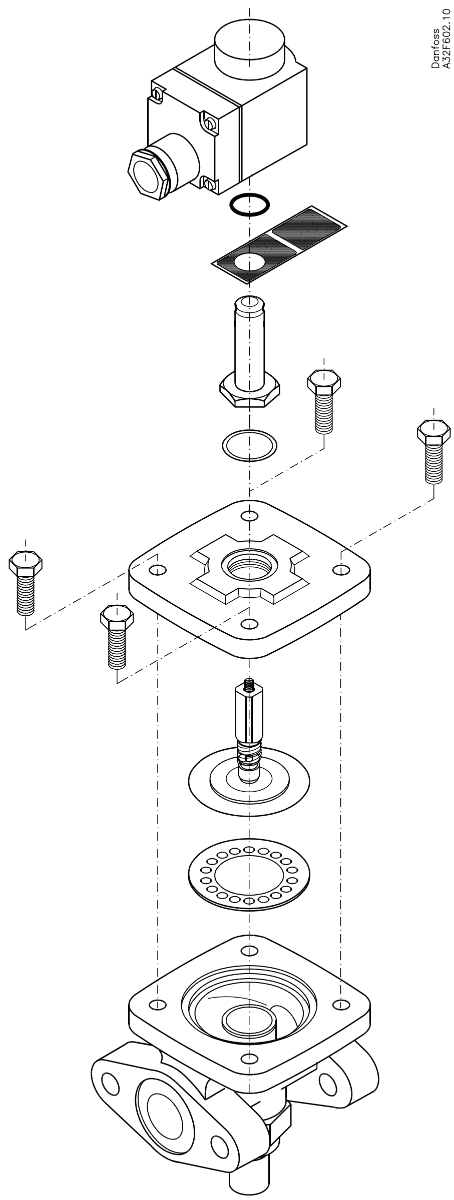
EVRA 3



EVRA 10 - 20



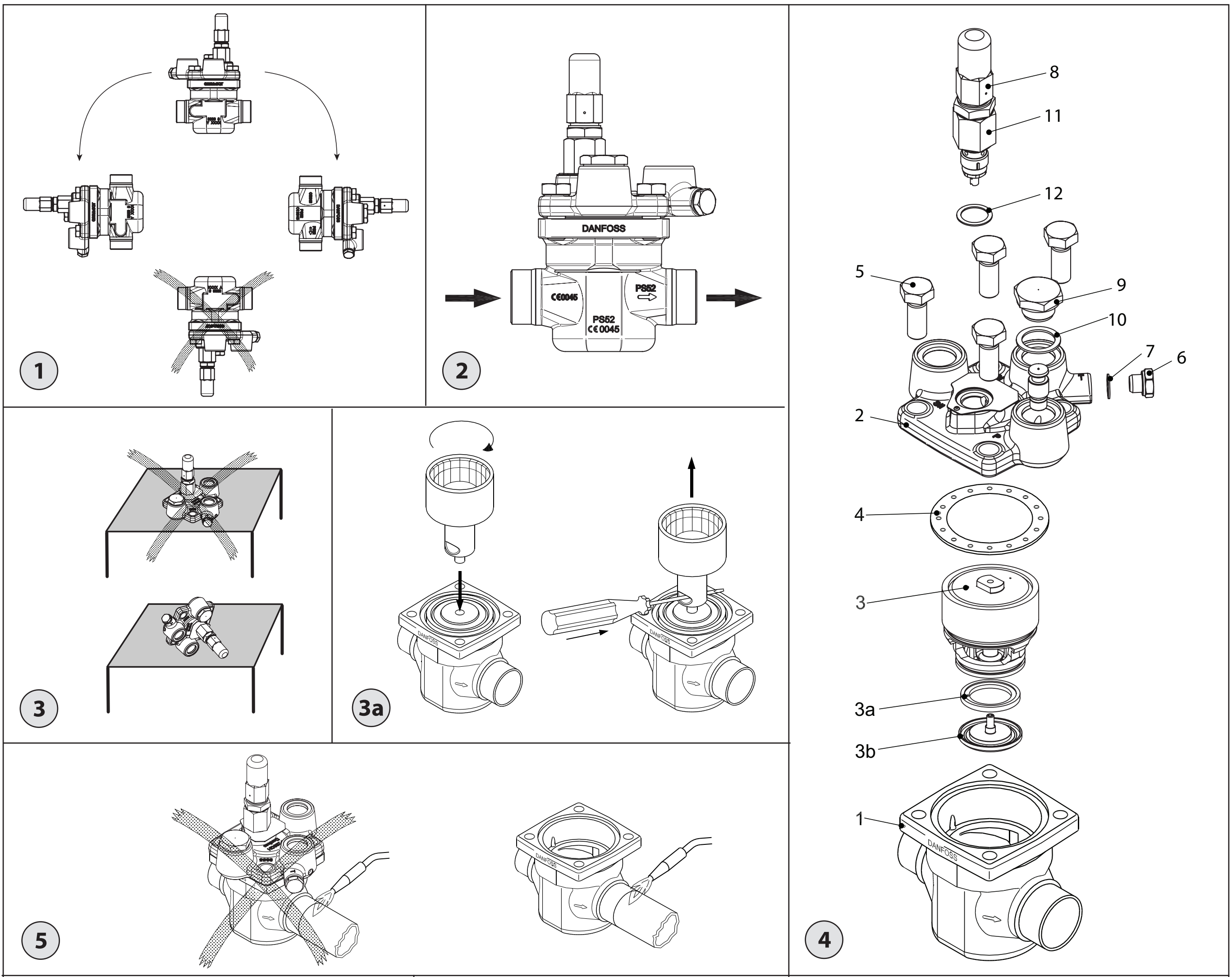
EVRAT 10 - 20

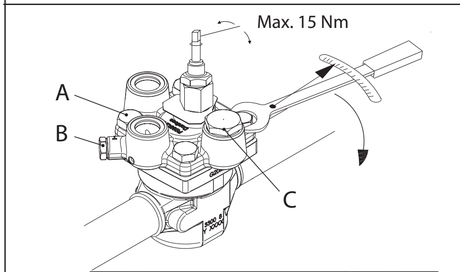


Installation Guide

Dual Position solenoid valve ICSH 25-65

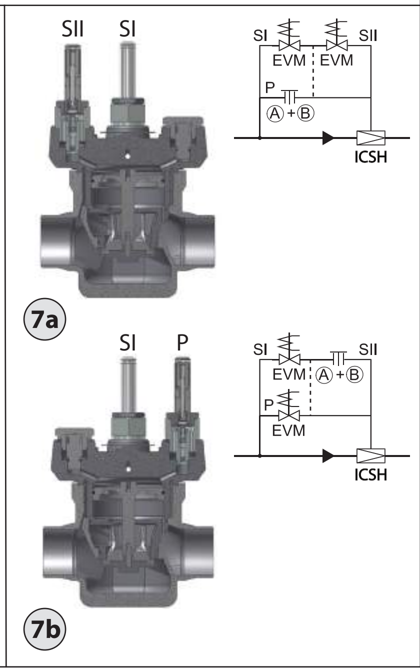
027R9977

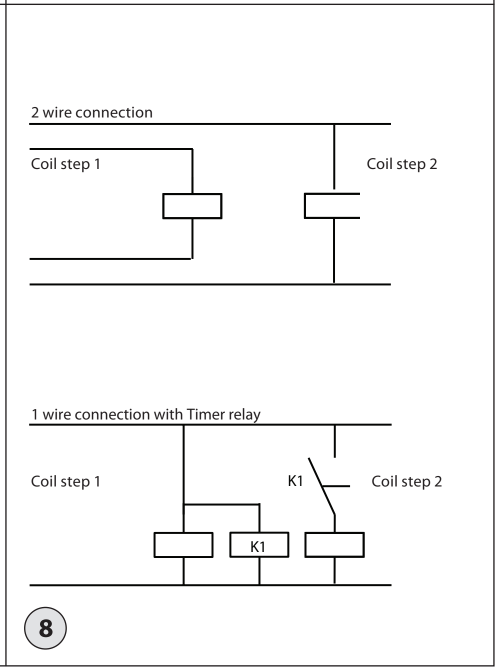




	Valve body size	Nm	ft lb
Pos.	25	100	74
	32	120	88
	40	120	88
	50	140	103
	65	150	110
Pos.	25	25	18
	32		
	40		
	50		
	65		
Pos.	25	50	37
	32		
	40		
	50		
	65		

6





027R9977

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717(Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended.
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
-60 – 120 °C / -76 – 248 °F

Pressure range
The valves are designed for a max. working pressure of 52 bar g / 754 psi g.

Application
The ICSH is designed for the hotgas line to open for the flow in 2 steps - 20% and 100%. The valve includes 2 identical EVM NC pilot valves with 2 identical coils energized in a controlled sequence by an external controller like PLC.

Design (fig. 4)
1. Body
2. Top cover
3. Function module
3a Valve plate (Teflon) (available as spare part)
3b Washer plate
4. Gasket
5. Bolts
6. Plug
7. Gasket
8. Manual operating spindle
9. Plug
10. Gasket
11. Needle housing
12. Flat gasket

Installation

The ICSH can be oriented as shown in fig. 1 and must be installed with the arrow in the direction of the flow (fig. 2).

The top cover can be rotated 4 X 90° in relation to the valve body.

The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 3, 4 and 5)
The top cover (fig. 4, pos. 2) and function module (fig. 4, pos. 3), must be removed before welding to prevent damage to o-rings and teflon (PTFE) in the function module and to avoid getting welding debris in the module.

Caution: After removing the top cover make sure to protect the vital parts protruding the underside of the cover. Never lay aside with the bottomside down (see fig. 3)

The function module can be lifted out using a bolt size M6 or multi-function tool screwed into the threaded hole of the piston on the function module (fig. 3a). Debris blocking the bolt hole will need cleaning.

Note:
Remove all parts from the valve body before welding (as shown in fig. 5).

The internal surfaces and weld connections of the enclosed ICSH valve has been applied anti-corrosion protection.

In order to maintain the effectiveness of this anti-corrosion treatment, it is important to ensure that the valve is disassembled just prior to the welding / brazing process being undertaken.

In the event that the function modules are to be left disassembled for any length of time, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only welding materials and welding methods compatible with the valve housing material must be used. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

The valve body must be free from stresses (external loads) after installation.

The valves must never be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the o-rings are intact before replacing the function module. If possible, apply some refrigeration oil to facilitate the insertion and to protect the o-rings. Check that the top gasket has not been damaged. If the surface has been damaged or the gasket has been bent, it must be replaced.

Tightening/Operation of Manual spindle (fig.6)
Tighten the top cover with a torque wrench to the values indicated in the table.

If the manual opening spindle needs to be activated it is important not to exceed 15 Nm in any directions.

Corrosion protection and identification
The ICSH valves are Zinc-Chromated from factory. The Zinc-Chromatization does not cover the welding areas.
The external surface of the valve housing must be protected against corrosion with a suitable top coating after installation involving welding and consequent assembly.
Identification of the valve is made via the ID plate on the top cover.
Protection of the ID plate when painting the valve is recommended.

Configuration
The ICSH can be configured to 2 operation modes:
1. Dependent mode
The functioning of the valve is always relaying on the opening of step 1. Only when step 1 is working properly the step 2 can be mechanically activated.

2. Independent mode:
The full opening of the valve can be controlled independent of the state of step 1. If the partly opening of step 1 is not performed the fully opening can be done by activation of step 2.
Note: When choosing the independent configuration there is a risk of hydraulic shock due to instant full opening.

Dependent configuration is done by installing the 2 EVM's in port SI and SII, and blanking off port P by Plug A+B. See fig. 7a.
The SI coil must be activated some period of time before SII being activated.

Independent configuration is done by installing the 2 EVM's in port SI and P, and blanking off port SII by Plug A+B. See fig. 7b.

The SI coil must be activated some period of time before P being activated.
The control of activating the coils is done by a PLC or a PLC / Timer (see fig. 8) and the required time delay must be decided based on in situ trials.

Wiring
The wiring of the 2 coils can be done directly by 2 wires from the controller, or by 1 wire controlling step 1 (SI) directly in parallel with a Timer relay controlling step 2. See fig. 8.

Maintenance

Service
The ICSH valves are easy to dismantle.
Do not open the valve while the valve is still under pressure.

The function module can be lifted out using a bolt size M6 screwed into the threaded hole of the piston on the function module (fig. 3). Debris blocking the bolt hole will need cleaning.

Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged. A valve with a damaged o-ring might not regulate according to the specification.
- Check that the piston and cylinder is free of scratches and look for wear marks. If the wear is excessive the function module should be replaced to prevent false pilot signal around the piston ring.
- Check that the movement of the cylinder and valve seat is free and with low friction.
- If the teflon valve plate is damaged it must be replaced. It is available as spare part:

Type	Code number
ICS 25 repair kit	**027H2219**
ICS 32 repair kit	**027H3017**
ICS 40 repair kit	**027H4015**
ICS 50 repair kit	**027H5015**
ICS 65 repair kit	**027H6017**
ICS 80 repair kit	**027H6017**

For mounting instructions please see DKRCI.PI.HS0.D.

Assembly
Remove any dirt from the body before the valve is assembled. Check that all channels in the valve are not blocked by any particles.
If possible, apply some refrigeration oil to facilitate the insertion and to protect the o-rings.

Tightening/Operation of Manual spindle (fig.6)
Tighten the top cover with a torque wrench to the values indicated in the table.

If the manual opening spindle needs to be activated it is important not to exceed 15 Nm in any directions.

Note:
Always pay attention to the spindle during operation of the manual opener
1. Pay attention to the C-clip reaching the top of the spacer between C-clip and manual stem top nut when turning the manual stem clockwise for opening the valve. **Never use excessive torque and stop turning when the C-clip gets in contact with the spacer.**
2. When turning the spindle anticlockwise, for deactivation of the manual opener, to the top point, tighten the spindle further anticlockwise to 8 Nm (5.9 lb/ft) torque for back-seating.
3. Remount the cap and tighten it clockwise to 8 Nm (5.9 lb/ft) torque.

If the manual opener or needle housing assembly is damaged it must be replaced. It is available as spare part:

Type	Code number
ICSH-25 Needle Housing Assembly	**027H8413**
ICSH-32 Needle Housing Assembly	**027H8414**
ICSH-40 Needle Housing Assembly	**027H8415**
ICSH-50 Needle Housing Assembly	**027H8416**
ICSH-65 Needle Housing Assembly	**027H8417**
ICSH-80 Needle Housing Assembly	**027H8418**

ENGLISH

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.
In cases of doubt, please contact Danfoss.

Drawings are only for illustration, not for dimensioning or construction.

Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

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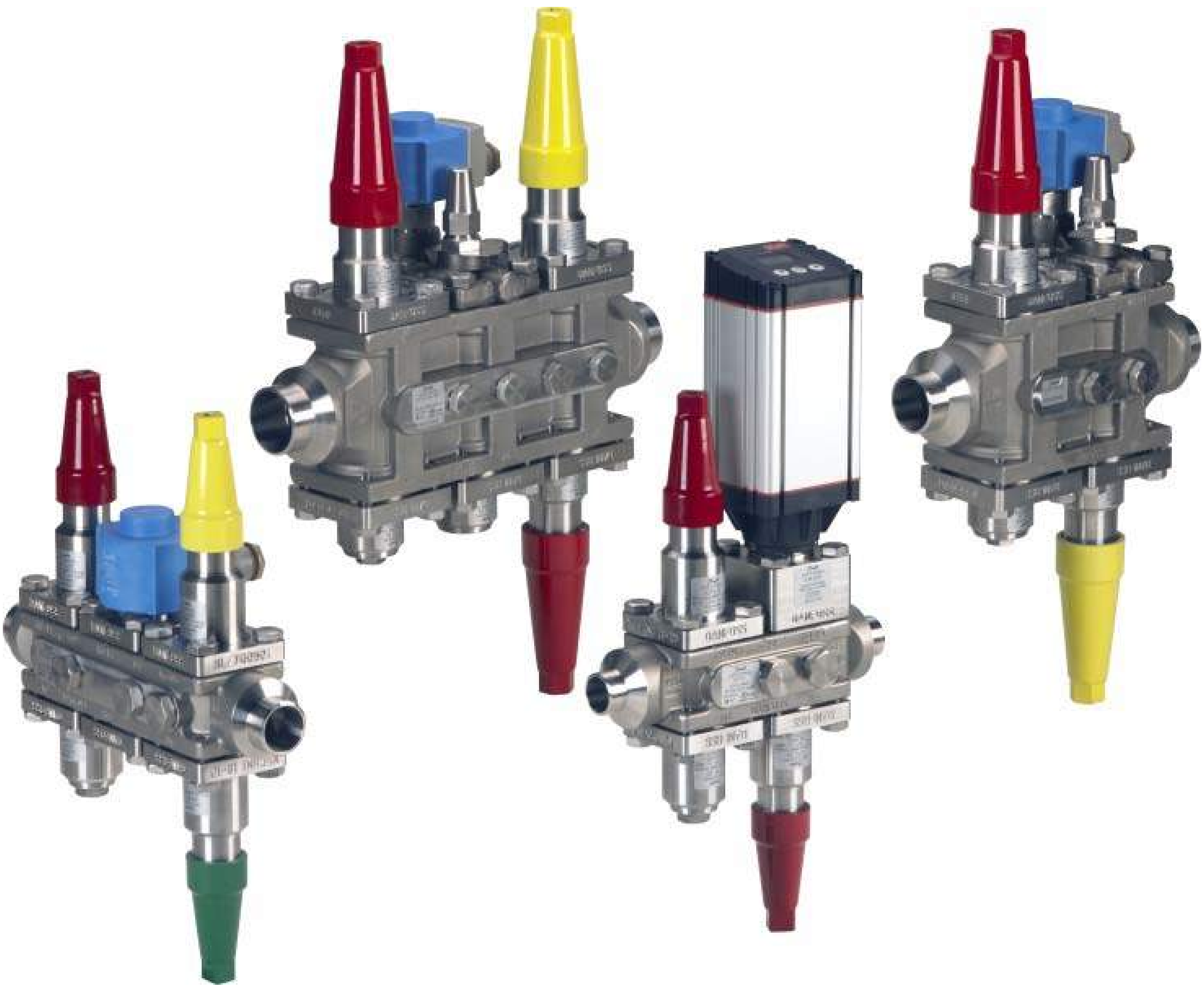
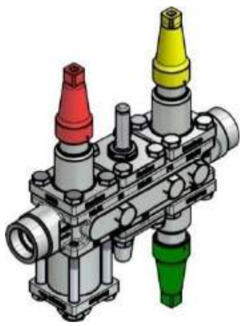
LISTED

The following text is applicable to the UL listed products ICS 25-65
Applicable to all common non-flammable refrigerants, including R717 and to non-corrosive gases / liquids dependent on sealing material compatibility. The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ ASHRAE 15 for the refrigerant used in the system.

Valve Stations Type ICF

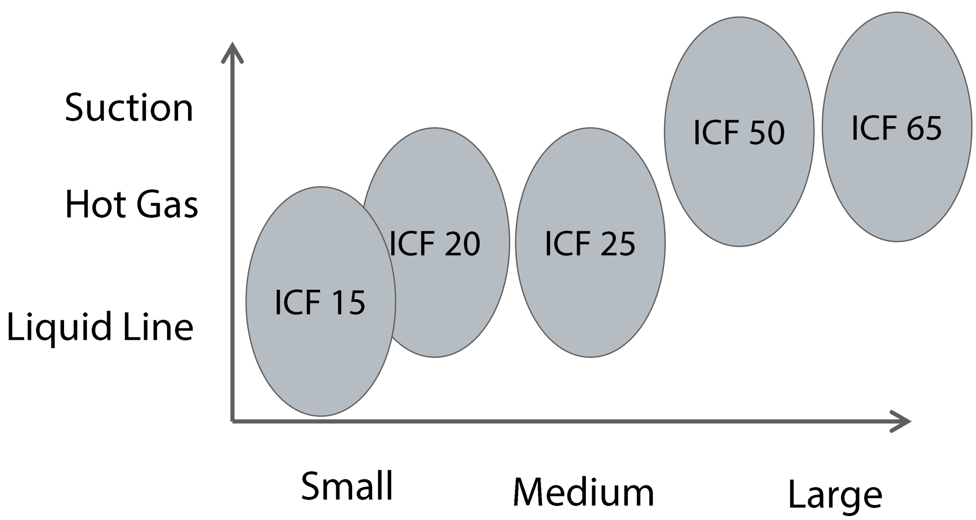


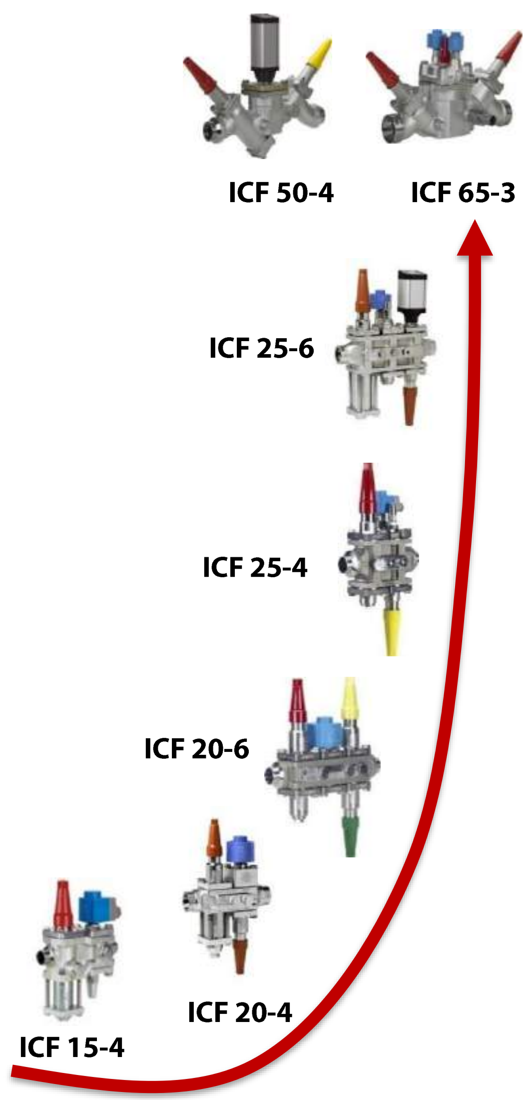


Direct welding without disassembly

ICF Flexline™ Portfolio

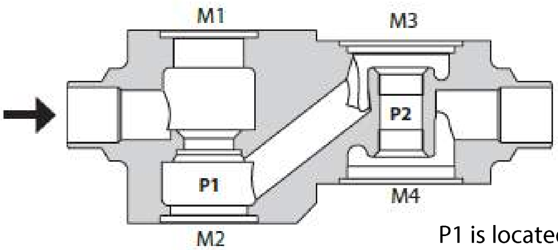
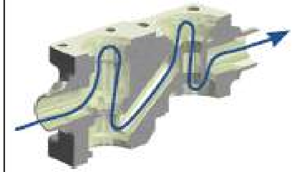
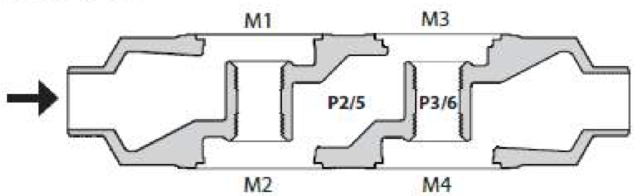
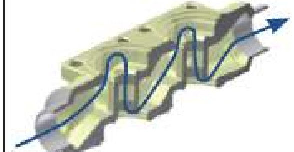
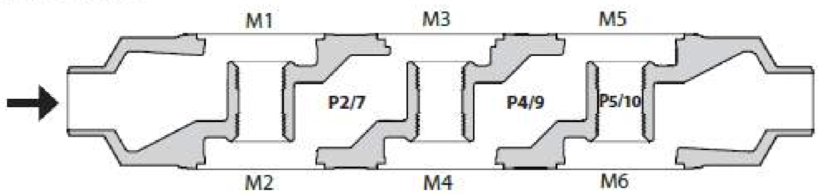
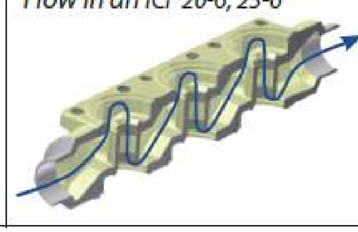
Range has ½" thru 3" connections



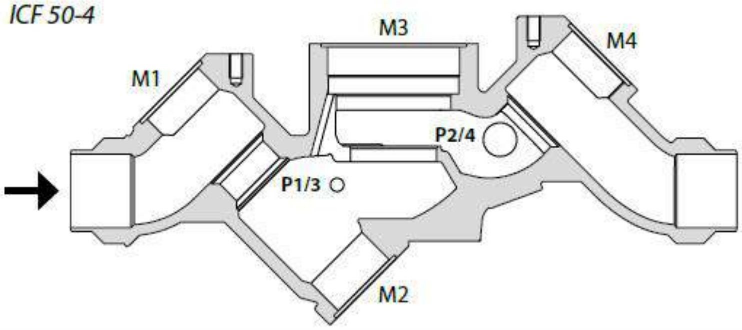
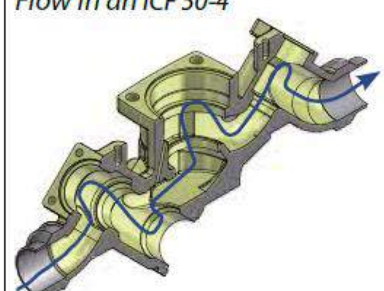
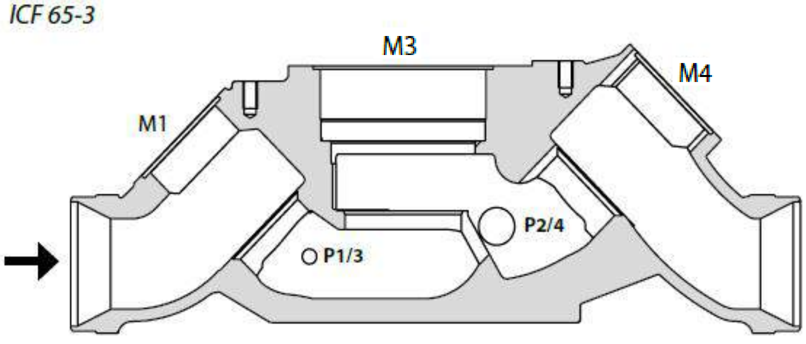
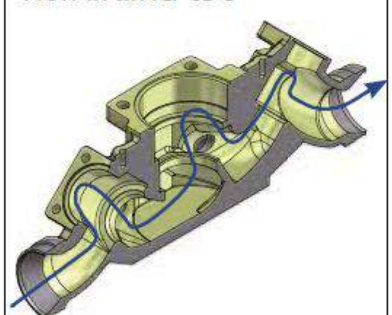


Stainless Steel ICF now available in size 20 & 25

Flow and Side Port Locations

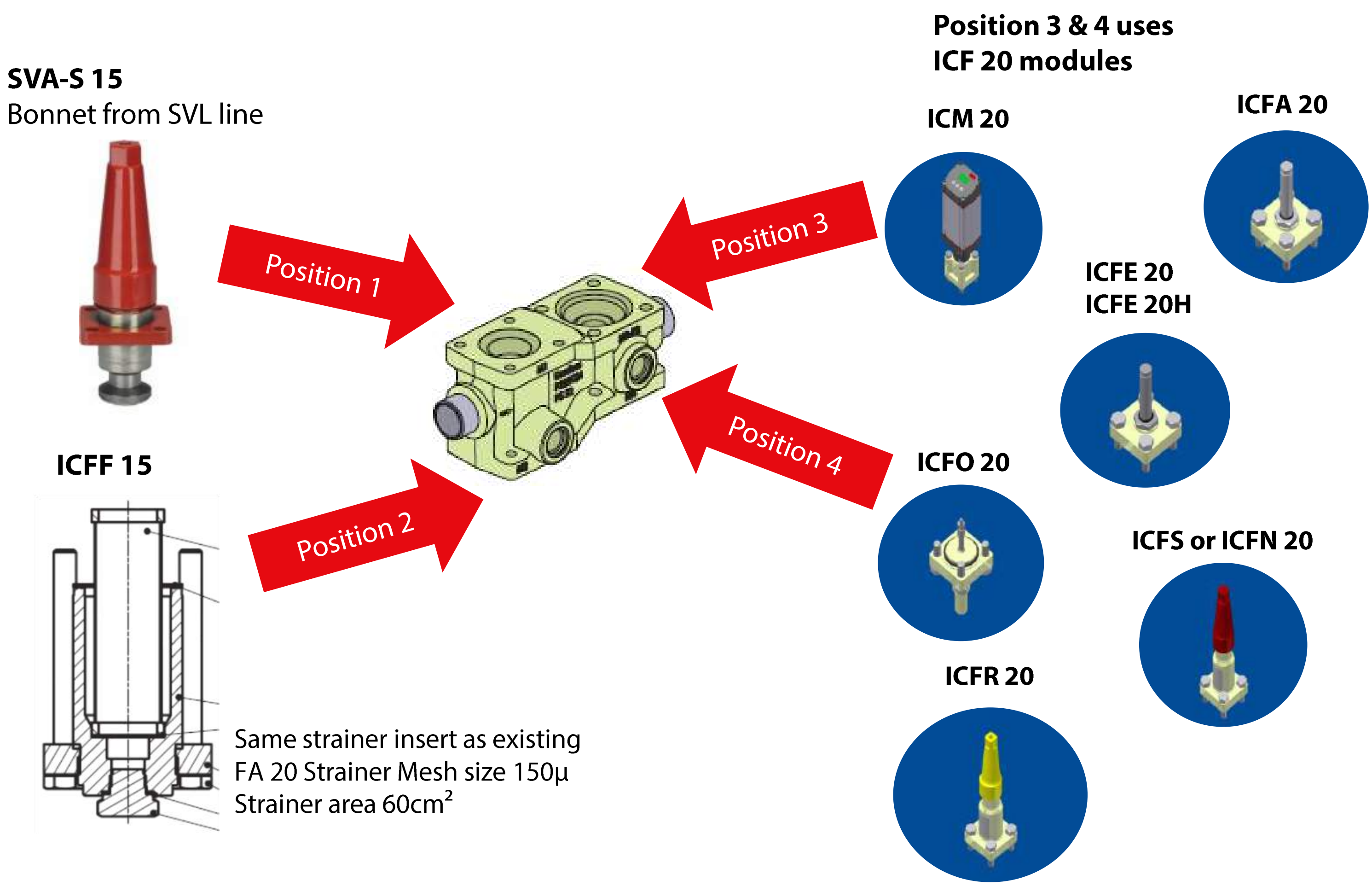
ICF 15-4  P1 is located after filter insert	*Flow in an ICF 15-4* 	Socket-weld Connections: ½″ only
ICF 20-4, 25-4 	*Flow in an ICF 20-4, 25-4* 	Socket-weld Connections: ¾″, 1″, 1-1/4″
ICF 20-6, 25-6 	*Flow in an ICF 20-6, 25-6* 	Socket-weld Connections: 1″, 1-1/4″, 1-1/2″

NOTE: ICF size 15 to 40 with socket-weld connections will have all **3/8″ NPT** side ports and strainer purge connection.

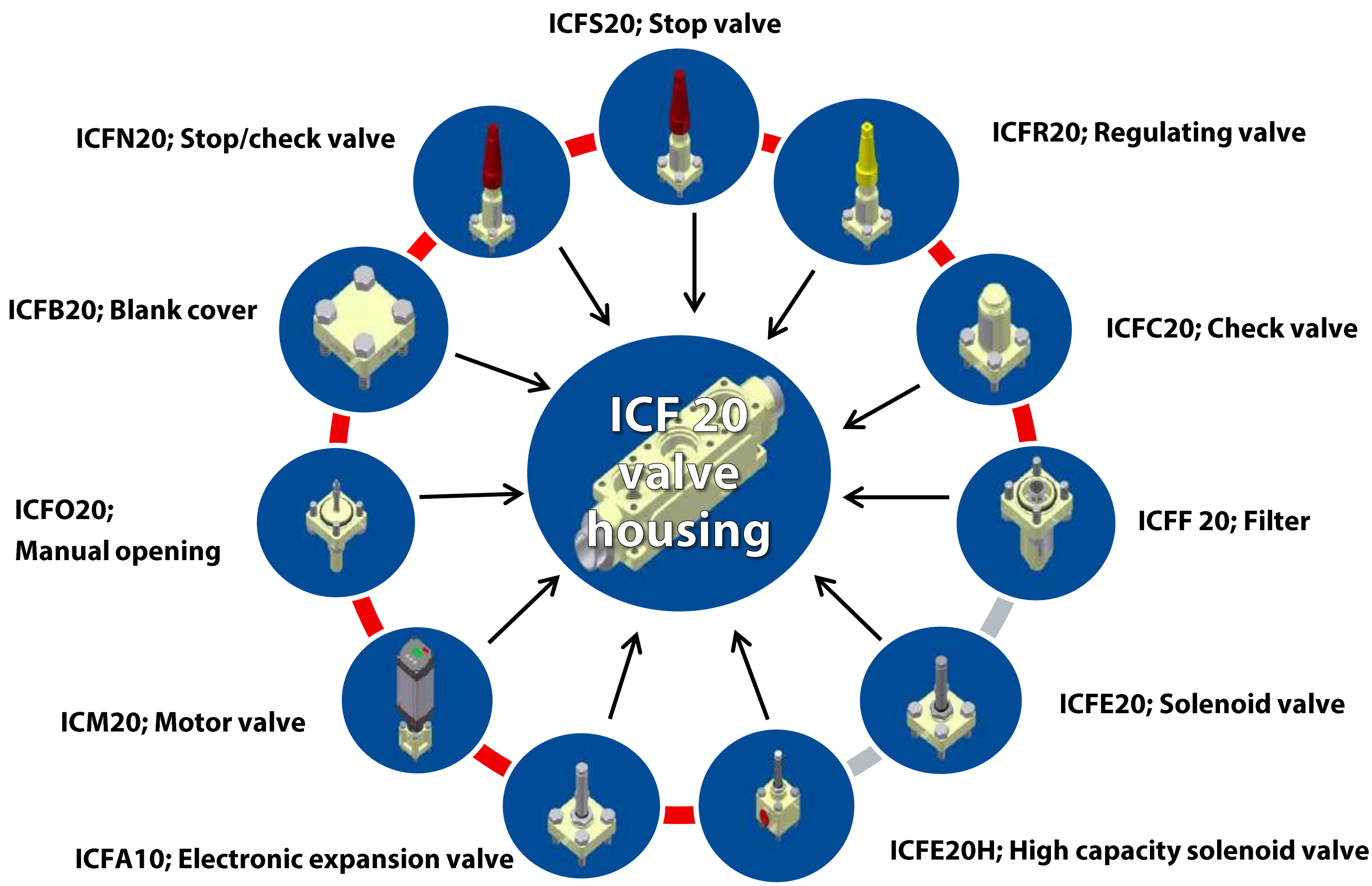
ICF 50-4 	*Flow in an ICF 50-4* 	Socket-weld Connections: 1-½″, 2″
ICF 65-3 	*Flow in an ICF 65-3* 	Butt-weld Connections: 2-1/2″, 3″

NOTE: ICF size 50 and 65 with ANSI connections will have **3/8″ NPT** side ports P1/3 and M33 x 1.5 connection in P2/4 for mounting optional 1″ weld defrost condensate return connection.

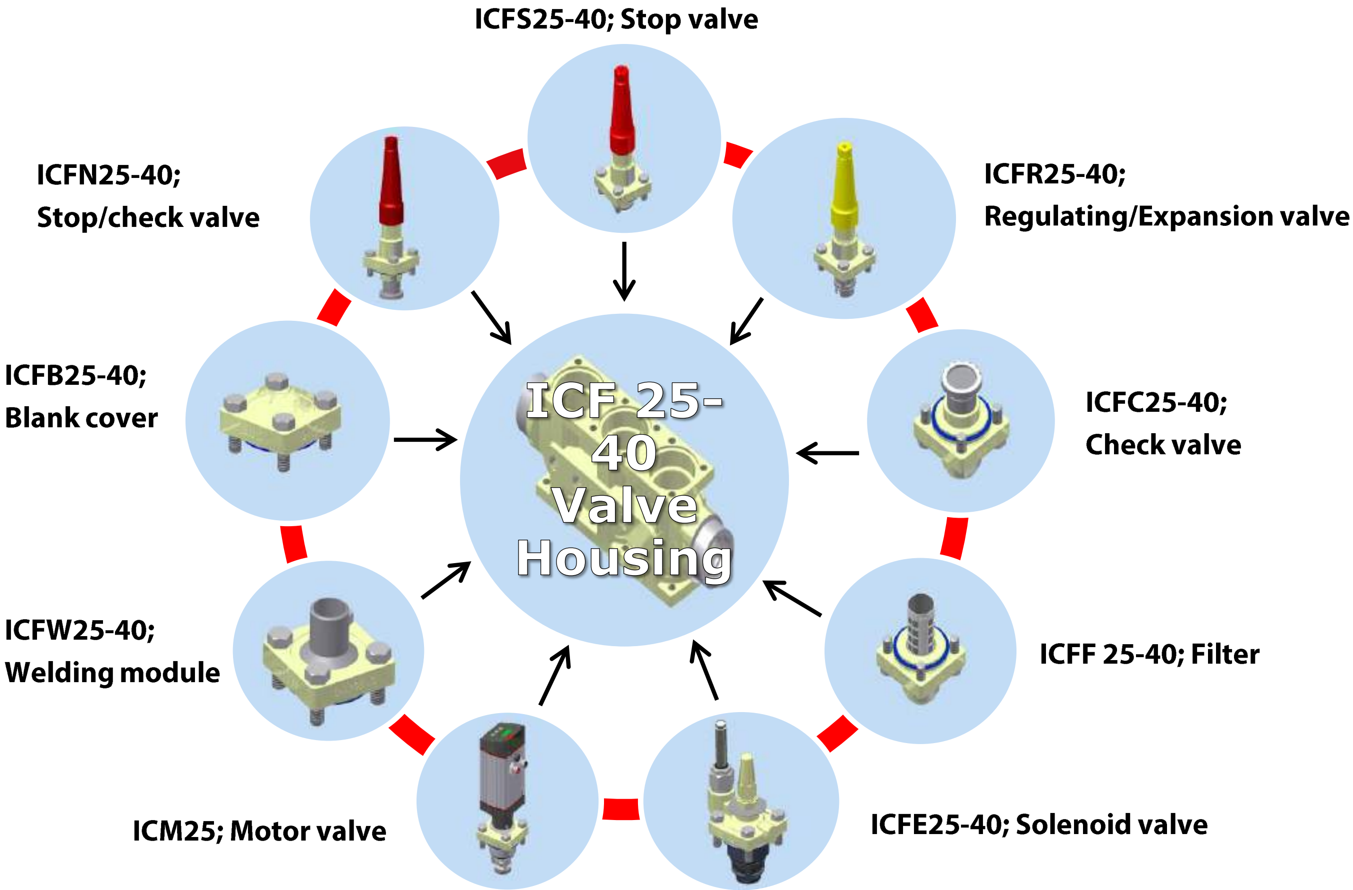
ICF 15 Modules
Range of Combinations



ICF 20 Modules
Range of Combinations



ICF 25-40 Modules
Range of Combinations



ICF 20-40
Module Names and Possible Locations

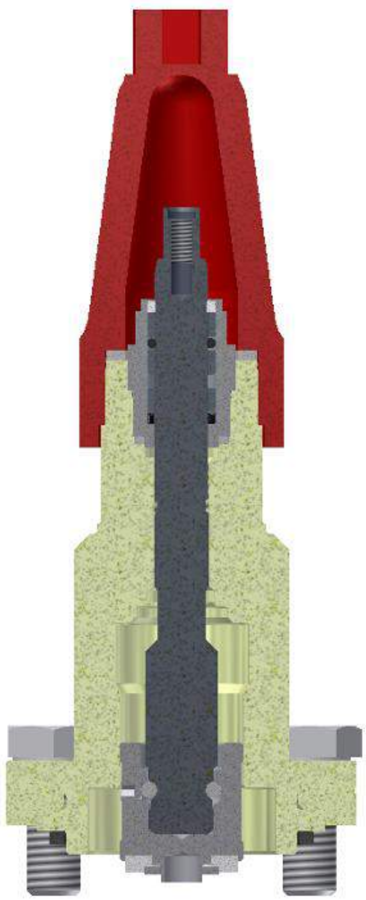
Function Module Type		Can be installed in these locations					
ICFS	Stop valve module	M1	M2	M3	M4	M5	M6
ICFR	Manual regulating (HEV) valve module	M1	M2	M3	M4	M5	M6
ICFF	Filter (strainer) module		M2		M4		M6
ICFE	Solenoid valve module			M3			
ICFC	Check valve module				M4		M6
ICFN	Stop/check valve module				M4		M6
ICM	Motorized valve module	M1		M3		M5	
ICFB	Blank module port cover	M1	M2	M3	M4	M5	M6
ICFA	Electronic expansion valve module for ICF 20 only	M1		M3		M5	
ICFO	Manual opening module for ICFE 20 solenoid				M4		
ICFW	Welding module for ICF 25-40 only	M1	M2	M3	M4	M5	M6

Module locations are indicated by M1, M2, M3, M4, M5, and M6. With respect to refrigerant flow, M1 is closest to inlet.

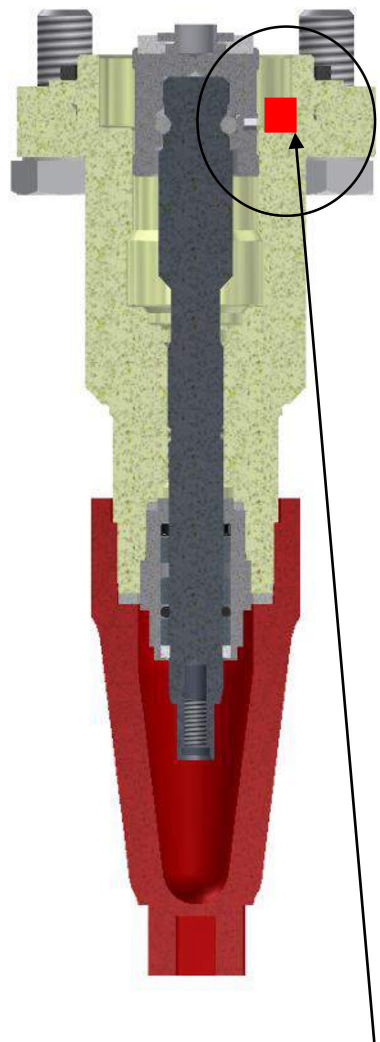
ICFS Stop Module

- Same packing gland and CAP as same size SVA stop valves
- Fully Zn-chromate (after Machining) including the thread for cap.
- Can be mounted in all module positions

ICFS 20



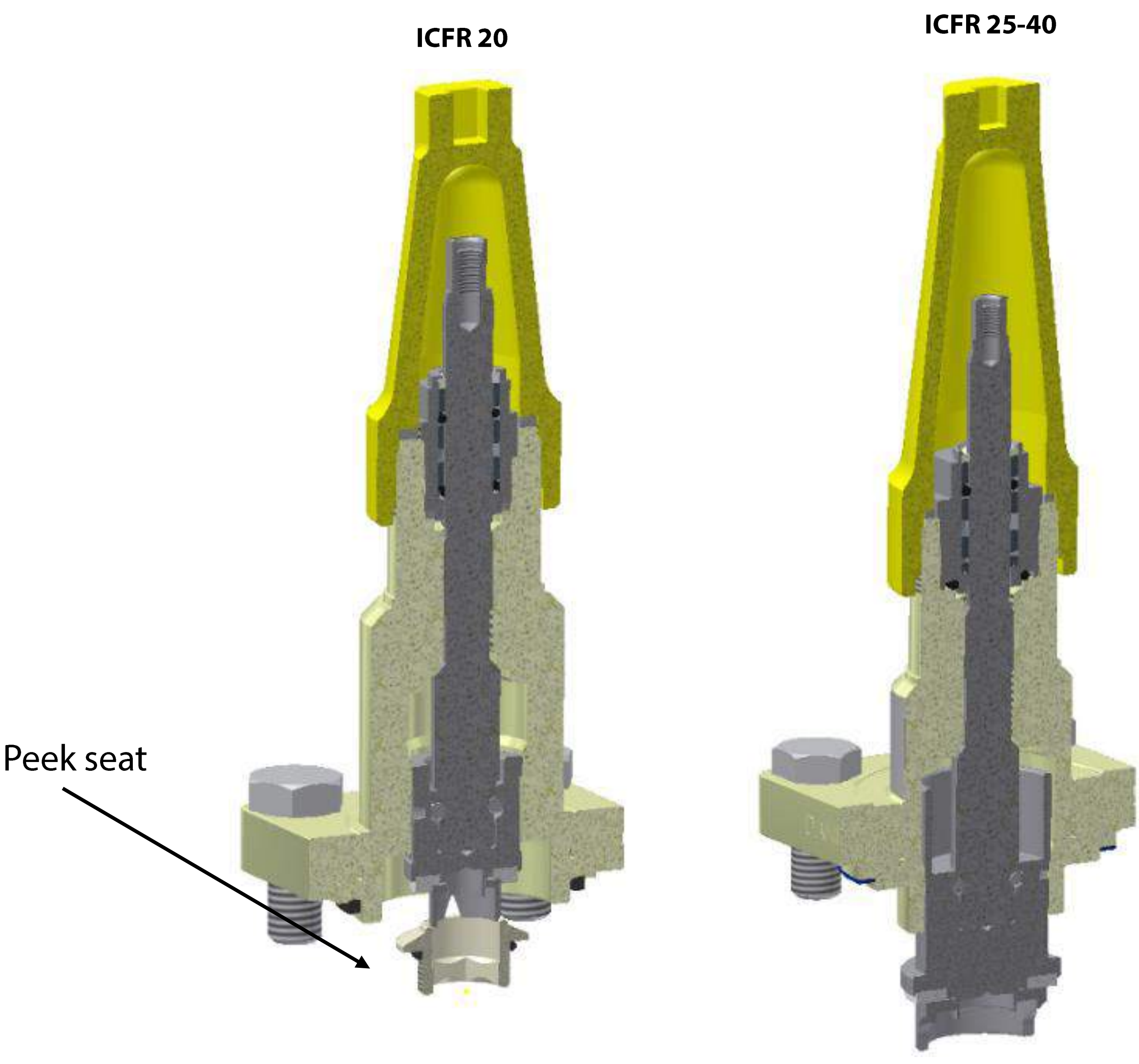
ICFS 25-40



It is normally not allowed to mount standard stop valves upside down, as dirt may enter the tread between the spindle and the bonnet but the ICFS and ICFR cone is designed as a cylinder that prevents the dirt from entering the thread. Clearance is 50 micron

ICFR HEV/Regulating Module

- Same Packing gland as the same size SVA stop valves. Cap is yellow.
- Fully Zn-chromate (after Machining)
- V-port regulation
- Can be mounted in any location – also upside down
- ICFR 20 has a PEEK seat and ICFR 25-40 does not

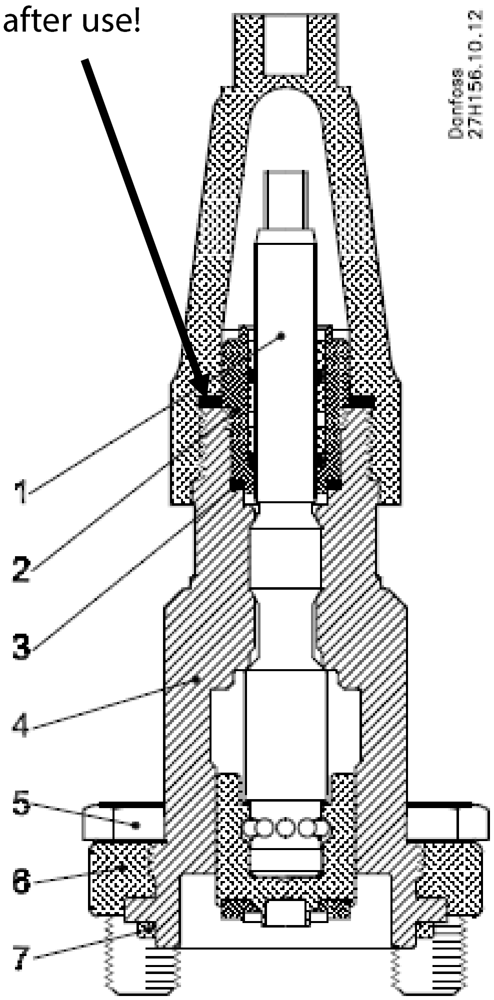


Seal Caps

- Seal Caps should always be completely tightened onto the valve after use to ensure that no moisture/water can enter under the seal cap.
- Seal Caps can be used to open and close shut off modules, stop/check modules, and hand expansion modules by removing them from the valve and using the “square” built into the top of cap as a wrench.

Tighten seal caps to the following torque to ensure proper sealing:
Caps for ICF 20; 16 Nm (12 ft-lbs)
Caps for ICF 25-40; 24 Nm (18 ft-lbs)

Make sure gasket is installed before remounting after use!

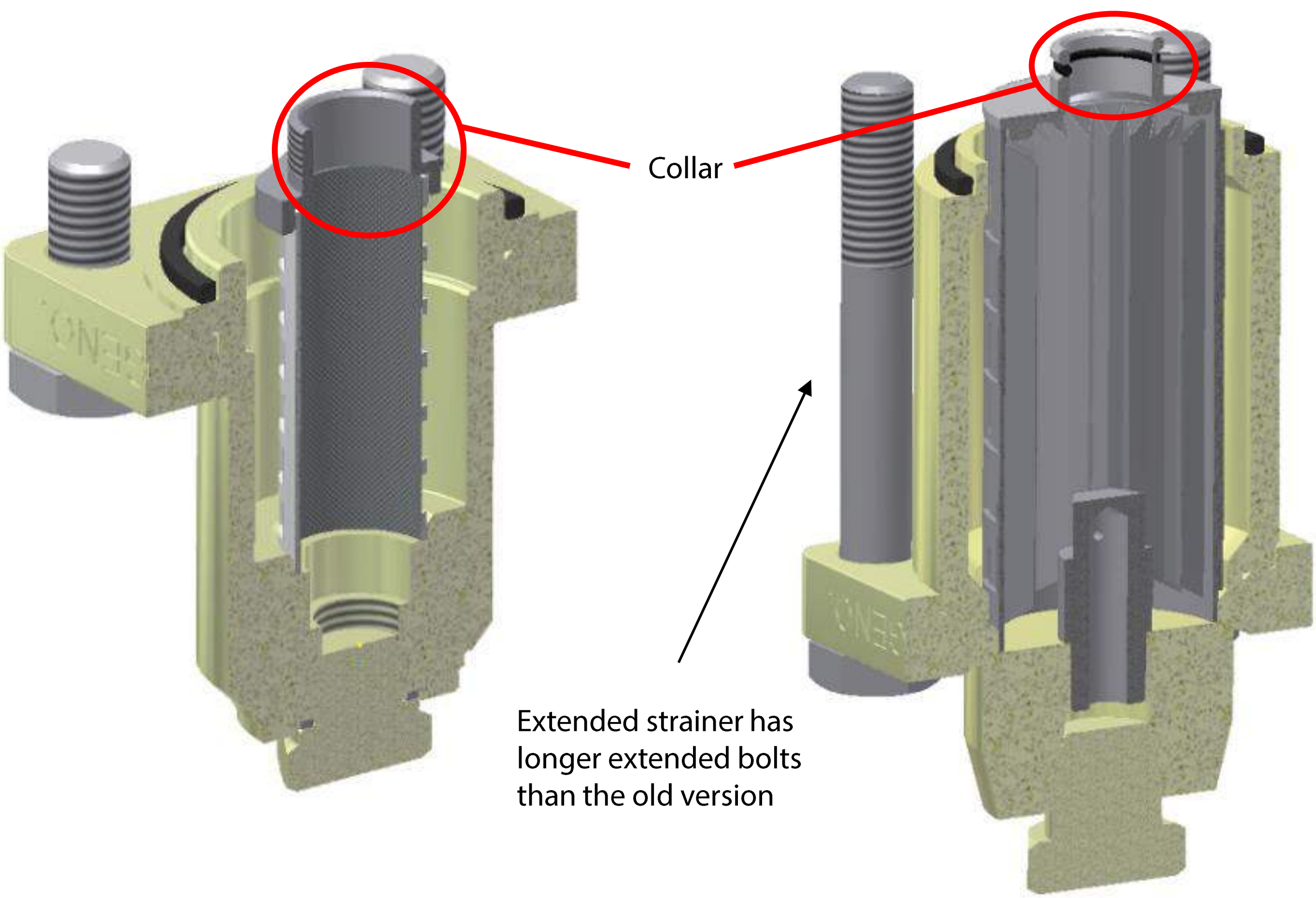


ICFF 20 and ICFF 20E Modules

- ICFF 20 has same Filter element as FIA filter/strainer size 15-20 and ICFF 20E has same filter element as FIA size 25-40
- Fully Zn-chromate (after Machining)
- Can be drained from 3/8" NPT connection in bottom
- Can only mounted in down (outlet positions) M2, M4 & M6

ICFF 20 Filter/Strainer module
Delivered on valve stations prior to
March 1st, 2010

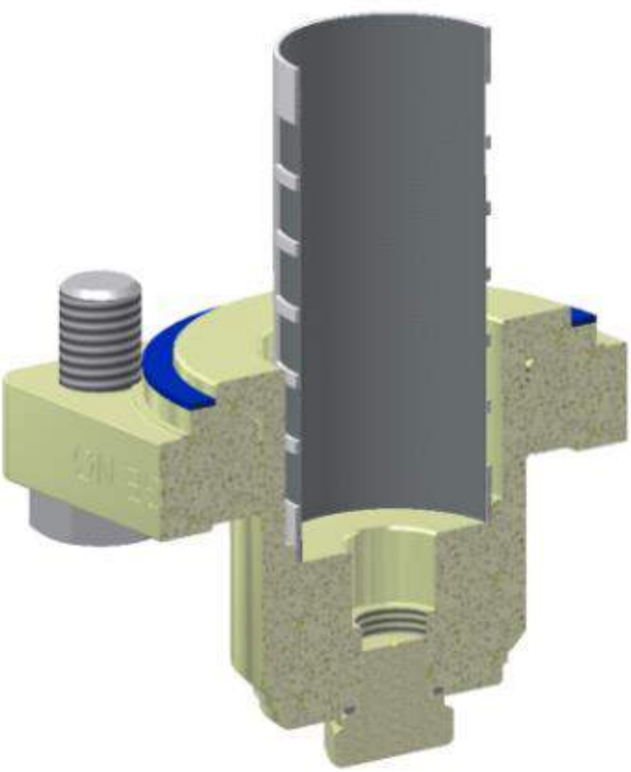
ICFF 20E Extended Filter/Strainer module
Delivered on valve stations on or after
March 1st, 2010



ICFF25-40 and ICFF25-40E Modules

- ICFF 25-40 has same Filter element as FIA filter/strainer size 25-40 and ICFF 25-40E has a special filter element not used by other strainers
- Fully Zn-chromate (after Machining)
- Can be drained from 3/8" NPT connection in bottom
- Can only mounted in down (outlet positions) M2, M4 & M6

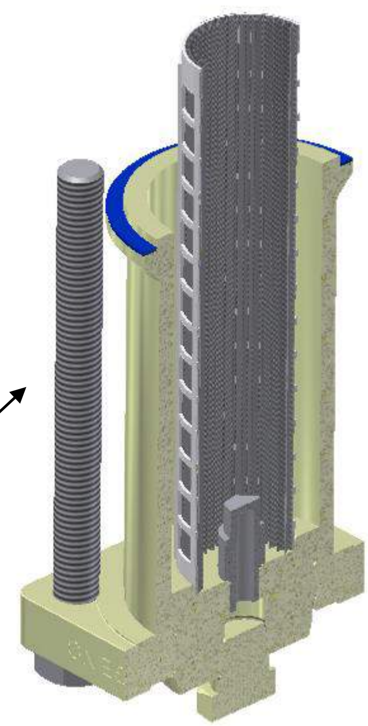
ICFF 25-40 Filter/Strainer module
Delivered on valve stations prior to
March 1st, 2010



ICFF 25-40E Extended Filter/Strainer module
Delivered on valve stations on or after
March 1st, 2010

No Collar

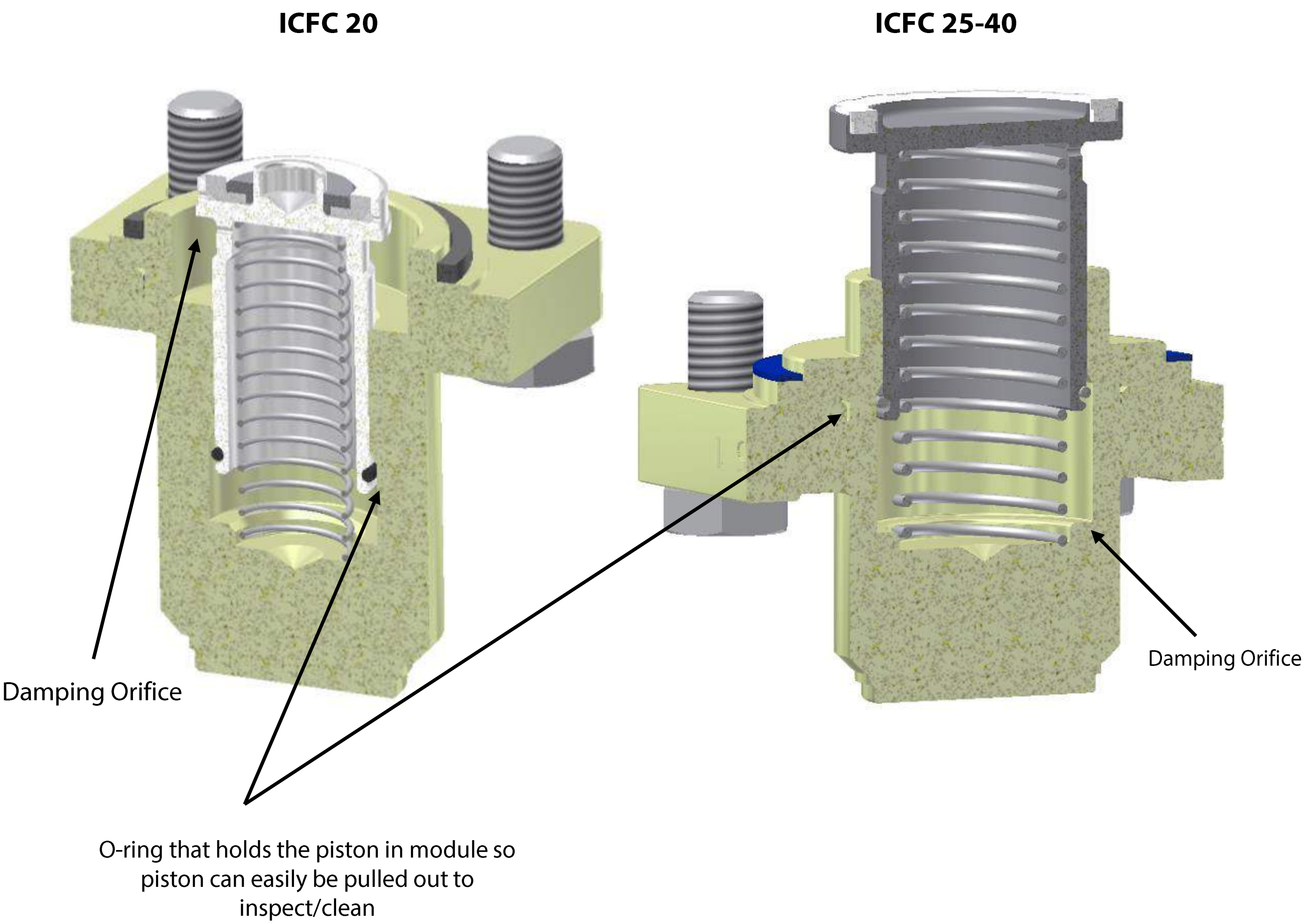
Needed



Extended strainer has
longer extended bolts
than the old version

ICFC Check Valve Module

- Low opening DP.
- Fully Zn-chromate (after Machining)
- Can be mounted in M2, M4 or M6 location – otherwise the flow will open the valve!

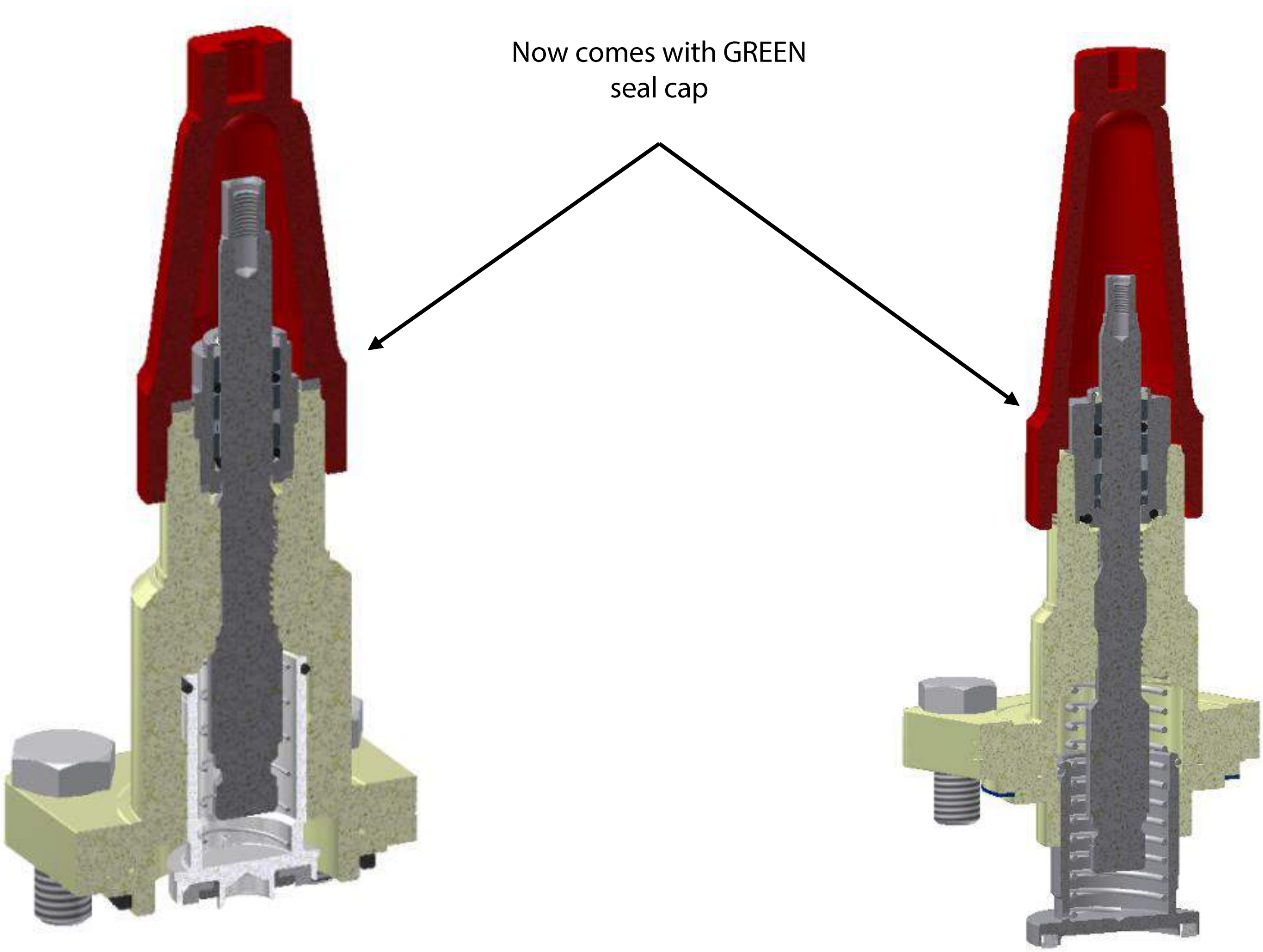


ICFN Stop/Check Module

- Same Packing gland and Cap as SVA stop valve size
- Fully Zn-chromate (after Machining)
- Low opening DP and damped like ICFC check valve modules
- Can be mounted in M2, M4 or M6 location

ICFN 20

ICFN 25-40

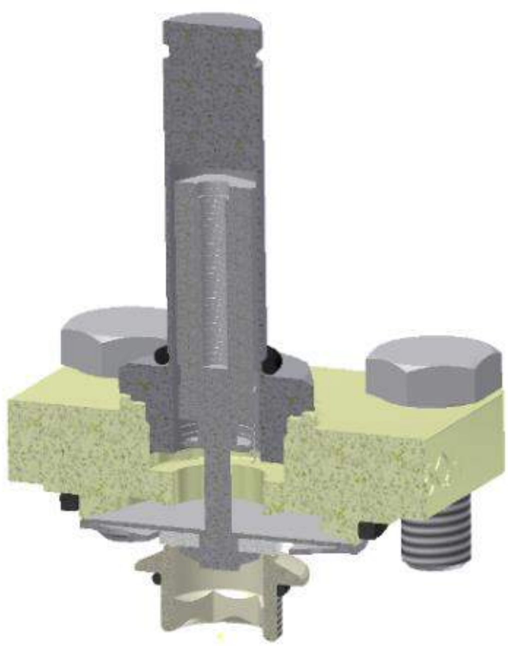


Note: An O-ring holds the piston in module so you can easily pull out the piston to inspect/clean it.

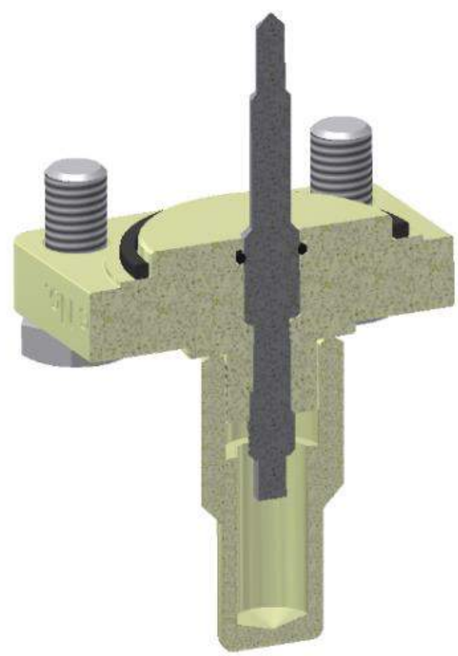
ICFE 20 Solenoid Module and ICFO

- Fully Zn-chromate (after Machining)
- Uses Same Peek seat as ICM 20 motorized valve
- Can only be mounted in M3(ICFE)/M4(ICFO) – due to special machining of the valve body

ICFE 20
Solenoid Module



ICFO 20
Manual opener for ICFE 20



Automatic Mode

Spindle all the way out (Turn counter clockwise)

Max. 20 Nm (15 ft lbs) at stop. Automatic mode (ICFE ON/OFF by coil)

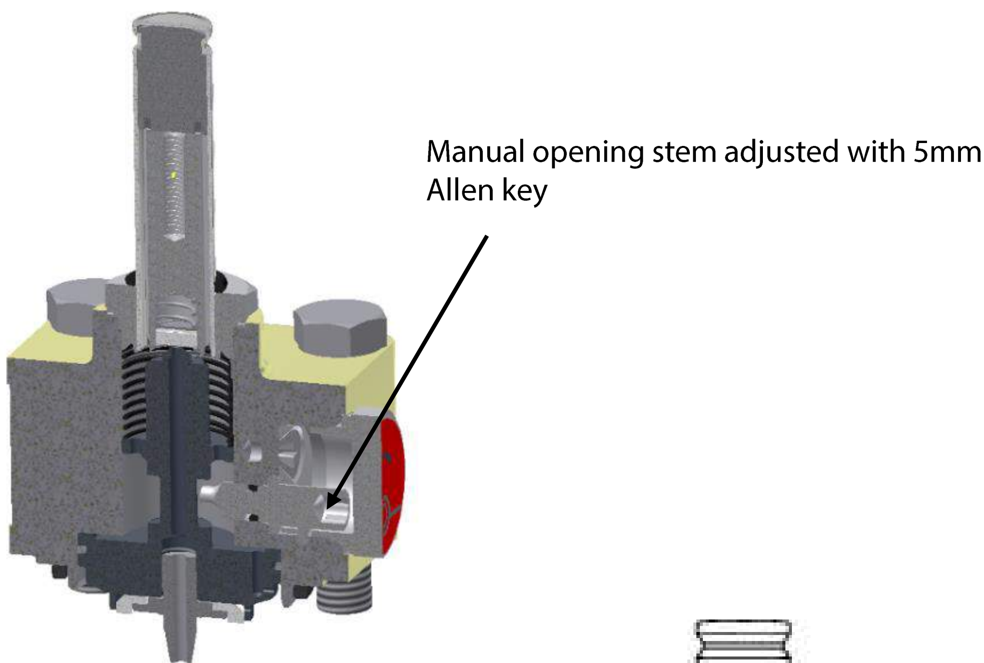
Manual Mode

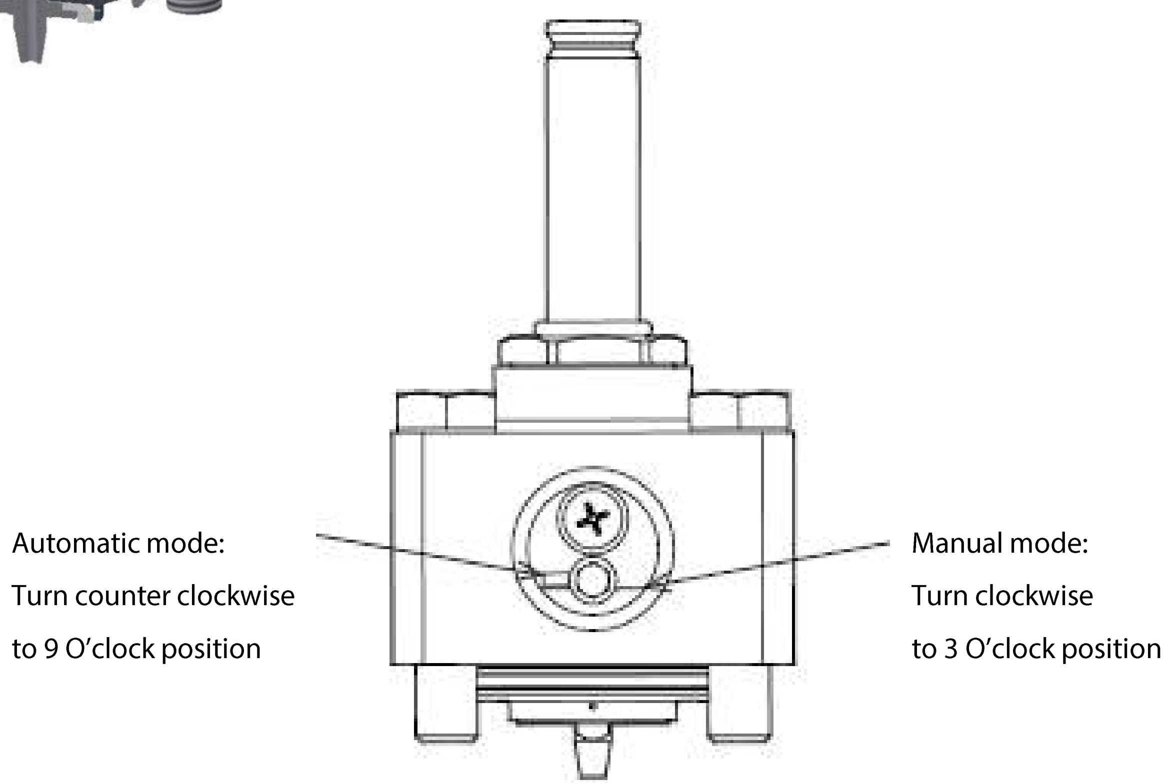
Spindle all the way in (Turn clockwise)

Max. 2.5 Nm (1.8 ft lbs) at stop. Manual mode (ICFE forced open)

ICFE 20H Solenoid Module

- Built-in manual opening device
- Fully Zn-chromate (after Machining)
- Can only be mounted in M3 - due to special machining of the valve body



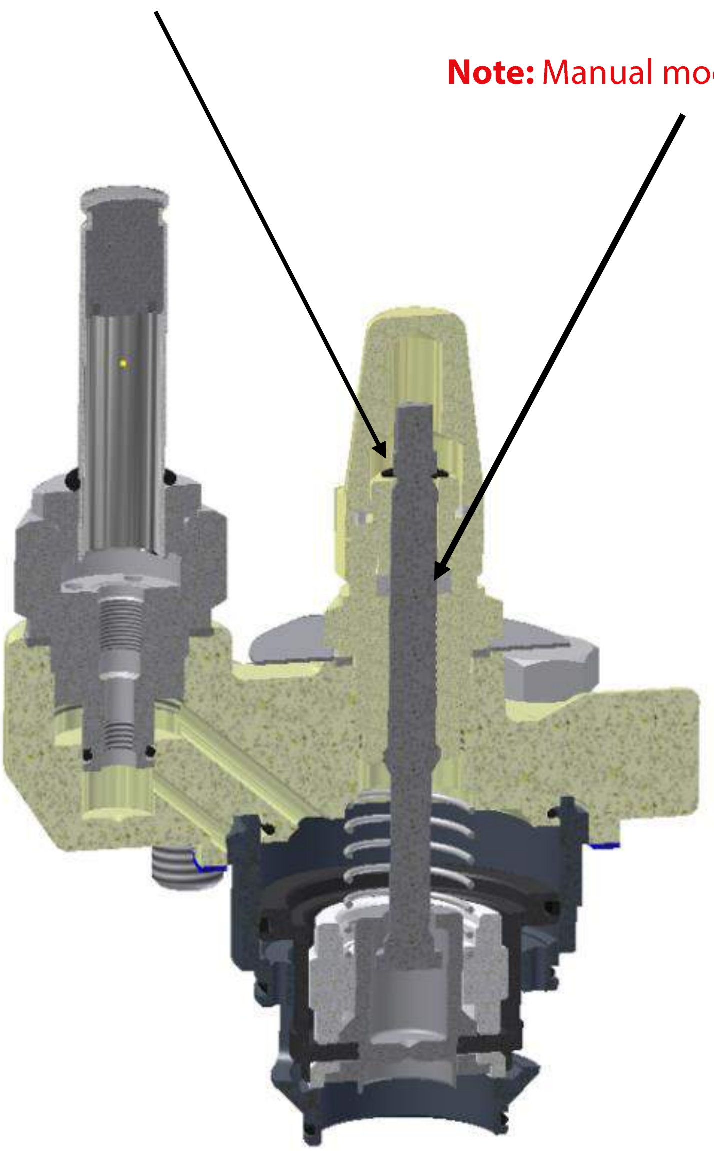


ICFE 25-40 Solenoid Valve Module

- Built-in manual opening device
- Fully Zn-chromate (after Machining)
- Can only be mounted in M3 - due to special machining of the valve body

Locking ring/C-clip on stem. Packing nut can be tightened to stop leak

Note: Manual mode is opposite compared to other solenoids



Automatic Mode:

Spindle all the way in (Turn clockwise) until stopped by locking ring

Max. 4 Nm (3 ft lbs) at stop. Automatic mode (ICFE ON/OFF by coil)

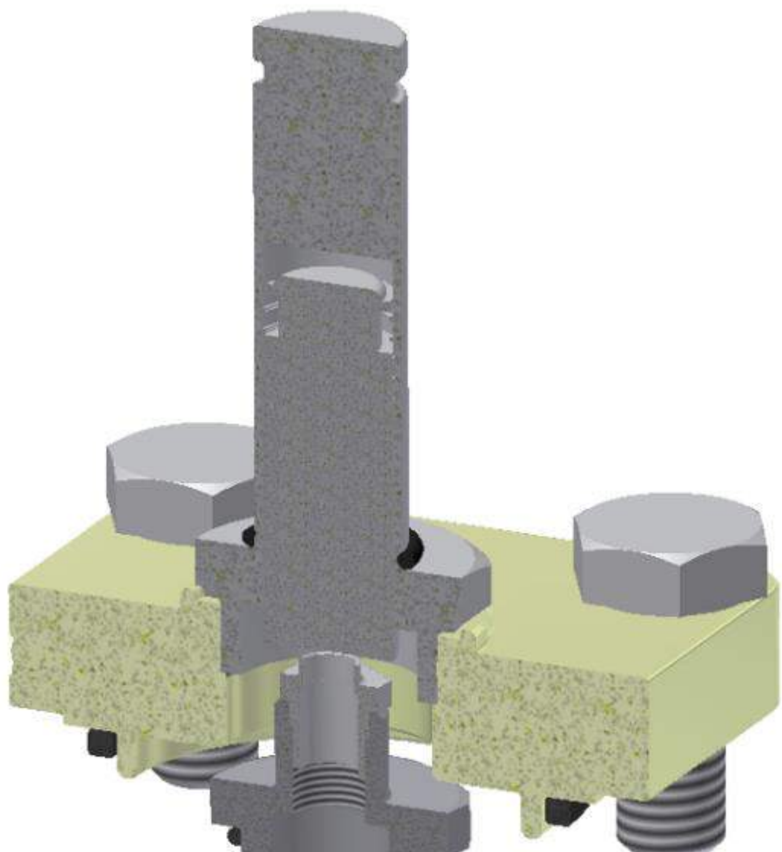
Manual Mode

Spindle all the way out (Turn counter clockwise)

Max. 10 Nm (7 ft lbs) at stop. Manual mode (ICFE forced open)

ICFA Pulse Expansion Module for ICF 20

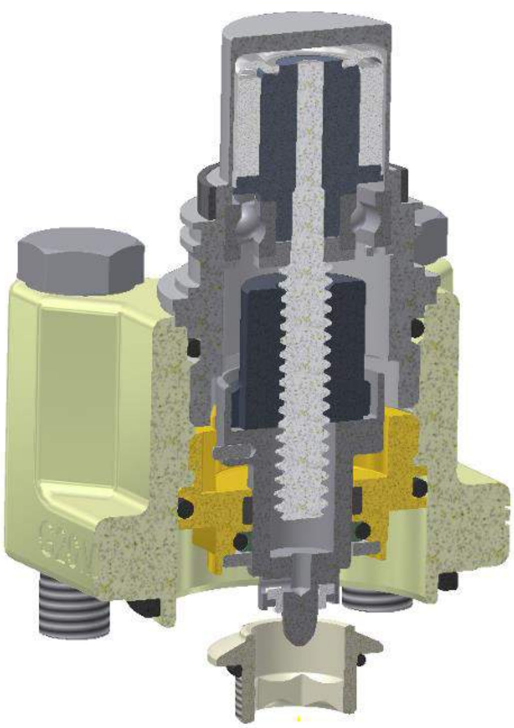
- Use same top & orifice as AKVA 10 (pulse modulating valve)
- Fully Zn-chromate (after Machining).
- Can only be mounted in M1, M3 and M5



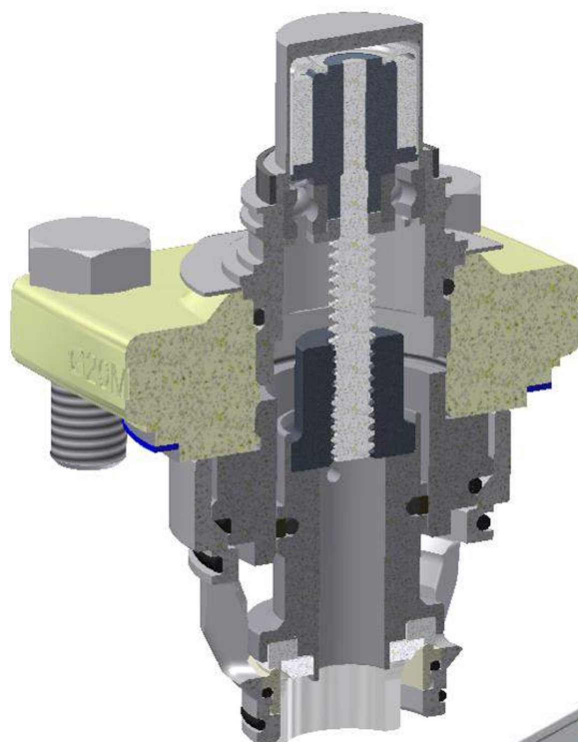
ICM Motorized Modules

- ICM (motor regulating valve) module
- V-port regulation
- PEEK seat screws into body on ICM 20
- Can be mounted in locations M1, M3 and M5

ICM 20 motor valve module

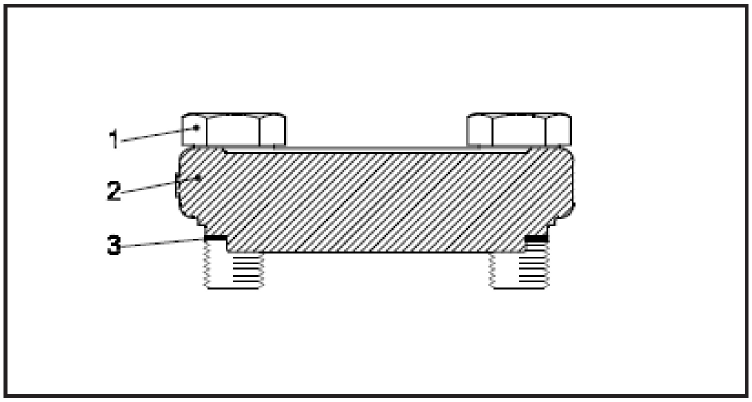


ICM 25 motor valve module



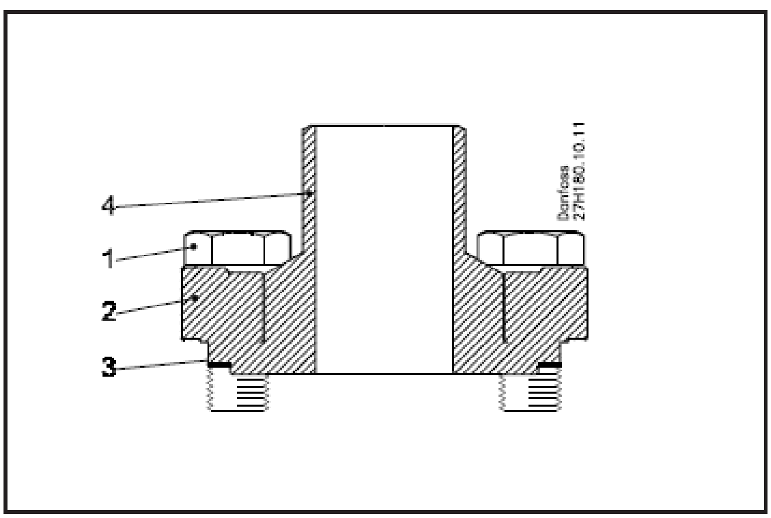
ICFB and ICFW Modules for ICF 20 to 40

ICFB Blank Cover Module



ICFB module is used to close off modules that are not being used

ICFW Welding Module

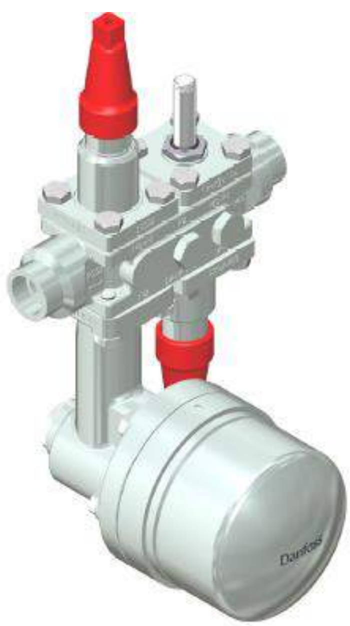


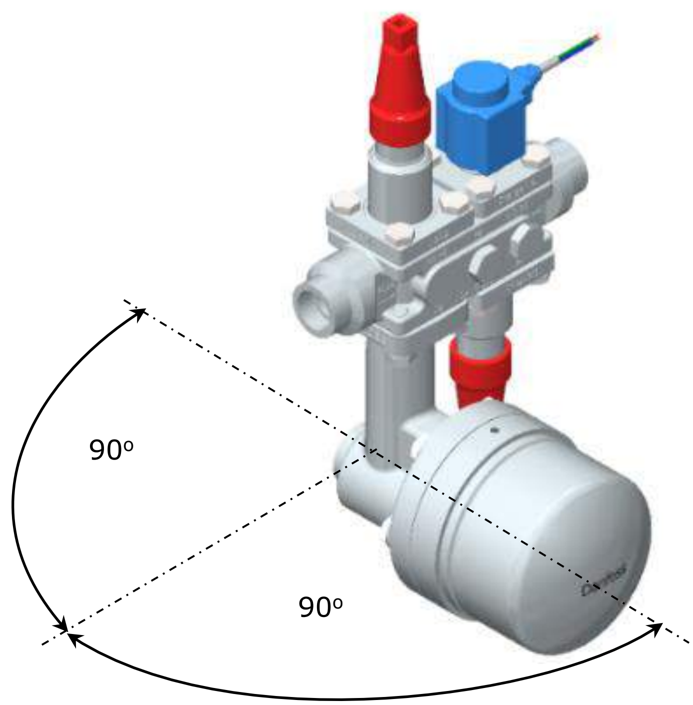
ICFW module has a 1” welding connection for hot gas defrost (drain line)

- No control function
- Can be mounted in any location

ICFD Defrost Float Module for ICF 15 and 20

- Design based on a mechanical float.
- Built-in bleed to maintain a liquid lift without any additional bypass valve.
- Has a very high capacity compared to its size and designed to work well at the full capacity range.
- Manual opening stem for service (uses 5mm hex key)
- ICFD module can be rotated w/o affecting operation

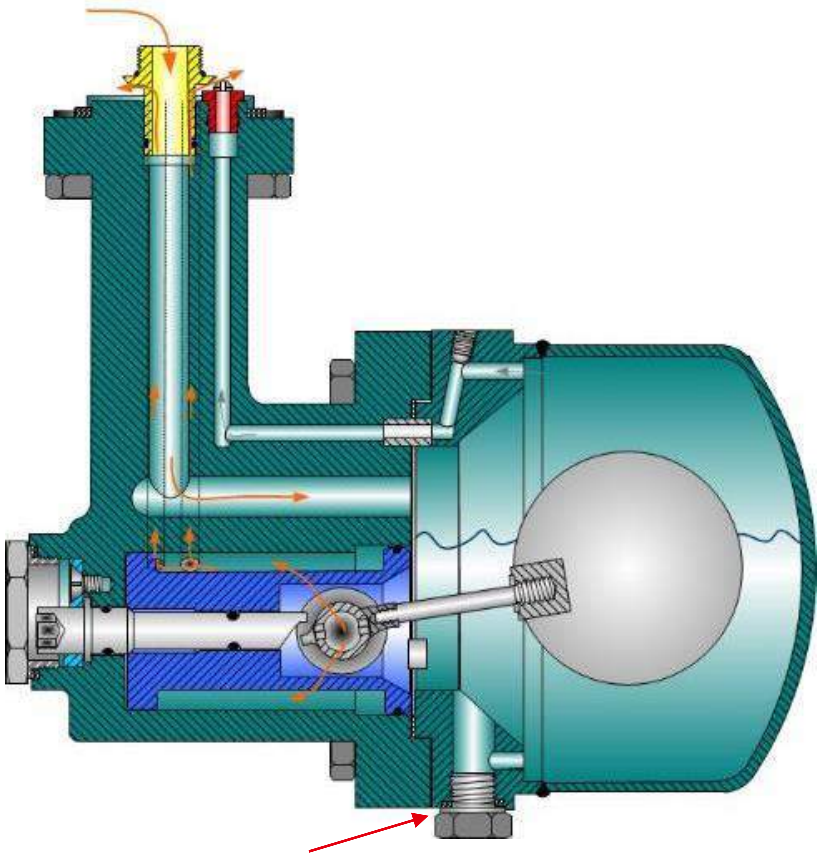




https://www.youtube.com/watch?v=582dULAgj-U

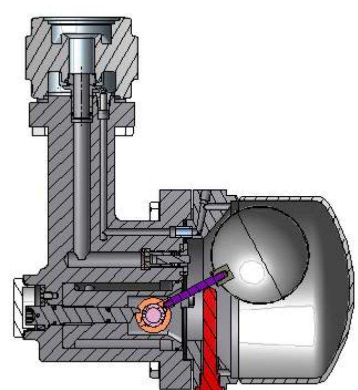
ICFD Defrost Float Module for ICF 15 and 20

Manual opening device under cap (turn clockwise for manual Mode with 5 mm hex key)



NOTE: Drain connection thread is ¼″ BSP (European) straight thread and must be sealed with aluminum gasket when mounting plug or SNV-ST purge valve with adapter.

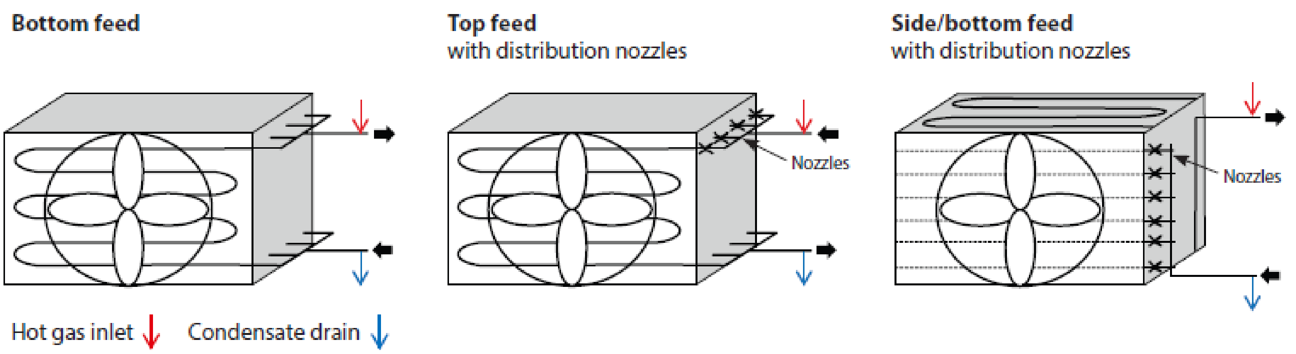
SNV-ST 3/8″ purge valve and adapter p/n 148B6607 for ICFD drain connection



NOTE: A transportation plug is installed at factory and needs removed after installation in system and replaced with aluminum gasket and plug that comes with ICF or the below purge valve and adapter kit.

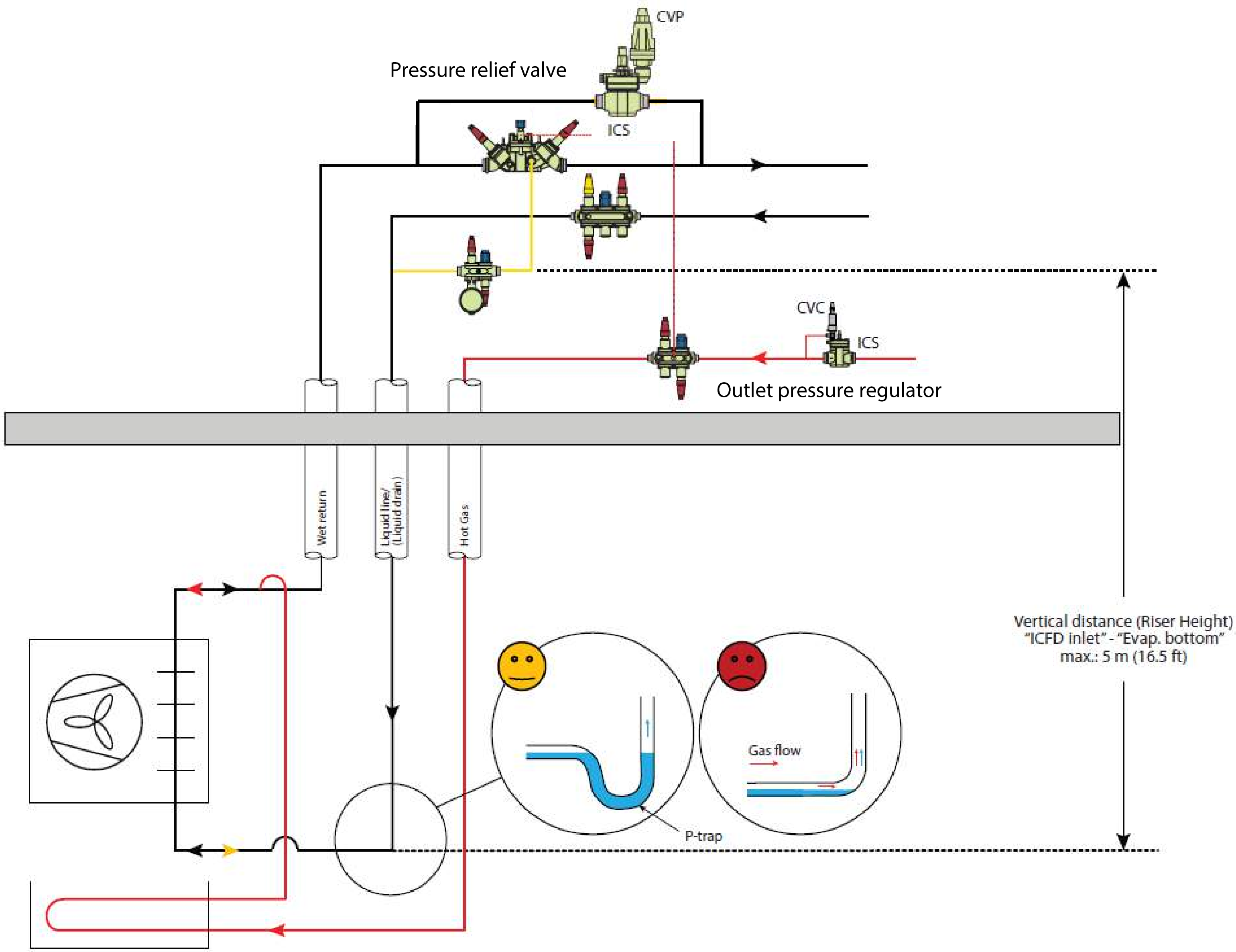
ICFD Application Guidelines

Typical Evap Configurations

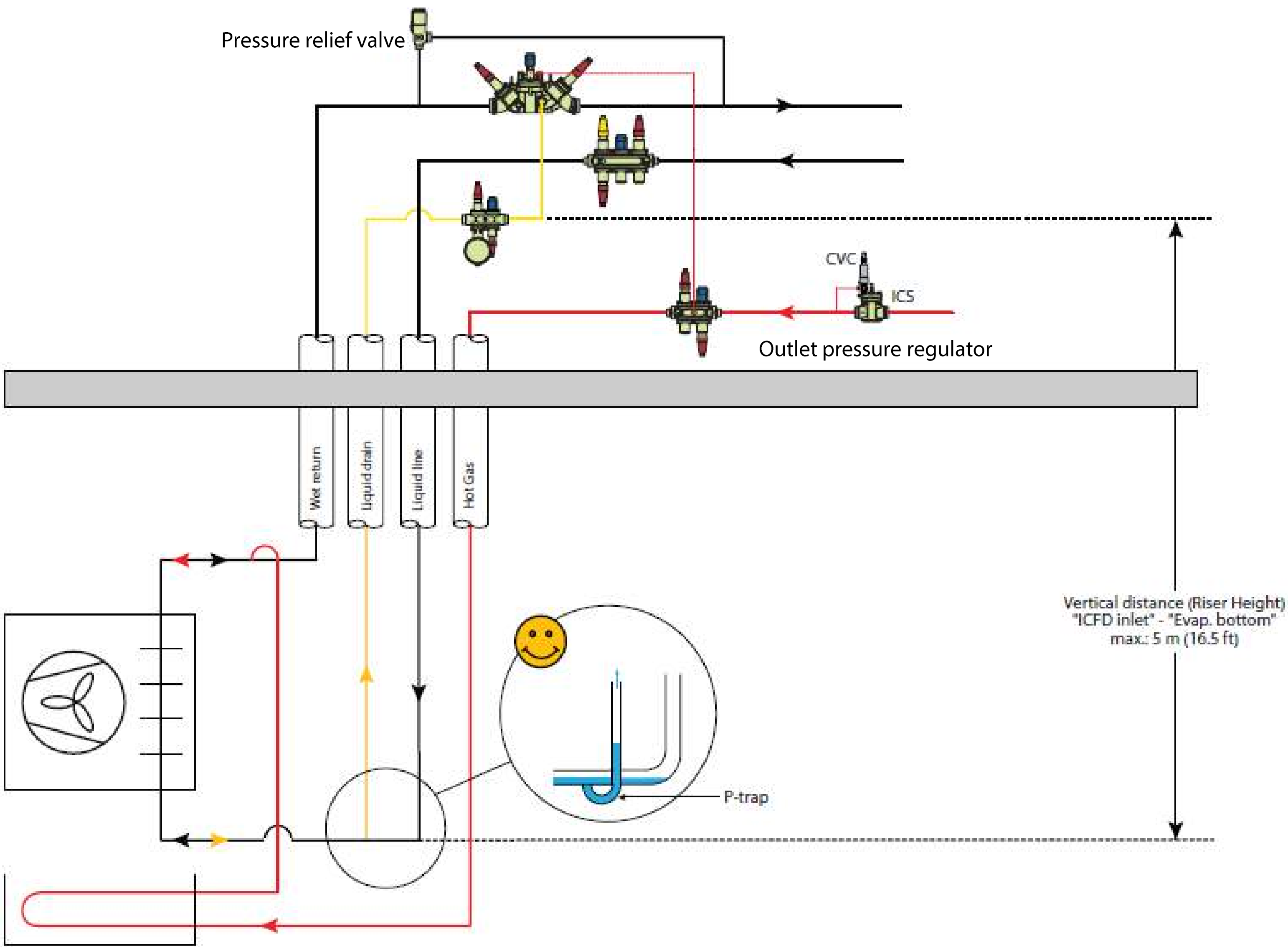


- Account for additional pressure drop for evaporators with distributors when sizing
- P-trap must always be installed on the condensate drain line
- Max Riser Height is 16.5 ft
- ICFD does not have a pressure relief function so consider trapped liquid and the hot gas supply should be regulated to a lower pressure with outlet pressure regulator to stay below the max. operating pressure of evaporator
- Use Coolselector 2 to confirm sizing for application

ICFD Piping Example – Shared Liquid Riser for Condensate Return



ICFD Piping Example – Dedicated Condensate Drain Riser (Ideal Piping to size for drain capacity)



Product Concept ICF 50-4

Uses standard modules from SVL and ICV line!

ICS 50
3 pilot top cover & ICS 50, ICS 50-40 (reduced port) or ICS 50-32 (reduced port) module

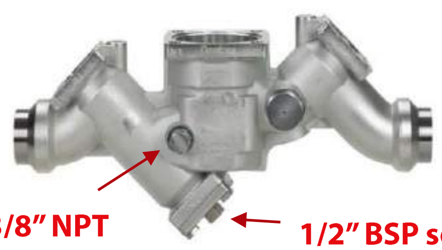
ICM 50
Motorized valve

ICLX 50
Gas-powered valve

ICSH 50
Dual Position Solenoid (uses same ICS modules)

M3

SVA-S 50 M1



M4 **SVA-S 50** or **REG-SB 50**

3/8" NPT

1/2" BSP so an adapter is needed

1-1/2" or 2" socket-weld connections

M2

FIA cover
Uses FIA 50 strainer element/insert and cover which has ½" BSP (European thread) so an adapter is needed for gauge valve in cover.

Product Concept ICF 65-3

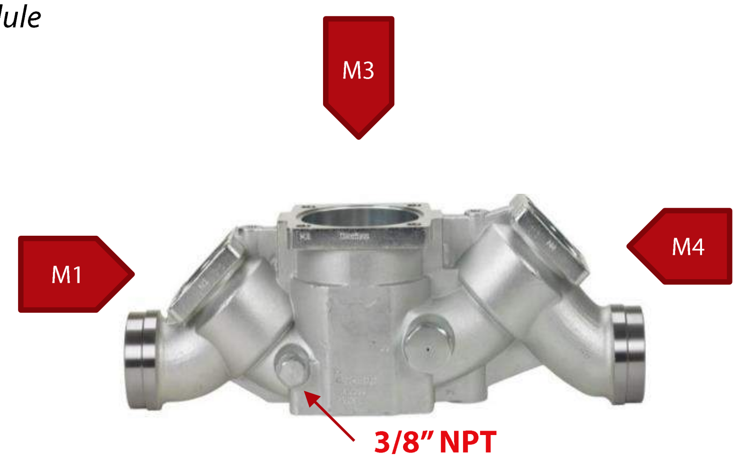
Uses standard modules from SVL and ICV line!

ICS 65
3 pilot top cover &
ICS 65 or
ICS 65-40 (reduced port)
module

ICM 65
Motorized
valve

ICLX 65
Gas-powered
valve

SVA-S 65



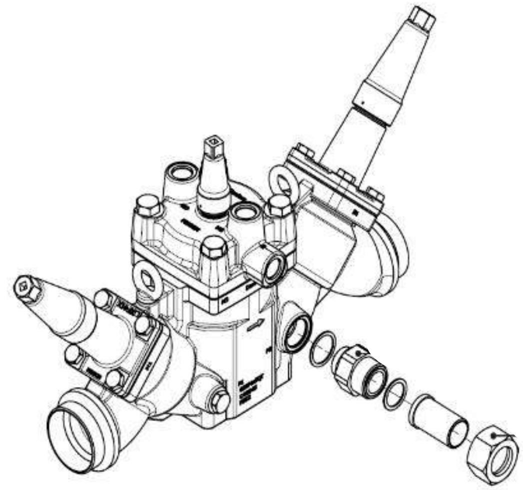
SVA-S 65
or
REG-SB 65

2-1/2" or 3" butt-weld connections

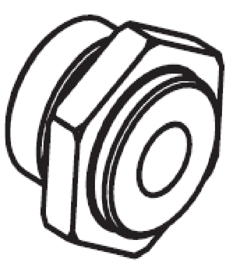
ICF 50 and 65 Accessories

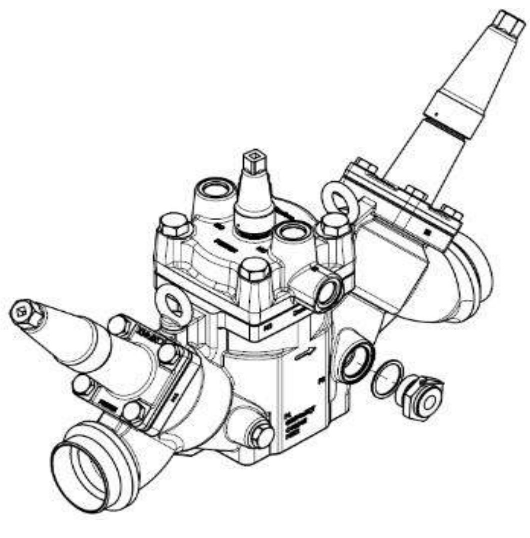
Details:

- Defrost drain connection kit converts metric M33 defrost side port to 1″ ANSI butt-weld connection which fits into 1″ socket weld



- Adapter for converting M33 defrost drain connection to regular 3/8″ FPT side port





- Filter/Strainer insert for ICF 50 is same as FIA 50 insert

ICF Nomenclature and Applications

ICF 20 - 6 - 3

- **3**: Application# which indicates how the ICF is configured (see below table)
- **6**: Number of module ports (3, 4 or 6)
- **20**: Housing size (15, 20, 25, 32, 40, 50 or 65)
- **ICF**: Product Type

Application #		Sequence of functions					
Liquid feed							
1	Liquid feed (No hotgas defrost)	Shut-off	Strainer	Solenoid	Man Open	Regul.	Shut-off
2	Liquid feed	Shut-off	Strainer	Solenoid	Man Open	Regul.	Stop & check
3	Liquid feed	Shut-off	Strainer	Solenoid	Check	Regul.	Shut-off
10	Liquid feed (No hotgas defrost)	Shut-off	Strainer	Solenoid	Regul.		
15	Liquid feed w. external Conn.	Shut-off	Strainer	Solenoid	Check	Welding	Regul.
Solenoid common							
4	Solenoid - Liquid & Hot gas lines	Shut-off	Strainer	Solenoid	Man Open	Shut-off	
8	Solenoid - Liquid & Hot gas lines	Shut-off	Strainer	Solenoid	Man Open		
Liquid injection							
5	Liquid injection (expansion)	Shut-off	Strainer	Solenoid	Man Open	Motor	Shut-off
12	Liquid injection (expansion) PWM	Shut-off	Strainer	El. Exp.	Shut-off		
14	Liquid injection (expansion)	Shut-off	Strainer	Motor	Shut-off		
Hot gas defrost							
9	Hot gas defrost	Shut-off	Strainer	Solenoid	Shut-off		
Solenoid multiple evaporators							
11	Solenoid - Multiple evaporators	Shut-off	Strainer	Solenoid	Check		
18	Solenoid - Multiple evaporators	Shut-off	Strainer	Solenoid	Stop & check		
Liquid PWM							
13	Liquid injection & liquid feed PWM	Shut-off	Strainer	El. Exp.	Stop & check		
Return line (ICF 50 and ICF 65 only)							
41	ON/OFF 2-step solenoid	Shut-off	Strainer option*	Solenoid	Shut-off		
42	Pressure (temperature) Mechanical control	Shut-off	Strainer option*	ICS options**	Shut-off		
43	Pressure (temperature) Electronic control	Shut-off	Strainer option*	Motor	Shut-off		
44	ON/OFF 2-step solenoid + Manuel Regulating	Shut-off	Strainer option*	Solenoid	Regul.		
45	Pressure (temperature) Mechanical control + Manuel Regulating	Shut-off	Strainer option*	ICS options**	Regul.		
46	Pressure (temperature) Electronic control + Manuel Regulating	Shut-off	Strainer option*	Motor	Regul.		

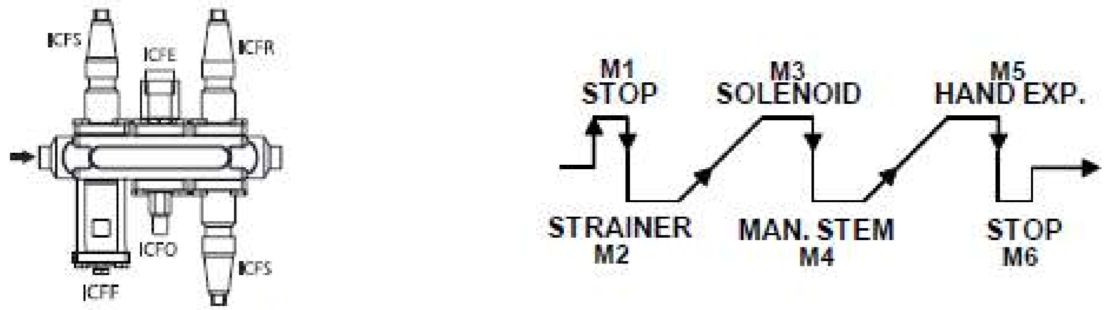
* ICF 50 only
** ICS typical options: On/Off solenoid, Pressure or Temperature control (see ICS data sheet)

Miscellaneous

90	Multipurpose configurations						

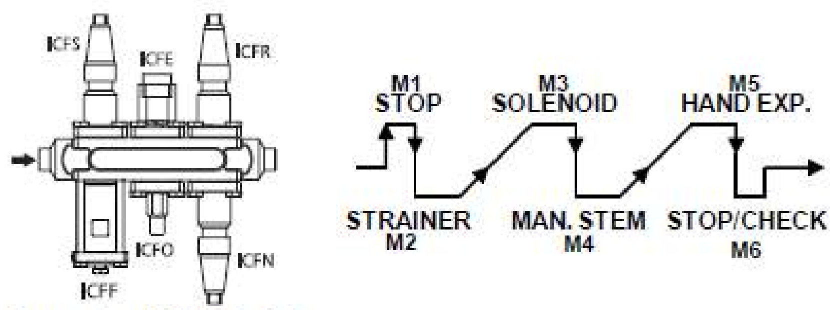
Common ICF Applications

Application #1 is typically used for:
Pumped liquid lines for flooded systems **without hot gas defrost** or liquid make-up to a vessel

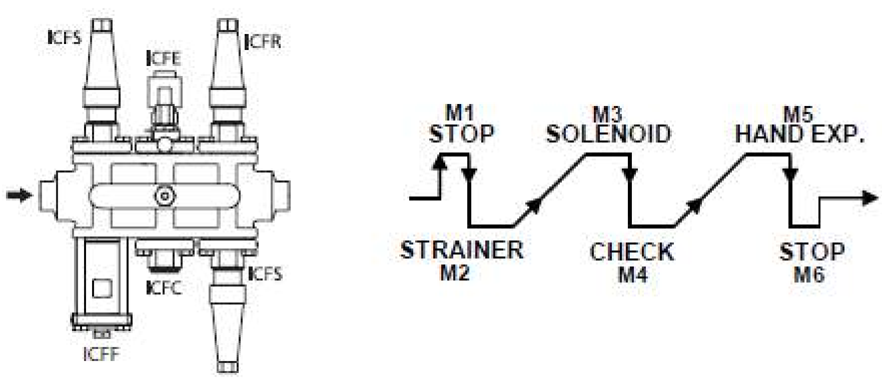


Example of ICF 20-6-1

Application #2 and 3 are typically used for:
Pumped liquid lines for flooded systems **with hot gas defrost**



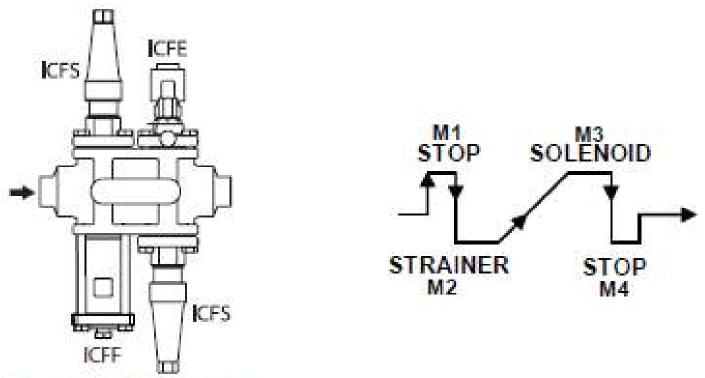
Example of ICF 20-6-2



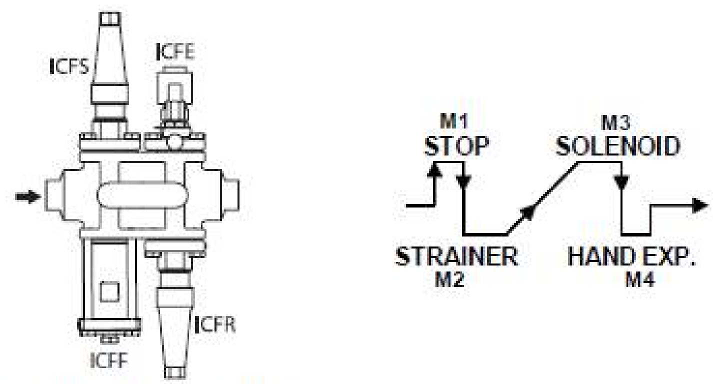
Example of ICF 32-6-3B

Common ICF Applications

Application #9 and 10 are typically used for:
Hot gas defrost lines

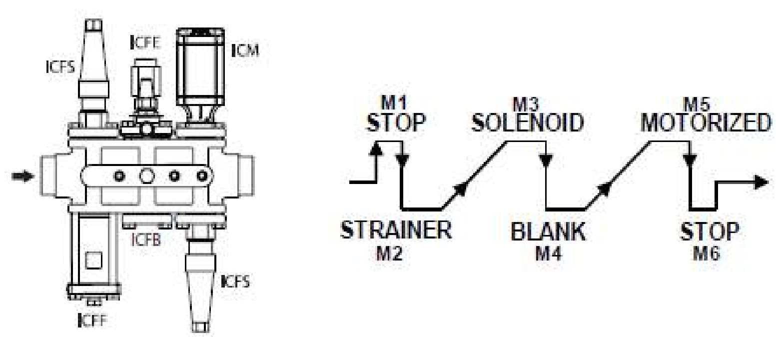


Example of ICF 25-4-9



Example of ICF 25-4-10B

Application #5 and 6 are typically used for**:**
Liquid make-up or direct expansion applications where a solenoid valve is needed before the electronic valve.



Example of ICF 25-6-5A

Common ICF Applications

ICF 50 or 65 **Application #41** is for low temperature suction lines needing a gas-powered solenoid valve

ICF 50 or 65 **Application #42** is for suction lines with regulators and are available with the standard ICS configurations: STD, B, S, D, etc.

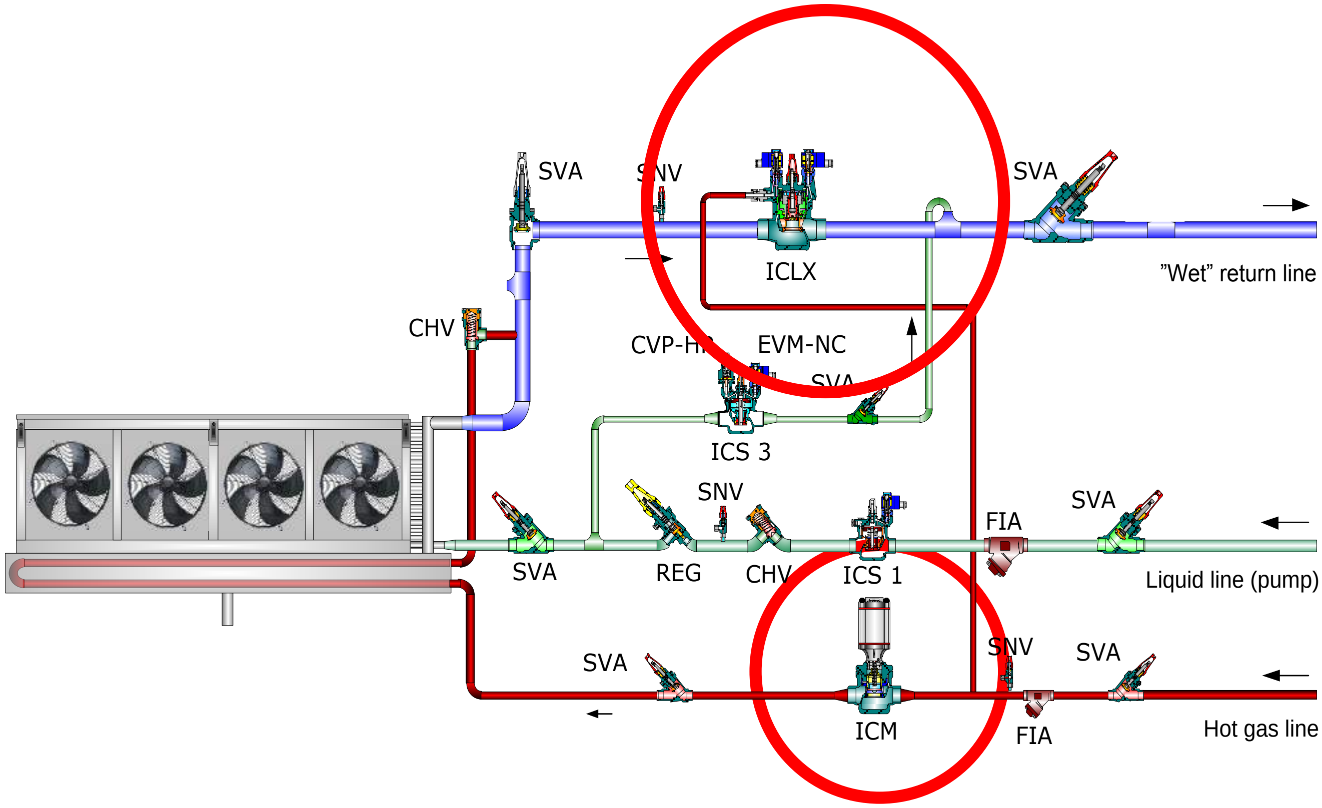
Common ICF Applications

ICF 50 or 65 **Application #43** is for suction line with motorized valve station without strainer

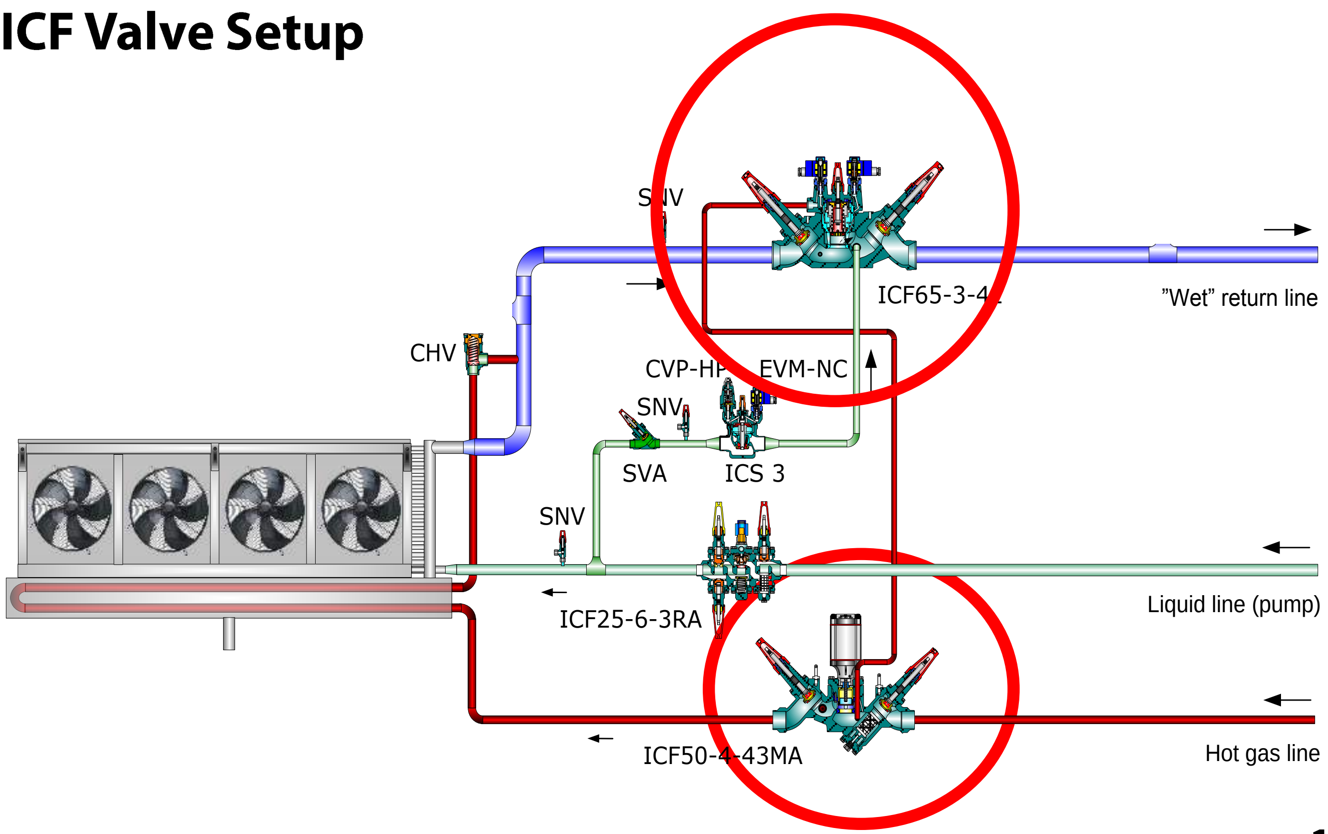
ICF Ordering

- ICF will not come with ICAD motor or coils
- ICF valves stations with ICM or ICFA modules will have sight glasses pre-mounted just after ICFE solenoid module as standard
- When ICF valves are ordered with socket-weld connections and side ports the side ports will be 3/8" NPT

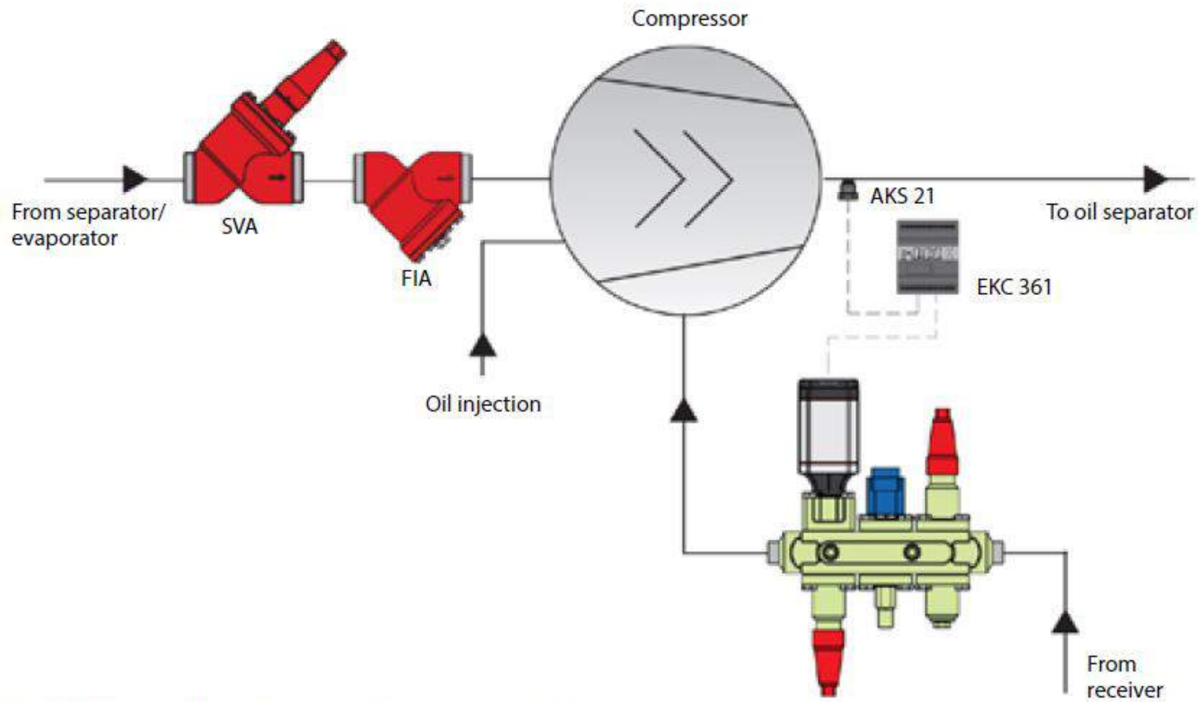
Evaporator Valve Group
Stand-Alone Valve Setup



Evaporator Valve Group
ICF Valve Setup

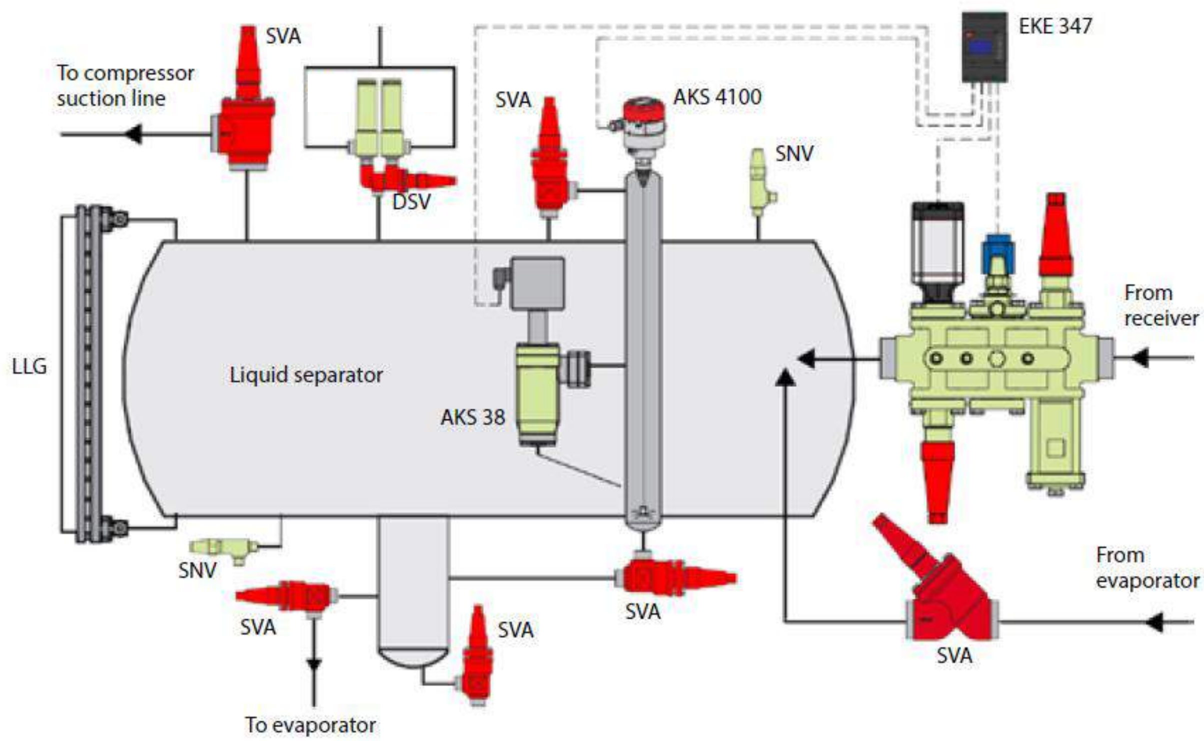


Compressor Liquid Injection with EKC 361



Not all valves are shown. Not to be used for construction purposes.

Liquid Make-Up to a Recirculator



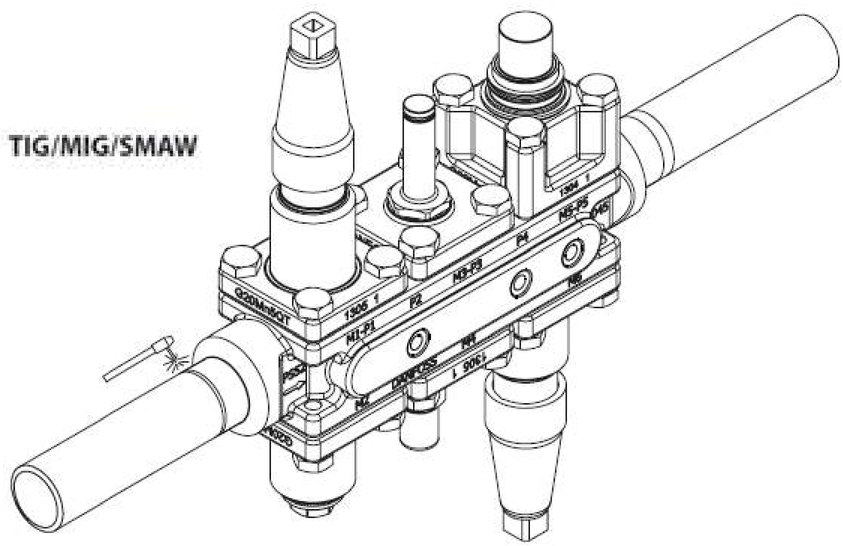
Not all valves are shown. Not to be used for construction purposes.

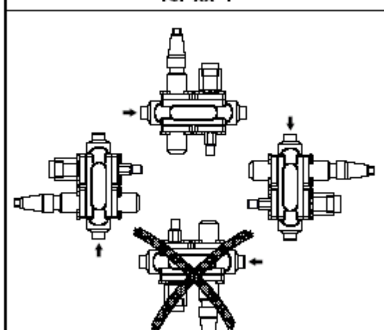
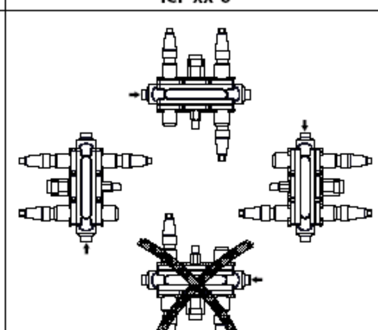
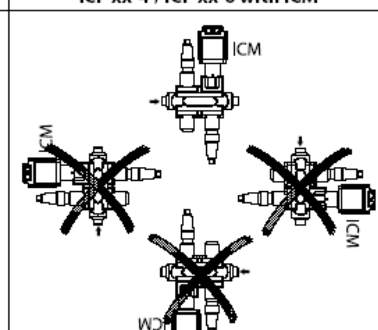
Installation of ICF Sizes 15, 20 and 25

It is not necessary to remove any of the function modules prior to TIG/MIG/SMAW welding and auxiliary cooling (wet cloth around valve) is not needed at normal heat impact. Every precaution must be taken to minimize weld spatter.

To avoid any weld spatter entering the valve station and to avoid heat impact to the Teflon seat during welding, it is recommended to open the valves slightly (approx. 1 turn from closed position) in first and last module.

When welding is completed it is recommended to close the 1st and last modules again in order to protect the interior of the valve until the system is ready for operation.



Direction and Position		
ICF xx-4	ICF xx-6	ICF xx-4 / ICF xx-6 with ICM
 Fig. 1a	 Fig. 1b	 Fig. 1c

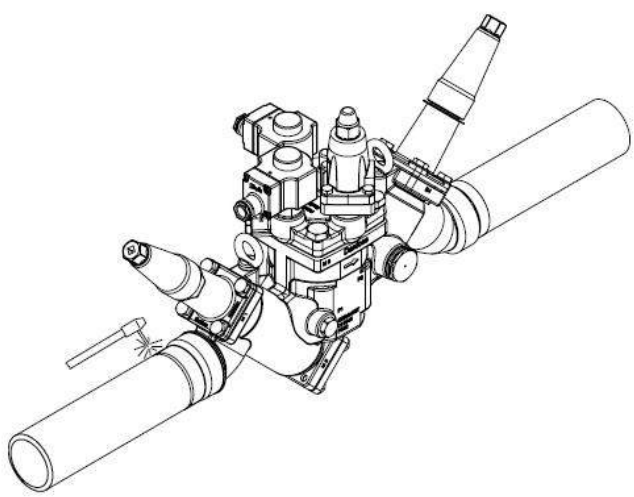
Installation of ICF Sizes 50 and 65

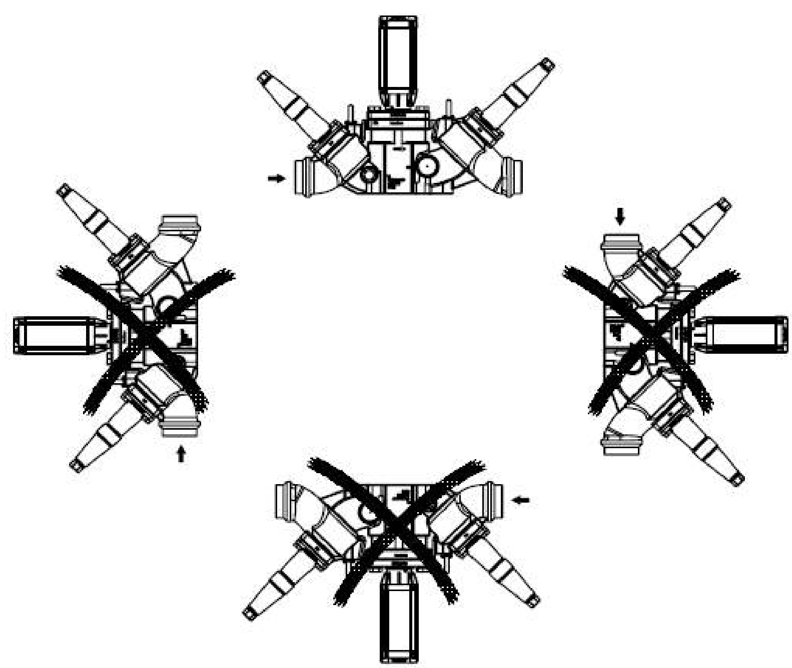
It is not necessary to remove any of the function modules prior to TIG/MIG/SMAW welding and auxiliary cooling (wet cloth around valve) is not needed at normal heat impact. Every precaution must be taken to minimize weld spatter.

To avoid any weld spatter entering the valve station and to avoid heat impact to the Teflon seat during welding, it is recommended to open the valves slightly (approx. 1 turn from closed position) in first and last module (M1 and M4).

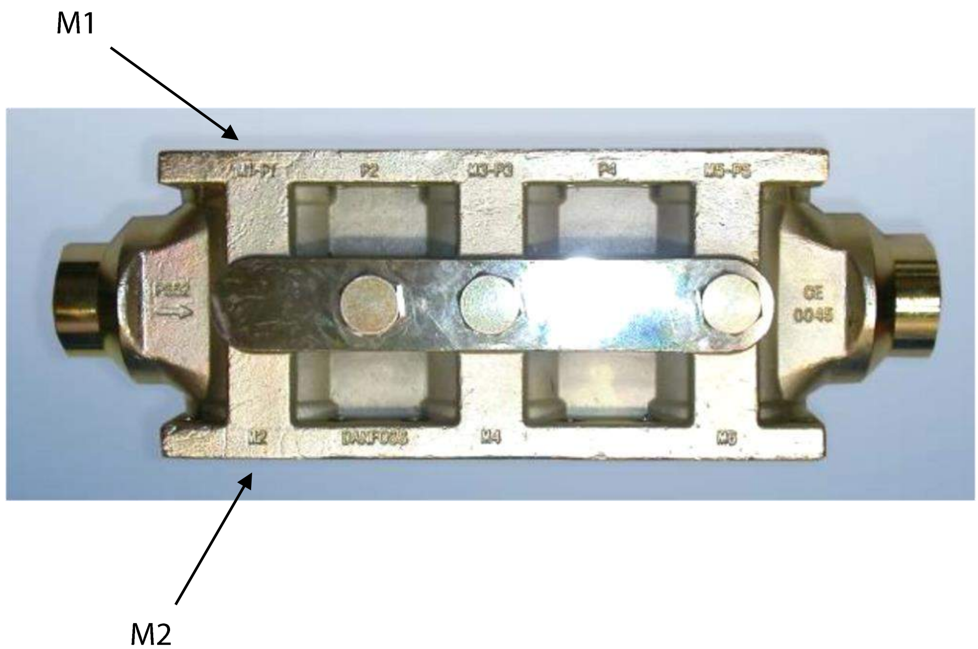
When welding is completed it is recommended to close the 2 modules again (M1 and M4) in order to protect the interior of the valve until the system is ready for operation.

TIG/MIG/SMAW





ICF Tags from MSI



Module locations M1, M2 etc. are in valve body

Servicing the Valve Station

- 4 bolt access to all modules
- Modules can be turned 90° either direction w/o affecting the function
- Isolation with stop valves in first and last position
- Purge valve recommended for vent/drain connections
- Stainless steel trim

ENGINEERING
TOMORROW

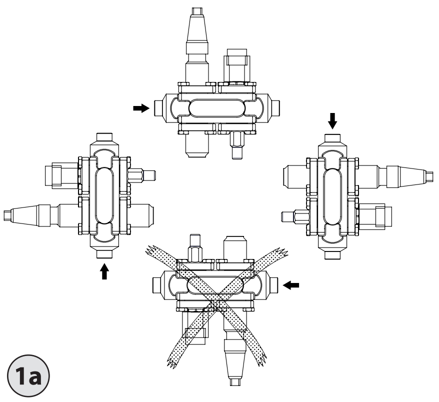
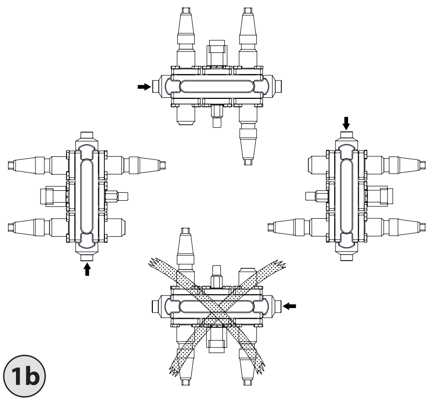
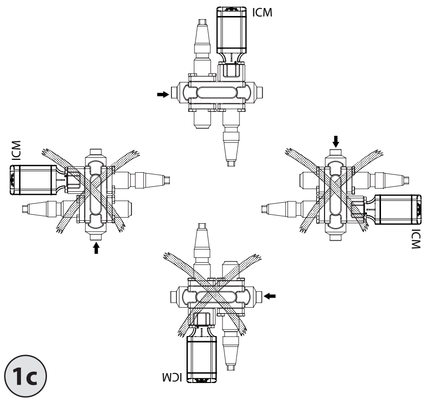
Installation guide

Valve Station

Types ICF 15, ICF 20, ICF 25, ICF SS 20 and ICF SS 25

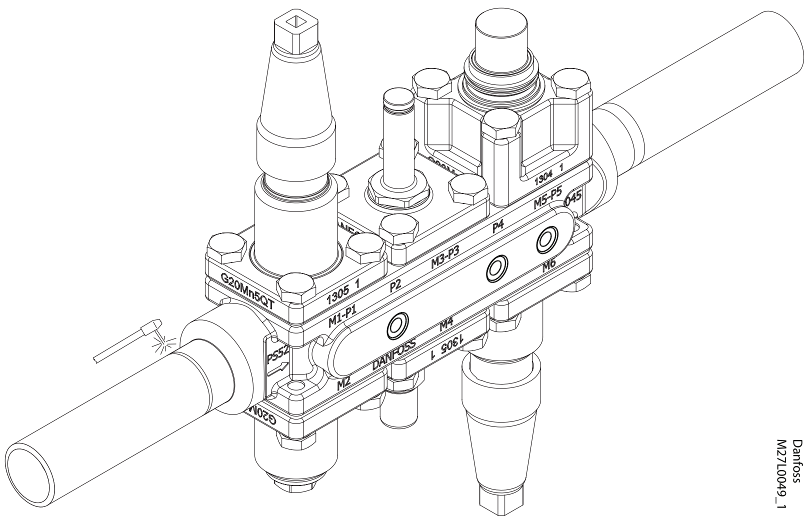
027R9782

Installation

ICF xx-4	ICF xx-6	ICF xx-4 / ICF xx-6 + ICM
		
1a	1b	1c

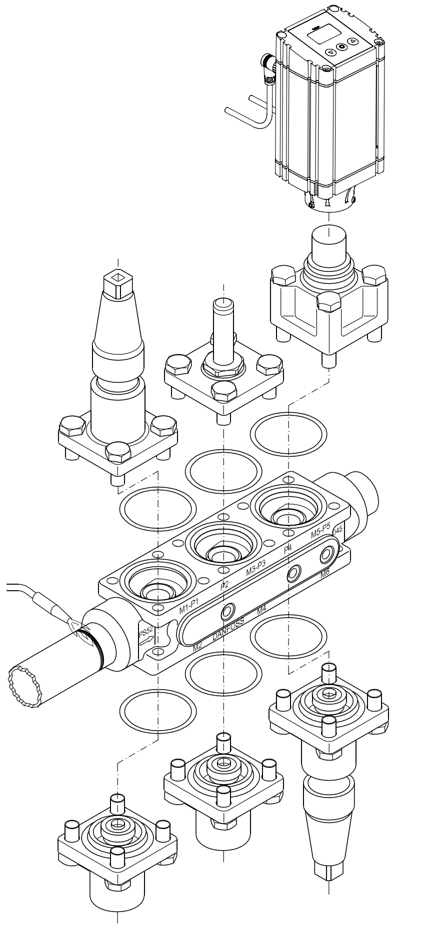
Welding

TIG/MIG/SMAW



2

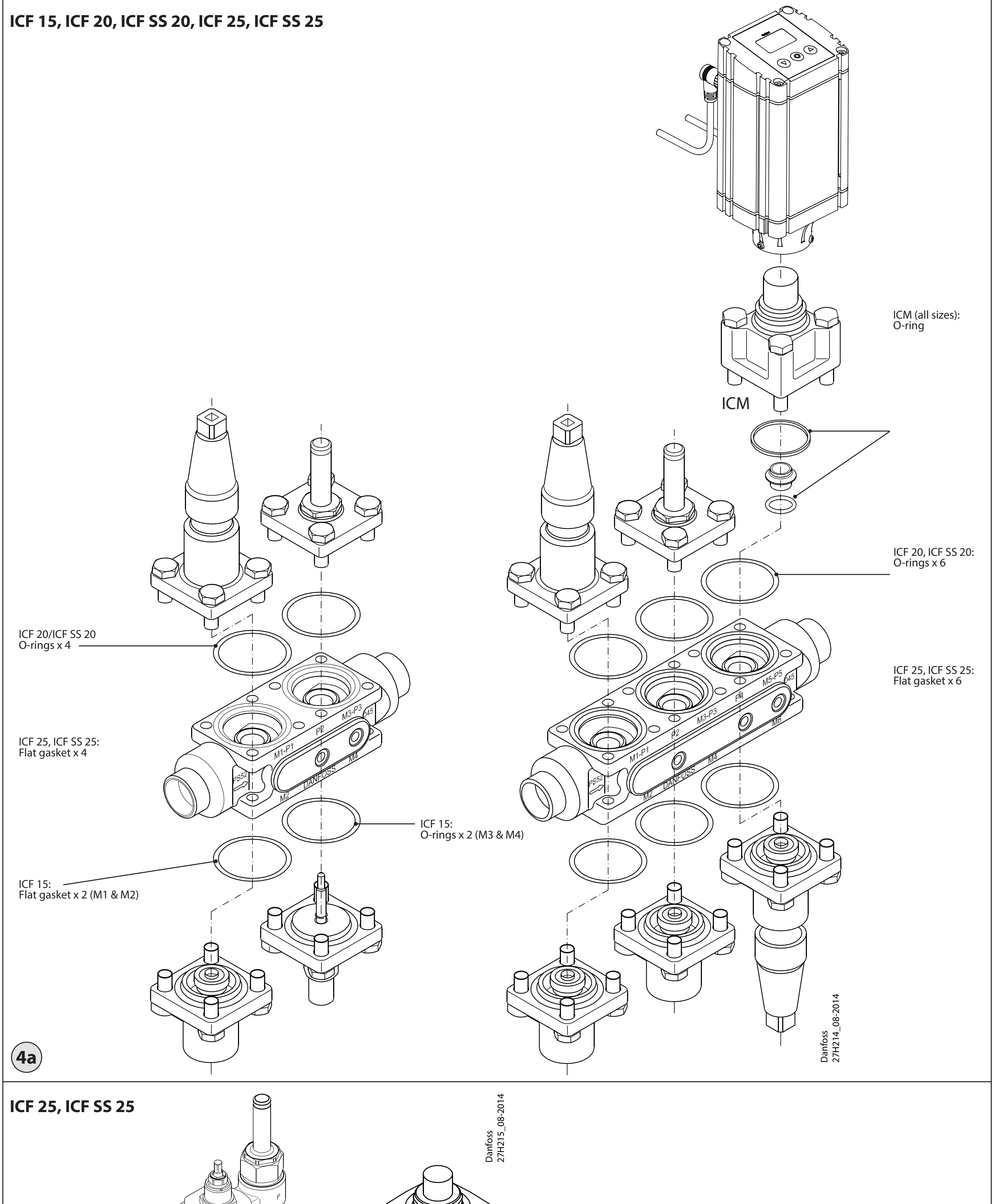
Gas welding



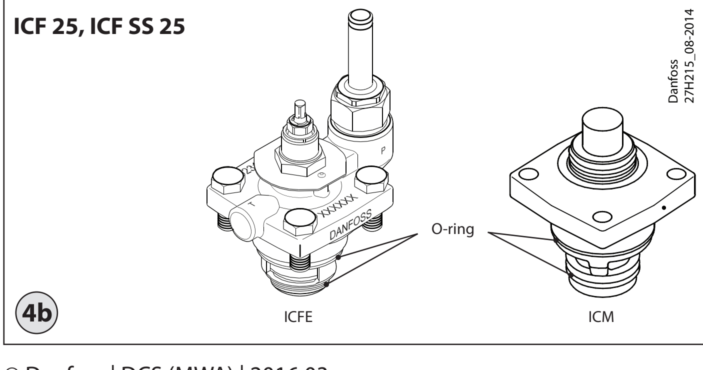
3

Maintenance

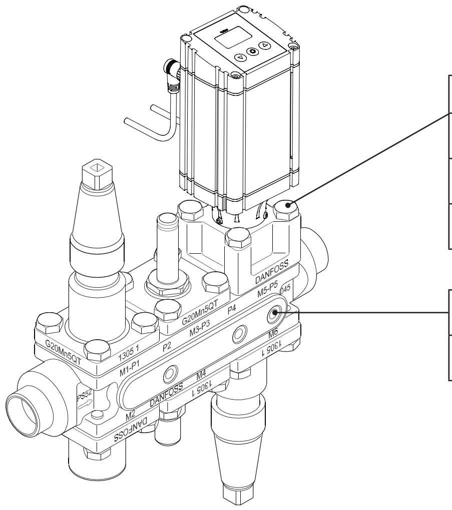
ICF 15, ICF 20, ICF SS 20, ICF 25, ICF SS 25



ICF 25, ICF SS 25



Tightening



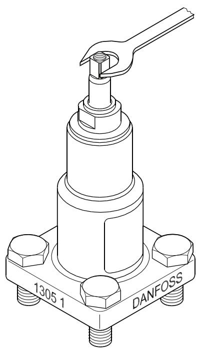
	M1	M2	M3	M4	M5	M6
ICF 15	22 Nm (16 ft lbs)	22 Nm (16 ft lbs)	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)		
ICF 20 ICF SS 20	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)	50 Nm (36 ft lbs)
ICF 25 ICF SS 25	80 Nm (58 ft lbs)	80 Nm (58 ft lbs)	80 Nm (58 ft lbs)	80 Nm (58 ft lbs)	80 Nm (58 ft lbs)	80 Nm (58 ft lbs)

ICF 15-25	60 Nm (44 ft lbs)
ICF SS 20-25	80 Nm (58 ft lbs)

5

ICF 15, ICF 20, ICF SS 20 Manual stem

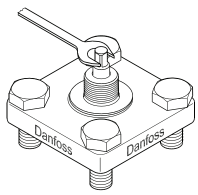
Max. 25 Nm (18 ft lbs) (Closing ICFR: max. 4 Nm (3 ft lbs)



6a ICFS, ICFS SS, ICFR, ICFR SS, ICFN, ICFN SS

Max. 20 Nm (15 ft lbs) at stop. Automatic mode (ICFE ON/OFF by coil)

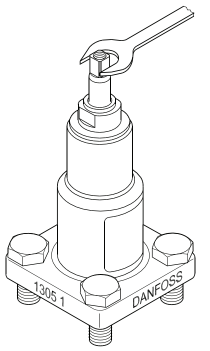
Max. 2.5 Nm (1.8 ft lbs) at stop. Manual mode (ICFE forced open)



6b ICFO, ICFO SS

ICF 25, ICF SS 25 Manual stem

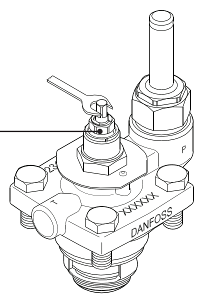
Max. 40 Nm (30 ft lbs) (Closing ICFR, ICFN: max. 10 Nm (7 ft lbs)



7a ICFS, ICFS SS, ICFR, ICFR SS, ICFN, ICFN SS

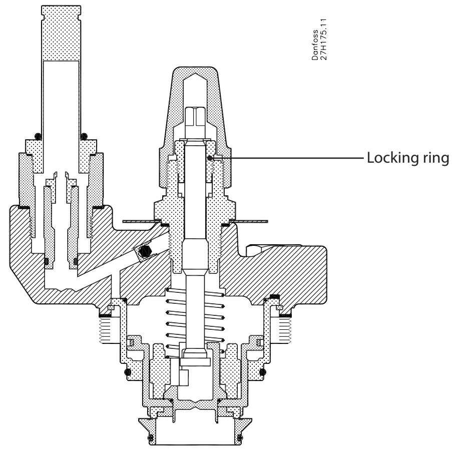
Max. 4 Nm (3 ft lbs) at stop. Automatic mode (ICFE ON/OFF by coil)

Max. 10 Nm (7 ft lbs) at stop. Manual mode (ICFE forced open)

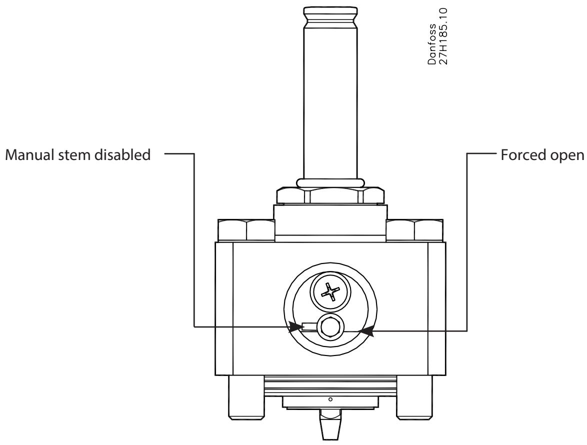


7b ICFE, ICFE SS

ICFE 25, ICFE SS 25, ICFE 20H, ICFE SS 20H Manual stem



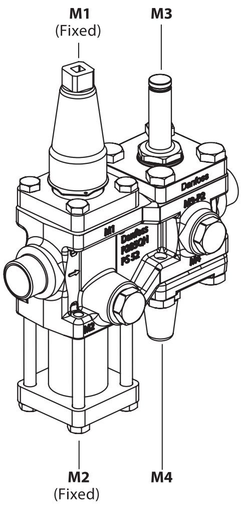
8a ICFE 25, ICFE SS 25



8b ICFE 20H, ICFE SS 20H

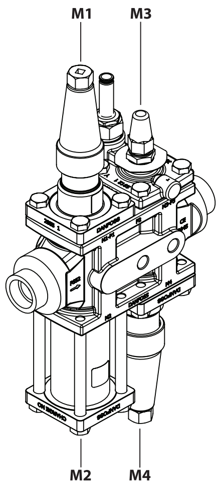
Module location

ICF 15-4



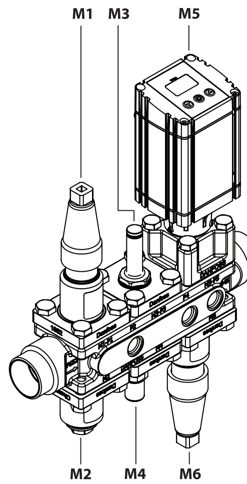
9a

ICF 20/20 SS-4, ICF 25/25 SS-4



9b

ICF 20/20 SS-6, ICF 25/25 SS-6



9c

ENGLISH

Refrigerants
Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2).

The use of ICF valve stations with flammable hydrocarbons is not recommended.

The ICF is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+120°C (–76/+248°F)

Pressure range
The ICF is designed for a max. working pressure of 52 bar g (754 psi g).

Application
The ICF can be used in suction, liquid, hotgas and liquid/vapor lines. The ICF is available with 4 or 6 function modules. The ICF regulates the flow of the medium by modulation or on/off function, depending on function modules installed in the ICF.

Regulating range
Dependent on the chosen type and combination of modules installed in the valve.

Installation (fig. 1)

The ICF must be installed according to fig. 1. The ICF must be installed with the arrow in the direction of the flow).

The ICF will be delivered with all the function modules fully assembled. The modules can be taken out for service or inspection and may be rotated 4 x 90° in relation to the valve body upon installation.

The ICF may be fitted with a spindle for manual opening of the solenoid valve.

The ICF is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

It must be ensured that the ICF is protected from pressure transients like “liquid hammer” in the system.

Welding (fig. 2 and 3)

The ICF valve station can be welded by using either TIG/MIG/SMAW welding (fig. 2) or gas welding (fig. 3)
Always keep inlet and outlet protecting caps on the valve until the valve is ready to be installed, in order to prevent rust formation inside the valve station.

TIG/MIG/SMAW welding
It is not necessary to remove any of the function modules prior to TIG/MIG/SMAW welding (fig. 2) and auxiliary cooling is not needed at normal heat impact.
Every precaution must be taken to minimize welding spatter.
For ICF valve stations equipped with a stop valve in the first module (M1) and a stop-, regulating- or stop/check valve in the last module (M4 or M6), it is recommended to open these valves slightly (approx. 1 turn from closed position) to minimize welding heat impact to the Teflon seats.

After welding it is recommended to close these valves again to avoid potential pull through of gases, and keep them closed until the system is ready for operation.
All other valve modules are able, in any module position, to compensate for normal welding heat impact and need no special attention.

Gas welding
Remove all inserts before welding (fig. 3).
Auxiliary cooling is not needed at normal heat impact.
Every precaution must be taken to minimize welding spatter.
After welding, clean the valve inside for welding spatter and welding debris.
It is recommended to reinstall the modules right after welding and to close the manual-operable M1 and M4/M6 in order to protect the interior of the valve until the system is ready for operation.
In case the valve is not assembled immediately make sure that rust protective oil is applied to the inside surfaces.

The housing must be free from stresses (external loads) after installation. The ICF must not be mounted in systems where the outlet side of the ICF is open to atmosphere. The outlet side of the ICF must always be connected to the system or properly capped off, for example with a welded-on end plate.

Surface protection and identification (not applicable for SS versions)
The external surface is zinc-chromated to provide corrosion protection according to EN 12284:2003 8.13. The Zinc-Chromatization does not cover the welding connections. After installation has been completed the external surface of the valve must be protected against corrosion with a suitable top coating.
Coverage of the ID label when painting the ICF is recommended.

Precise identification of the ICF is made via the ID label on each of the 4 or 6 function modules.

Maintenance (fig. 4)

Do not to mix up carbon steel parts with stainless steel parts.

Service
The ICF valve stations are easy to service. Do not open the ICF while it is still under pressure.

Upon opening and removal of the function modules:

- Check that the flat gaskets and/or O-rings between the function module and the housing and O-rings on the function module has not been damaged. Replace flat gaskets and O-rings if not intact.

  A valve with a damaged o-ring/gasket might not modulate according to the specification.

  Flat gaskets are present in ICF 15 module M1/M2 and ICF 25/ICF SS 25 all modules.

  O-rings are present in these locations: (see fig 4a, 4B)
  ICF 15: 1 O-ring in each module M3/M4 and 2 O-rings in ICM module.
  ICF 20/ ICF SS 20: 1 O-ring in all modules and 2 O-rings in ICM module.
  ICF 25/ICF SS 25: 2 O-rings in ICM and ICFE modules.

CO_2 applications
When used in CO_2 systems the O-rings (see fig. 4a and 4b) can swell (grow).
At service it is recommended to replace the actual number of used O-rings before the function modules are reinstalled in the ICF valve body.

- Check that the piston and cylinder is free of scratches and look for wear marks. If the wear is excessive the function module should be replaced to prevent false pilot signal around the piston ring.
- Check that the movement of the cylinder and valve seat is free and with low friction.
- If the teflon valve plate has been damaged, the function module must be replaced.
- On ICM 20 motor valve modules check that the PEEK seat has not been damaged or scratched. If damaged or scratched; replace the PEEK seat.

Assembly
Remove any dirt from the housing before the ICF is assembled.
- Check that all channels in the ICF are free of particles or similar debris. If possible, apply some refrigeration oil to ease the insertion of the modules and to protect the O-rings.

Tightening (fig. 5, 6 and 7)

Tighten the top cover with a torque wrench, to the values indicated in the table (see fig. 5).

ENGLISH

Operating the manual stem (fig. 6 to 8)

ICF 15, ICF 20, ICF SS 20 (fig. 6a and 6b)

- ICFS/ICFS SS - stop valve module
- ICFR/ICFR SS - manual regulating valve module
- ICFN/ICFN SS - stop/check valve module
- ICFO/ICFO SS - manual opening module

Before remounting the cap on the modules ICFS/ICFS SS (stop valve module), ICFR/ICFR SS (manual regulating valve module) or ICFN/ICFN SS (stop/check valve module) please ensure that the gasket is present in the cap. Then tighten the cap with 16 Nm (12 ft lbs).

ICF 25, ICF SS 25 (see fig. 7a)

- ICFS/ICFS SS - stop valve module
- ICFR/ICFR SS - manual regulating valve module
- ICFN/ICFN SS - stop/check valve module
- ICFE/ICFE SS - manual opening module

Before remounting the cap on the modules ICFS/ICFS SS (stop valve module), ICFR/ICFR SS (manual regulating valve module) or ICFN/ICFN SS (stop/check valve module) please ensure that the gasket is present in the cap. Then tighten the cap with 24 Nm (18 ft lbs).

Packing gland (ICFE/ICFE SS) (see fig. 7b):
If the packing gland is leaking, tighten it carefully with a wrench. Do not apply too much force.
Danfoss recommends that you conduct a stepwise tightening of the packing gland. For each turn check for possible leaks.

Operating the manual stem on ICFE 25/ICFE SS 25 solenoid module (see fig. 8a):
To force open the solenoid by the manual stem turn it **counter clockwise** full way up. (Manual mode)
To operate the solenoid in automatic mode, turn the manual stem **clockwise** until the locking ring stops.

Do not force the spindle further. If the locking ring is damaged or removed the spindle will start to leak.
The valve cannot be forced closed by the manual stem.

Operating the manual stem on ICFE 20H/ICFE SS 20H solenoid valve module (see fig. 8b)
Remove the cap on the side of the ICFE 20H/ICFE SS 20H
At 9 o'clock position the manual opener is disabled (not active).

To force the ICFE 20H/ICFE SS 20H solenoid to open use a 5 mm Allen key and turn it clockwise to 3 o'clock position.

Module location (fig. 9a, 9b, 9c)

ICF with four modules

Function Module Type		Can be installed in these locations			
ICFS/ICFS SS	Stop valve module	M1 *)	M2	M3	M4
ICFR/ICFR SS	Manual regulating valve module	M1	M2	M3	M4
ICFF/ICFF SS	Filter (strainer) module		M2 *)		M4
ICFE/ICFE SS	Solenoid valve module			M3	
ICFC/ICFC SS	Check valve module				M4
ICFN / ICFN SS	Stop/check valve module				M4
ICM/ICM SS	Motor valve module	M1		M3	
ICFB/ICFB SS	Blank top cover	M1	M2	M3	M4
ICFA/ICFA SS	Electronic expansion valve module (not for ICF 25)	M1		M3	
ICFE 20H/ICFE SS 20H	Solenoid valve module (not for ICF 25)	M1		M3	
ICFO/ICFO SS	Manual opening module (not for ICF 25)				M4
ICFW/ICFW SS	Welding module	M1	M2	M3	M4

ICF with six modules

Function Module Type		Can be installed in these locations					
ICFS/ICFS SS	Stop valve module	M1	M2	M3	M4	M5	M6
ICFR/ICFR SS	Manual regulating valve module	M1	M2	M3	M4	M5	M6
ICFF/ICFF SS	Filter (strainer) module		M2		M4		M6
ICFE/ICFE SS	Solenoid valve module			M3			
ICFC/ICFC SS	Check valve module				M4		M6
ICFN / ICFN SS	Stop/check valve module				M4		M6
ICM/ICM SS	Motor valve module	M1		M3		M5	
ICFB/ICFB SS	Blank top cover	M1	M2	M3	M4	M5	M6
ICFA/ICFA SS	Electronic expansion valve module (not for ICF 25)	M1		M3		M5	
ICFE 20H/ICFE SS 20H	Solenoid valve module (not for ICF 25)	M1		M3		M5	
ICFO/ICFO SS	Manual opening module (not for ICF 25)				M4		
ICFW/ICFW SS	Welding module	M1	M2	M3	M4	M5	M6

Module locations are indicated by M1, M2, M3, M4, M5 and M6. With respect to refrigerant flow, M1 is closest to inlet.

location not possible

**) ICF 15 - M1 and M2 modules are fixed (stop valve and filter, respectively)*

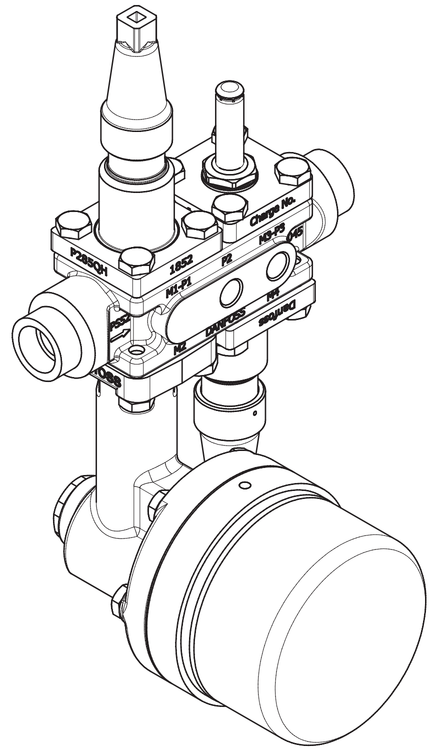
Use only original Danfoss parts, including O-rings and gaskets for replacement.
Materials of new parts are certified for the relevant refrigerant.
In cases of doubt, please contact Danfoss.

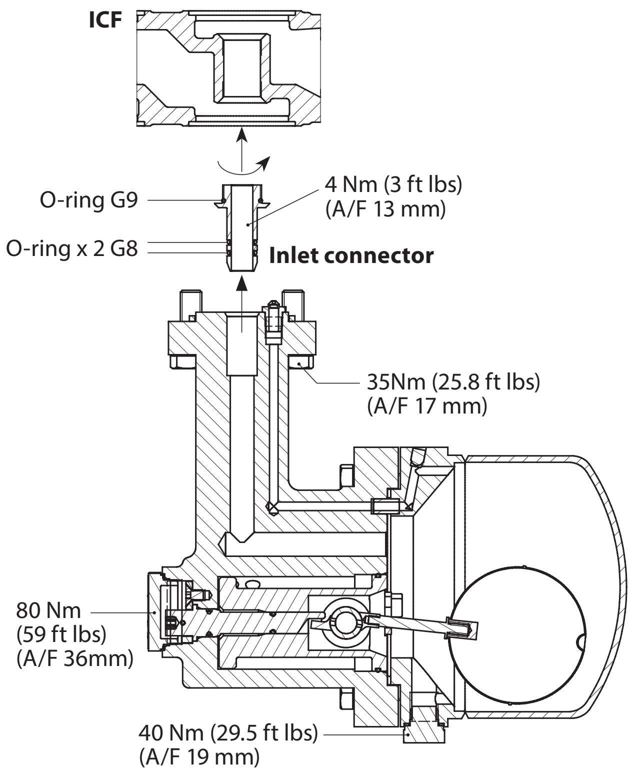
Installation guide

ICFD Defrost Module
Disassembly / Assembly

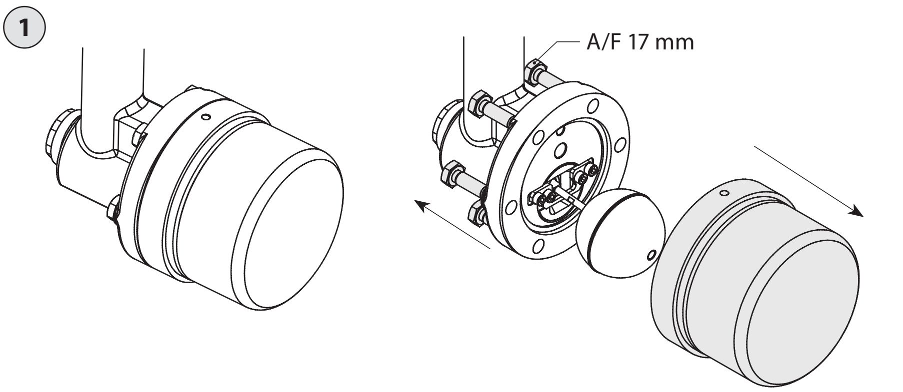
027R9976

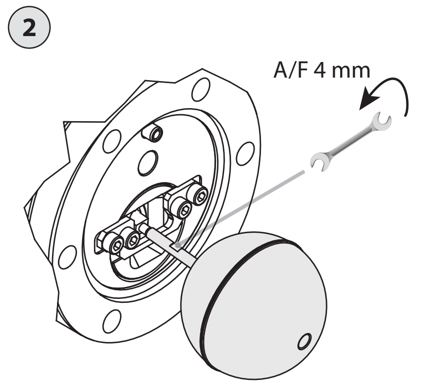
Module mounting on ICF

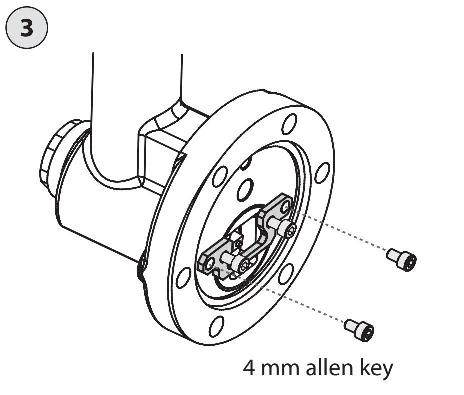


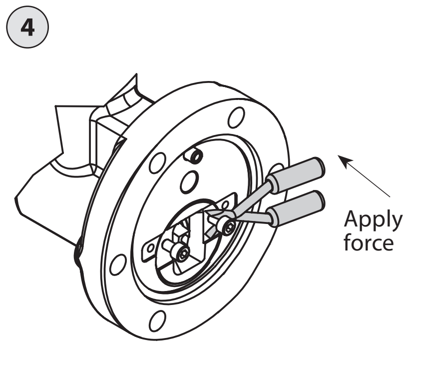


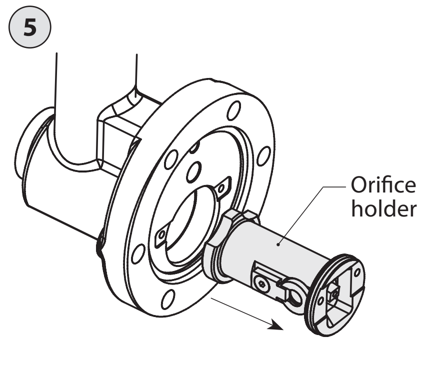
Disassembly of the orifice holder











Disassembly of the orifice holder

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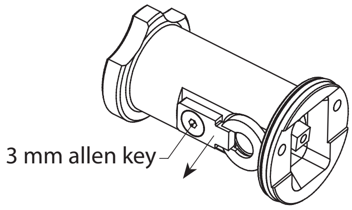

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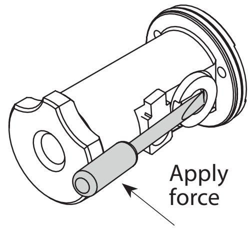

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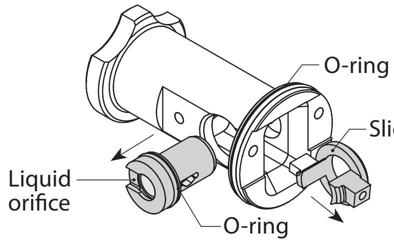

Assembly of the orifice holder

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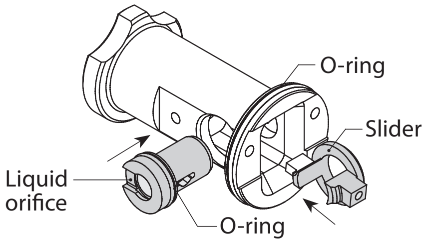

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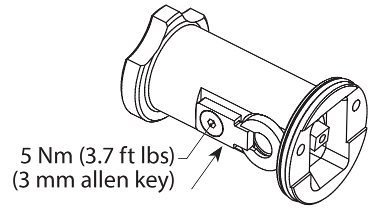

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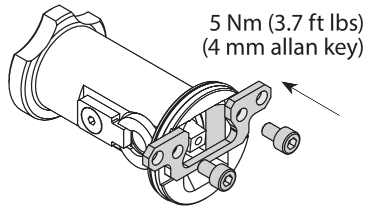

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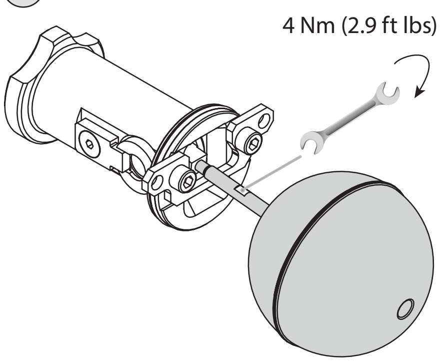

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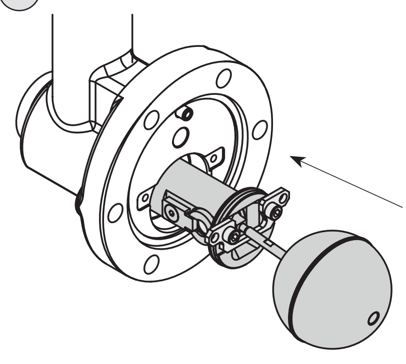

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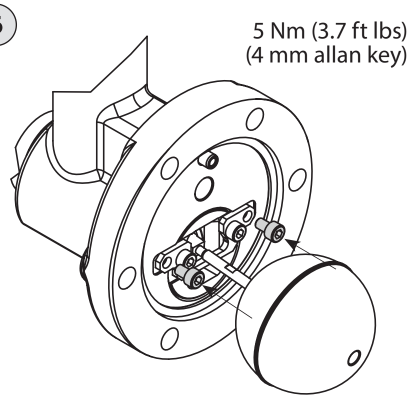

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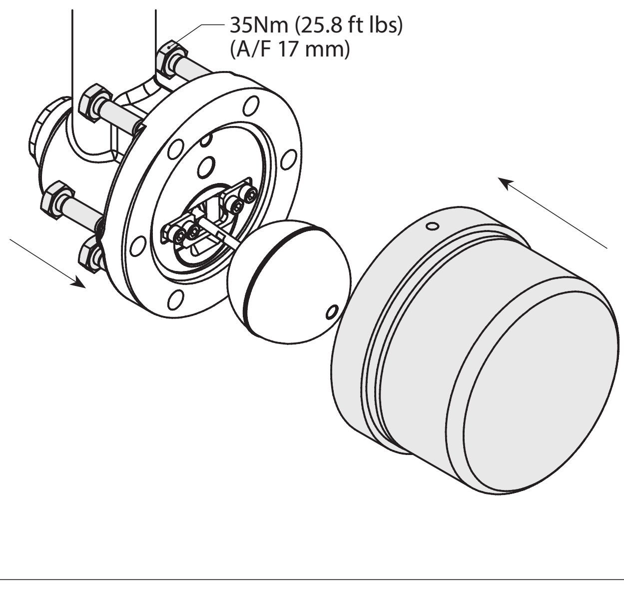
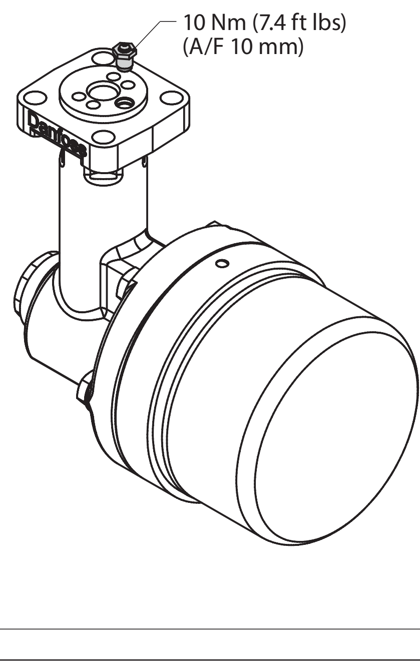
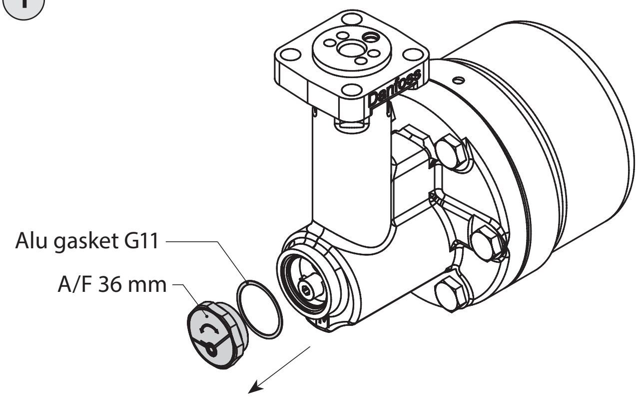


Replacing the AKV orifice



Disassembly of the manual opener

1



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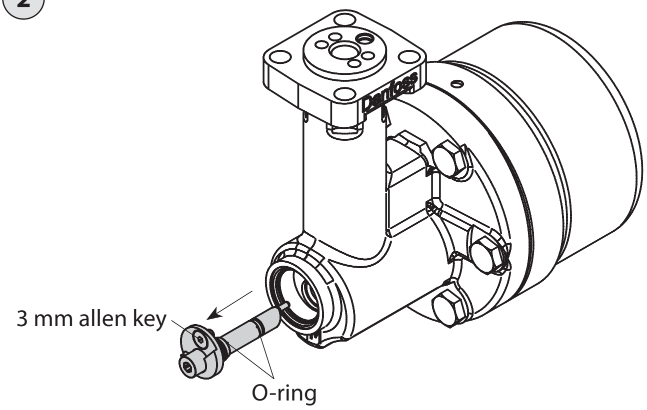
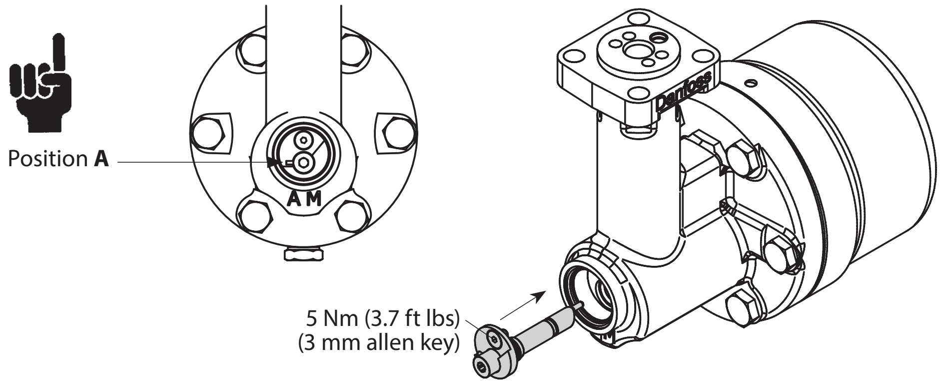


Assembly of the manual opener

1



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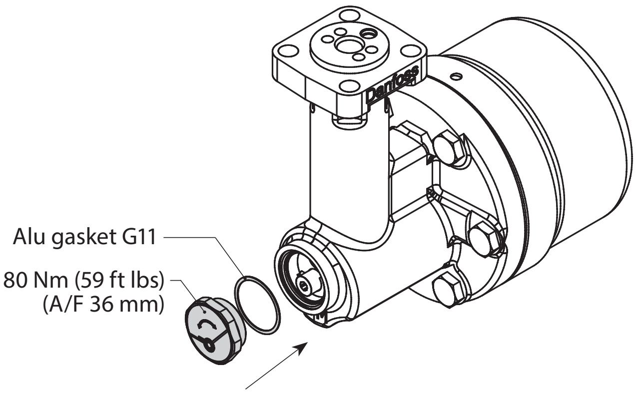


Installation Guide

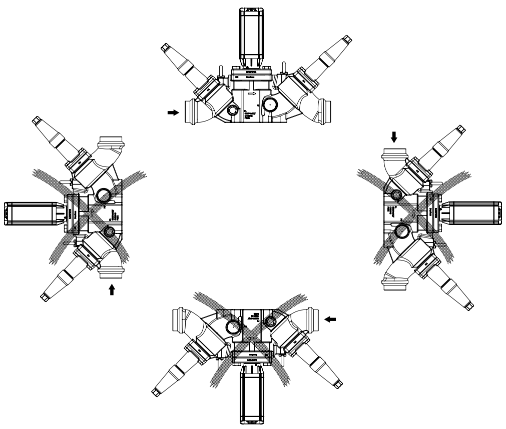
Valve station

ICF 50-4 and ICF 65-3

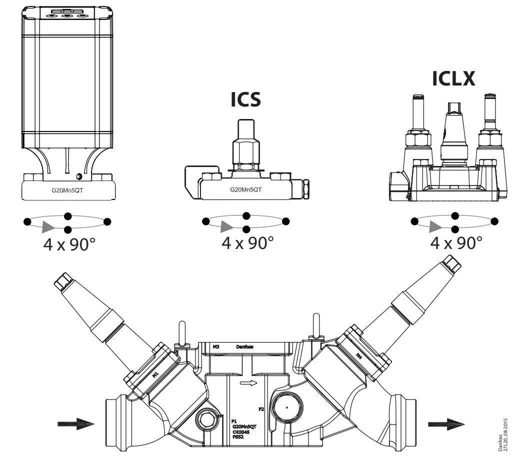
027R9969

Orientation (all configurations)

ICF 50-4 & ICF 65-3



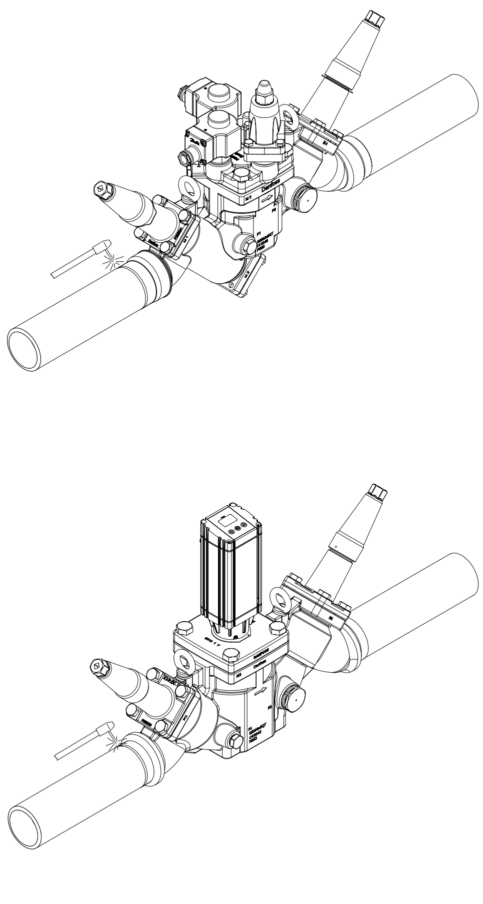
1a



1b

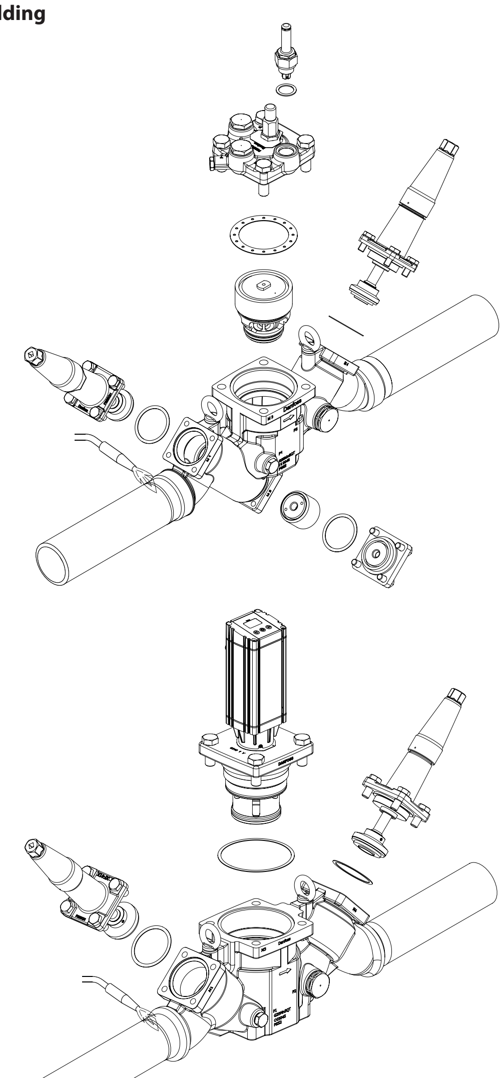
Welding

TIG/MIG/SMAW



2

Gas welding

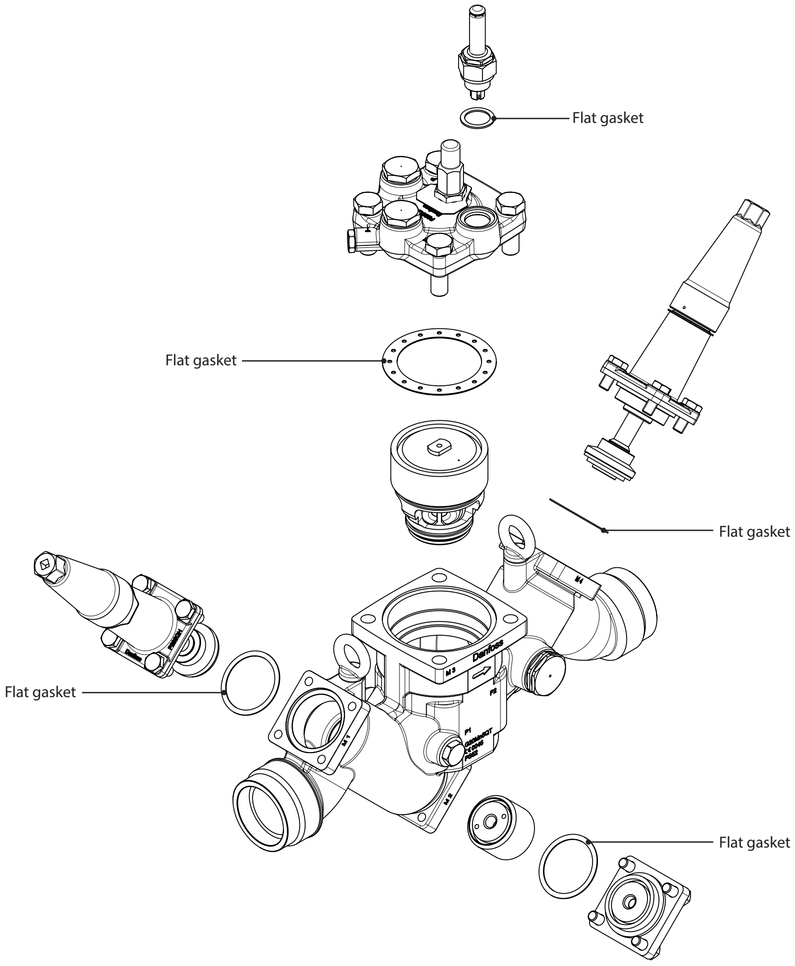


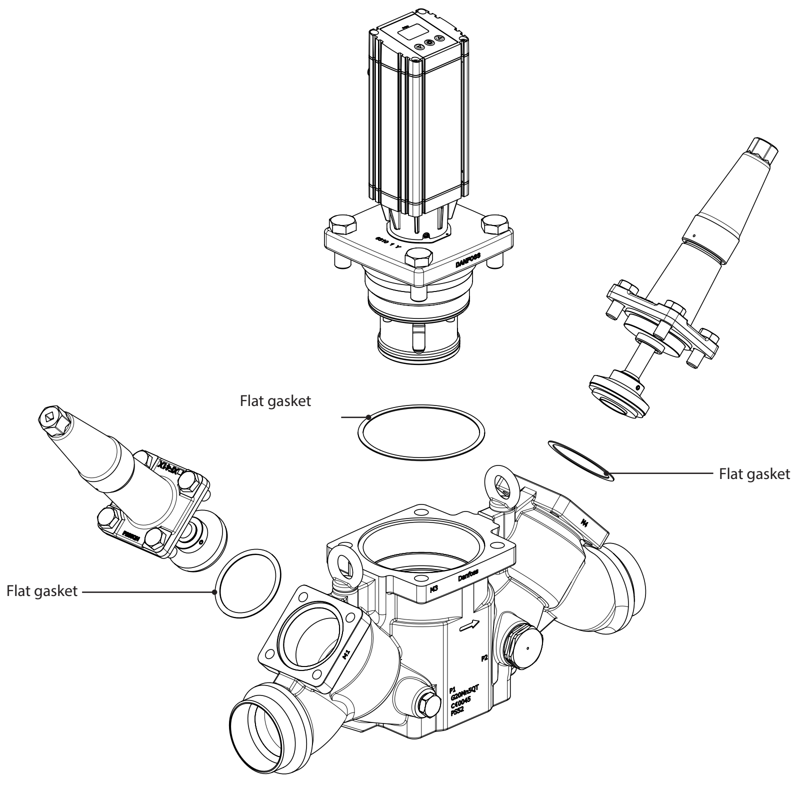
3

027R9969

Maintenance

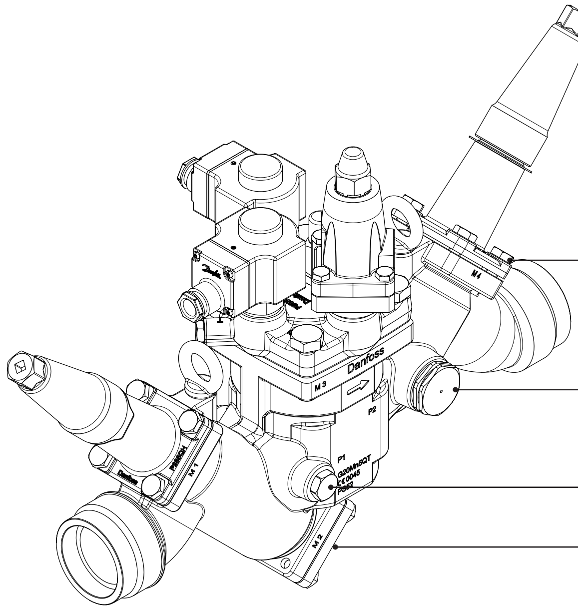
ICF 50-4 / ICF 65-3





4

Maintenance



	M1	M2	M3	M4
ICF 50-4	33 Nm (24.3 ft lbs)	33 Nm (24.3 ft lbs)	140 Nm (103.3 ft lbs)	33 Nm (24.3 ft lbs)
ICF 65-3	57 Nm (42 ft lbs)		150 Nm (110.6 ft lbs)	57 Nm (42 ft lbs)

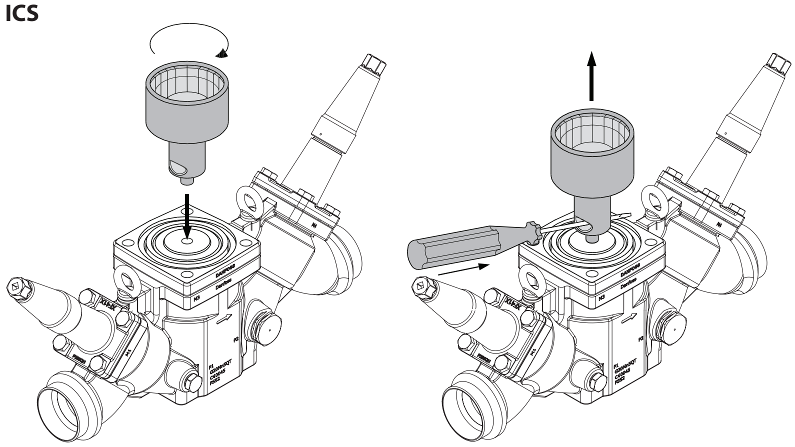
ICF 50-4	110 Nm (81.1 ft lbs)
ICF 65-3	110 Nm (81.1 ft lbs)

ICF 50-4	60 Nm (44.3 ft lbs)
ICF 65-3	60 Nm (44.3 ft lbs)

ICF 50-4	45 Nm (33.2 ft lbs)

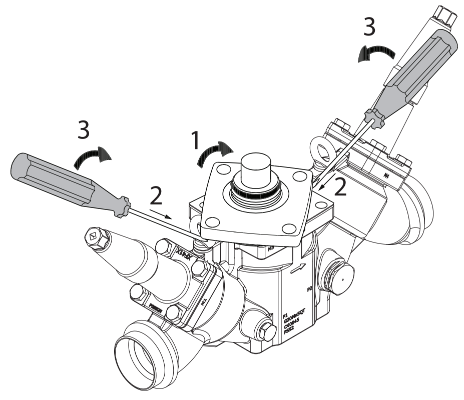
5

ICS



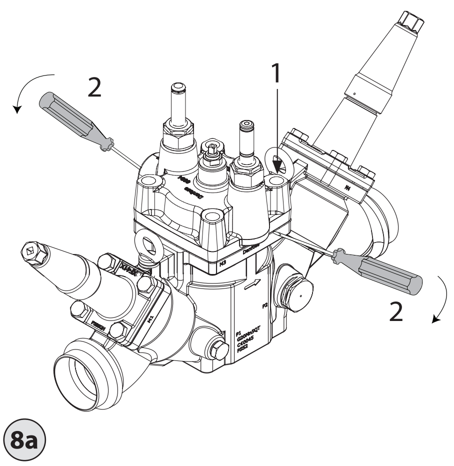
6

ICM

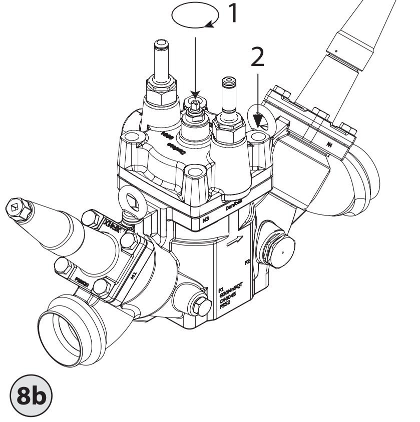


7

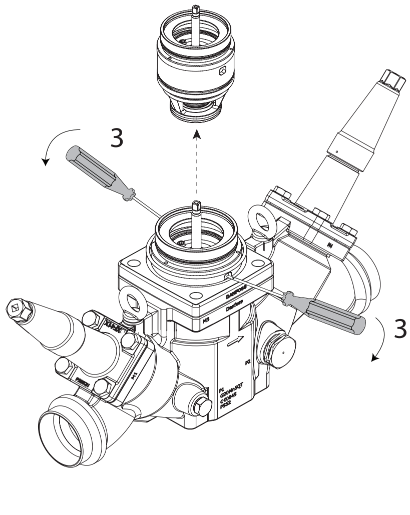
ICLX



8a

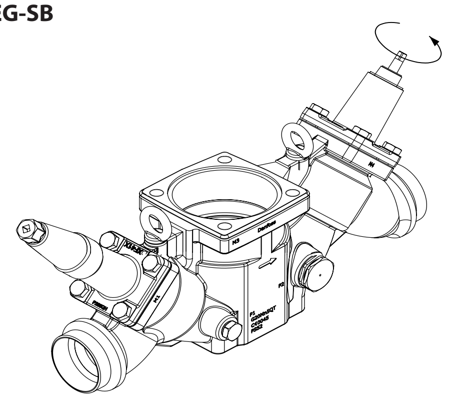


8b



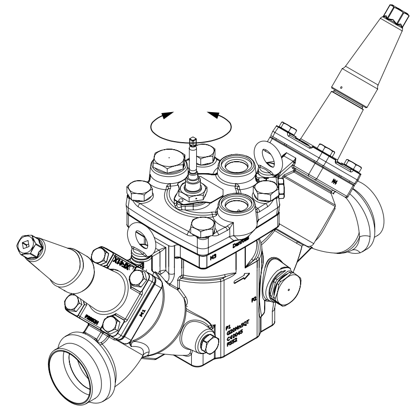
Manual operation

SVA-S / REG-SB



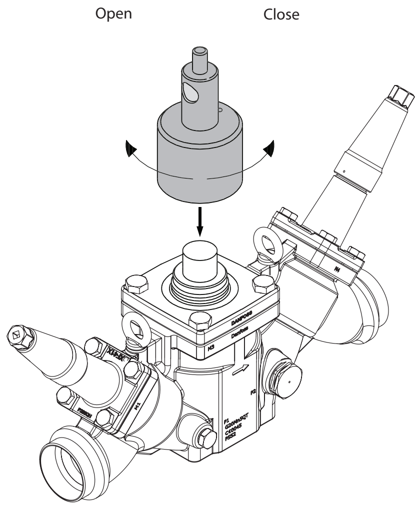
9

ICS / ICLX



10

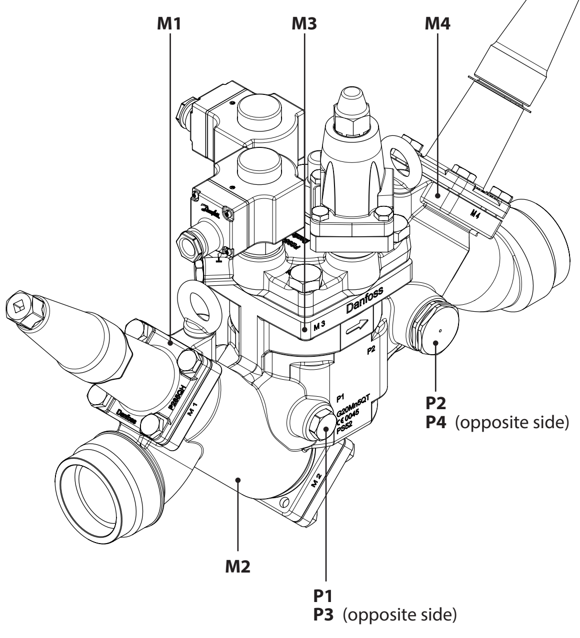
ICM



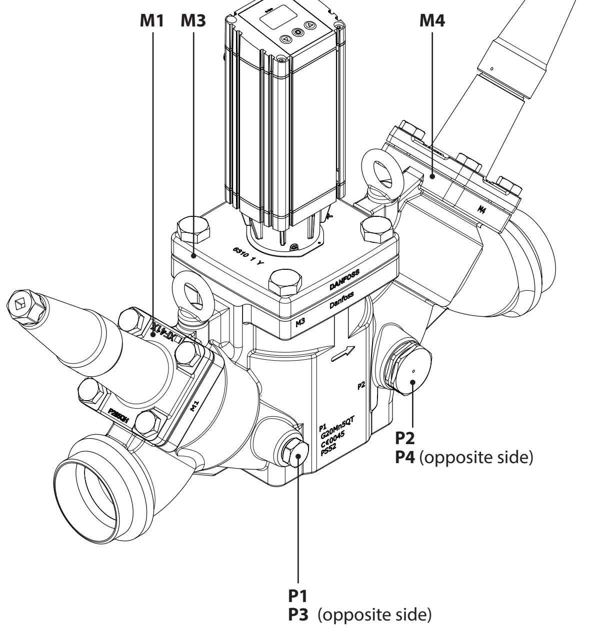
11

Module and side port location

ICF 50-4



ICF 65-3



12

ENGLISH

Refrigerants
Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2).

The use of ICF valve stations with flammable hydrocarbons is not recommended.

The ICF is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+120°C (–76/+248°F)

Pressure range
The ICF is designed for a max. working pressure of 52 bar g (754 psi g).

Application
The ICF can be used in suction, liquid, hotgas and liquid/vapor lines. The ICF regulates the flow of the medium by modulation or on/off function, depending on function modules installed in the ICF.

Regulating range
Dependent on the chosen type and combination of modules installed in the valve.

Orientation (fig. 1)
The ICF must be installed according to fig. 1. The ICF must be installed with the arrow in the direction of the flow).

The ICF will be delivered with all the function modules fully assembled. The modules can be taken out for service or inspection and may be rotated 4 x 90° in relation to the valve body upon installation (fig. 1b).

The ICF is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion.

It must be ensured that the ICF is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 2 and 3)
The ICF valve station can be welded by using either TIG/MIG/SMAW welding (fig. 2) or gas welding (fig. 3).
Always keep inlet and outlet protecting caps on the valve until the valve is ready to be installed, in order to prevent rust formation inside the valve station.

TIG/MIG/SMAW welding
It is not necessary to remove any of the function modules prior to TIG/MIG/SMAW welding (fig. 2) and auxiliary cooling is not needed at normal heat impact.
Every precaution must be taken to minimize welding spatter.
To avoid any welding spatter entering the valve station and to avoid heat impact to the Teflon seat during welding, it is recommended to open the valves slightly (approx. 1 turn from closed position) in first and last module (M1 and M4).
When welding is completed it is recommended to close the 2 modules again (M1 and M4) in order to protect the interior of the valve until the system is ready for operation.

Gas welding
Remove all inserts before welding (fig. 3).
Auxiliary cooling is not needed at normal heat impact.
Every precaution must be taken to minimize welding spatter.
After welding, clean the valve inside for welding spatter and welding debris.
It is recommended to reinstall the modules right after welding and to close the 2 modules again (M1 and M4) in order to protect the interior of the valve until the system is ready for operation.
In case the valve is not assembled immediately make sure that rust protective oil is applied to the inside surfaces.

Mounting of valves
- Make sure that piping into which a valve is installed is properly supported and aligned square and plumb to the joining sections.
- Ensure that the finalized valve assembly is free of any stresses from external loads.
- Use only new gaskets manufactured by Danfoss.
- Ensure that installed valves are properly pressure tested, leak tested, evacuated before charging with refrigerant in accordance with ANSI /IIAR 5, EN378-2 or ISO 5149-2.

The enclosed valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Side port connections (fig. 12)
The ICF features 2 groups of 2 individual side ports. The 2 smaller ports P1 and P3 are intended for service devices like service valve, gauge or sight glass, while the bigger ports P2 and P4 can be used for defrost drain from the evaporator when doing defrost (typically hot gas).
P2 and P4 can be converted to side ports similar to P1 and P3 by installing separate accessories (see the ICF data sheet).

Surface protection and identification
The external surface is zinc-chromated to provide corrosion protection according to EN 12284:2003 8.13.
The Zinc-Chromatization does not cover the welding connections. After installation has been completed the external surface of the valve must be protected against corrosion with a suitable top coating.
Coverage of the ID label when painting the ICF is recommended.

Precise identification of the ICF is made via the ID label on each of the 4 function modules.

Maintenance (fig. 4)
Service
The ICF valve stations are easy to service.
Do not open the ICF while it is still under pressure.

Upon opening and removal of the modules:
- Check that the flat gaskets and/or O-rings between the module and the housing and O-rings on the function module has not been damaged. Replace flat gaskets and O-rings if not intact.
  A valve with a damaged o-ring/gasket might not modulate according to the specification.

  Flat gaskets and O- are present in the locations shown in fig. 4.

CO_2 applications
When used in CO_2 systems the O-rings (see fig. 4) can swell (grow).
At service it is recommended to replace the actual number of used O-rings before the modules are reinstalled in the ICF valve body.

Assembly
Remove any dirt from the housing before the ICF is assembled.
- Check that all channels in the ICF are free of particles or similar debris.
  If possible, apply some refrigeration oil to ease the insertion of the modules and to protect the O-rings.

Tightening (fig. 5)
Tighten the top covers and plugs with a torque wrench, to the values indicated in the table (see fig. 5).

Replacing or servicing the function module in the ICS, ICM and ICLX modules:

ICS module (fig. 6)
Remove the top cover.
The function module can be lifted out using a bolt size M6 or multi-function tool screwed into the threaded hole of the piston on the function module (fig. 6). Debris blocking the bolt hole will need cleaning.
- Remove the old module.
- Oil the O-rings on the new module with a small amount of refrigeration oil.

ICM module (fg. 7)
Remove the existing module (fig. 7):
1. After removing the 4 bolts twist the module approx. 45° in either direction.
2. Push two screwdrivers in between the top cover and the valve body.
3. Pull the screwdrivers upwards to release the function module and its o-rings.
- Remove the old module.
- Oil the O-rings on the new module with a small amount of refrigeration oil.

ICLX modules (fig. 8a and 8b)
Often the cover and function module can be removed while still assembled (fig. 8a).
1. Unscrew and remove all top cover screws.
2. Push two screwdrivers in between the top cover and the valve body and pull the screwdrivers downwards to release the function module and its o-rings.

If the internal O-rings stick to the metal surface it is necessary to disassemble in 2 steps (fig. 8b).
1. Remove spindle sign, lock ring and lock washer and turn the spindle downwards, out of thread.
   Remove the top cover.
2. Insert two screwdrivers into the two grooves in the function module and press the screwdrivers downwards to release the function module and its o-rings.

Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged.
  A valve with a damaged o-ring might not operate according to the specification.
- The insert and piston assembly can be disassembled and wear parts can be replaced.

For detailed information please see the installation guide for ICS, ICM or ICLX valves.

Backseating SVA-S or REG-SB module (fig. 9)
To backseat turn the spindle counter-clockwise until the valve is fully open.
Before remounting the cap on the modules please ensure that the gasket is present in the cap. Then tighten the cap with 16 Nm (12 ft lbs).

Manual operation of ICLX module (fig. 10)
Normal operation mode:
For the valve to operate normally under the influence of the pilot valves the spindle of the manual operation device needs to be turned fully clockwise.

Manual forced opening:
To manually open the valve the spindle of the manual operation device needs to be turned fully counter clockwise.

Manual operation of ICS module (fig. 10)
Normal operation mode:
For the valve to operate normally under the influence of the pilot valves the spindle of the manual operation device needs to be turned fully counter clockwise.

Manual forced opening:
To manually open the valve the spindle of the manual operation device needs to be turned fully clockwise.

Manual operation of ICM module (fig. 11)
A magnetic coupling can be used to rotate the spindle manually when the actuator has been removed. To make use of the manual operation, a multi-function tool (optional) is used (see fig. 11).

Manual operation is also possible with the actuator mounted on the valve and the power supply connected to the actuator. No matter if the signal connections are wired to the actuator it will be possible to use the manual operation function built into the actuator electronics allowing the motor to step in 1% increments meaning that 100 steps will correspond to a fully open valve. Please refer to the separate instruction on ICAD to address the manual function.

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.
In cases of doubt, please contact Danfoss.

For further service / maintenance details on the modules ICM, ICS, ICLX, SVA-S, REG-SB and FIA; please refer to the individual product installation guide, which can be downloaded from danfoss.com.

Module and side port location (fig. 12)
ICF 50-4

Function Module Type		Can be installed in these locations			
ICM	Motor operated valve module			M3	
ICS	Pilot operated serco valve module			M3	
ICLX	Solenoid valve module			M3	
SVA-S	Shut-off valve module	M1 *)			M4
REG-SB	Regulating valve module				M4
FIA	Strainer module		M2		

P1 & P3 (P3 on the opposite side of P1): Side ports for gauge valve, sight glass, etc..
P2 & P4 (P4 on the opposite side of P2): Side ports for defrost drain or other purposes.

ICF 65-3

Function Module Type		Can be installed in these locations			
ICM	Motor operated valve module			M3	
ICS	Pilot operated serco valve module			M3	
ICLX	Solenoid valve module			M3	
SVA-S	Shut-off valve module	M1 *)			M4
REG-SB	Regulating valve module				M4

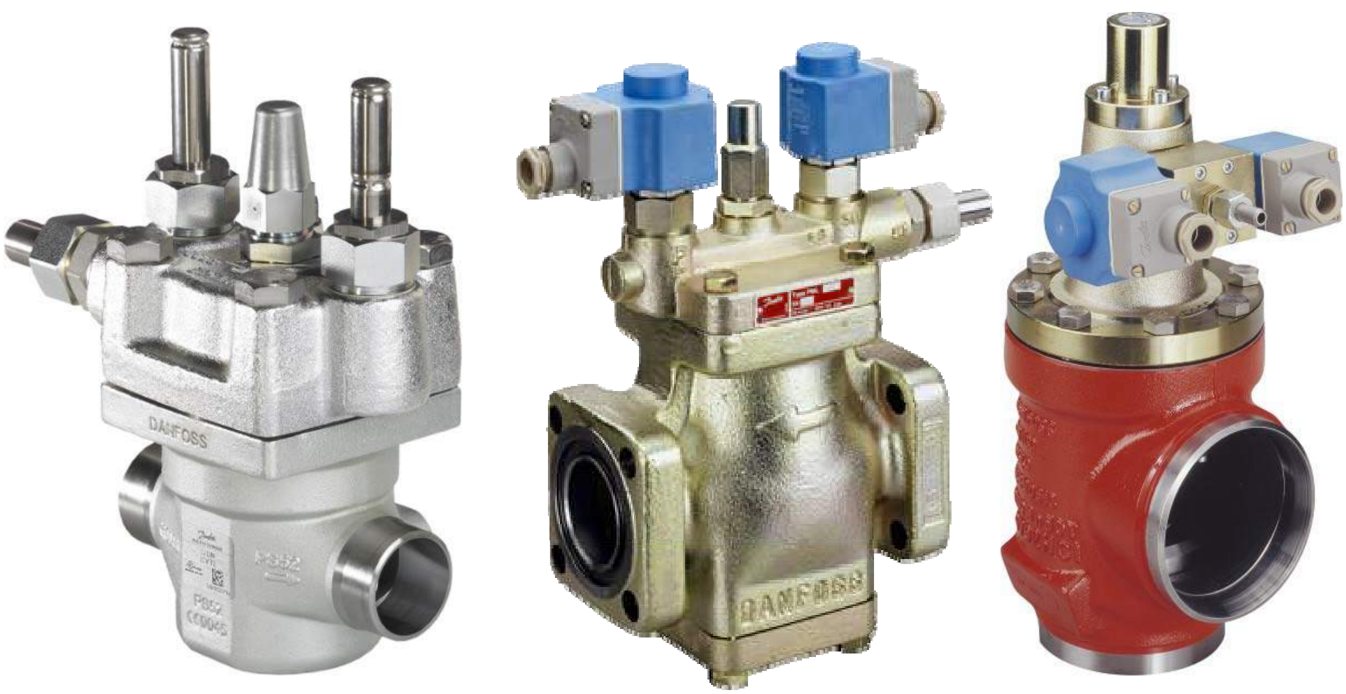
P1 & P3 (P3 on the opposite side of P1): Side ports for gauge valve, sight glass, etc..
P2 & P4 (P4 on the opposite side of P2): Side ports for defrost drain or other purposes.

location not possible

**) Modules are fixed*

ENGINEERING
TOMORROW

Gas-Powered Solenoid Valves Type
ICLX, PML, PMLX and GPLX



Gas-Powered Solenoid Valves
Type ICLX, PML, PMLX and GPLX

- Are all **normally-closed** gas-powered solenoid valves that are used for applications that require very low pressure drop.
- Require no pressure drop across the valve to open or stay open for lower temperature/pressure drop in lower temperature suction lines.
- Only need one electrical signal to open or close the valve.
- ICLX valves are standard with 2-step opening but can be converted to a singe step during installation if needed.
- PML, PMLX and GPLX type have been discontinued but will be covered to have an understanding of how they work when coming across them at existing facilities.

Danfoss ICLX

Two-Step Gas Powered Solenoid Valves

754 psi

Working pressure with a maximum working pressure of 745 psi, ready for CO_2 and future refrigerants

Technical Data

- Can function as a single step or 2-step opening
- Temperature range: -76°F to 248°F
- 754 psig pressure rating
- Opening differential pressure is limited by the external gas pressure

  Max. Opening Pressure Differential (MOPD):

  - 400 psi (28 bar) if external pressure is 22 psi (1.5 bar) higher than inlet pressure of the ICLX valve
  - 580 psi (40 bar) if external pressure is 30 psi (2 bar) higher than inlet pressure of the ICLX valve

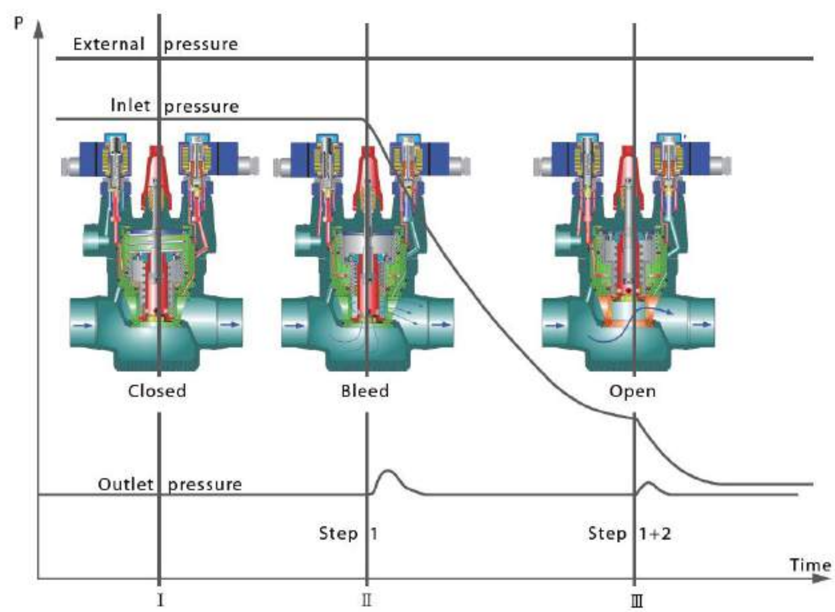
Factory Setting is for ICLX to have 2-Step Opening

- **Step one**

  opens to 10% of the capacity, when the pilot solenoid valves are activated

- **Step two**

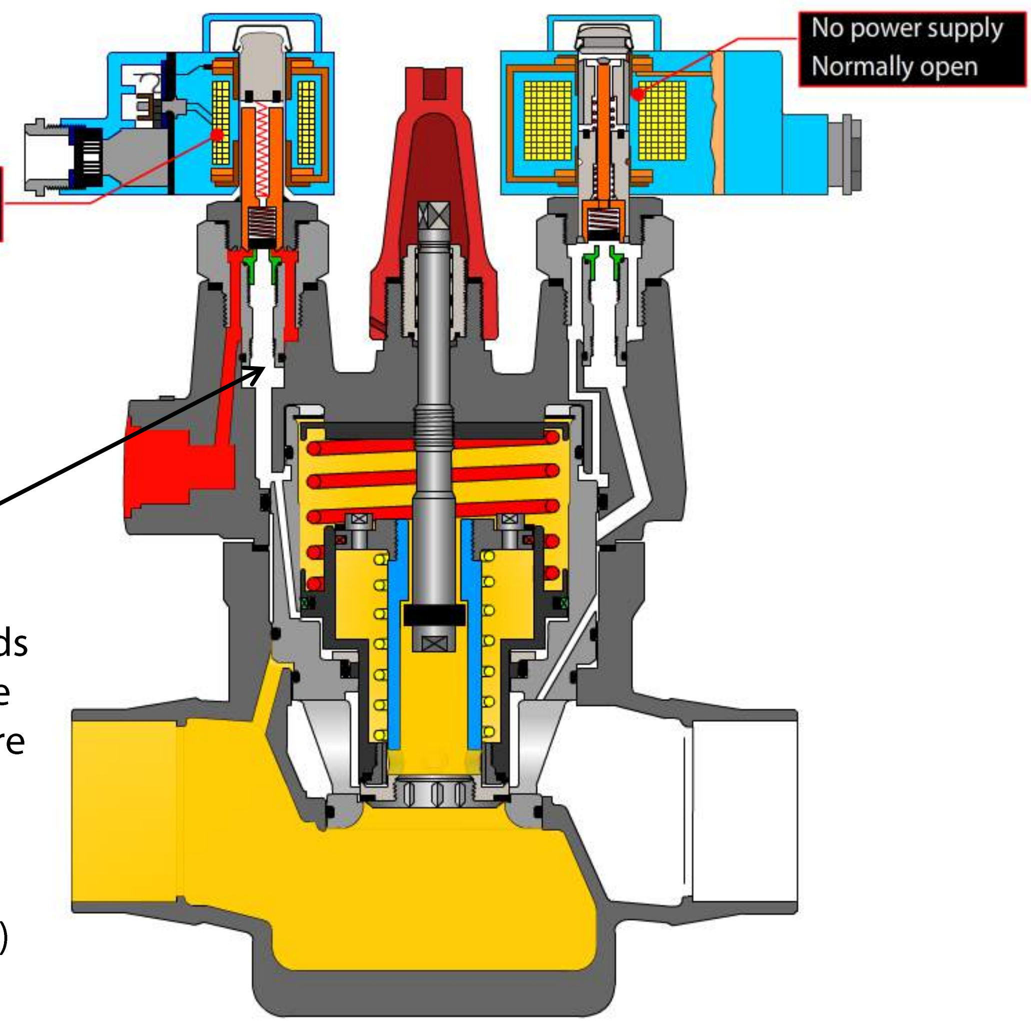
  opens automatically after the pressure differential across the valve reaches about 18 psi (1.25 bar)



NOTE: If the pumped liquid line is turned on before the 2nd step opens and the pump pressure is more than 18 psi higher than suction pressure the valve will not bleed the evaporator pressure down fully which will not let valve open fully after defrost.

ICLX Function as 2-Step Valve

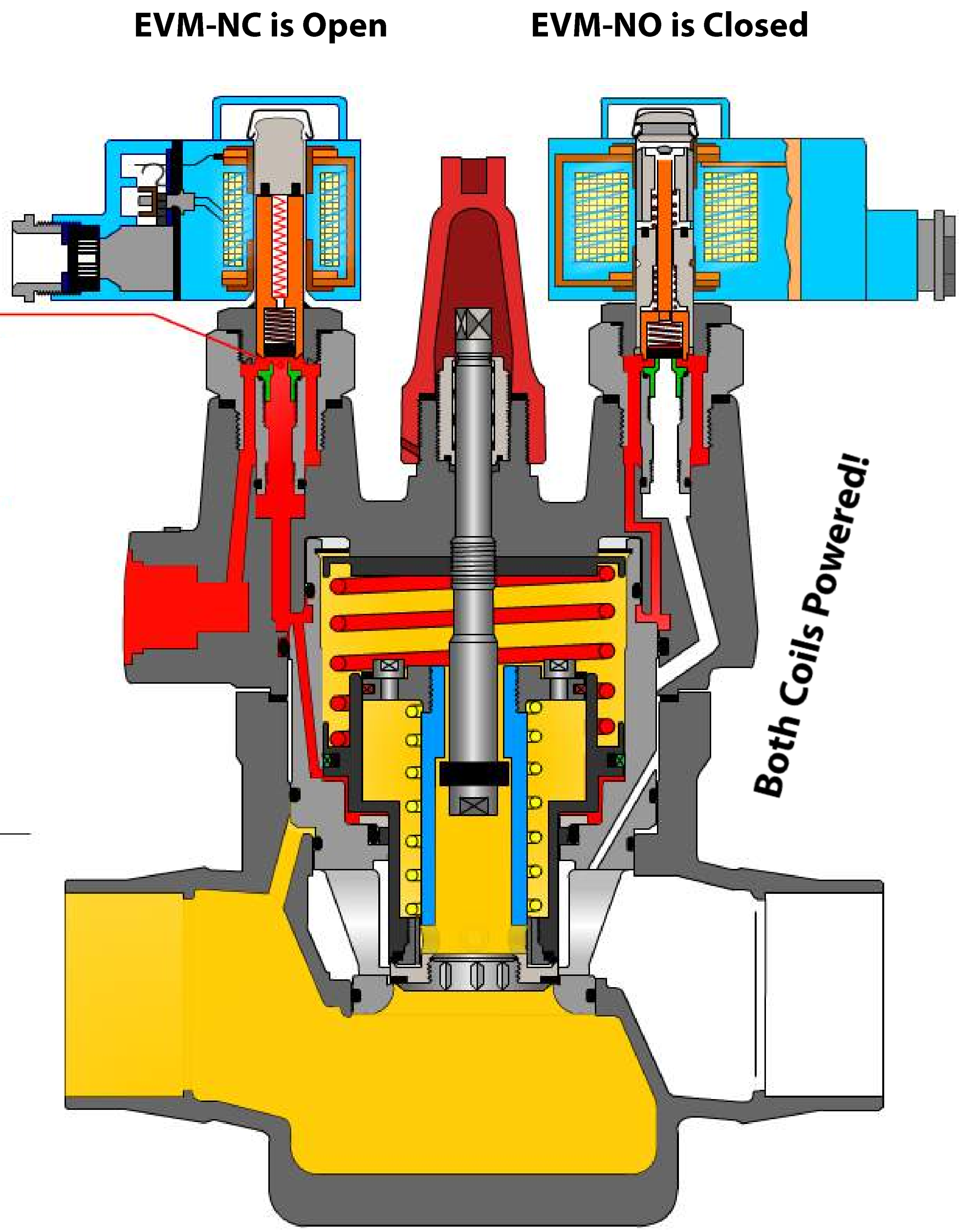
Function

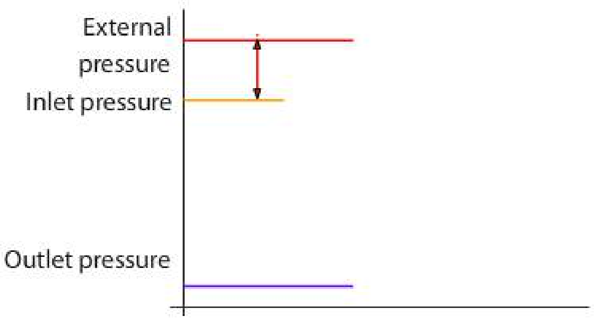


Damping orifice only needs installed into the tip of the EVM-NC if the gas pressure going into valve is more than 87 psi greater than the pressure before valve (typically defrost pressure) when valve is opening. Note: if small tubing is run to the ICLX it will already drop the gas supply pressure a lot.

ICLX Function as 2-Step Valve

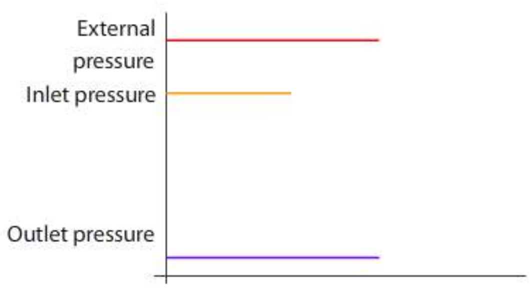
Function

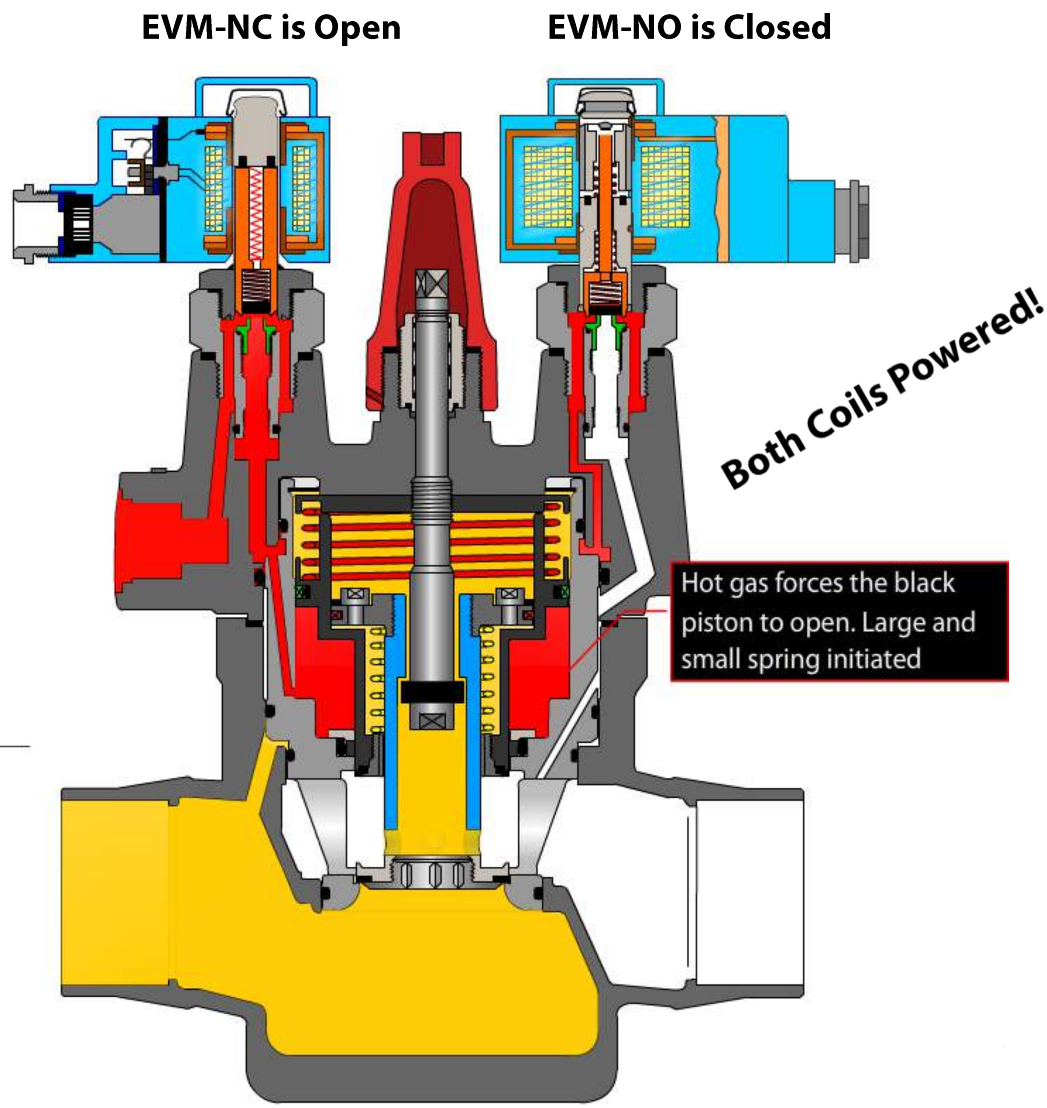




ICLX Function as 2-Step Valve

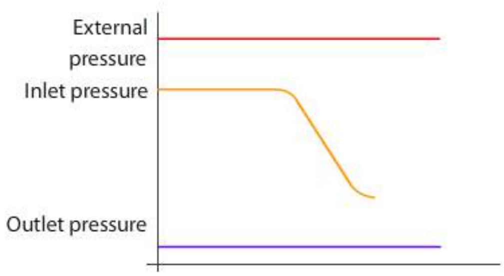
Function

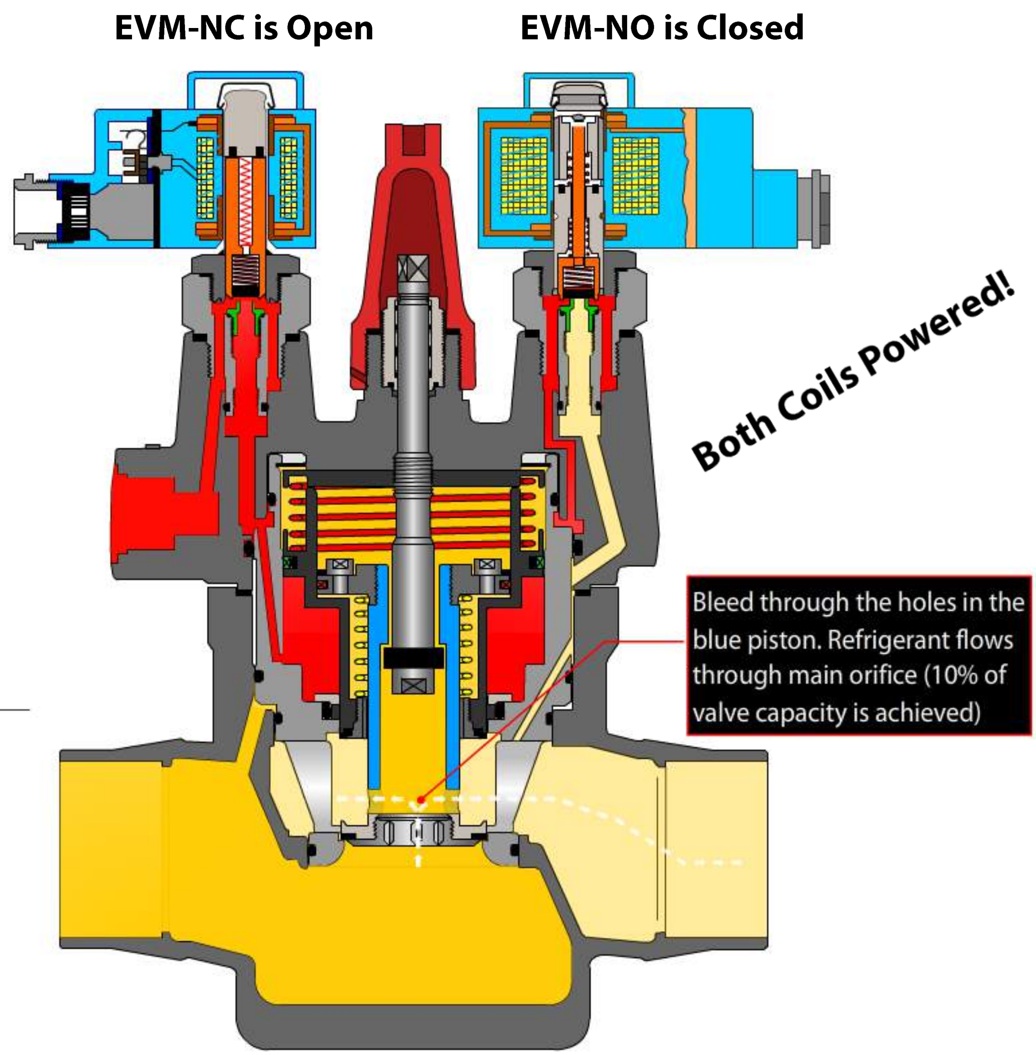




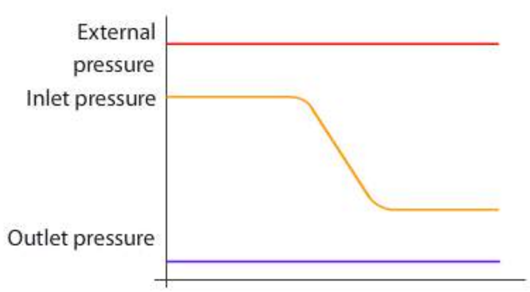
ICLX Function as 2-Step Valve

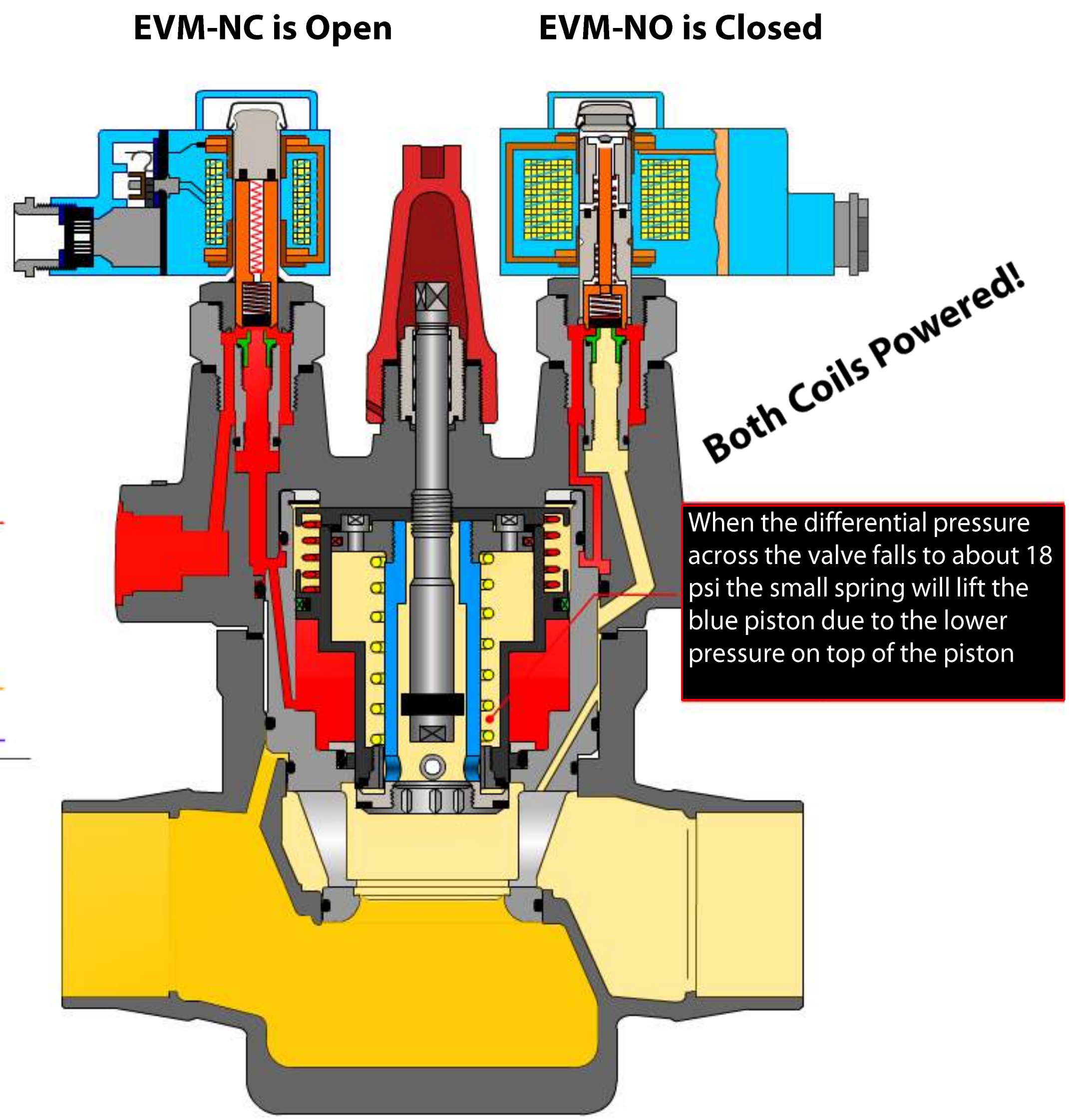
Function



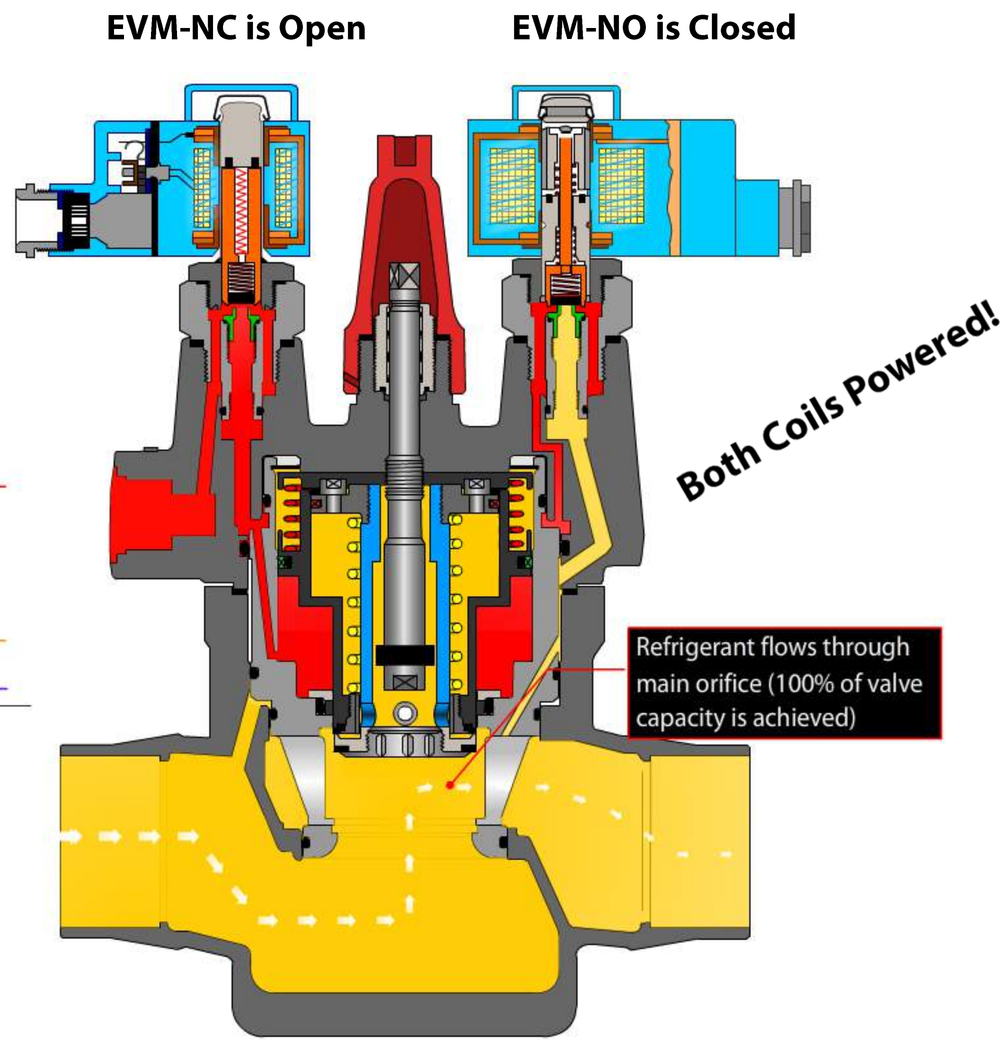


ICLX Function as 2-Step Valve

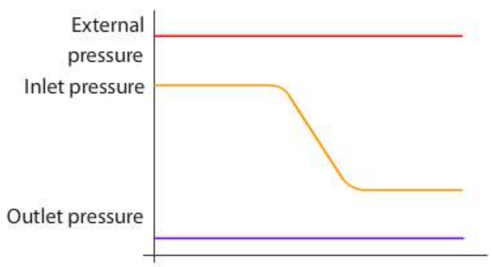




ICLX Function as 2-Step Valve



Function



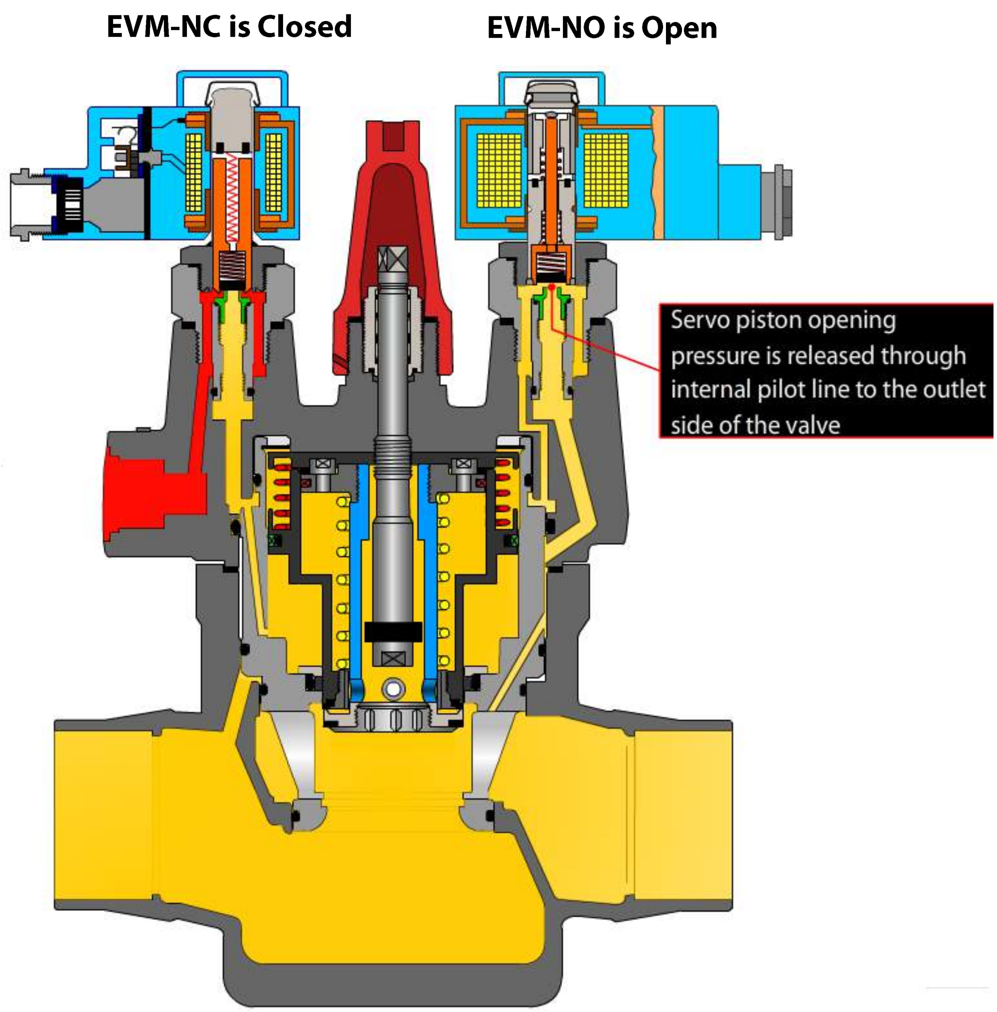
ICLX Function as 2-Step Valve

NOTE: The hot gas used to hold the ICLX open will condense in the piston chamber of the cold valve which will delay the closing of the valve when the coils are de-energized. The exact time for the refrigerant to blead out of the piston chamber to let the valve completely close will depend on temperature, pressure, refrigerant type and the size of the valve. Thus an exact closing time for the valves cannot be given but, in general, lower temperatures give longer closing times.

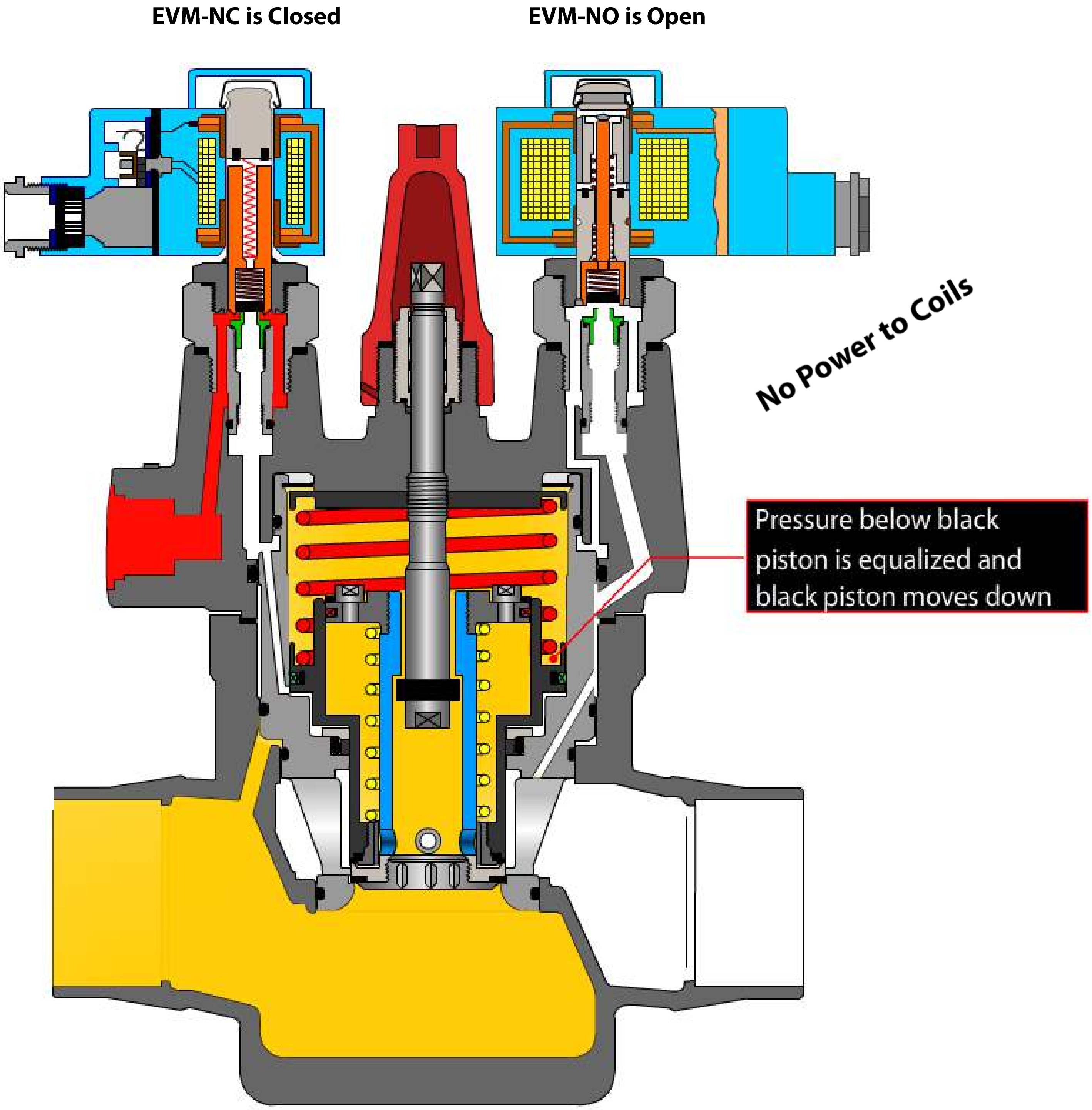
It is very important to take the closing times into consideration when a hot gas defrost is performed on evaporators to ensure that the hot gas supply valve is not opened before the ICLX in the suction valve is completely closed. If the hot gas supply valve is opened before the ICLX in the suction line is closed, considerable energy will be lost and potentially dangerous situations might arise because of “liquid hammer” causing the valve or other parts of the system to be damaged.

As a rule of thumb a closing time of 2 minutes can be used as a starting point. The optimum closing time for each individual system must be determined at initial start-up of the plant at intended operating conditions. It is recommended to check if the closing time needs to be changed when conditions changes (suction pressure, ambient temp. etc.) and closing time should be checked at service of the valve. Once the optimum closing time has been identified it is recommended to add a safety margin of 30 sec. to the optimum closing time.

No Power to Coils

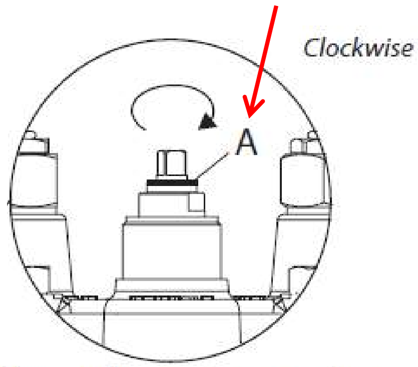


ICLX Function as 2-Step Valve

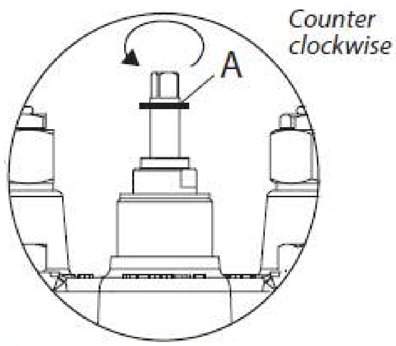


Manually Opening the Valve

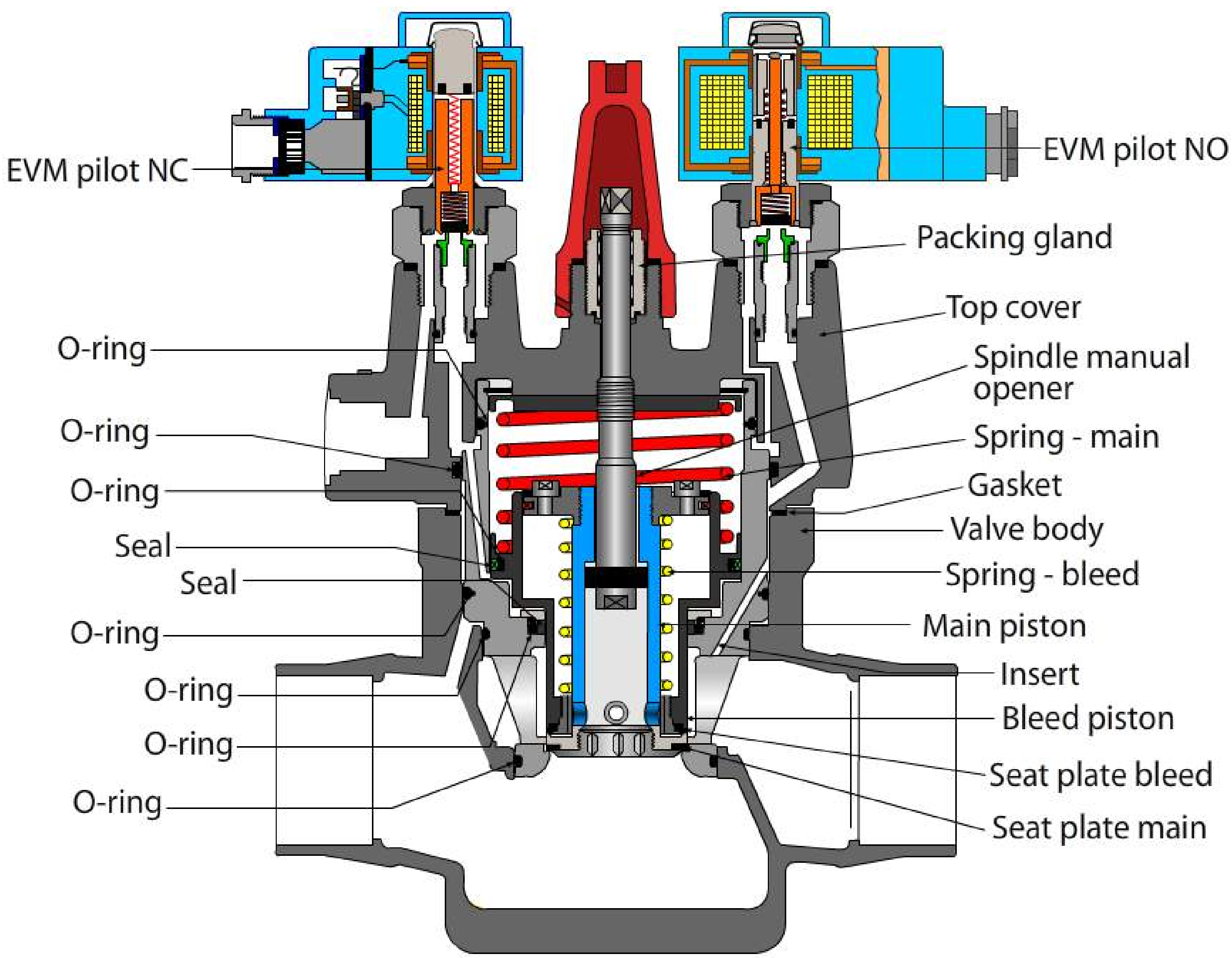
C-clip (pos.A)



Normal operation mode

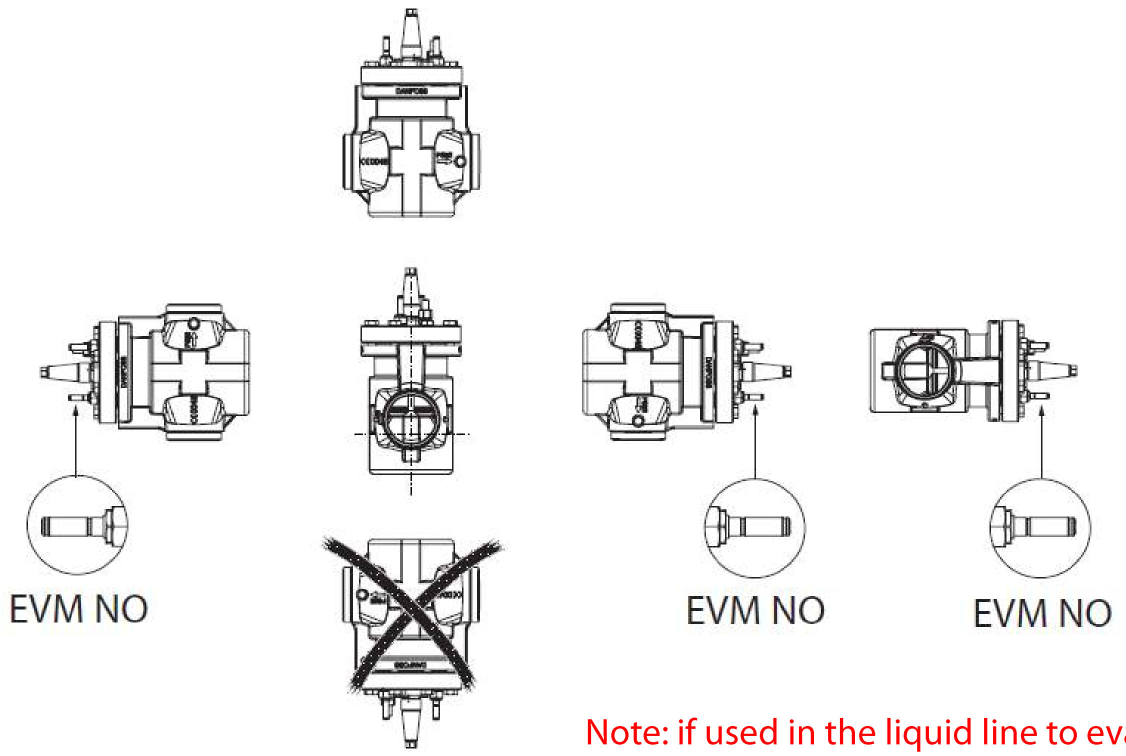


Manual forced opening



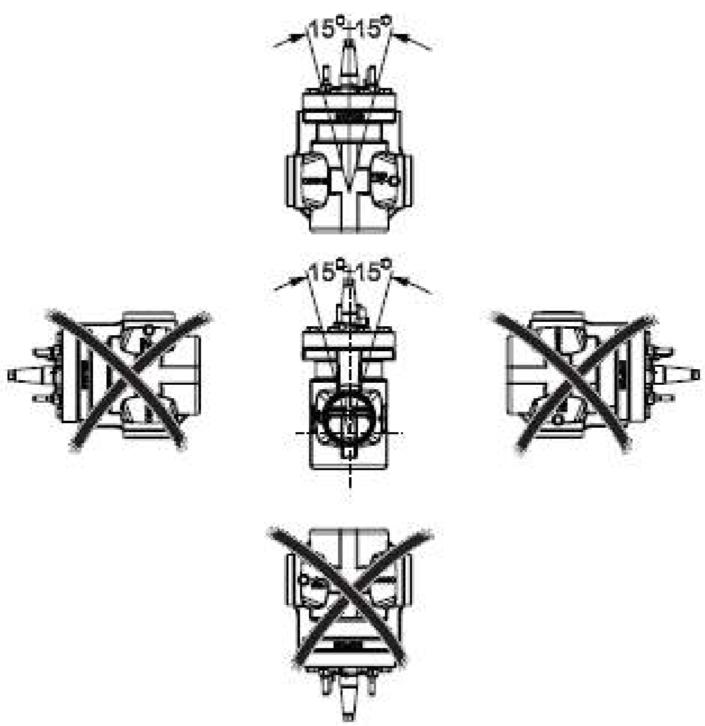
Installation – Mounting Restrictions

ICLX sizes 32 to 125 (1-1/4" to 5")



Note: if used in the liquid line to evaporator with defrost the valve should be installed with arrow away from evaporator so defrost pressure is at inlet of valve and lock valve to single step function.

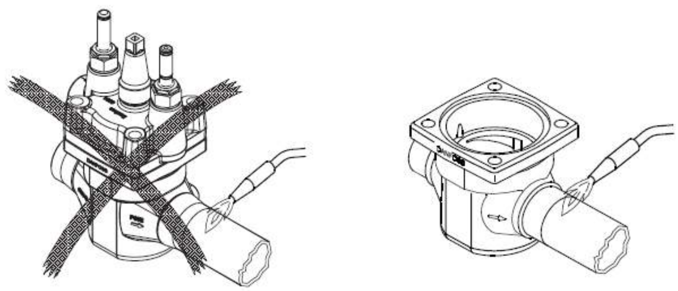
ICLX Size 150 (6")

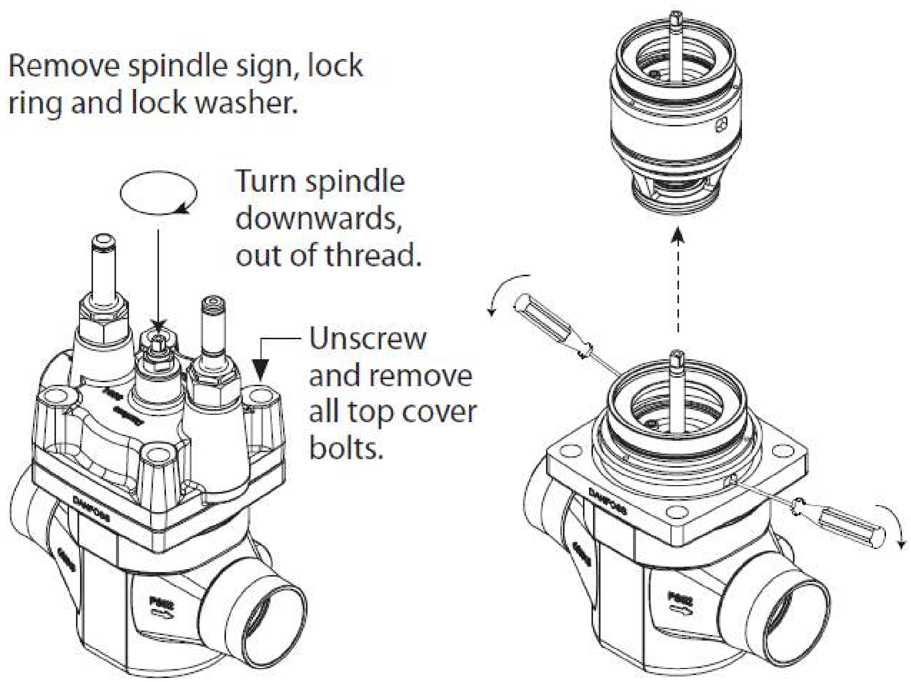


It is not recommended to mount the 6" ICLX 150 on its side due to the very large weight of the piston.

Installation

Module/bonnet should not be installed when body is welded into the system





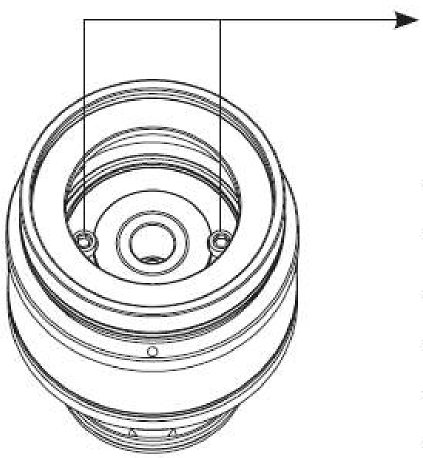
External connector parts

¼" FPT thread

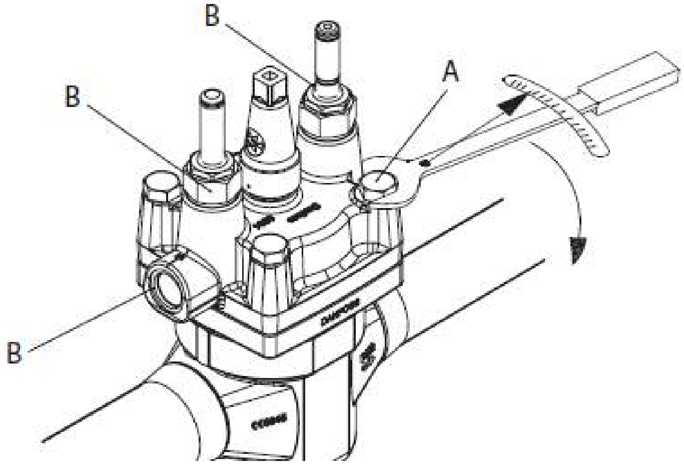
Aluminum gasket goes between these 2 parts

Changing ICLX 32-65 to Single Step Function

- Remove the top cover from body
    - 1st the C-clip on manual stem needs removed
    - Screw the manual stem clockwise until it drops down out of the top cover then pull off the top cover
- Remove the 2 bolts in the function module (this can be done while it is still in the valve body) and replace with the longer bolts included in the box.
- After bolts are tightened, the top cover can be installed back on valve body to proper torque.



	two-step	one-step
ICLX 32	M5 x 6	M5 x 16
ICLX 40	M5 x 6	M5 x 16
ICLX 50	M5 x 6	M5 x 16
ICLX 65	M5 x 6	M5 x 16
	Allen key	Allen key



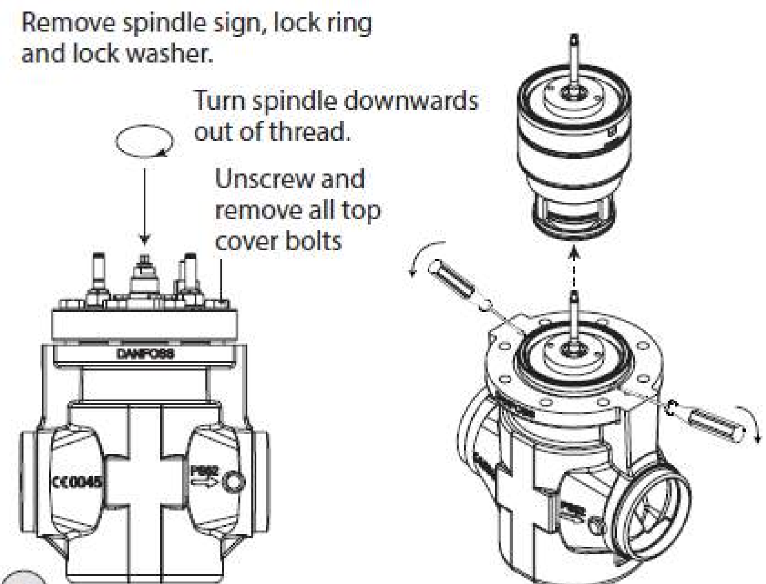
	Valve body size	Nm	ft lb
Pos. A	32	120	88
	40	120	88
	50	140	103
	65	150	110
Pos. B	32	50	37
	40		
	50		
	65		

Changing ICLX 100-150 to Singe Step Function

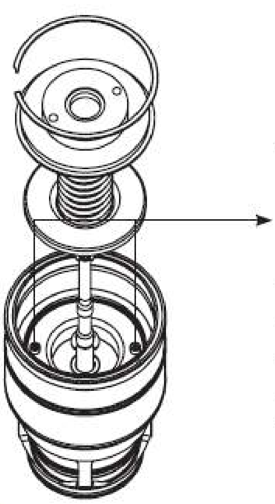
Changing from two step to one step function

The ICLX valve is from factory side setup as two step function. To change the opening characteristics to one step function the following step must be completed:

- Remove the function module from the valves house (fig 3.).
- Remove the locking ring, upper spring retainer, spring and lower spring retainer (fig. 4).
- Change the two bolts
- The length of the two bolts corresponds to the desired characteristic of the valve and should be applied according to the table (fig. 4).
- After changing the bolts the valve can be reassembled.

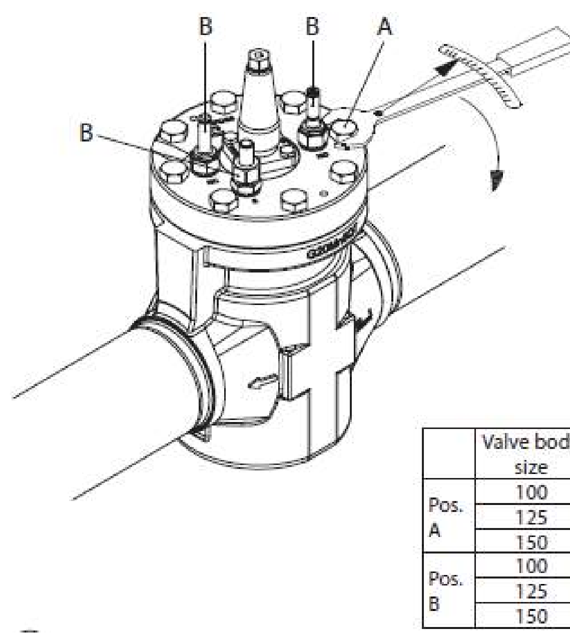


3



	two-step	one-step
ICLX 100	M6 x 6	M6 x 16
ICLX 125		
ICLX 150		
	Allen key	Allen key

4



	Valve body size	Nm	ft lb
Pos. A	100	220	162
	125		
	150		
Pos. B	100	50	37
	125		
	150		

PML and PMLX valves

Discontinued Oct. 2015

PML, PMLX 32 – 65
Note: top cover can be rotated w/o affecting the function of the valve

PML, PMLX 80 – 125
Note: top cover can NOT be rotated

Manual Operation

Automatic Mode:

- Spindle all the way out (Turn counter clockwise)

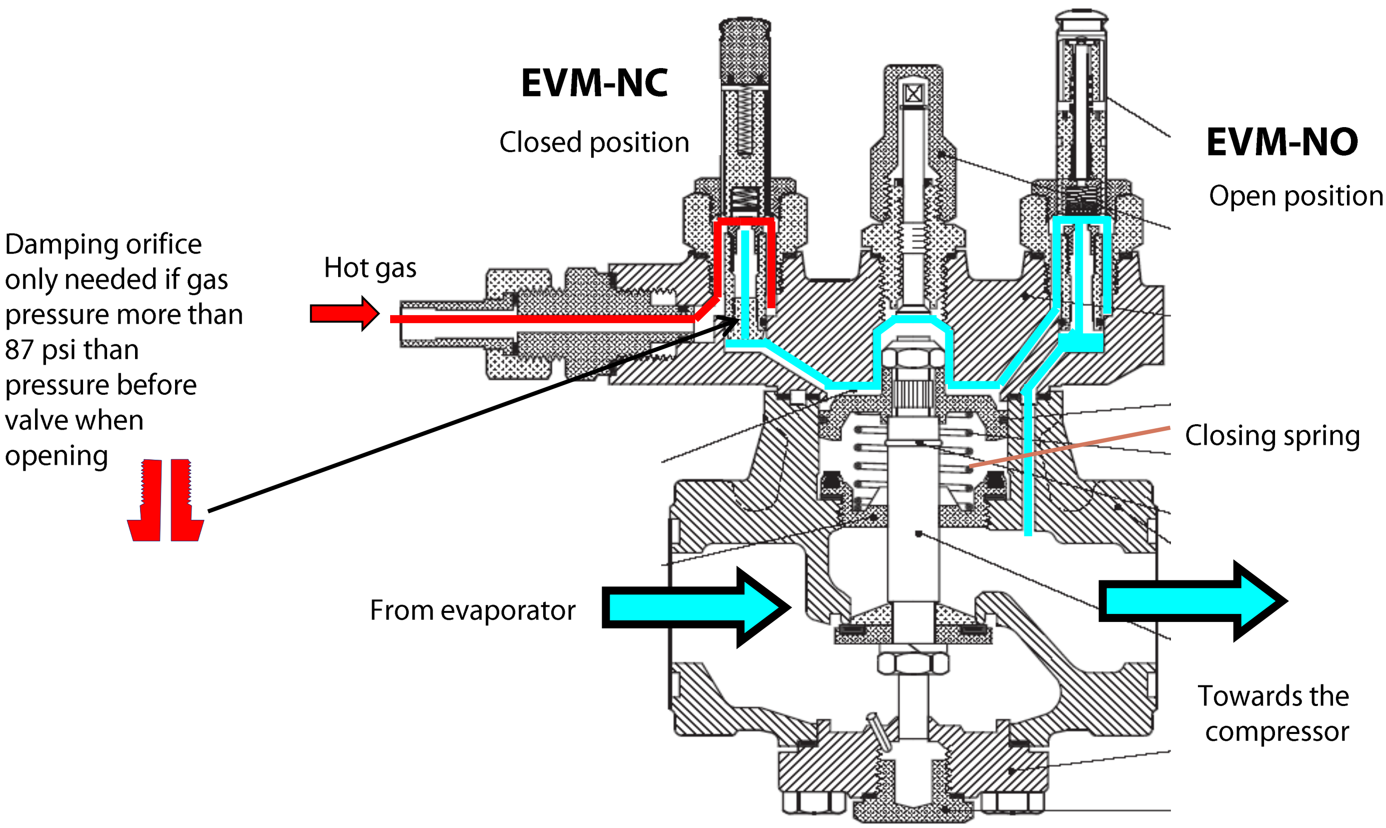
Manual Mode:

- Spindle all the way in (Turn clockwise)

Important! During auto mode be sure to fully backseat the spindle and replace the cap.

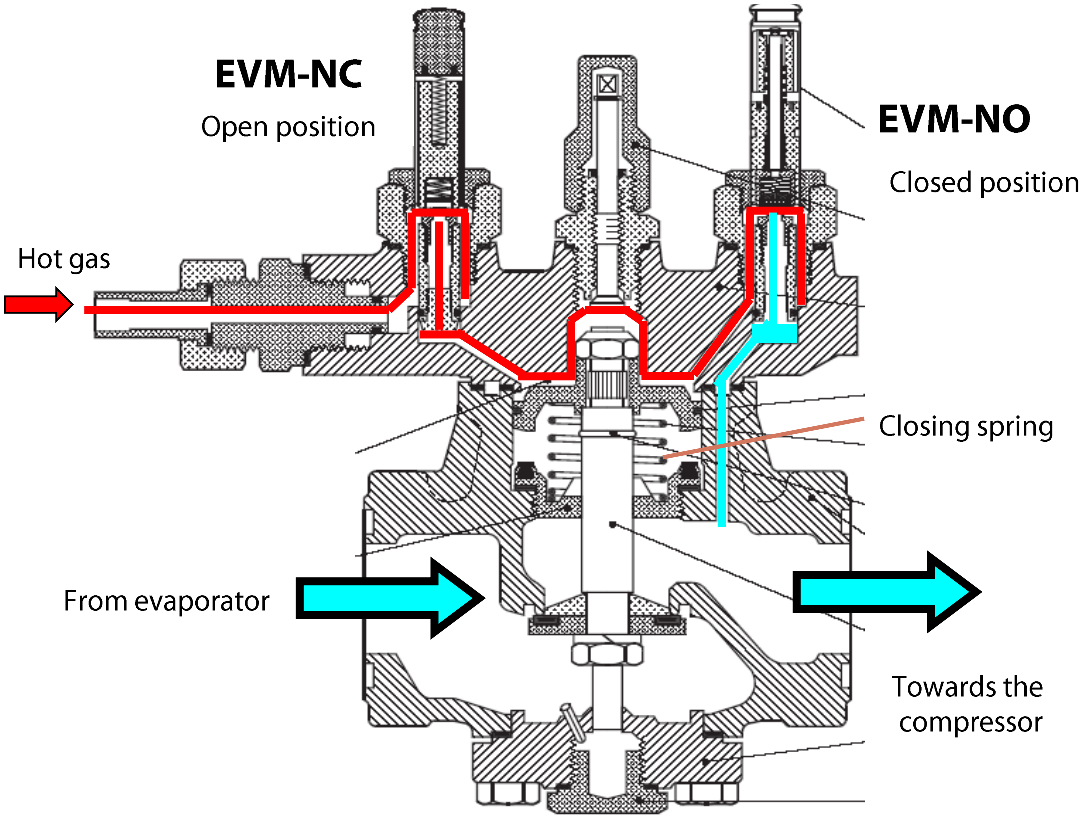
PML Working Principles is Similar to Current ICLX

Solenoid coils are de-energized – valve is closed

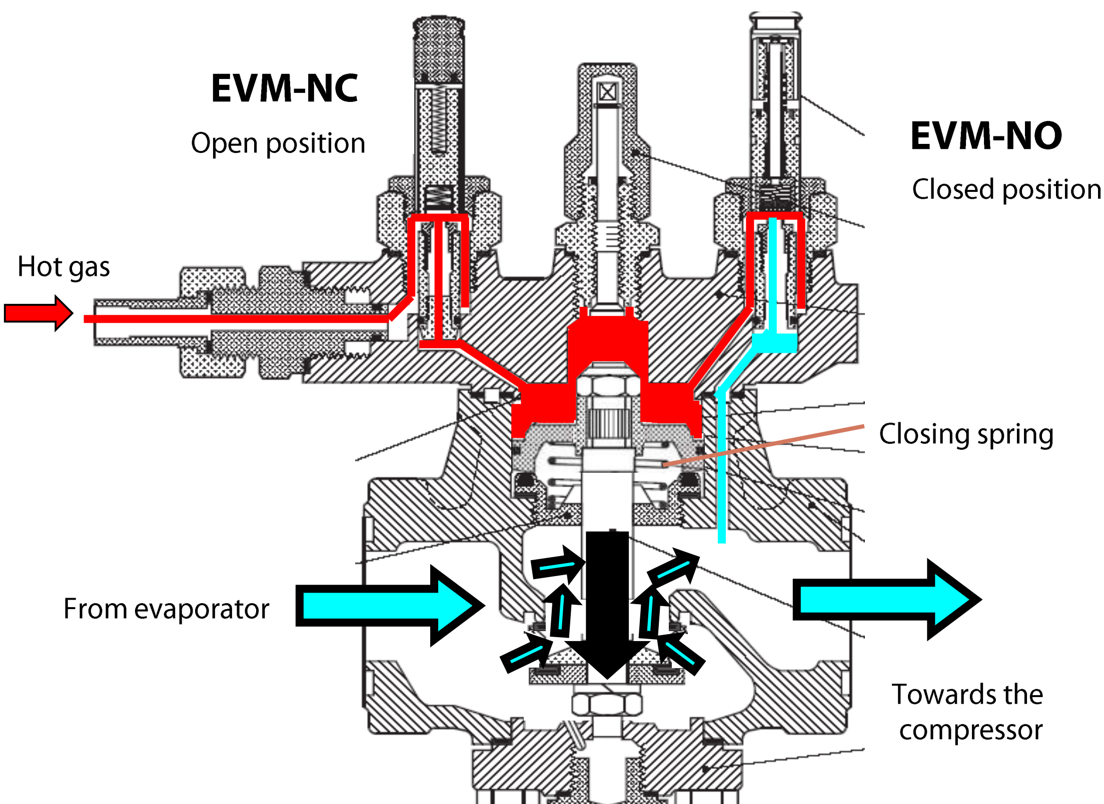


PML Working Principles

Solenoid coils are energized – valve starts to open

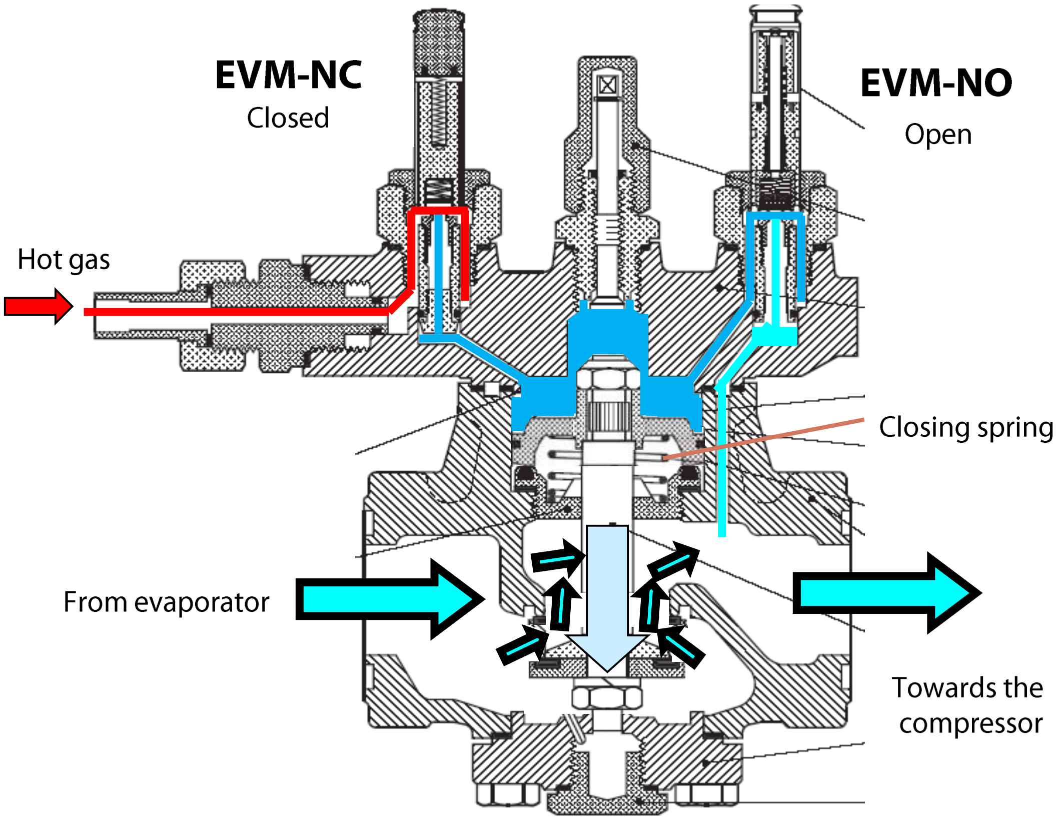


Solenoid coils are energized – valve is fully open

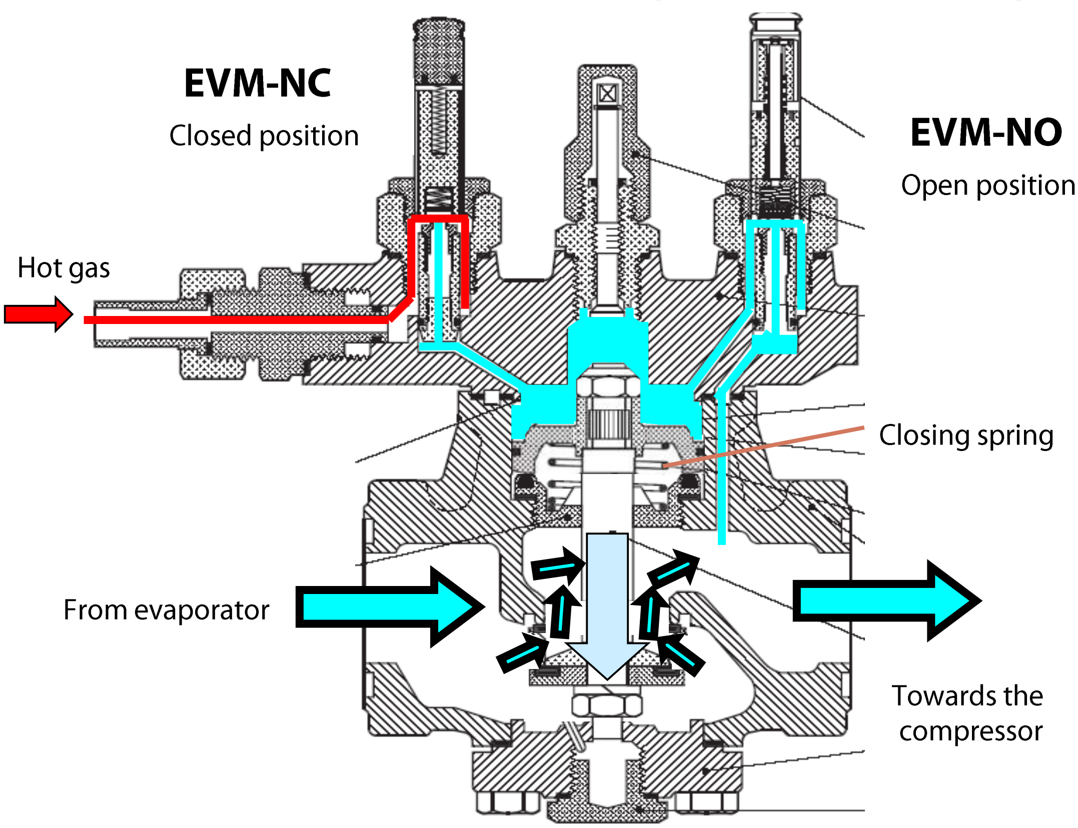


PML Working Principles

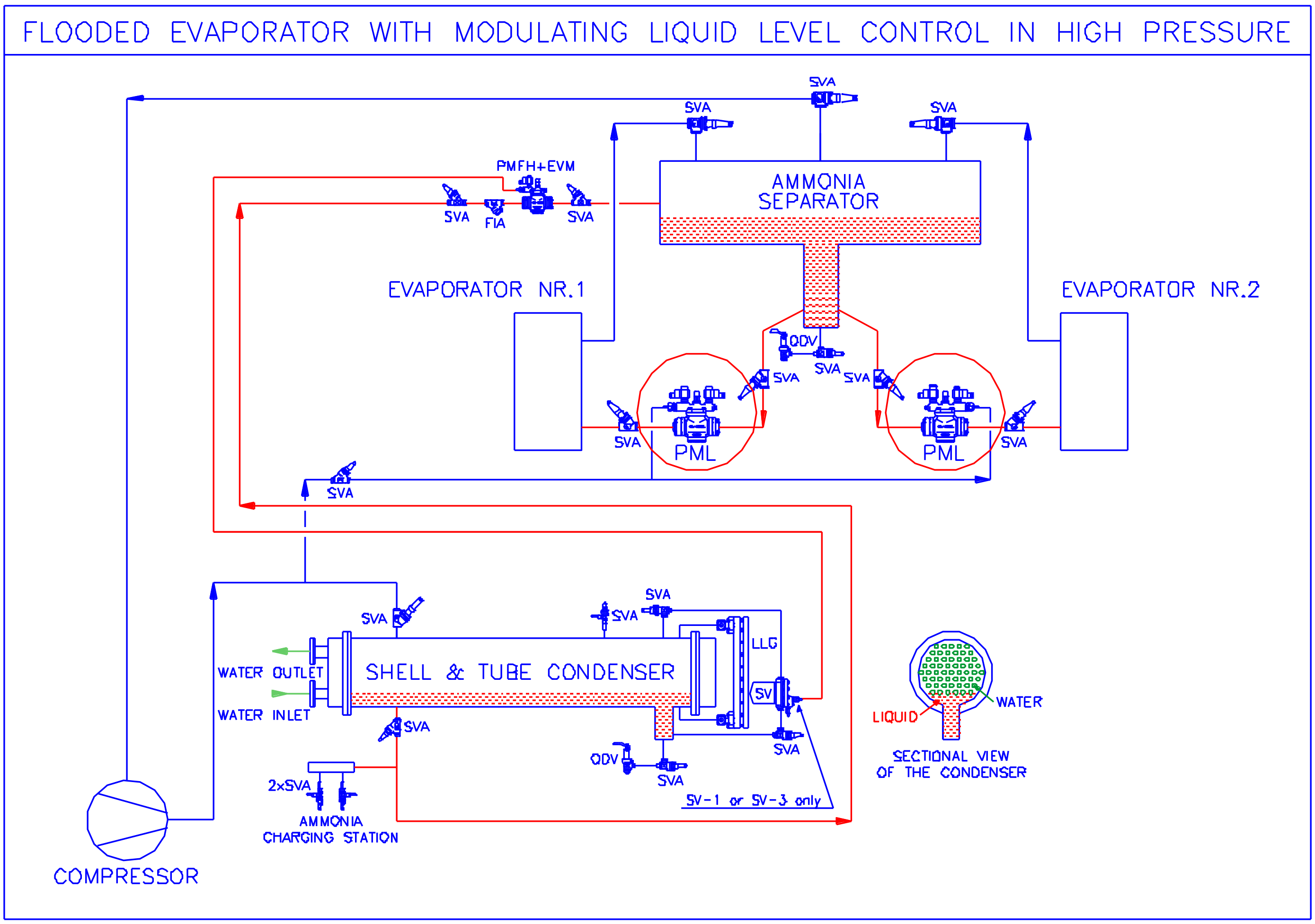
Solenoid coils are de-energized – valve starts to close



Solenoid coils are de-energized – valve is closing

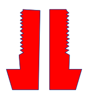


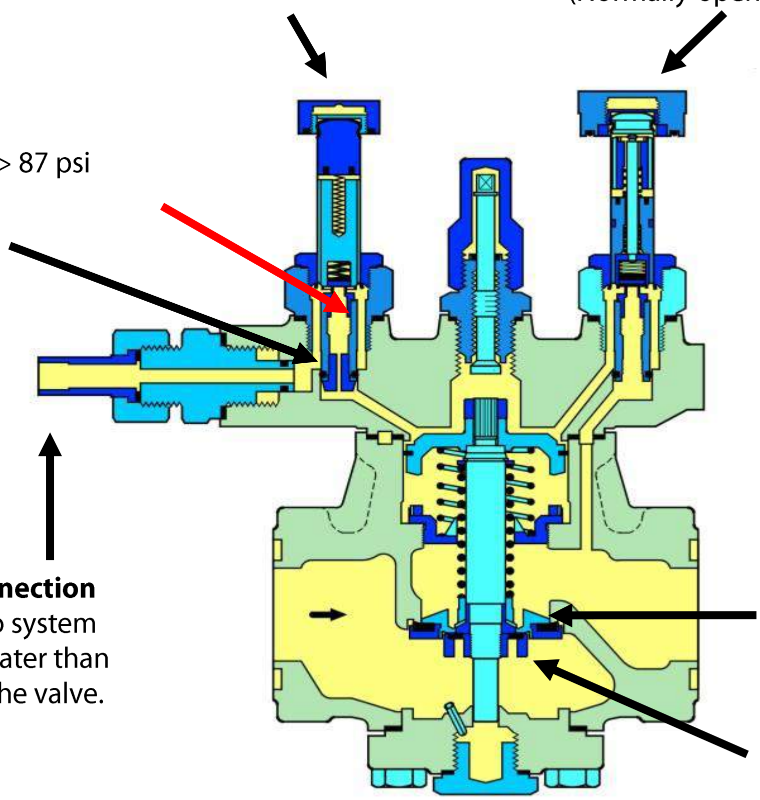
Application Example Where a Single Step Function Should be Used



Note: if used in the liquid line and the evaporator is defrosted the valve should be installed with arrow away from evaporator so defrost pressure is at inlet of valve.

PMLX Gas Powered Valves





Manual Operation

Automatic Mode:

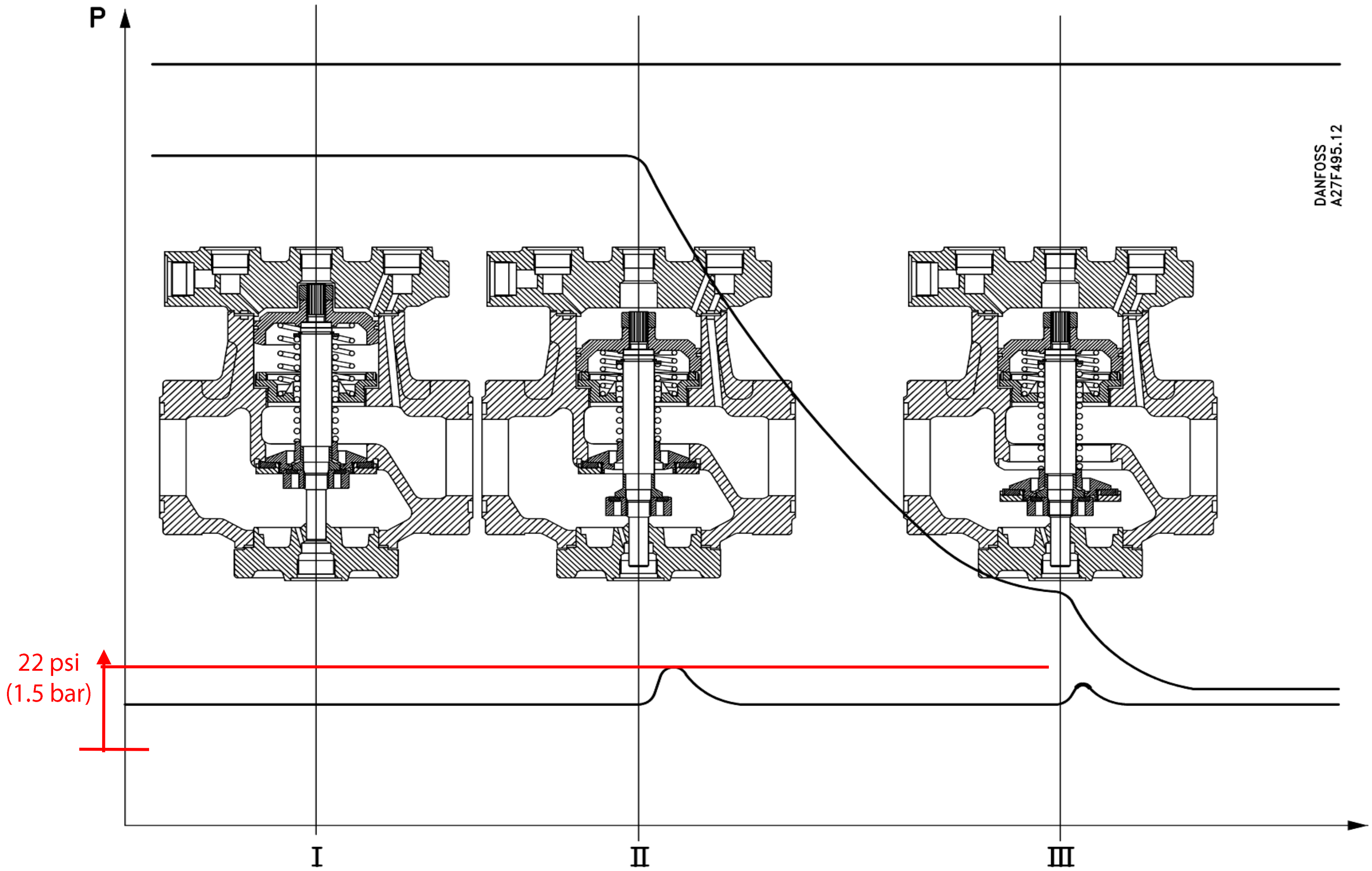
- Spindle all the way out (Turn counter clockwise)

Manual Mode:

- Spindle all the way in (Turn clockwise)

Important! During auto mode be sure to fully backseat the spindle and replace the cap.

PMLX Opening Sequence



Discontinued GPLX 80-150 (3" – 6")

Discontinued Dec. 2015

Manual stem located under cap.
Note: Stem must be turned counterclockwise to manually open.

Normally-open solenoid pilot (has crimp in tube)

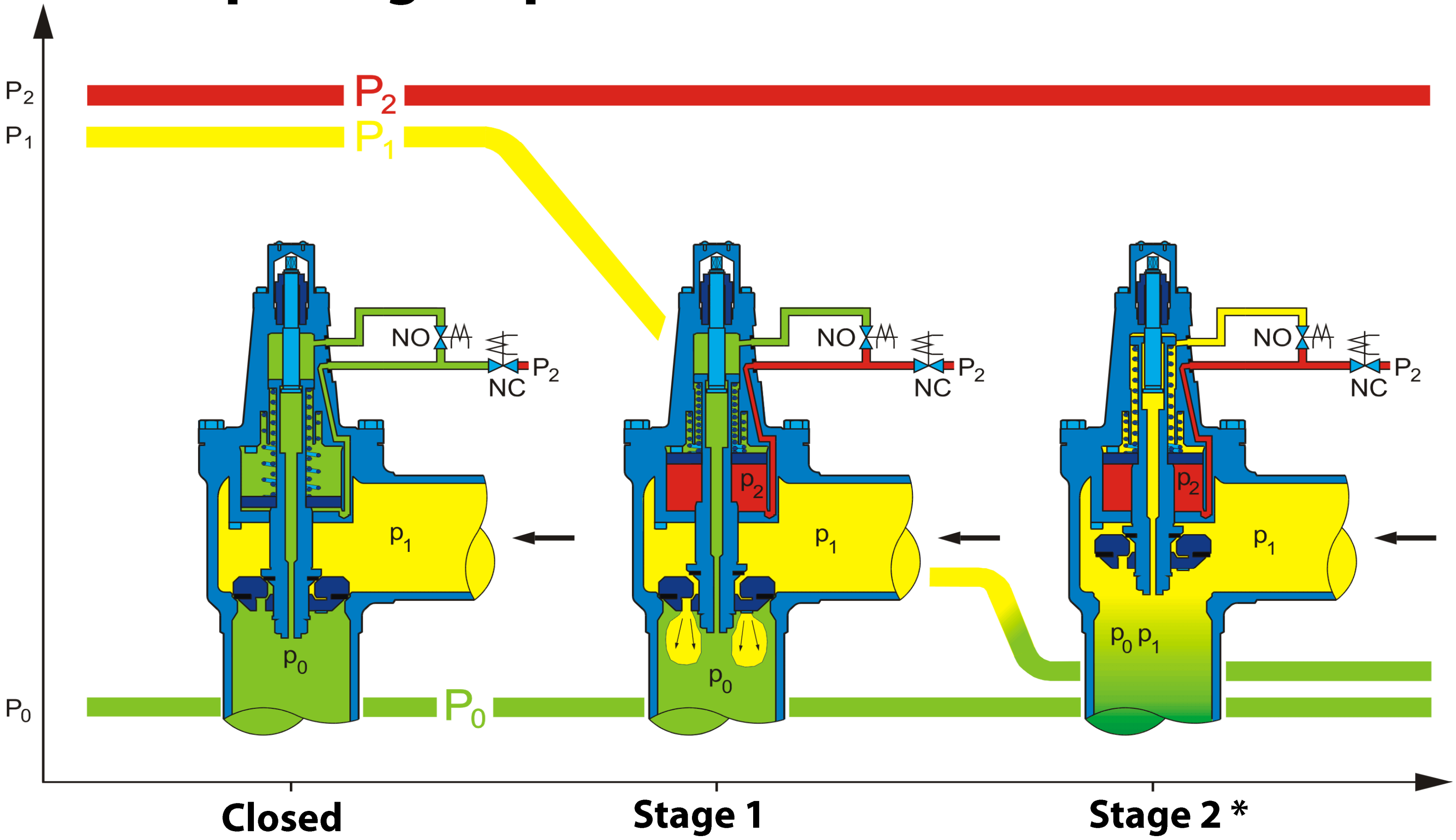
Normally-closed solenoid pilot

G ¼" European connection on valve
(must use the strainer w/ adapter or just the adapter)

Note: The direction of flow is opposite of stop valves

Optional strainer accessory for GPLX

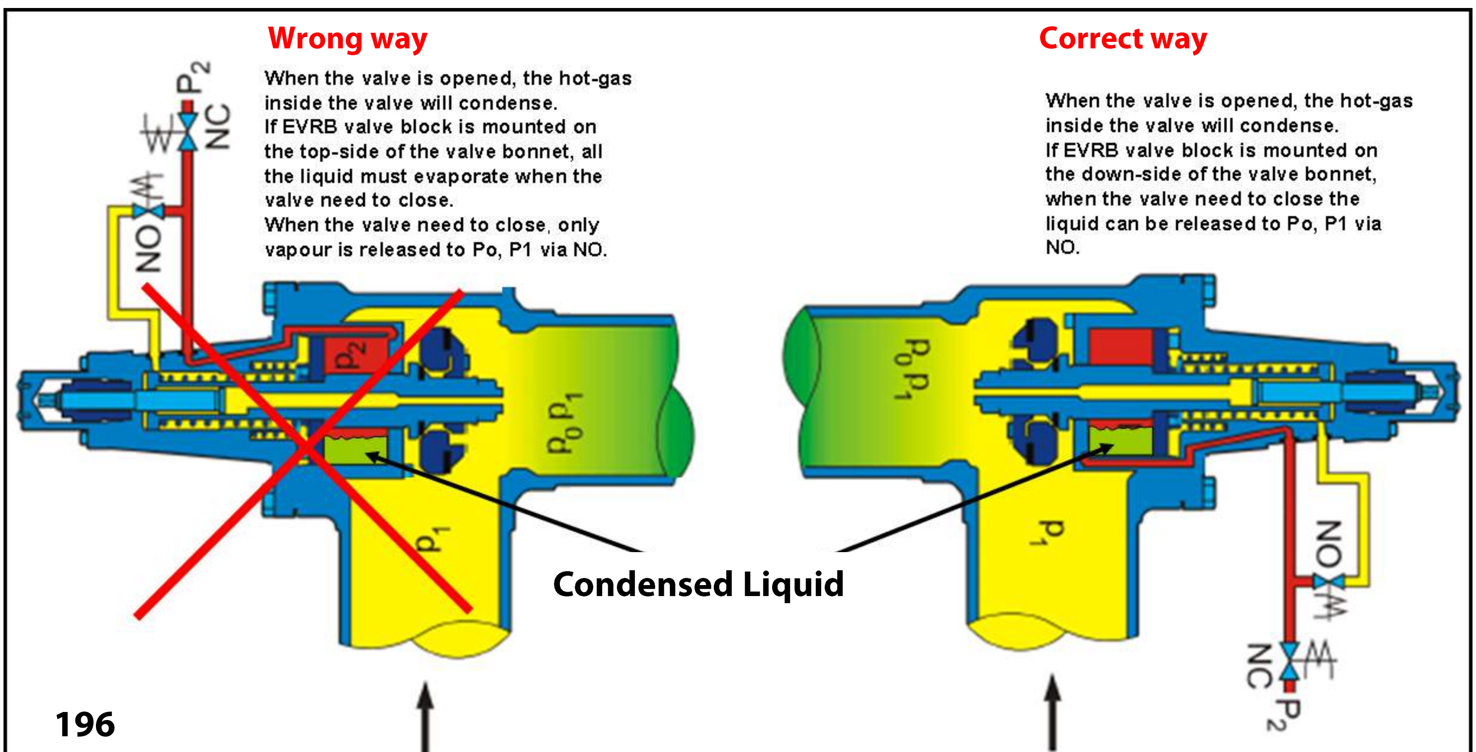
GPLX Opening Sequence



* Stage 2 opens when the differential pressure across valve is about 22 psi (1.5 bar)

GPLX Mounting Restrictions

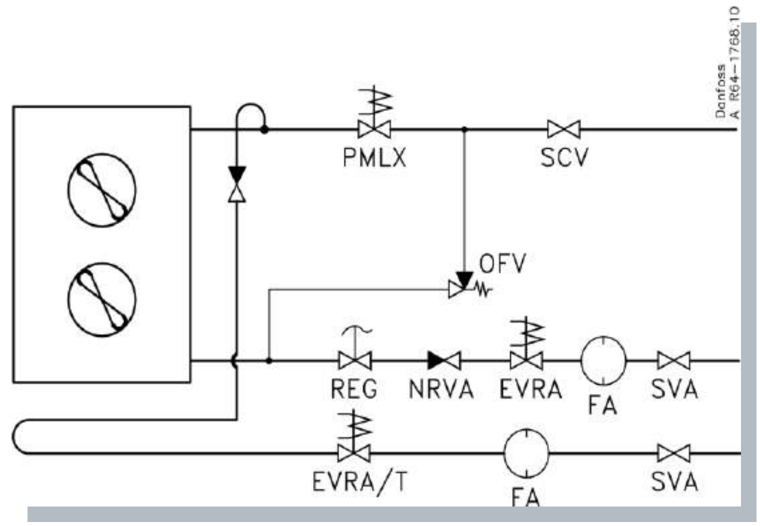
When mounting on its side, the solenoid block valve must be located at the bottom. When the bonnet is mounted up it can be in any position.



Hot Gas Defrost Control / Sequence

Recommended guidelines!

Flooded air coolers using R717



Note: must account for closing times

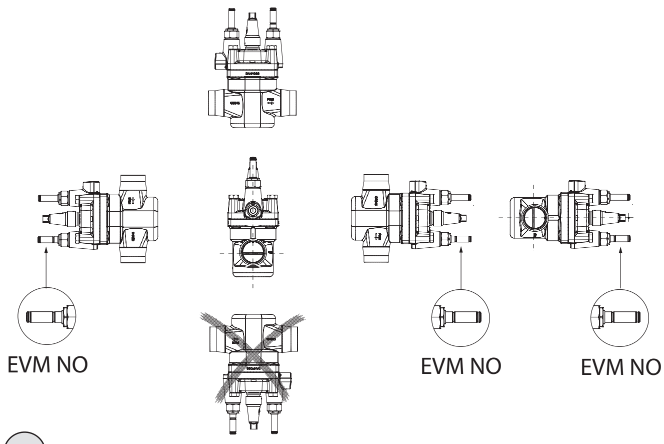
	LIQUID EVRA/T	SUCTION PML/X - GPLX	HOT GAS EVRA/T - PM	FAN	TIMER SEC	REMARK
Cooling	OPEN	OPEN	CLOSED	ON	-	Cooling
Request for defrost	CLOSED	OPEN	CLOSED	ON	120-600	Evacuation of liquid (pump down) Time depending on evaporator size
	CLOSED	**CLOSING**	**CLOSED**	**ON**	**45-?**	**Closing time for hot gas powered suction valve. Time depending on valve size refrigerant and evaporating temperature**
	CLOSED	CLOSED	CLOSED	OFF	10-20	allow liquid to settle in bottom of evaporator without vapor bubbles
DEFROST	CLOSED	CLOSED	OPEN	OFF	1200-1800	Defrost timer depends on application
STOP DEFROST	CLOSED	CLOSED	CLOSED	OFF	60-200	Drain time - pressure equalizing
	CLOSED	OPEN	CLOSED	OFF	100-300	Two-step suction valve opens slowly Static cooling 1.(freezing water drops)
	OPEN	OPEN	CLOSED	OFF	60-100	Static cooling 2.(freezing water drops)
Cooling	OPEN	OPEN	CLOSED	ON	-	Cooling

Installation guide

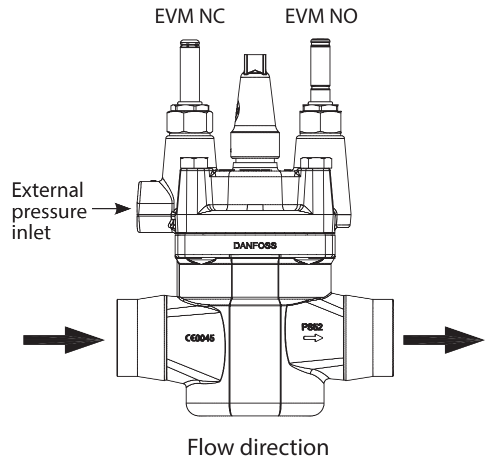
2-step solenoid valve
Type ICLX 32-65

027R9901

Installation



1



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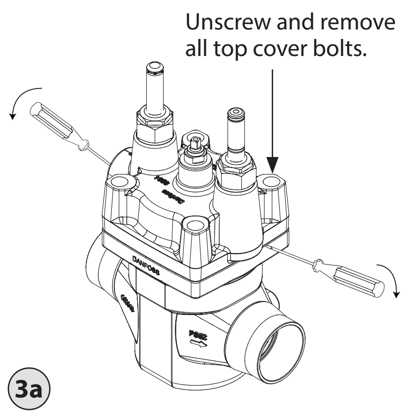
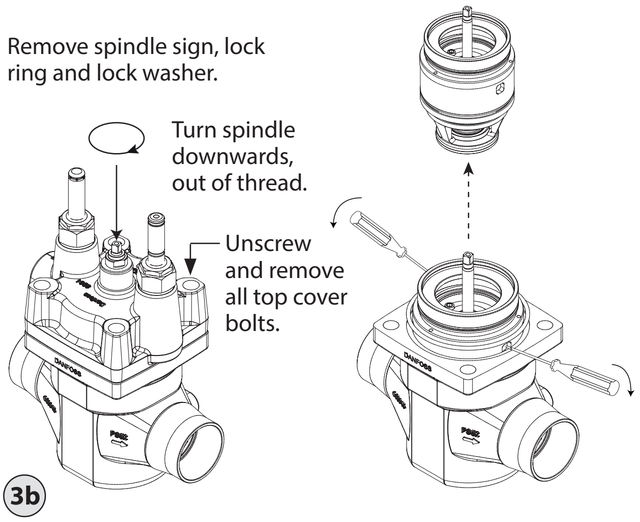
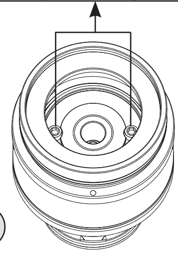


3a



3b

	two-step	one-step
ICLX 32	M5 x 6	M5 x 16
ICLX 40	M5 x 6	M5 x 16
ICLX 50	M5 x 6	M5 x 16
ICLX 65	M5 x 6	M5 x 16
	Allen key	Allen key



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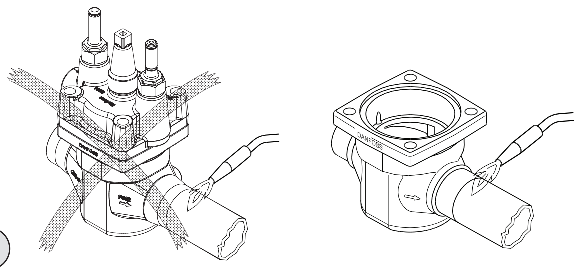
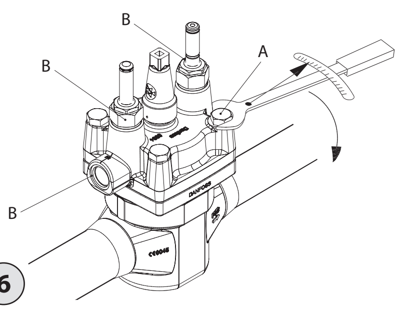
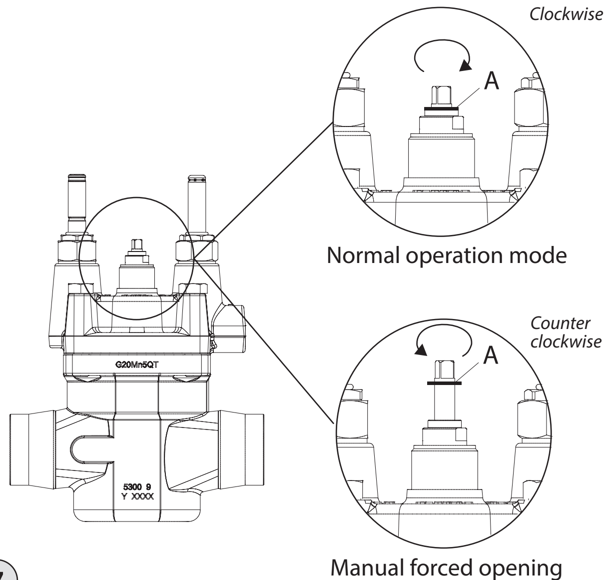


5



	Valve body size	Nm	ft lb
Pos. A	32	120	88
	40	120	88
	50	140	103
	65	150	110
Pos. B	32	50	37
	40		
	50		
	65		

6



7

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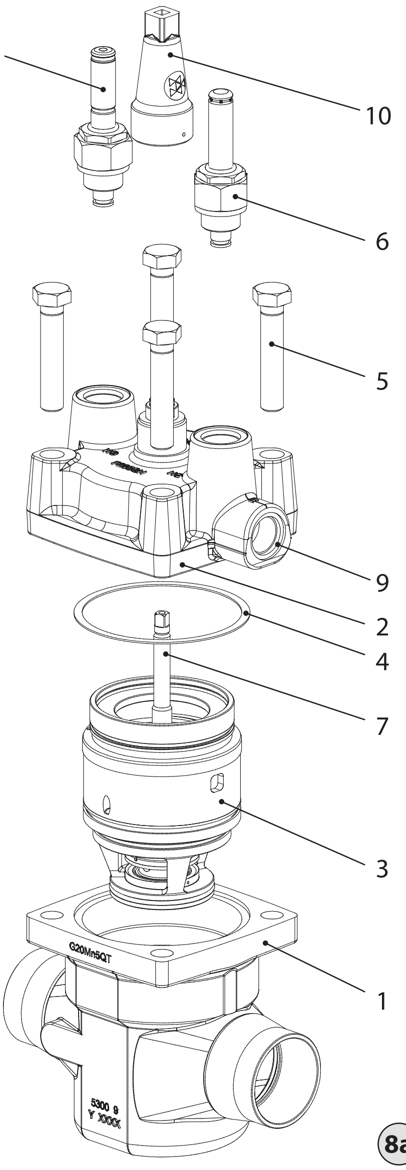
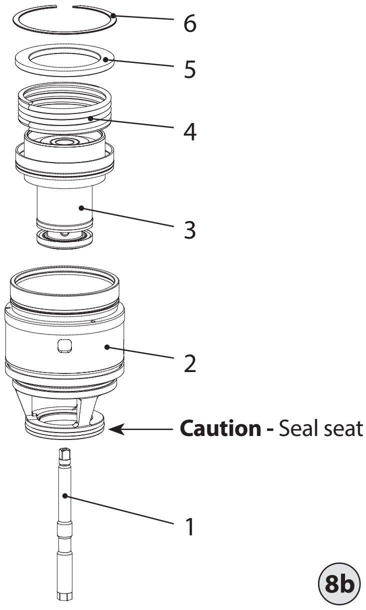


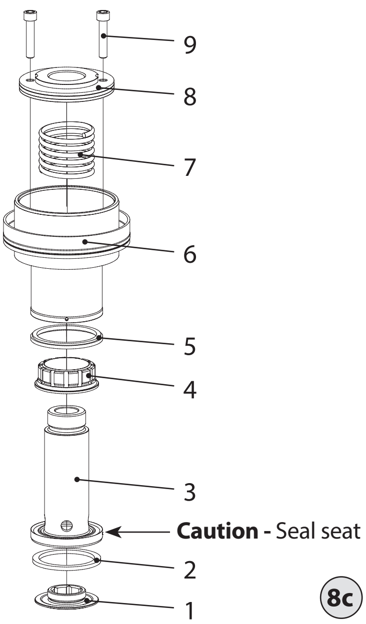
1. Body
2. Top cover
3. Function module
4. Gasket
5. Bolts
6. EVM NC
7. Manual operating spindle
8. EVM NO
9. External pressure inlet
10. Cap

8a



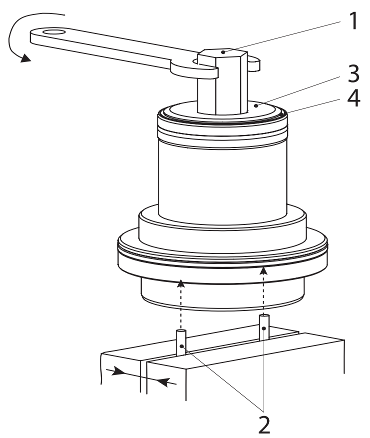
1. Manual operating spindle
2. Insert
3. Piston assembly
4. Spring
5. Spring plate
6. Retaining ring

8b



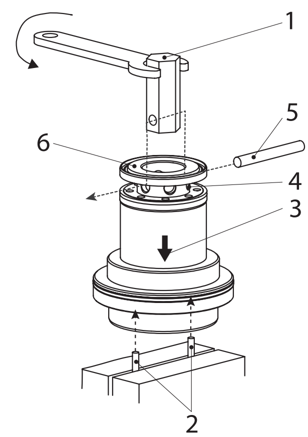
1. Sealing retainer
2. PTFE valve plate
3. Main piston
4. Sealing retainer
5. PTFE valve plate
6. Bleed piston
7. Bleed spring
8. Main piston top
9. Bolts

8c



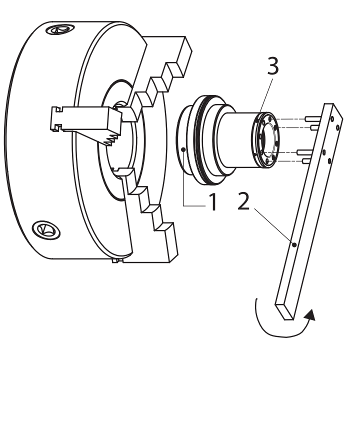
Valve size	Nm	lb-ft
ICLX 32	30	22
ICLX 40	30	22
ICLX 50	50	37
ICLX 65	50	37

9a



Valve size	Nm	lb-ft
ICLX 32	30	22
ICLX 40	30	22
ICLX 50	50	37
ICLX 65	50	37

9b



Valve size	Nm	lb-ft
ICLX 32	30	7
ICLX 40	30	7
ICLX 50	30	22
ICLX 65	50	37

9c

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717(Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended.
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Please note:
The ICLX function modules can only be used in housings produced in or after week 49 2012; thus the week code on the housing must be 4912 or higher.

Temperature range
–60/+120°C (–76/+248°F)

Pressure
The valves are designed for a max. working pressure of 52 bar g (754 psi g).

Application
The ICLX is used in suction lines for the opening against high differential pressure, e.g. after hot gas defrost in large industrial refrigeration systems with ammonia, flourinated refrigerants or CO_2.

The ICLX opens in two steps:
Step one opens to approx. 10% of the capacity, when the pilot solenoid valves are activated.
Step two opens automatically after the pressure differential across the valve reaches approximately 1 bar.

External pressure
The external pressure applied to the ICLX should always be 1.5 bar higher than the inlet pressure of the valve. This will give the valve a MOPD of 28 bar. If the external pressure is 2 bar higher than the inlet pressure the MOPD of the ICLX will be 40 bar.

Electrical wiring
The ICLX valve is a normally closed design. To ensure that the valve operates as normally closed it is important that the EVM NC pilot is mounted in the pilot port next to the external pressure inlet (fig. 2). For normal operation mode both pilots should be energized simultaneously, e.g. same signal can be used for both pilots.

Coil requirements
Both coils must be IP67.
EVM NC: 10W ac (or higher) for MOPD up to 21 bar
EVM NC: 20W ac for MOPD 21 → 40 bar
EVM NO: 10W ac (or higher)

The valve will have a malfunction in systems where the pressure differential across the valve in normal open conditions will exceed 1 bar (15 psig). In this case the step two of the valve will close.

Orientation
The valve must be installed with the arrow in the direction of the flow and with the pilots pointing in one of the directions shown in fig.1. Downwards pointing pilots (any angle) is not possible. The top cover can be rotated 4 X 90° in relation to the valve body.

If the ICLX is installed with a vertical pilot orientation (see fig. 1) attention should be paid to have the EVM NO in lower position. If needed rotate the top cover.

The valve is fitted with a spindle for manual opening. Make sure that the external pilot line is connected to the upper side of the main line so that any dirt and oil from the plant will not find its way into the pilot line.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 5 and 8a)
The top cover (fig. 8a, pos. 2) and function module (fig. 8a, pos. 3), must be removed before welding to prevent damage to o-rings and teflon (PTFE) in the function module.
Often the cover and function module can be removed while still assembled (fig. 3a), but if the internal O-rings stick to the metal surface it is necessary to disassemble in 2 steps (fig. 3b). In both cases the parts can be lifted out by the careful use of 2 screwdrivers.

Note: Remove <u>all</u> parts from the valve body before welding (as shown in fig. 5).

The internal surfaces and weld connections of the enclosed ICLX valve have been applied with an anti-corrosion treatment.

In order to maintain the effectiveness of this anti-corrosion treatment, it is important to ensure that the valve is disassembled just prior to the welding process being undertaken.

In the event that the function modules are to be left disassembled for even a short period, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be applied to the valve body.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

The valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the o-rings are intact before replacing the function module. If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings. Check that the top gasket has not been damaged. If the surface has been damaged or the gasket has been bent, it must be replaced.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Colours and identification
The ICLX valves are Zinc-Chromated from factory. The Zinc-Chromatization does not cover the welding connections.

If further corrosion protection is required, the valves can be painted.
The external surface of the valve housing must be protected against corrosion with a suitable top coating after installation involving welding and consequent assembly.
Protection of the ID plate when painting the valve is recommended.

Maintenance

Service
The ICLX valves can be disassembled for service purposes.

Only skilled and trained refrigeration engineers are allowed to service the ICLX valves.
Do not open the valve while the valve is still under pressure.

Pressure relief can be done by carefully opening the manual operating spindle. Small grooves along the thread will release refrigerant into open air. This operation must only be done after providing the correct countermeasures under local legislation.
Often the cover and function module can be removed while still assembled (fig. 3a), but if the internal O-rings stick to the metal surface it is necessary to disassemble in 2 steps (fig. 3b). In both cases the parts can be lifted out by the careful use of 2 screwdrivers.

Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged.
  A valve with a damaged o-ring might not operate according to the specification.
- The insert and piston assembly can be disassembled according to figure 8b & 8c. Be careful when removing the retaining ring (fig. 8b, pos. 6). The retaining ring (fig. 8b, pos. 6) will be submitted to the force from the compressed spring (fig 8b, pos. 4).

Be careful not to damage the two Seal Seats shown in fig. 8b and 8c since any deformation of the steel surface will lead to malfunction of the valve.

- Check pistons, cylinders and valve plates for wear and scratches and replace if needed.
- Check that the movement of the pistons and valve seats are free and with low friction.

Replacement of Valve Plates (ordinary wear parts)
It is possible to replace the two PTFE valve plates (fig. 8c, pos. 2 and pos. 5) by following fig. 9 and these instructions:

Fig. 9a, pos.1 shows a hexagon profile (tool) that fits into the female hexagon hole in the sealing retainer (pos. 3) of the piston assembly of ICLX 50 – 65.
For ICLX 32 – 40 the corresponding tool has to be a hollow hexagon to fit onto the male hexagon.

As backstop when unscrewing the sealing retainer it is recommended to make an arrangement of two steel pins that fits into the small female hexagon holes of the Allen bolts (fig. 8c, pos. 9), clamped into a vice (fig. 9a, pos. 2).

Once the sealing retainer is removed, the Valve plate (pos. 4) can be lifted out.

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Move the two steel pins (fig. 9b, pos.2) to a higher position in the vice to allow the bleed piston (fig. 9b, pos. 3) to be slided downwards and expose a ring of holes (pos.4).

While there is access to the holes (pos. 4) a steel pin (pos.5) with matching diameter is inserted through two opposed holes with tool pos. 1 (or similar punched tool) in the middle.

Unscrew the main piston (fig. 9b, pos. 6).

For disassembling of the last sealing retainer it is recommended to utilise a mandrel with three point suspension to avoid deformation of the surfaces (fig. 9c).

Clamp the bleed piston carefully to the mandrel at surface pos.1. Block the mandrel from rotation and unscrew the sealing retainer with a tool (pos.2) manufactured for the purpose.
When the sealing retainer is removed the remaining valve plate (pos. 3) can be replaced.
Reassembling of the piston assembly is done in reverse order. The torque values for the different joints are shown in fig. 9.

Assembly
Remove any dirt from the body before the valve is assembled. Check that all channels in the valve are not blocked by particles or similar.

If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Changing from two step to one step function
The ICLX valve is from factory side setup as two step function. To change the opening characteristics to one step function the following step must be completed:
- Remove the topcover from the valve housing (fig. 3).
- Change the two bolts (fig 8c, pos.9), with insert still in the valve housing.
- The length of the two bolts corresponds to the desired characteristic of the valve and should be applied according to the table (fig. 4).
- After changing the bolts the valve can be reassembled.

Manual opening device (fig. 7)
Normal operation mode
For the valve to operate normally under the influence of the pilot valves the spindle of the manual operation device needs to be turned fully clockwise until the locking ring (A) sits on the top of the packing gland.

Manual forced opening
To manually open the valve the spindle of the manual operation device needs to be turned fully counter clockwise until hitting the mechanical stop.

Commissioning
The time span required to secure full closing of the ICLX valve depends on valve size and application, and needs to be investigated on site. The optimum should be determined during commissioning.

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.
In cases of doubt, please contact Danfoss.

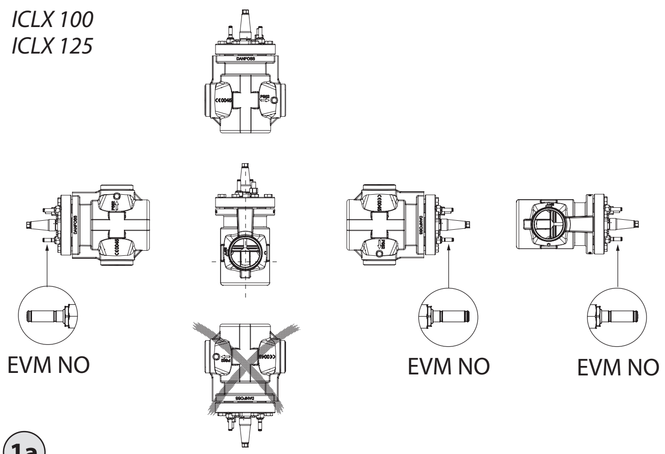
Drawings are only for illustration, not for dimensioning or construction.

Installation guide

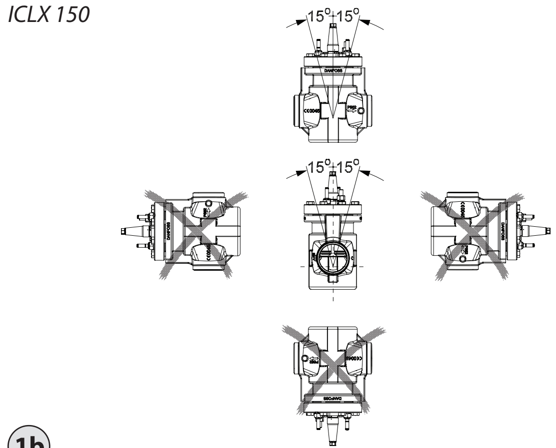
2-step solenoid valve
ICLX 100-150

027R9902
027R9902

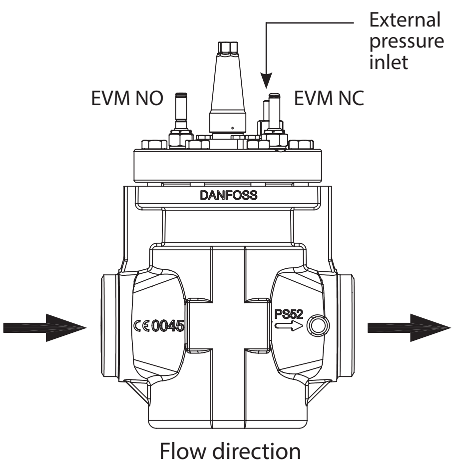
Installation



1a



1b



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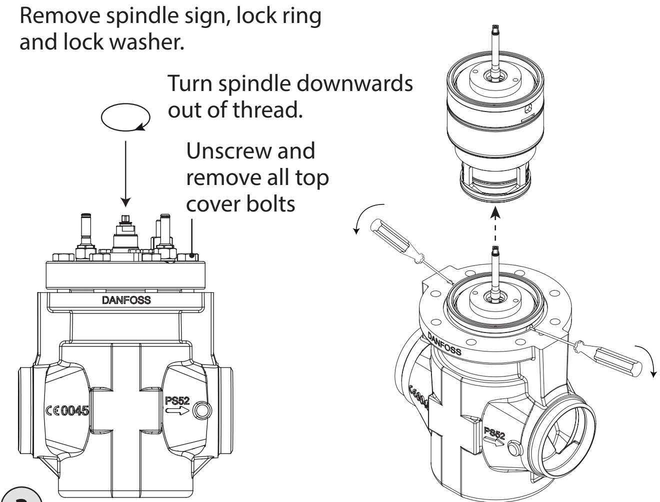

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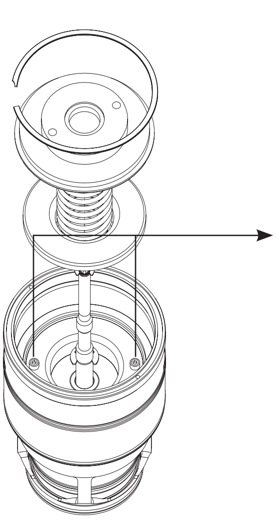
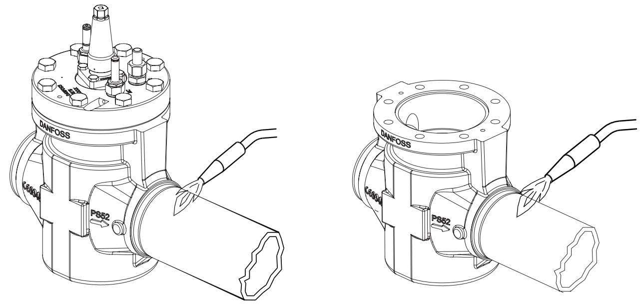


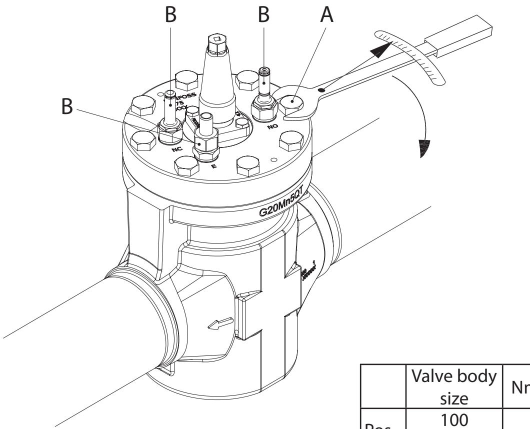
	two-step	one-step
ICLX 100 ICLX 125 ICLX 150	M6 x 6	M6 x 16
	Allen key	Allen key

4



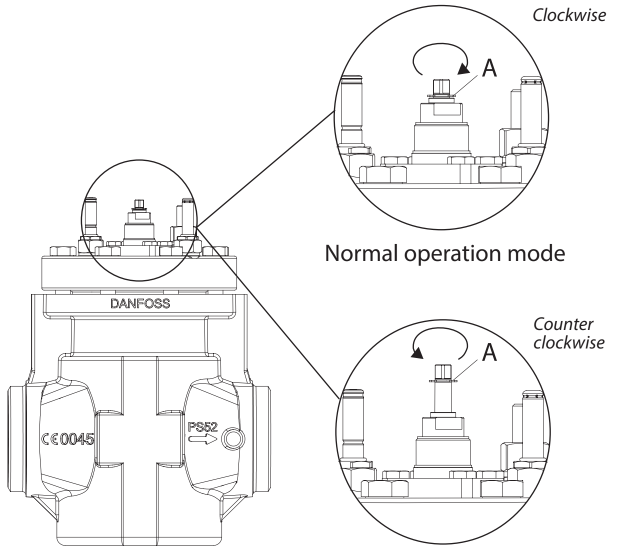
Only for heat controlled
welding with no welding debris.

5

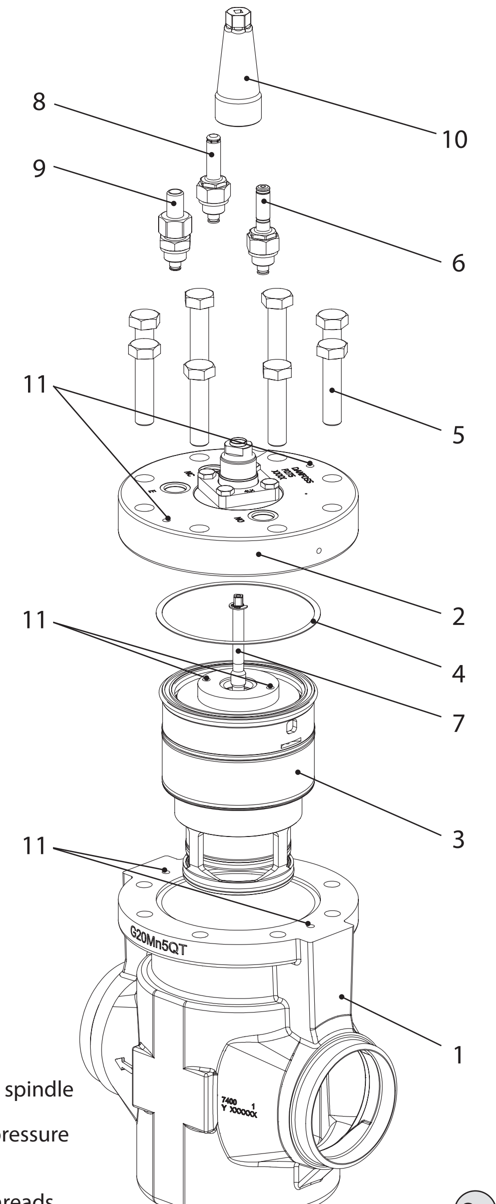


	Valve body size	Nm	ft lb
Pos. A	100	220	162
	125		
	150		
Pos. B	100	50	37
	125		
	150		

6

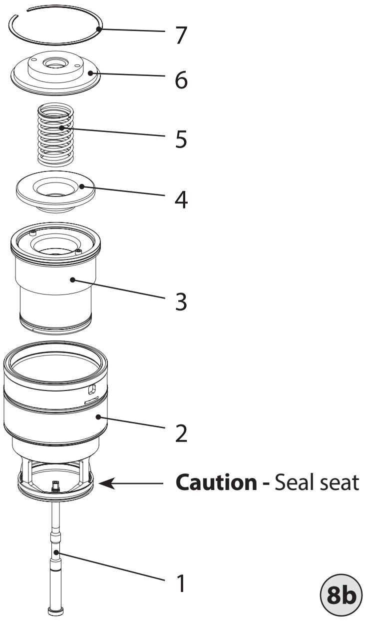


7



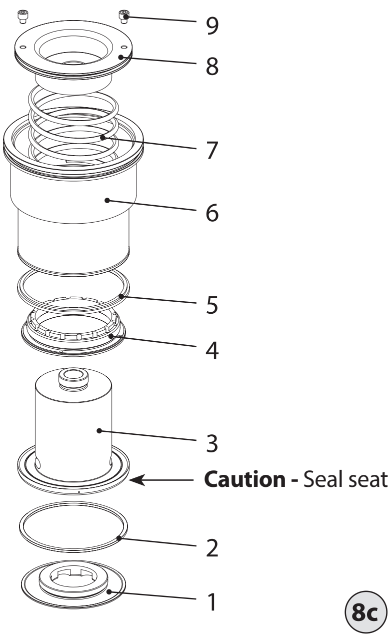
1. Body
2. Top cover
3. Function module
4. Gasket
5. Bolts
6. EVM NO
7. Manual operating spindle
8. EVM NC
9. External pressure inlet
10. Cap
11. Eyebolt threads

8a



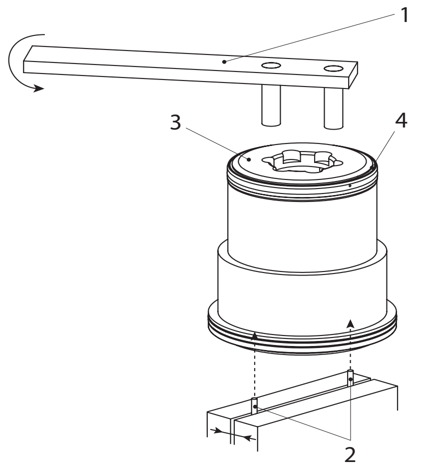
1. Manual operating spindle
2. Insert
3. Piston assembly
4. Spring retainer (lower)
5. Spring
6. Spring retainer (upper)
7. Retaining ring

8b



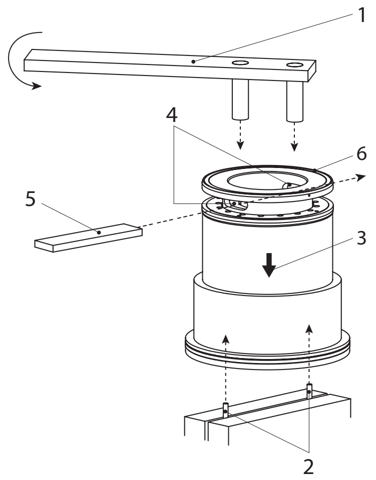
1. Sealing retainer
2. PTFE seat plate main
3. Main piston
4. Sealing retainer
5. PTFE seat plate bleed
6. Bleed piston
7. Bleed spring
8. Main piston top
9. Bolts

8c



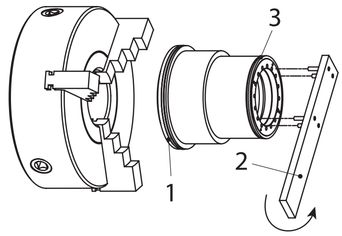
Valve size	Nm	lb-ft
100-150	100	74

9a



Valve size	Nm	lb-ft
100-150	100	74

9b



Valve size	Nm	lb-ft
100	100	74
125	150	111
150	260	192

9c

ENGLISH

Installation

Refrigerants
Applicable to all common non-flammable refrigerants, including R717 and R744 (CO_2) and all non-corrosive gases/liquids. Flammable hydrocarbons are not recommended.
The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
–60/+120°C (–76/+248°F)

Pressure
The valves are designed for a max. working pressure of 52 bar g (754 psi g).

Application
The ICLX is used in suction lines for the opening against high differential pressure, e.g. after hot gas defrost in large industrial refrigeration systems with ammonia, flourinated refrigerants or CO_2.

The ICLX opens in two steps:
Step one opens to approx. 10% of the capacity, when the pilot solenoid valves are activated.
Step two opens automatically after the pressure differential across the valve reaches approximately 1 bar.

External pressure
The external pressure applied to the ICLX should always be 1.5 bar higher than the inlet pressure of the valve. This will give the valve a MOPD of 28 bar. If the external pressure is 2 bar higher than the inlet pressure the MOPD of the ICLX will be 40 bar.

Electrical wiring
The ICLX valve is a normally closed design. To ensure that the valve operates as normally closed it is important that the EVM NC pilot is mounted in the pilot port marked NC in the top cover, EVM NO in port NO and the external pressure to E (fig. 2). For normal operation mode both pilots should be energized simultaneously, e.g. same signal can be used for both pilots.

Coil requirements
Both coils must be IP67.
EVM NC: 10W ac (or higher) for MOPD up to 21 bar
EVM NC: 20W ac for MOPD 21 → 40 bar
EVM NO: 10W ac (or higher)

The valve will have a malfunction in systems where the pressure differential across the valve in normal open conditions will exceed 1 bar (15 psig). In this case the step two of the valve will close.

The valve/valve housing can be lifted by means of eyebolts positioned like shown in fig. 8a, pos. 11.

Orientation
The valve must be installed with the arrow in the direction of the flow (fig. 2).
The top cover can be rotated 4x90° in relation to the valve body.

ICLX 150
The valve must be installed with the spindle in upwards position 15°/15° (fig. 1b).

ICLX 100 and 125
The valve must be installed with the pilots pointing in one of the directions shown in fig. 1a. Downwards pointing pilots (any angle) is not possible.
If the ICLX is installed with a vertical pilot orientation (see fig. 1a) attention should be paid to have the EVM NO in lower position. If needed rotate the top cover.

The valve is fitted with a spindle for manual opening. Make sure that the external pilot line is connected to the upper side of the main line so that any dirt and oil from the plant will not find its way into the pilot line.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Welding (fig. 5 and 8a)
For heat controlled welding methods and welding methods ensuring no debris, the valve can stay assembled during the welding process.

The top cover (fig. 8a, pos. 2) and function module (fig. 8a, pos. 3), can be removed before welding to prevent damage to o-rings and teflon (PTFE) in the function module. The function module can be lifted out by applying a vertical force on the grooves as shown in figure 3. Additionally eyebolts can be threaded as shown in fig. 8a, pos. 11 for external lifting.

The internal surfaces and weld connections of the enclosed ICLX valve have been applied with an anti-corrosion treatment.

In order to maintain the effectiveness of this anti-corrosion treatment, it is important to ensure that the valve is disassembled just prior to the welding / brazing process being undertaken.

In the event that the function modules are to be left disassembled for even a short period, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be applied to the valve body.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

The valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly.

Check that the o-rings are intact before replacing the function module. If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings. Check that the top gasket has not been damaged. If the surface has been damaged or the gasket has been bent, it must be replaced.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Colours and identification
The ICLX valves are Zinc-Chromated from factory. The Zinc-Chromatization does not cover the welding connections. If further corrosion protection is required, the valves can be painted.
The external surface of the valve housing must be protected against corrosion with a suitable top coating after installation involving welding and consequent assembly. Protection of the ID plate when painting the valve is recommended.

Maintenance

Service
The ICLX valves can be disassembled for service purposes.
Only skilled and trained refrigeration engineers are allowed to service the ICLX valves.
Do not open the valve while the valve is still under pressure.
Pressure relief can be done by carefully opening the manual operating spindle. Small grooves along the thread will release refrigerant into open air. This operation must only be done after providing the correct countermeasures under local legislation.
The function module can be lifted out by applying a vertical force on the grooves shown in figure 3.
Upon opening and removal of the function module:
- Check that the o-rings on the function module has not been damaged.
  A valve with a damaged o-ring might not operate according to the specification.
- The insert and piston assembly can be disassembled according to figure 8b & 8c. Be careful when removing the retaining ring (fig. 8b, pos. 7). The retaining ring (fig. 8b, pos. 7) will be submitted to the force from the compressed spring (fig 8b, pos. 5).

Be careful not to damage the two Seal Seats shown in fig. 8b and 8c since any deformation of the steel surface will lead to malfunction of the valve

- Check pistons, cylinders and valve plates for wear and scratches and replace if needed.
- Check that the movement of the pistons and valve seats are free and with low friction.

Replacement of Valve Plates (ordinary wear parts)
It is possible to replace the two PTFE valve plates (fig. 8c, pos. 2 and pos. 5) by following fig. 9 and these instructions:

Fig. 9a, pos.1 shows a tool (purpose made) that fits into the hole pattern of the sealing retainer (pos. 3) of the piston assembly.

As backstop when unscrewing the sealing retainer it is recommended to make an arrangement of two steel pins that fits into the female hexagon holes of the Allen bolts (fig. 8c, pos. 9), clamped into a vice (fig. 9a, pos. 2).

Once the sealing retainer is removed, the Valve plate (pos. 4) can be lifted out.

Move the two steel pins (fig. 9b, pos.2) to a higher position in the vice to allow the bleed piston (fig. 9b, pos. 3) to be slided downwards and expose two elongated holes (pos.4).

While there is access to the holes (pos. 4) a steel bar (pos.5) with matching dimensions is inserted through the two opposed holes with tool pos. 1 (or similar fork tool) bridging the bar.

Unscrew the main piston (fig. 9b, pos. 6).

For disassembling of the last sealing retainer it is recommended to utilise a mandrel with three point suspension to avoid deformation of the surfaces (fig. 9c).

Clamp the bleed piston carefully to the mandrel at surface pos.1. Block the mandrel from rotation and unscrew the sealing retainer with a tool (pos.2) manufactured for the purpose.

When the sealing retainer is removed the remaining valve plate (pos. 3) can be replaced.

Reassembling of the piston assembly is done in reverse order. The torque values for the different joints are shown in fig. 9.

Assembly
Remove any dirt from the body before the valve is assembled. Check that all channels in the valve are not blocked by particles or similar.
If possible, apply some refrigeration oil to ease the insertion and to protect the o-rings.

Tightening (fig. 6)
Tighten the top cover with a torque wrench, to the values indicated in the table.

Changing from two step to one step function
The ICLX valve is from factory side setup as two step function. To change the opening characteristics to one step function the following step must be completed:
- Remove the function module from the valves house (fig 3.).
- Remove the locking ring, upper spring retainer, spring and lower spring retainer (fig. 4).
- Change the two bolts (fig 8c, pos. 9).
- The length of the two bolts corresponds to the desired characteristic of the valve and should be applied according to the table (fig. 4).
- After changing the bolts the valve can be reassembled.

Manual opening device (fig. 7)
Normal operation mode
For the valve to operate normally under the influence of the pilot valves the spindle of the manual operation device needs to be turned fully clockwise until the locking ring (A) sits on the top of the packing gland.

Manual forced opening
To manually open the valve the spindle of the manual operation device needs to be turned fully counter clockwise until hitting the mechanical stop.

Commissioning
The time span required to secure full closing of the ICLX valve depends on valve size and application, and needs to be investigated on site. The optimum should be determined during commissioning.

Use only original Danfoss parts, including O-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss.

Drawings are only for illustration, not for dimensioning or construction.

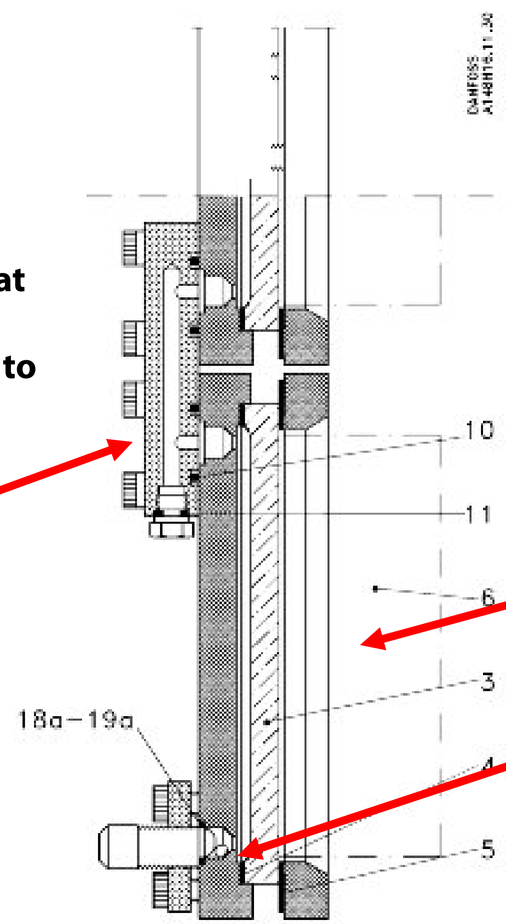
ENGINEERING
TOMORROW

Liquid Level Glasses
Type LLG

LLG Liquid Level Glasses

- Available with or without a sight adapter
- Standard with built-in safety system that will limit the refrigerant loss in case the glass is broken.
- Available in lengths from 7-1/4" to 61"
- Available with extended weld nipple connections that fit directly into a ½" socket-weld connection.

Connector that combines the basic lengths to make other lengths



Sight adapter/frost shield

Built-in safety system

Available Spare Parts

- Complete gasket set
- Replacement sight adapter
- Replacement glass is available in case it has been damaged

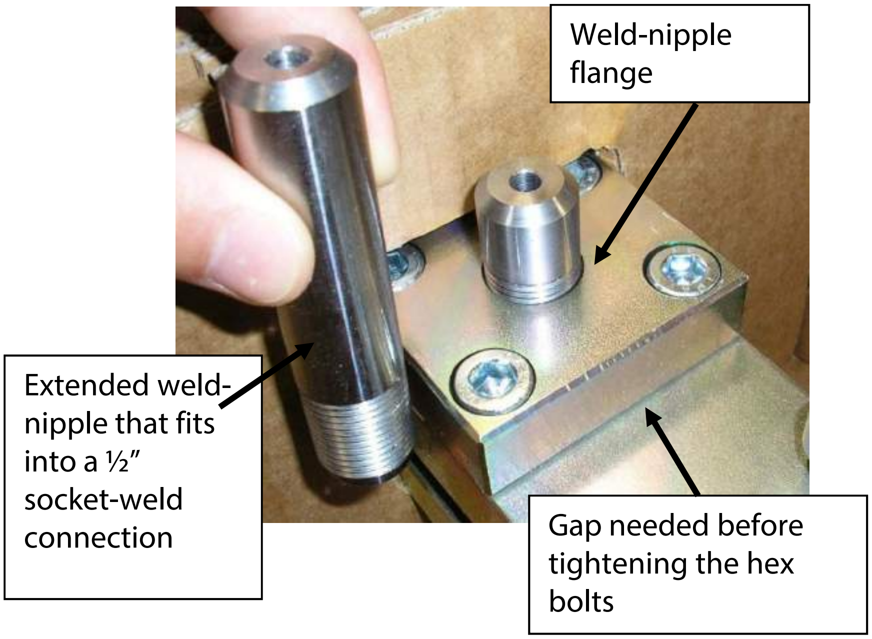
LLG Liquid Level Glasses

The range of liquid level glasses is based on 3 basic lengths: LLG 185, LLG 335 and LLG 740. The other lengths are created with a combination of these three basic lengths.

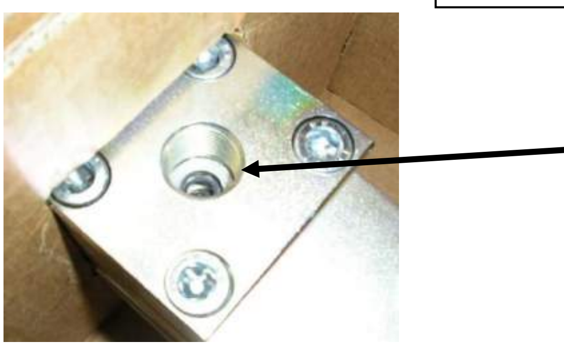
LLG Type and length	Combined by
LLG 185 (7-1/4")	Basic length
LLG 335 (13-1/4")	Basic length
LLG 590 (23-1/4")	LLG 185 + LLG 335
LLG 740 (29-1/4")	Basic length *
LLG 995 (39-1/4")	LLG 185 + LLG 740
LLG 1145 (45")	LLG 335 + LLG 740
LLG 1550 (61")	LLG 740 + LLG 740

* 1 back piece and 2 front pieces

Installing the LLG



NOTE: The weld-nipple must be screwed into the flange until the threaded part of the weld nipple extends past the surface of the flange so there is a small gap between the weld-nipple flange and the LLG sight glass. The weld-nipple will seal against the LLG with the aluminum gasket when the 4 flange hex bolts are tightened.



NOTE: Make sure the aluminum gasket remains in the LLG sight glass to seal the connection between the weld-nipple and the LLG.

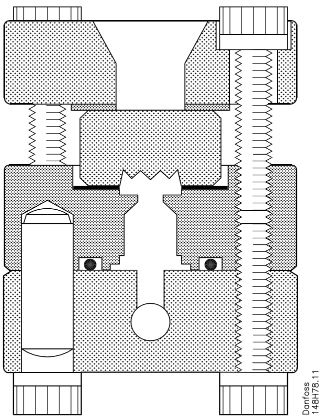
Installation with sight adapter

Installation without sight adapter

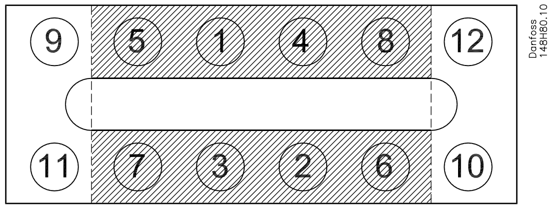
148R9536

Installation Guide

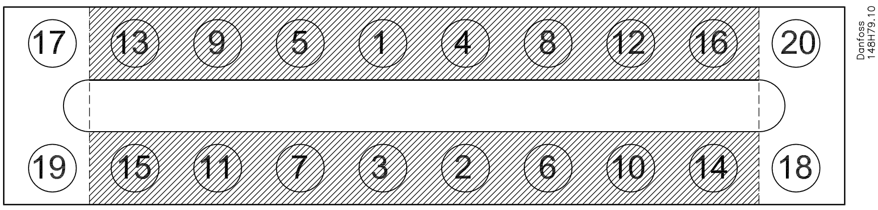
Sight glass
LLG



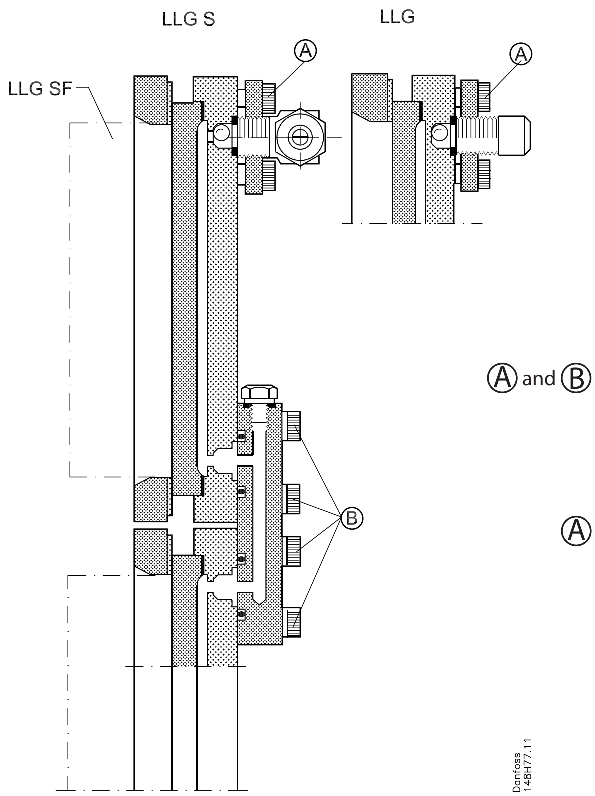
1



2 **Segment with 12 screws**



3 **Segment with 20 screws**



A and B

	Nm	LB-feet
LLG	44	32

A **Note!**
Bolts for flanges are not tightened from factory. The bolts must be tightened on site.

4

ENGLISH

Installation

Install LLG 185-1550 on a bracket using the 4 screws delivered together with the glass. Use the threaded holes on the back of the frame to mount the glass on the bracket (no Danfoss delivery).

Always connect the piping after mounting on the bracket. Note the importance of a minimum of stress in the liquid level glasses from the connected pipes.

Make sure that there is sufficient space behind the LLG to secure proper insulation and service inspection etc.

Max. operating pressure
25 bar g (362 psi g).

Working temperature
LLG, LLG S:
Min. –10°C (+14°F)
Max. + 100°C (+212°F)

LLG SF (with sight adapter):
Min. –50°C (–58°F)
Max. + 30°C (+86°F)

Errors and omissions excepted. The data are subject to change without notice.

Maintenance

Replacement of packing
Loosen all the screws of the LLG by ¼ of a turn in reverse order of the tightening sequence. Loosen all the screws completely, in the same order.

Remove all remains of old packing material and clean all surfaces. There must be no burrs, marks or scratches on the surface.

Unpack the packing. Do not damage (bend or scratch) the packing. Keep it clean.

Place the packing on the packing surface of the back piece and mount the glass hereon (see fig. 1). Place the protection plate on the glass and mount the front piece on top. (As far as the LLG SF is concerned the sight adapter also serves as protection plate).

Tighten the screws. The sequence of tightening (see fig. 2 and 3) *must* be observed. Tighten the screws according to the following torque moments:

Point 1
Tighten the screws by hand till they touch the front piece.

Point 2
Use a torque wrench to tighten the screws to 15 Nm (11 ft•lb).

Point 3
12 screws; Tighten the screws number 1-8 to 30 Nm (22 ft•lb) and number 9-12 to 15 Nm (11 ft•lb).

20 screws; Tighten the screws number 1-16 to 30 Nm (22 ft•lb) and number 17-20 to 15 Nm (11 ft•lb).

Repeat point 3 till none of the screws can be turned at the moments stated.

ENGINEERING
TOMORROW

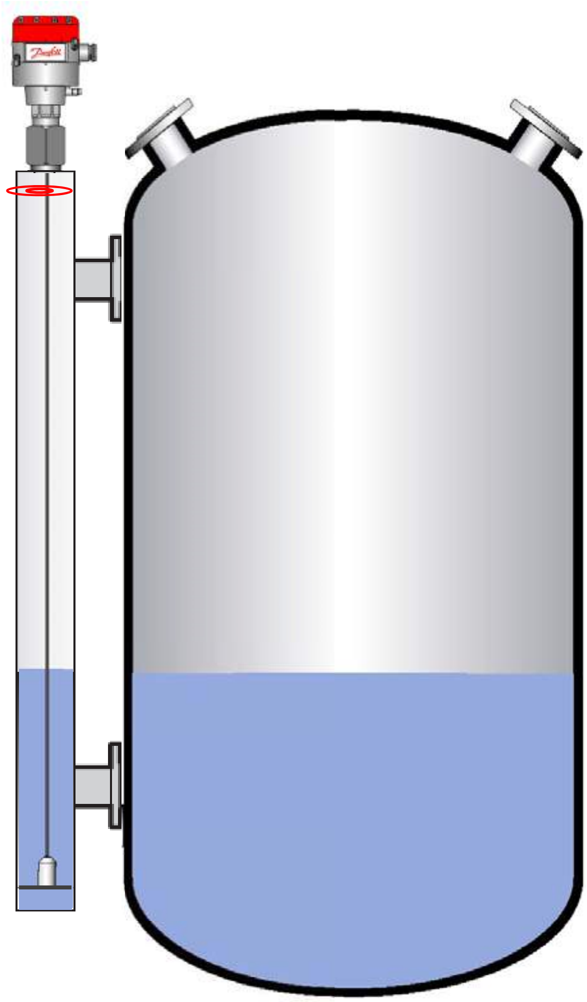
Liquid Level Sensors
Type AKS 4100U

Benefits of AKS 4100U Level Sensor

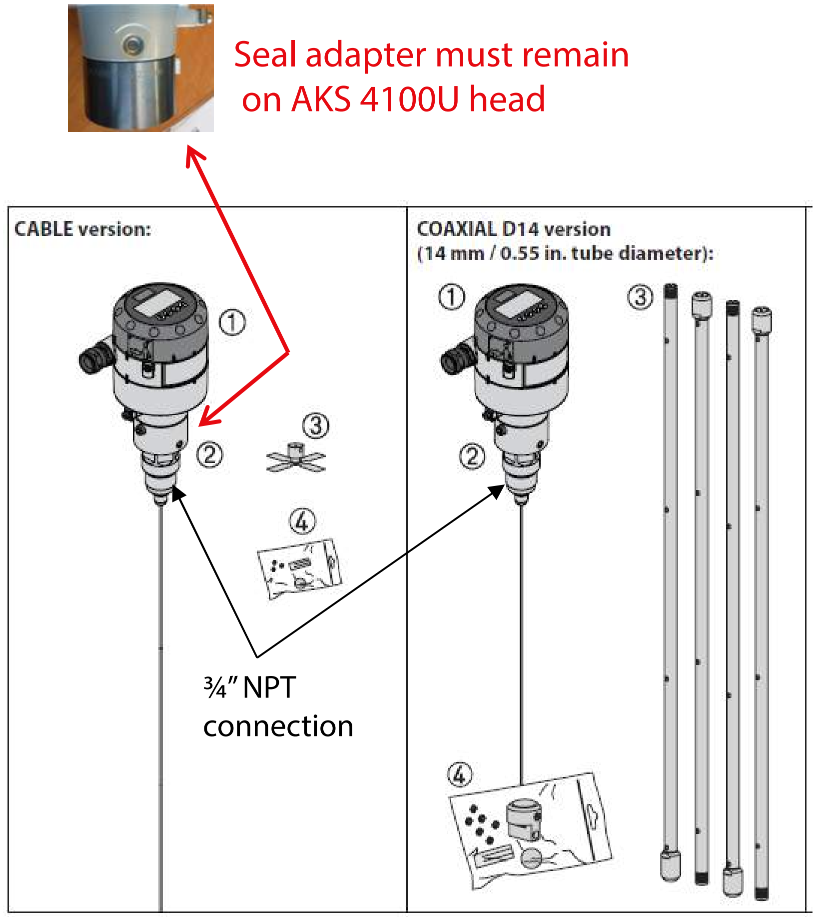
- One part number covers standard applications over a wide range of lengths and is easily adjusted to the required length in the field
- No on-site calibration needed.
- Cable version not affected by oil in the system
- Standard with LCD display interface for quick on-site commissioning and troubleshooting
- Electronic head is replaceable while the system is under pressure.
- Cable version requires less top-end clearance for installation and service
- Very compact and easy to handle, ship, install and use with different lengths and refrigerants.

Basics of TDR Guided Wave Radar Technology

- TDR = (Time Domain Reflectometry)
- Electromagnetic pulses are emitted at the speed of light and guided along the cable
- Measuring range based on the programed cable length
- These pulses are reflected back at the liquid surface
- Level is calculated by the transit time of the electromagnetic pulses
- High Frequency technology. About 1.000.000 pulses per second.



AKS 4100U Versions



Cable Version

- Used for the majority of applications with a probe length range from **31.5 in**. and up to **197 in.**
- For use with R717 (ammonia), HCFC, HFC
- **Not for use with CO2 (R744) or Marine applications**

Coaxial D14 Version (14 mm tubes)

- Designed for use with CO2 and Marine Applications and is available with standard lengths from **19.2 in.** and up to **85 in.**
- Can also be used for R717 (ammonia), HCFC, HFC and other non corrosive gases/liquids.

Coaxial D22 Version (22 mm/0.87 in. Tube diameter)

- Fixed insertion length of 11 in. and currently only tested for use with R717 (ammonia),

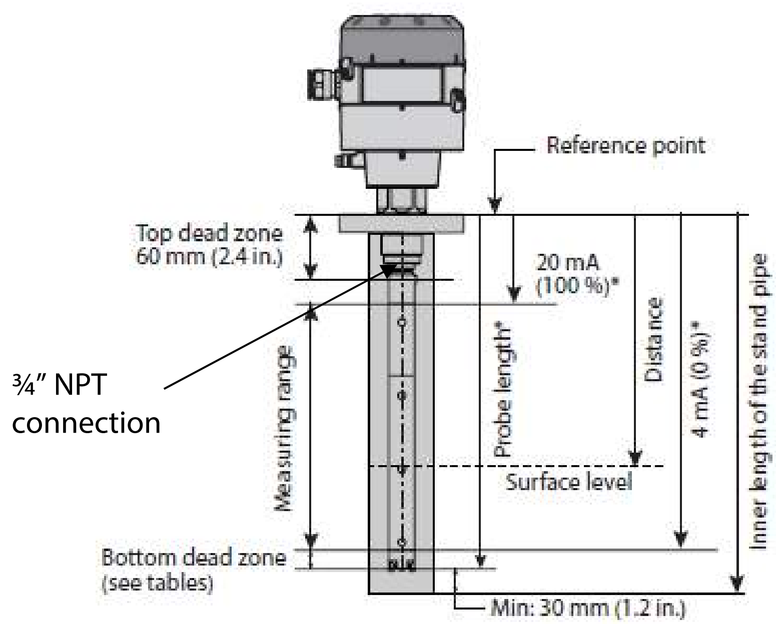
AKS 4100U

Factory setting

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	11.0	1.9	48

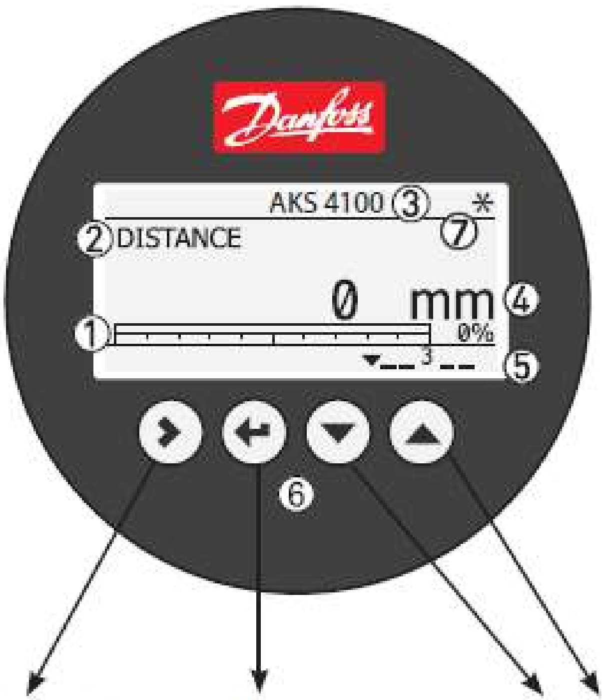
Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	11.0	1.6	40



LCD Display/Interface Unit

Used for commissioning and quick on-site setup.



① 4-20 mA output displayed as bar graph and in percentage [%]

② Measurement name (in this example, distance)

③ Sensor name

④ Measurement reading and unit

⑤ Device status codes
1 = Hardware problem (any hardware problem making the device unable to provide a correct measurement (communication, memory problem…)
2 = No Reference Pulse
3 = Low Voltage or Measurement Old
4 = Level Lost

⑥ Keypad buttons

⑦ Flashing star indicating unit in operation.

Enter menu system
Enter QUICK SETUP

Unit change at distance/level readout:
m, cm, mm, in, ft

Change between:
Distance*, level**, output (%)***, output (mA)****

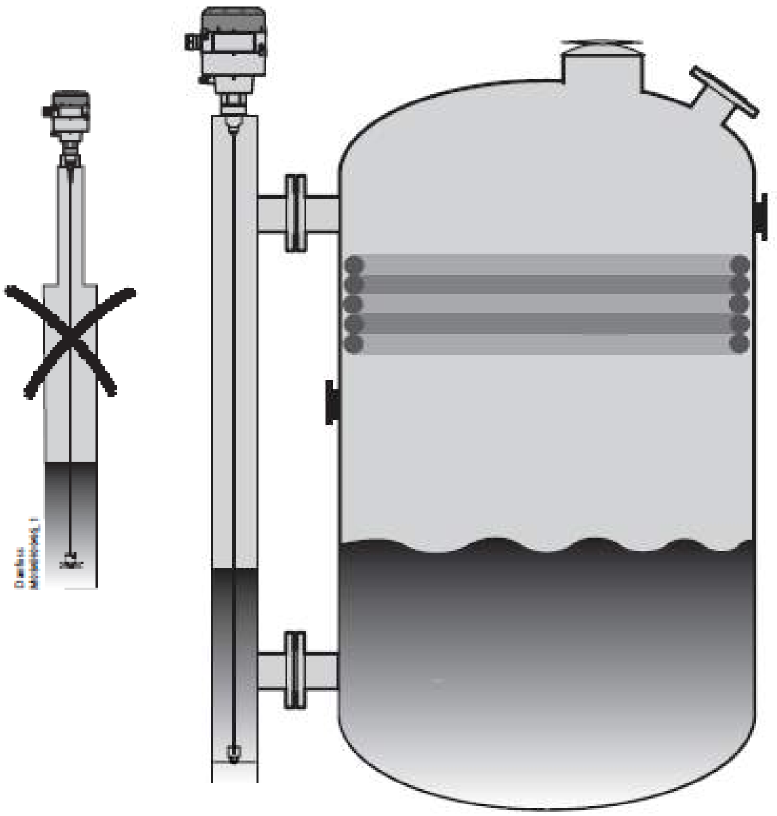
* If the display is set to "DISTANCE" then the value displayed will be the distance from the reference point to the top surface of the liquid refrigerant.
** If the display is set to "LEVEL" then the value displayed will be the length of the probe length that is covered by the refrigerant (distance from bottom of level probe to the surface of the liquid refrigerant).

*** If the display is set to "OUTPUT (%)" then the value displayed will be the % refrigerant level according to the 4 mA (0%) and 20 mA (100%) scale settings entered during setup.

**** If the display is set to "OUTPUT (mA)" then the value displayed will be the mA output of the probe based on the refrigerant level and the 4 mA (0%) and 20 mA (100%) scale settings entered during setup.

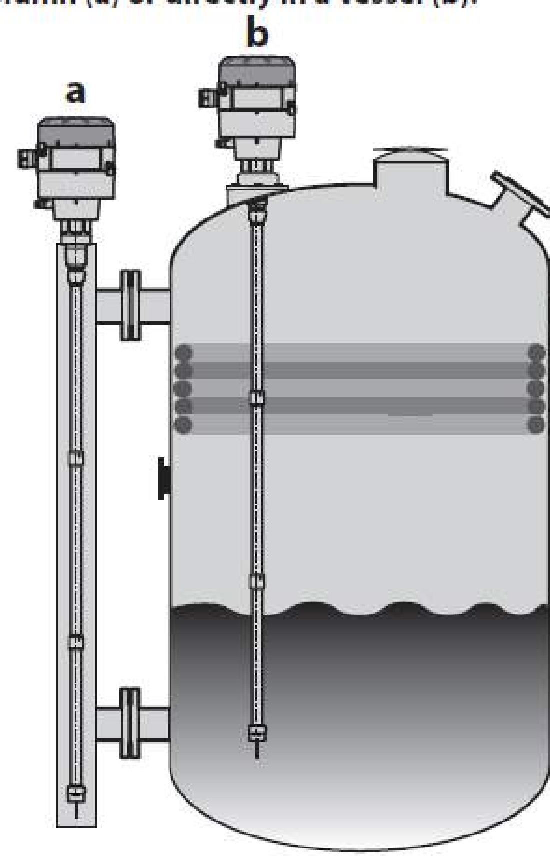
Installation

AKS 4100U cable version must ALWAYS be installed in a level column.



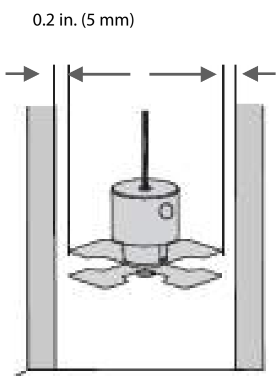
Note: If the level column is not within 2" to 4" in size, the coaxial version should be used.

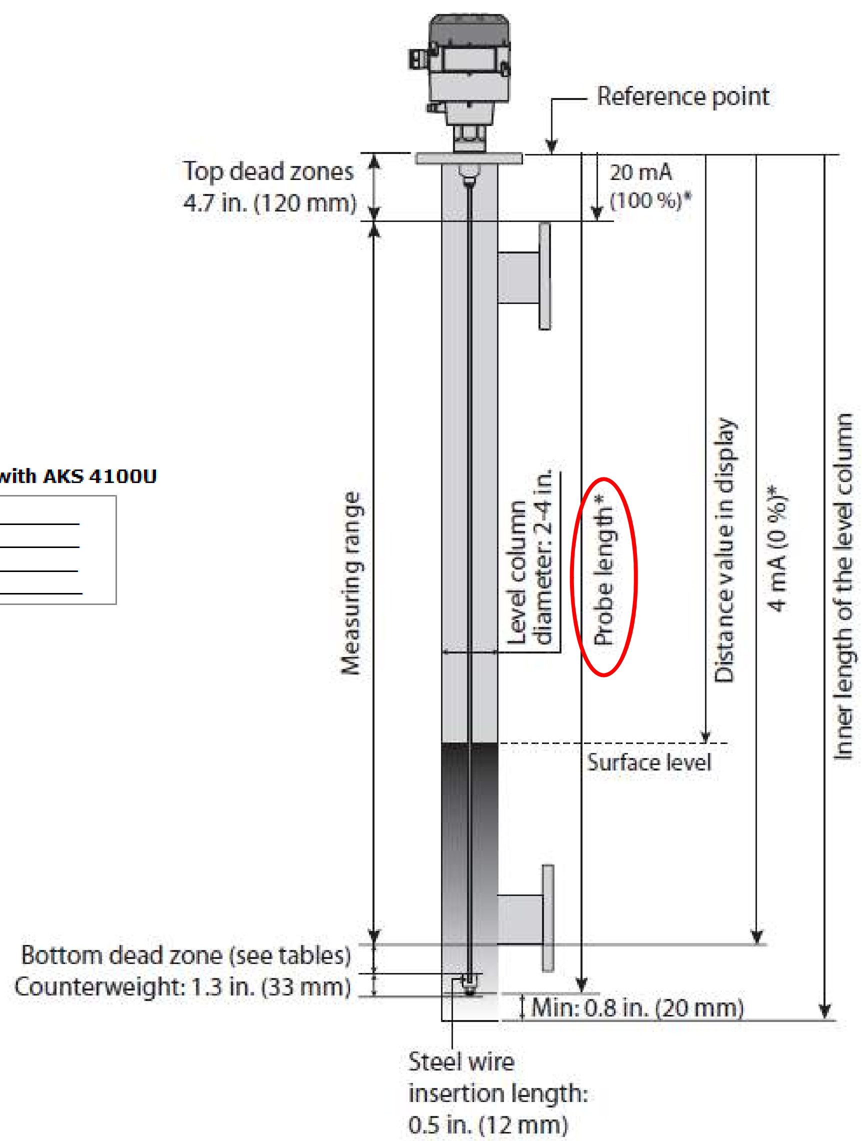
Coaxial version can be installed in a level column (a) or directly in a vessel (b).



Installation of Cable Version

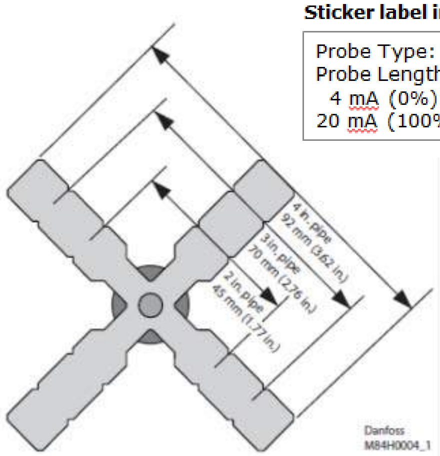
- Cable can be trimmed to the desired length but the total probe **length must be greater than 31.5 in.** and give min. 0.8 in. clearance from the bottom. See figure.
- Counterweight must have 0.2 in. of clearance from the inside diameter of the column as shown below. The counterweight comes from factory sized for a standard 4" column and the tabs on it can be trimmed for a column size down to 2"
- You must record the probe length and AKS 4100U type (cable or coaxial) on the setting label that comes with probe and stick in on signal converter for later use when programming.



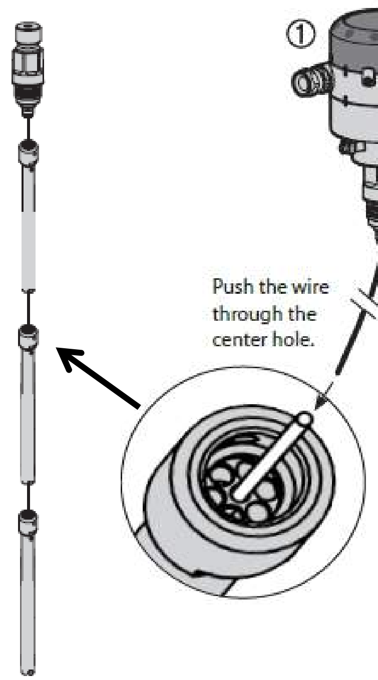


Sticker label included with AKS 4100U

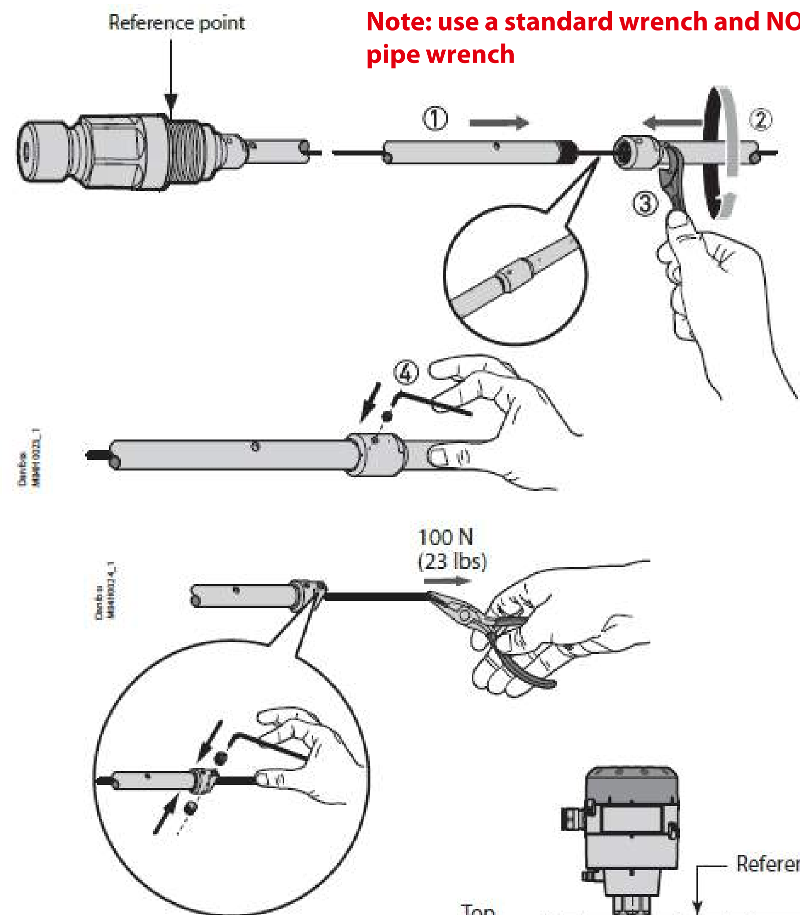
Probe Type: ____________
Probe Length: ____________
4 mA (0%): ____________
20 mA (100%): ____________

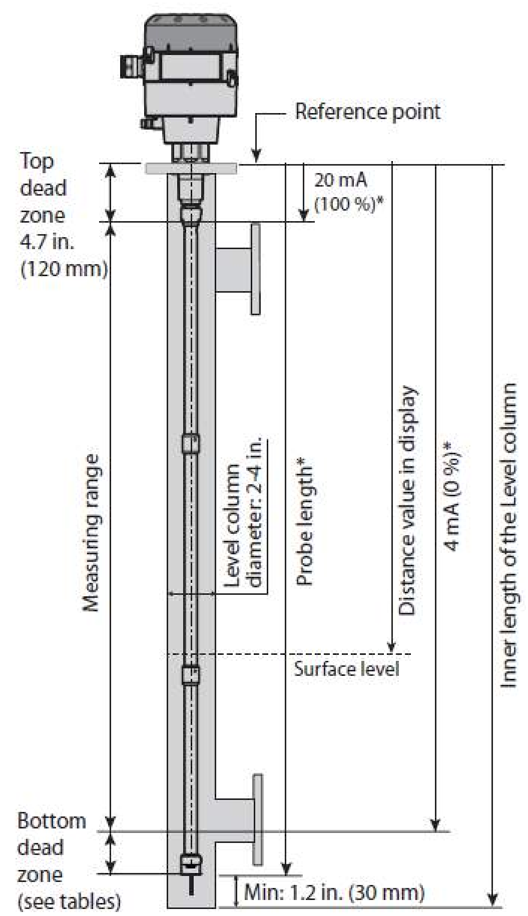


Installation of Coaxial Version



Note: use a standard wrench and NOT a pipe wrench

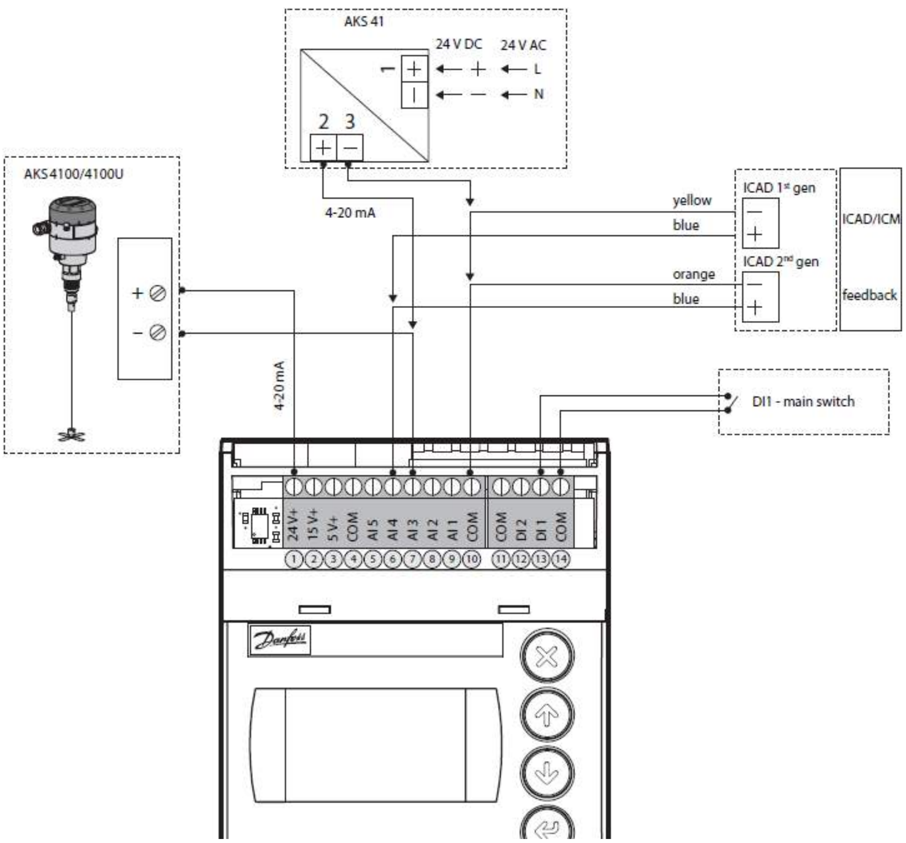




- If the standard length of the coaxial version is too long, it can be cut to the desired length but **the total probe length must be greater than 19.2 in.** and give min. 1.2 in. clearance from the bottom. See figure.
- You must record the probe length and AKS 4100U type (cable or coaxial) on the setting label that comes with probe and stick in on signal converter for later use when programming.

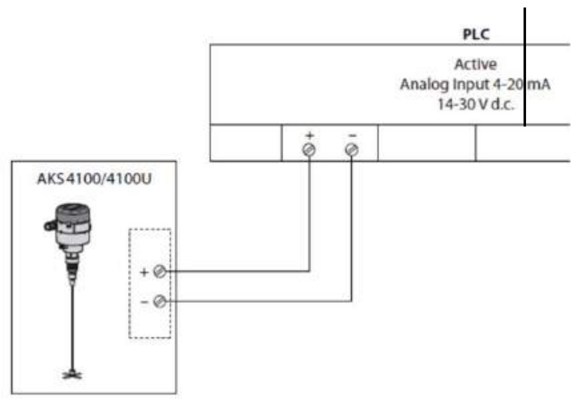
Wiring Diagram with Danfoss EKE 347 Level Controller or PLC

EKE 347 level controller

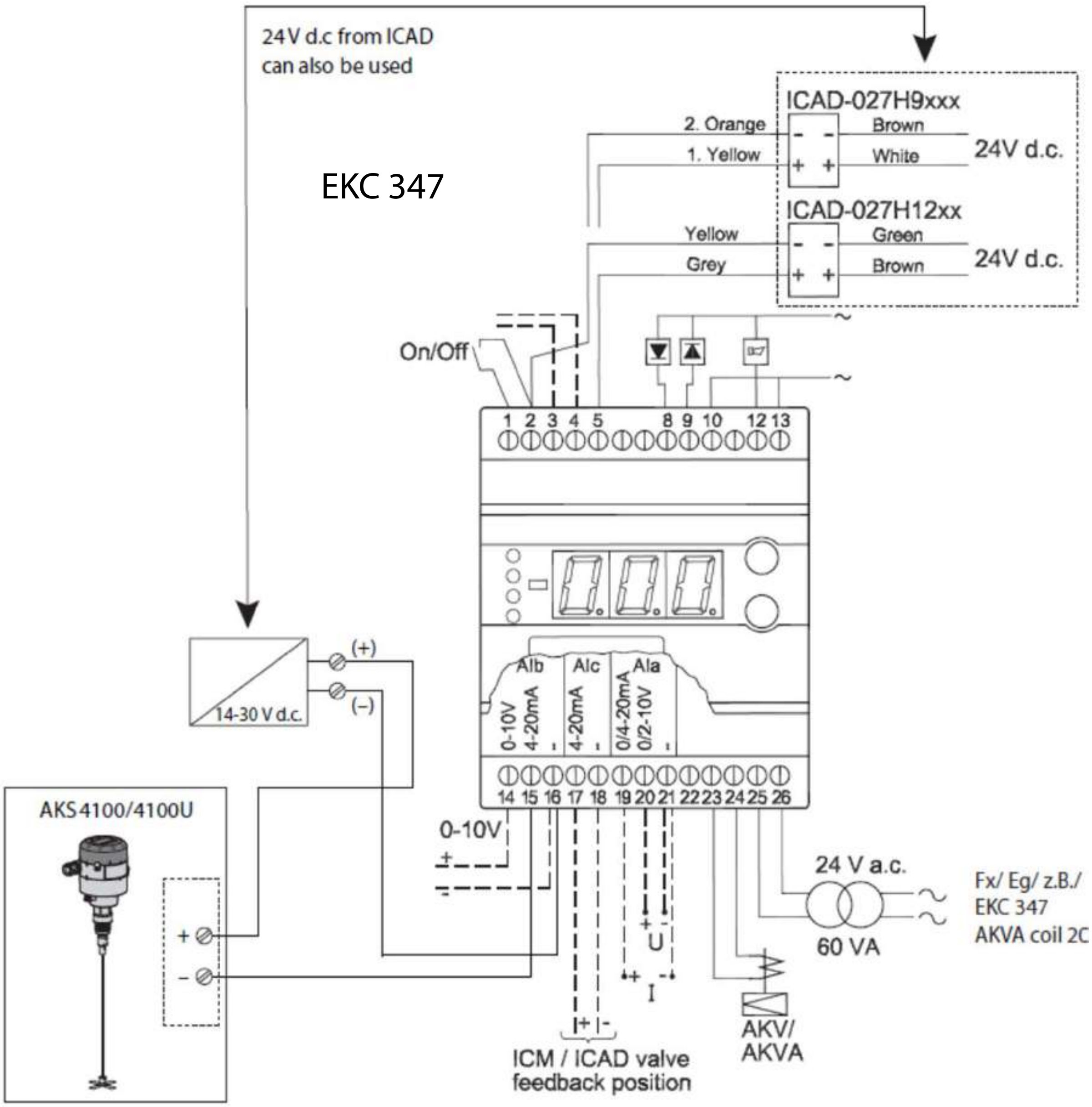


PLC

Supply Voltage needs to be 14-30Vd.c. and wired in series with the 4-20 mA loop



Wiring diagram with Discontinued EKC 347 Level Controller



Dead Zones for Cable Version

Bottom deadzone values based on the factory setting of dielectric constant

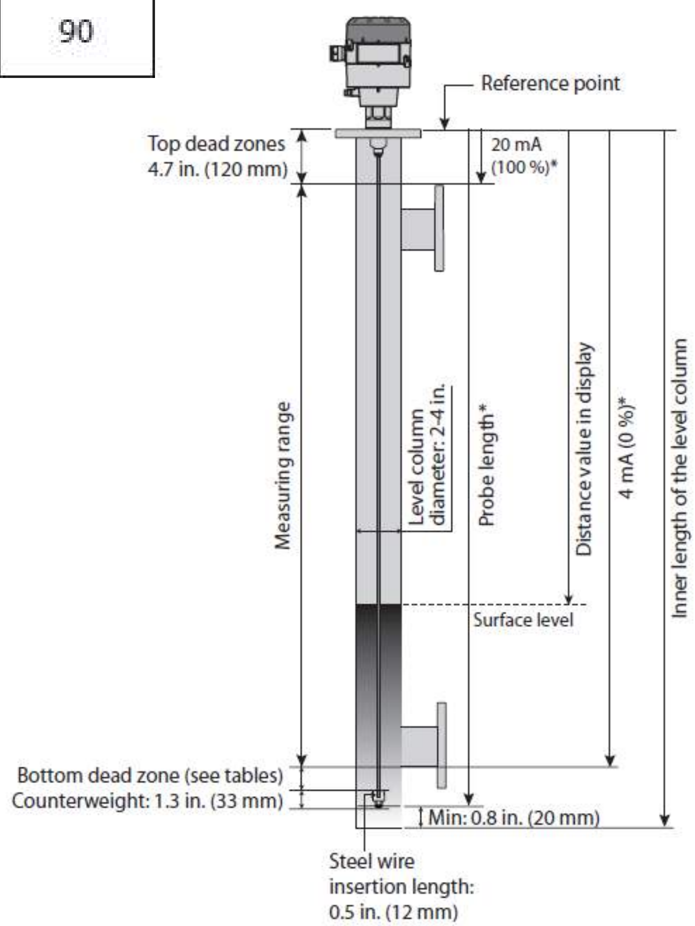
Refrigerant	Probe length range		Bottom dead zone	
	[in.]	[mm]	[in.]	[mm]
Ammonia, HFC, HCFC	31.5	800	4.2	115
	31.6 - 39	801 - 999	4.7	120
	40 - 79	1000 - 1999	5.9	150
	80 - 118	2000 - 2999	7.1	180
	119 - 157	3000 - 3999	8.3	210
	158 - 197	4000 - 5000	9.4	240

Improved Bottom dead zone value after the adjustment of dielectric constant

Refrigerant	Probe length range		Bottom dead zone	
	[in.]	[mm]	[in.]	[mm]
Ammonia, HFC, HCFC	31.5 - 197	800 - 5000	3.5	90

Dielectric constant of refrigerant gas

- The dielectric constant of the refrigerant gas will change based on the temperature
- The factory setting of dielectric constant is 1.066
- If the refrigerant and temperature of the application is known an improved dielectric constant can be taken from the tables in instructions and programmed in sensor to improve the measuring range.



Dead Zones for Coaxial Version

Please note: It is mandatory to input dielectric constant for CO_2 applications.

AKS 4100U

Dielectric Constant εr always set during Quick Setup

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
CO_2	19.2	6.7	170
	30		
	45		
	55		
	65		
	85		

* Values to be entered into HMI Quick Setup menu and recorded on the setting label.
Stick the setting label onto the Signal Converter either inside or outside.

Bottom dead zone values based on the factory setting of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.73	95
	30	4.05	103
	45	4.50	114
	55	4.80	122
	65	5.10	130
	85	5.70	145

Bottom dead zone values based on the factory setting of dielectric constant

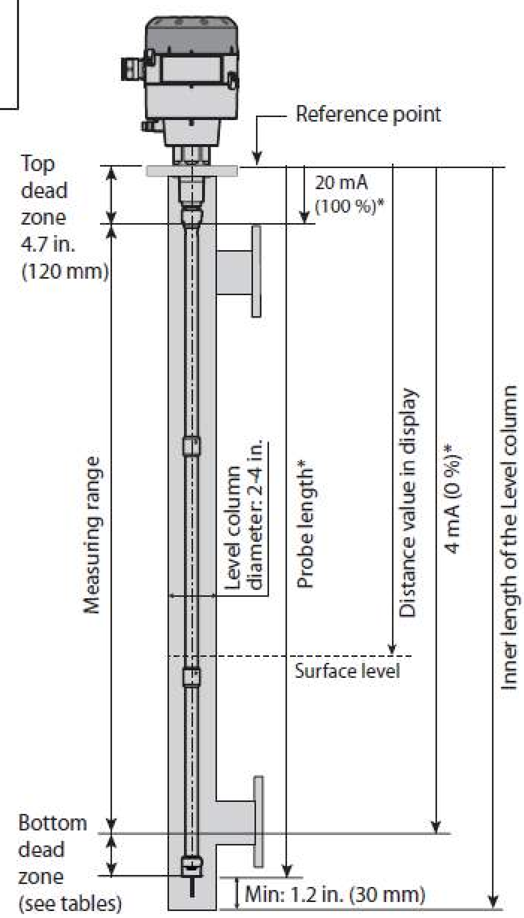
Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	4.52	115
	30	4.84	123
	45	5.29	134
	55	5.59	142
	65	5.89	150
	85	6.49	165

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.1	80
	30		
	45		
	55		
	65		
	85		

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	3.94	100
	30		
	45		
	55		
	65		
	85		



Programming AKS 4100U

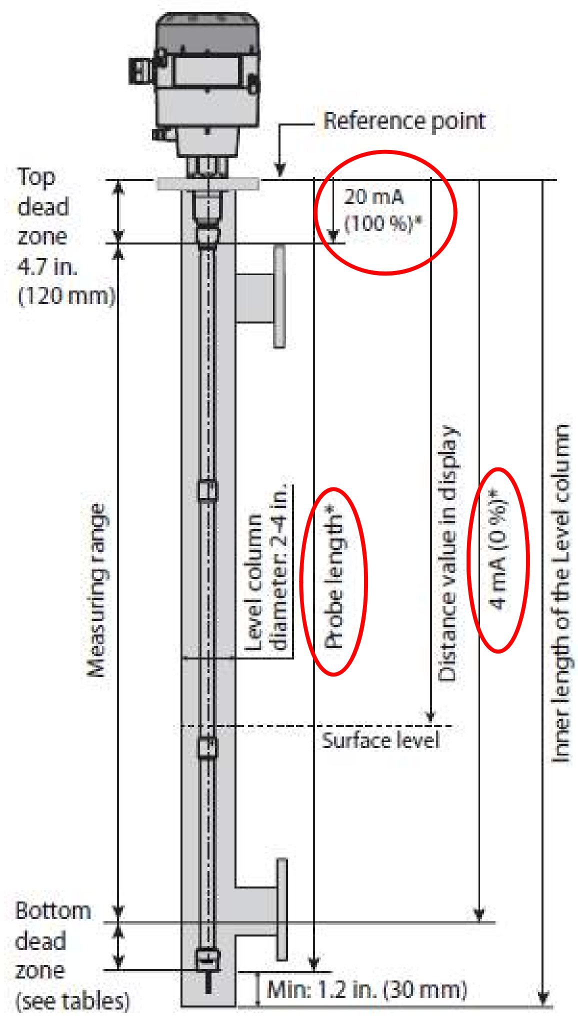
Min Settings during start-up

- Cable or Coaxial setting (if selecting coaxial select “coaxial D14” if 19.2 in. or longer and D22 for 11 in version)
- Probe length
- Length of 4 mA point (0%).
- Length of 20 mA point (100 %). (This will be 4.7 in. if you want the max. measuring range of sensor)
- Dielectric constant (0nly needed if used with CO2 (R744), but may improve measuring range for other refrigerants)

Sticker label included with AKS 4100U

Probe Type: ____________
Probe Length: ____________
4 mA (0%): ____________
20 mA (100%): ____________

* Length values should be recorded on the setting label included with sensor and then stick label either inside or outside the sensor top.



Programing Dielectric Constants

The dielectric constant of the refrigerant gas will change based on the temperature in the level column. If the refrigerant temperature is known the corresponding dielectric constant from the tables can be entered into the AKS 4100U to improve the measuring range.

For CO2 (R744) this setting is mandatory in the quick setup procedure. It is optional for refrigerants other than CO2 (R744).

R717 (NH_3)

Temperature range:
–40°F → +122°F (–40°C → +50°C)

Temperature range [°F]	Temperature range [°C]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–40.0 → 0	–40 → –18	1.01
1 → 23	–17 → –5	1.02
24 → 39	–4 → 4	1.03
40 → 54	5 → 12	1.04
55 → 64	13 → 18	1.05
65 → 75	19 → 24	1.06
76 → 82	25 → 28	1.07
83 → 91	29 → 33	1.08
92 → 99	34 → 37	1.09
100 → 104	38 → 40	1.10
105 → 111	41 → 44	1.11
112 → 117	45 → 47	1.12
118 → 122	48 → 50	1.13

R744 (CO_2)

Temperature range:
–58°F → +59°F (–50°C → +15°C)

Temperature range [°F]	Temperature range [°C]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–58.0 → –43	–50.0 → –42.0	1.01
–42 → –18	–41.0 → –28.0	1.02
–17 → 2	–27.0 → –17.0	1.03
3 → 16	–16.0 → –9.0	1.04
17 → 27	–8.0 → –3.0	1.05
28 → 36	–2.0 → 2	1.06
37 → 45	3 → 7	1.07
46 → 52	8 → 11	1.08
53 → 58	12 → 14	1.09
59	15	1.10

Note: Tables for other refrigerants are listed in the installation instructions.

Spare Parts & Accessories

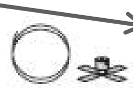
Accessories

Description	Code number
AKS 4100U HMI Display	**084H4548**
AKS 4100U Signal Converter + Metaglass **with** HMI, excluding cable gland	**084H4555**
AKS 4100U converter connecting cable (5 pcs.)	**084H4557**

Seal adapter must remain on AKS 4100U head

Note: must crimp cables together in top dead-zone area

Service kits

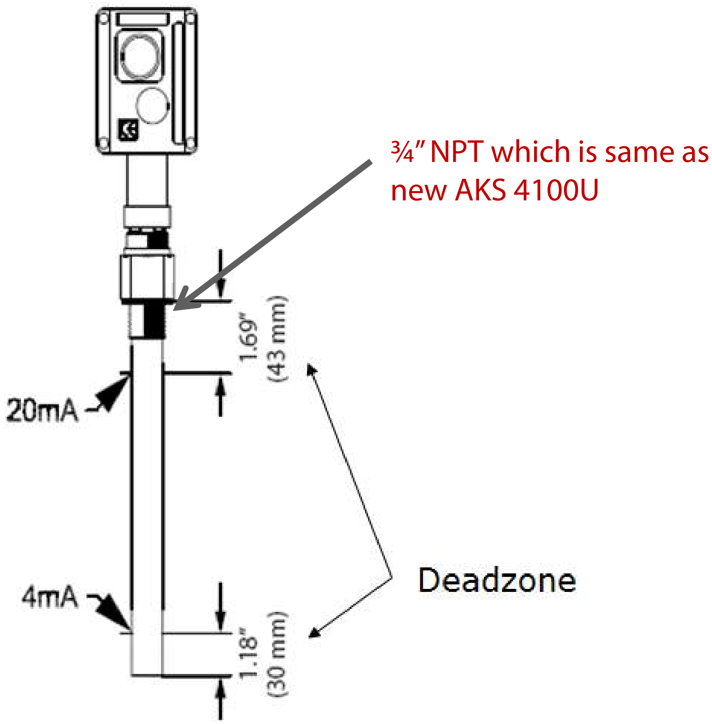


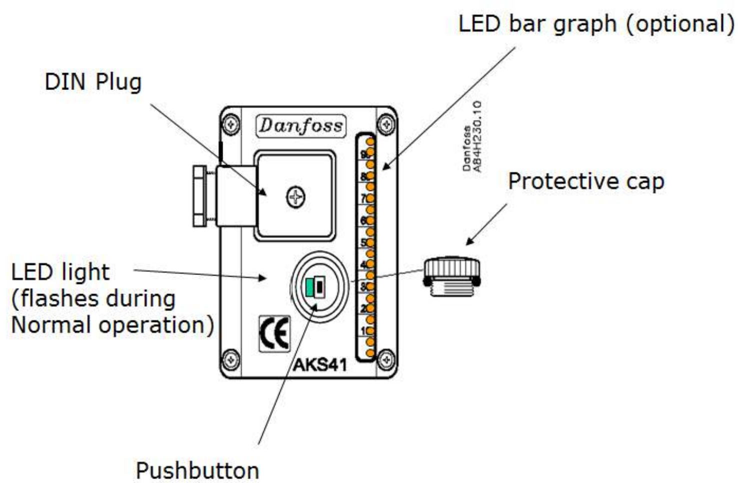
Description	Content	Code number
Cable and counterweight for **AKS 4100U** - CABLE version	Cable - 5 m / 197 in., Ø2 mm / Ø0.08 in.	**084H4542**
	Crimp	
	Counterweight	
End connector incl screws for **AKS 4100U** - COAXIAL D14 version	End connector (incl. 3 mm / 0.12 in set screws)	**084H4549**
Process connection, counterweight and 5 m / 197 in., Ø2 mm / Ø0.08 in. cable for **AKS 4100U** - CABLE and COAXIAL D14 version	¾ in. NPT process connection	**084H4546**
	Counterweight	

Other spare parts

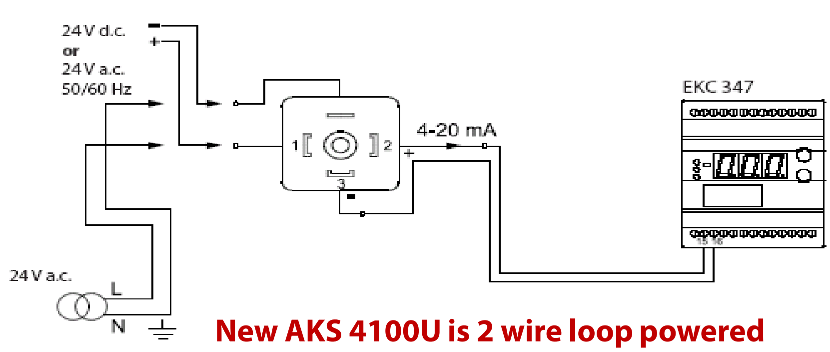
Description	Code number
AKS 4100U Coaxial tube. Tube length : 680 mm / 26.8 in.	**084H4543**
AKS 4100U blank top cover for signal converter	**084H4544**
Process connection **AKS 4100U** - Coaxial D22 - ¾ in. NPT – 11 in.	**084H4552**

Old Discontinued AKS 41U





Wiring diagram with EKC 347 level controller



New AKS 4100U is 2 wire loop powered

Instruction

Type AKS 4100/4100U
Cable version

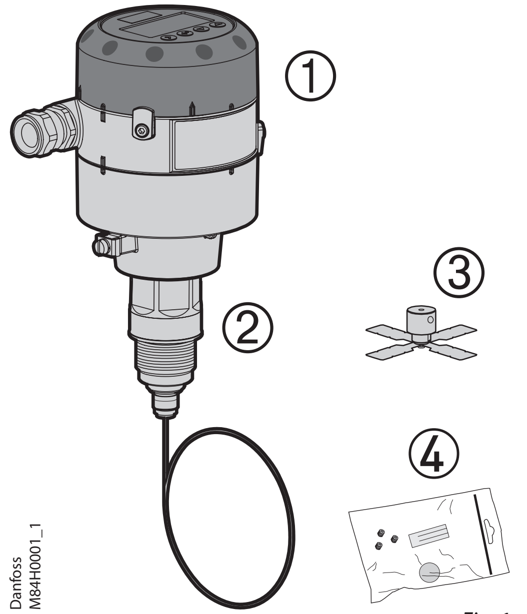


Fig. 1

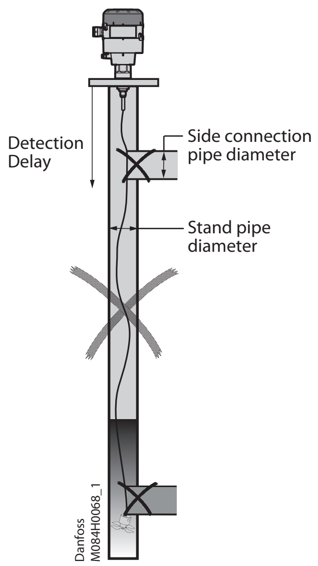


Fig. 2a

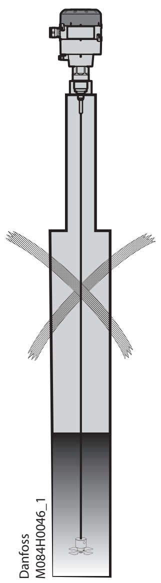


Fig. 2b

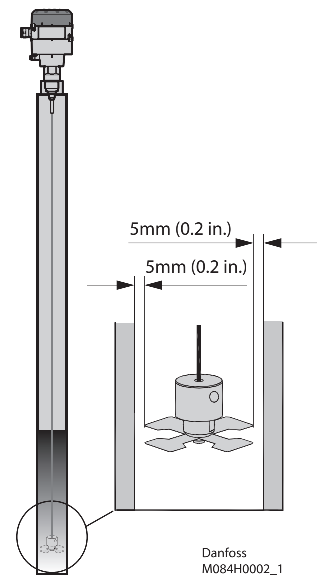


Fig. 2c

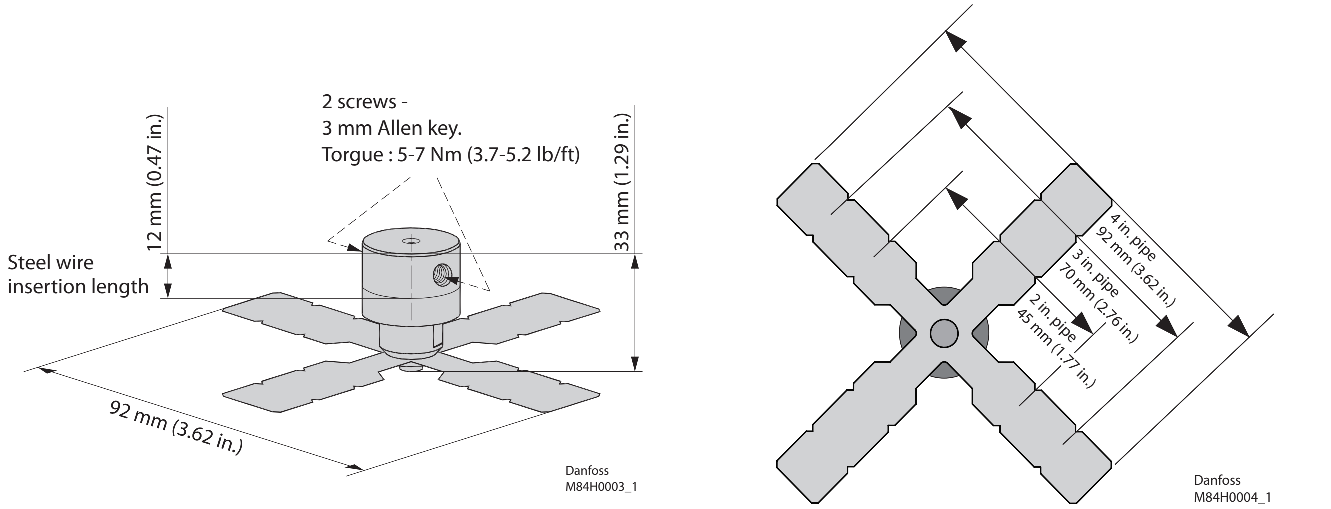


Fig. 3

	Standpipe / Columm					
	2 in. pipe		3 in. pipe		4 in. pipe	
Inner diameter	52 mm	2.05 in.	78 mm	3.07 in.	102 mm*	4.02 in.*
Total length of guided blades after cutting	45 mm	1.77 in.	70 mm	2.76 in.	92 mm*	3.62 in.*

* No need to cut guided blades

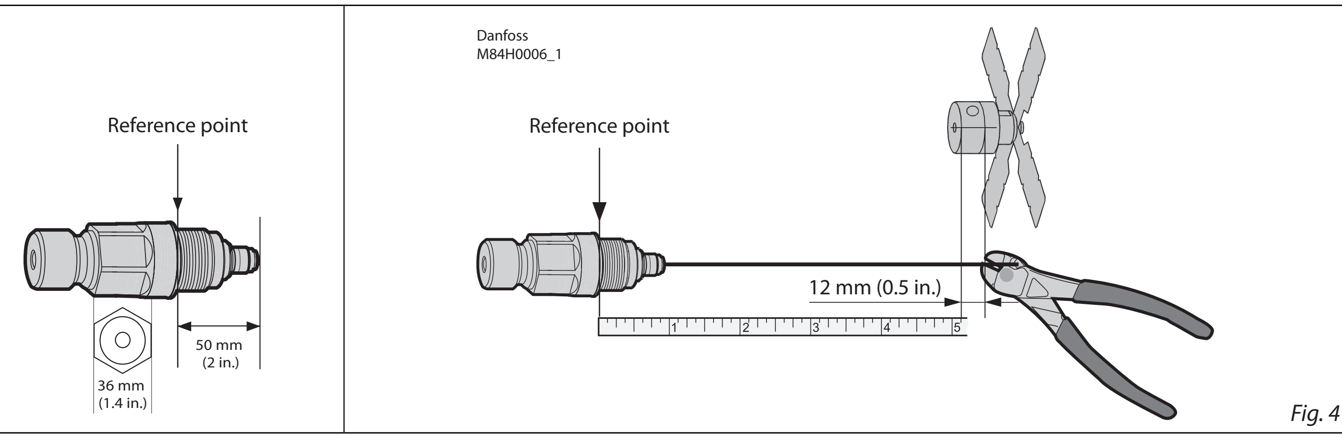


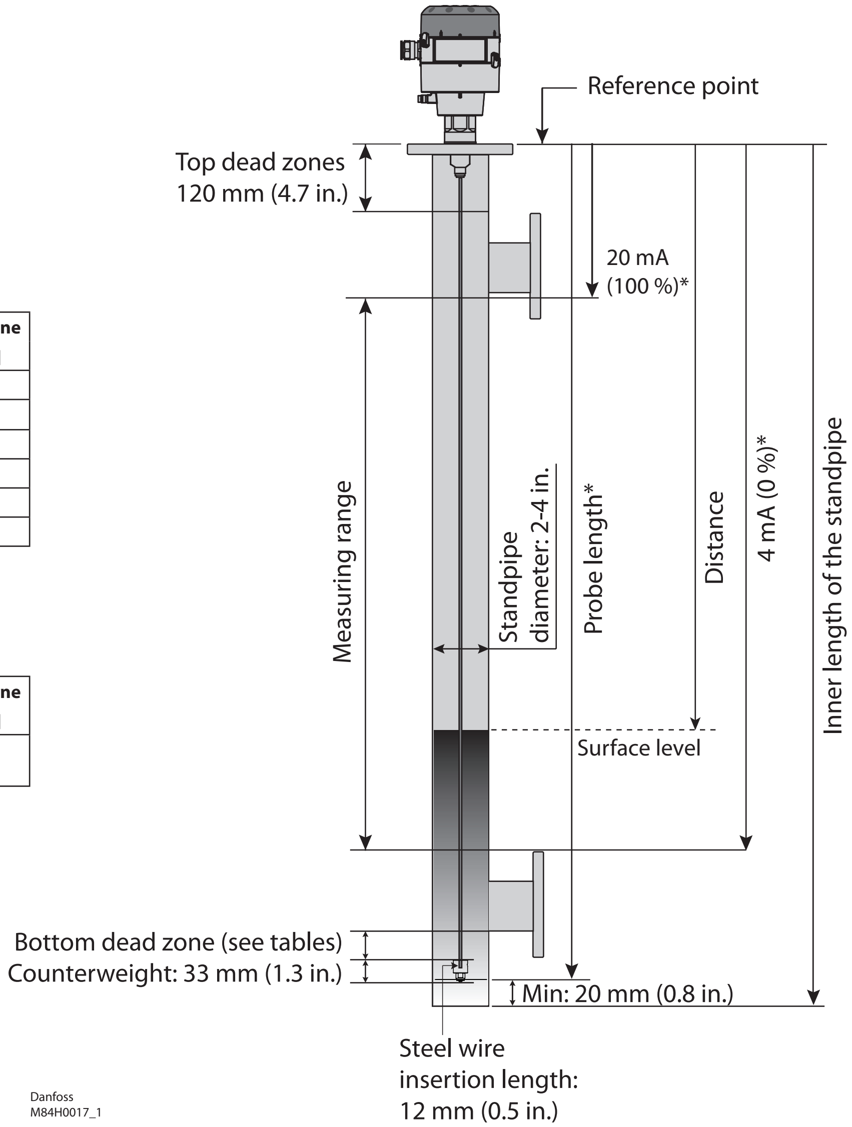
Fig. 4

Bottom deadzone values based on the factory setting of dielectric constant

Refrigerant	Probe length range		Bottom dead zone	
	[mm]	[in.]	[mm]	[in.]
Ammonia, HFC, HCFC	800	31.5	115	4.2
	801 - 999	31.5 - 39	120	4.7
	1000 - 1999	39 - 79	150	5.9
	2000 - 2999	79 - 118	180	7.1
	3000 - 3999	118 - 157	210	8.3
	4000 - 5000	157 - 197	240	9.4

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe length range		Bottom dead zone	
	[mm]	[in.]	[mm]	[in.]
Ammonia, HFC, HCFC	800 - 5000	31.5 - 197	90	3.5



* Values to be entered into HMI Quick Setup menu and recorded on the setting label. Stick the setting label onto the Signal Converter either inside or outside.

Danfoss
M84H0017_1

Fig. 5

Danfoss
M84H0031_1

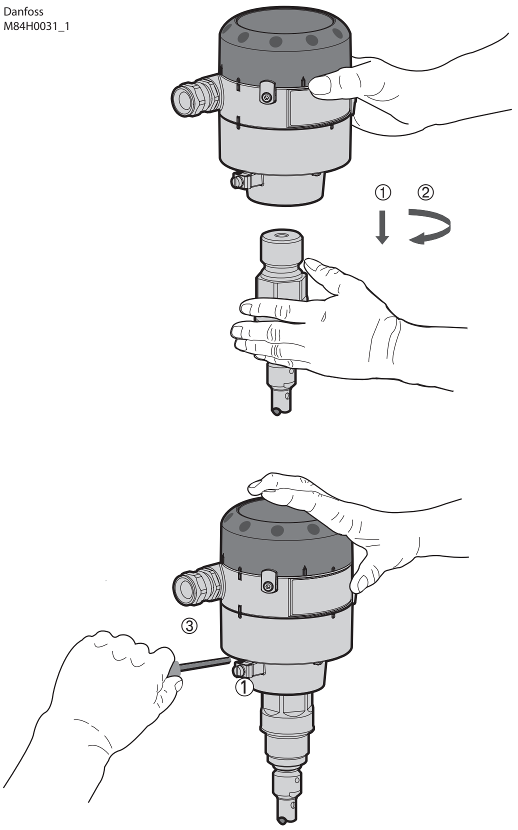
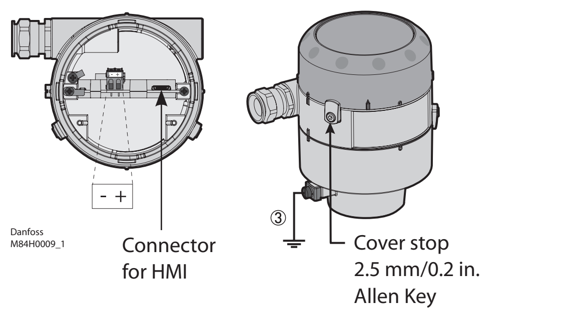
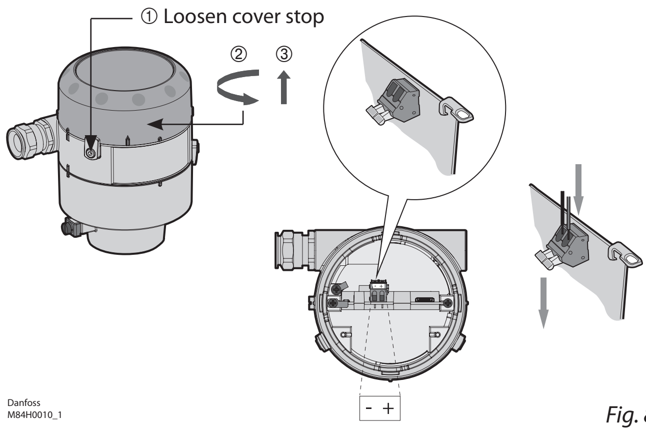


Fig. 6



Danfoss
M84H0009_1

Fig. 7



Danfoss
M84H0010_1

Fig. 8

AKS 41/41U to AKS 4100/4100U
AKS 41/41U with a.c supply to AKS 4100/4100U with d.c supply

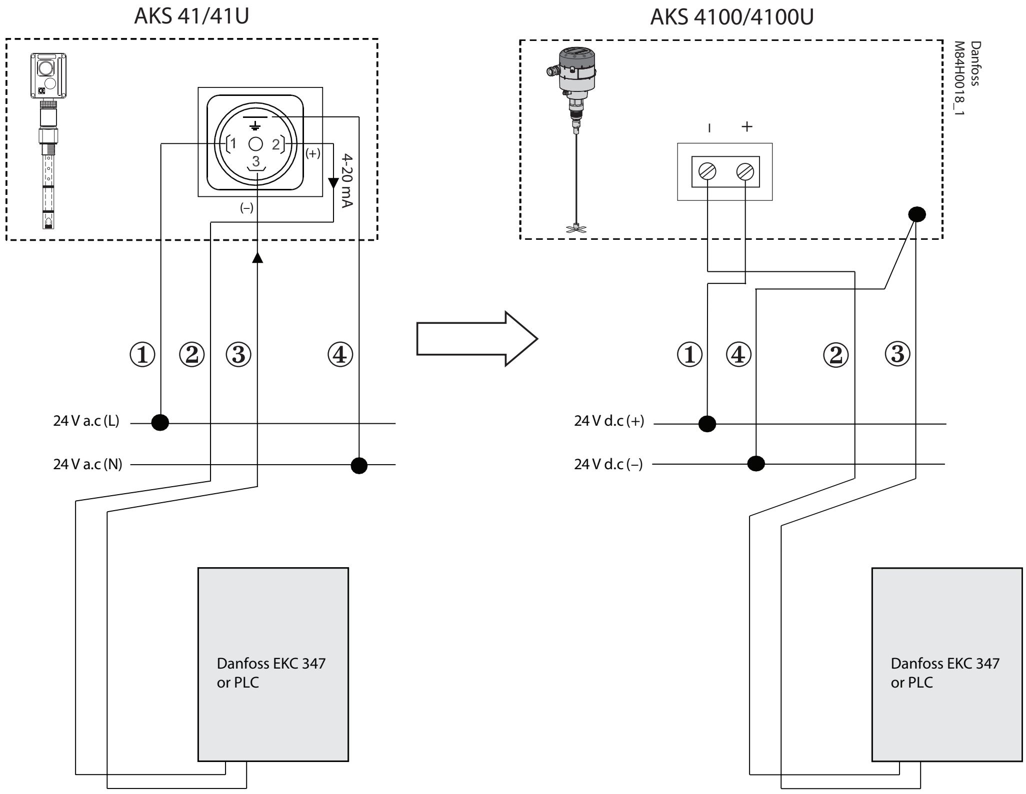


Fig. 9

AKS 4100/4100U connected to EKC 347

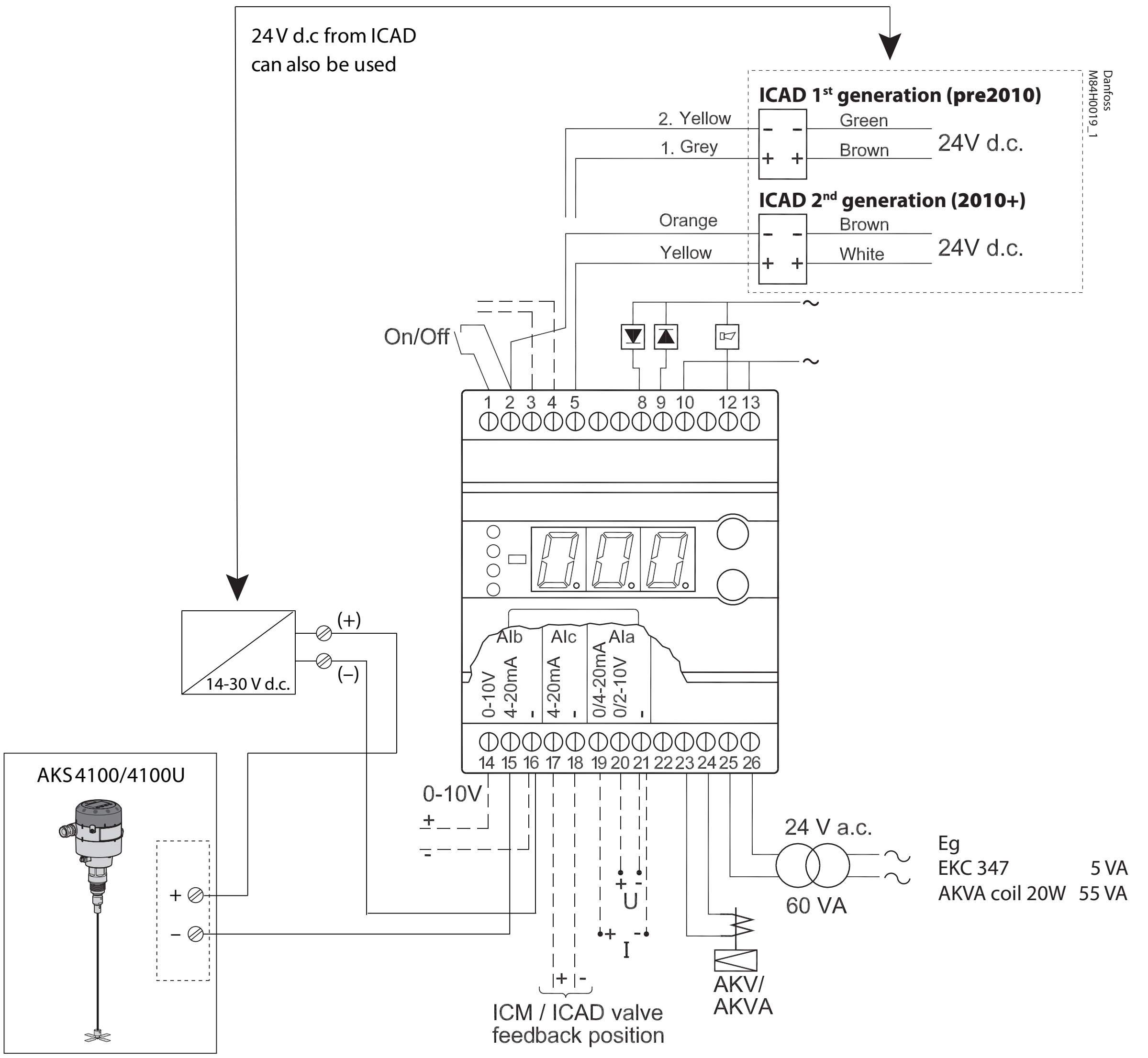


Fig. 10

AKS 4100/4100U
connected to PLC

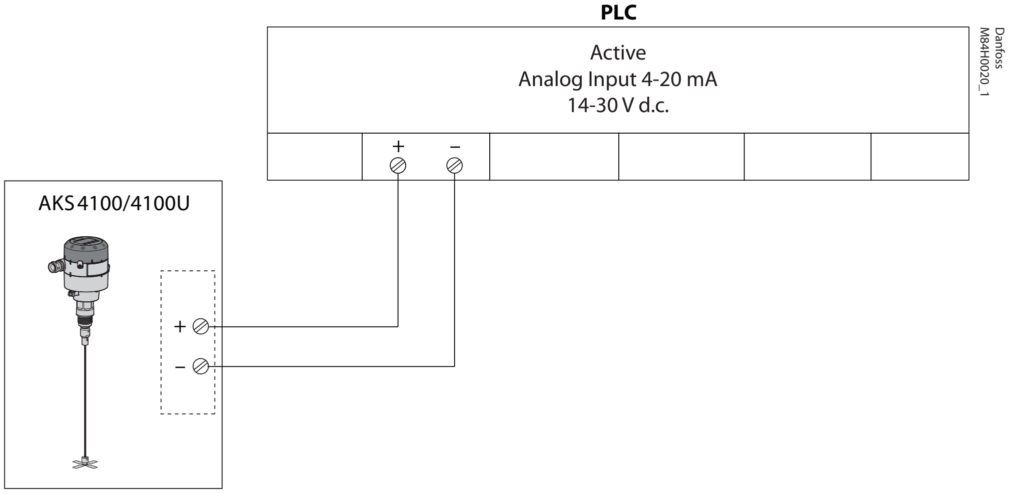


Fig. 11

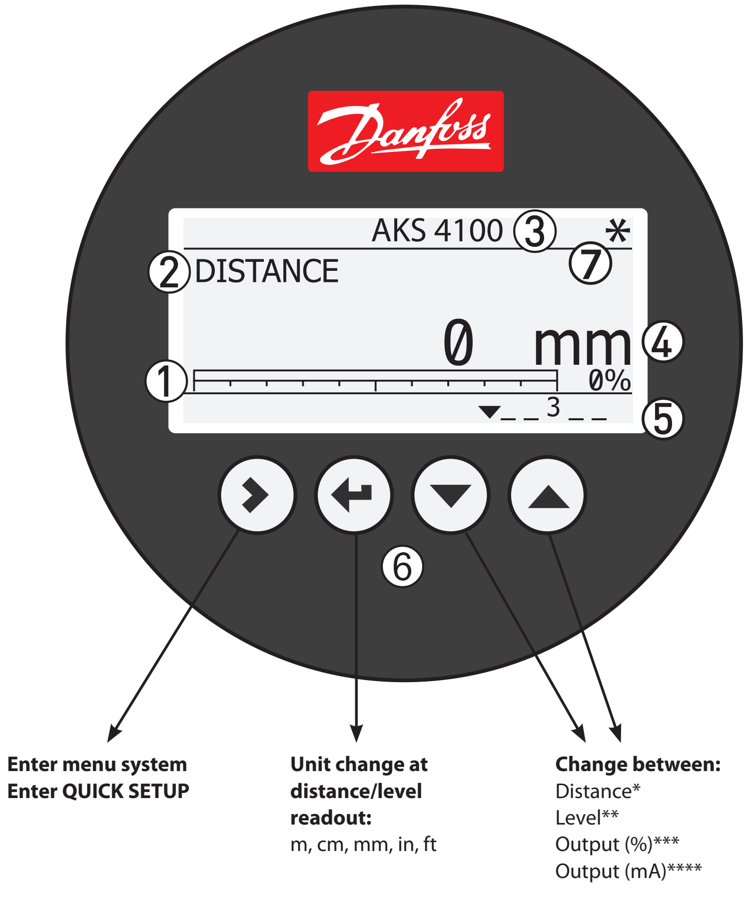


Fig. 12

① 4-20 mA output displayed as bar graph and in percentage [%]

② Measurement name (in this example, DISTANCE)

③ Device tag name

④ Measurement reading and unit

⑤ Device status (markers)
Marker 1, 2 and 3 (Error)
Hardware problem; the Signal Converter hardware is defective. Contact Danfoss.

Marker 4 and 5 (Notification)
Depending on the level, the marker is ON or OFF. Used for Danfoss service information only.

⑥ Keypad buttons

⑦ Flashing star indicating unit in operation.

* DISTANCE is a display option.
If the display is set to "DISTANCE" the displayed value will be the distance from the Reference point to the top surface of the liquid refrigerant (see fig. 5).

** LEVEL is display option.
If the display is set to "LEVEL" then the value displayed will be:
PROBE LENGTH (entered in QUICK SETUP)
– DISTANCE (see fig. 5).

*** OUTPUT (%) is display option.
Will represent the level of refrigerant,in percent, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (0%), SCALE 20 mA (100%) (see fig. 5).

**** OUTPUT I (mA) is display option.
Will represent the level of refrigerant,in 4-20 milliampere, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (4 mA), SCALE 20 mA (20 mA) (see fig. 5).

English

Please observe that AKS 4100/4100U is intended to always be installed in a standpipe (column/bypass/stilling well). A Standpipe is commonly used when:

- Servicing the AKS 4100
- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.

Refrigerants

AKS 4100/4100U is designed specifically to measure liquid level in the most commonly used refrigerants, including R717(ammonia), HCFC, HFC and non corrosive gases/liquids.

AKS 4100/4100U can also be used with R744 (CO_2) in the coaxial version. Please see the technical brochure for further details.

Basic data

AKS 4100/4100U is a passive 2-wired 4-20 mA sensor that is loop powered.

Supply Voltage
14-30 V d.c. Min/Max. value for a max. output of 22 mA at the terminal

Load
RL [Ω] ≤ ((Uext -14 V)/20 mA).
– Default (Error output set to 3.6 mA)
RL [Ω] ≤ ((Uext -14 V)/22 mA).
– (Error output set to 22 mA)

Cable gland
AKS 4100 PG 13, M20×1.5 ; (cable diameter: 6-8 mm (0.24-0.31in.)
AKS 4100U ½ in. NPT

Terminals (spring loaded)
0.5-1.5 mm² (~20-15 AWG)

Enclosure
IP 67 (~NEMA type 4X)

Refrigerant temperature
–60°C/100°C (–76°F/212°F)

Refrigerants
The listed refrigerants are qualified and approved by Danfoss:

R717 / NH_3:	–40°C / +50°C (–40°F / +122°F)
R744 / CO_2:	–50°C / +15°C (–58°F / +59°F)
HCFC:	
R22:	–50°C / +48°C (–58°F / +118°F)
HFC:	
R404A:	–50°C/ +15°C (–58°F / +59°F)
R410A:	–50°C /+15°C (–58°F / +59°F)
R134A	–40°C /+50°C (–40°F /+122°F)

(Further details in the Technical Brochure)

Ambient temperature
–40°C / +80°C (–40°F / +175°F)
For HMI : –20°C / +60°C (–4°F / +140°F)

Process pressure
–1 barg / 100 barg (–14.5 psig / 1450 psig)

Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless cable:
AKS 4100 G1 inch pipe thread. Aluminium gasket included
AKS 4100U ¾ in. NPT

(Further details in the Technical Brochure)

Mechanical Installation

Preparations prior to Mechanical Installation
Disassemble the Signal Converter from the Mechanical process connection (use 5´mm hex key, **see fig. 6**). Fit the red protection cover on top of the Mechanical process connection to protect it againt any moisture or dirt paticles.

Content supplied (fig. 1)
① Signal Converter (with or without HMI)
② Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless wire
③ Counterweight
④ Accessory bag comprising:
3 mm set screws.
Red cover to protect mechanical process connection ② prior to mounting Signal converter.
Setting label.

Note:
Stand pipe design guidelines:

The side connection pipes must NOT penetrate into the stand pipe (**fig. 2a**)

Recommended diameter of the side connection pipe: 0.5 x stand pipe diameter (e.g. if stand pipe has diameter DN100, the side connection must be diameter DN50 or smaller) (**fig. 2a**).

If above design guidelines for side connection are not fulfilled, one of the following options are recommended:

1. Increase Detection Delay. Parameter 2.3.6.
   We recommend to increase the Detection Delay (parameter 2.3.6) from the standard 0 mm to a value below the lowest point of the top side connection plus 50 mm (**fig. 2a**).

   Changing the Detection Delay (parameter 2.3.6) does not require changing the (0%) 4mA and (100%)20mA settings in the AKS 4100/4100U Within the Detection Delay zone, no measuring will take place.
2. Exchange from Cable to Coaxial version.

The stand pipe must have the SAME diameter through out the entire length. If standpipe diameter differs in width (**fig. 2b**) the Cable version is not recommended. Coaxial version should be used.

Adjustment of the counterweight blades
Allow 5 mm space between the guided blades and the inner wall of the pipe **(see fig. 2c)**. Use side cutters to trim the guided blades to fit the actual standpipe diameter **(see fig. 3)**.

Adjustment of the cable probe

Please observe that the stainless steel wire is not permanently creased or kinked.

Always use the reference point, at the **Mechanical Process Connection (see fig. 4)**, as a starting point for all measuring to determine:

- Where to cut the cable.
- Probe length **(see fig. 5)**
- Scale 4 mA **(see fig. 5)**
- Scale 20 mA **(see fig. 5)**

Note the probe length, Scale 4 mA and Scale 20 mA for use later when programming the HMI (Human Machine Interface) on the AKS 4100/4100U.

Follow these instructions and **see fig. 4 & 5**:

1. Measure the inner length of the Standpipe.
2. *Preparation before cutting the cable*
   Known data:
   Space below counterweight: 20 mm (0.8 in.)
   Steel wire insertion length in counterweight: 12 mm (0.5 in.)
   counterweight height: 33 mm (1.3 in.)

   Max Probe length =
   Standpipe inner length
   – Space below counterweight (20 mm (0.8 in.))

   The cable length =
   Max probe length
   \+ Steel wire insertion length in counterweight (12 mm (0.5 in.))
   – Counterweight height (33 mm (1.3 in.))
3. Measure out the cutting point of the cable. Measure from the reference point **(fig. 4)** and cut the cable.
4. Fit the counterweight on the cable and secure the two set screws with a 3 mm Allen Key **(fig. 3)**.
5. Lower the counterweight down through the threaded hole. **Make sure that the counterweight is gliding down through the pipe without any resistance and that the cable is straight (not touching the inner walls of the stand pibe or any incoming piping (see fig. 2a)).**
6. Use a torque wrench to tighten the mechanical process connection **(fig. 1, item 2)** to 120 Nm (89 lb/ft).

Calculating the measuring range

***4 mA** setting for max. measuring range:*
= Max probe length
– Counterweight height (33 mm (1.3 in.))
– Bottom dead zone (see **fig. 5**)

***20 mA** setting for max. measuring range:*
= Top dead zone (see **fig. 5**)

Example
Known data:
Space below counterweight: 20 mm (0.8 in.)
Steel wire insertion length in counterweight: 12 mm (0.5 in.)
counterweight height: 33 mm (1.3 in.)
Preconditions:
Factory setting is used
Refrigerant = Ammonia
Standpipe inner length = 3100 mm (122 in.)
Max probe length =
3100 mm – 20 mm = 3080 mm
(122 in. – 0.8 in. = 121.3 in.)

The cable length:
Max probe length =
\+ Steel wire insertion length in counterweight (12 mm (0.5 in.))
– Counterweight height (33 mm (1.3 in.))
3080 mm + 12 mm – 33 mm = **3059 mm**
(121.3 in. + 0.5 in. – 1.3 in. = **120.4 in.)**

***4 mA** Setting for Max. Measuring Range:*
Max probe length (3080 mm (121.3 in.))
– Counterweight height (33 mm (1.3 in.))
– Bottom dead zone (see fig. 5)
(210 mm (8.3 in.)) = **2837 mm (111.7 in.)**

***20 mA** Setting for Max. Measuring Range:*
= Top dead zone (see fig. 5) = 120 mm (4.7 in.)

How to mount the AKS 4100/4100U Converter (see fig 6)

1. Unscrew the set screw with a 5 mm Hexagon key in the Signal converter.
2. Push the Signal Converter downwards to stop on the Mechanical process connection
3. Turn the Signal Converter to the wanted position and tighten the set screw with a 5 mm Hexagon key

Electrical installation/connection

Output terminals (fig. 7 and 8):
1. Current output –
2. Current output +
3. Grounding terminal

Electrical installation procedure
1. Use a 2.5 mm Allen wrench to loosen the cover stop.
2. Remove the terminal compartment cover from the housing.
3. Do not disconnect the wire from the terminal compartment cover.
Put the terminal compartment cover adjacent to the housing.
4. Connect the wires to the device. Tighten the cable entry glands.
5. Attach the terminal compartment cover to the housing.
6. Use a 2.5 mm Allen wrench to tighten the cover stop.

Start up:
- Connect the converter to the power supply.
- Energize the converter.

Devices with the HMI display option only:
After 10 seconds the screen will display "Starting up". After 20 seconds the screen will display the software version numbers. After 30 seconds the default screen **(fig. 12)** will appear.

Precautions when changing from AKS 41/41U to AKS 4100/4100U

Note:
AKS 41/41U supports both a.c. and d.c. supply whereas the AKS 4100/4100U is using d.c. supply only. **Follow the instructions in fig. 9.**

Connecting to controller or PLC
Follow the instructions in **fig. 10 or 11**.

The current output will be set to 3.6 mA whenever the AKS 4100/4100 detects an error like Marker 1, 2 or 3 (see page 4).

Quick Setup →

Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Quick Setup (all values below are only examples)

- Connect the device to the power supply (see the section "Electrical installation/ connection".
- Press (▶) 3 times.

```
AKS 4100
QUICK SETUP ?
YES          NO
```

- Press (▶)

```
AKS 4100
PROBE TYPE
SINGLE CABLE
```

- Press (▼) or (▲) to select between SINGLE, COAXIAL D14 and COAXIAL D22.
  Choose **SINGLE** and press (↵) to confirm.

```
AKS 4100
PROBE  LENGTH
05000 mm
```

- Press (▶) to change the PROBE LENGTH.
  Press (▶) to change the position of the cursor.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

```
AKS 4100
SCALE 4 mA
04946 mm
```

- Press (▶) to change of SCALE 4 mA.
  Press (▶) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

```
AKS 4100
SCALE 20 mA
00070 mm
```

- Press (▶) to change of SCALE 20 mA.
  Press (▶) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

```
AKS 4100
QUICK SETUP
COMPLETED IN  8
```

- Wait for QUICK SETUP to complete 8-second timeout

```
AKS 4100
1.0.0
QUICK SETUP
```

- Press (↵) to confirm.

```
AKS 4100
1.0.0
STORE NO
```

- Press (▼) or (▲) to select either STORE NO or STORE YES.
  Press (↵) to confirm.

  Default screen appears:

```
AKS 4100
DISTANCE
5000 mm
```

Quick Setup completed

You have the possibility of checking your settings by pressing (▶) twice.

```
AKS 4100
SINGLE CABLE        5000 mm
(0%) 4 mA           4877 mm
(100%) 20 mA         120 mm
```

Press (↵) (▲) (↵) to return to default screen.

How to force mA output (all values below are only examples)

Default screen

```
AKS 4100
DISTANCE
5000 mm
```

- Press (▶)

```
AKS 4100
1.0.0
QUICK SETUP
```

- Press (▲)

```
AKS 4100
2.0.0
SUPERVISOR
```

- Press (▶)

```
AKS 4100
2.0.0
_ _ _ _ _ _
```

Enter password:
(▶) (↵) (▼) (▲) (▶) (↵)

```
AKS 4100
2.1.0
INFORMATION
```

- Press (▲)

```
AKS 4100
2.2.0
TESTS
```

- Press (▶)

```
AKS 4100
2.2.1
SET  OUTPUT
```

- Press (▶)

```
AKS 4100
SET  OUTPUT
3.5 mA
```

- Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

```
AKS 4100
SET  OUTPUT
8 mA
```

- Press (↵) 4 times to return to default screen.

  Default screen appears:

```
AKS 4100
DISTANCE
5000 mm
```

Force mA completed and disabled

Optional Procedure
If the temperature condition in the stand pipe is known, a constant (dielectric constant of the refrigerant gas) **can be** entered (parameter 2.5.3 GAS EPS.R), in order to obtain lower Top and Bottom Dead Zone values **(see fig. 5)**.

How to enter dielectric constant of refrigerant gas (all values below are only examples)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press (›)

AKS 4100
1.0.0
QUICK SETUP

- Press (▲)

AKS 4100
2.0.0
SUPERVISOR

- Press (›)

AKS 4100
2.0.0
____

Enter password:
(›) (↵) (▼) (▲) (›) (↵)

AKS 4100
2.1.0
INFORMATION

- Press (▲) 4 times.

AKS 4100
2.5.0
APLICATION

- Press (›)

AKS 4100
2.5.1
TRACING VEL.

- Press (▲) 2 times.

AKS 4100
2.5.3
GAS EPS. R

- Press (›) to check/change GAS EPS.R. (Select the correct value from the tables below and on page 8)
Press (›) to change cursor-position.
Press (▼) to decrease the value or (▲) to increase the value.

AKS 4100
GAS EPS. R
1.066

- Press (↵) to confirm.

AKS 4100
2.5.3
GAS EPS. R

- Press (↵) 3 times.

AKS 4100
1.0.0
STORE NO

- Press (▼) or (▲) to select between STORE NO or STORE YES.
Select STORE YES by pressing (↵)

Default screen appears:

AKS 4100
DISTANCE
5000 mm

Entering the dielectric constant of refrigerant gas completed

Saturated vapour dielectric constant (default value: 1.066)

R717 (NH_3)

Temperature range:
–60°C → +50°C (–76°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –42	–76 → –43	1.00
–41 → –18	42 → 0	1.01
–17 → –5	1 → 23	1.02
–4 → 4	24 → 39	1.03
5 → 12	40 → 54	1.04
13 → 18	55 → 64	1.05
19 → 24	65 → 75	1.06
25 → 28	76 → 82	1.07
29 → 33	83 → 91	1.08
34 → 37	92 → 99	1.09
38 → 40	100 → 104	1.10
41 → 44	105 → 111	1.11
45 → 47	112 → 117	1.12
48 → 50	118 → 122	1.13

R744 (CO_2)

Temperature range:
–56°C → +15°C (–69°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–56.0 → –42.0	–69 → –43	1.01
–41.0 → –28.0	–42 → –18	1.02
–27.0 → –17.0	–17 → 2	1.03
–16.0 → –9.0	3 → 16	1.04
–8.0 → –3.0	17 → 27	1.05
–2.0 → 2	28 → 36	1.06
3 → 7	37 → 45	1.07
8 → 11	46 → 52	1.08
12 → 14	53 → 58	1.09
15	59	1.10

R22

Temperature range:
–60°C → +48°C (–76°F → +118°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –50	–76 → –58	1.00
–49 → –25	57 → –13	1.01
–24 → –10	–12 → 14	1.02
–9 → 0	15 → 32	1.03
1 → 8	33 → 46	1.04
9 → 15	47 → 59	1.05
16 → 21	60 → 70	1.06
22 → 26	71 → 79	1.07
27 → 31	80 → 88	1.08
32 → 35	89 → 95	1.09
36 → 39	96 → 102	1.10
40 → 42	103 → 108	1.11
43 → 45	109 → 113	1.12
46 → 48	114 → 118	1.13

R134a

Temperature range:
–60°C → +50°C (–76°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –42	–76 → –43	1.00
–41 → –18	–42 → –0	1.01
–17 → –4	1 → 25	1.02
–3 → 5	26 → 41	1.03
6 → 13	42 → 56	1.04
14 → 20	57 → 68	1.05
21 → 25	69 → 77	1.06
26 → 30	78 → 86	1.07
31 → 34	87 → 94	1.08
35 → 38	95 → 100	1.09
39 → 42	101 → 108	1.10
43 → 45	109 → 113	1.11
46 → 48	114 → 119	1.12
49 → 50	120 → 122	1.13

Saturated vapour dielectric constant

R410A

Temperature range:
–65°C → +15°C (–85°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–65 → –47	–85 → –52	1.01
–46 → –35	–51 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –13	–1 → 9	1.05
–12 → –8	10 → 18	1.06
–7 → –4	19 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 4	33 → 40	1.09
5 → 7	41 → 45	1.10
8 → 10	46 → 50	1.11
11 → 12	51 → 54	1.12
13 → 15	55 → 59	1.13

R507

Temperature range:
–60°C → +15°C (–76°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –48	–76 → –54	1.01
–47 → –36	–53 → –32	1.02
–35 → –28	–31 → –18	1.03
–27 → –21	–17 → –6	1.04
–20 → –15	–17 → –5	1.05
–14 → –10	–4 → 14	1.06
–9 → –6	13 → 22	1.07
–5 → –2	23 → 29	1.08
–1 → 2	30 → 36	1.09
3 → 5	37 → 41	1.10
6 → 8	42 → 47	1.11
9 → 11	48 → 52	1.12
12 → 13	53 → 56	1.13
14 → 15	57 → 59	1.14

R404A

Temperature range:
–60°C → +15°C (–76°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –47	–76 → –52	1.01
–46 → –35	–51 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –14	–1 → 7	1.05
–13 → –9	8 → 16	1.06
–8 → –4	17 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 3	33 → 38	1.09
4 → 6	39 → 43	1.10
7 → 9	44 → 49	1.11
10 → 12	50 → 54	1.12
13 → 15	55 → 59	1.13

How to change the language setting (Default: English)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ▶

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ▶

AKS 4100
2.0.0
____

Enter password:
▶ ↵ ▼ ▲ ▶ ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 6 times

AKS 4100
2.7.0
DISPLAY

- Press ▶

AKS 4100
2.7.1
LANGUAGE

- Press ▶

AKS 4100
LANGUAGE
ENGLISH

- Press ▼ or ▲ to see the language possibilities
  Press ↵ to confirm.

AKS 4100
2.7.1
LANGUAGE

- Press ↵ 3 times

AKS 4100
2.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵
  Default screen appears:

AKS 4100
DISTANCE
5000 mm

Language setup completed

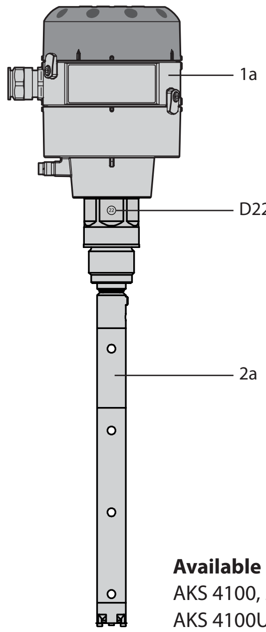
Reset to factory setting

- Go to SUPERVISOR menu (see page 7).
- Go to parameter 2.9.4 Reset Factory.
- Select RESET FACTORY YES
- Press ↵ 3 times to return to default screen.

Factory reset completed.

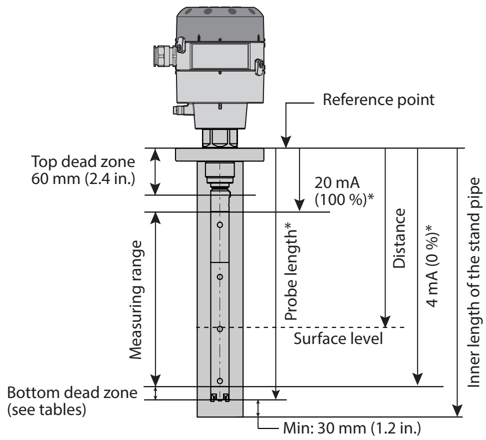
Installation guide

Liquid level sensor - Coaxial D22 version
Type AKS 4100 / AKS 4100U



Available lengths:
AKS 4100, 280 mm
AKS 4100U, 11.0 in.

1



* Values to be entered into HMI Quick Setup menu and recorded on the setting label.
Stick the setting label onto the Signal Converter either inside or outside.

2

AKS 4100
Factory setting

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	280	11.0	48	1.9

Improved Bottom dead zone values after the adjustment of dielectric constant

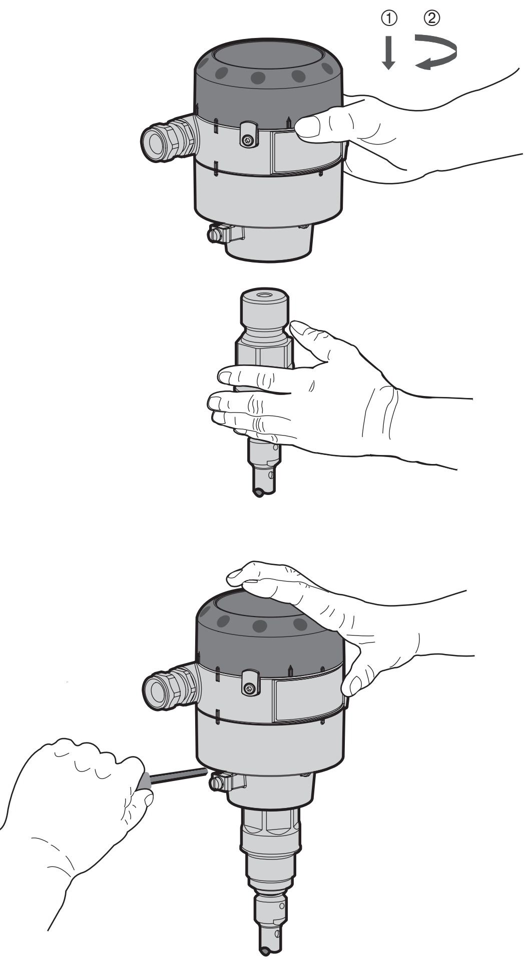
Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	280	11.0	40	1.6

AKS 4100U
Factory setting

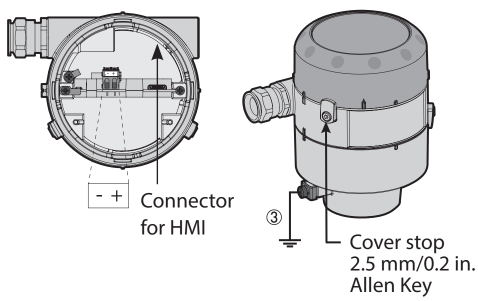
Refrigerant	Probe Length [in.]	Probe Length [mm]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	11.0	280	1.9	48

Improved Bottom dead zone values after the adjustment of dielectric constant

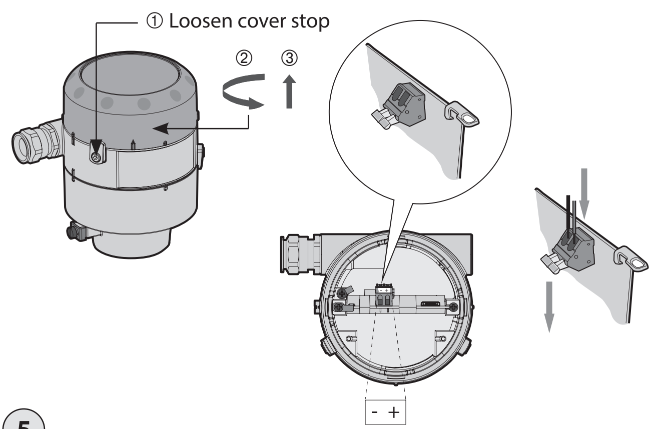
Refrigerant	Probe Length [in.]	Probe Length [mm]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	11.0	280	1.6	40



3



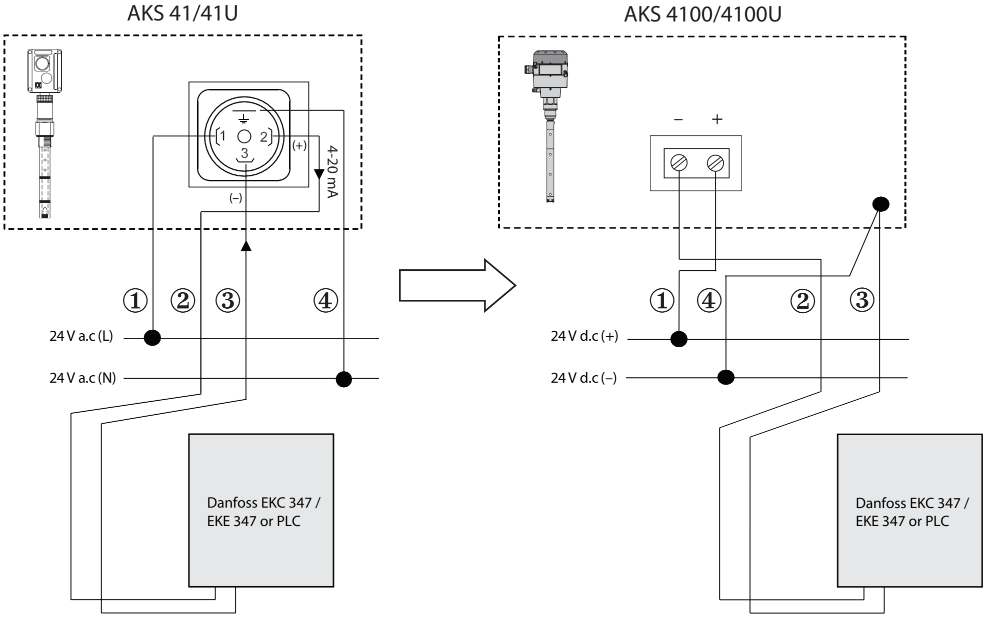
4



5

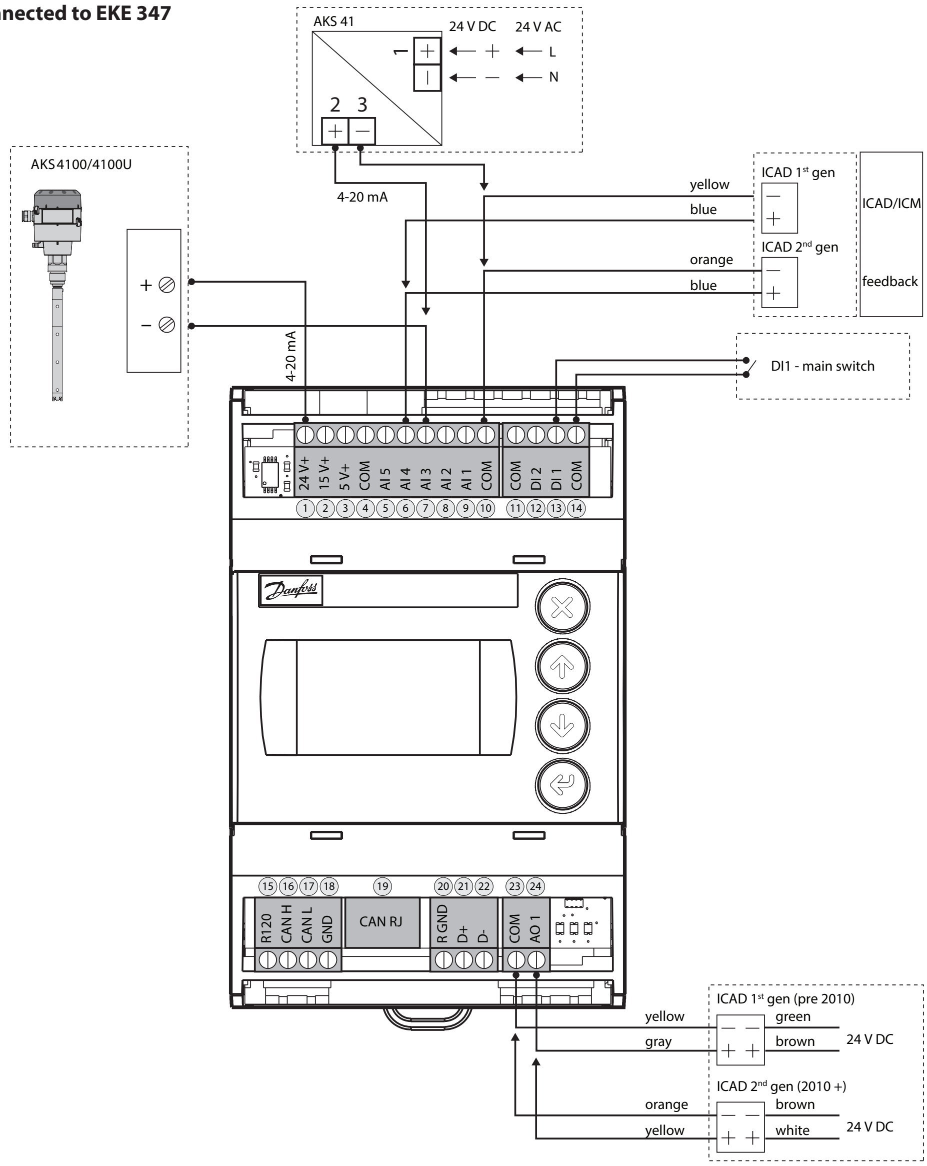
AKS 41/41U to AKS 4100/4100U

AKS 41/41U with a.c supply to AKS 4100/4100U with d.c supply



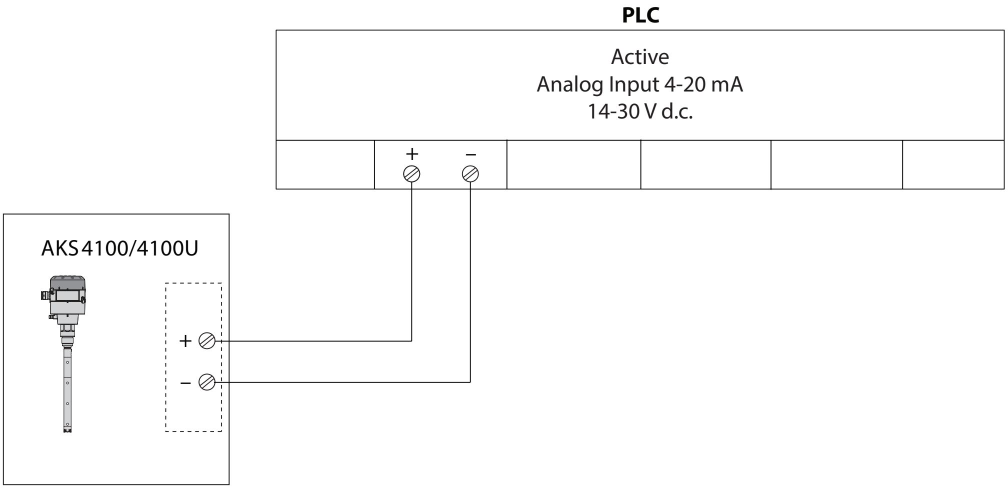
6

AKS 4100/4100U connected to EKE 347

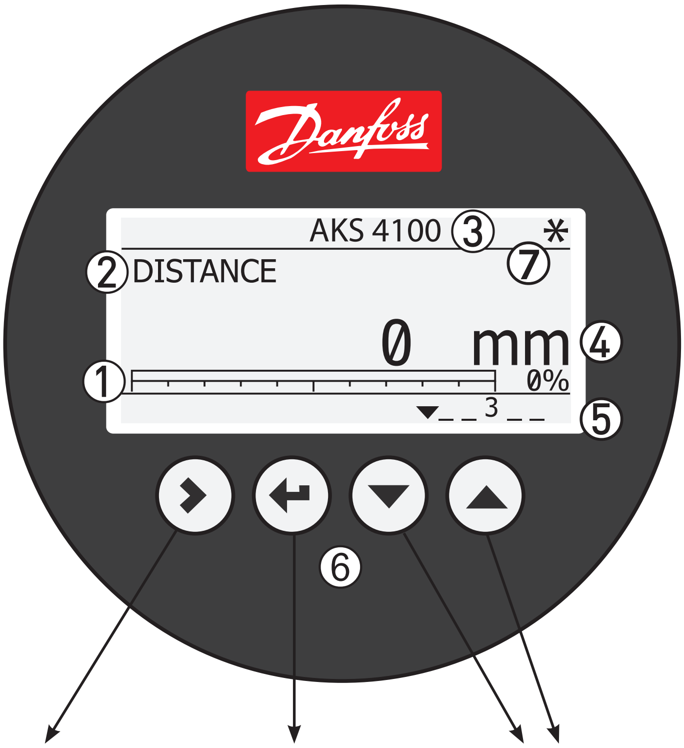


7

AKS 4100/4100U connected to PLC



8



Enter menu system
Enter QUICK SETUP

Unit change at distance/level readout:
m, cm, mm, in, ft

Change between:
Distance*
Level**
Output (%)***
Output (mA)****

① 4-20 mA output displayed as bar graph and in percentage [%]

② Measurement name (in this example, DISTANCE)

③ Device tag name

④ Measurement reading and unit

⑤ Device status (markers)
Marker 1, 2 and 3 (Error)
Hardware problem; the Signal Converter hardware is defective. Contact Danfoss.

Marker 4 and 5 (Notification)
Depending on the level, the marker is ON or OFF. Used for Danfoss service information only.

⑥ Keypad buttons

⑦ Flashing star indicating unit in operation.

* DISTANCE is a display option.
If the display is set to "DISTANCE" the displayed value will be the distance from the Reference point to the top surface of the liquid refrigerant (see fig. 2).

** LEVEL is display option.
If the display is set to "LEVEL" then the value displayed will be:
PROBE LENGTH (entered in QUICK SETUP) – DISTANCE (see fig. 2)

*** OUTPUT (%) is display option.
Will represent the level of refrigerant,in percent, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (0%), SCALE 20 mA (100%) (see fig. 2).

**** OUTPUT I (mA) is display option.
Will represent the level of refrigerant, in 4-20 milliampere, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (4 mA), SCALE 20 mA (20 mA) (see fig. 2).

9

ENGLISH

Please observe that AKS 4100/4100U is intended to always be installed in a standpipe (column/bypass/stilling well). A standpipe is commonly used when:

- Servicing the AKS 4100/4100U
- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.

AKS 4100/4100U Coaxial with or without HMI does not need any change of setting to operate.

Presetting:
4 mA : 230 mm (9.1 in.)
20 mA: 60 mm (2.4 in.)

Refrigerants

AKS 4100/4100U is designed to measure liquid level in R717(ammonia) applications.

Basic data

AKS 4100/4100U is a passive 2-wire 4-20 mA sensor that is loop powered.

Supply Voltage
14-30 V d.c. min/max. value for a max. output of 22 mA at the terminal

Load
RL [Ω] ≤ ((Uext -14 V)/20 mA).
– Default (Error output set to 3.6 mA)
RL [Ω] ≤ ((Uext -14 V)/22 mA).
– (Error output set to 22 mA)

Cable gland
AKS 4100 PG 13, M20×1.5 ; (cable diameter: 6-8 mm (0.24-0.31in.)
AKS 4100U ½ in. NPT

Terminals (spring loaded)
0.5-1.5 mm² (~20-15 AWG)

Enclosure
IP 67 (~NEMA type 4X)

Refrigerant temperature
–60°C/100°C (–76°F/212°F)

Refrigerants
The listed refrigerants are qualified and approved by Danfoss:
R717 / NH3: –40°C / +50°C (–40°F / +122°F)

Ambient temperature
–40°C / +80°C (–40°F / +175°F)
For HMI : –20°C / +60°C (–4°F / +140°F)

Process pressure
–1 barg / 100 barg (–14.5 psig / 1450 psig)

Mechanical process connection 280 mm (11 in.). 8 mm (0.3 in.) inner rod.
AKS 4100 G1 inch pipe thread. Aluminium gasket included
AKS 4100U ¾ in. NPT

(Further details in the data sheet)

Mechanical Installation

Preparations prior to Mechanical Installation
Disassemble the Signal Converter from the Mechanical process connection (use 5´mm hex key, **see fig. 3**). Fit the red protection cover on top of the Mechanical process connection to protect it againt any moisture or dirt paticles.

Content supplied (fig. 1)
1a: Signal Converter (with or without HMI)
2a: Mechanical process connection

If factory setting needs adjustment
Probe length, scale 4 mA and 20 mA for HMI Quick Setup.

Probe length: 280 mm (11 in.)

Scale 4 mA: (for max. measuring range)
= Probe Length
– Bottom dead zone **(see fig. 2)**

Scale 20 mA:(for max. measuring range:)
= Top dead zone **(see fig. 2)**

Example (AKS 4100)

Given conditions:
Probe length: 280 mm
Refrigerant: NH_3, –10°C
The gas constant Er is always adjusted from the Quick Setup

Probe length:
= 280 mm
SCALE 4 mA setting for max. measuring range:
= Probe length (280 mm)
– Bottom dead zone **(see fig. 2)** (40 mm) = **240 mm (9.4 in.)**

SCALE 20 mA Setting for Max. Measuring range:
= Top dead zone **(see fig. 2)**
= **60 mm (2.4 in.)**

From page 6:
Dielectric constant of refrigerant gas parameter 2.5.3 GAS EPS.R
= **1.02**

How to mount the AKS 4100/4100U Converter (see fig 3)

1. Using a 5-mm hex key, loosen the setscrew in the Signal Converter.
2. Slide the Signal Converter down until it rests on the mechanical process connection.
3. Turn the Signal Converter to the wanted position and tighten the set screw with a 5 mm Hexagon key

Electrical installation/connection

Output terminals (fig. 4 and 5):
1. Current output –
2. Current output +
3. Grounding terminal

Electrical installation procedure
1. Use a 2.5 mm Allen wrench to loosen the cover stop.
2. Remove the terminal compartment cover from the housing.
3. Do not disconnect the wire from the terminal compartment cover. Put the terminal compartment cover adjacent to the housing.
4. Connect the wires to the device. Tighten the cable entry glands.
5. Attach the terminal compartment cover to the housing.
6. Use a 2.5 mm Allen wrench to tighten the cover stop.

Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Start up:
- Connect the converter to the power supply.
- Energize the converter.

Devices with the HMI display option only:
After 10 seconds the screen will display "Starting up". After 20 seconds the screen will display the software version numbers. After 30 seconds the default screen **(fig. 9)** will appear.

Precautions when changing from AKS 41/41U to the AKS 4100/4100U:

Please note:
The AKS 41/41U can be used with a.c. and d.c. supply, but the AKS 4100/4100U can only be used with a d.c. supply. **Follow the instructions in fig. 6.**

Connecting to controller or PLC
Follow the instructions in **fig. 7 or 8**.

Quick Setup →

Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Quick Setup (all values below are only examples)

When used in NH_3

- Connect the device to the power supply (see the section "Electrical installation/ connection").
- Press (›) 3 times.

AKS 4100
QUICK SETUP ?
YES NO

- Press (›)

AKS 4100
PROBE TYPE
SINGLE CABLE

- Press (▼) or (▲) to select between SINGLE, COAXIAL D14 and COAXIAL D22. Choose **COAXIAL D22** and press (↵) to confirm.

AKS 4100
LIQUID CO2 ?
YES NO

- Press (▲) (NO) to confirm

AKS 4100
PROBE LENGTH
280 mm

- Press (›) to change the PROBE LENGTH.
  Press (›) to change the position of the cursor.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

AKS 4100
SCALE 4 mA
230 mm

- Press (›) to change of SCALE 4 mA.
  Press (›) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

AKS 4100
SCALE 20 mA
60 mm

- Press (›) to change of SCALE 20 mA.
  Press (›) to change the cursor position.
  Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

AKS 4100
QUICK SETUP
COMPLETED IN 8

- Wait for QUICK SETUP to complete. Count down from 8 sec.

AKS 4100
1.0.0
QUICK SETUP

- Press (↵) to confirm.

AKS 4100
1.0.0
STORE NO

- Press (▼) or (▲) to select between STORE NO or STORE YES.
  Press (↵) to confirm.

  Default screen appears:

AKS 4100
DISTANCE
250mm

Quick Setup completed

How to force mA output (all values below are only examples)

Default screen

AKS 4100
DISTANCE
250 mm

- Press (›)

AKS 4100
1.0.0
QUICK SETUP

- Press (▲)

AKS 4100
2.0.0
SUPERVISOR

- Press (›)

AKS 4100
2.0.0
____

Enter password:
(›) (↵) (▼) (▲) (›) (↵)

AKS 4100
2.1.0
INFORMATION

- Press (▲)

AKS 4100
2.2.0
TESTS

- Press (›)

AKS 4100
2.2.1
SET OUTPUT

- Press (›)

AKS 4100
SET OUTPUT
3.5 mA

- Press (▼) to decrease the value or (▲) to increase the value.
  Press (↵) to confirm.

AKS 4100
SET OUTPUT
8 mA

- Press (↵) 4 times to return to default screen.

  Default screen appears:

AKS 4100
DISTANCE
250 mm

Force mA completed and disabled

Optional Procedure
If the temperature condition in the stand pipe is known, a constant (dielectric constant of the refrigerant gas) **can be** entered (parameter 2.5.3 GAS EPS.R), in order to obtain lower Top and Bottom Dead Zone values **(see fig. 2)**.

How to enter dielectric constant of refrigerant gas (all values below are only examples)

Default screen

AKS 4100
DISTANCE
250 mm

- Press ▶

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ▶

AKS 4100
2.0.0
____

Enter password:
▶ ↵ ▼ ▲ ▶ ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 4 times.

AKS 4100
2.5.0
APLICATION

- Press ▶

AKS 4100
2.5.1
TRACING VEL.

- Press ▲ 2 times.

AKS 4100
2.5.3
GAS EPS. R

- Press ▶ to check/change GAS EPS.R. (Select the correct value from the table below)
  Press ▶ to change cursor-position.
  Press ▼ to decrease the value or ▲ to increase the value.

AKS 4100
GAS EPS. R
1.066

- Press ↵ to confirm.

AKS 4100
2.5.3
GAS EPS. R

- Press ↵ 3 times.

AKS 4100
1.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵

Default screen appears:

AKS 4100
DISTANCE
250 mm

Entering the dielectric constant of refrigerant gas completed

Saturated vapour dielectric constant (default value: 1.066)

R717 (NH_3)

Temperature range:
–60°C → +50°C (–76°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –42	–76 → –43	1.00
–41 → –18	42 → 0	1.01
–17 → –5	1 → 23	1.02
–4 → 4	24 → 39	1.03
5 → 12	40 → 54	1.04
13 → 18	55 → 64	1.05
19 → 24	65 → 75	1.06
25 → 28	76 → 82	1.07
29 → 33	83 → 91	1.08
34 → 37	92 → 99	1.09
38 → 40	100 → 104	1.10
41 → 44	105 → 111	1.11
45 → 47	112 → 117	1.12
48 → 50	118 → 122	1.13

How to change the language setting (Default: English)

Default screen

AKS 4100
DISTANCE
250 mm

- Press ▶

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ▶

AKS 4100
2.0.0
____

Enter password:
▶ ↵ ▼ ▲ ▶ ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 6 times

AKS 4100
2.7.0
DISPLAY

- Press ▶

AKS 4100
2.7.1
LANGUAGE

- Press ▶

AKS 4100
LANGUAGE
ENGLISH

- Press ▼ or ▲ to see the language possibilities
  Press ↵ to confirm.

AKS 4100
2.7.1
LANGUAGE

- Press ↵ 3 times

AKS 4100
2.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵
  Default screen appears:

AKS 4100
DISTANCE
250 mm

Language setup completed

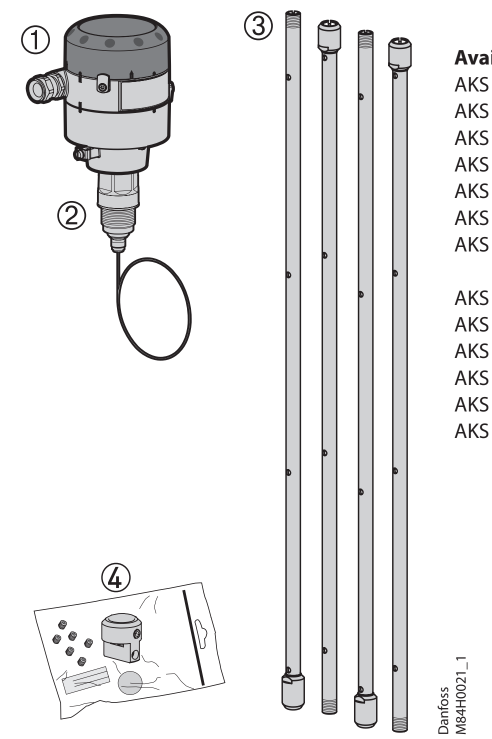
Reset to factory setting

- Go to SUPERVISOR menu (see page 5).
- Go to parameter 2.9.4 Reset Factory.
- Select RESET FACTORY YES
- Press ↵ 3 times to return to default screen.

Factory reset completed.

Instruction

Type AKS 4100/4100U Coaxial D14 version



Available lengths:
AKS 4100, 500 mm
AKS 4100, 800 mm
AKS 4100, 1000 mm
AKS 4100, 1200 mm
AKS 4100, 1500 mm
AKS 4100, 1700 mm
AKS 4100, 2200 mm

AKS 4100U, 19.2 in.
AKS 4100U, 30 in.
AKS 4100U, 45 in.
AKS 4100U, 55 in.
AKS 4100U, 65 in.
AKS 4100U, 85 in.

Fig. 1

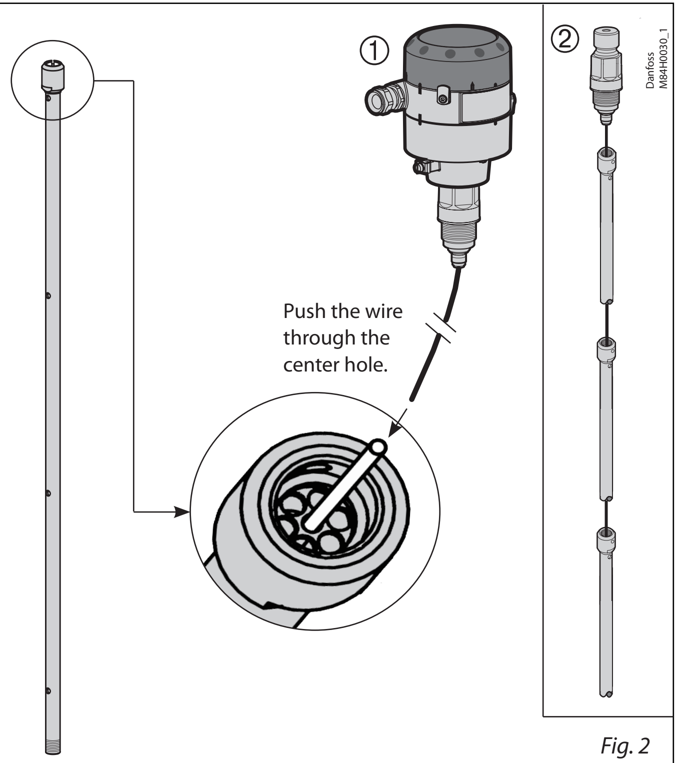


Fig. 2

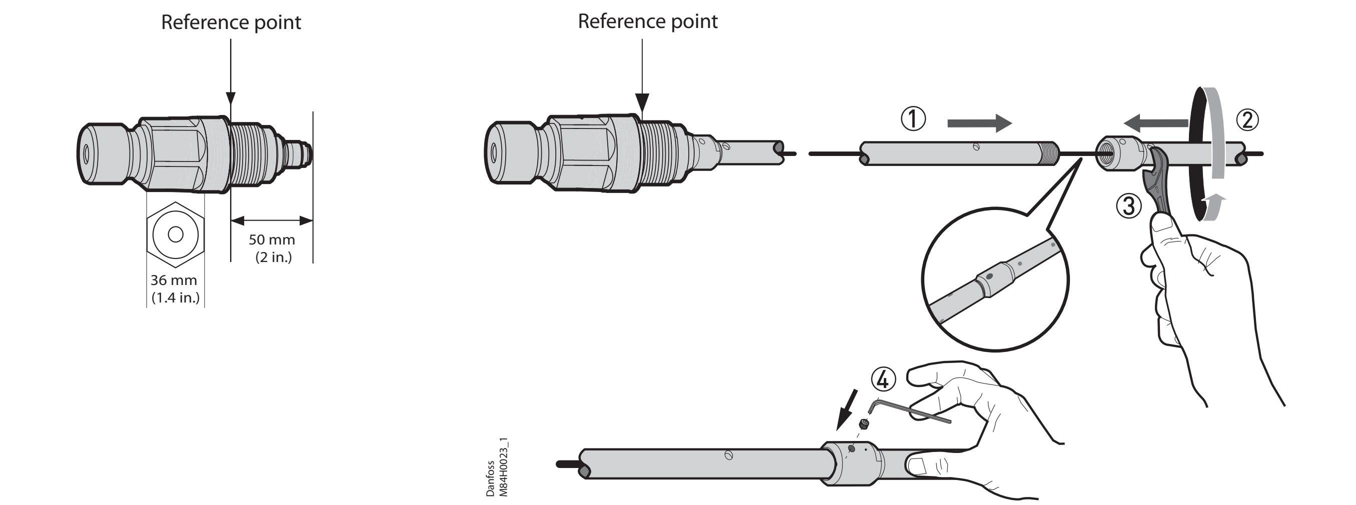


Fig. 3

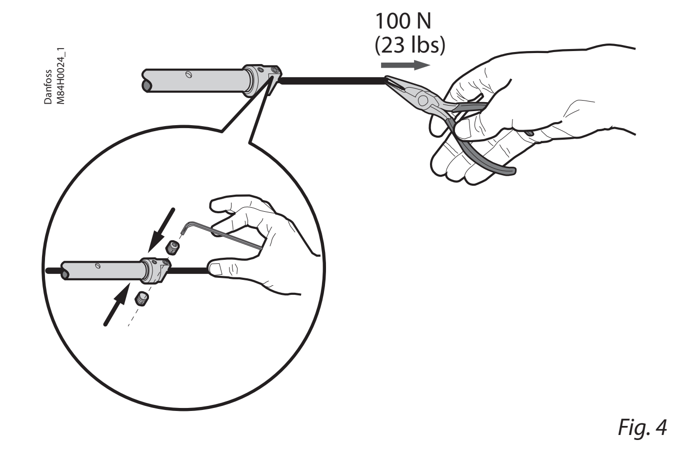


Fig. 4

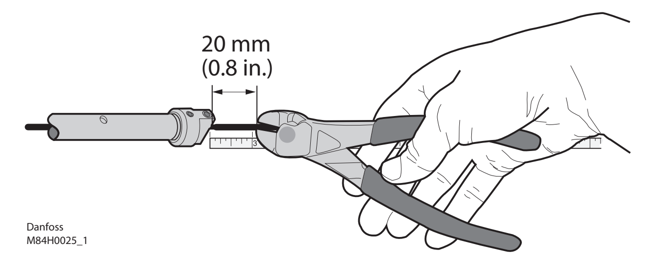
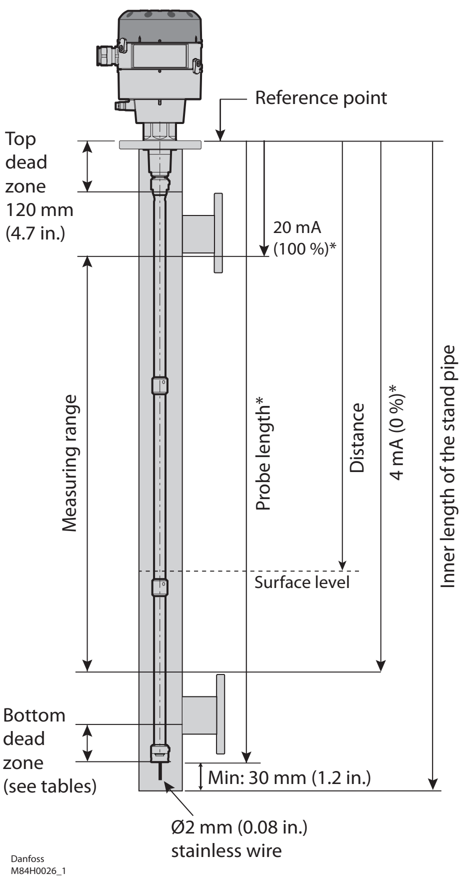


Fig. 5



* Values to be entered into HMI Quick Setup menu and recorded on the setting label. Stick the setting label onto the Signal Converter either inside or outside.

Fig. 6

Please note: It is mandatory to input dielectric constant for CO_2 applications.

AKS 4100

Dielectric Constant εr always set during Quick Setup

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
CO_2	500	19.7	170	6.7
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

Factory setting

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	500	19.7	95	3.7
	800	31.5	104	4.1
	1000	39.4	110	4.3
	1200	47.2	116	4.6
	1500	59.1	125	4.9
	1700	66.9	131	5.2
	2200	86.6	146	5.8

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
Ammonia	500	19.7	80	3.2
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

Factory setting

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
HCFC,HFC	500	19.7	115	4.5
	800	31.5	124	4.9
	1000	39.4	130	5.1
	1200	47.2	136	5.4
	1500	59.1	145	5.7
	1700	66.9	151	5.9
	2200	86.6	166	6.5

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [mm]	Probe Length [in.]	Bottom Dead Zone [mm]	Bottom Dead Zone [in.]
HCFC,HFC	500	19.7	100	3.9
	800	31.5		
	1000	39.4		
	1200	47.2		
	1500	59.1		
	1700	66.9		
	2200	86.6		

AKS 4100U

Dielectric Constant εr always set during Quick Setup

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
CO_2	19.2	6.7	170
	30		
	45		
	55		
	65		
	85		

Factory setting

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.73	95
	30	4.05	103
	45	4.50	114
	55	4.80	122
	65	5.10	130
	85	5.70	145

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
Ammonia	19.2	3.1	80
	30		
	45		
	55		
	65		
	85		

Factory setting

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	4.52	115
	30	4.84	123
	45	5.29	134
	55	5.59	142
	65	5.89	150
	85	6.49	165

Improved Bottom dead zone values after the adjustment of dielectric constant

Refrigerant	Probe Length [in.]	Bottom Dead Zone [in.]	Bottom Dead Zone [mm]
HCFC,HFC	19.2	3.94	100
	30		
	45		
	55		
	65		
	85		

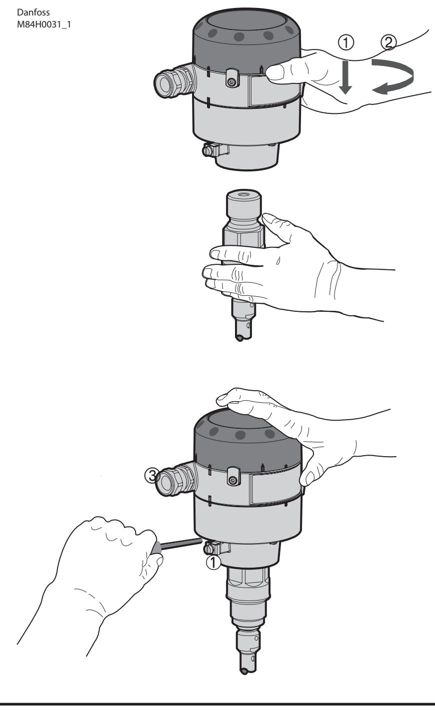


Fig. 7

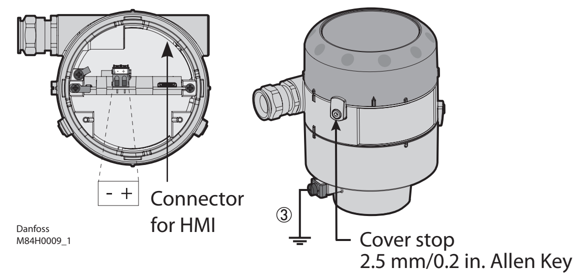


Fig. 8

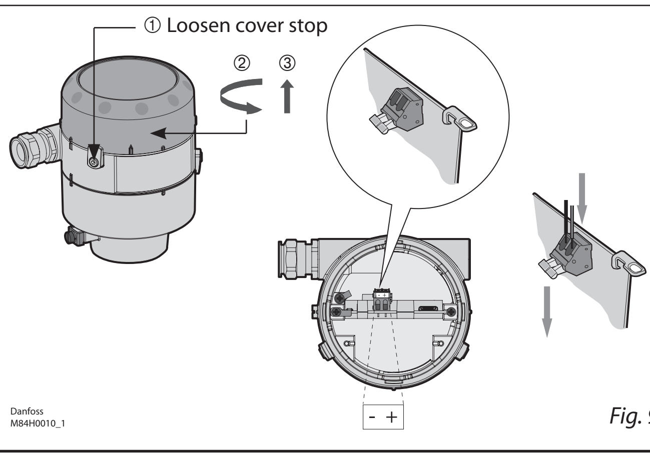


Fig. 9

AKS 41/41U to AKS 4100/4100U

AKS 41/41U with a.c supply to AKS 4100/4100U with d.c supply

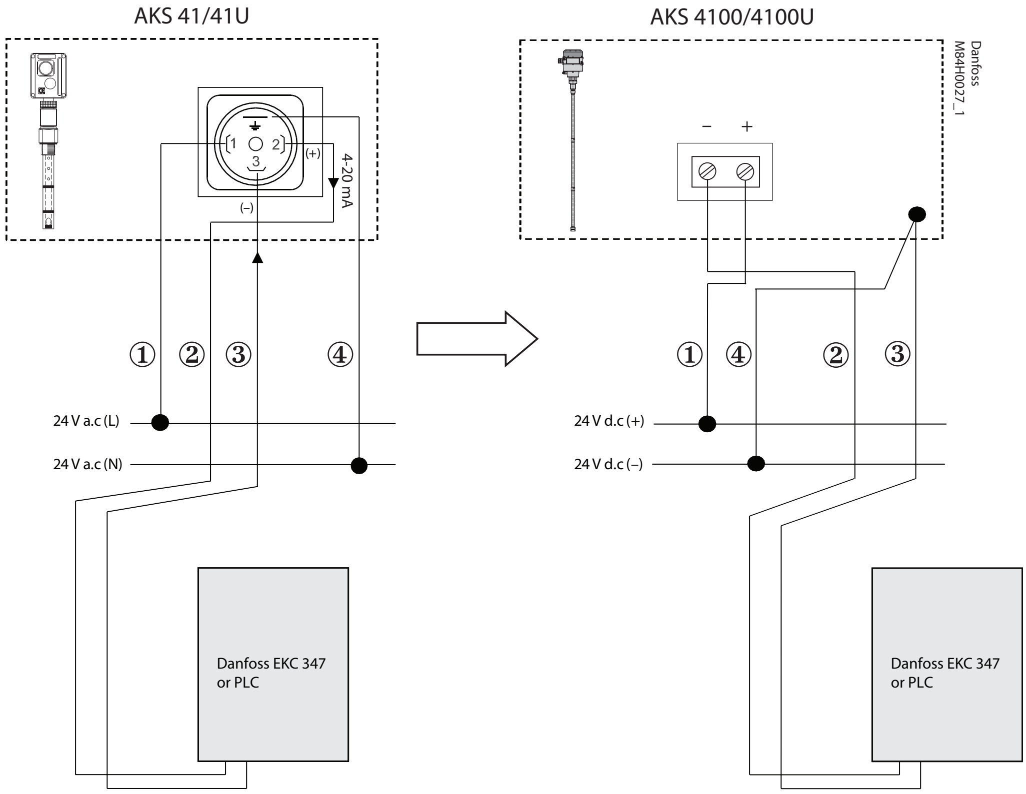


Fig. 10

AKS 4100/4100U connected to EKC 347

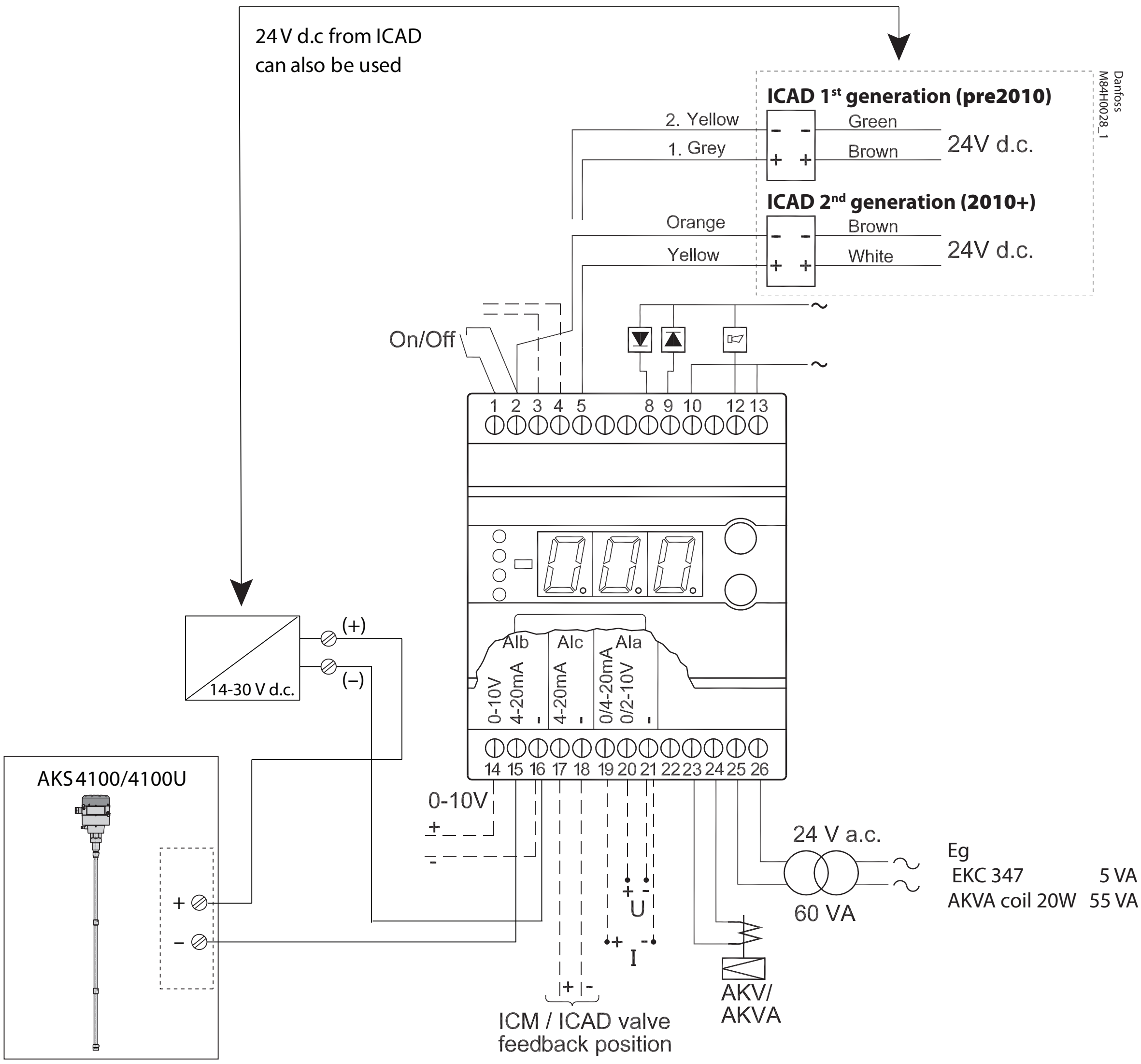


Fig. 11

AKS 4100/4100U connected to PLC

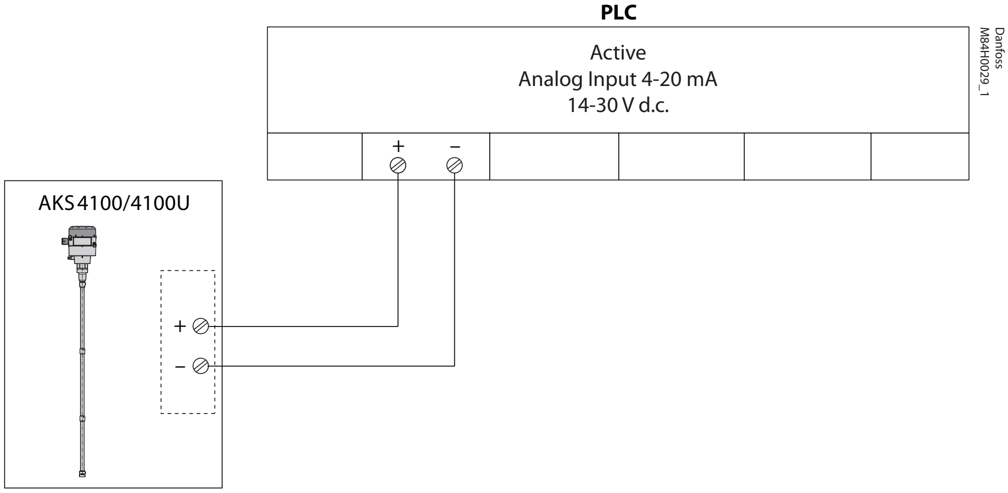


Fig. 12

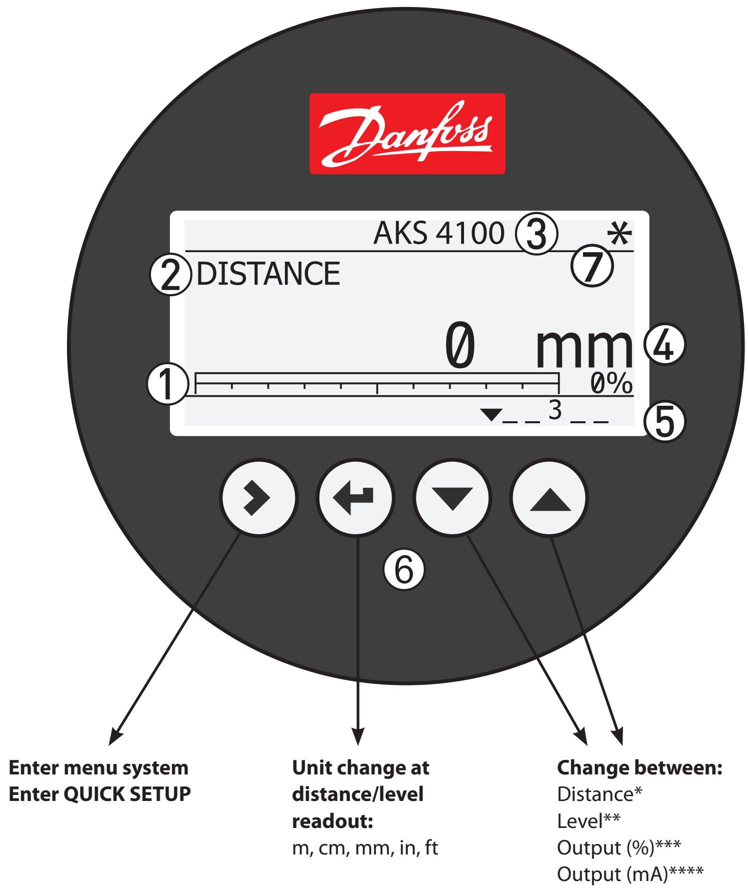


Fig. 13

① 4-20 mA output displayed as bar graph and in percentage [%]

② Measurement name (in this example, DISTANCE)

③ Device tag name

④ Measurement reading and unit

⑤ Device status (markers)
Marker 1, 2 and 3 (Error)
Hardware problem; the Signal Converter hardware is defective. Contact Danfoss.

Marker 4 and 5 (Notification)
Depending on the level, the marker is ON or OFF. Used for Danfoss service information only.

⑥ Keypad buttons

⑦ Flashing star indicating unit in operation.

* DISTANCE is a display option.
If the display is set to "DISTANCE" the displayed value will be the distance from the Reference point to the top surface of the liquid refrigerant (see fig. 6).

** LEVEL is display option.
If the display is set to "LEVEL" then the value displayed will be:
PROBE LENGTH (entered in QUICK SETUP) – DISTANCE (see fig. 6)

*** OUTPUT (%) is display option.
Will represent the level of refrigerant,in percent, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (0%), SCALE 20 mA (100%) (see fig. 6).

**** OUTPUT I (mA) is display option.
Will represent the level of refrigerant, in 4-20 milliampere, scaled (entered in QUICK SETUP) according to: SCALE 4 mA (4 mA), SCALE 20 mA (20 mA) (see fig. 6).

English

Please observe that AKS 4100/4100U is intended to always be* installed in a standpipe (column/bypass/ stilling well). A standpipe is commonly used when:

- Servicing the AKS 4100/4100U
- There is highly conductive foam in the tank.
- The liquid is very turbulent or agitated.

AKS 4100/4100U Coaxial with or without HMI does not need any change of setting to operate, unless used in CO_2.

Presetting:
4 mA : Probe length - 100 mm (4 in.)
20 mA: 120 mm (5 in.)

Refrigerants

AKS 4100/4100U is designed specifically to measure liquid level in the most commonly used refrigerants, including R744 (CO_2), R717(ammonia), HCFC, HFC and non corrosive gases/liquids.

Basic data

AKS 4100/4100U is a passive 2-wire 4-20 mA sensor that is loop powered.

Supply Voltage
14-30 V d.c. min/max. value for a max. output of 22 mA at the terminal

Load
RL [Ω] ≤ ((Uext -14 V)/20 mA).
– Default (Error output set to 3.6 mA)
RL [Ω] ≤ ((Uext -14 V)/22 mA).
– (Error output set to 22 mA)

Cable gland
AKS 4100 PG 13, M20×1.5 ; (cable diameter: 6-8 mm (0.24-0.31in.)
AKS 4100U ½ in. NPT

Terminals (spring loaded)
0.5-1.5 mm^2 (~20-15 AWG)

Enclosure
IP 67 (~NEMA type 4X)

Refrigerant temperature
–60°C/100°C (–76°F/212°F)

Refrigerants
The listed refrigerants are qualified and approved by Danfoss:
R717 / NH3: –40°C / +50°C (–40°F / +122°F)
R744 / CO2: –50°C / +15°C (–58°F / +59°F)

HCFC:
R22: –50°C / +48°C (–58°F / +118°F)

HFC:
R404A: –50°C/ +15°C (–58°F / +59°F)
R410A: –50°C /+15°C (–58°F / +59°F)
R134A –40°C /+50°C (–40°F /+122°F)

Ambient temperature
–40°C / +80°C (–40°F / +175°F)
For HMI : –20°C / +60°C (–4°F / +140°F)

Process pressure
–1 barg / 100 barg (–14.5 psig / 1450 psig)

Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless cable:
AKS 4100 G1 inch pipe thread. Aluminium gasket included
AKS 4100U ¾ in. NPT

(Further details in the Technical Brochure)

Mechanical Installation

Preparations prior to Mechanical Installation
Disassemble the Signal Converter from the Mechanical process connection (use 5´mm hex key, **see fig. 7**). Fit the red protection cover on top of the Mechanical process connection to protect it againt any moisture or dirt paticles.

Content supplied (fig 1)
① Signal Converter (with or without HMI)
② Mechanical process connection with 5 m (197 in.) Ø2 mm (0.08 in.) stainless wire
③ Tube(s)
④ Bag with:
End Connector (incl. 3 mm set screws.)
3 mm set crews (1 set screw pr. tube)
Red cover to protect Mechanical process connection ②, before Signal converter is mounted
Setting label.

Assembly of the segmented coaxial probe

Please observe that the stainless steel wire is not permanently creased or kinked.

1. Take the end of the stainless wire and feed it through the center hole of the plastic spacer located at the top of each tube **(see fig. 2)**. Feed the entire length of the stainless wire through the tube and out at the bottom. If more than one tube; repeat the steps.
2. Assemble the segments of tube ① and ② **(see fig. 3)**. Use a 17 mm open-end wrench to tighten the assembled parts.
3. If more than one tube; repeat the steps **(see fig. 3)**.
4. Prior to assemble, disassemble signal converter and mechanical process connection, and fit red protection cap at mechanical process connection. Thread the fully assembled tube onto the mechanical process connection ②.
5. Lock each tube by tightening the set screw ④ with a 3 mm hex key **(see fig. 3)**.
6. Pull the stainless wire through the end connector **(see fig.4)**.
7. Attach the end connector to the bottom of the fully assembled tube. Tighten the set screw with a 3 mm hex key **(see fig. 4)**.
8. Pull the end of the stainless steel wire extending from the end connector with pliers **(see fig. 4)** to ensure that the tension in the signal cable is correct. Tighten the 2 set screws with a 3 mm hex key to lock the stainless wire.
9. Cut the stainless wire about 20 mm (0.8 in.) below the end connector **(see fig. 5)**.
10. Measure the probe length (without the signal converter) before fitting the assembled probe in the standpipe **(see fig. 6)**. Use a torque wrench to tighten the mechanical process connection **(fig. 1, item 2)** to 120 Nm (89 lb/ft).

If factory setting needs adjustment
Probe length, scale 4 mA and 20 mA for HMI Quick Setup.

Probe length:
See probe length on Danfoss product label or measure probe length **(see fig. 6)**.

Scale 4 mA: (for max. measuring range)
= Probe Length
– Bottom dead zone **(see fig. 6)**

Scale 20 mA:(for max. measuring range:)
= Top dead zone **(see fig. 6)**

Example (AKS 4100)

Given conditions:
Probe length: 1200 mm
Refrigerant: CO_2, –35°C
The gas constant Er is always adjusted from the Quick Setup

Probe length:
= 1200 mm
SCALE 4 mA setting for max. measuring range:
= Probe length (1200 mm)
– Bottom dead zone **(see fig. 6)** (170 mm) = **1030 mm (40.9 in.)**

SCALE 20 mA Setting for Max. Measuring range:
= Top dead zone **(see fig. 6)**
= **120 mm (4.7 in.)**

From page 8:
Dielectric constant of refrigerant gas parameter 2.5.3 GAS EPS.R
= **1.02**

How to mount the AKS 4100/4100U Converter (see fig 7)

1. Using a 5-mm hex key, loosen the setscrew in the Signal Converter.
2. Slide the Signal Converter down until it rests on the mechanical process connection.
3. Turn the Signal Converter to the wanted position and tighten the set screw with a 5 mm Hexagon key

Electrical installation/connection

Output terminals (fig. 8 and 9):
1. Current output –
2. Current output +
3. Grounding terminal

Electrical installation procedure
1. Use a 2.5 mm Allen wrench to loosen the cover stop.
2. Remove the terminal compartment cover from the housing.
3. Do not disconnect the wire from the terminal compartment cover. Put the terminal compartment cover adjacent to the housing.
4. Connect the wires to the device. Tighten the cable entry glands.
5. Attach the terminal compartment cover to the housing.
6. Use a 2.5 mm Allen wrench to tighten the cover stop.

Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Start up:
- Connect the converter to the power supply.
- Energize the converter.

Devices with the HMI display option only:
After 10 seconds the screen will display "Starting up". After 20 seconds the screen will display the software version numbers. After 30 seconds the default screen **(fig. 13)** will appear.

Precautions when changing from AKS 41/41U to the AKS 4100/4100U:

Please note:
The AKS 41/41U can be used with a.c. and d.c. supply, but the AKS 4100/4100U can only be used with a d.c. supply. **Follow the instructions in fig. 10.**

Connecting to controller or PLC
Follow the instructions in **fig. 11 or 12**.

Note:
The current output will be set to 3.6 mA whenever the AKS 4100/4100 detects an error like Marker 1, 2 or 3 (see page 4).

Quick Setup →

Note:
The signal converter can be programmed with or without mechanical process connector assembled.

Quick Setup (all values below are only examples)

When CO_2 is used:

- Connect the device to the power supply (see the section "Electrical installation/ connection").
- Press ▶ 3 times.

```
AKS 4100
QUICK SETUP ?
YES          NO
```

- Press ▶

```
AKS 4100
PROBE TYPE
SINGLE CABLE
```

- Press ▼ or ▲ to select between SINGLE, COAXIAL D14 and COAXIAL D22. Choose **COAXIAL D14** and press ↵ to confirm.

```
AKS 4100
LIQUID CO2 ?
YES          NO
```

- Press ▶ (YES) to confirm

```
AKS 4100
GAS EPS R ?
001.000
```

- Press ▶ to change GAS EPS.R.
(Select the correct value from the tables on page 8)
Press ▶ to change cursor-position.
Press ▼ to decrease the value or ▲ to increase the value.
- Press ↵ to confirm.

```
AKS 4100
PROBE  LENGTH
05000 mm
```

- Press ▶ to change the PROBE LENGTH.
Press ▶ to change the position of the cursor.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
SCALE 4 mA
04946 mm
```

- Press ▶ to change of SCALE 4 mA.
Press ▶ to change the cursor position.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
SCALE 20 mA
00070 mm
```

- Press ▶ to change of SCALE 20 mA.
Press ▶ to change the cursor position.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
QUICK SETUP
COMPLETED IN  8
```

- Wait for QUICK SETUP to complete.
Count down from 8 sec.

```
AKS 4100
1.0.0
QUICK SETUP
```

- Press ↵ to confirm.

```
AKS 4100
1.0.0
STORE NO
```

- Press ▼ or ▲ to select between STORE NO or STORE YES.
Press ↵ to confirm.

Default screen appears:

```
AKS 4100
DISTANCE
5000 mm
```

Quick Setup completed

You have the possibility of checking your settings by pressing ▶ twice.

```
AKS 4100
COAXIAL D14          2200 mm
(0 %) 4 mA           1900 mm
(100 %) 20 mA          70 mm
```

Press ↵ ▲ ↵ to return to default screen.

For all other refrigerants:

- Connect the device to the power supply (see the section "Electrical installation/ connection").
- Press ▶ 3 times.

```
AKS 4100
QUICK SETUP ?
YES          NO
```

- Press ▶

```
AKS 4100
PROBE TYPE
SINGLE CABLE
```

- Press ▼ or ▲ to select between SINGLE, COAXIAL D14 and COAXIAL D22. Choose **COAXIAL D14** and press ↵ to confirm.

```
AKS 4100
LIQUID CO2 ?
YES          NO
```

- Press ▲ (NO) to confirm

```
AKS 4100
PROBE  LENGTH
05000 mm
```

- Press ▶ to change the PROBE LENGTH.
Press ▶ to change the position of the cursor.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
SCALE 4 mA
04946 mm
```

- Press ▶ to change of SCALE 4 mA.
Press ▶ to change the cursor position.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
SCALE 20 mA
00070 mm
```

- Press ▶ to change of SCALE 20 mA.
Press ▶ to change the cursor position.
Press ▼ to decrease the value or ▲ to increase the value.
Press ↵ to confirm.

```
AKS 4100
QUICK SETUP
COMPLETED IN  8
```

- Wait for QUICK SETUP to complete.
Count down from 8 sec.

```
AKS 4100
1.0.0
QUICK SETUP
```

- Press ↵ to confirm.

```
AKS 4100
1.0.0
STORE NO
```

- Press ▼ or ▲ to select between STORE NO or STORE YES.
Press ↵ to confirm.

Default screen appears:

```
AKS 4100
DISTANCE
5000 mm
```

Quick Setup completed

How to force mA output (all values below are only examples)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ►

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ►

AKS 4100
2.0.0
____

Enter password:
► ↵ ▼ ▲ ► ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲

AKS 4100
2.2.0
TESTS

- Press ►

AKS 4100
2.2.1
SET OUTPUT

- Press ►

AKS 4100
SET OUTPUT
3.5 mA

- Press ▼ to decrease the value or ▲ to increase the value.
  Press ↵ to confirm.

AKS 4100
SET OUTPUT
8 mA

- Press ↵ 4 times to return to default screen.

Default screen appears:

AKS 4100
DISTANCE
5000 mm

Force mA completed and disabled

Optional Procedure
If the temperature condition in the stand pipe is known, a constant (dielectric constant of the refrigerant gas) **can be** entered (parameter 2.5.3 GAS EPS.R), in order to obtain lower Top and Bottom Dead Zone values **(see fig. 6)**.

How to enter dielectric constant of refrigerant gas (all values below are only examples)

Default screen

AKS 4100
DISTANCE
5000 mm

- Press ►

AKS 4100
1.0.0
QUICK SETUP

- Press ▲

AKS 4100
2.0.0
SUPERVISOR

- Press ►

AKS 4100
2.0.0
____

Enter password:
► ↵ ▼ ▲ ► ↵

AKS 4100
2.1.0
INFORMATION

- Press ▲ 4 times.

AKS 4100
2.5.0
APLICATION

- Press ►

AKS 4100
2.5.1
TRACING VEL.

- Press ▲ 2 times.

AKS 4100
2.5.3
GAS EPS. R

- Press ► to check/change GAS EPS.R. (Select the correct value from the tables below and on page 8)
  Press ► to change cursor-position.
  Press ▼ to decrease the value or ▲ to increase the value.

AKS 4100
GAS EPS. R
1.066

- Press ↵ to confirm.

AKS 4100
2.5.3
GAS EPS. R

- Press ↵ 3 times.

AKS 4100
1.0.0
STORE NO

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵

Default screen appears:

AKS 4100
DISTANCE
5000 mm

Entering the dielectric constant of refrigerant gas completed

R717 (NH_3)

Temperature range:
–60°C → +50°C (–76°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –42	–76 → –43	1.00
–41 → –18	42 → 0	1.01
–17 → –5	1 → 23	1.02
–4 → 4	24 → 39	1.03
5 → 12	40 → 54	1.04
13 → 18	55 → 64	1.05
19 → 24	65 → 75	1.06
25 → 28	76 → 82	1.07
29 → 33	83 → 91	1.08
34 → 37	92 → 99	1.09
38 → 40	100 → 104	1.10
41 → 44	105 → 111	1.11
45 → 47	112 → 117	1.12
48 → 50	118 → 122	1.13

R22

Temperature range:
–60°C → +48°C (–76°F → +118°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –50	–76 → –58	1.00
–49 → –25	57 → –13	1.01
–24 → –10	–12 → 14	1.02
–9 → 0	15 → 32	1.03
1 → 8	33 → 46	1.04
9 → 15	47 → 59	1.05
16 → 21	60 → 70	1.06
22 → 26	71 → 79	1.07
27 → 31	80 → 88	1.08
32 → 35	89 → 95	1.09
36 → 39	96 → 102	1.10
40 → 42	103 → 108	1.11
43 → 45	109 → 113	1.12
46 → 48	114 → 118	1.13

R410A

Temperature range:
–65°C → +15°C (–85°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–65 → –47	–85 → –52	1.01
–46 → –35	–51 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –13	–1 → 9	1.05
–12 → –8	10 → 18	1.06
–7 → –4	19 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 4	33 → 40	1.09
5 → 7	41 → 45	1.10
8 → 10	46 → 50	1.11
11 → 12	51 → 54	1.12
13 → 15	55 → 59	1.13

R507

Temperature range:
–60°C → +15°C (–76°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –48	–76 → –54	1.01
–47 → –36	–53 → –32	1.02
–35 → –28	–31 → –18	1.03
–27 → –21	–17 → –6	1.04
–20 → –15	–17 → –5	1.05
–14 → –10	–4 → 14	1.06
–9 → –6	13 → 22	1.07
–5 → –2	23 → 29	1.08
–1 → 2	30 → 36	1.09
3 → 5	37 → 41	1.10
6 → 8	42 → 47	1.11
9 → 11	48 → 52	1.12
12 → 13	53 → 56	1.13
14 → 15	57 → 59	1.14

R744 (CO_2)

Temperature range:
–56°C → +15°C (–69°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–56.0 → –42.0	–69 → –43	1.01
–41.0 → –28.0	–42 → –18	1.02
–27.0 → –17.0	–17 → 2	1.03
–16.0 → –9.0	3 → 16	1.04
–8.0 → –3.0	17 → 27	1.05
–2.0 → 2	28 → 36	1.06
3 → 7	37 → 45	1.07
8 → 11	46 → 52	1.08
12 → 14	53 → 58	1.09
15	59	1.10

R134a

Temperature range:
–60°C → +50°C (–76°F → +122°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –42	–76 → –43	1.00
–41 → –18	–42 → –0	1.01
–17 → –4	1 → 25	1.02
–3 → 5	26 → 41	1.03
6 → 13	42 → 56	1.04
14 → 20	57 → 68	1.05
21 → 25	69 → 77	1.06
26 → 30	78 → 86	1.07
31 → 34	87 → 94	1.08
35 → 38	95 → 100	1.09
39 → 42	101 → 108	1.10
43 → 45	109 → 113	1.11
46 → 48	114 → 119	1.12
49 → 50	120 → 122	1.13

R404A

Temperature range:
–60°C → +15°C (–76°F → +59°F)

Temperature [°C]	Temperature [°F]	Dielectric constant of refrigerant gas Parameter 2.5.3 GAS EPS.R
–60 → –47	–76 → –52	1.01
–46 → –35	–51 → –31	1.02
–34 → –26	–30 → –14	1.03
–25 → –19	–13 → –2	1.04
–18 → –14	–1 → 7	1.05
–13 → –9	8 → 16	1.06
–8 → –4	17 → 25	1.07
–3 → 0	26 → 32	1.08
1 → 3	33 → 38	1.09
4 → 6	39 → 43	1.10
7 → 9	44 → 49	1.11
10 → 12	50 → 54	1.12
13 → 15	55 → 59	1.13

How to change the language setting (Default: English)

Default screen

```
AKS 4100
DISTANCE
5000 mm
```

- Press ›

```
AKS 4100
1.0.0
QUICK SETUP
```

- Press ▲

```
AKS 4100
2.0.0
SUPERVISOR
```

- Press ›

```
AKS 4100
2.0.0
_________
```

Enter password:
› ↵ ▼ ▲ › ↵

```
AKS 4100
2.1.0
INFORMATION
```

- Press ▲ 6 times

```
AKS 4100
2.7.0
DISPLAY
```

- Press ›

```
AKS 4100
2.7.1
LANGUAGE
```

- Press ›

```
AKS 4100
LANGUAGE
ENGLISH
```

- Press ▼ or ▲ to see the language possibilities
  Press ↵ to confirm.

```
AKS 4100
2.7.1
LANGUAGE
```

- Press ↵ 3 times

```
AKS 4100
2.0.0
STORE NO
```

- Press ▼ or ▲ to select between STORE NO or STORE YES.
  Select STORE YES by pressing ↵
  Default screen appears:

```
AKS 4100
DISTANCE
5000 mm
```

Language setup completed

Reset to factory setting

- Go to SUPERVISOR menu (see page 7).
- Go to parameter 2.9.4 Reset Factory.
- Select RESET FACTORY YES
- Press ↵ 3 times to return to default screen.

Factory reset completed.

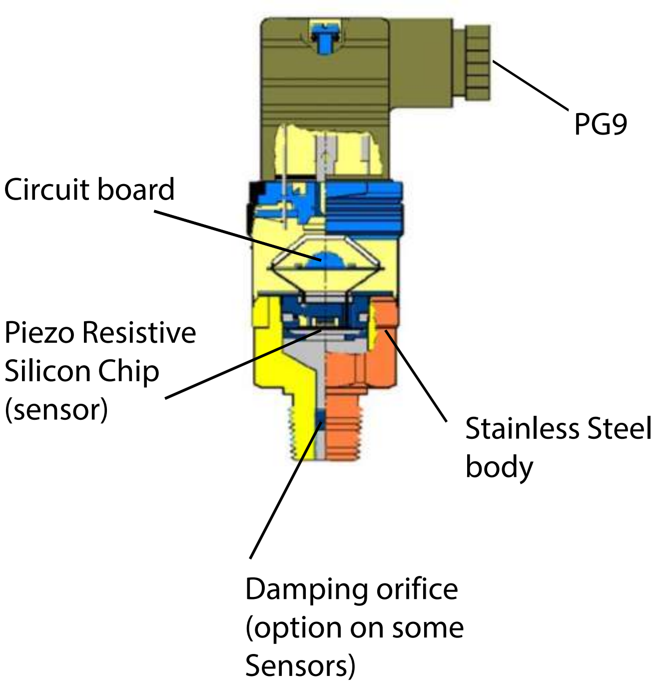
ENGINEERING
TOMORROW

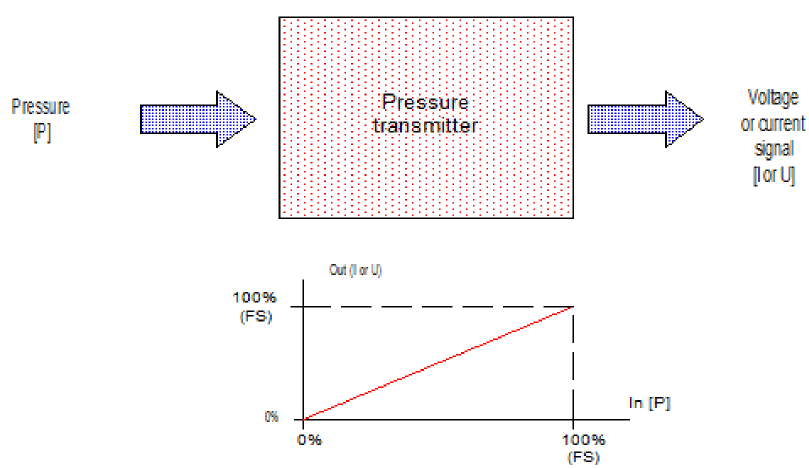
Pressure & Temperature Sensors

AKS Pressure Transmitters

- Temperature compensated
- Built-in voltage stabilizer
- Stainless steel body and material in contact with medium
- Class I, Group A,B,C,D, Div. 2 approved
- Standard with DIN plug but fixed wire is available
- Standard with ¼" NPT connection

AKS Product Design





Output signal is directly proportional with the applied pressure

Pressure Transmitter Types

- AKS 33, 4-20 mA Output (most common in industrial refrigeration)
- AKS 32, 1 to 5 VDC or 0 to 10 VDC
- AKS 3000, OEM version

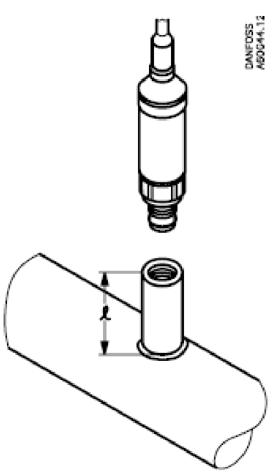
Standard ranges

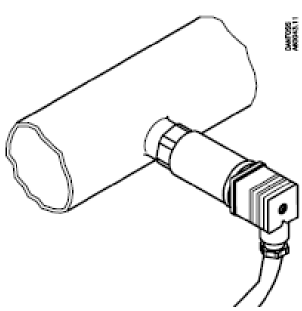
- 0 to 14.5 PSIG
- 0 to 100 PSIA
- 0 to 200 PSIA
- 0 to 500 PSIG
- 0 to 870 PSIG, primarily used for CO_2 applications

Application example using sensor to monitor water level

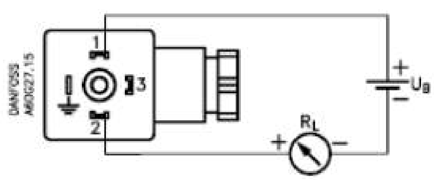
Installation and Wiring

Can be mounted horizontal or vertical with the pressure connection facing downwards as shown below. A pipe stub can be added to reduce temperature influence.





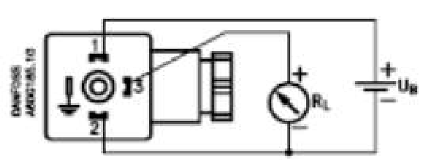
Wiring the AKS 33 and 3000 Pressure Transmitters (current output)



1 Supply +
2 Supply –
3 Unused
⊕ Connected to transmitter housing

Wiring the AKS 32 Pressure Transmitters (voltage output)

1-5V, 1-6V, 0-10V
AKS 32



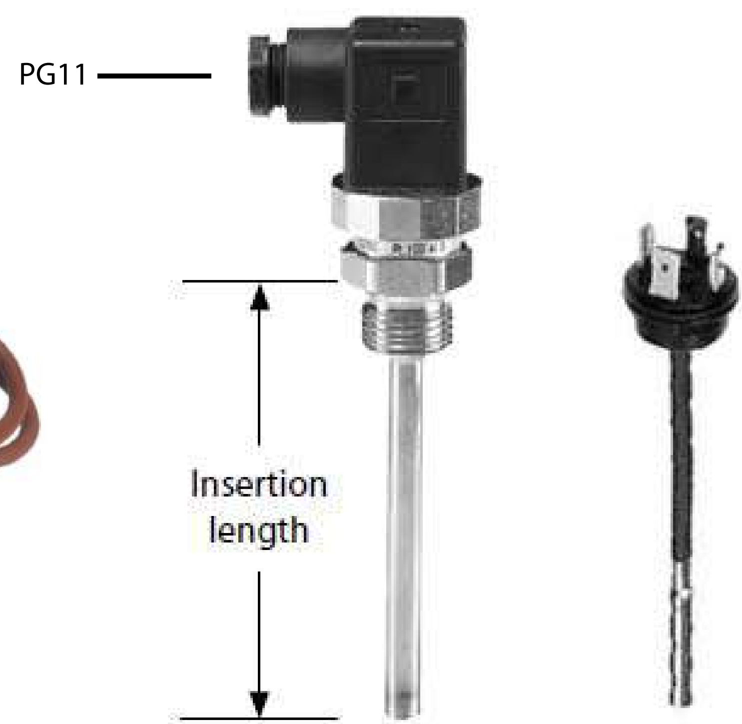
Note: The sensor should NOT be mounted with the pressure connection up as dirt/debris could enter the sensor and affect the reading.

Temperature Sensors, PT 1000 ohm

- AKS 21M, Multipurpose surface/air temperature sensor
  - o PT 1000 ohm
  - o Range: -94 to +356 °F
  - o 8.2 ft. cable
- MBT 5250, Immersion temp. sensor with ½" NPT well
  - o PT 1000 ohm
  - o Range: -58 to +392 °F
  - o DIN electrical connector (connections should be made on terminals 1 & 2)
  - o Available in 2", 4", 6" and 8" insertion lengths

AKS 21M

MBT 5250



MBT 5250

Interchangeable measuring insert for MBT 5250

PT 1000 Ohm Sensor Resistance Table

°C	°F	Ohm	°C	°F	Ohm
0	32.0	1000.0	0	32.0	1000.0
1	33.8	1003.9	-1	30.2	996.1
2	35.6	1007.8	-2	28.4	992.2
3	37.4	1011.7	-3	26.6	988.3
4	39.2	1015.6	-4	24.8	98.4
5	41.0	1019.5	-5	23.0	980.4
6	42.8	1023.4	-6	21.2	976.5
7	44.6	1027.3	-7	19.4	972.6
8	46.4	1031.2	-8	17.6	968.7
9	48.2	1035.1	-9	15.8	984.8
10	50.0	1039.0	-10	14.0	960.9
11	51.8	1042.9	-11	12.2	956.9
12	53.6	1046.8	-12	10.4	953.0
13	55.4	1050.7	-13	8.6	949.1
14	57.2	1054.6	-14	6.8	945.2
15	59.0	1058.5	-15	5.0	941.2
16	60.8	1062.4	-16	3.2	937.3
17	62.6	1066.3	-17	1.4	933.4
18	64.6	1070.2	-18	-0.4	929.5
19	66.2	1074.0	-19	-2.2	925.5
20	68.0	1077.9	-20	-4.0	921.6
21	69.8	1081.8	-21	-5.8	917.7
22	71.6	1085.7	-22	-7.6	913.7
23	73.4	1089.6	-23	-9.4	909.8
24	75.2	1093.5	-24	-11.2	905.9
25	77.0	1097.3	-25	-13.0	901.9

°C	°F	Ohm	°C	°F	Ohm
26	78.8	1101.2	-26	-14.8	898.0
27	80.6	1105.1	-27	-16.6	894.0
28	82.4	1109.0	-28	-18.4	890.1
29	84.2	1112.8	-29	-20.2	886.2
30	86.0	1116.7	-30	-22.0	882.2
31	87.8	1120.6	-31	-23.8	878.3
32	89.6	1124.5	-32	-25.6	874.3
33	91.4	1128.3	-33	-27.4	870.4
34	93.2	1132.2	-34	-29.2	866.4
35	95.0	1136.1	-35	-31.0	862.5
36	96.8	1139.9	-36	-32.8	858.5
37	98.6	1143.8	-37	-34.6	854.6
38	100.4	1147.7	-38	-36.4	850.6
39	102.2	1151.5	-39	-38.2	846.7
40	104.0	1155.4	-40	-40.0	842.7
41	105.8	1159.3	-41	-41.8	838.8
42	107.6	1163.1	-42	-43.6	835.0
43	109.4	1167.0	-43	-45.4	830.8
44	111.2	1170.8	-44	-47.2	826.9
45	113.0	1174.7	-45	-49.0	822.9
46	114.8	1178.5	-46	-50.8	818.9
47	116.6	1182.4	-47	-52.6	815.0
48	118.4	1186.3	-48	-54.4	811.0
49	120.2	1190.1	-49	-56.2	807.0
50	122.0	1194.0	-50	-58.0	803.1

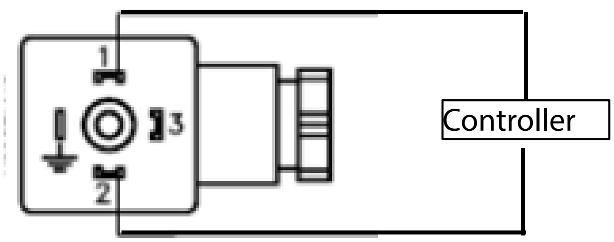
NOTE: Danfoss EKC controllers only use PT 1000 Ohm temperature sensors

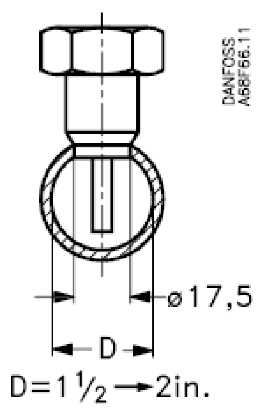
Installation and Wiring

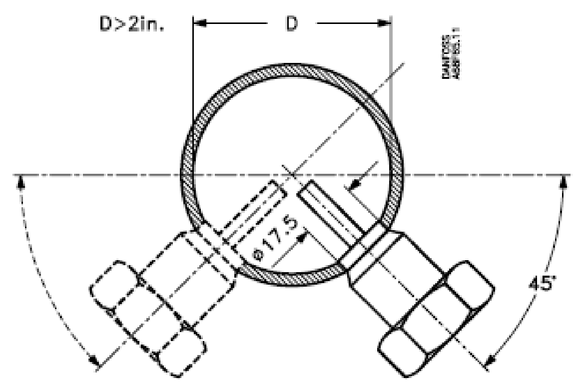
Installation of well

- Installation in a horizontal pipe can be as shown to the right and also in the 3 or 9 O-clock positions if you think there will be liquid droplets in the vapor line.
- The ideal probe length would be so the tip of the well is in the center of the pipe.
- Danfoss has no recommendations on temperature sensor location as every application can be different. If in a vapor line it should be located in a location to avoid any possible liquid droplets. Liquid droplets are likely to be present within 4 to 5 pipe diameters above the elbow in the vertical line so this location should be avoided.

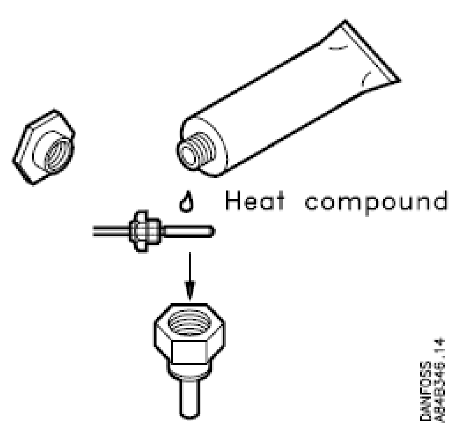
MBT 5250 Wiring







Heat compound between the sensor and well is recommended and can be ordered from Danfoss if needed.



Temperature Sensors, 4-20mA Output

For use with PLC etc. (not with Danfoss controllers)

- MBT 5252, Immersion temp. sensor
  - o 4-20 mA output
  - o Range: -58 to +302 °F
  - o ½" NPT well, 2" insertion length
  - o Terminal box electrical conn.
- MBT 3560, Immersion temp. sensor
  - o 4-20 mA output
  - o Range: -58 to +302 °F
  - o ½" NPT well, 2" insertion length. Sensor & well are integrated so must both well and sensor must be replaced.
  - o DIN electrical connector (connections should be made on terminals 1 & 2)

MBT 5252

PG16

PG9

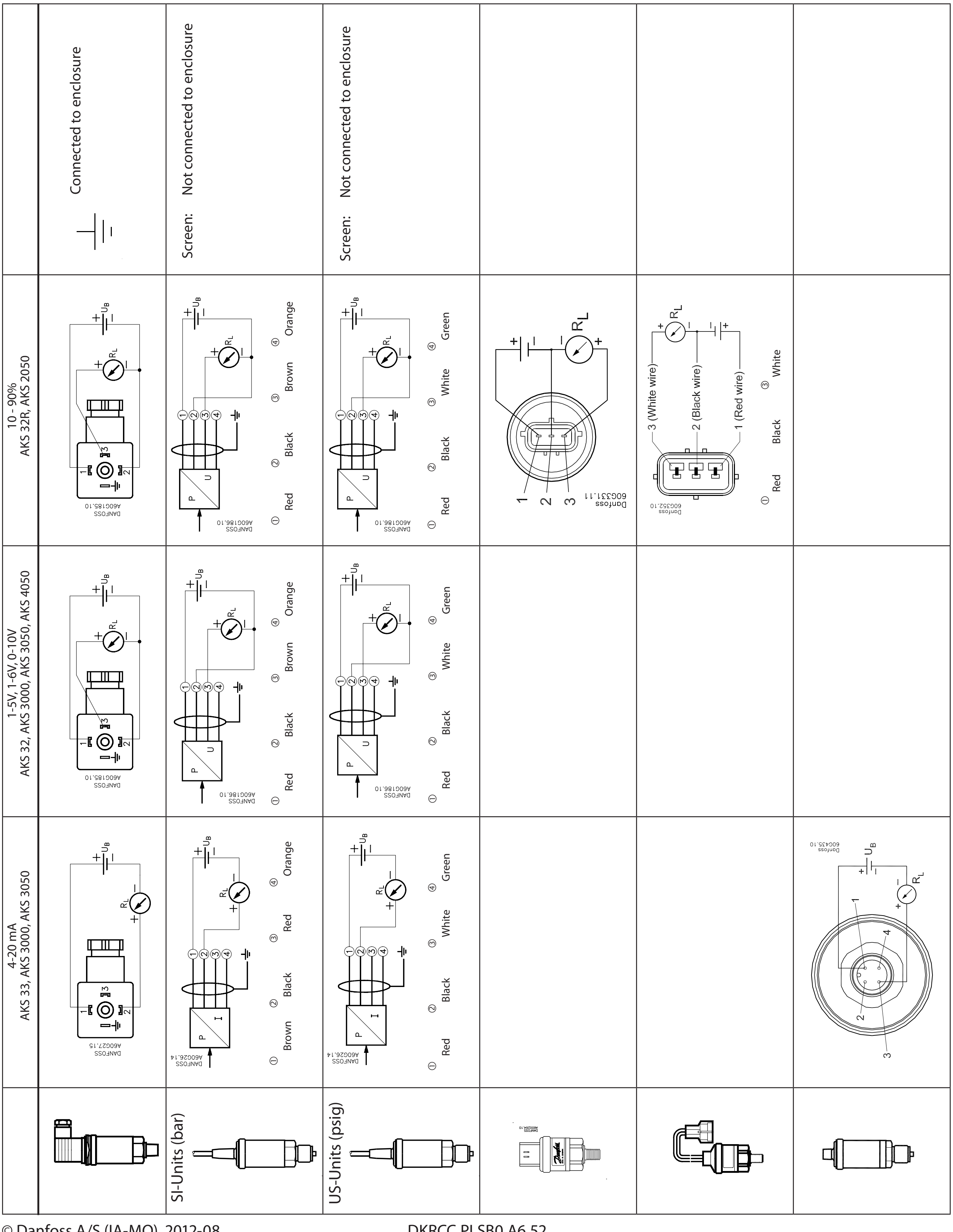
MBT 3560

Installation Guide

Pressure Transmitters

AKS 32, AKS, 32R, AKS 33, AKS 2050, AKS 3000, AKS 3050, AKS 4050

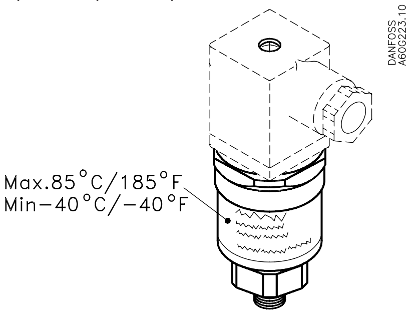
060R9512



060R9512

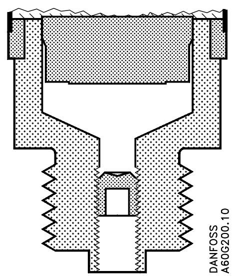
Refrigerants

NH_3, R 22, R134a, R 404A, R 407C, R410A, R507 et.al.



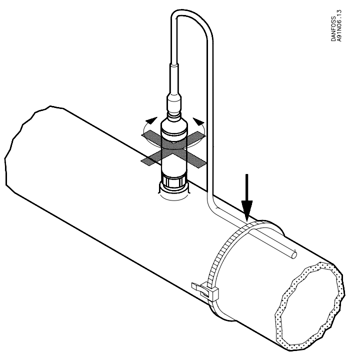
Can only be used with flammable refrigerants in hazard zone 2 or in non-classified hazardous zones.

Note



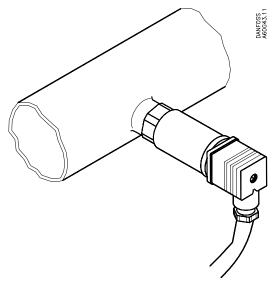
AKS 2050, 3050 & 4050 are equipped with a damping orifice

Cable version



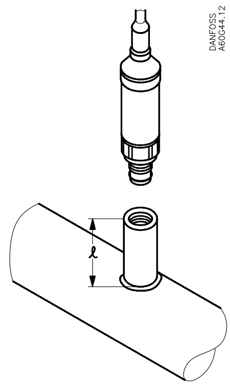
The pressure transmitter must be mounted before cable is fastened.

Orientation



Can be mounted horizontal or vertical with pressure connection facing downwards. Plug cable facing downwards prevents water collection in cable entry.

Hot gas pipe



Use a distance sleeve to reduce temperature influence.

Output signal	Supply voltage		
	AKS 32, 3000, 3050, 4050	AKS 32R, 2050	AKS 33, 3000, 3050
4 - 20 mA			10 - 30 V d.c.
10 - 90%		nom. 5 V d.c.	
1 - 5 V	9 - 30 V d.c.		
1 - 6 V	9 - 30 V d.c.		
0 - 10 V	15 - 30 V d.c.		

American approvals: Must be powered by Class 2 power supply.

1. Temperature indicating and regulating equipment acc. to UL 873, file no E31024
2. Class I, Div. 2, Group A,B,C and D acc. to UL 1604, file no E227388. MWP 75 bar/1088 bar. Temperature code T4.

Australian approvals:
According to N1297

Canadian approvals: Must be powered by Class 2 power supply.
1. Process control equipment acc. to CSA std. C22.2 no. 142-M1987
2. Non-incendive electrial equipment for use in class I, Division 2, Group A, B, C and D acc. to CSA std. no. C22.2 no. 213-M1987. MWP 75 bar/1088 bar. Temperature code T4.

ENGINEERING
TOMORROW

Motorized Valves Type ICM with ICAD Motor Actuator

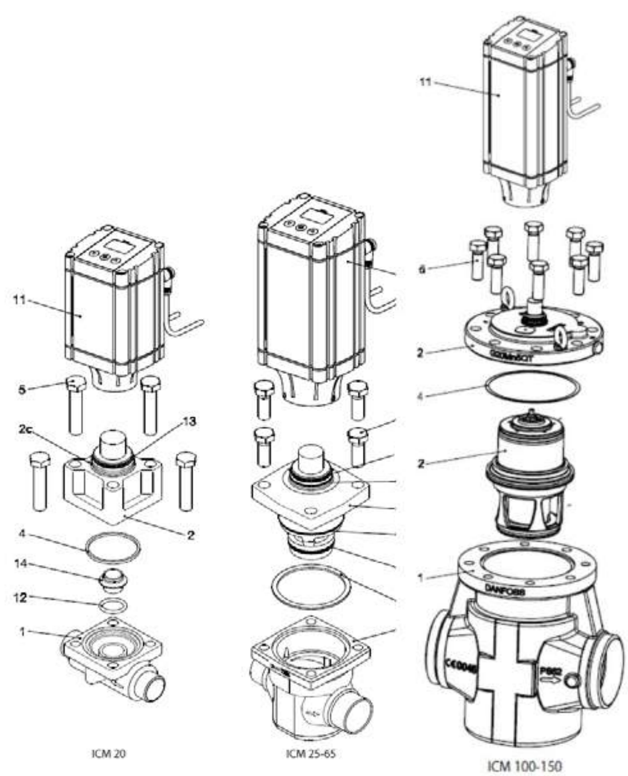
ICM/ICAD Features

- Magnetically coupled digital stepper motor
- Valve OD (opening degree) shown in the display
- Manual control of valve via ICAD motor or manual operating tool
- Speed Control
- Digital and Analog Outputs
- UPS Feature w/ alarm function
- Can be controlled by a variety of signals depending on application
  - o Analog input: 0-20 mA, 4-20 mA (default setting), 0-10V or 2-10V for modulating control
  - o One digital input for on-off solenoid function
  - o Two digital inputs for floating 3-point control (open-neutral-close)

ICM/ICAD Overview

- The ICM motorized valve is comprised of up to 4 components:
  - o the valve body (often referred to as ICV)
  - o the function module/bonnet
  - o the top cover (the function module and top cover are one part for ICM sizes 20 to 65)
  - o the ICAD motor actuator
- The combinations of valve and actuator are:

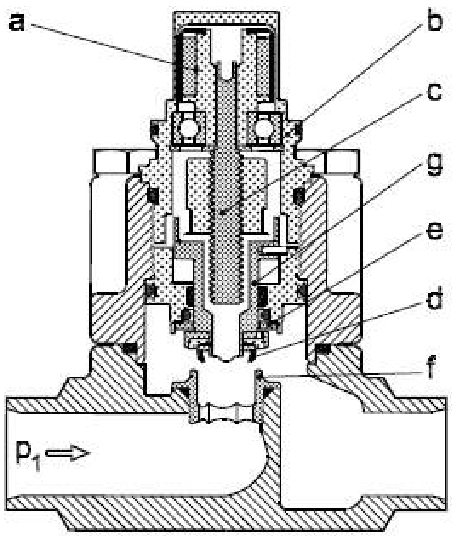
Actuator	ICAD 600A	ICAD 1200A
Valve size	ICM 20	ICM 40
	ICM 25	ICM 50
	ICM 32	ICM 65
		ICM 100
		ICM 125
		ICM 150



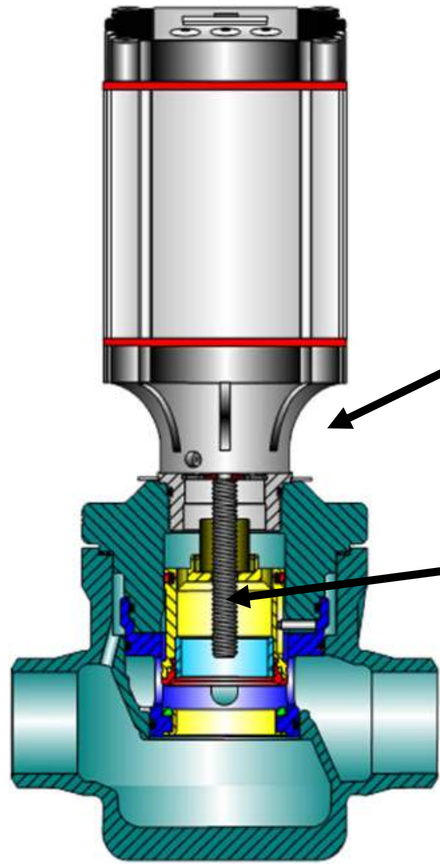
Note: old ICAD 900 that was used for ICM sizes 40, 50 and 65 was discontinued at the end of 2014 and ICAD 1200A should be used in its place.

ICM 20 to 65 (¾″ to 2-1/2″) Function

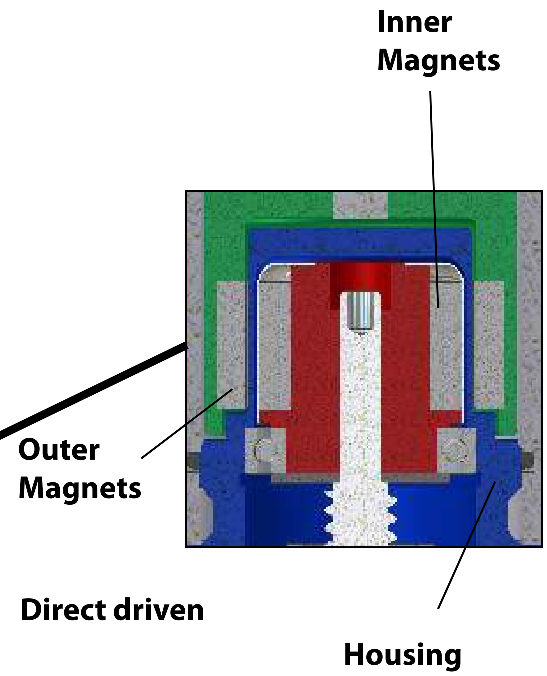
Inlet pressure passes through hollow piston assembly to balance forces on both top and bottom of the piston.



ICM 20

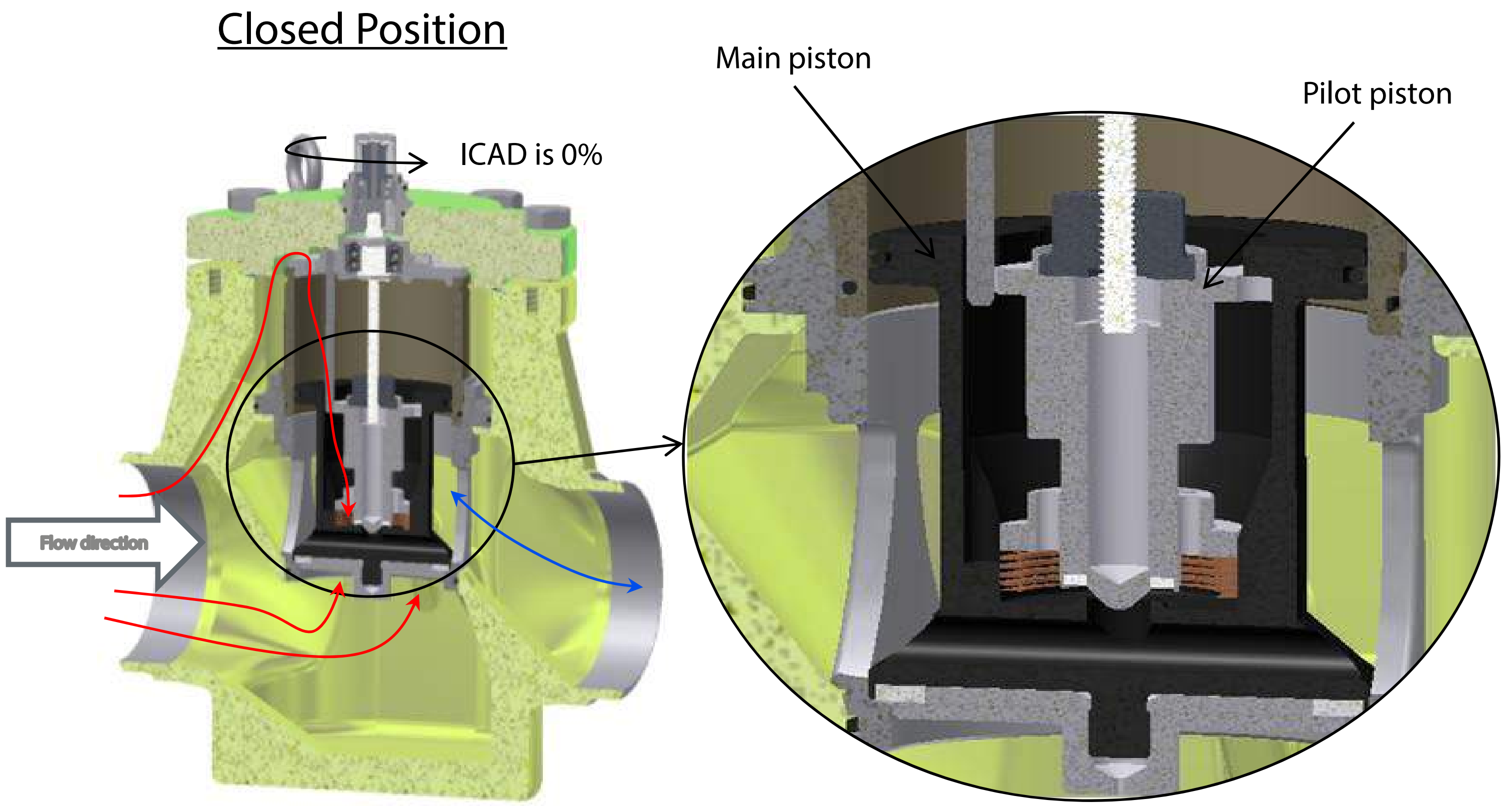


ICM 25-65



Note: For ICM 20-65 applications it is recommended that the valve opening degree at the minimum operating conditions is greater than 5%.

ICM 100 to 150 (4 to 6”) Function

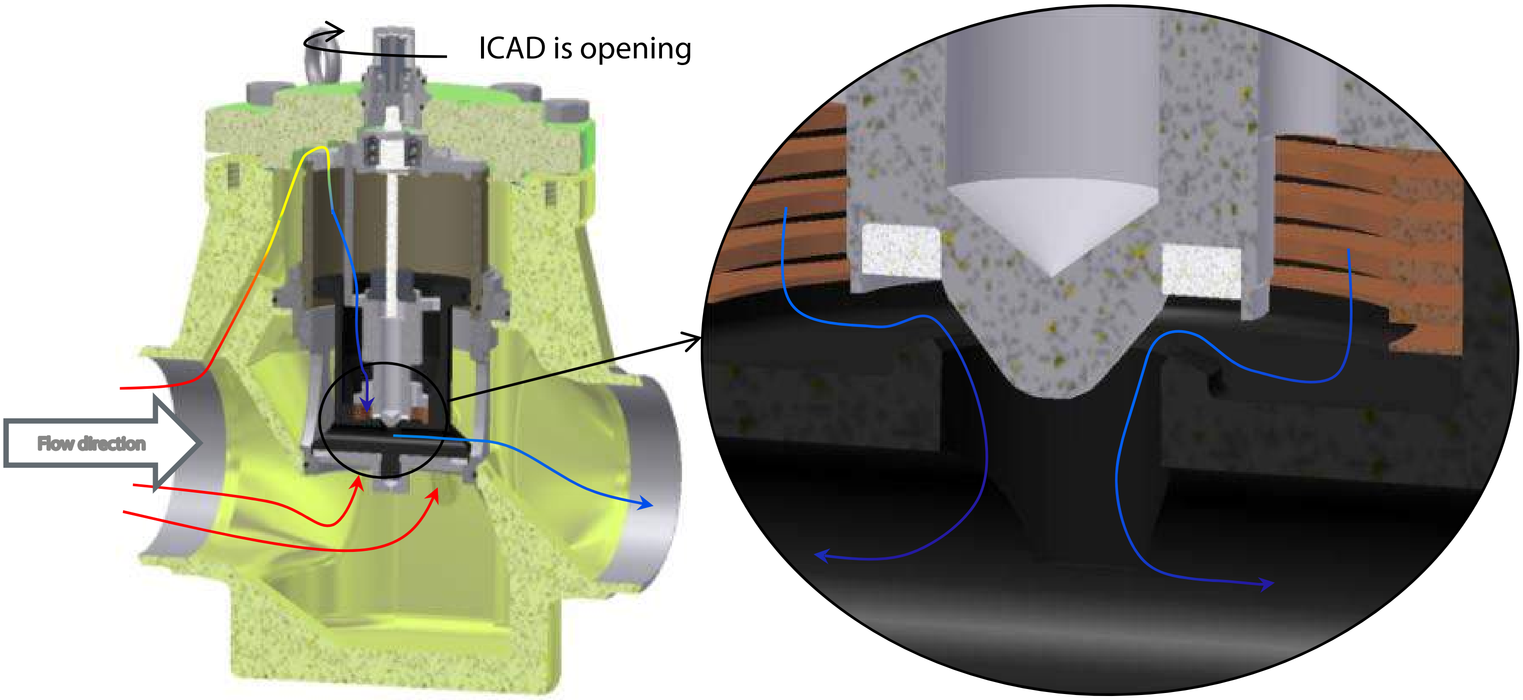


Note: For ICM 100-150 applications it is recommended that the valve opening degree at the minimum operating conditions is greater than 10%.

ICM 100 to 150 (4 to 6”) Function

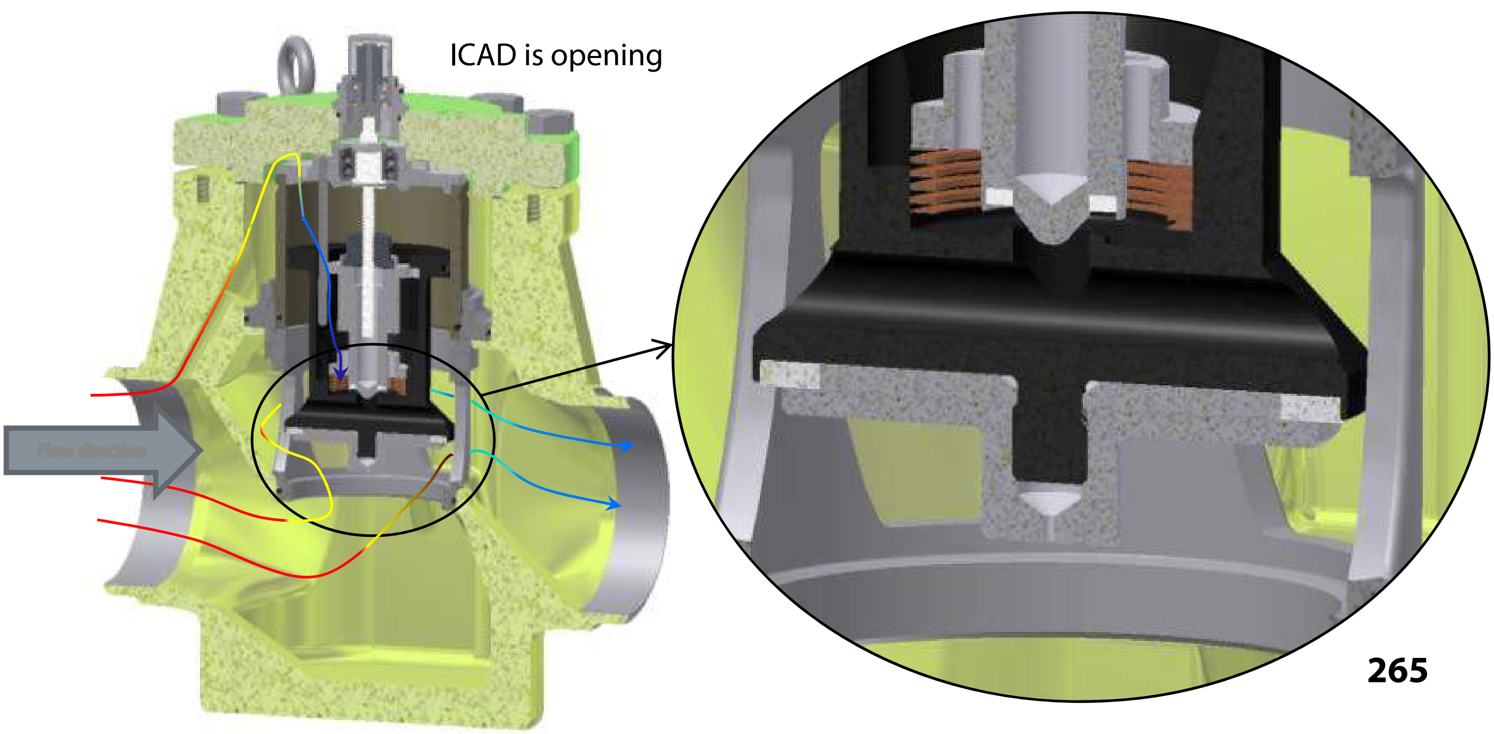
ICM starts to open

- ICAD turns spindle which lifts up the pilot piston
- Pressure escapes from on top of the main piston assembly balancing the forces and making it easy to open and move main piston



ICM is open

- ICAD turns spindle to the desired position which moves the pilot piston
- The main piston moves with the pilot piston because they are mechanically attached.



ICM/ICAD Overview

ICM Sizes and C_v Values

Type	Valve body size	K_v (m³/h)	C_v (USgal/min)
ICM 20A-33	20	0.2	0.23
ICM 20-A		0.6	0.7
ICM 20-B66		1.6	1.9
ICM 20-B		2.4	2.8
ICM 20-C		4.6	5.3
ICM 25-A	25	6	7.0
ICM 25-A33		2	2.3
ICM 25-B		12	13.9
ICM 32-A	32	9	10.4
ICM 32-B		17	20
ICM 40-A	40	15	17
ICM 40-B		26	30
ICM 50-A	50	23	27
ICM 50-B		40	46
ICM 65-A	65	35	41
ICM 65-B		70	81
ICM 100-B	100	142	167
ICM 125-B	125	223	260
ICM 150-B	150	370	430

ICM Applications

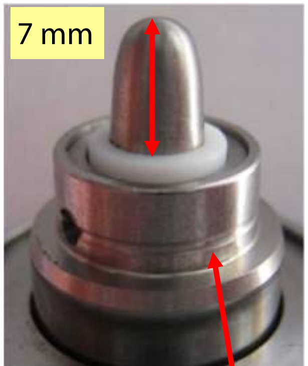
Expansion Applications

- ICM 20 A33, A, B66, B, C
- ICM 25 A33, A
- ICM 32 A
- ICM 40 A
- ICM 50 A
- ICM 65 A

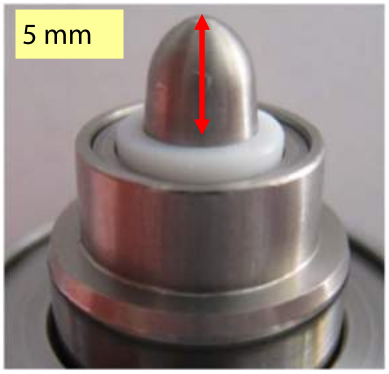
Control Valve or Solenoid Valve Applications

- ICM 20 A33, A, B66, B, C
- ICM 25 B 1″
- ICM 32 B 1-1/4″
- ICM 40 B 1-1/2″
- ICM 50 B 2″
- ICM 65 B 2-1/2″
- ICM100B 4″
- ICM125B 5″
- ICM150B 6″

Different ICM 20 cone and orifice designs



ICM20-A33
Has a groove here
for identification



ICM20-A (2nd gen.)
Introduced mid 2009

ICM20-A (1st gen.)
Discontinued mid 2009

ICM 20 Orifice (valve seat)

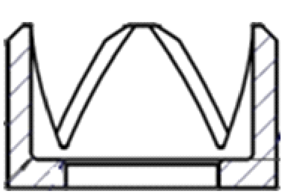
ICM 20-A33
ICM 20-A (2nd gen.)

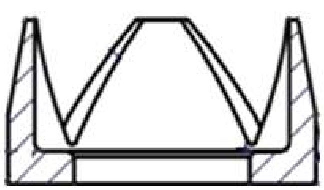
ICM 20-A (1st gen.)
ICM 20-B66
ICM 20-B
ICM 20-C

ICM20-B66
Introduced Jan. 2011

ICM20-B

ICM20-C





Note: The outside edges of the B66 cone has more of a cylindrical shape compared to the B cone which forms more of a conical shape

ICM 25 to 65 design change

Improvements:

Outer cage fixed, no moving parts. No set screws

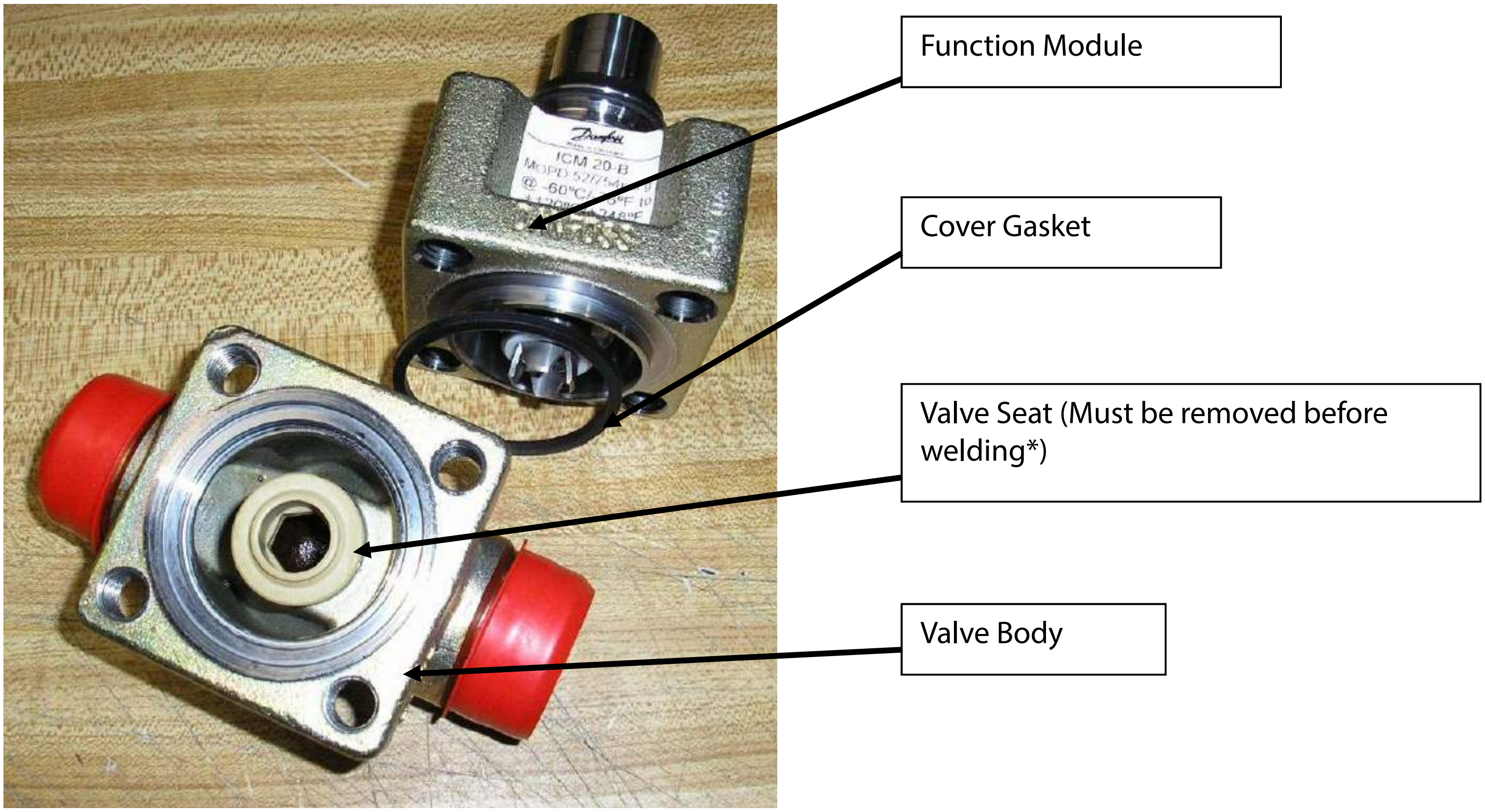
Old Design

New Design
ICM 40-65 changed in 2009 and
ICM 25-32 in 2010

Note: new design is a direct replacement of old design

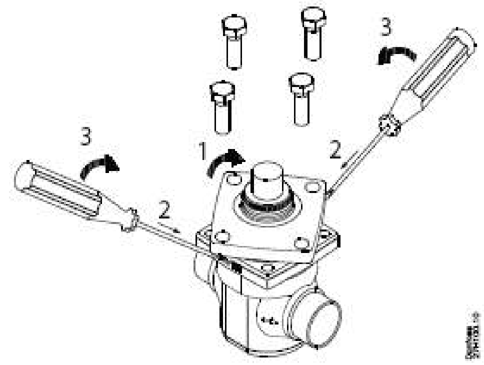
Installing ICM 20

Valve Seat must be removed before welding!



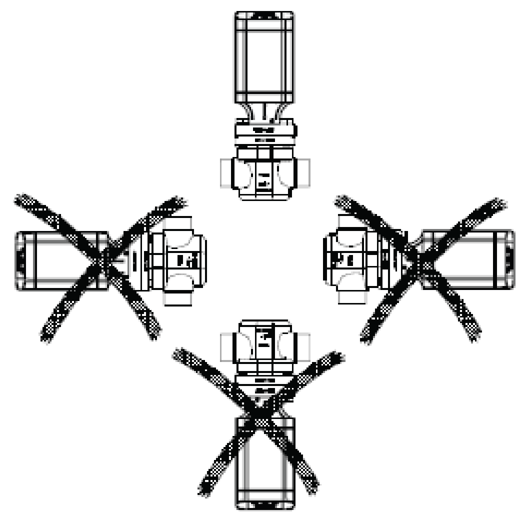
* Valve seat is removed with a 12 mm hex key

Installing ICM 25 - 65



Step 1 : Remove the function module

Step 2 : Weld the body in the line so that the ICAD motor will be upright and the arrow on the body points in the direction of flow.



Step 3 : After welding, clean out any debris which may be left in the valve body before reinstalling the function module.

Step 4 : Re-install the function module (rotating the bonnet by 90° either way does not affect the function)

Check all gaskets to make sure that they are still in good condition.

A light coating of refrigerant oil on the O-rings will help facilitate the installation of the module

Torque the 4 bonnet bolts to their specifications.

Valve Size	lb-ft	Nm
ICM 20	29	40
ICM 25	74	100
ICM 32	88	120
ICM 40	88	120
ICM 50	103	140
ICM 65	110	150
ICM 100	162	220
ICM 125	162	220
ICM 150	162	220

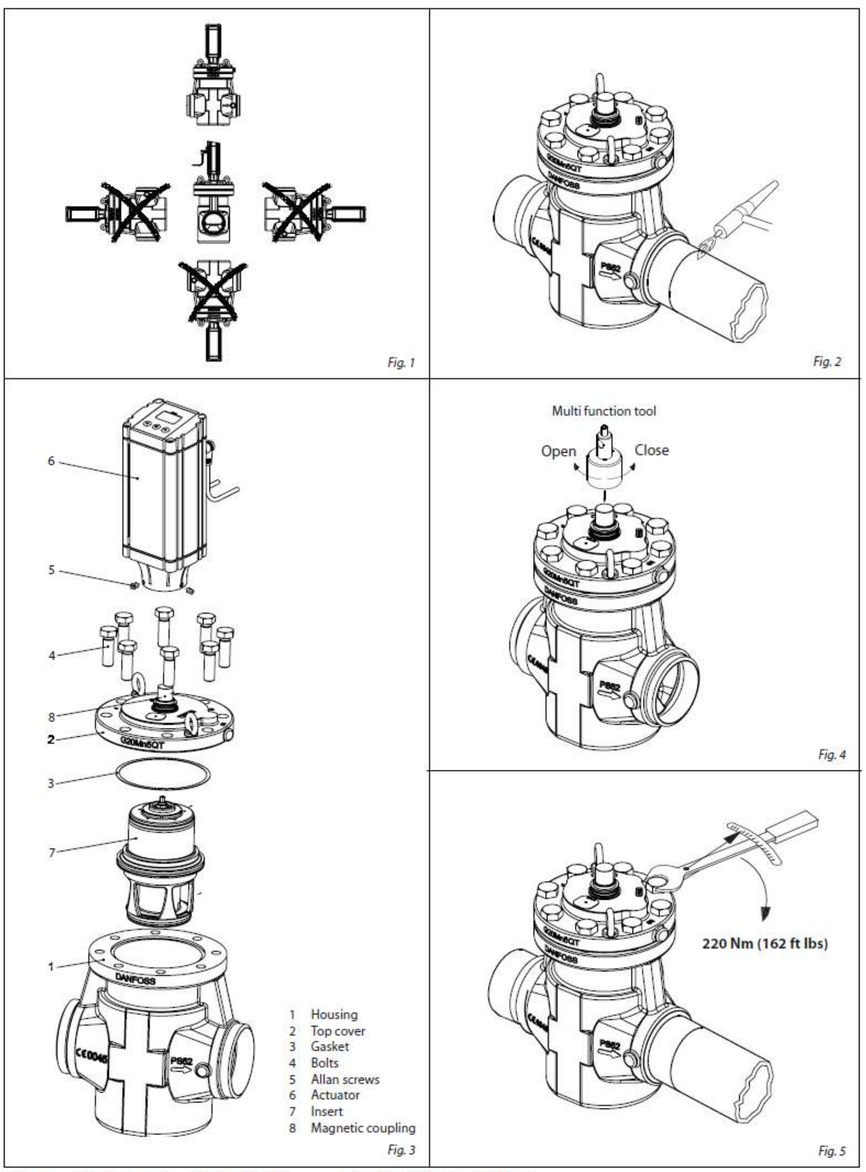
Installing ICM 100 to 150

Position – The valve must be installed in a horizontal pipe with the actuator pointing up.

Welding – The valve can remain assembled during the welding process. The welding process must be a form of arc, MIG or TIG welding.

Installation of Function Module – use a small amount of refrigerant oil on the O-rings when installing the module.

Installation of Top Cover – use the manual tool to turn the coupling in order to align with the function module.



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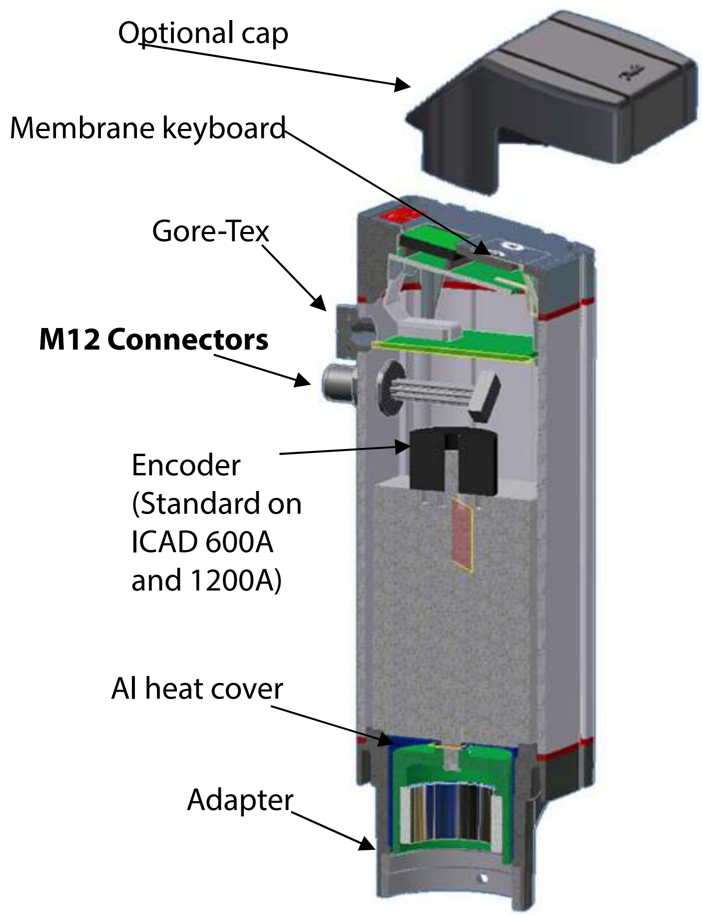
Installing the ICAD

- Make sure the magnetic coupling/valve stem on ICM and inner magnets of ICAD motor are dry and free from any debris.
- For applications below freezing, the ICM coupling/stem O-ring must be removed and Molycote G 4500 grease (supplied with ICAD motor) needs to be applied in the O-ring groove and O-ring before it is re-installed on ICM. The O-ring should be removed with your fingers by squeezing it and pushing it to the side to prevent any damage by tools.
- Install the ICAD motor actuator on the ICM coupling/valve stem making sure it is pushed completely down. Tighten the set screws evenly using a 2.5 mm hexagon key so the motor is centered on the ICM valve stem. Torque screws to approximately 3Nm (2.5 ft-lbs)

ICM coupling/stem O-ring and
Molycote G 4500 grease

ICAD Motor Actuator for ICM, 2nd Generation

- Insulating adapter to avoid the need for a heater like 1st generation
- Removable cables connectors
- Cable connectors located in metal part of ICAD and not plastic part like 1st generation
- Protective cap available for outdoors



1st Generation pre 2010

2nd Generation

Advanced ICAD 600A and 1200A

Original ICAD offering:

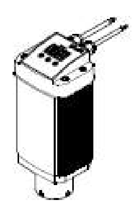
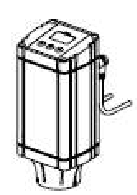
Actuator	ICAD 600	ICAD 900/1200	ICAD 1200
Valve size	ICM 20	ICM 40	ICM 100
	ICM 25	ICM 50	ICM 125
	ICM 32	ICM 65	ICM 150

ICAD 900 discontinued end of 2014

ICAD 600A, used with ICM 20, 25 and 32
ICAD 1200A, used with ICM 40, 50, 65, 100, 125 and 150

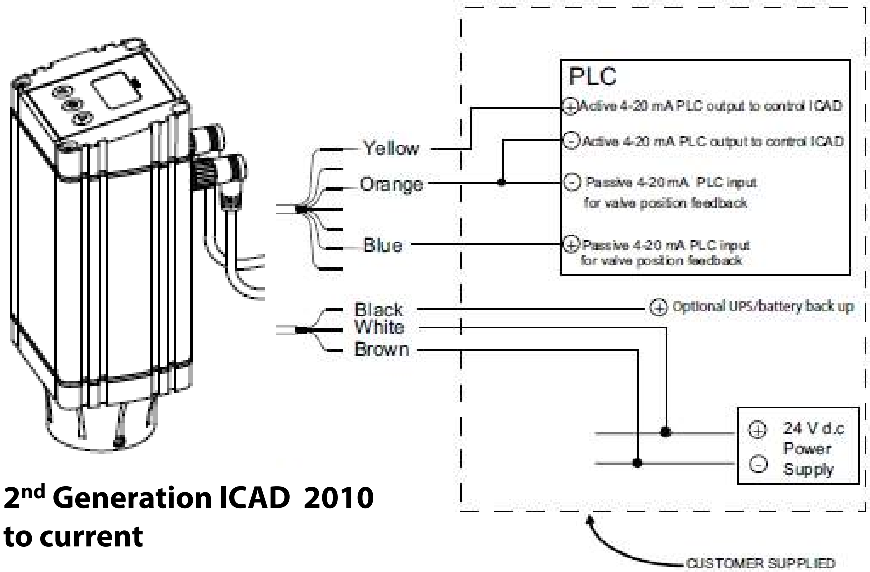
- Optical encoder is standard in new ICAD 600A and 1200A which gives true valve position feedback
- Intelligent force compensation function which increases torque when needed and corrects for any lost steps
- ICAD 600A is about 1.3" taller than old ICAD 600 and ICAD 1200A is same size as old ICAD 1200 but is about 1" taller than old ICAD 900

ICAD 2nd Generation Wire Color Differences

		1st Generation ICAD	2nd Generation ICAD
			
Power cable (3-wire)	+ 19-24 V d.c. fail safe supply	White (+)	Black (+)
	+ 24 V d.c.	Brown (+)	White (+)
	- 24 C d.c. (GND)	Green (-)	Brown (-)
Communication cable (7-wire)	Digital output (common alarm)	White (-)	Black (-)
	Digital output (ICM fully open)	Brown (-)	Brown (-)
	Digital output (ICM fully closed)	Green (-)	Red (-)
	GND - ground	Yellow (-)	Orange (-)
	Analog input (0/4-20 mA	Grey (+)	Yellow (+)
	Analog input 0/2-10 V / Digital ON/OFF input	Pink (+)	Green (+)
	Analog output 0/4-20 mA	Blue (+)	Blue (+)

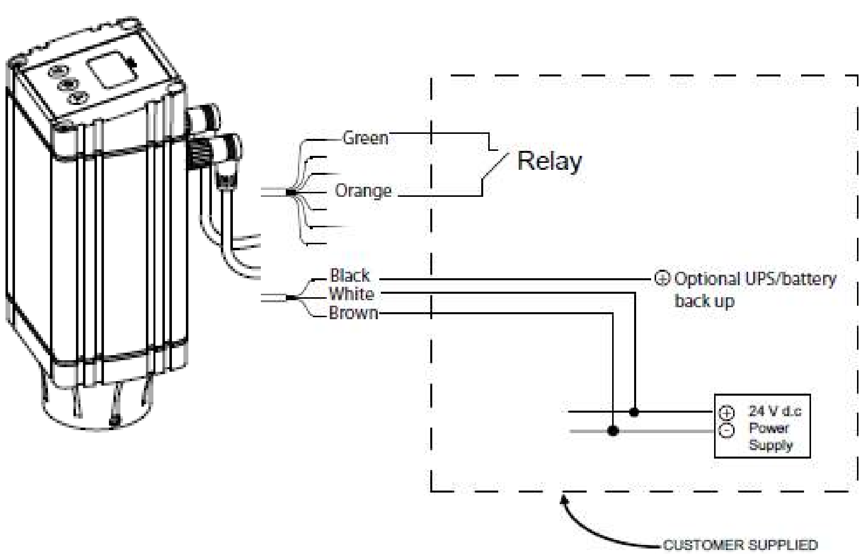
ICAD Wiring Examples

Wiring to PC or PLC with mA input



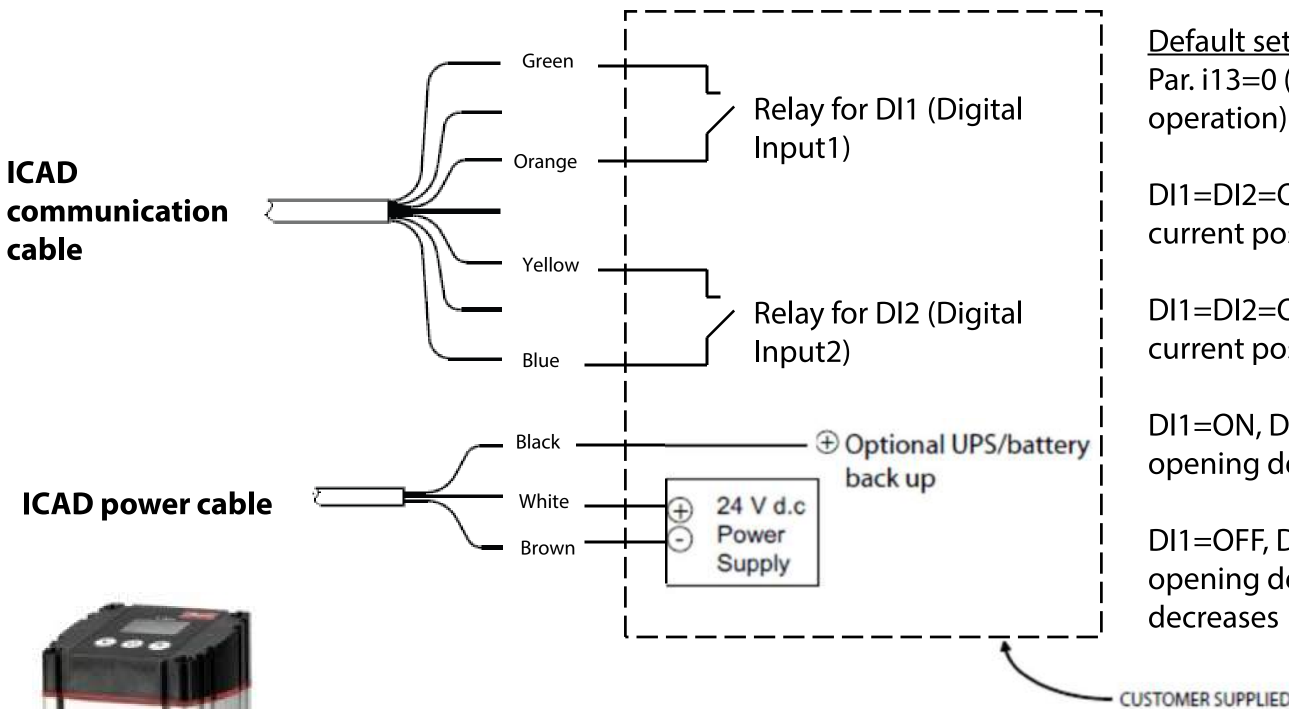
2nd Generation ICAD 2010 to current

Wiring for on-off operation (solenoid)
Only 1 Digital input needed



Wiring for Floating 3-Point Control
Controls with 2 Digital Inputs (Open – Neutral – Close)

Only applicable with 2nd Generation released in 2010



Default setting
Par. i13=0 (Direct operation)

DI1=DI2=OFF: maintains current position

DI1=DI2=ON: maintains current position

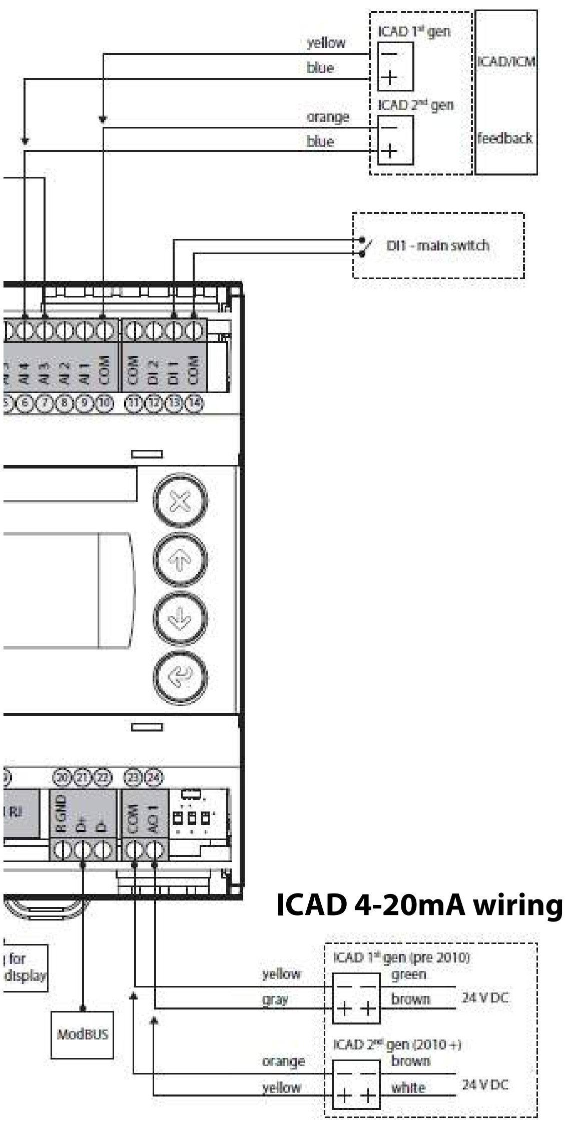
DI1=ON, DI2=OFF: opening degree increases

DI1=OFF, DI2=ON: opening degree decreases

Wiring with Danfoss Controllers

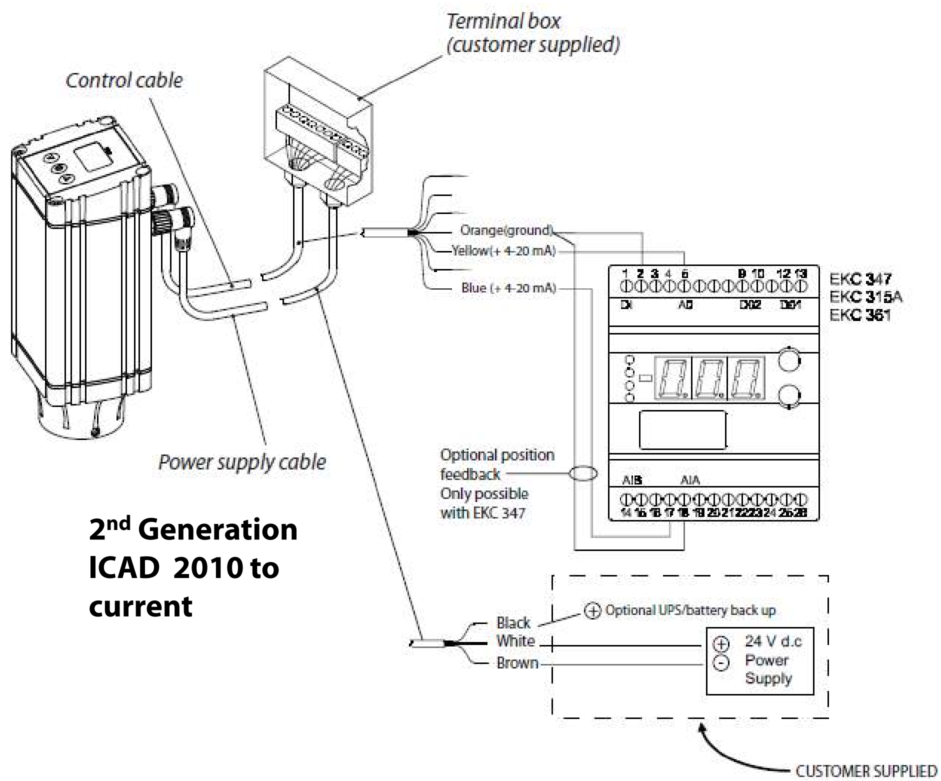
Wiring with current EKE 347

Optional Valve feedback wiring



ICAD 4-20mA wiring

Wiring with old EKC 347



2nd Generation ICAD 2010 to current

Note: for ICAD wiring with EKC 315A and EKC 361 controllers, please see the controller training presentation.

Principles of Operation

- The ICAD is a digital stepper motor – it is always counting steps! If the ICAD is removed from the valve without cutting power, and the valve is manually turned open or closed, the ICAD will be "lost" after being re-mounted on the valve.
- Upon power up, the motor will drive itself to the closed position to re-establish its point of reference. It will then move to the point at which the control signal is telling it to move to.
- In the manual mode, the ICAD will override the control signal. The display will continually flash while in the manual mode of operation.
- When the ICAD is initially powered, the display will flash "A1" alarm which means you still need to program the ICM valve size in ICAD.
- Once the appropriate valve size has been selected from the menu, the ICAD will calibrate itself by driving to the closed position. During this time, the display will flash "CA" if you exit the parameter list.
- The most current version will also flash "CS" in the display every time the valve closes which indicates that the ICAD is giving extra closing step to ensure it is closed completely.
- Because the ICAD has additional "play" beyond the 100% open point, it is important to remember to that it should not be in the fully opened position during initial set-up. If its position has been changed from the factory setting, reset the position to a point between 0% and 75% using the manual tool

Valve Size	Time to Open/Close	Total # of Turns
ICM 20	3 seconds	1.25
ICM 25	7 seconds	2.5
ICM 32	8 seconds	3
I CM 40	10 seconds	4
ICM 50	13 seconds	5
ICM 65	13 seconds	5
ICM100	33 seconds	12.75
ICM125	40 seconds	15.25
ICM150	47 seconds	18.25

Open/closing times at max speed. Speed can be changed

There are 200 steps per complete revolution

Electrical Data

Supply Voltage

24 VDC +10%/-15%

Load

ICAD 600A: 1.2 A

ICAD 1200A: 2.0 A

Discontinued ICADs

ICAD 600: 1.2 A

ICAD 900: 2.0 A

ICAD 1200: 3.0 A

Digital Input

On/Off operation by means of volt-free contact (Signal/telecom relays with gold plated contacts recommended

ON Contact Impedance ≤ 50Ω

OFF Contact Impedance ≥ 100kΩ

Digital Output

3 pcs. NPN transistor output

External Supply – 5 to 24 VDC

Can use the same supply as for the ICAD but the ICAD will no longer be galvanically isolated.

Output Load 50 Ω

Load: Max. 50 mA

Temperature Range

-22 °F to 122 °F

Enclosure

IP 67~ NEMA 6

Analog Input

Current

0/4 – 20 mA

Load: 200 Ω

Voltage

0/2 – 10 VDC

Load: 10k Ω

Programming the ICAD

Step 1: Press and hold the middle button until the menu screen appears

Step 2: Use the Up and Down arrows to move through the list of parameters

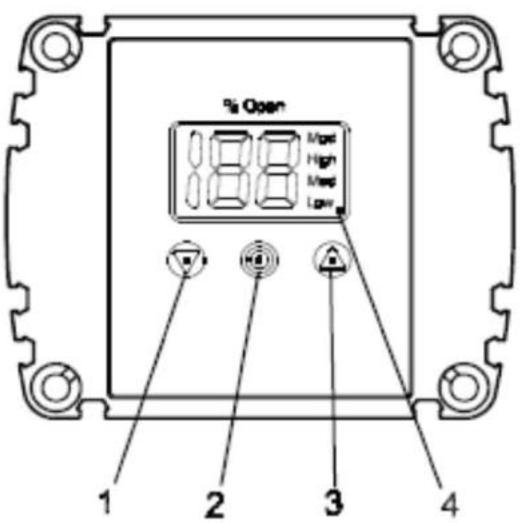
Step 3: To display a current value of a parameter press the middle button

Step 4: To change the value of the parameter, move the Up or Down area to arrive at the desired value.

Step 5: Press the middle button again to save the new setting.

Step 6: Repeat for all parameters that need to be changed.

Step 7: To exit the menu, press and hold the middle button or wait for the ICAD to reset.



1. Down arrow push button
2. Enter
3. Up arrow push button
4. Display

See ICAD instructions for full parameter list

Service/Trouble-Shooting Parameters
View Only parameters

Description	ICAD parameter	Min	Max	Unit	Comments
OD %	**¡50**	0	100	%	ICM valve Opening Degree
AI [mA]	**¡51**	0	100	mA	Analog input signal
AI [V]	**¡52**	0	100	V	Analog input signal
AO [mA]	**¡53**	0	100	mA	Analog output signal
DI Digital input Status	**¡54**	0	1	-	DI signals. Depending of **¡02** If **¡02** = 2, one digit is shown. 0 : DI1 = OFF 1 : DI1 = ON If **¡02** = 3, two digits are shown. 00 : DI1 = OFF, DI2 = OFF 10 : DI1 = ON, DI2 = OFF 01 : DI1 = OFF, DI2 = ON 11 : DI1 = ON, DI2 = ON
DO Status for ICM closed	**¡55**	0	1	-	1: DO = ON when OD < 3 %; 0: DO = OFF
DO status for ICM opened	**¡56**	0	1	-	1: DO = ON when OD > 97 % 0: DO = OFF
DO Alarm status	**¡57**	0	1	-	1: DO = ON when a Alarm is detected 0: DO = OFF
Display mP SW ver.	**¡58**	0	100	-	Software version for display microprocessor
Motor mP SW ver.	**¡59**	0	100	-	Software version for motor microprocessor

To restore all parameters to factory setting

- Disconnect power supply
- Push UP and DOWN buttons simultaneously
- While holding UP and DOWN buttons, reconnect power supply
- Release buttons simultaneously

ICAD should return to flashing between CA and A1

ICAD Alarms

- A1 ⇒ No valve has been selected in parameter j26
- A2 ⇒ Problem with the ICAD electronics (If this alarm appears you should try to remove power and see if it goes away and if not reset ICAD to factory setting and if the problem still exists, return ICAD to factory).
- A3 ⇒ Control signal problem
  - o Not applicable when the valve is in the manual mode or the digital input mode
  - o In the analog mode, this alarm will flash if there is no control signal or if it is outside of the range selected by parameter j03
- A4 ⇒ Low voltage for UPS supply. Check the UPS battery
- A5 ⇒ Low voltage from main power supply ≤ 18VDC
- A6 ⇒ Calibration failed. Check valve type selected, check present of foreign material in valve body.
- A8 ⇒ Thermal Overload. ICAD motor temperature too high
- A9 ⇒ Valve locked up. Alarm will go on if valve is locked for more than 15 seconds.
  The alarm can be reset by removing the power to ICAD.

Trouble-Shooting

- ICM appears to be losing steps
  - o Has the ICAD been mounted properly on the valve stem?
  - o What temperature is the system operating at?
    - Is there ice inside on the magnets?
    - Has grease been applied to the valve stem o-ring?
  - o What kind of refrigerant is in use?
  - o Has the manual tool been used without cutting power to the ICAD?
- ICM doesn't appear to close valve all of the way.
  - o Small ICM 20 – do the seats and the cones match?
  - o Are the o-rings on the module?
- Can't get to Parameter j26
  - o Did you enter the password at j10?
- A3 Alarm is flashing
  - o Are you sending the proper control signal to the ICAD?
- ICM/ICAD doesn't seem to be operating properly.
  - o Can the valve be opened and closed with the manual tool easily?
  - o Is the power supply 24 VDC?

Multifunction tool

- Manually operating ICM
- Hex key for mounting or removing ICAD motor
- Thread on tip for removing ICS control valve modules
- Operates ICS/PM manual stems

Always bring your manual tool to the jobsite!!!

24V DC Power Supply

- P/n 080Z0055
- 24Vd.c., 2.5 Amp
- Output variable 22.5-29.5 Vd.c.
- 100-240 Va.c. Input
- UL Listed and many other approvals
- DIN rail or surface mounted
- Internal, auto-resetting fuse on the secondary side

Input:
100-240Va.c.

Output: 24Vd.c.

Light Indicator
that shows
it is powered

Variable output

Side View

Back View

These red tabs can be pushed out for surface mounting

ENGINEERING
TOMORROW

Quick Start Guide

ICM/ICAD Motorized Valves
Installation, Programming, and Troubleshooting

The ICM motorized valve is comprised of up to 4 components:

- the valve body – often referred to as the ICV body because it is used for ICM motor valves, ICS pilot operated valves and ICLX solenoid valves.
- the function module – the flow regulating part of the valve
- the top cover – on the ICM 20 through 65, the function module and top cover are one part
- the ICAD motor actuator – the "brains" of the valve

ICM/ICAD overview

The combinations of valve and actuator are as follows:

Actuator	ICAD 600A	ICAD 1200A	Old ICAD 600*	Old ICAD 900*	Old ICAD 1200*
Valve Size	ICM 20	ICM 40	ICM 20	ICM 40	ICM 40
Valve Size	ICM 25	ICM 50	ICM 25	ICM 50	ICM 50
Valve Size	ICM 32	ICM 65	ICM 32	ICM 65	ICM 65
Valve Size		ICM 100			ICM 100
Valve Size		ICM 125			ICM 125
Valve Size		ICM 150			ICM 150

* ICAD 600, 900 and 1200 were discontinued at the end of 2014. ICAD 600A is a direct replacement of ICAD 600 and ICAD 1200A is a direct replacement of ICAD 900 or ICAD 1200.

Contents **Page**

Identifying ICM sizes

All ICM sizes except ICM 20 have a stainless steel ID tag located around the valve stem on the top cover which the ICAD mounts on. When the ICAD is mounted it can be difficult to locate this. The sticker on the valve body of the large valves states ICV and the valve size because the body is shared between the ICM motor valves, ICS pilot operated valves and ICLX solenoid valves.

The ICV size is the same size as the ICM size which is needed during programming. ICM 20 only has a sticker on the side of the valve body to identify the size.

If the sticker is missing the size can be identified by the shape of the cone. The below figure shows how to indentify the ICM 20 size by looking at the cone.

Different ICM 20 cone and orifice designs

ICM20-A33
A33 has a groove here for identification

ICM20-A (2nd gen.)
Introduced mid 2009

ICM20-A (1st gen.)
Discontinued mid 2009

ICM20-B66
Introduced Jan. 2011

ICM20-B

ICM20-C

Note:
The outside edges of the B66 cone has more of a cylindrical shape compared to the B cone which forms more of a conical shape.

ICM 20 orifice (valve seat)

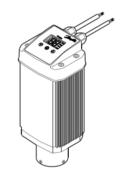
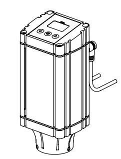
ICM 20-A33
ICM 20-A (2nd gen.)

ICM 20-A (1st gen.), ICM 20-B, ICM 20-B66, ICM 20-C

Differences between 1st and 2nd generation ICAD motor actuators

The 2nd generation ICAD was released in the beginning of 2010. The part numbers on the label for the 2nd generation start with 027H9… and the 1st generation part numbers started with 027H12… The cables of the 1st generation were mounted through cable glands located in the plastic top whereas the 2nd generation has the cables mounted on connectors located in the aluminum body.

Note: The wire colors are different between the two generations and the following is a table with the differences and pictures of old and new generation.

		1st Generation ICAD	2nd Generation ICAD
			
Power cable (3-wire)	+ 19-24 V d.c. fail safe supply	White (+)	Black (+)
	+ 24 V d.c.	Brown (+)	White (+)
	- 24 C d.c. (GND)	Green (-)	Brown (-)
Communication cable (7-wire)	Digital output (common alarm)	White (-)	Black (-)
	Digital output (ICM fully open)	Brown (-)	Brown (-)
	Digital output (ICM fully closed)	Green (-)	Red (-)
	GND - ground	Yellow (-)	Orange (-)
	Analog input (0/4-20 mA	Grey (+)	Yellow (+)
	Analog input 0/2-10 V / Digital ON/OFF input	Pink (+)	Green (+)
	Analog output 0/4-20 mA	Blue (+)	Blue (+)

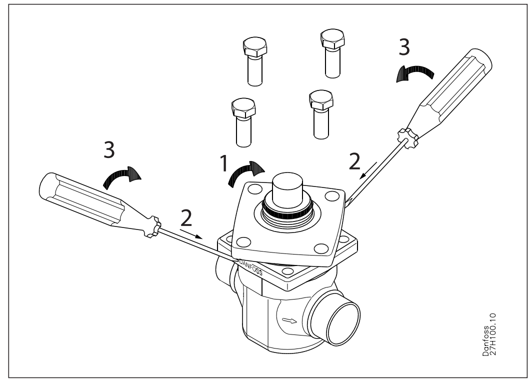
Installation

1. All ICM valves and ICAD motor actuators must be installed in horizontal pipelines with the motor actuator in an upright position.

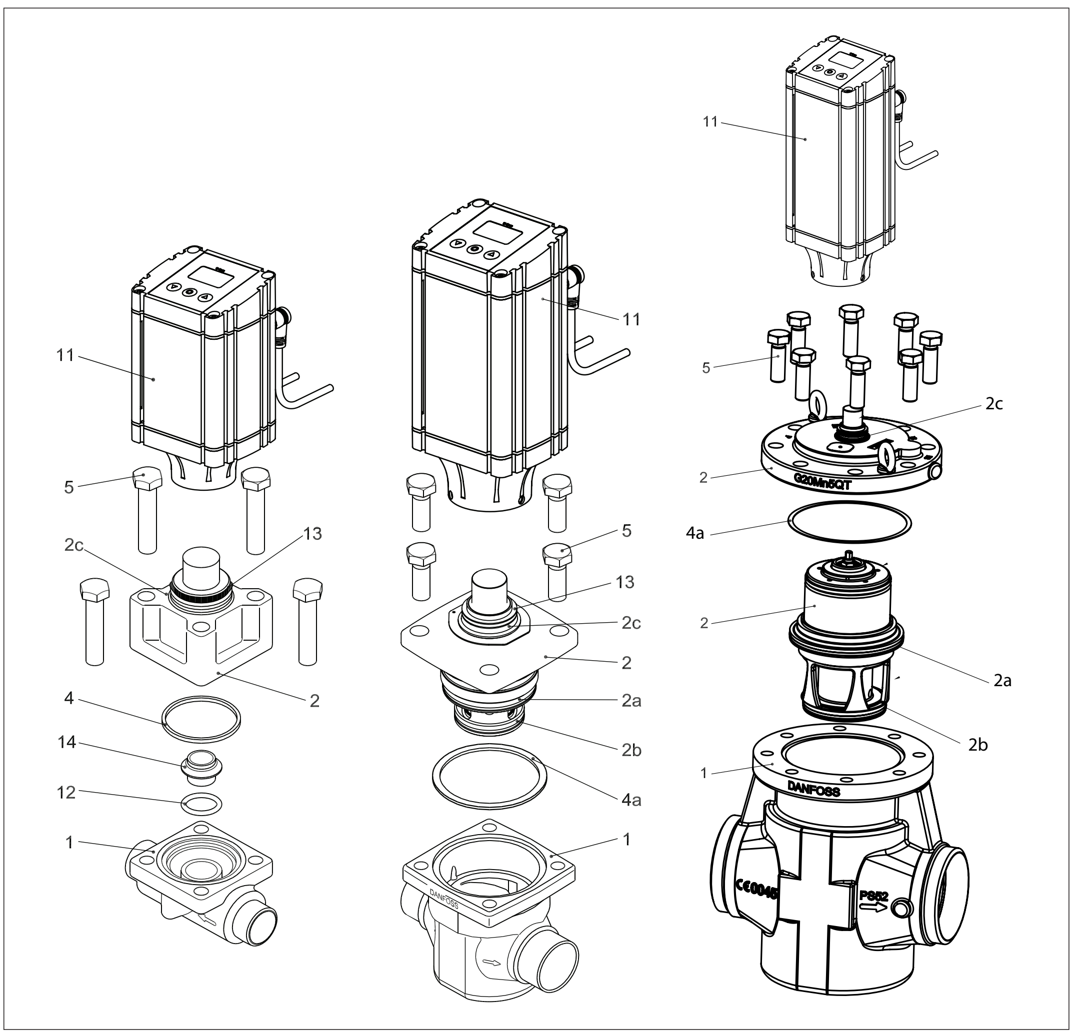
2. Preparation of Valve Body
ICM 20 (3/4") valves: both the integrated bonnet/function module and the separate valve seat must be removed from the valve body prior to welding. To remove the ICM20-A33 or ICM20-A valve seat use a 13mm socket and to remove the ICM20-B66, ICM 20-B or ICM20-C valve seat, use a 12 mm hex key.

   - ICM 25 to 65 (1" to 2-1/2") valves, the integrated bonnet and function module should be removed as shown in the figure.

   - ICM 100 to 150 (4" to 6") valves, the function module and bonnet are separate pieces and do not need to be removed prior to welding. However, some form of arc welding should be used to weld the valve into the piping and care should be taken to protect the valve stem from becoming contaminated.



Removing the bonnet/function module from the body of the ICM 25 to 65 valves.



No.	Part
1	Housing
2	Top cover / function module
2a	O-ring
2b	O-ring
2c	O-ring
4	Gasket
4a	Gasket
5	Bolts
11	Actuator
12	O-ring
13	O-ring
14	Seat

Installation (continued)

Care should be taken to protect the ICM function module when it is removed and stored during installation of valve body.

3. Weld the valve body in line making sure that the arrow on the valve body is pointing in the direction of flow.

   - For ICM 20 through 65, make sure that all debris is removed from valve body before bonnet/function module is re-installed.

   - For the ICM 20, make sure that the removable orifice seat is re-installed in the valve body with the small o-ring between the orifice seat and the body. Use a 13mm socket to tighten the ICM20-A33 or ICM20-A valve seat to a torque of 6.5 ft-lbs (9 N-m). Use a 12 mm hex key to tighten the ICM 20-B66, ICM20-B or ICM20-C valve seat to a torque of 1.5 ft-lbs (2 Nm).
     DO NOT OVERTIGHTEN THE REMOVABLE SEAT.
     Make sure that the bonnet gasket is installed and in good condition.

   - For the ICM 25 through ICM 65, check that the two o-rings are installed on the function module and that the gasket located on the top of the valve body is installed and all are in good condition.
     A light coating of refrigerant oil on the bonnet o-rings and the cover gasket will facilitate assembly of the valve.

4. Install the bolts and torque to the following specifications:

Valve Body	Nm	ft lbs
ICM 20	40	29
ICM 25	100	74
ICM 32	120	88
ICM 40	120	88
ICM 50	140	103
ICM 65	150	110
ICM 100 through 150	220	162

5. Install the ICAD Motor on the ICM valve:
   The ICM valve must not be in its full opened position while the ICAD motor is calibrated with the valve (at a later step). Therefore, if the opening degree of the ICM valve was changed from the factory setting, it should be set to an opening degree between 0% and 75% using the manual magnet tool. To easily ensure correct positioning, turn the manual tool counter-clockwise until it is clear that it cannot be turned any further.

   - Make sure that the ICM adapter/valve stem and inner ICAD magnets are completely dry and free from any debris.

   - For applications below freezing, the ICM adapter O-ring (position 2c in the diagram on page 5) must be removed and Molycote G 4500 grease (supplied with ICAD motor) needs to be applied in the O-ring groove on the adapter and on the O-ring before it is re-installed on the ICM adapter. The Molycote grease ensures a good seal between the ICAD motor and the ICM adapter to prevent moisture from entering the ICAD magnets.

   - Place the ICAD motor on the valve stem.

   - Push the ICAD motor completely down to the identification ring on the valve stem. Using a 2.5 mm hex key, tighten the set screws evenly so the ICAD motor is centered on the ICM valve stem. Torque the set screws to approximately 3 Nm (2.5 ft-lbs).

Electrical data

Supply voltage is galvanically isolated from input and output wires

Supply Voltage	Fail Safe Supply
24 VDC + 10%/-15%	Min. 19 VDC

Load	ICAD 600A	1.2 A	ICAD 600A	1.2 A
	ICAD 1200A	2.0 A	ICAD 1200A	2.0 A

Analog Input – Current or Voltage		Analog Output
Current	0/4 – 20 mA	0/4 – 20 mA
	Load: 200Ω	Load: ≤ 250 Ω
Voltage	0/2 – 10 VDC	
	Load: 10k Ω	

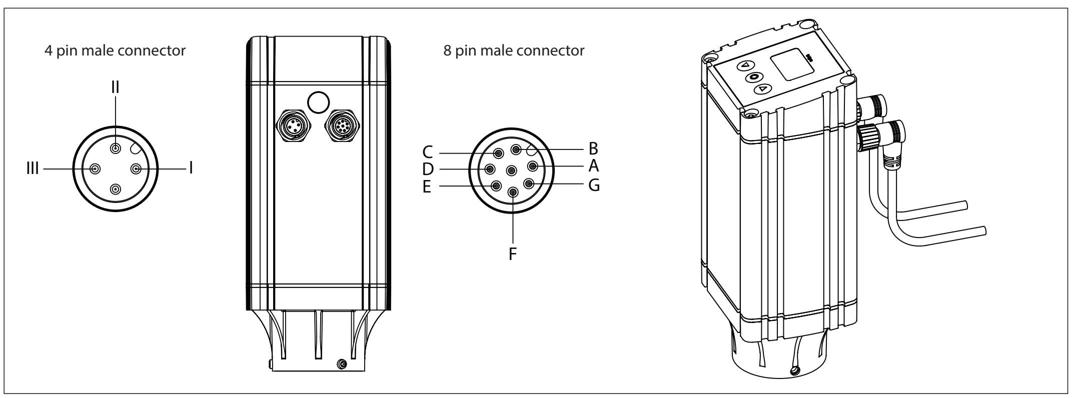
Digital Input – Digital On/Off input by means of voltfree contact with gold-plated contacts recommended

Voltage Input Used
ON: contact impedance < 50 Ω
OFF: contact impedance > 100 k Ω

Digital Output:	3 pcs. NPN transistor output
External Supply:	5 – 24 VDC (same supply as for ICAD can be used but note that galvanically isolated system will be spoiled.
Output Load:	50 Ω
Load	Max. 50 mA

Wiring the ICAD actuator

There are two cables which are connected to the ICAD motor with M12 connectors:



Communication connector / cable

Ref.	Color		Description	
A	Black	–	Common Alarm	Digital Ouput
B	Brown	–	ICM fully open	
C	Red	–	ICM fully closed	
D	Orange	–	GND ground	
E	Yellow	+	0/4 - 20 mA Input*	
F	Green	+	0/2 - 10 V Input. Also used with GND (orange wire) as a digital input #1 for on-off operation or floating 3-point control	
G	Blue	+	0/4 - 20 mA Output*	

Power connector/cable (3 wires)

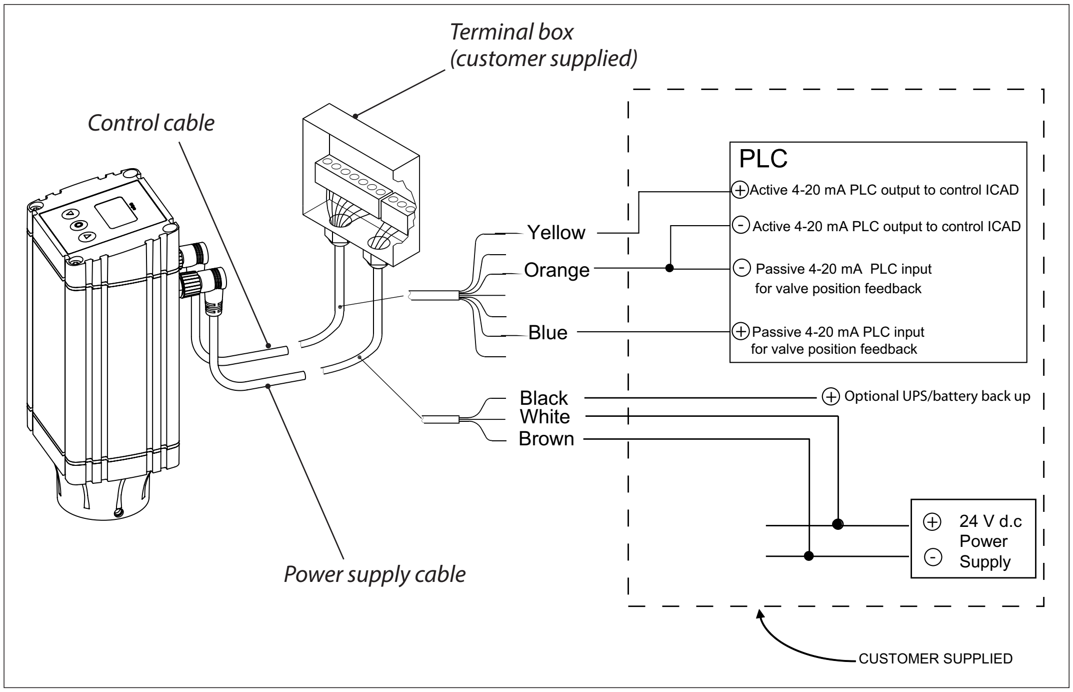
I	Black	+	Fail safe supply Battery / UPS (uninterruptable power supply) 19 V d.c.
II	White	+	Supply voltage 24 V d.c.
III	Brown	–	

* If using floating 3-point control (parameter i02=3) then wire colors yellow and blue are combined to make the 2nd digital input

Wiring the ICAD actuator

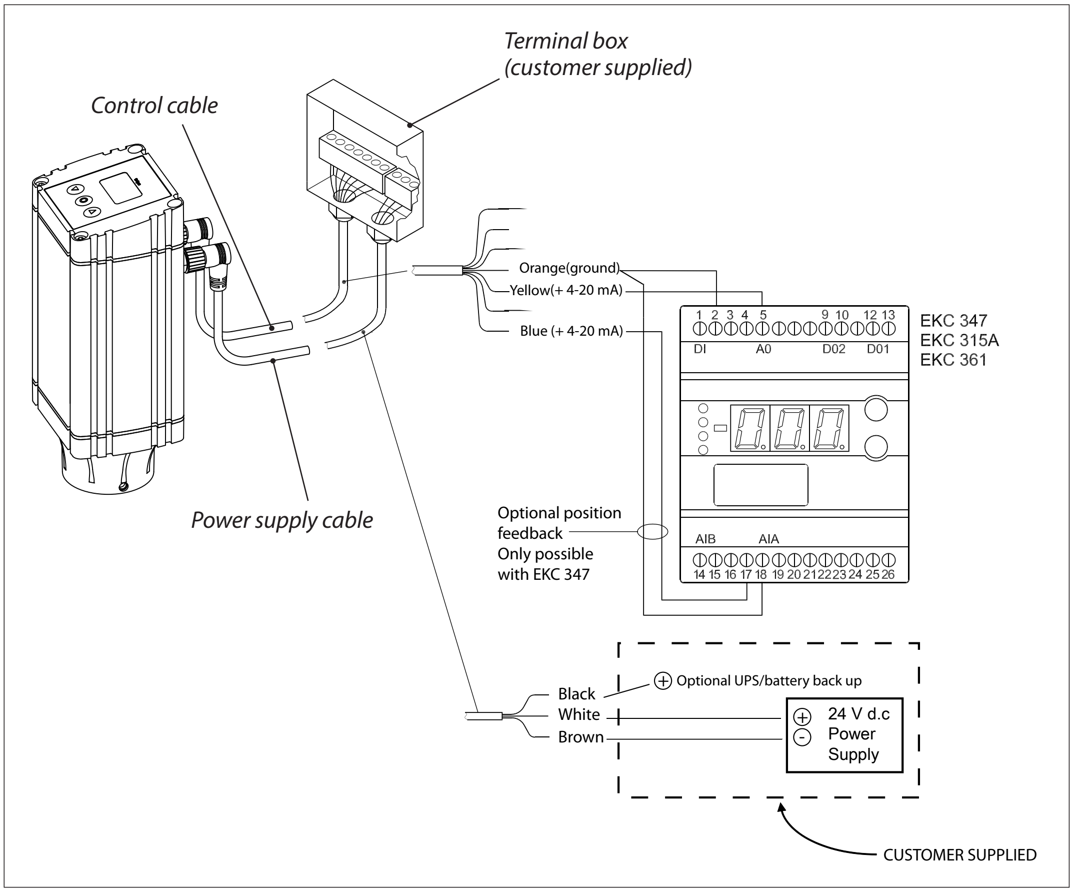
Wiring diagram showing ICAD wired to a PLC or other type of third party electronics

Note: The ICAD supplies the power for the 4-20 mA feedback signal.



Wiring diagram showing ICAD wired to a Danfoss EKC controller

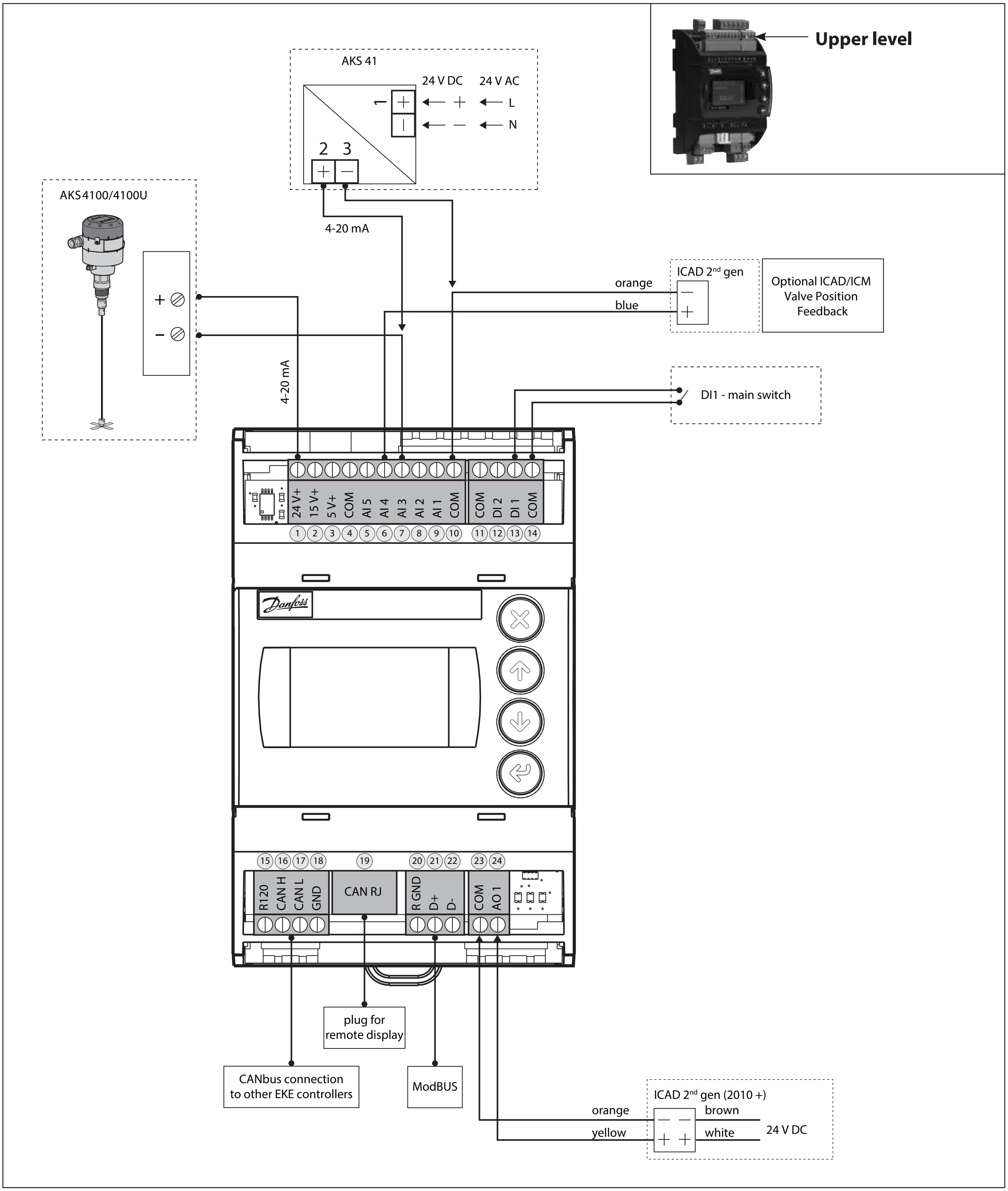
Note: For instructions on completely wiring an EKC controller, please see the relevant EKC controller manual.



Wiring the ICAD actuator continued

Wiring diagram showing ICAD wired to a Danfoss EKE controller

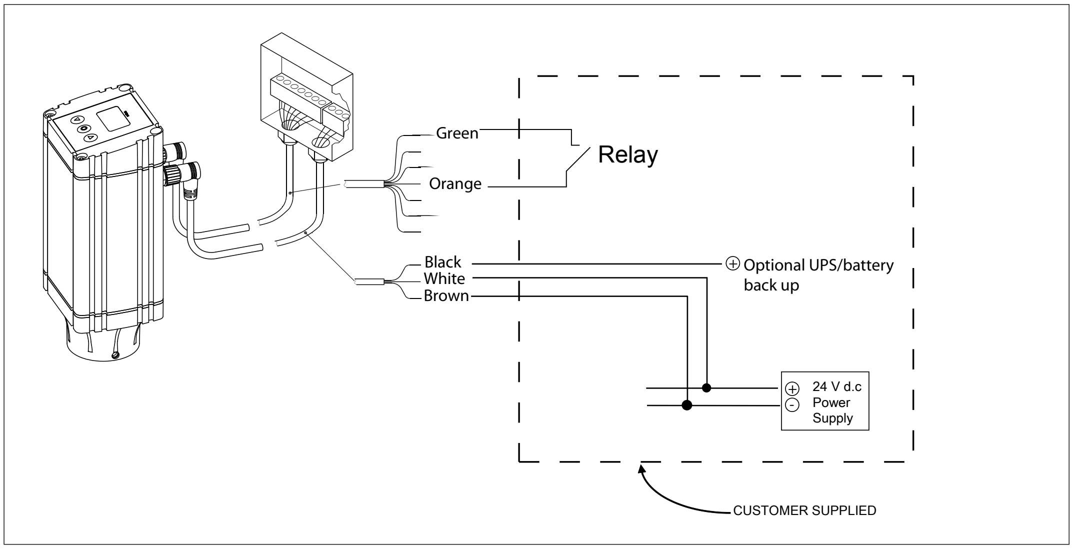
Note: For instructions on completely wiring an EKE controller, please see the relevant EKE controller manual.



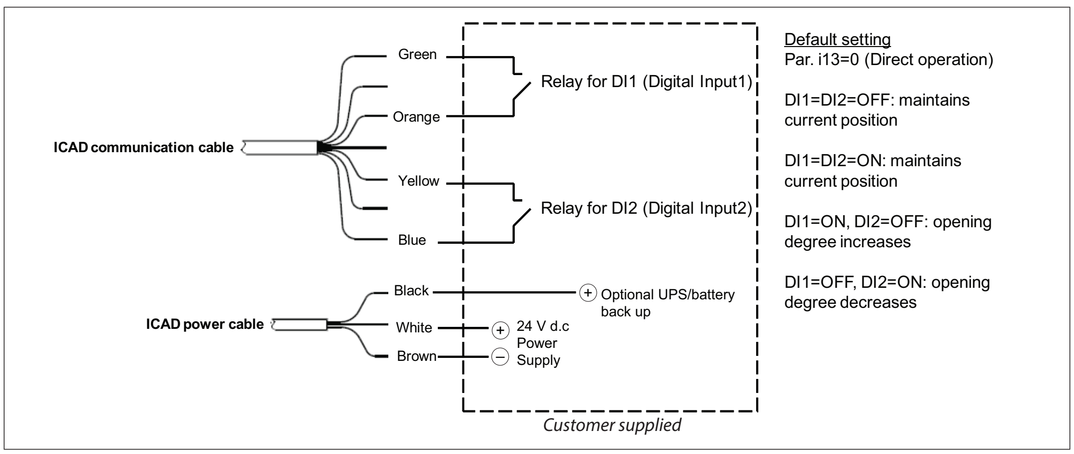
Wiring the ICAD actuator continued

Wiring diagram showing ICAD wired with one digital input for ON/OFF solenoid valve operation

Note: The ICAD motor can be programmed to open or close when the relay is closed. See parameter ¡09 in programming section.

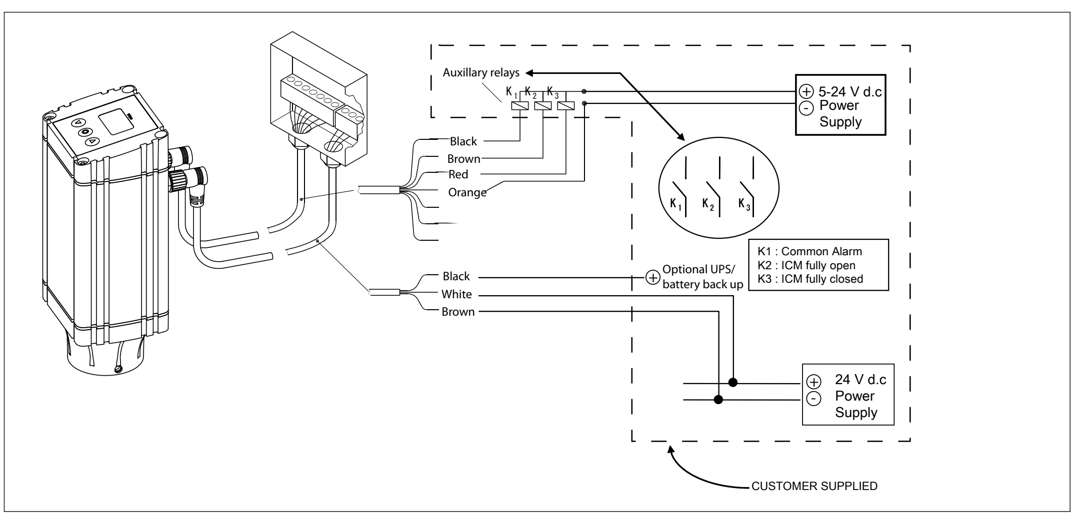


Wiring diagram for floating 3-point control (open-neutral-close)



Wiring diagram showing ICAD digital outputs wired with customer supplied auxiliary relays

NOTE: The same 24 V d.c. power that powers the ICAD can be used with the ICAD digital outputs to power auxiliary relays (or other small load devices) but the system will no longer be galvanically isolated.



ICAD overview

1. All ICAD actuators are digital stepper motors. As the control signal changes ICAD will electronically count steps up or down from its previous position. The ICAD 600A, ICAD 1200 and 1200A have an optical encoder which will actually measure the steps to recalibrate while operating if needed. In all cases, the ICAD actuators will recalibrate every time that power is cut and then reconnected. Recalibration is also accomplished when the valve is driven closed, the ICAD will take an extra closing step to make sure it is completely closed and start counting from 0 again.

2. The ICAD actuators can also be put into manual mode by using parameter **¡01**. Once the parameter has been selected and the manual mode entered, the valve can be opened and closed independent of the control signal. When in the manual mode, the display screen will flash the opening degree and continue to flash until the parameter is restored to its normal operation setting.

3. The ICAD actuator can be controlled with an analog input for modulating control, 1 digital input for open/close solenoid function or with 2 digital inputs for floating 3-point control (open-neutral-close). The speed of the ICAD can be altered (see parameters **¡04** and **¡14**).

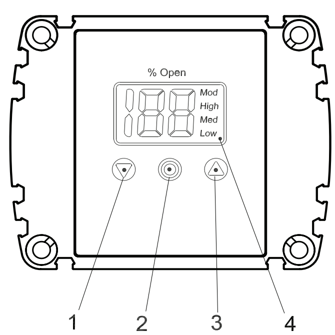
4. The ICAD display will continuously display the ICM valve opening degree in % unless there is an alarm or the parameter list is being viewed. The display will also indicate **Mod** if being controlled by an analog input signal (modulating mode) or if being controlled by digital inputs the display will indicate **Low**, **Med** or **High** depending on the speed setting.

5. The ICAD actuator can be connected to a 24 V d.c. UPS (uninterruptable power supply) and can be programmed for a specific action in the event of a disruption to the normal power supply (see parameters **¡07, ¡08 and ¡12**). Please note that the UPS provides a discrete short term action in the event of a power failure. It cannot be used for normal operation.

6. The ICAD actuator also has an inverse function (see parameter **¡13**). This feature allows the valve to either open or close on a rising analog signal.

Operation the ICAD menu

1. To access the ICAD actuator menu, press and hold the middle button (2) until the menu appears.



1. Down arrow push button
2. Enter
3. Up arrow push button
4. Display

2. Once you are in the menu, use the UP (3) and DOWN (1) arrows to move through the list of parameters.

3. To display and/or change the value of the parameter, press the middle button (2) to view the current settings.
   a) To change the value of a parameter, use the up or down arrow to establish the new value for that parameter.
   b) Once the new value for the parameter has been selected, press the middle button to save the change and return to the menu.

4. Repeat this procedure for all parameters.

5. Exit from the parameter list by pressing and holding the middle button for 2 seconds or simply wait for the ICAD to return to the main display (approx. 20 seconds).

Programming the ICAD actuator

When the ICAD actuator is first powered on, the ICAD display will flash an A1 alarm. This alarm is a reminder that the ICM valve being moved by the ICAD has not been selected in parameter **¡26**. Parameter **¡26** is password protected and will not appear in the parameter list until the user enters the password in parameter **¡10**. The password is "11" and will allow the user to access parameter **¡26** where the appropriate valve size can be selected. Once the ICM valve size is selected (see page 3 on how to identify ICM size), the ICAD actuator will calibrate itself to that particular size and will then be ready to receive a control signal.

Description	ICAD parameter	Min	Max	Factory Setting	Stored	Unit	Pass word	Comments
OD (Opening degree)	-	0	100			%	-	ICM/ICMTS valve Opening Degree is displayed during normal operation. Running display value (see **¡01**, **¡05**).
Main Switch	**¡01**	1	2	1	✔	-	No	Internal main switch 1: Normal operation 2: Manual operation. Valve Opening Degree will be flashing. With the down arrow and the up arrow push buttons the OD can be entered manually.
Mode	**¡02**	1	2	1	✔	-	No	Operation mode 1: Modulating – ICM positioning according to Analog Input (see **¡03**) 2: ON/OFF - operating the ICM valve like an ON/OFF solenoid valve controlled via Digital Input. See also **¡09**. 3: Neutralzone / 3 point control. Increase/Decrease Opening Degree by Digital Input. See fig. 9
AI signal	**¡03**	1	4	2	✔	-	No	Type of AI signal from external controller 1: 0-20 mA 2: 4-20 mA 3: 0-10 V 4: 2-10 V
Speed In **Modulating Mode** Opening/closing speed In **ON/OFF Mode** Opening speed	**¡04**	1	100	50/ 100	✔	-	No	Speed can be decreased. Max. speed is 100 % - Not active in manual operation (**¡01** = 2) If **¡26**= 1 - 3 then factory setting =100 If **¡26**= 4 - 9 then factory setting =50 If ICM is opening and (**¡04** < = 33) or ICM is closing and (**¡14** < = 33) => Low is displayed. If ICM is opening and (33 < If **¡04** < = 66) or ICM is closing and (33 < If **¡14** < = 66) => Med is displayed. If ICM is opening and (**¡04** > = 67) or ICM is closing and (**¡14** > = 67) => High is displayed"
Automatic calibration	**¡05**	0	2	0		-	No	Not active before **¡26** has been operated. Always auto reset to 0. CA will flash in the display during calibration, if Enter push button has been activated for two seconds 0: No Calibration 1: Normal forced calibration - CA flashing slowly 2: Extended calibration – CA flashing rapidly"
AO signal	**¡06**	0	2	2	✔	-	No	Type of A0 signal for ICV valve position 0: No signal 1: 0-20 mA 2: 4-20 mA
Failsafe	**¡07**	1	4	1	✔	-	No	Define condition at power cut and fail safe supply is installed. 1: Close valve 2: Open Valve 3: Maintain valve position 4: Go to OD given by **¡12**"
Fail safe supply	**¡08**	0	1	0	✔		Yes	Fail safe supply connected and enable of A4 alarm: 0: No 1: Yes
DI function	**¡09**	1	2	1	✔		No	Define function when DI is ON (short circuited DI terminals) when **¡02** = 2 1: Open ICM valve (DI = OFF = > Close ICM valve) 2: Close ICM valve (DI = OFF = > Open ICM valve)
Password	**¡10**	0	199	0		-	-	Enter number to access password protected parameters: **¡26** Password = 11
Old Alarms	**¡11**	A1	A99	-		-	No	Old alarms will be listed with the latest shown first. Alarm list can be reset by means of activating down arrow and up arrow at the same time for 2 seconds.
OD at power cut.	**¡12**	0	100	50	✔		No	Only active if **¡07** = 4 If fail safe supply is connected and power cut occurs, the ICM will go to the specified OD.
Inverse operation	**¡13**	0	1	0	✔		No	When **¡02** = 1 0: Increasing Analog Input signal => Increasing ICM Opening Degree 1: Increasing Analog Input signal => Decreasing ICM Opening Degree When **¡02** = 3 0: DI1 = ON, DI2 = OFF => Increasing ICM Opening Degree. DI1 = OFF, DI2 = ON => Decreasing ICM Opening Degree DI1 = DI2 = OFF => ICAD/ICM maintain current position DI1 = DI2 = ON => ICAD/ICM maintain current position 1: DI1 = ON, DI2 = OFF => Decreasing ICM Opening Degree DI1 = OFF, DI2 = ON => Increasing ICM Opening Degree DI1 = DI2 = OFF => ICAD/ICM maintain current position DI1 = DI2 = ON => ICAD/ICM maintain current position

Parameter list
(continued)

Description	ICAD parameter	Min	Max	Factory Setting	Stored	Unit	Pass word	Comments
In **ON/OFF Mode** Closing speed	**¡14**	0	100	50/ 100	✔	-	No	See **¡04**. If **¡26**= 1 - 3 then factory settin qg = 100 If **¡26**= 4 - 9 then factory setting = 50
Manual set point	**¡15**	0	100	0			No	When **¡01**= 2, **¡15** determine the start up value.
Encoder operation	**¡16**	0	1	1	✔		Yes	**NB:** Password protected. Password = 7 0: Encoder disabled. Means ICAD operation as ICAD 600A/ICAD 600A-TS/1200A without encoder 1: Encoder enabled
Forced closing when ICM valve Opening Degree < 3%	**i17**	0	1	0	✔	-	No	Enable/Disable forced closing 0: When ICM valve Opening Degree < 3% it will be forced to close regardless of requested ICM valve Opening Degree 1: When ICM valve Opening Degree < 3% no forced to closing will take place
ICM configuration	**¡26**	0	9	0	✔		Yes	**NB:** Password protected. Password = 11 0: No valve selected. Alarm A1 will become active. 1: ICM 20 with ICAD 600A / ICMTS 20 with ICAD 600A-TS 2: ICM 25 with ICAD 600A 3: ICM 32 with ICAD 600A 4: ICM 40 with ICAD 1200A 5: ICM 50 with ICAD 1200A 6: ICM 65 with ICAD 1200A 7: ICM 100 with ICAD 1200A 8: ICM 125 with ICAD 1200A 9: ICM 150 with ICAD 1200A

It is possible to **restore the original factory settings** to the ICAD by the following procedure:

1. Remove the power supply.
2. Activate the up arrow and the down arrow push buttons at the same time.
3. While pushing the up and down arrows, reconnect the power supply.
4. Release the up and down arrows.
5. When the display on the ICAD is alternating between CA and AI, the factory parameters have been restored.

Pre-startup Checklist

- Valve Assembly
  - Bonnet bolts are secure
  - Seat has been replaced in body (ICM 20)
  - The degree of opening of the valve is 75% or less
  - Grease has been applied to o-ring area on valve stem
  - Set screws have been uniformly tightened on ICAD Actuator
- Power has been connected to actuator (24 V d.c.)
- Back up power (UPS) has been connected to actuator (optional)
- Control Wiring has been connected
  - Signal input: digital or analog
  - Feedback wiring (optional)
- Programming (mandatory parameters)
  - The mode of operation has been set (**¡02**)
  - The input signal type has been set (**¡03**)
  - The ICM valve size has been set (**¡26**)

  Battery back-up (optional) parameters have been established (**¡07, ¡08, ¡12**)

Troubleshooting

Overview

The ICAD actuator has a number of very useful service parameters which should always be consulted first. In addition, a manual tool should always be available to manually close the valve completely in the event the ICAD has failed. When using the manual tool, turn the tool clockwise to open the valve and counter-clockwise to close the valve.

NOTE:
When rotating the valve manually you are changing the position of the valve to a value different than what is in the actuator's memory. Therefore, a calibration must be performed when ICAD is remounted to the valve. If power is cut from the actuator prior to using the manual tool or after the valve has been adjusted, no problem will occur as the valve will automatically recalibrate itself once power is restored. Power can easily be disconnected and reconnected by unscrewing and then reconnecting the power cable from the ICAD actuator.

Service parameter (View only)

Description	ICAD parameter	Min	Max	Unit	Comments
OD %	**¡50**	0	100	%	ICM valve Opening Degree
AI [mA]	**¡51**	0	100	mA	Analog input signal
AI [V]	**¡52**	0	100	V	Analog input signal
AO [mA]	**¡53**	0	100	mA	Analog output signal
DI Digital input Status	**¡54**	0	1	-	DI signals. Depending of **¡02** If **¡02** = 2, one digit is shown. 0 : DI1 = OFF 1 : DI1 = ON If **¡02** = 3, two digits are shown. 00 : DI1 = OFF, DI2 = OFF 10 : DI1 = ON, DI2 = OFF 01 : DI1 = OFF, DI2 = ON 11 : DI1 = ON, DI2 = ON
DO Status for ICM closed	**¡55**	0	1	-	1: DO = ON when OD < 3 %; 0: DO = OFF
DO status for ICM opened	**¡56**	0	1	-	1: DO = ON when OD > 97 % 0: DO = OFF
DO Alarm status	**¡57**	0	1	-	1: DO = ON when a Alarm is detected 0: DO = OFF
Display mP SW ver.	**¡58**	0	100	-	Software version for display microprocessor
Motor mP SW ver.	**¡59**	0	100	-	Software version for motor microprocessor

Alarms

Description	ICAD alarm text	Definition of event	Comments
No Valve type selected	**A1**	Alarm ON	At start-up **A1** will be displayed until parameter **¡26** is set
Controller fault	**A2**	Alarm ON	Internal fault inside electronics. Carry out: 1) Power OFF and Power ON If A2 still active. 2) Make a Reset to factory setting If A2 still active. Return ICAD to Danfoss
Analog input error	**A3**	Alarm ON	Not active if **¡01** = 2, or **¡02** = 2 When **¡03** = 1 and AI A > 22 mA When **¡03** = 2 and AI A > 22 mA or AI A < 2 mA When **¡03** = 3 and AI A > 12 V When **¡03** = 4 and AI A > 12 V or AI A < 1 V
Low voltage of fail safe Supply	**A4**	Alarm ON	If 5 V < fail safe supply <18 V. Enabled by **¡08**
Check supply to ICAD	**A5**	Alarm ON	If supply voltage < 18 V
Calibration extended failed	**A6**	Alarm ON	Check valve type selected. Check presence of foreign debris inside ICM valve
Thermal overload	**A8**	Alarm ON	ICAD stepper motor temperature too high
Valve locked	**A9**	Alarm ON	Only active if i16 = 1 If the ICM valve is locked for more than 15 seconds (unable to reach its requested position) A9 will flashin display. A9 alarm can only be reset by Power OFF/ON of ICAD

Note: old alarms that may not be active anymore will be saved and listed in paramenter i11

Troubleshooting continued

The alarms and service values work together to allow the user to quickly diagnose the source of operating issues. The most common alarms are:

A1 The user has not selected the valve type. Each ICAD actuator is capable of driving several different valve sizes. Upon installation of the valve, it is mandatory that the user select the valve size from parameter **¡26**.

A3 The control signal is out of the range of the selected values. The most common causes of this problem are:

1. Improper wiring
2. Incorrect selection of control signal (parameter **¡03**)
3. The source of the control signal is not outputting the correct type of signal.

A9 The valve is locked, disconnect and remove motor. Use magnetic tool to slowly open/close the valve thru the full range. There should be at no point a sticking/tight spot. You may need to remove the valve bonnet/module to clean debris or replace the bonnet/module if it is damaged. If A9 alarm continues please contact Danfoss with application details.

Of course, there are numerous other alarm messages designed to protect the equipment and help to diagnose problems as pro-actively as possible. Most of these alarms are fairly self-explanatory.

Troubleshooting Tips

The valve does not appear to close or stay closed completely.

- The display shows 0% opening degree but the valve can be driven further closed with the manual tool.
  Solution: Recalibrate the valve. In addition, if the manual tool has been used to open or close the valve, the valve should turn very easily. If there appears to be resistance in opening or closing the valve, replace the module.
- The display shows 0% opening degree and the valve cannot be driven closed any further with the manual tool.
  Solution: Pull the function module and check to ensure that there are 2 o-rings on the module for ICM 25 and larger. For size ICM 20, make sure valve seat is installed.

The valve does not appear to be moving to the correct position.

- Check service value **¡51**. This is the mA input from the control system. The degree of opening is linearly proportional to the mA input. (For example, if 4-20 mA was chosen as the input range and the service value shows 12mA, the valve should be 50% open.)
  Solution: Check parameter **¡03** to make sure that the correct scale was selected.
- Compare service value **¡51** to the value reported to be the output from the control system. If necessary, measure the actual current into the ICAD.
  Solution: If the two values do not equate, check wiring, paying special attention to wire polarity. If measured mA does not equate to the stated controllers output, the problem is likely to be in the control system. If measured mA does not equate to the value seen in **¡51** and everything is wired properly, the problem is likely with the ICAD actuator.
- The ICAD was not mounted properly on the valve stem.
  Solution: Check to make sure that the ICAD set screws are evenly torqued around the base of the ICAD.

The valve does not appear to be opening fast enough or seems too fast

- The speed of the ICM valves are preset at the factory:
  - For ICM valves 20, 25, and 32, the preset speed is 100%
  - For ICM valves 40, 50, 65, 100, 125, and 150, the preset speed is 50%

Solution: Check parameter **¡04** to note the actual setting and adjust accordingly

The valve position feedback signal is not working with the customer supplied controller/PLC.

- A power supply was installed in the 4-20mA/0-20 mA feedback loop. The ICAD motor actuator supplies power for the 4-20mA/0-20 mA feedback loop.
  Solution: Remove any power source that may be supplied to the feedback loop.
- Wiring problem.
  Solution: Check the service value of **¡53** (the analog output signal) to see what the ICAD is outputting. If nothing is revealed, check the output wire (blue) with an ammeter to verify the actual output value.
- The feedback output signal was not turned on in parameter **¡06**.
  Solution: Change this parameter to the appropriate signal.

Frequently Asked Questions

What happens in the event of a power failure?
The ICAD actuator will remain in the position it is in when power is lost. There are two approaches to solving the issue:
- Add a UPS (Uninterruptible Power Supply) device to the power wiring. This is easily accomplished with the brown (-) and black (+) wires in the power cable bundle. A UPS device is available from Danfoss and can provide up to 10 amps of power for up to 90 seconds in order to move the valve to the desired position. Because of the high amperage, the UPS is capable of providing power to several ICAD actuators depending on the size of the actuator. NOTE: The UPS is not a continuous power supply. It is only meant to change the valve position once in the event of a power failure.
- Add a solenoid valve in front of the ICM in order to stop refrigerant flow. This is a simple solution provided that there is no issue associated with the additional pressure drop through the solenoid valve.

How much power do I need to supply to the ICAD?
The total power required depends on the ICAD size and the number of ICAD's powered by the dc power supply. The power for each ICAD is:
- ICAD 600 (ICM 20, 25, and 32), the requirement per valve is approximately 30 watts.
- ICAD 900 (ICM 40, 50, and 65), the requirement per valve is approximately 50 watts.
- ICAD 1200 (ICM 100, 125, and 150) the requirement per valve is approximately 75 watts.
- ICAD 600A (ICM 20, 25, and 32), the requirement per valve is approximately 30 watts.
- ICAD 1200A (ICM 40, 50, 65, 100, 125, and 150) the requirement per valve is approximately 50 watts.

How can I monitor the valve position remotely?
The control wiring bundle provides for a 4 to 20 mA or 0 to 20 mA signal output with the blue (+) and orange (-) wires. The signal can be sent to:
- A remote display
- A PLC or PC
- Another ICAD actuator to provide the same input signal (daisy chain)

At what minimum OD%/mA will the ICAD automatically close and calibrate?
The ICAD will automatically close or be closed when the opening degree is below 3% which corresponds to 4.48 mA. After it is closed it will give a few extra steps to calibrate the valve.

If the 4-20mA signal is lost while the valve is open, will the ICAD close the valve?
Yes, if the input signal is lost while the valve is open, the ICAD will close the valve and flash an A3 alarm which is for an input error.

How many turns/revolutions with the manual tool will fully open/close ICM valve?
- ICM 20: 1.25 turns
- ICM 25: 2.5 turns
- ICM 32: 3 turns
- ICM 40: 4 turns
- ICM 50: 5 turns
- ICM 65: 5 turns
- ICM 100: 12.75 turns
- ICM 125: 15.25 turns
- ICM 150: 18.25 turns

Does the ICAD make a high frequency noise?
Yes, when the ICAD is at standstill, it will generate a high frequency noise which is normal.

What size wire gauge is recommended to run to the ICADs?
The typical wire gauge is 22 AWG. For power wiring, the recommended maximum lengths (for 22 AWG) are:
- ICAD 600 90 feet
- ICAD 900 50 feet
- ICAD 1200 30 feet
- ICAD 600A 90 feet
- ICAD 1200A 50 feet

Heavier wire gauge will allow for longer lengths of power wiring. For example with 17 AWG, maximum lengths are:
- ICAD 600 285 feet
- ICAD 900 170 feet
- ICAD 1200 115 feet
- ICAD 600A 285 feet
- ICAD 1200A 170 feet

Control wire lengths can be as long as 1500 feet.

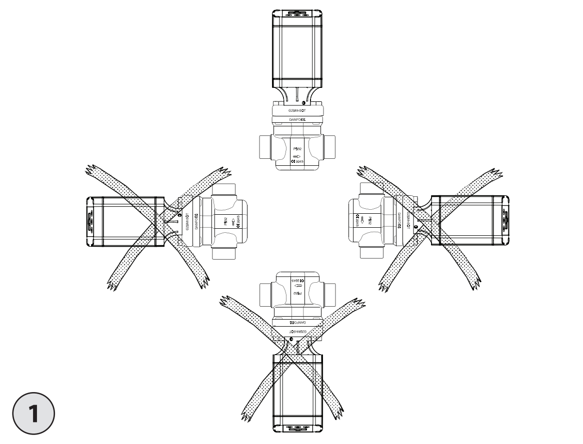
When running wire to the ICADs, does the wire need to be shielded?
There is no need for shielded cable; however, if used, the EMC capabilities of the ICAD will be improved.

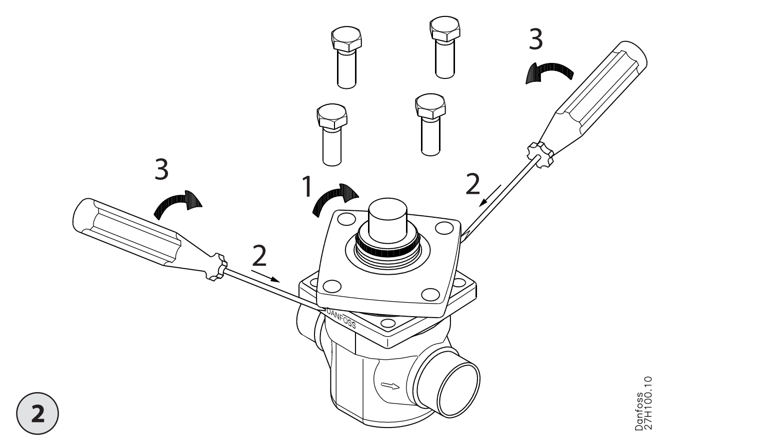
Installation Guide

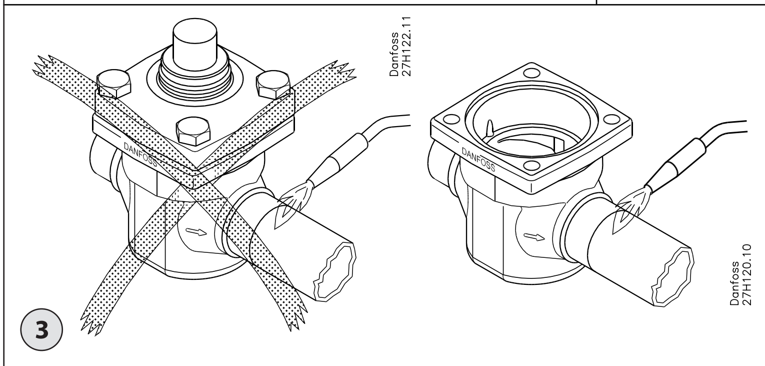
Motor operated valve
ICM 20-65

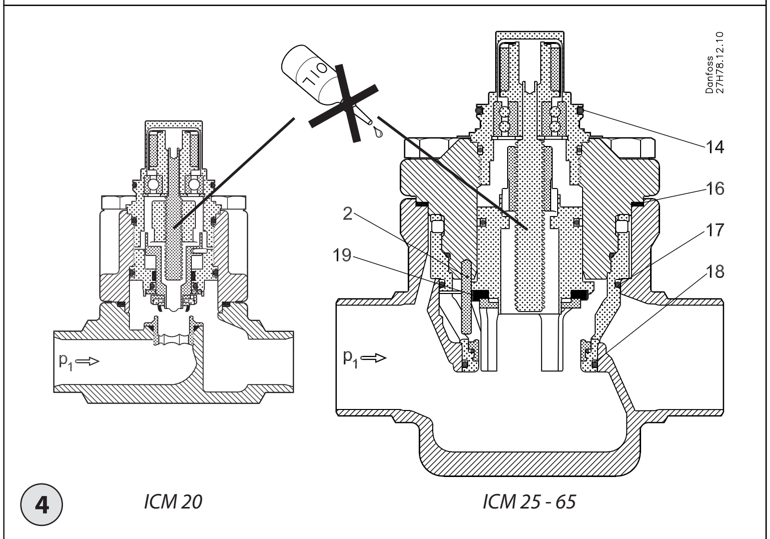
027R9777

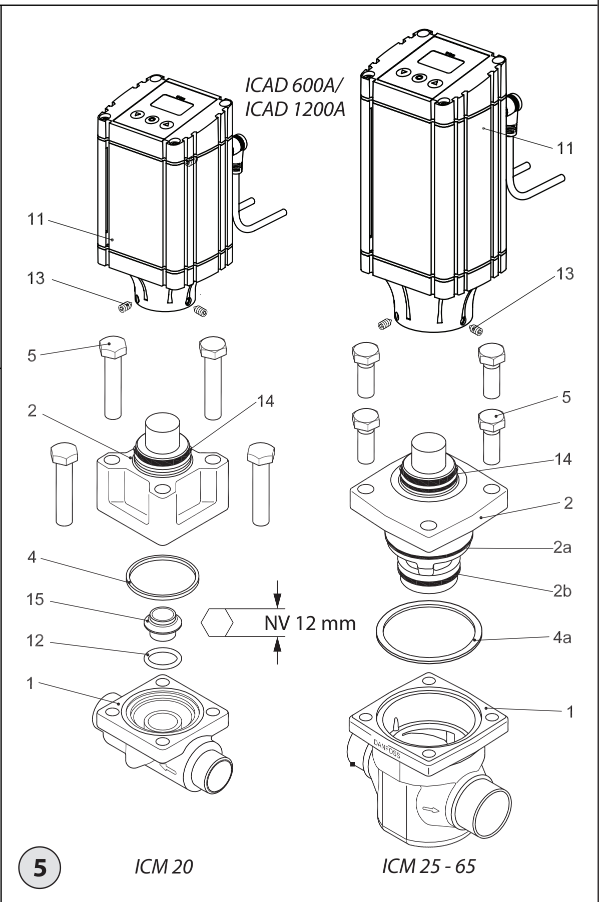
027R9777

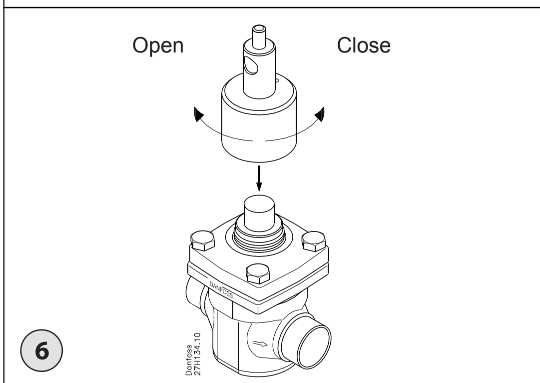


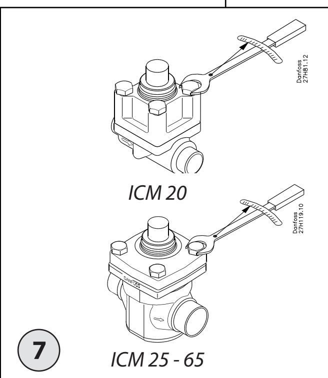












Valve body	Nm	ft lbs
ICM 20	40	29
ICM 25	100	74
ICM 32	120	88
ICM 40	120	88
ICM 50	140	103
ICM 65	150	110

ENGLISH

Installation

Refrigerants

ICM 20:
Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2)

ICM 25-65:
Applicable to HCFC, non flammable HFC, R717 (Ammonia), R744 (CO_2) and R1234ze

Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
Media: –60/+120°C (–76/+248°F)
Ambient: –30/+50°C (–22/+122°F)

Pressure
The valves are designed for a max. working pressure of 52 bar g (754 psig).

Technical data
ICM is a balanced valve which remains in its position. Return function must be provided with the actuator used.

The ICM can be used in suction, liquid, hot gas, and liquid/vapour lines. The ICM regulates the flow of the medium by modulation or on/off function, depending on the control impulse to the actuator. Refer to the technical leaflet for details on design and regarding selections.

The ICM valve is designed for use with the ICAD actuator from Danfoss. The ICAD actuator on the ICM ensures compatibility with the regulators provided by Danfoss plus a range of other controllers, especially PLC controllers. A control signal from a Danfoss controller or PLC will activate the ICAD motor and through a magnetic coupling rotate the spindle in the ICM to make the cone move vertically.

Valve cone
A V-shaped regulating cone provides optimum regulation accuracy.

Valve sizes
ICM is available in sizes from ICM 20-A (k_v: 0.6 m^3/h) to ICM 65-B (k_v: 70 m^3/h).

Modular valve concept
The ICM valve can be delivered as a parts program or a complete valve depending on the combination of parts wanted to form the selected and needed valve.
If the valve is delivered as a parts program it will consist of a valve body, a complete function module, and an actuator.

Installation
ICM + ICAD can be installed in horizontal pipelines with the actuator pointing upwards (fig. 1).

The top cover of the ICM can be turned 90° in any direction without any influence on the valve function. The motor can be mounted in any position before locking it with the 4 Allen screws (fig. 5, pos.13).

The ICM valve must be installed with the arrow in the direction of flow.
When installing an ICM, refrigerant must not be allowed to escape and dirt must not be allowed to enter the valve.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

ICM valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Welding (fig. 3)
The top cover, complete with function module, should be removed before welding to prevent damage to O-rings and Teflon (PTFE) in the function module and to avoid getting welding debris in the module.

Note: Remove <u>all</u> parts from the valve body before welding (as shown in fig. 3).
Especially on ICM 20 it is important to remove the seat
(fig. 5, pos. 15) as the heat will damage the seat.
Reassemble and tighten with hexagon key 12 mm (2 Nm).

The internal surfaces and weld connections of the enclosed ICS/ICM valve have been applied with an anti-corrosion treatment.

In order to maintain the effectiveness of this anti-corrosion treatment, it is important to ensure that the valve is disassembled just prior to the welding / brazing process being undertaken.

In the event that the function modules are to be left disassembled for any length of time, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be welded to the valve body. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

Manual operation
A magnetic coupling can be used to rotate the spindle manually if the actuator has been removed. To make use of the manual operation, a multi-function tool (optional) is used (see fig. 6). The code numbers for the multi-function tools are:

ICM 20 – ICM 32: **027H0180**
ICM 40 – ICM 65: **027H0181**

Manual operation is also possible with the actuator mounted on the valve and the power supply connected to the actuator. No matter if the signal connections are wired to the actuator it will be possible to use the manual operation function built into the actuator electronics allowing the motor to step in 1% increments meaning that 100 steps will correspond to a fully open valve. Please refer to the separate instruction on ICAD to address the manual function.

Insulation
Insulating the valve and its actuator is only necessary if an energy consideration in the plant requires this. Regarding the function of the ICM + ICAD no insulation is necessary when kept inside temperature limits.

Surface treatment and identification
The ICM valves are Zinc-Chromated from factory. If further corrosion protection is required, the valves can be painted.

Note: Magnet coupling must be protected.

Precise identification of the valve is made via the ID plate on the top cover. After welding, the external surface around the connections of the valve body must be protected to prevent against corrosion with a suitable coating.
Protection of the ID plate when repainting the valve is recommended.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. Check that the cone has been fully screwed back towards the top cover before it is mounted in the valve body. Use the manual magnetic tool (fig. 6) to achieve rotation through the top. A small amount of refrigeration oil on both O-rings can make the insert easier to install into the valve body.

Tightening
Tighten the top cover/function module with a torque wrench, to the values indicated in the table (fig. 7).

Maintenance

Service
A precise service schedule cannot be given for the valve as service intervals will depend on operating conditions, i.e. how often the valve operates and the amount of impurities and dirt the system carries. The ICM valves are easy to dismantle and all parts inside can be replaced by changing the function module.
Do not open the valve while the valve is still under pressure.

Be aware that the valve can be under pressure from both sides and that the manual magnet tool (fig. 6) can be used to open the seat and thus equalize pressure internally before removing the top cover.

If the Teflon ring (fig. 4, pos. 19) has been damaged, the Teflon must be machined or replaced according to the condition of the parts.

Dismantling the valve (fig. 2)
Do not remove the function module while the valve is still under pressure.
- (1) Upon removing the 4 bolts twist the module approx. 45° in either direction.
- (2) Push two screwdrivers in between the top cover and the valve body.
- (3) Pull the screwdrivers upwards to release the function module and its o-rings.

Replacement of the function module
The function module is easily replaced.
Remove the existing module (fig. 2):
(1) Upon removing the 4 bolts twist the module approx. 45° in either direction.
(2) Push two screwdrivers in between the top cover and the valve body.
(3) Pull the screwdrivers upwards to release the function module and its o-rings.
- Remove the old module.
- Oil the O-rings on the new module with a small amount of refrigeration oil.

The spindle inside the valve must not be greased or oiled (fig. 4).

If the valve seat has been dismounted, the ICM top must remain loosely connected to this. The two Allen screws that are holding the insert should not be tightened for the alignment to be precise.

Use only original Danfoss parts, including o-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss.

Drawings are only for illustration, not for dimensioning or construction.

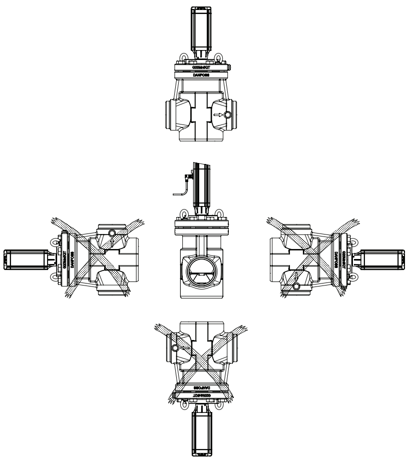
Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

c UL us
LISTED

The following text is applicable to the UL listed products ICM 20-65
Applicable to all common non-flammable refrigerants, including/excluding (+) R717 and to non-corrosive gases/liquids dependent on sealing material compatibility (++). The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. (+++).

Installation Guide

Motor operated valve
ICM 100-150



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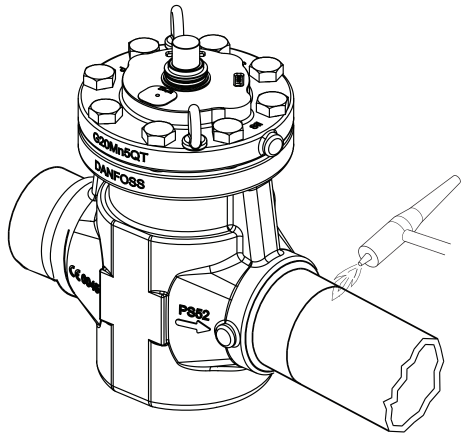

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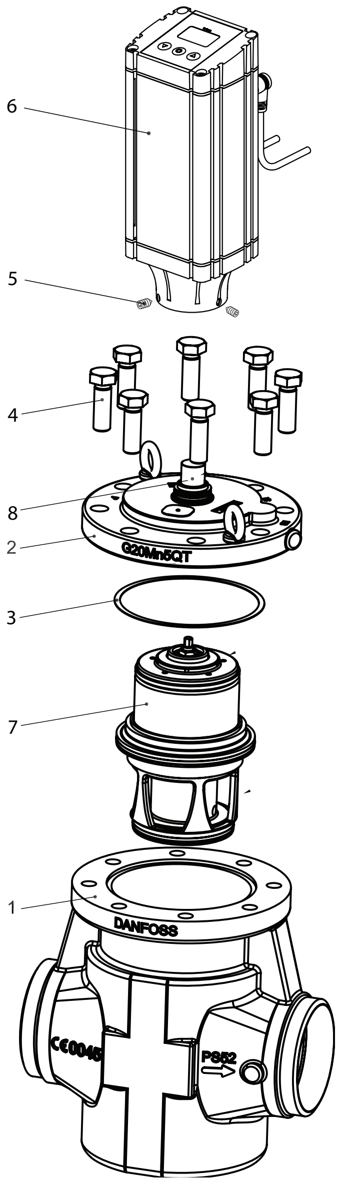
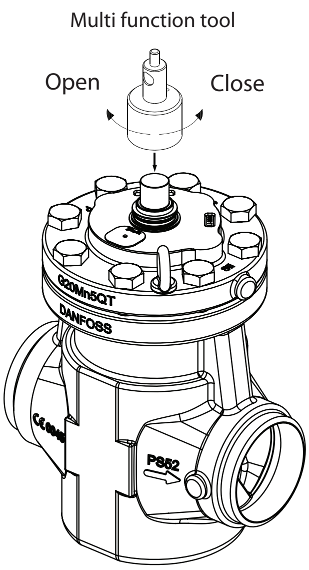


1 Housing
2 Top cover
3 Gasket
4 Bolts
5 Allan screws
6 Actuator
7 Insert
8 Magnetic coupling

3



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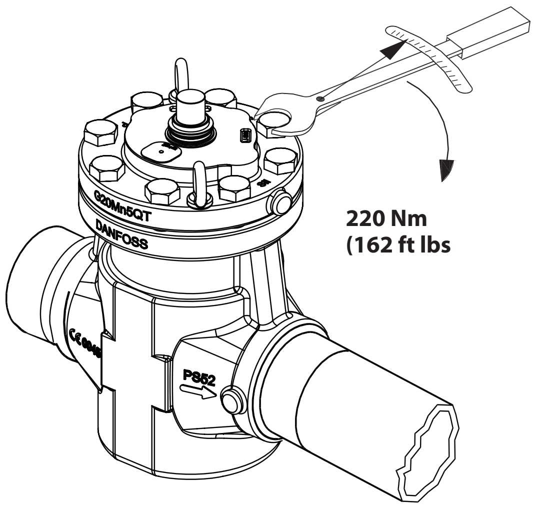

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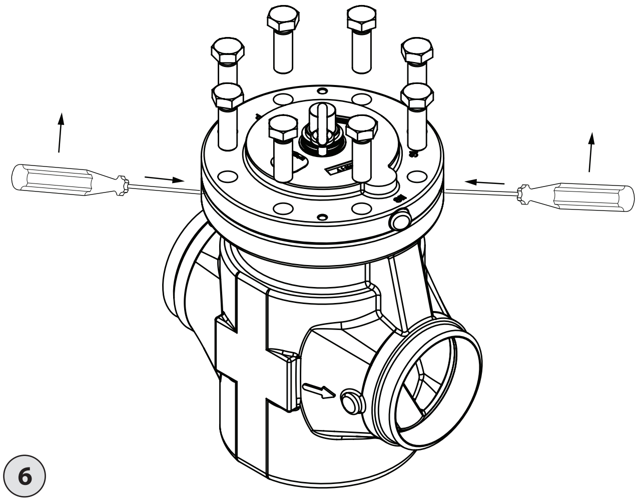
027R9794

Maintenance



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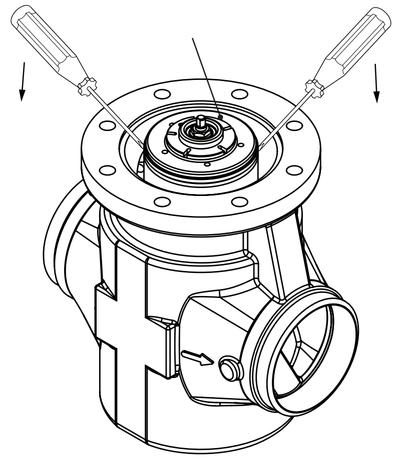

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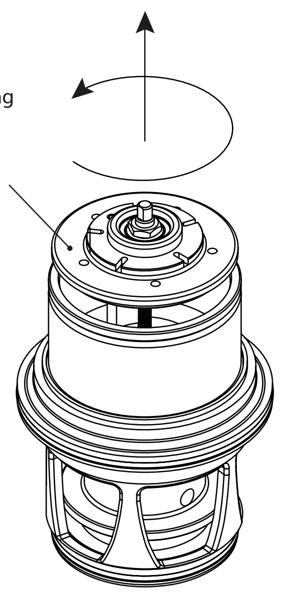

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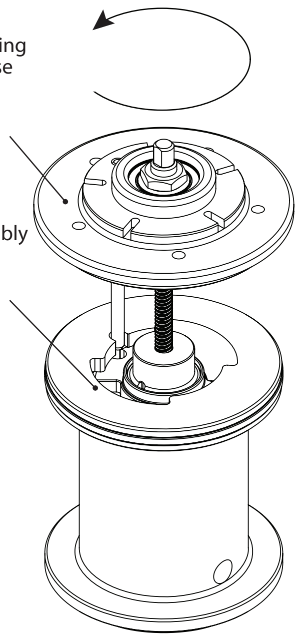

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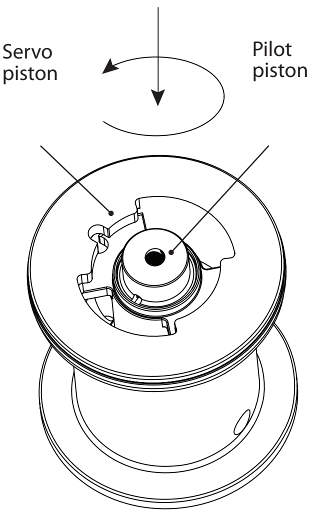

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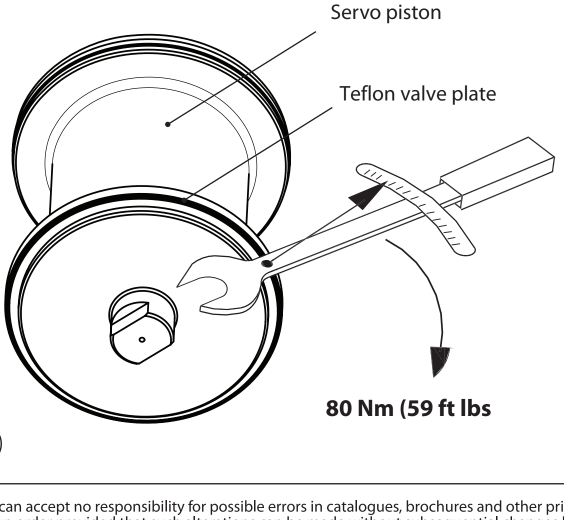

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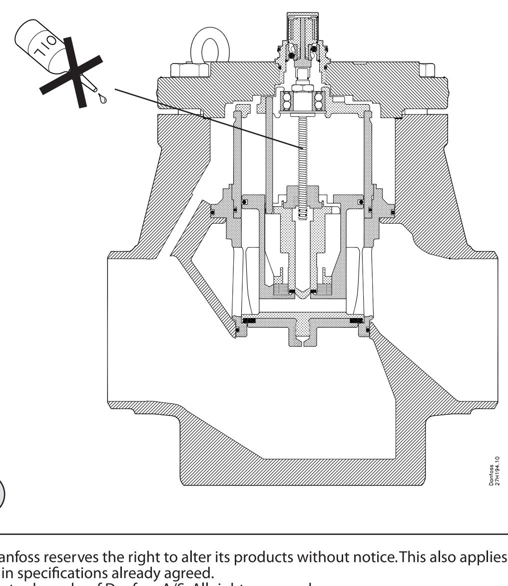


12

ENGLISH

Installation

Refrigerants
Applicable to HCFC, non flammable HFC, R717 (Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
Media: –60/+120°C (–76/+248°F)
Ambient: –30/+50°C (–22/+122°F)

Pressure
The valves are designed for a max. working pressure of 52 bar g (754 psi g).

Technical data
The ICM can be used in suction, liquid and hot gas lines. The ICM regulates the flow of the medium by modulation or on/off function, depending on the control impulse to the actuator. Refer to the technical leaflet for for design and selection information.

The ICM 100-150 valves are designed for use with the ICAD 1200 actuator from Danfoss. The ICAD actuator on the ICM ensures compatibility with the regulators provided by Danfoss plus a range of other controllers, especially PLC controllers. A control signal from a Danfoss controller or PLC will activate the ICAD motor and through a magnetic coupling rotate the spindle in the ICM to make the valve open or close.

Regulation performance
The V-shaped opening in the insert provides optimum regulation accuracy.

Valve sizes
ICM is available in sizes from ICM 100-B (k_v: 142 m^3/h) to ICM 150-B (k_v: 370 m^3/h)

Service friendly valve design
The ICM 100-150 is delivered as a complete valve. For service needs different spare part kits are available.

Installation
ICM + ICAD is installed in horizontal pipelines with the actuator pointing upwards (fig. 1).

The top cover can be rotated in any given direction without any influence on the valve function. The motor can be mounted in any position before locking it with the 3 Allen screws (fig. 3, pos.5).

The ICM valve must be installed with the arrow in the direction of flow.
When installing an ICM, refrigerant must not be allowed to escape and dirt ingress must be prevented.
The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

ICM valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Welding (fig. 2)
The valve can remain assembled during the welding process provided that the welding method is controlled and ensuring no welding debris.

The internal surfaces and weld connections of the enclosed ICS/ICM valve have been applied with an anti-corrosion treatment.

In the event that the function modules are to be left disassembled for any length of time, please ensure that the function modules are further protected by placing in a polyethylene bag or by applying a rust protection agent (e.g. refrigeration oil or BRANOROL) on the surfaces.

Only materials and welding methods, compatible with the valve body material, must be welded to the valve body. The valve should be cleaned internally to remove welding debris on completion of welding. Welding with open flame is not allowed.

Avoid welding debris and dirt in the valve body and the function module. The valve body must be free from stresses (external loads) after installation.

Manual operation
A multi function tool (fig. 4) can be used to rotate the spindle manually if the actuator has been removed. To make use of the manual operation, a multi-function tool (optional) is used (see fig. 4). The code number for the multi function tool is **027H0181**.

Manual operation is also possible with the actuator mounted on the valve and the power supply connected to the actuator. Irrespective if the signal connections are wired to the actuator it will be possible to use the manual operation function built into the actuator electronics allowing the motor to step in 1% increments meaning that 100% will correspond to a fully open valve. Please refer to the ICAD instruction sheet for further information regarding manual operation via the ICAD actuator.

Insulation
Insulating the valve and its actuator is only necessary if an energy consideration in the plant requires this. Regarding the function of the ICM + ICAD no insulation is necessary when kept inside temperature limits.

Surface treatment and identification
The ICM valves are Zinc-Chromated from factory. If further corrosion protection is required, the valves can be painted.

Note: Magnet coupling must be protected.

Precise identification of the valve is made via the ID plate on the top cover. After welding, the external surface around the connections of the valve body must be protected to prevent against corrosion with a suitable coating.
Protection of the ID plate when repainting the valve is recommended.

Assembly
Remove welding debris and any dirt from pipes and valve body before assembly. When installing the insert into the valve house a small amount of refrigerant oil on both O-rings will ease the installation. Use the magnetic tool when mounting the top cover.

Tightening
Tighten the top cover/function module with a torque wrench, to the values indicated in fig. 5.

Maintenance

Service
A precise service schedule cannot be given for the valve as service intervals will depend on operating conditions, i.e. how often the valve operates and the amount of impurities and dirt within the system.

The ICM 100-150 valves are easy to dismantle and spare part kits are available for servicing the valves.
Do not open the valve while the valve is still under pressure.

Be aware that the valve can be under pressure from both sides and that the manual magnet tool (fig. 4) can be used to open the seat and thus equalize pressure internally before removing the top cover.

If the teflon valve plate has been damaged this should be replaced as shown in (fig. 11). When reassembling the servo piston after replacement of the Teflon valve plate, Danfoss recommends to use Loctite 586 or similar on the thread of the servo piston.

Dismantling the valve
Do not remove the top cover while the valve is still under pressure.
- (1) Remove the 8 to 10 bolts from the top cover (fig. 6).
- (2) Push two screwdrivers in between the top cover and the valve body (fig. 6).
- (3) Pull the screwdriver upwards to remove the top cover (fig. 6).
- (4) Use the same two screwdrivers to remove the insert from the valve body. Place the end of the screwdrivers in the machined groove on the outside of the insert (fig. 7) and pull the screwdrivers downwards to release the function module and its o-rings from the valve body.

Servicing and replacing the function module
The function module can easily be serviced or replaced.
- (1) Remove the 8 to 10 bolts from the top cover (fig. 6).
- (2) Push two screwdrivers in between the top cover and the valve body (fig. 6).
- (3) Pull the screwdriver upwards to remove the top cover (fig. 6).
- (4) Use the same two screwdrivers to remove the insert from the valve body. Place the end of the screwdrivers in the machined groove on the outside of the insert (fig. 7) and pull the screwdrivers downwards to release the function module and its o-rings from the valve body.
- (5) Screw the spindle 4 times counter clockwise to lift the bearing house from the insert (fig. 8).
- (6) By pulling up on the bearing house the piston assembly can be withdrawn from the insert (fig. 8).
- (7) Unscrew the spindle and bearing house from the piston assembly (fig. 9).
- (8) By pushing down and turning on the pilot piston the piston assembly can easily be dismantled (fig. 10).
- (9) Replace wear parts according to the sparepart kits and reassemble the valve.

Oil the new o-rings on the insert with a small amount of refrigerant oil when reassembling the valve.

The spindle inside the valve must not be greased or oiled (fig. 12).

Use only original Danfoss parts, including o-rings and gaskets for replacement. Materials of new parts are certified for the relevant refrigerant.

In cases of doubt, please contact Danfoss. Drawings are only for illustration, not for dimensioning or construction.

C UL US LISTED

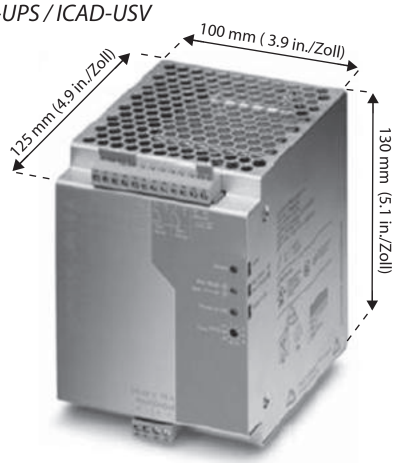
The following text is applicable to the UL listed products ICM 100-150
Applicable to all common non-flammable refrigerants, including/excluding (+) R717 and to non-corrosive gases/liquids dependent on sealing material compatibility (++). The design pressure shall not be less than the value outlined in Sec. 9.2 of ANSI/ASHRAE 15 for the refrigerant used in the system. (+++).

Installation Guide

ICAD-UPS for ICM motor operated valves

027R9784

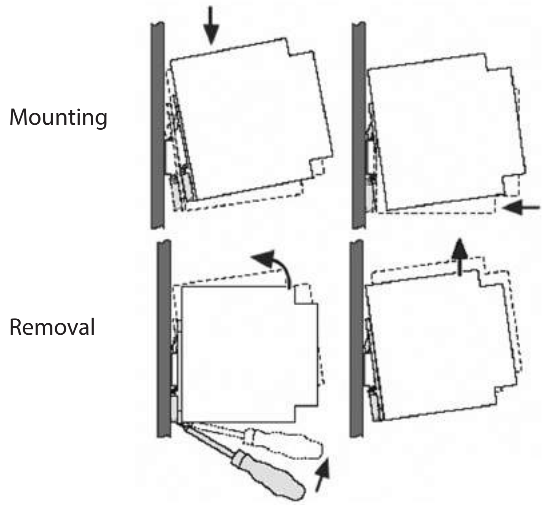
ICAD-UPS / ICAD-USV



Danfoss code no.: **027H0182**

1

DIN rail mounting



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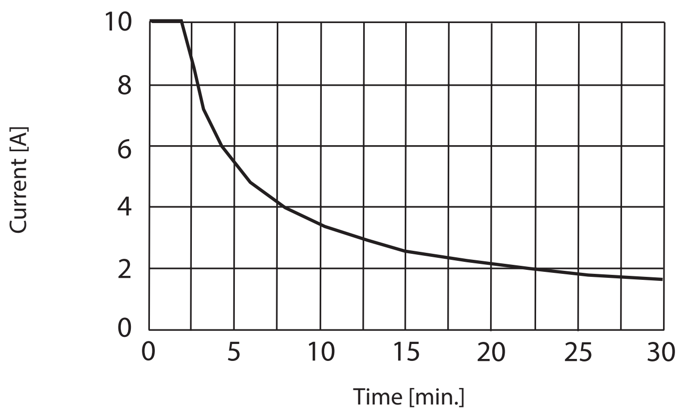
027R9784

Current output at power failure



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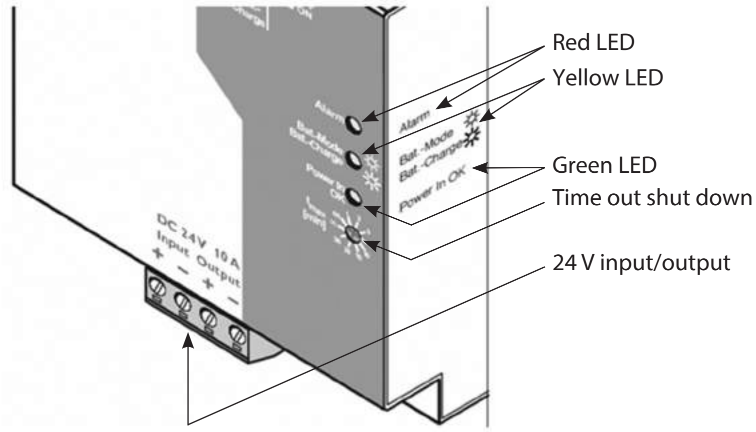
DKRCI.PI.HV0.B4.52 / 520H0949

GB *Digital output relays and LED function*

Condition	Green LED	Bat.-charge output Terminal 31, 32, 33	Yellow LED	Bat.-mode output Terminal 21, 22, 23	Red LED	Alarm output Terminal 11, 12, 13
Supply voltage OK Charging battery	ON	31-33 ON (makes) 31-32 OFF (brakes)	Flashing	21-22 ON (makes) 21-23 OFF (brakes)	OFF	11-12 ON (makes) 11-13 OFF (brakes)
Supply voltage OK No charging (normal operation)	ON	31-33 OFF (brakes) 31-32 ON (makes)	OFF	21-22 ON (makes) 21-23 OFF (brakes)	OFF	11-12 ON (makes) 11-13 OFF (brakes)
No power - Buffer mode	OFF	31-33 OFF (brakes) 31-32 ON (makes)	ON	21-22 OFF (brakes) 21-23 ON (makes)	OFF	11-12 ON (makes) 11-13 OFF (brakes)
Battery fully discharged	OFF	31-33 OFF (brakes) 31-32 ON (makes)	OFF	21-22 ON (makes) 21-23 OFF (brakes)	ON	11-12 OFF (brakes) 11-13 ON (makes)
Supply voltage OK Battery faulty	ON	31-33 OFF (brakes) 31-32 ON (makes)	OFF	21-22 ON (makes) 21-23 OFF (brakes)	ON	11-12 OFF (brakes) 11-13 ON (makes)
No power Buffer time ended or Terminal R1-R2 OFF (Brakes)	OFF	31-33 OFF (brakes) 31-32 ON (makes)	OFF	21-22 ON (makes) 21-23 OFF (brakes)	OFF	11-12 OFF (brakes) 11-13 ON (makes)



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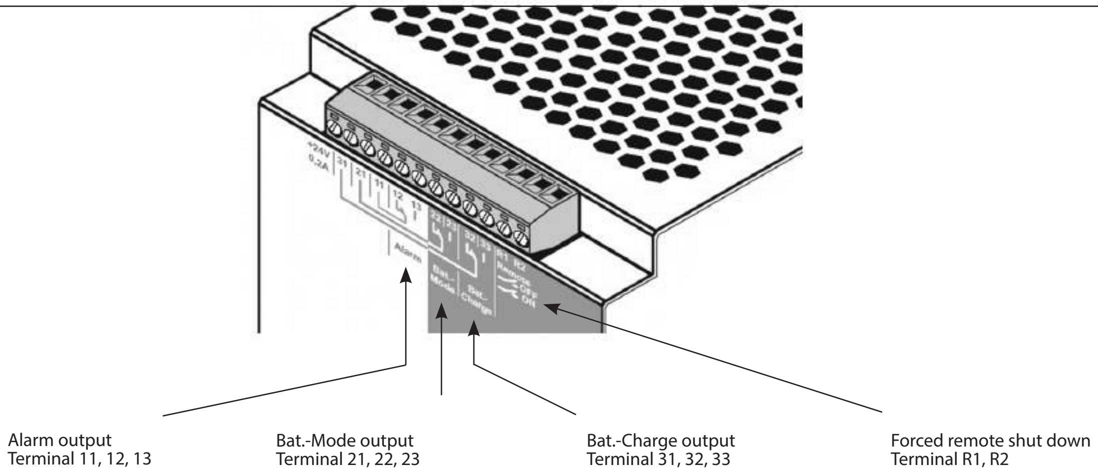
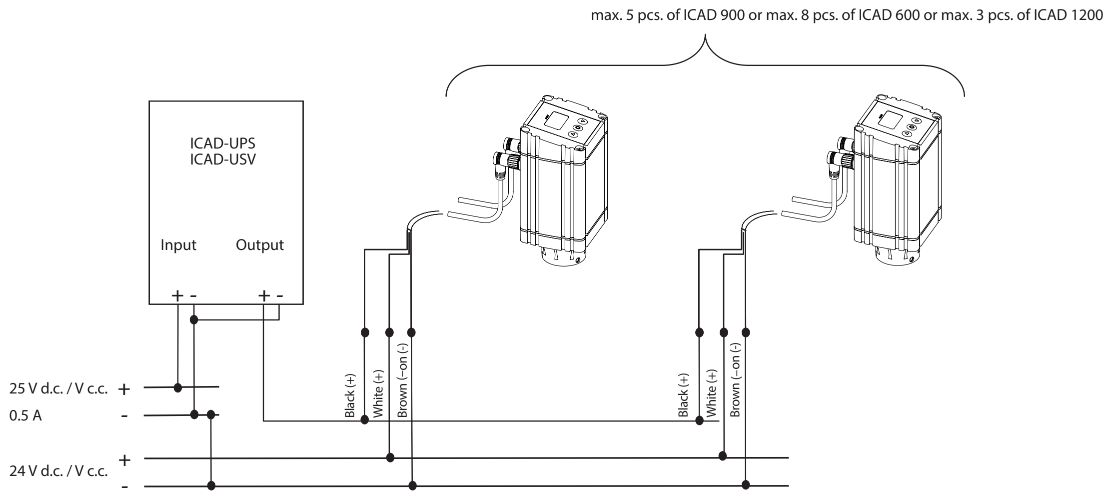


5

Seperate 24 V d.c tranformer for both ICAD-UPS and ICAD 600/900/1200



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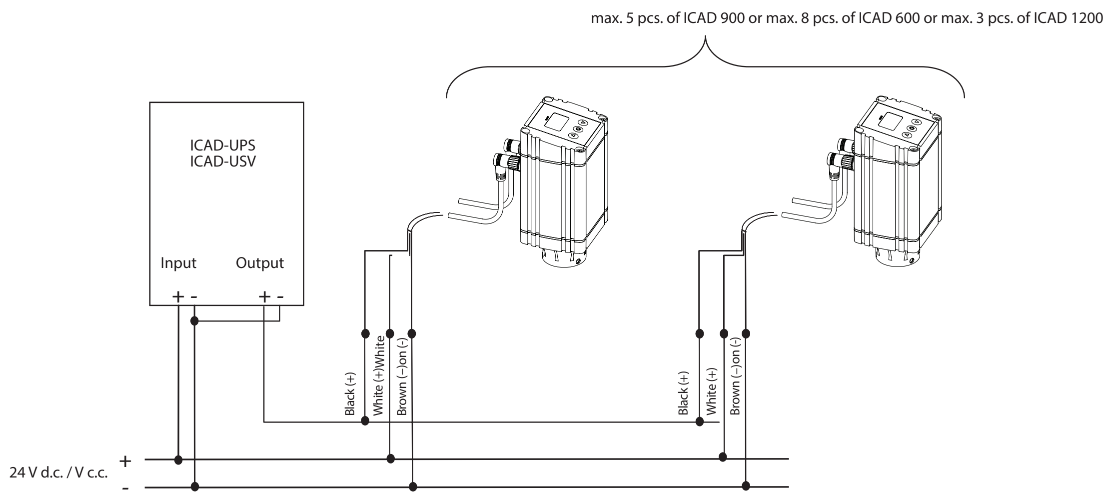
One 24 V d.c tranformer for ICAD-UPS and ICAD 600/900/1200



8

ENGLISH

Technical data

Input Data
Input voltage range:
22.5 - 30 V d.c

Current consumption:
No load/charging/maximum -
0.1 A/0.5 A/10.5 A

Switching threshold:
Ua< 22 V; dynamic
Uin- 1 V/0.1 s

Input fuse:
Internal, 15 A

Output Data – Normal Operation
Nominal output voltage:
24 V DC

Output voltage:
Correspond to Input voltage range

Output current:
10 A

Current limit:
None

Overload fuse:
Internal, 15 A

Output Data – At power failure (buffer Mode)
Nominal output voltage:
24 V d.c

Output voltage:
27.9 V DC, maximum

Output current:
10 A

Current limit:
15 A

Overload fuse:
15 A, internal fuse

Charging
Charge characteristic curve
I/U characteristic curve

End-of-charge voltage
27 V

Charge current
400 mA

Time interval for check of battery
60 seconds

General
Nominal capacity:
1.3 Ah

Service life:
6 years at +20°C (68°F)

Ambient temperature:
Operation/storage:
0°C(32°F) to +50°C(122°F)/
0°C(32°F) to +40°C(104°F)

Enclosure:
IP 20 (~NEMA 1)

Terminals:
0.2 mm^2 to 2.5 mm^2 (25 AWG -14 AWG)

Digital Output relays:
30 V a.c/d.c. , Max. 1 A
Alarm Output
Bat.-Mode Output
Bat- Charge Output.

Installation

Mounting
ICAD-UPS is for DIN rail mounting and must always be installed in an electrical panel. See fig.2.

ICAD-UPS
When ICAD-UPS is fully charged it can provide capacity according to fig. 3., at power failure
From fig. 3: 10 A in 1.5 min
2 A in 20 min

Definition of Power failure
If the supply voltage drops more than 1 V in a period of 0.1 seconds or falls below the minimum threshold of 22 V, the ICAD-UPS switches to buffer mode.

If the output voltage drops below 20.4 V in buffer mode, this will be indicated by the Alarm relay and Red LED.

If the output voltage drops to 19.2 V due to a flat (low) battery module, the ICAD-UPS will be shut down completely.

When the supply voltage is reapplied, the ICAD-UPS automatically switches on again.

At power failure there are two different ways to shut down the ICAD-UPS, when all connected ICAD 600/900 has been driven to the predefined condition (closed/open/ stay/go to specific opening degree).
This will save capacity and shorten the time to fully recharge again, when power comes back.

1. Remote shut down via digital input R1 and R2. See fig. 6
When the connection between terminal R1 and R2 is OFF (brakes) the ICAD-UPS will unconditionally shut down, i.e. the DC output will be forced to switch off, independent of the current capacity of the ICAD-UPS.

2. Time out [min] which can be adjusted on ICAD-UPS. See fig 5
After power failure has taken place an internal time-out timer is started in ICAD-UPS.

With this timer the ICAD-UPS automatically can shut down when a selected time has elapsed. See fig. 5.

Possible time out time which can be selected : 0.5, 1,2,3,5,10,15,20,30 [min].
Also *infinite* (no shut down due to time out) can be selected.

Digital output relays and the LED on the front of ICAD-UPS, can be used to indicate the condition of the ICAD-UPS.
See fig. 4 for detailed information on digital output relays.

Overall general function
Alarm relay (terminal 11,12,13)
Battery fully discharged (red LED)
Battery quality check negative (red LED)

Bat-Mode relay (terminal 21,22,23)
Power failure (buffer mode) (yellow LED)

Bat-Charge relay (terminal 31,32,33)
Battery is charging (yellow LED flashing)

ICAD-UPS used together with ICAD 600/900
See fig. 7 and fig. 8 for different applications with ICAD-UPS, ICAD 600/900 and 24 V d.c. transformer.

The number of ICAD 600/900 to be supported by ICAD-UPS must not exceed 10 A.
ICAD 600: 1.2 A
ICAD 900: 2.0 A

This means:
- max 8 pcs. of ICAD 600 connected to 1 pcs. ICAD-UPS or
- 5 pcs. of ICAD 900 connected to 1 pcs. ICAD-UPS or
- A number of ICAD 600 and ICAD 900 which does not exceed 10 A. (See example below)

In fig. 7, separate transformers are used for both ICAD-UPS and all ICAD 600/900.

The ICAD-UPS will only load the 24 V d.c. transformer with 0.5 A.

In fig 8, one common transformer is used for both ICAD-UPS and all ICAD 600/900. The 24 V d.c. transformer will be loaded with the load of all ICAD 600 (1.2 A)/ICAD 900 (2.0 A) plus the load of ICAD-UPS (0.5 A).

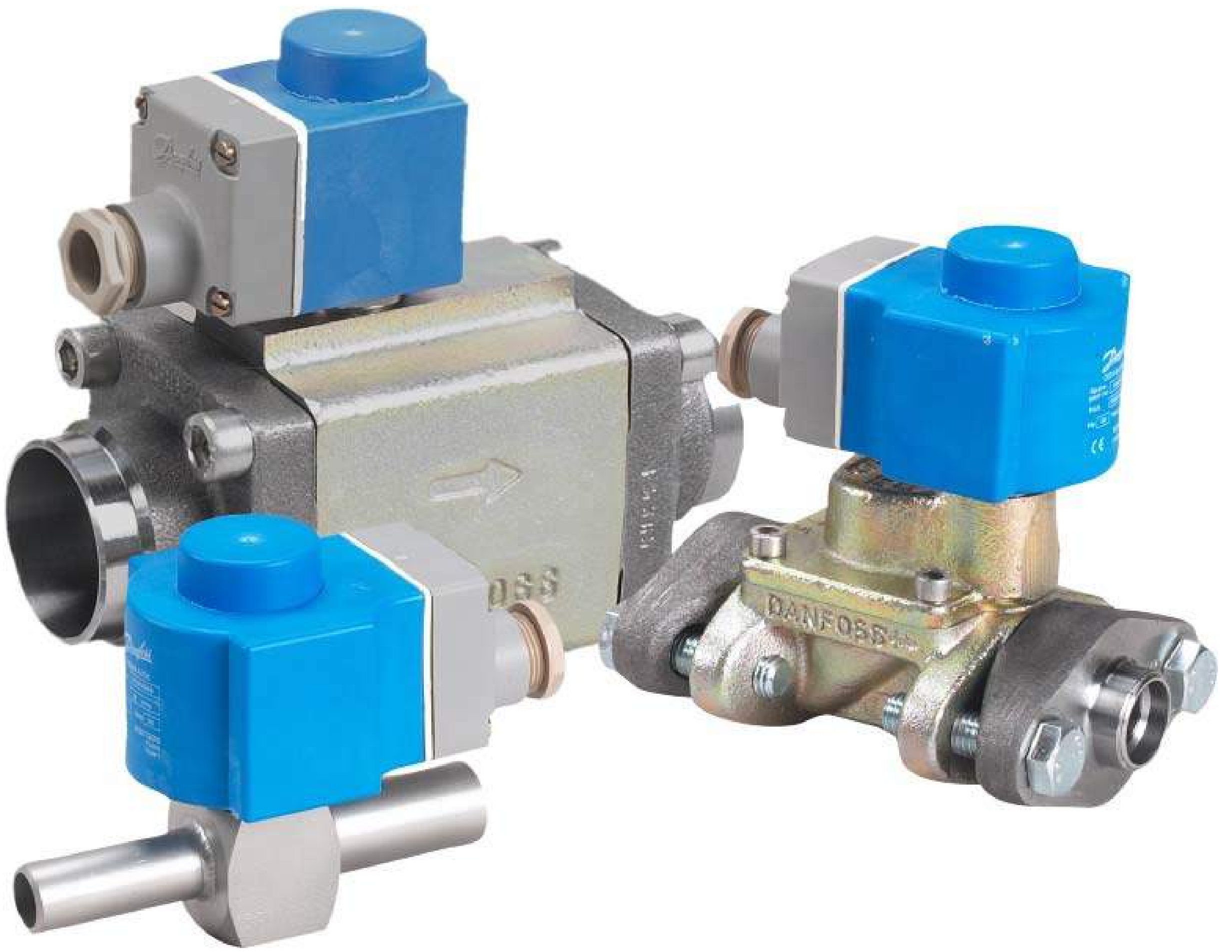
Sizing of transformer when one common transformer is used
Example
ICAD UPS: 0.5 A
ICAD 600 : 1.2 A
ICAD 900 : 2.0 A

E.g. 3 pcs. ICAD 600 and 2 pcs. of ICAD 900 means that the size of the d.c. transformer is : $0.5 + (3 \times 1.2) + (2 \times 2.0) = 8.1$ A

ENGINEERING
TOMORROW

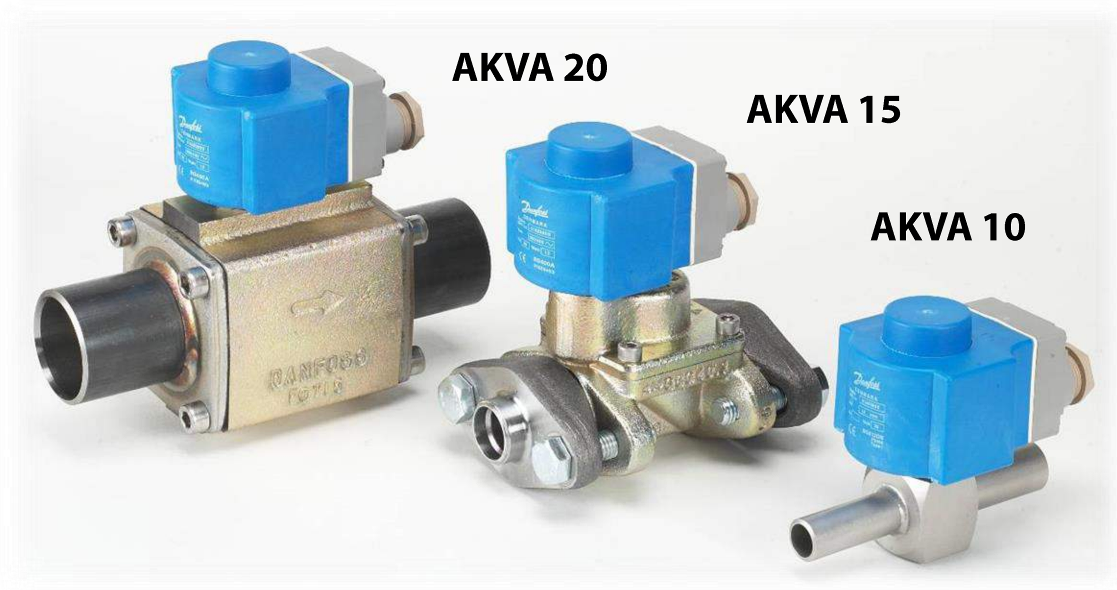
Danfoss

Electronic Pulse Width Modulating Expansion Valves
Type AKVA



AKVA Electronic Expansion Valves

- The AKVA Pulse Width Valve is essentially a solenoid valve which has been constructed for very high cycle service and with a special cone which precisely controls the expansion of liquid refrigerant.
- Unlike a modulating motorized valve, the pulse valve does not control the mass flow of the refrigerant as it is passing through the valve. Rather, it controls the flow through an on/off pulsing action.



- When using a solenoid valve before the AKVA valve it is recommended to use the assisted lift type EVRAT.
- Be aware that if regulators are installed between the evaporator and compressor, it can affect their lifetime because the piston in the regulator will move with each pulse of the AKVA.
- Always install a 100 micron/150 mesh strainer in front of AKVA valves.
- The AKVA is not recommended for use in systems with 1 evaporator and 1 compressor due to the pressure variation in the suction line that is will cause.
- In applications where the internal volume of the evaporator is limited (such as in plate and frame evaporators), the flow from the pulse width valve can "overwhelm" the evaporators ability to manage the amount of liquid refrigerant within it so the AKVA valve is not recommended for these applications.
- See the AKVA technical leaflet for a complete list of guidelines and contact Danfoss when in doubt.

AKVA Valve Sizing

- Should be sized in the range of 50 to 75 % of full capacity under design loads.
- Valves must be sized for the pressure drop that is going to occur **across the valve**. It is essential that the distributor pressure drop is subtracted from the available pressure differential.
- The AKVA valve requires a certain amount of pressure differential across it for it to function properly. An appropriately sized valve will have approximately 45 psid or higher across the valve.

AKVA Working Principles

- PWM principle
- Requires no adjustment
- Quick reaction to changes in loads
- Works within 10-100% of its rated capacity
- Replaceable orifice assembly
- Can be used as both expansion and solenoid valve in some applications.

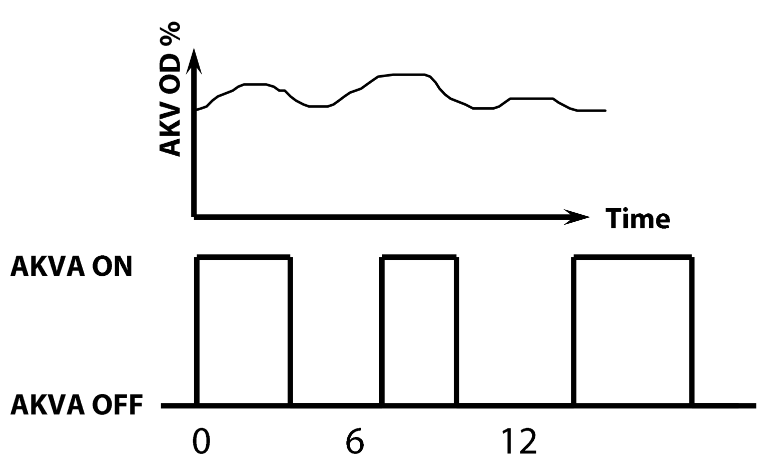
OT : Opening Time.

TP : Time Period.

OD : Opening degree

TP : 6/3 sec. fixed.

$$\mathbf{OD\ \% = \frac{OT \times 100}{TP}}$$



AKVA 10 with Orifice Sizes 1 to 7

- Stainless steel body with butt-weld connections only
- Built-in replaceable 100 micron (150 mesh) strainer
- Capacity (R717):

  1.1 – 17.9 Tons Nominal

Note: Highly recommended to have an additional strainer in front of valve which would have a larger surface area to collect dirt instead of relying on the small internal strainer

AKVA 15 Capacity Sizes 1 to 4

- Flanged housing
- FPT, SW & WN flanges available
- Should install a 100 micron (150 mesh) strainer before the valve
- Capacity (R717):

  35 – 140 Tons Nominal

AKVA 20 Capacity Sizes 1 to 5

- Butt-weld connections only
- Should install a 100 micron (150 mesh) strainer before the valve
- Capacity (R717):

  140 - 900 Tons Nominal

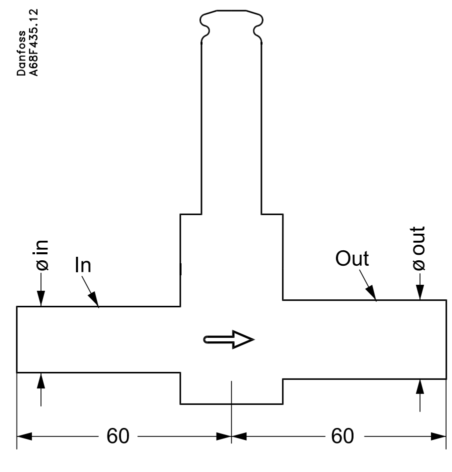
Note: the amount of grooves/rings on AKVA 15 or 20 piston indicates the AKVA 15 or 20 size

Installation guide

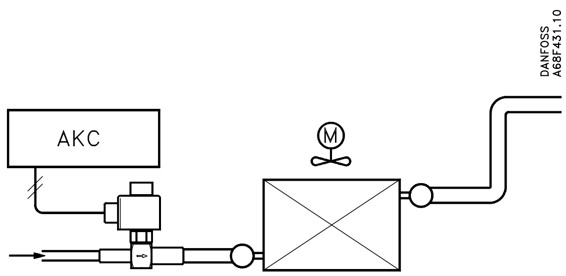
Electric expansion valve
AKVA 10-n (n = 1-8)

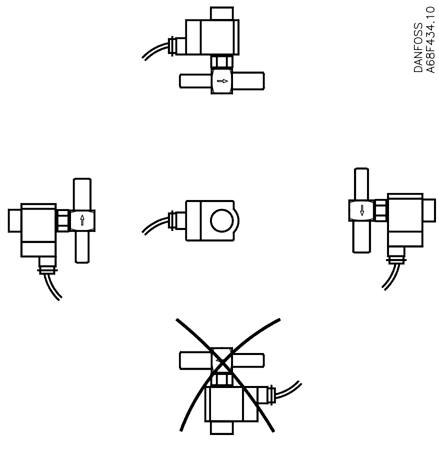
068R9546

068R9546

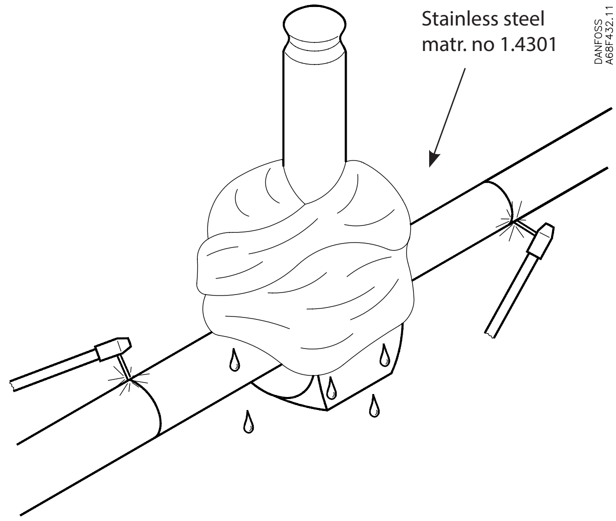


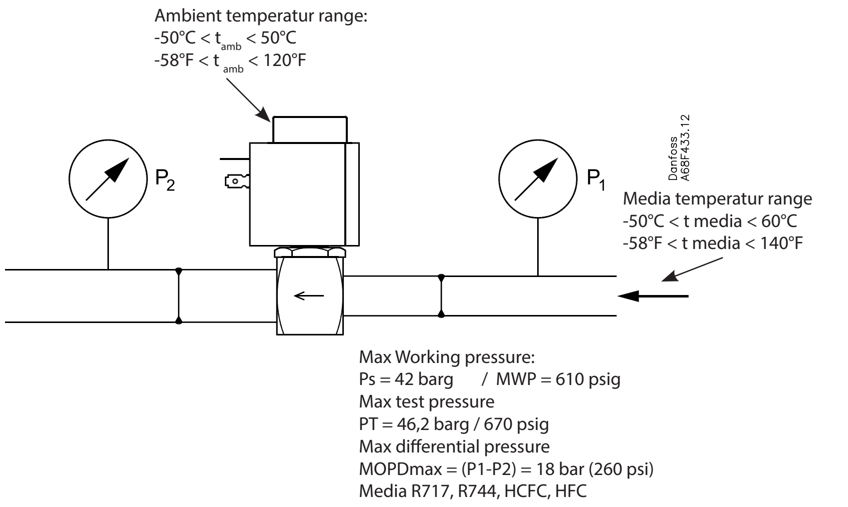
AKVA 10 -	1, 2, 3, 4, 5, 6	7,8
In	⅜" ($Ø_{in}$ = 17.2 mm)	½" ($Ø_{in}$ = 21.3 mm)
Out	½" ($Ø_{out}$ = 21.3 mm)	¾" ($Ø_{out}$ = 26.9 mm)



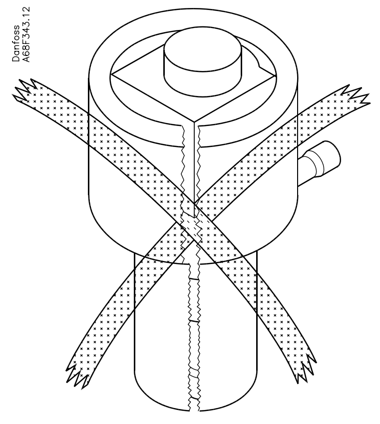


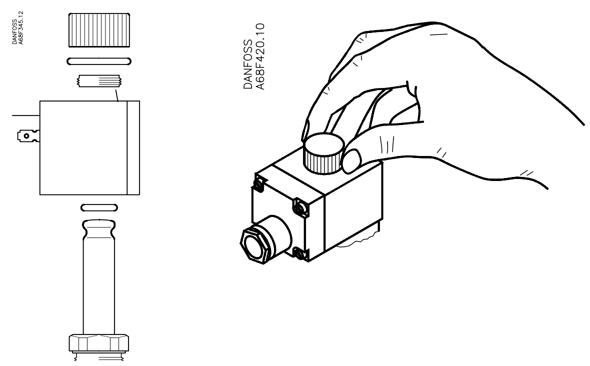
Orifice		kW	TR
n	Code no.		
1	**068F0526**	4.0	1.1
2	**068F0527**	6.3	1.8
3	**068F0528**	10.0	2.8
4	**068F0529**	16.0	4.5
5	**068F0530**	25.0	7.1
6	**068F0531**	40.0	11.4
7	**068F0532**	63.0	18.0
8	**068F0533**	100.0	



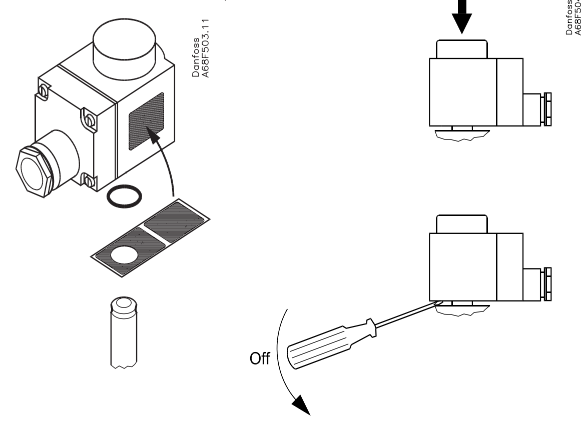


Do not insulate the valve.

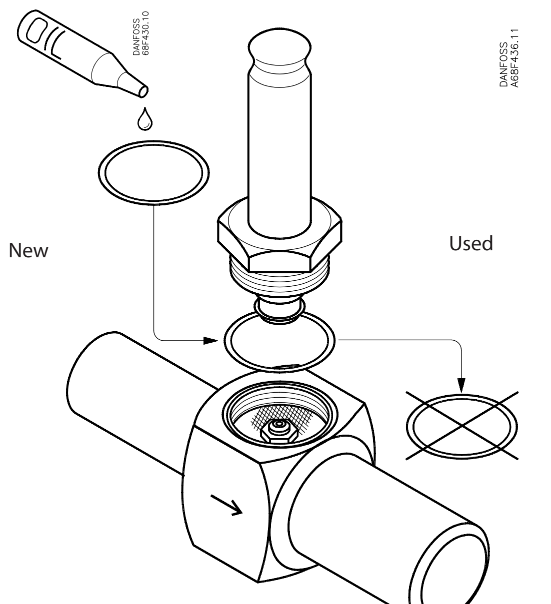


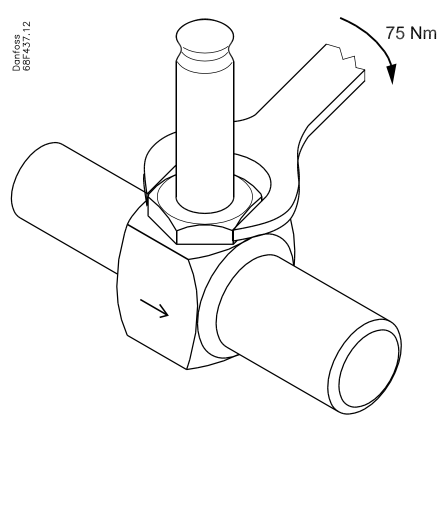


Clip-on coil



The gasket must be exchanged, if the valve is dismantled





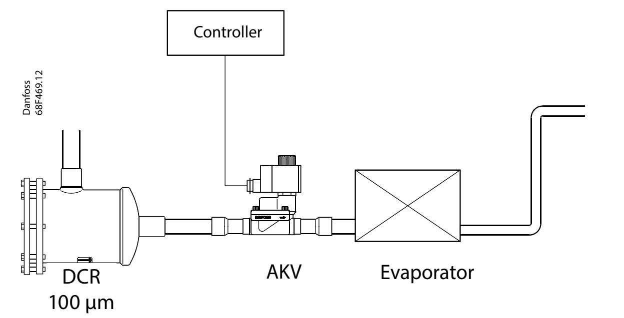
Installation guide

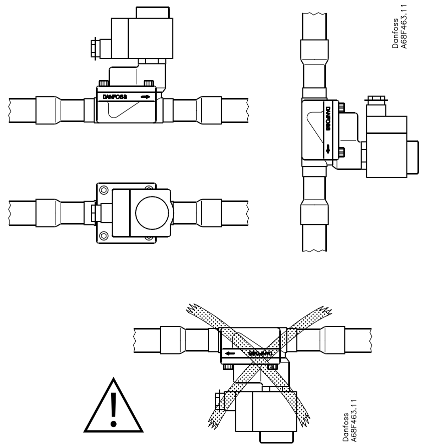
Electric Expansion Valve
Types AKV 15, AKVA 15

068R9548

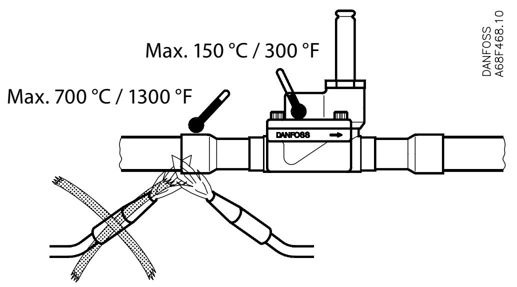
Refrigerants:	Max. working pressure:
AKV R744, R22/R407C, R404A/R507, R410A, R134a, R407A, R407F, R23, R448A, R449A, R449B, R452A, R513A, R450A, R422B, R422D	**AKV 15:** PS/MWP = 46 barg / 667 psig **AKVA 15:** PS/MWP = 42 barg / 610 psig
AKVA R717, R744, R22/R407C, R404A/R507, R410A, R134a, R407A, R23,	**Max. test pressure:** P_e = 52 barg / 754 psig
For other refrigerants, please contact Danfoss.	**Max. differential pressure:** MOPD = 22 bar / 319 psi

Media temperature range:	Ambient temperature range:
Min. t_{media} -50 °C / -58 °F	Min. t_{amb} -40 °C / -58 °F
Max. t_{media} 60 °C / 140 °F	Max. t_{amb} 50 °C / 120 °F

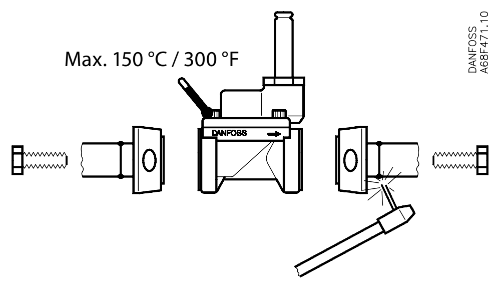


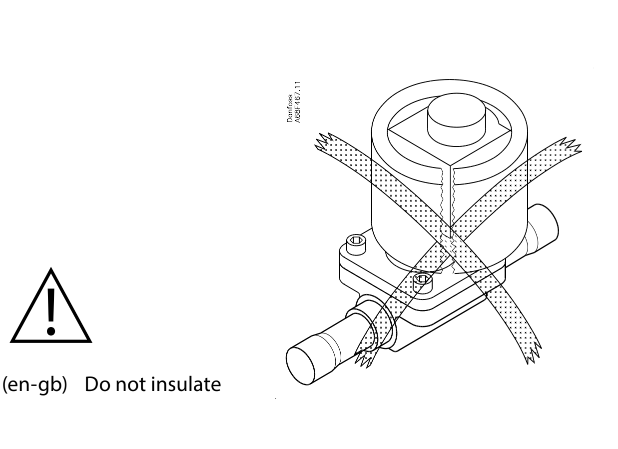


AKV 15

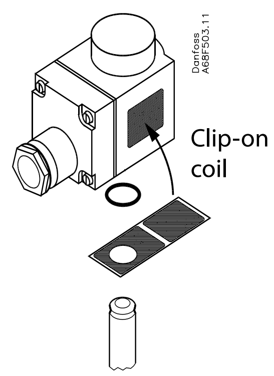


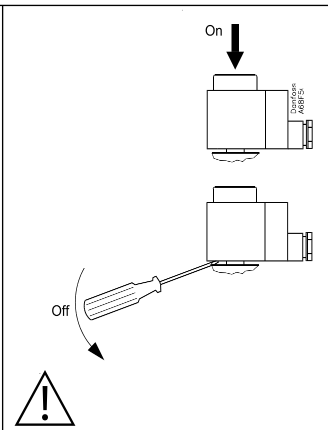
AKVA 15





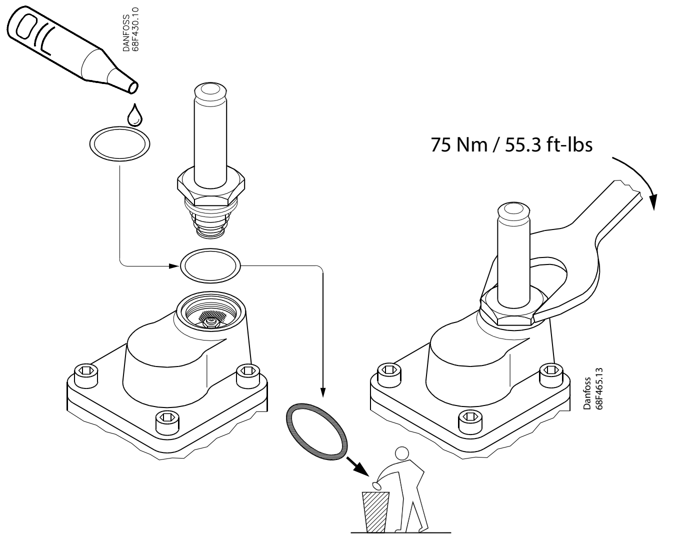
(en-gb) Do not insulate



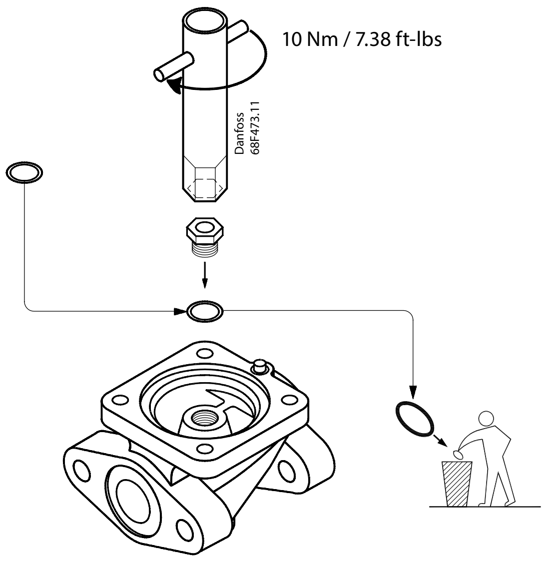


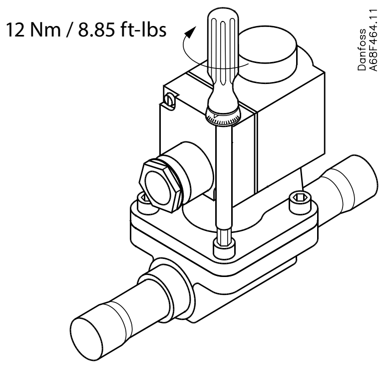
Warning
Never switch on power to the coil when the coil is dismounted from the valve. Otherwise the coil may be damaged and there is risk of injuries

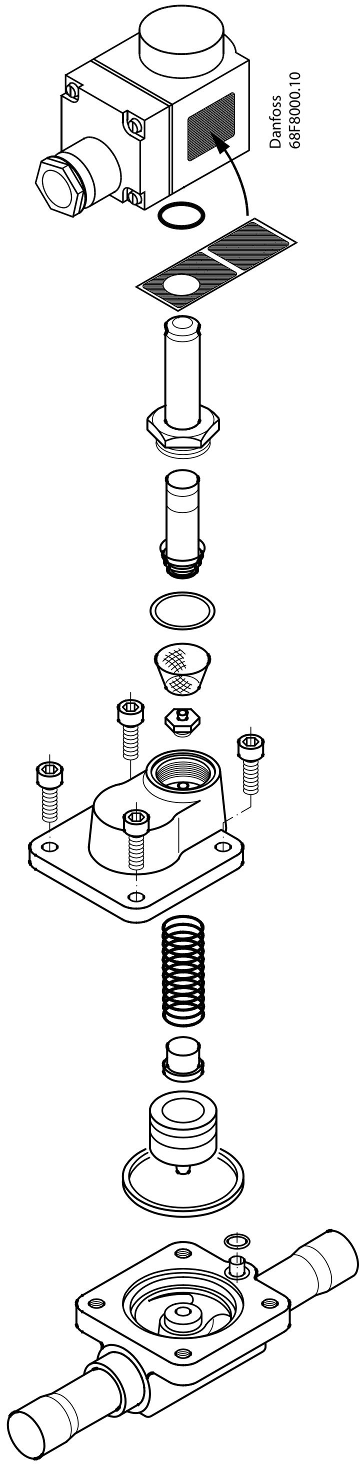
Service



AKVA 15 only







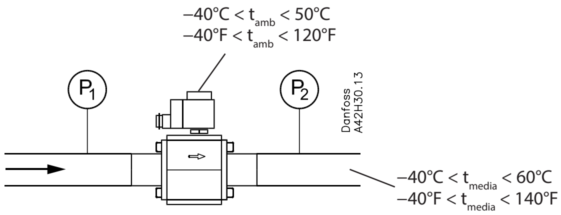
en-gb
The gasket must be exchanged, if the valve is dismantled.

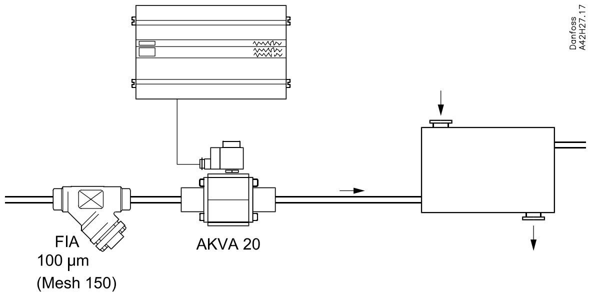
Installation Guide

Electric expansion valve
AKVA 20

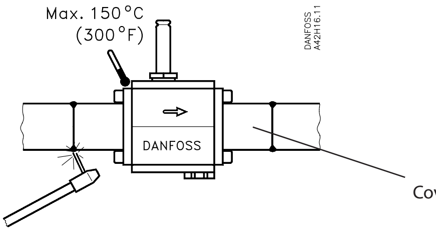
068R9558

Refrigerants: R717, HCFC, HFC
MWP = PS 42 bar g (609 psi g)
MOPD max. = (P1-P2)max. = 18 bar g (261 psi g)

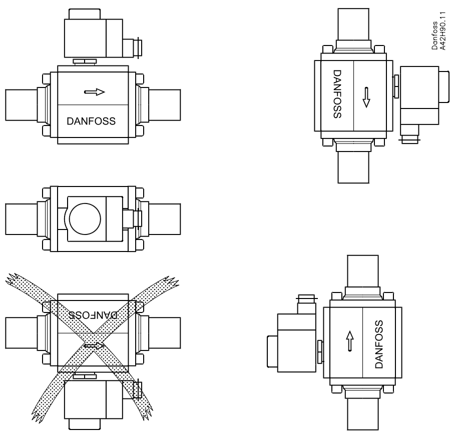


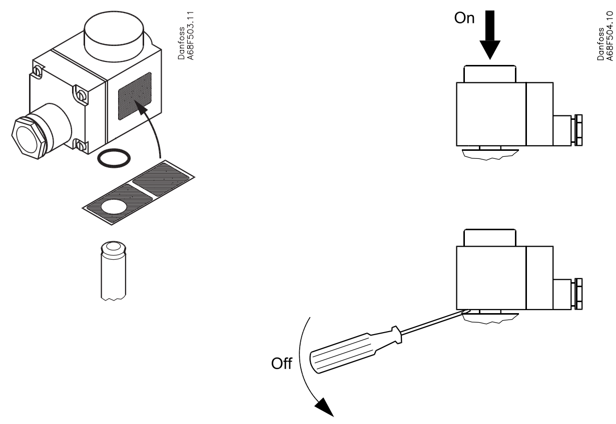


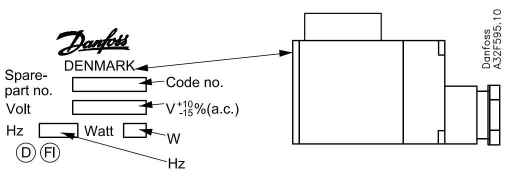
068R9558

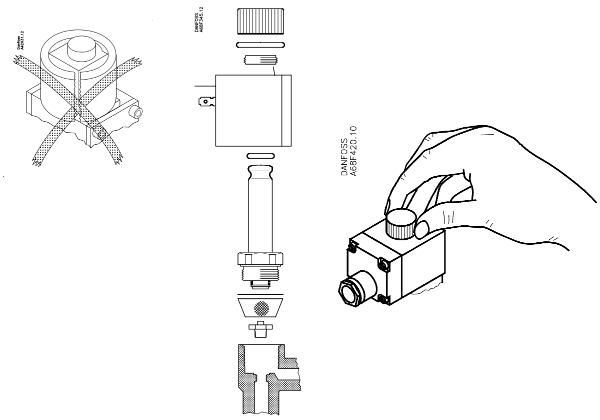


Cover material P285QH EN 10222-4. Installation is to be carried out with qualified personnel and processes only. After welding, the valve should be surfaced to be corrosion-proof.

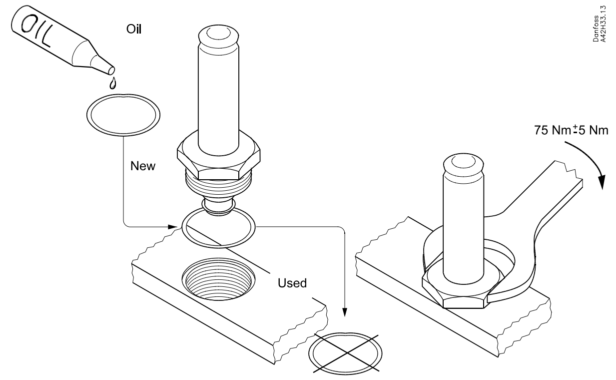




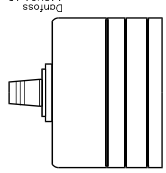




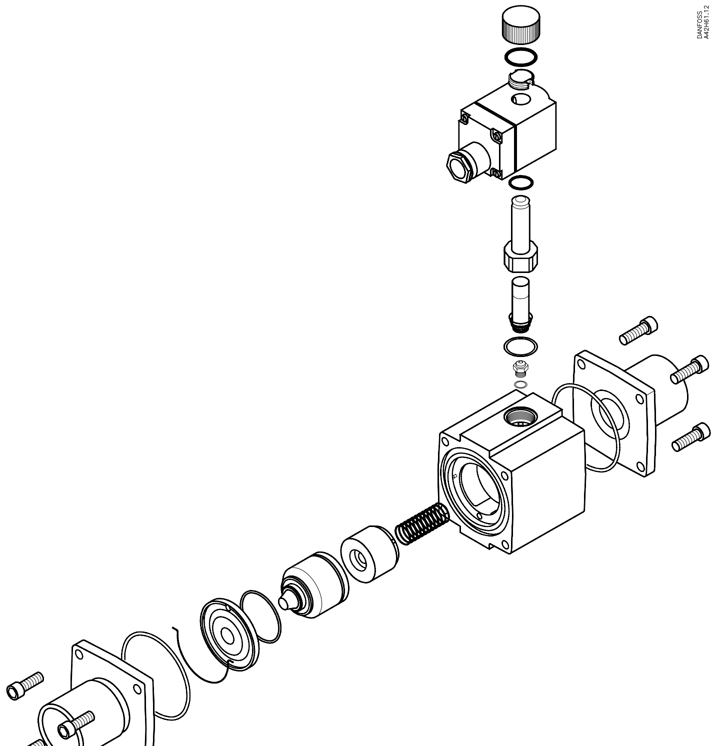
The gasket must be replaced if the valve is dismantled.

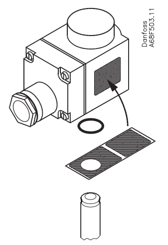


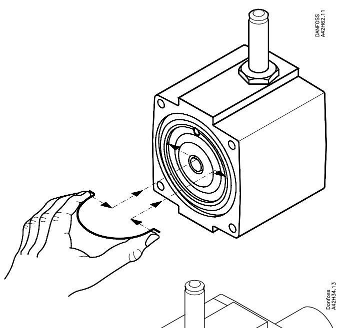
Each line marking indicates size of valve. Here shown AKVA 20-3.

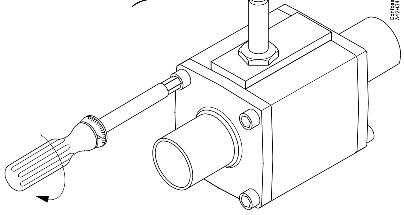


No of line marking	Type
1	AKVA 20-1
2	AKVA 20-2
3	AKVA 20-3
4	AKVA 20-4
5	AKVA 20-5









English

Do not carry out service when internal pressure is present in the valve.

Use only original Danfoss spare parts.

Only authorized personnel is to carry out all service and installation

ENGINEERING
TOMORROW

EKE 347 Liquid Level Controller

Main Function of EKE 347

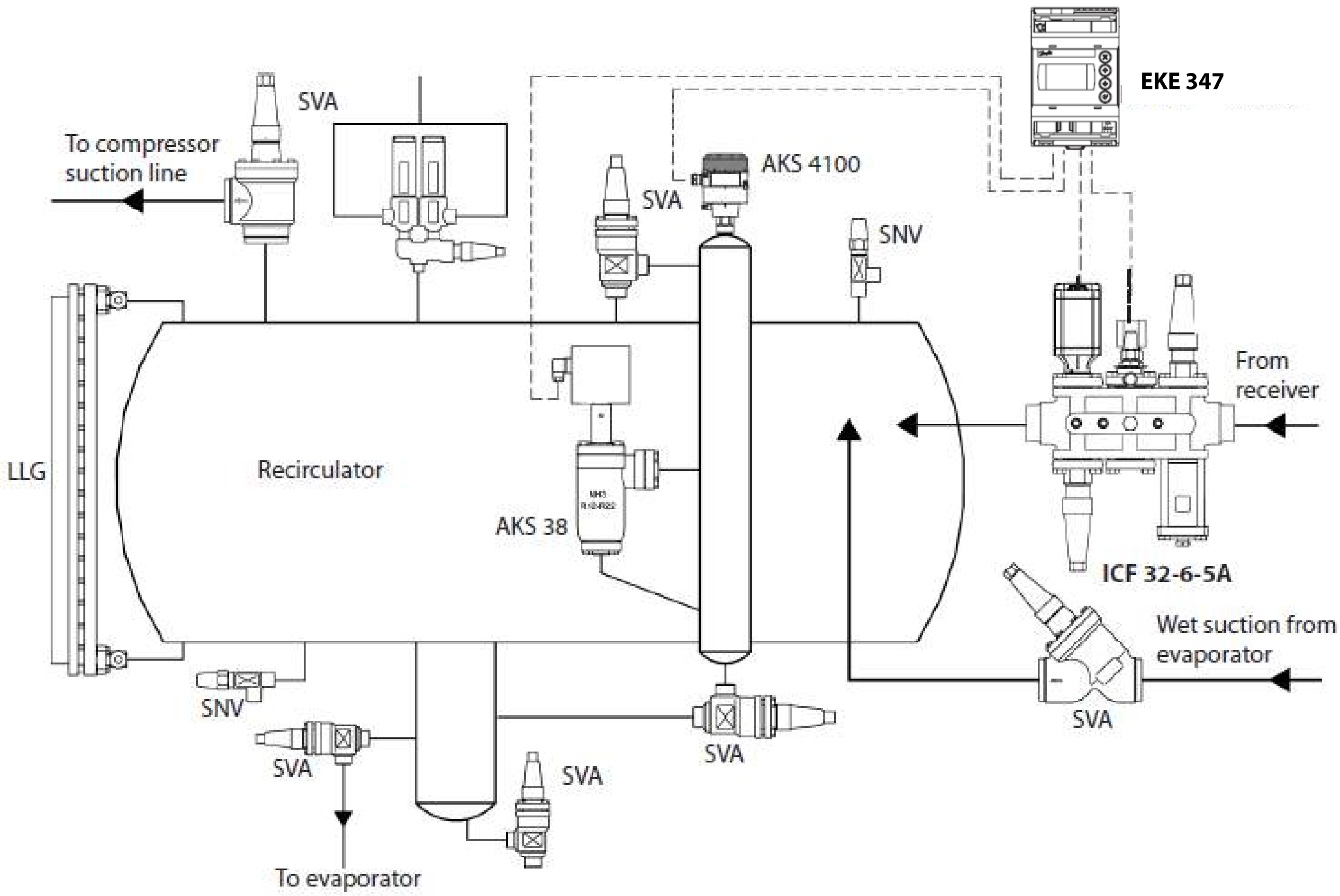
- The EKE 347 level controller is used for regulation of the liquid level in:
  - Pump packages
  - Separators
  - Intermediate coolers
  - Economizers
  - Condensers
  - Receivers

- The controller receives a 4-20mA signal from a level sensor and uses advanced algorithms to control any one of the following valves to maintain a set liquid level:
  - ICM motorized modulating valve with ICAD motor
  - AKVA pulse-width modulating expansion valve
  - Solenoid valve for on-off control

EKE 347 Features

- Graphical and full text display
- Quick setup wizard for 1st time configuration
- Controls liquid level on low or high pressure side of the system
- 3 relay outputs for upper and lower level limits and for alarm level or output used to control a solenoid before motorized valves etc.
- Easy integration with PLC systems with Modbus-RTU
- Manual control of relay outputs

EKE 347 Application Example

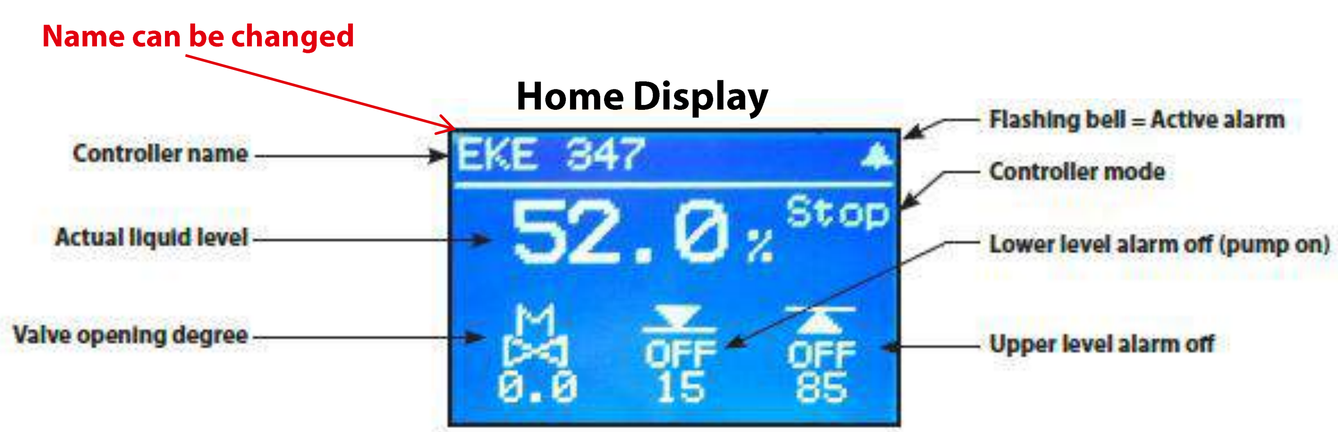


Clear Information
Graphical and full text display

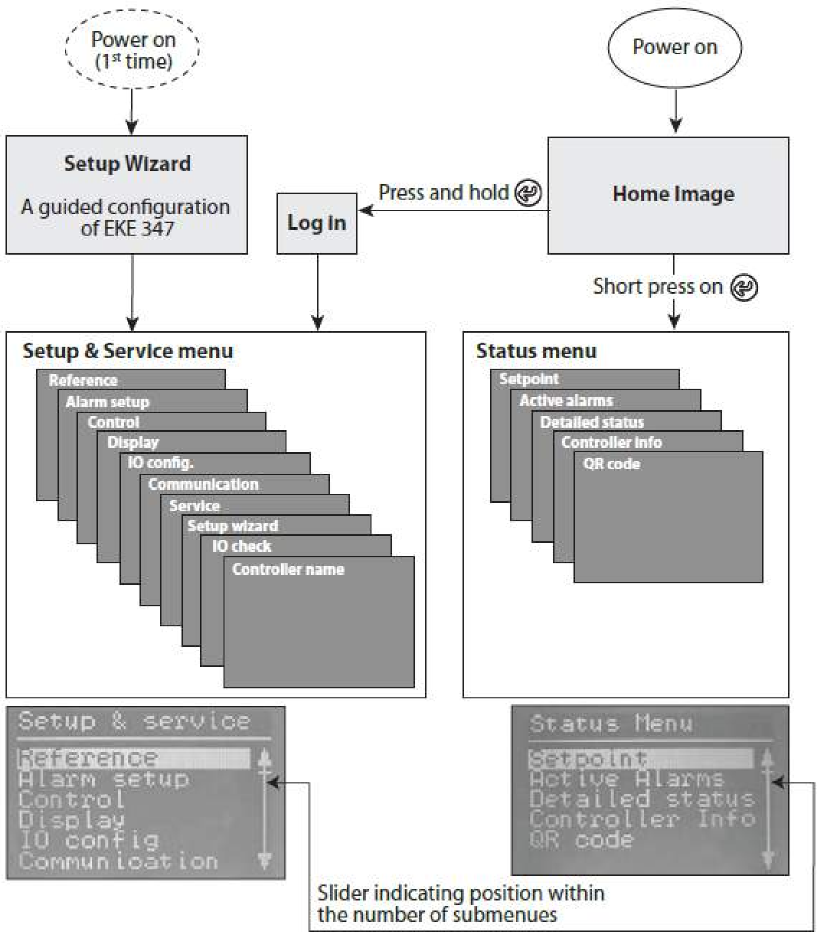
- For Status menu push enter button for 1 sec. while at home display
- For Setup & Service menu push and hold enter button while at home display and enter 300 when it asks for a password to get full access to change all parameters.
- There are other passwords that give less access for people to make daily changes if needed.
- Press enter if you want to change the value highlighted
- Adjust value with up/down arrows
- Save changes by pressing enter
- Press "X" if you need to cancel and go back 1 level in menu

EKE Interface

Home Display



Quick Setup Wizard



- Status menu (the safe section)
  - No access restriction
  - Level set point can be adjusted
  - View alarms and other operational info
- Setup and service
  - Access restricted by passwords depending of access level (Daily, Service, Commissioning)
  - Some configurations can only be done with "main switch" off. Either by terminals DI1 & COM or internal main switch setting

Note: Settings are retained during power failure!

EKE 347 Quick Setup

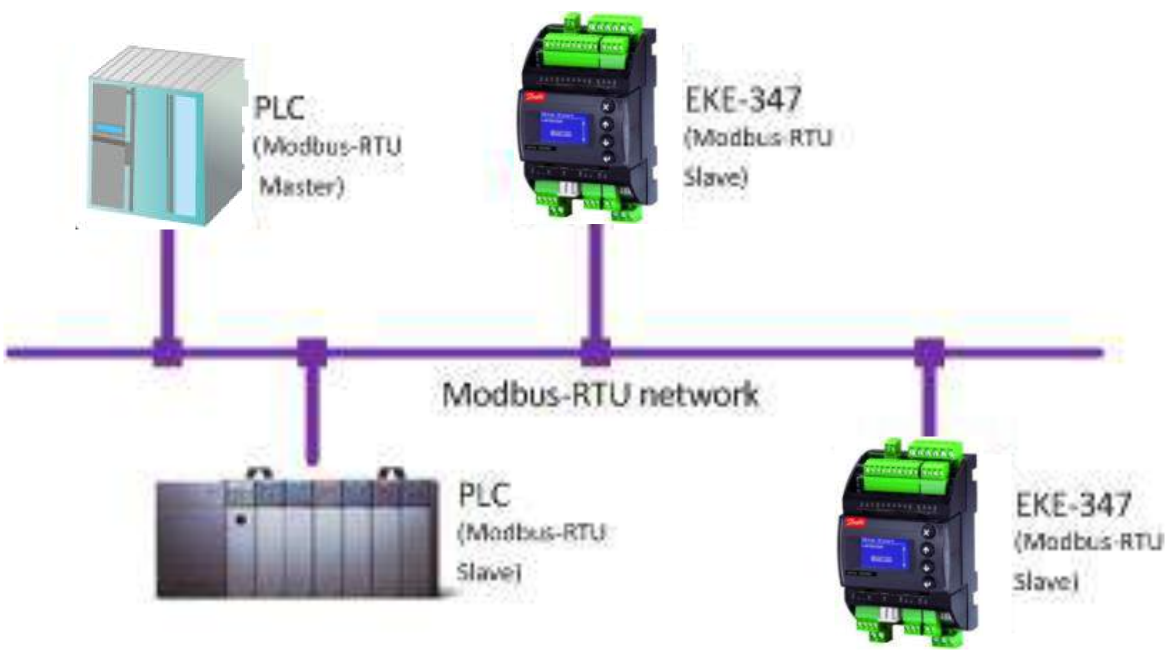
- Select Language – Default is English
- System Configuration – Default is ICAD + NC (NC= Normally Closed Solenoid)
- Operation Mode – Default is Master
- Regulating Principal – Default is Low
- Liquid Level Setpoint – Default is 50%
- Lower level limit – Default is 15%
- Upper level limit – Default is 85%
- Level signal setup – Default is AKS 4100U
- Valve position feedback – Default is not used
- Common alarm setup – Default is High Alarm

Default password **300** gives full access

When done it will state "Choose to go to" and default is "Main menu"
Note: the controller will not regulate until the internal main switch setting is turned on.
This setting is located in the reference menu list

Easy Integration with PLC Systems

- Standard with Modbus-RTU communication, RS485
- Eliminates wiring of analog signals and
  related work
  - Saves cables between controller and PLC like 4-20mA signals as well as alarm signals via
    relays
  - Saves AI card in PLC

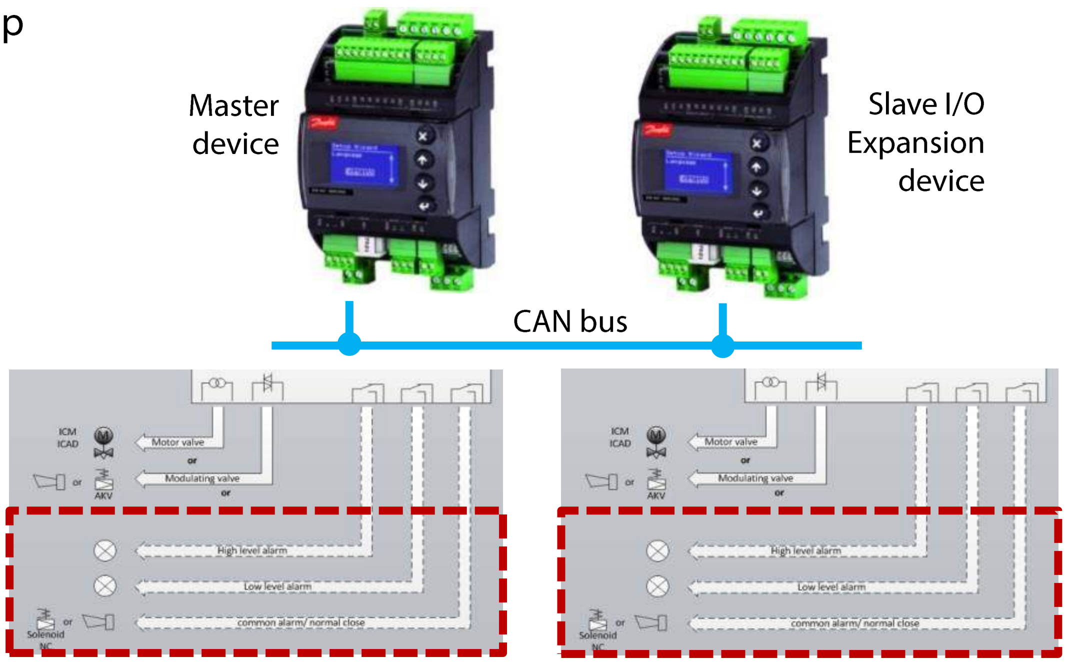


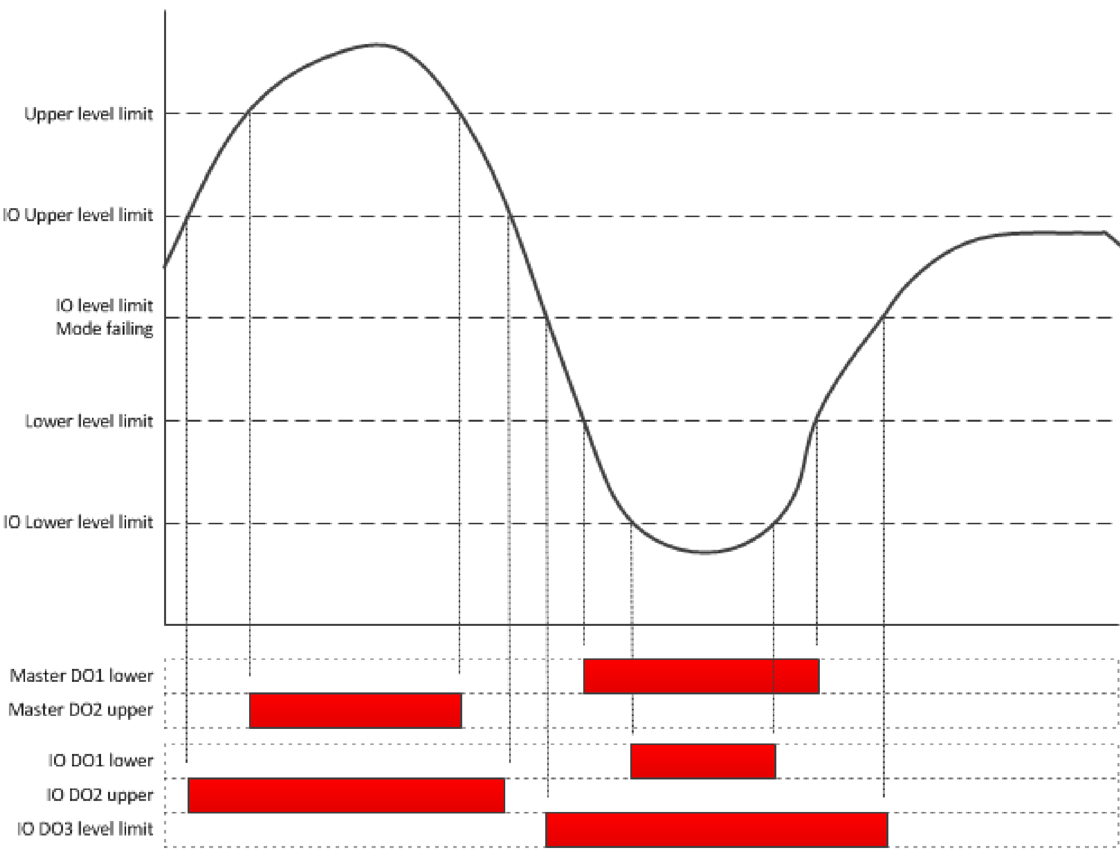
PLC
Siemens

PLC
Allen-Bradley

Expandable I/O Module

- 3 extra digital output relays with additional EKE 347 connected to the main EKE 347
- Easy to wire and set up

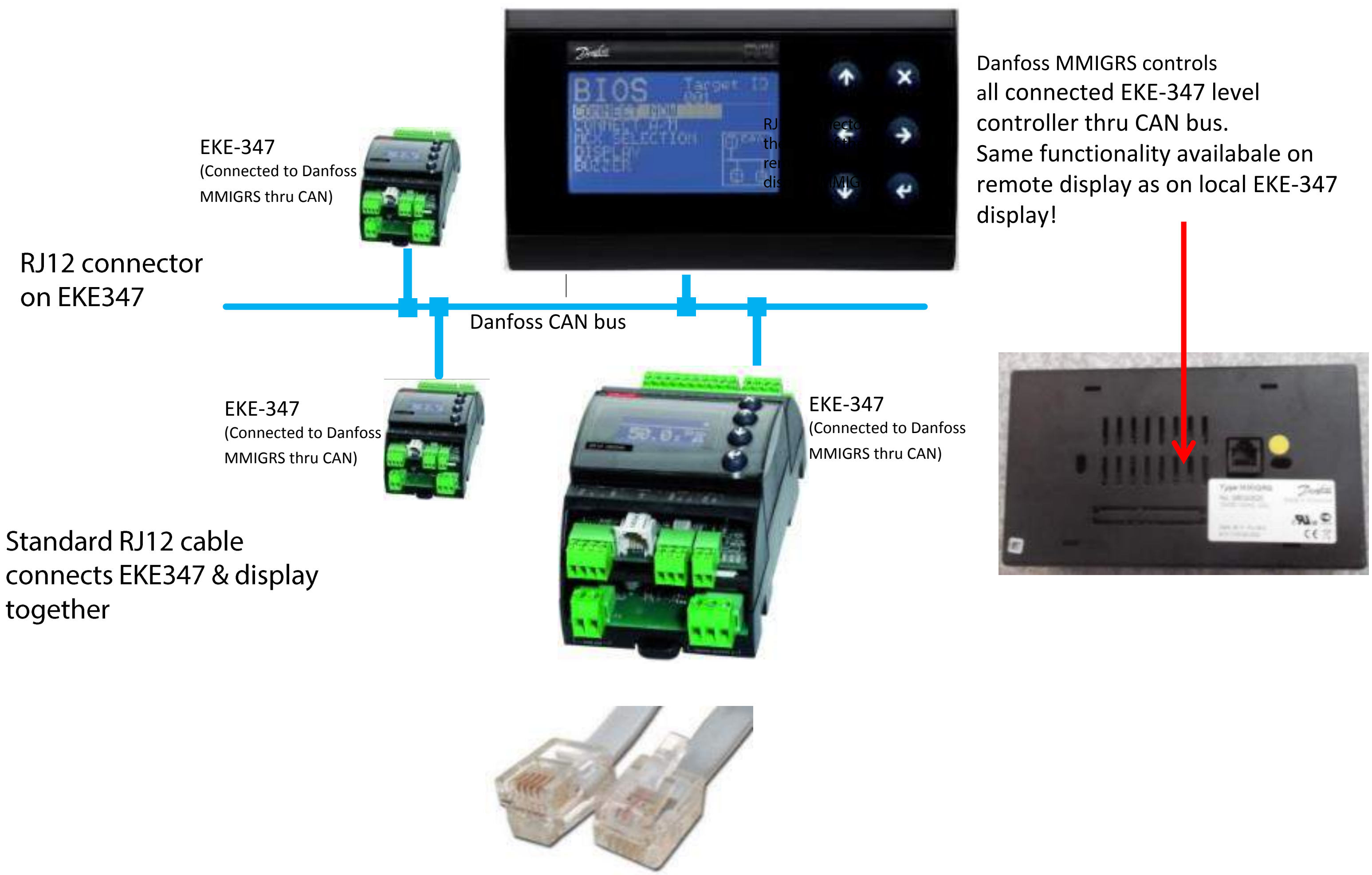




Note: IO alarm limits are controlled by the EKE 347 used as Input/output module

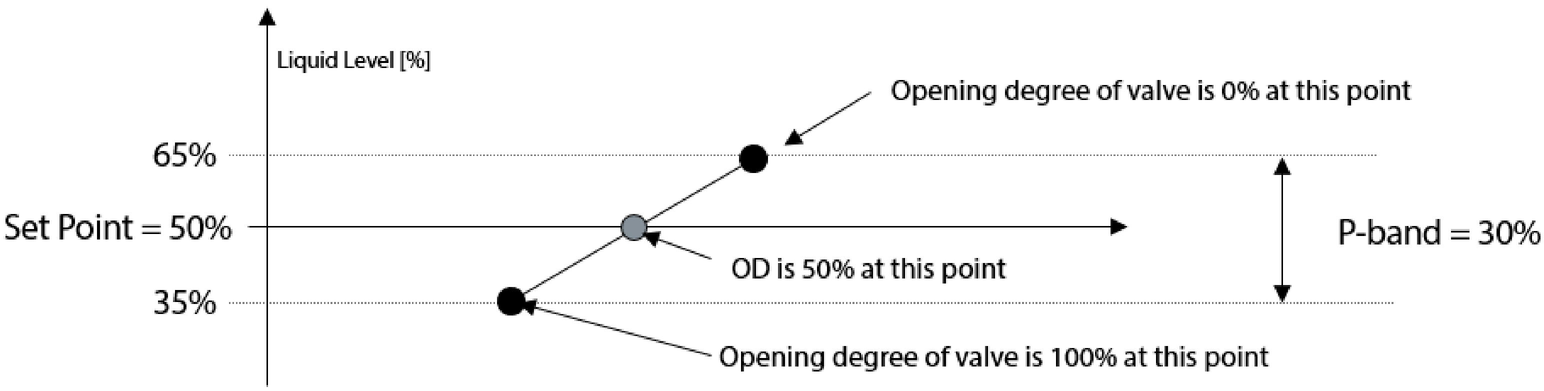
Flexible Mounting
Remote Graphical Display

- One Remote graphical display can serve many EKE controllers
- One location to view and change settings in the connected EKE controllers.
- Plug and play solution—easy connection through standard RJ12 connector; no additional power supply required for MMIGRS display
- Less wiring and time required for commissioning



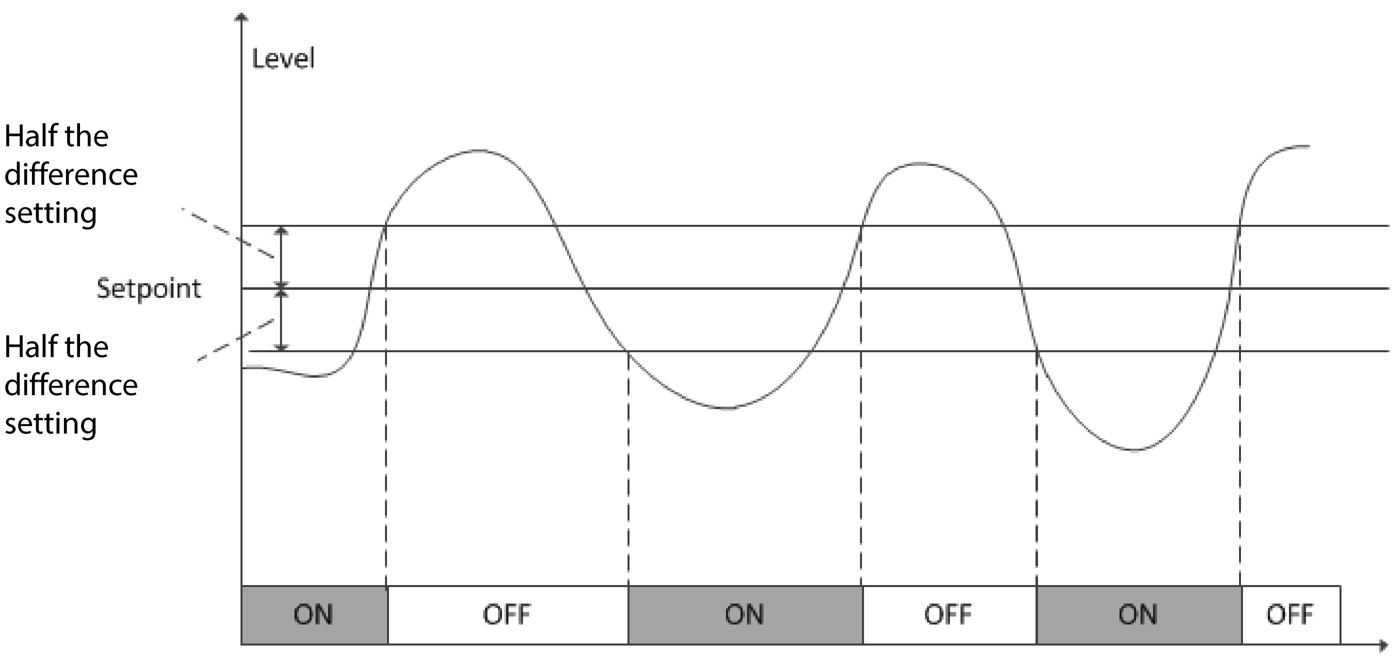
Regulation Examples

Regulation on low pressure side of system and based on modulating P control (no integration) and factory settings



Note: If the dead-band is set to 2% and the OD of the ICM valve is at 60%, then the valve will not readjust until the controller needs the valve to be at an OD of 58% or 62%. This is to increase the lifetime of the motor.

Solenoid on-off control on low pressure side of system

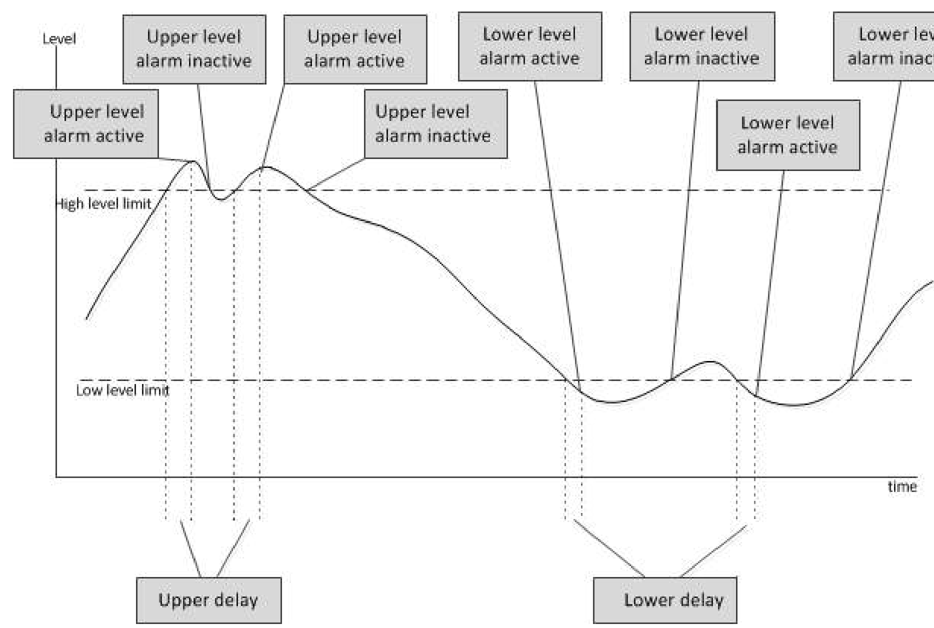


EKE 347 Level Alarms

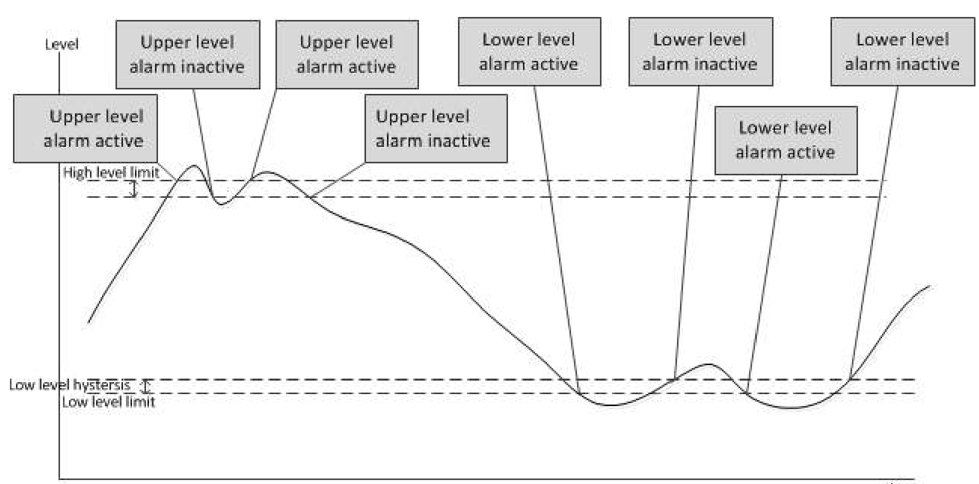
Available level alarm modes:

- Time delay mode
  - Activation of alarm is delayed
  - Alarm is cleared when level is back within setting
- Hysteresis mode
  - Activation of alarm when level passes setting
  - Alarm is cleared when level is within the hysteresis setting
- Level alarms can be set up to activate common alarm

Alarms controlled by time delay

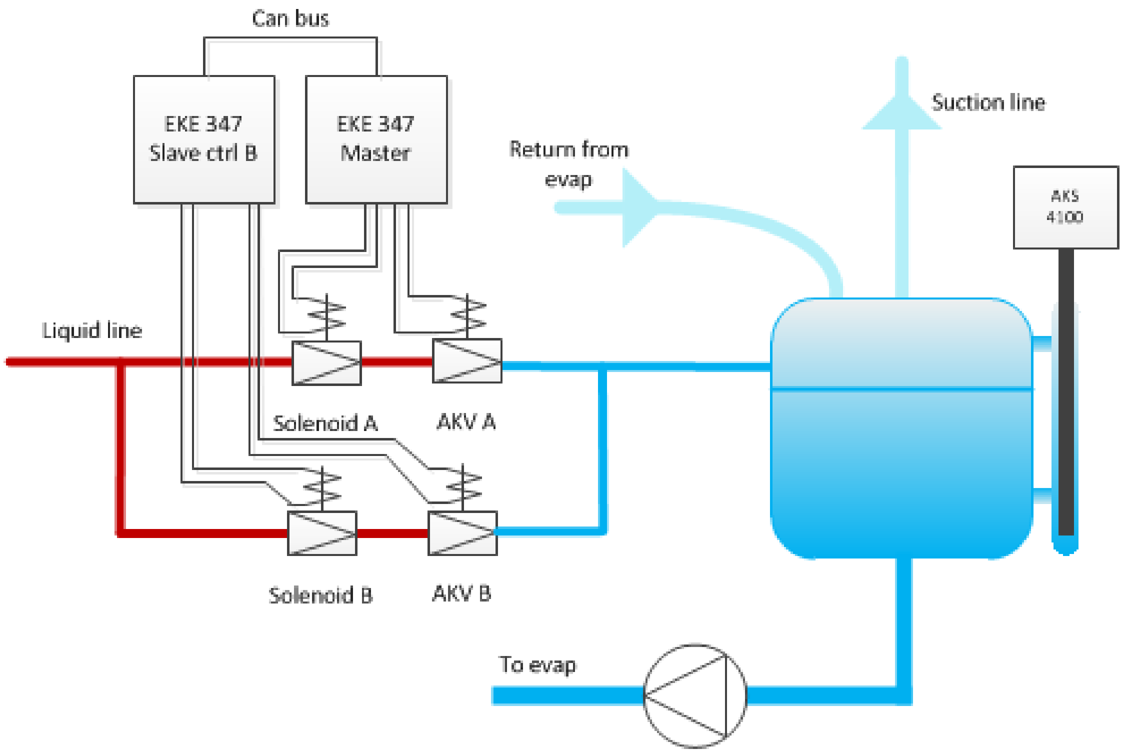


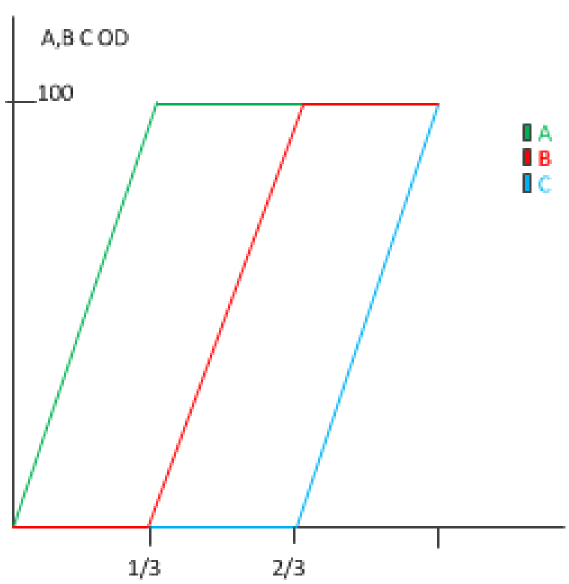
Alarms controlled by hysteresis

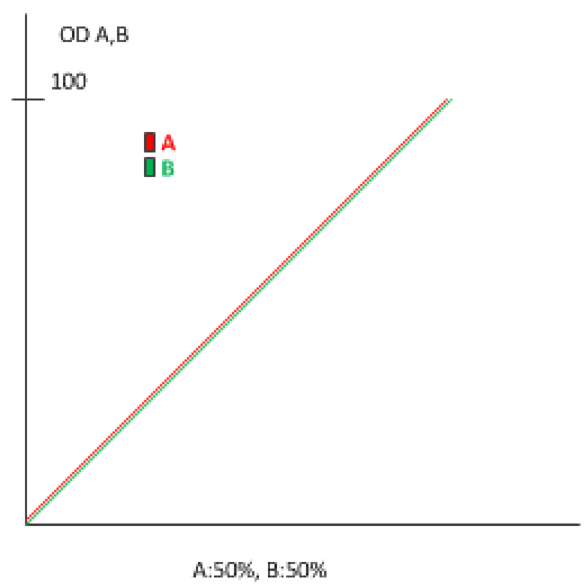


Better Control with Multiple Valve Setup

- Supports both ICM/ICAD and AKVA
- Different modes of operation available when multiple valves are selected
  - Parallel (both valves operate at same time)
  - Sequential (additional valve opens based on opening degree the user sets for 1st valve in EKE)
- Advanced control algorithms applied when multiple valve operation is selected
- Smart, hassle-free communication between multiple valves via integrated CAN bus







3 Valves In Sequential Mode

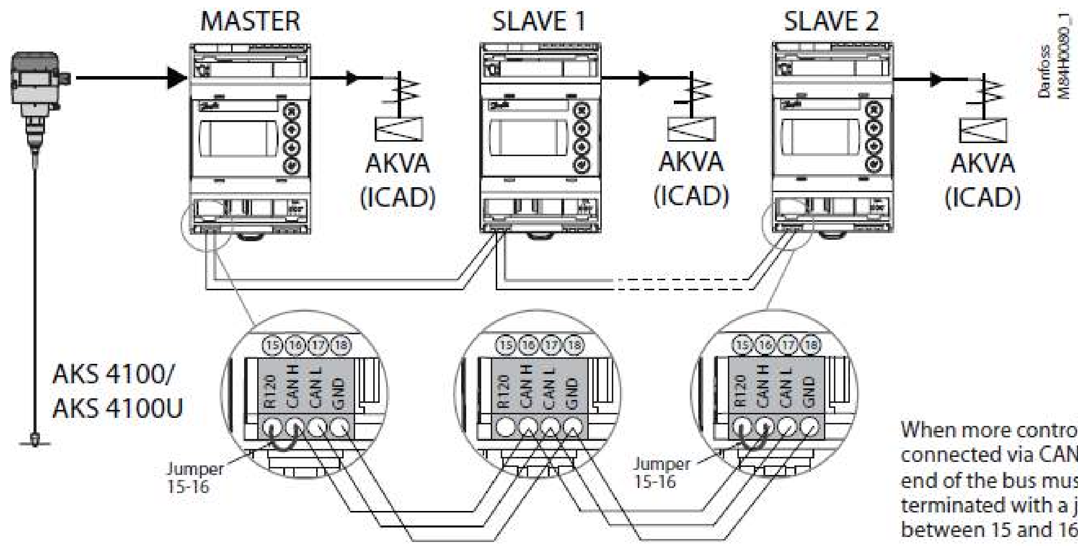
2 Valves In Parallel Mode

Technical Data

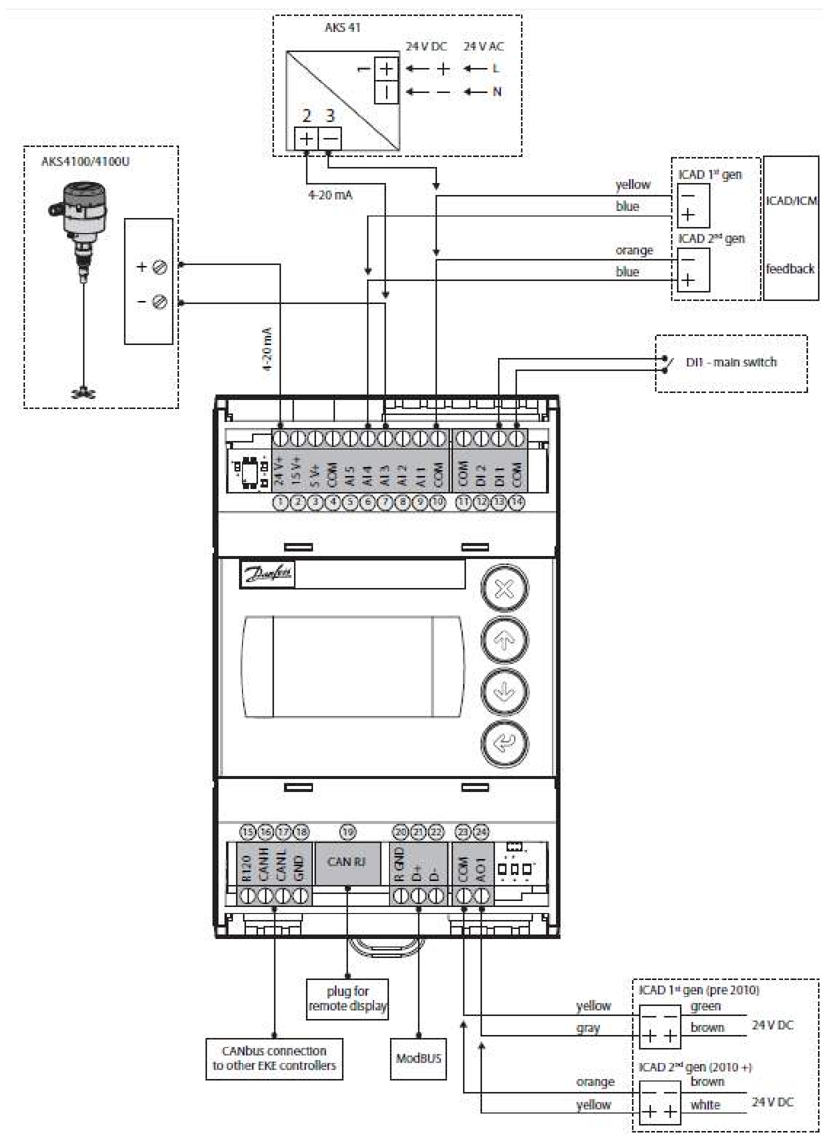
Supply voltage	24 V a.c. +/-20% 50/60 Hz or 24 V d.c. +/-20% (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV	15 VA / 10W 55 VA
Input signal * Ri = 0(4)-20mA: 33 ohm 0(2)-10 V: 100 kohm	Level signal *	4-20 mA or 0-10 V
	ICM valve feedback signal *	From ICAD 0/4-20 mA
	Contact function start/stop of regulation	
Relay output	3 pcs. SPDT (Lower level alarm, Upper level alarm, Common alarm / NC Solenoid)	3 A (ohmic) 1 A (inductive) Max 240 V a.c. or 24V a.c./d.c. can be used, but same voltage type must be used on DO3 and DO2
Current output	0-20 mA or 4-20 mA Max. load: 500 ohm	
Valve connection	ICM - via current output AKV/A- via 24 a.c. Pulse-Width Modulating output	
Data communication	MODBUS RTU: Communication to system controller, MODBUS on RS485: galvanic isolation (500 V d.c.) CAN: Communication to other EKE controllers	
Environments	–20 - 55°C, during operation –30 - 80°C, during storage	
	90% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20 /IP 40 for the front mounted into a panel	
Weight	193 g	
Mounting	DIN rail	
Display	Graphical LCD display	
Terminals	plugs 1.5 or 2.5 mm² multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN61000-6-3 and EN 61000-6-2	

Wiring Upper Terminal Strip Connections

Wiring multiple EKE controllers for controlling multiple valves

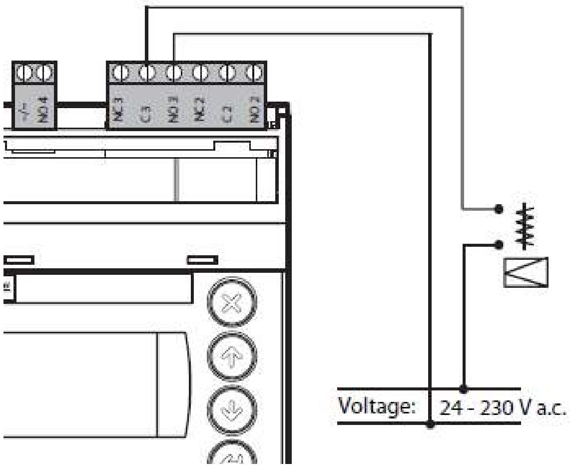


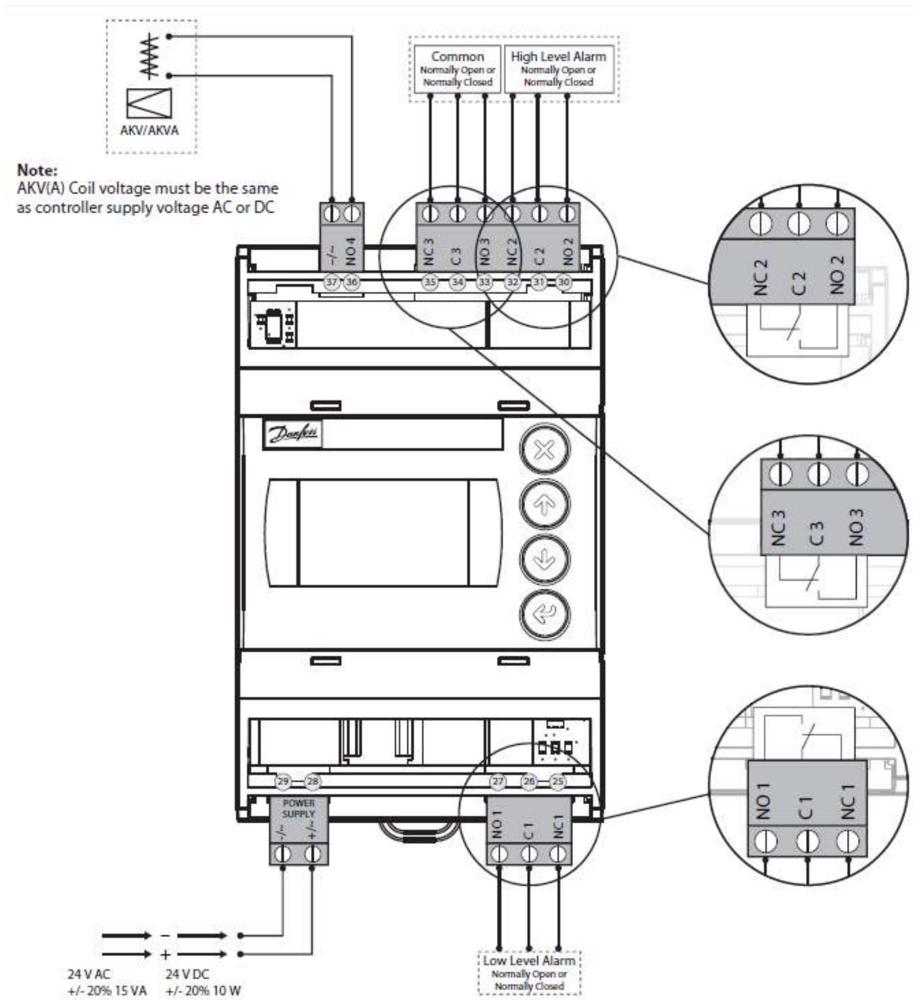
When more controllers are connected via CAN bus each end of the bus must be terminated with a jumper between 15 and 16.



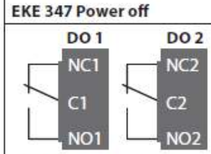
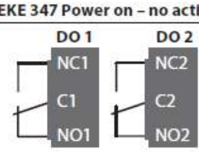
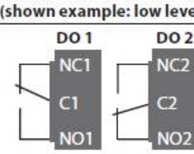
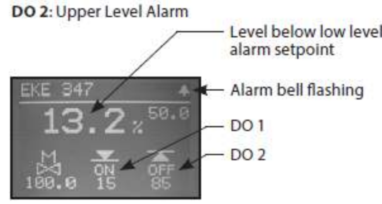
Wiring Lower Terminal Strip Connections

Example of wiring a solenoid valve which is mounted before motorized valve etc.



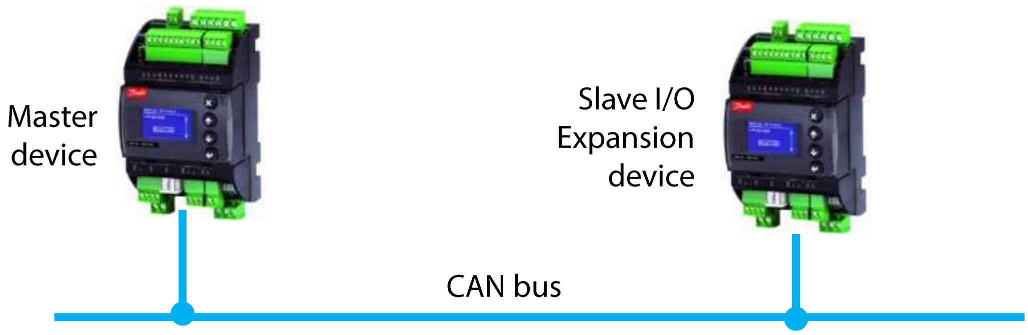


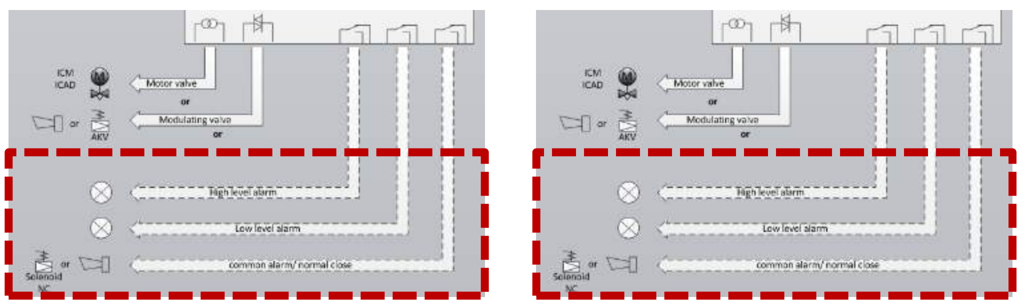
EKE 347 Alarm Relay Function

EKE 347 Power off	EKE 347 Power on – no active alarms	EKE 347 Power on – active alarm(s) (shown example: low level alarm)
 **DO 1:** Low Level Alarm **DO 2:** Upper Level Alarm  Black screen	 **DO 1:** Low Level Alarm **DO 2:** Upper Level Alarm 	 **DO 1:** Low Level Alarm **DO 2:** Upper Level Alarm 
Result: (If PLC connected) PLC show Alarm(s) ON	**Result:** Alarm text showing OFF	**Result:** Low level showing ON, Upper level showing OFF

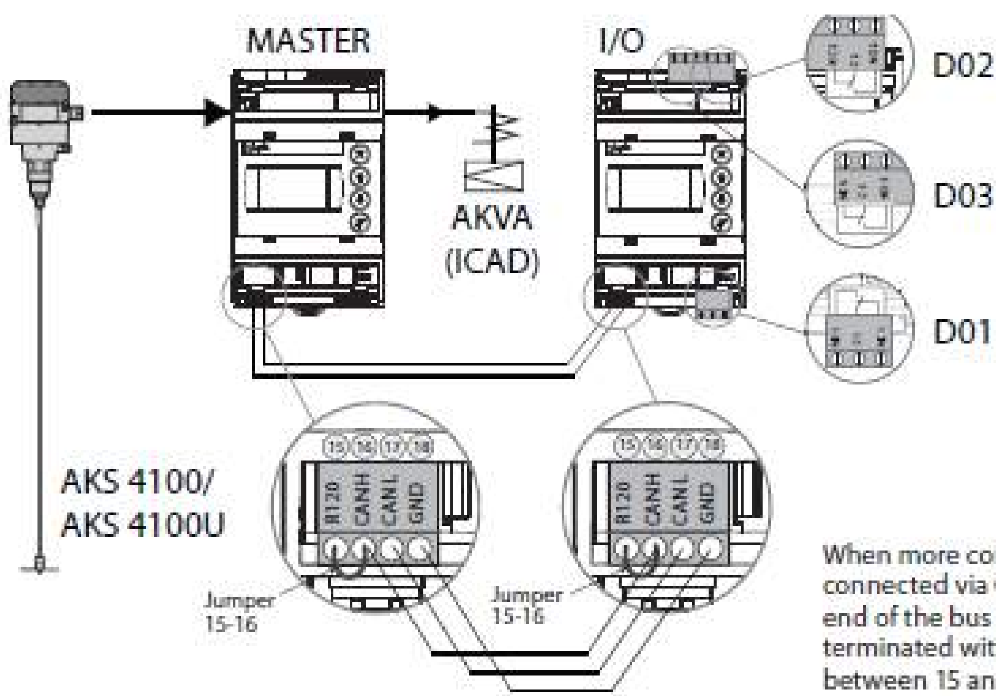
Add-On Function

Expandable I/O module





- Easy to gain 3 extra digital output relays with additional EKE 347 configured as I/O expansion device
- Dry contacts/change-over relays to output advanced alarm conditions
- Easy set-up via display

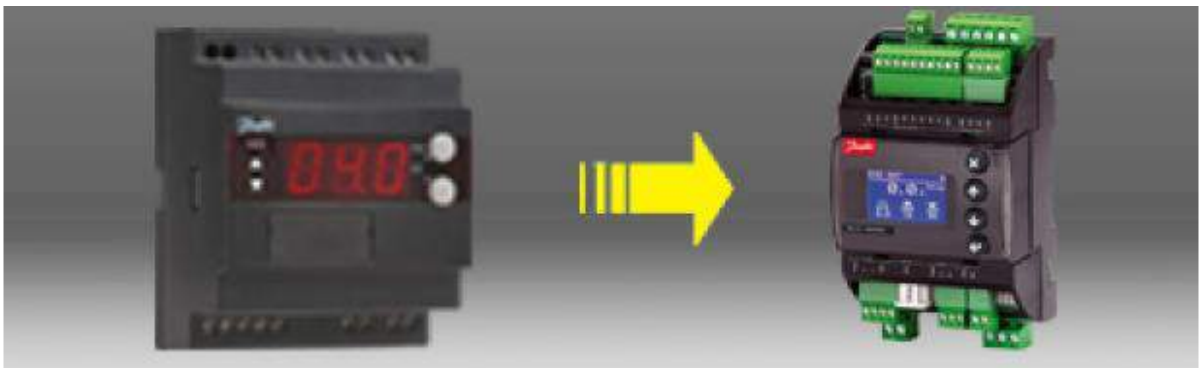


When more controllers are connected via CAN bus each end of the bus must be terminated with a jumper between 15 and 16.

EKC 347 Liquid Level Controller

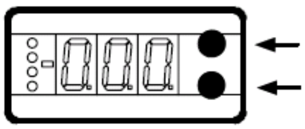
- EKE 347 is the new series liquid level controller to replace the EKC 347
- The EKE 347 has many new features and upgrades compared to the EKC 347 which will be discontinued in 2015

EKC 347 EKE 347

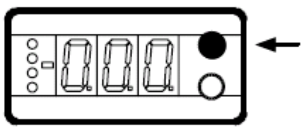


EKC 347 Operation

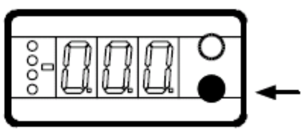
To view or change liquid level set point:



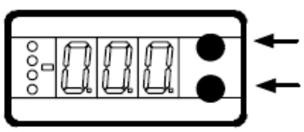
To enter change mode
Press both buttons simultaneously



To raise the setpoint
Press the upper button



To lower the setpoint
Press the lower button

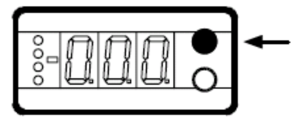


To save the change
Press both buttons simultaneously

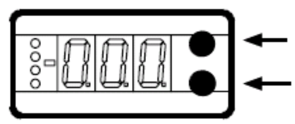
To reset all setting to factory default values:

1) Remove the supply power to EKC 347
2) While pressing both buttons simultaneously, restore power. Settings are now back to factory settings

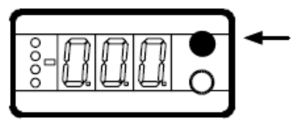
To change a parameter setting:



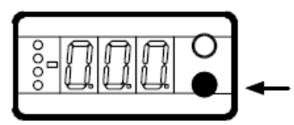
To access parameter menu
Press the upper button for 5 seconds, then
Use the upper and lower buttons to scroll through the parameter list



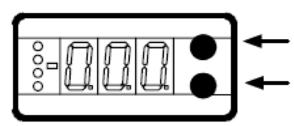
To enter change mode for a parameter you have scrolled to
Press the both buttons simultaneously



To increase the setting
Press the upper button



To decrease the setting
Press the lower button



To save the new setting and return to the parameter menu
Press both buttons simultaneously. You can then make other parameter changes or,
The EKC 347 will exit the parameter menu and return to its normal display when no buttons have been pressed for approximately 18-20 seconds.

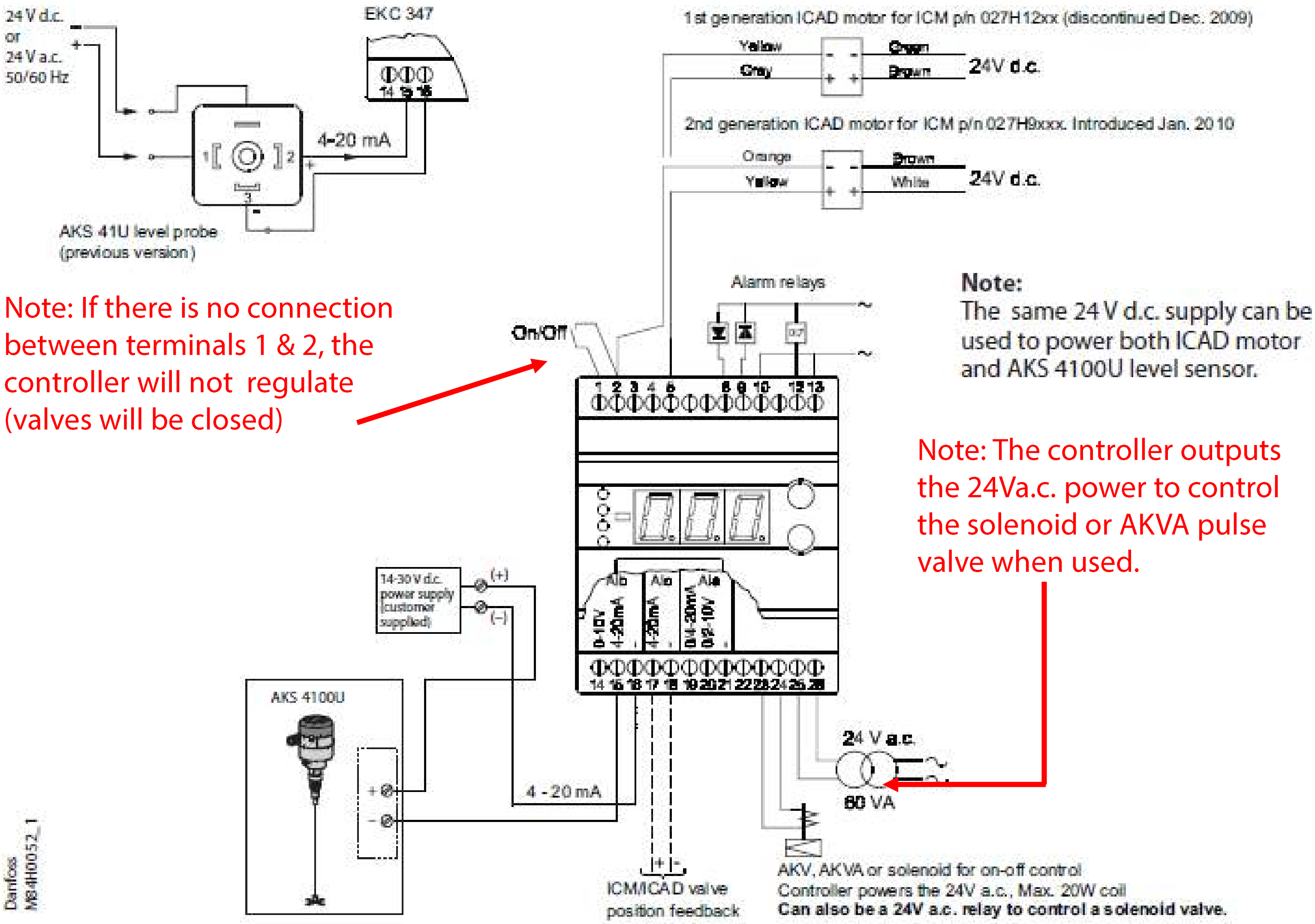
EKC 347 Error, Alarm & Status Codes

When any of the 3 lower LEDs (not the valve indication LED) are shown in the display, a brief push of the upper button will result in the display showing the corresponding error, alarm or status code.

Meaning of error, alarm and status codes

Code	Description
E1	Errors in the controller
E12	Analog input value on terminals 19 & 21 or 20 & 21 is out of range
E21	No signal from the liquid level sensor, or the signal value is out of range*
E22	Valve position feedback on terminals 17 & 18 is out of range
A1	High level alarm A1 has been detected
A2	Low level alarm A2 has been detected
A3	Additional level alarm A3 has been detected
S10	Level regulation stopped by internal (parameter r12) or external (terminals 1 &2) start-stop
S12	High or low level alarm has been detected when not using alarm A3 as a common alarm

EKC 347 Wiring Diagram



Note: If there is no connection between terminals 1 & 2, the controller will not regulate (valves will be closed)

Note:
The same 24 V d.c. supply can be used to power both ICAD motor and AKS 4100U level sensor.

Note: The controller outputs the 24Va.c. power to control the solenoid or AKVA pulse valve when used.

EKC 347 Alarm Relay Outputs

EKC 347 Relay Output	Relay Function **	Status During Power Failure
High level relay A1, terminals 9 & 10	**Cut-in** when liquid level is **higher** than the set limit	Cut-out
Low level relay A2, terminals 8 & 10	Two setting options: Can be set to **cut-in or cut-out** when level is **lower** than the set limit.	Cut-out
Additional alarm relay A3*, terminals 12 & 13	**Cut-in on a rising** liquid level or **cut-in on a falling** liquid level or it can be cut-in with any A1 or A2 alarm as a commn alarm.	Cut-in

***** This relay will also be cut-in if the controller loses the power input signal from the level sensor. Please note that when this relay is cut-in, a brief push of the upper button will display the alarm code and cut-out the A3 relay (A1 and A2 relays will not do this).

****** If a time delay is set, the relay will not switch until it has expired.

Installation guide

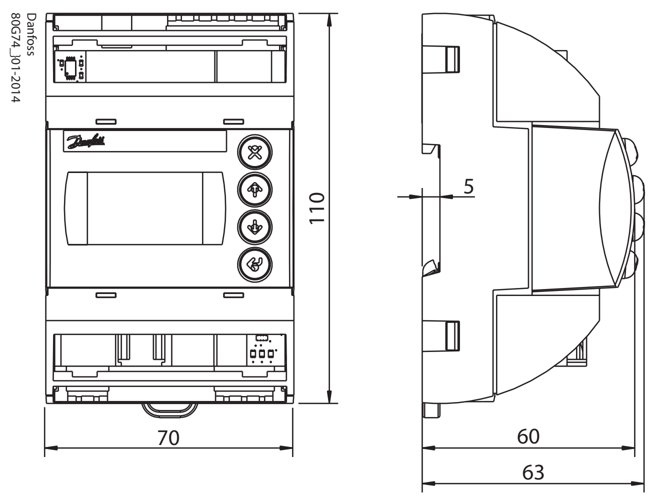
Liquid level controller
EKE 347

080R0430

080R0430

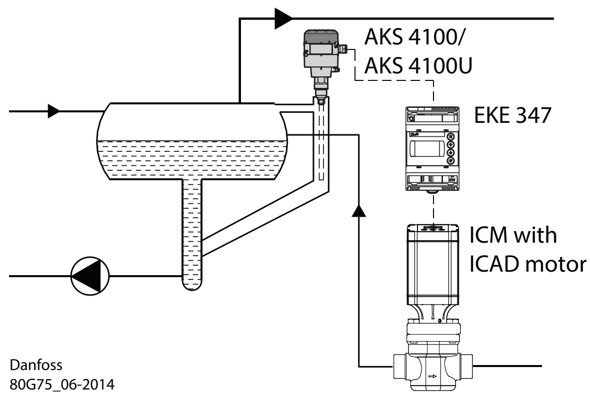
080G5000

1

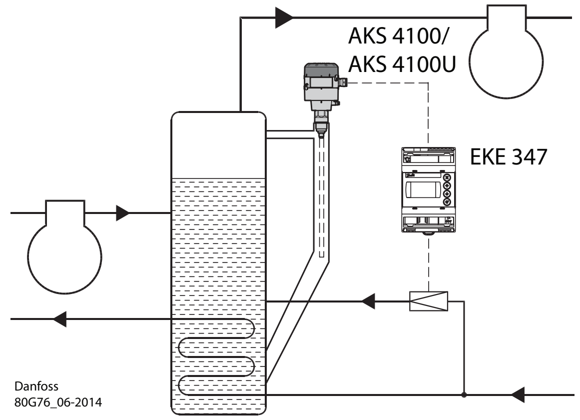


2

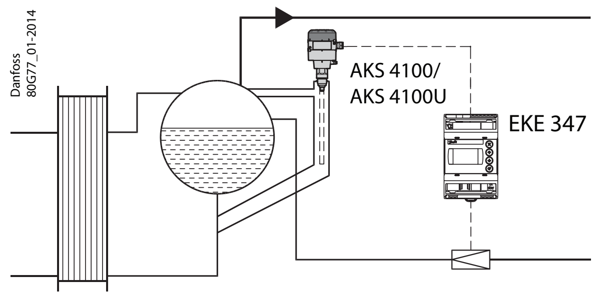
Liquid Level Regulating principle



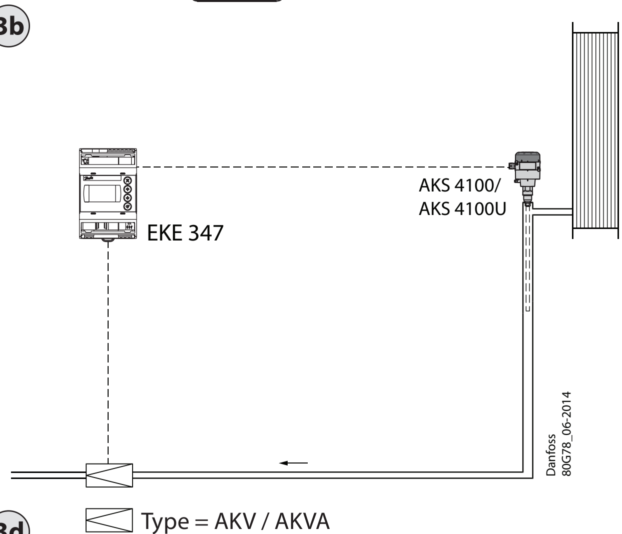
3a



3b

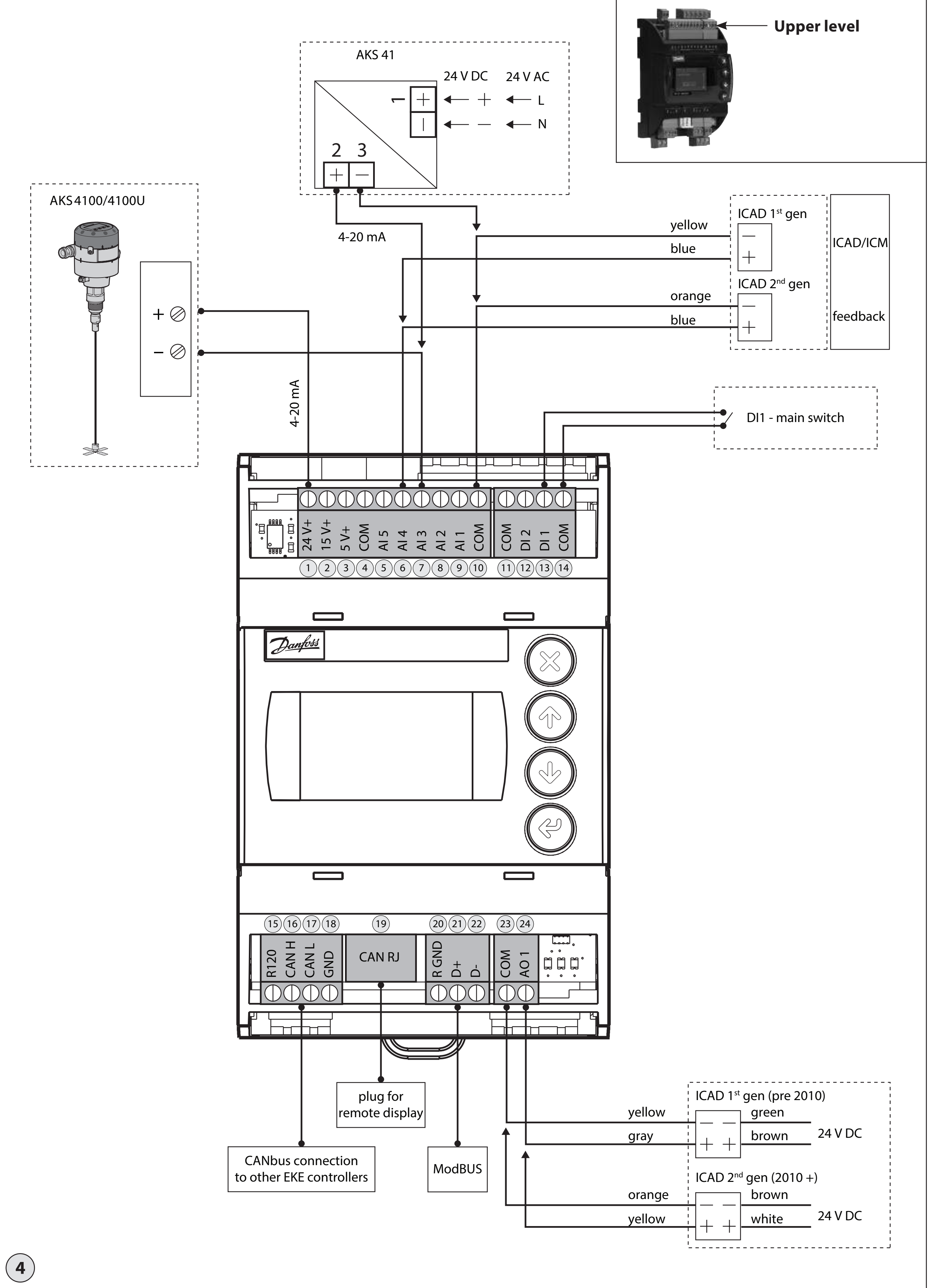


3c

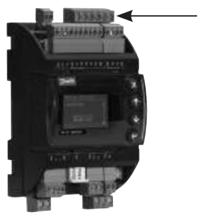


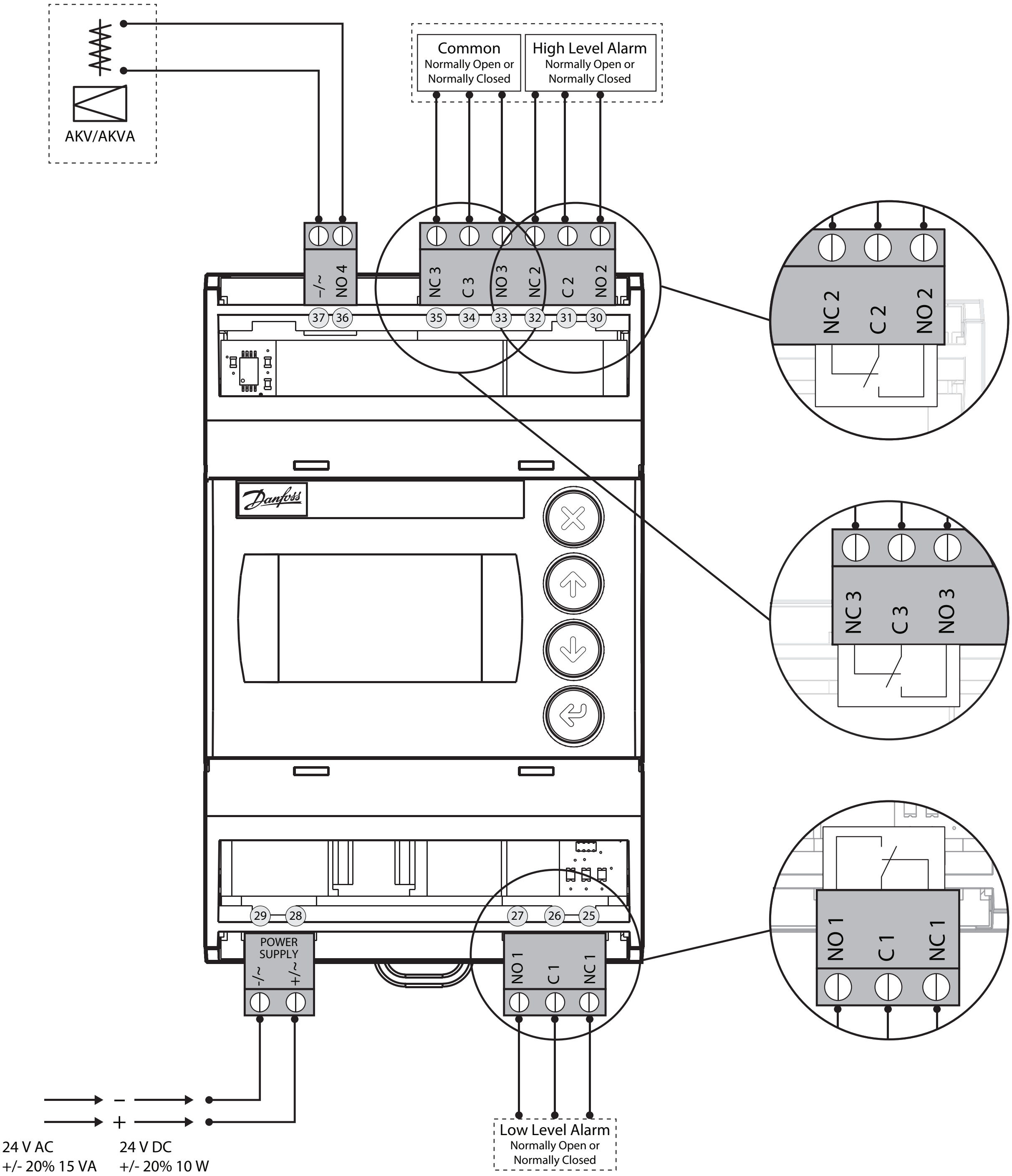
3d

Connections - upper level



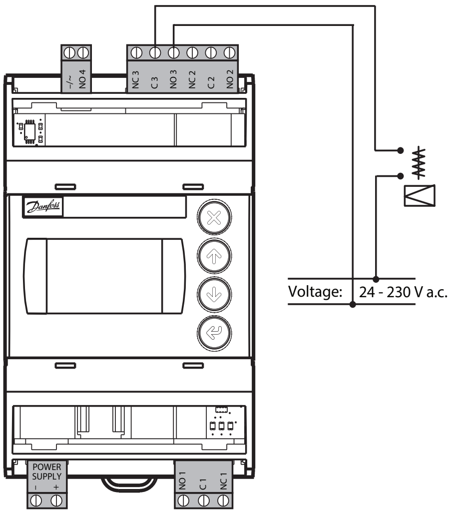
Connections - lower level





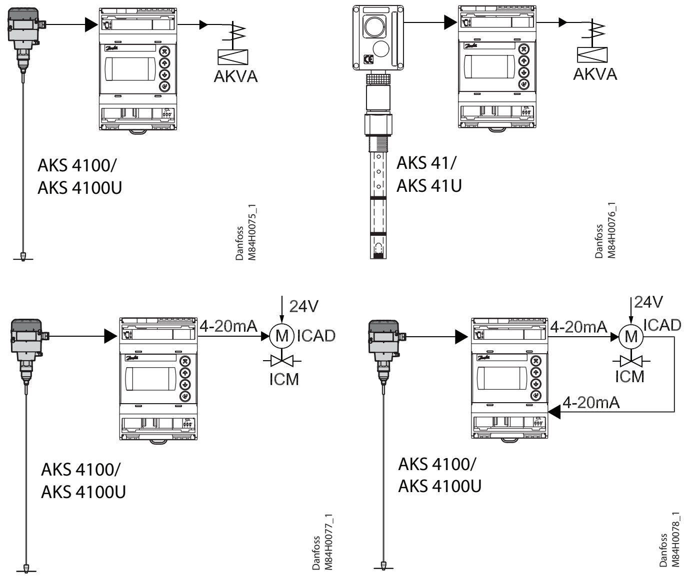
5

EKE 347 - ON/OFF Application.
Open/Close solenoid valve with coil 24V - 230V



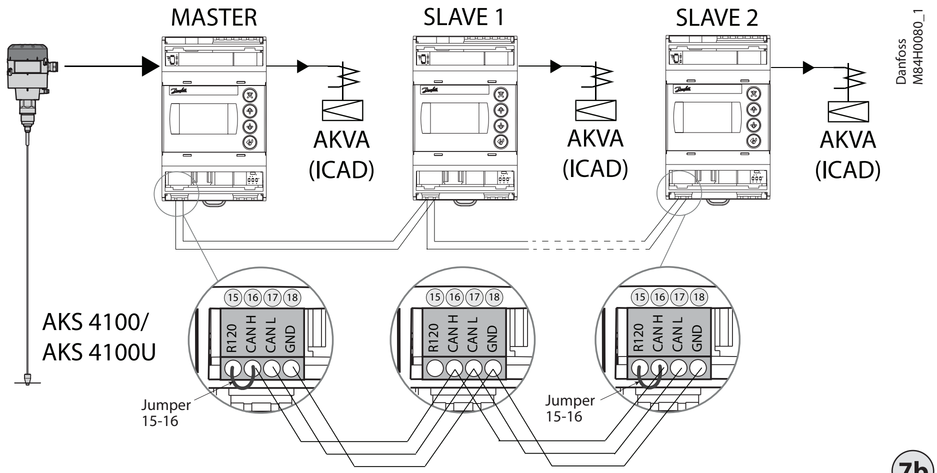
6

Connection examples



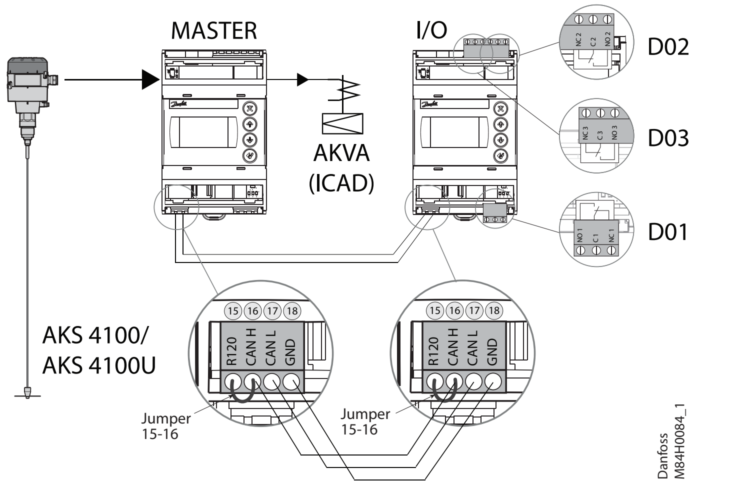
7a

MASTER / SLAVE configuration



7b

I/O configuration



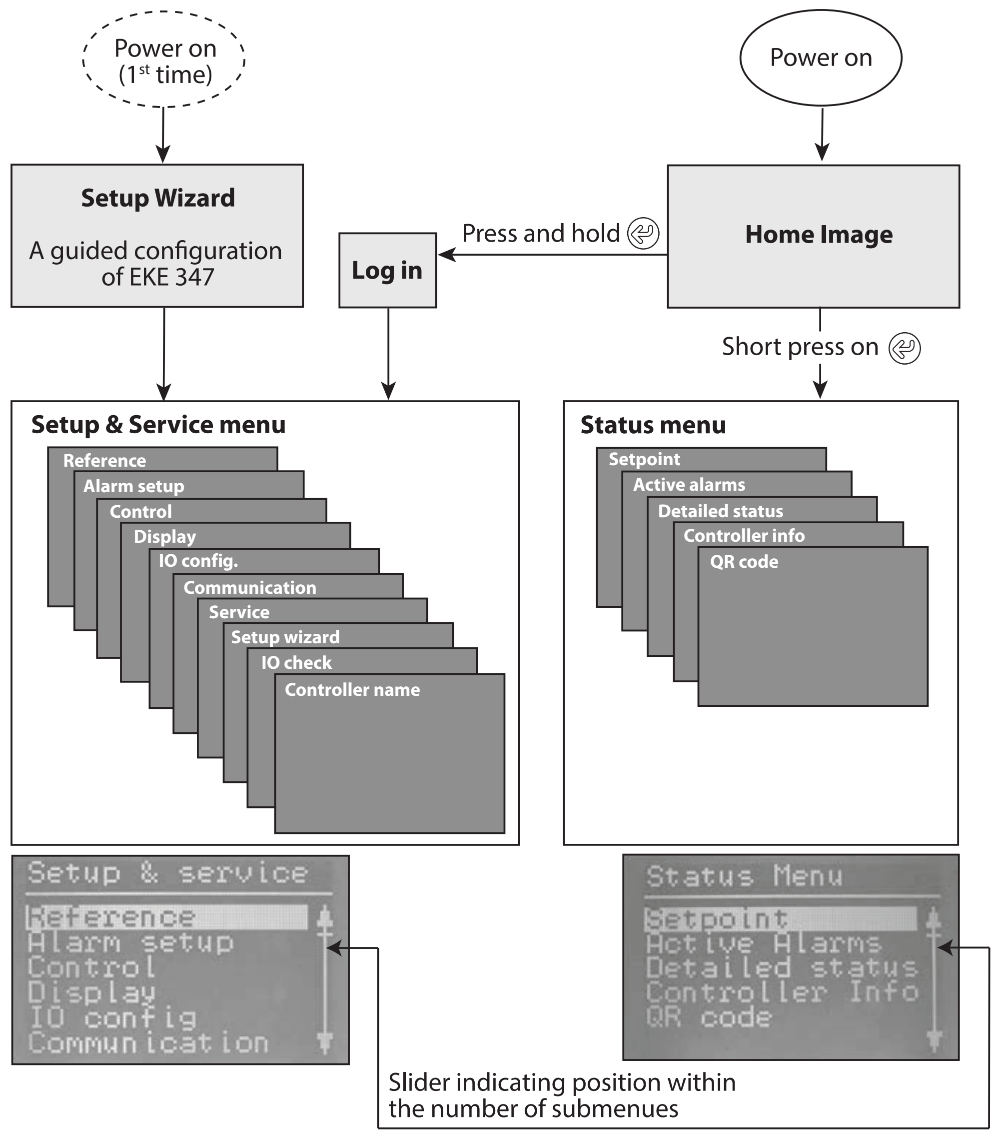
7c


Home Image
EKE 347
52.0 % Stop
0.0
OFF 15
OFF 85
Back - Press and hold = Log Out
Scroll up
Scroll down
Enter - Press and hold = Log In

8


Controller name
Actual liquid level
Valve opening degree
EKE 347
52.0 % Stop
0.0
OFF 15
OFF 85
Flashing bell = Active alarm
Controller mode
Lower level alarm off (pump on)
Upper level alarm off

9


Power on (1st time)
Power on
Setup Wizard
A guided configuration of EKE 347
Log in
Press and hold
Home Image
Short press on
Setup & Service menu
Reference
Alarm setup
Control
Display
IO config.
Communication
Service
Setup wizard
IO check
Controller name
Status menu
Setpoint
Active alarms
Detailed status
Controller info
QR code
Setup & service
Reference
Alarm setup
Control
Display
IO config
Communication
Status Menu
Setpoint
Active Alarms
Detailed status
Controller Info
QR code
Slider indicating position within the number of submenues

10

ENGLISH

Liquid Level Regulating principle

Fig. 3a:
LOW

System configuration	ICAD
Regulating principle	Low
Level Signal setup	AKS 4100

Fig. 3b:
LOW

System configuration	AKV/A
Regulating principle	Low
Level Signal setup	AKS 4100

Fig. 3c:
LOW

System configuration	AKV/A
Regulating principle	Low
Level Signal setup	AKS 4100

Fig. 3d:
HIGH

System configuration	AKV/A
Regulating principle	High
Level Signal setup	AKS 4100

Necessary connections (fig. 4, 5 and 6)
Terminals:

28-29	Supply voltage 24 V a.c. or d.c.
1-7	Signal from level transmitter type AKS 4100/4100U **or**
7-10	Signal from level transmitter type AKS 41
36-37	Expansion valve type AKV or AKVA (see note to the right) **or**
23-24	Expansion valve type: ICM with ICAD
13-14	Switch function for start/stop of controller. If a switch is not connected, terminals 13 and 14 must be shortcircuited.

Application dependent connections (fig. 4, 5 and 6)
Terminals:

33-35	Relay for common alarm. Installer can choose between Normally Open (33-34) or Normally Closed (34-35) circuits. The relay will switch according to the programmed setting.
25-27	Relay for low level limit. Installer can choose between Normally Open (26-27) or Normally Closed (25-26) circuits. The relay will switch when the set value is passed.
30-32	Relay for upper level limit. Installer can choose between Normally Open (30-31) or Normally Closed (31-32) circuits. The relay will switch when the set value is passed.
6-10	ICM valve feedback signal from ICAD 0/4-20 mA

Note!
If AKV(A) is used, the power supply must cover the AKV(A) coil wattage additionally (see fig. 5).
AKV(A) Coil voltage must be the same as controller supply voltage AC or DC.

MASTER/SLAVE and I/O configuration (fig. 7b and 7c)
When more controllers are connected via CAN bus each end of the bus must be terminated with a jumper between 15 and 16.

Control Panel (fig. 8)
The user interface of the control panel consists of a multiline display and 4 individual push buttons: Enter button, Page up button, Page down button and Back button.

Fig. 8 shows the Home display image, which give the actual overview. This is the starting point for entering into menus, and you will revert to this image by pushing ⊗ 1 – 3 times (depending on actual position).

Display (fig. 9)
The display itself show the state of **Liquid level, Controller Mode** (controller On/Off), **Valve opening degree, Lower level alarm** (on = no alarm present) and **Upper level alarm** (off = no alarm present).

Additional to the external connected alarm audio/video sources, a Bell symbol will flash in the upper right corner in case of an alarm.

To see more details on system performance and setting of parameters, 2 different main menu levels can be reached by operation of the push buttons.

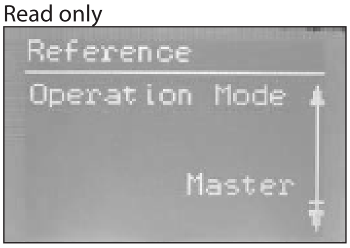
Menu's

Entrance to menu's (see fig. 10)

From Home Image the status menu can be reached by one push on . From Home Image the Setup & service menu can be reached by one push and hold on .
For entrance a Log in is required by the password given during commisioning.

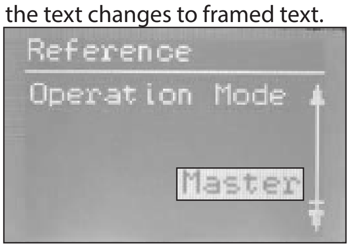
Parameter mode (read/write mode)
When maneuvering in Setup & service menu or Status menu there is an overall logic of showing possible actions for each parameter.

Plain text:
Read only



Framed text:
Parameter can be changed - push to highlight.

Highlighted text:
Scroll with / to the desired selection and push to enter the selection.
Once entered the parameter is valid and the text changes to framed text.



Status menu

To enter Status menu from Home image:
Push once.

The Status menu is an open menu accessible for all. Therefore only 1 parameter can be changed from here. A selection of other parameters can be seen from the status menu:

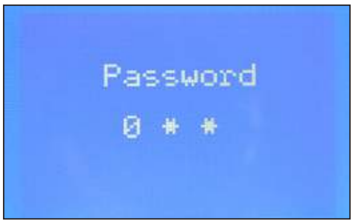
Status menu (Open menu)

	Options	
Setpoint		
Liquid level setpoint	0 - 100%	
Active alarms Example of alarm content. The list will be empty in normal operation as no alarm is active.		
Level signal out of range	hours	minutes
Standby mode	hours	minutes
Detailed status		
Controller state	Stop, Manual, Auto, Slave, IO	
Actual level	0.0 - 100%	
Actual reference	0.0 - 100%	
Actual OD	0.0 - 100%	
Digital input status	On / Off	
Actual level signal current		mA
Oscillation amplitude	0.0 - 100%	
Oscillation period		sec
Controller Info		
Type		
Name (Controller name)		
SW (Software version)		
Bios (Bios version)		
Adr (Controller address)		
SN (Serial Number)		
PV (Product version)		
Site (Production site)		
QR code		
Code		

(white)	Read & Write
(grey)	Read only

Setup & service menu

(Requires log-in password assigned in Commisioning menu)



To enter Setup and service menu from Home image:
Push and hold .

Maneuvering in the Status menu and the Setup and service menu's are done by use of the 4 push buttons shown in fig. 8.

The Setup & service menu is divided into 3 access levels, where personnel have individual authority.

Most advanced level is **Commissioning**, where you have access to change all allowable parameters, including password issuing and re-run of Setup wizard. Default password for commissioning is 300.

Service level is for service personnel and has fewer rights than commissioning. Default password is 200.

The lowest level is for **Daily** use, and allows only a few changes. Default password is 100.

Below table shows authority given to the 3 levels.

ENGLISH

Setup & service menu (Requires Log-In. Password to be assigned in Commisioning menu)

Parameter		Options	User level - access			Default values
			Daily	Service	Commissioning	
Reference	Main switch	On, Off	RW	RW	RW	Off
	Liquid level setpoint	0 - 100%	RW	RW	RW	50.0%
	Operation mode	Master, IO, Slave	R	R	RW (L)	Master
Alarm setup	Lower level limit	0 - 100%	RW	RW	RW	15%
	Upper level limit	0 - 100%	RW	RW	RW	85%
	Level alarm mode	Time, Hysteresis	R	R	RW	Time
	Lower delay	0 - 999 sec	R	RW	RW (D)	10 sec
	Upper delay	0 - 999 sec	R	RW	RW (D)	50 sec
	Lower level hysteresis	0-20 %	R	RW	RW (D)	3%
	Upper level hysteresis	0-20 %	R	RW	RW (D)	5%
	Function common alarm	Not follow; Follow up; Follow low; Follow all	R	R	RW	Not follow
	Oscillation detect band	0 - 100%	R	RW	RW (D)	100%
	Oscillation detect timeout	2 - 30 min	R	RW	RW (D)	20 min
	Force pump OFF in stop mode	Yes / No	R	RW	RW	No
	IO Lower level limit	0 - 100%	RW	RW	RW (D)	5%
	IO Upper level limit	0 - 100%	RW	RW	RW (D)	95%
	IO Lower level hysteresis	0-20 %	R	RW	RW (D)	3%
	IO Upper level hysteresis	0-20 %	R	RW	RW (D)	3%
	IO Lower delay	0 - 999 sec	R	RW	RW (D)	10 sec
	IO Upper delay	0 - 999 sec	R	RW	RW (D)	50 sec
	IO Level limit	0 - 100%	R	RW	RW (D)	50%
	IO Level delay	0 - 999 sec	R	RW	RW (D)	10 sec
	IO Level hysteresis	0-20 %	R	RW	RW (D)	3%
	IO Level action	Falling,Rising	R	RW	RW (D)	Falling
Control	Control Method	On/Off ,P, PI	R	RW	RW	PI
	Regulating principle	Low, High	R	RW	RW	Low
	P-band	5 - 200%	R	RW	RW (D)	30.0%
	Integration time Tn	60 - 600 sec	R	RW	RW (D)	400 sec
	Neutral zone	0 - 25%	R	RW	RW (D)	2.0%
	Difference	0,5-25%	R	RW	RW (D)	2%
	Period time for AKV/AKVA	3-15 sec	R	RW	RW (D)	6 sec
	Minimum OD	0 - 99%	R	RW	RW (D)	0%
	Maximum OD	1 - 100%	R	RW	RW (D)	100%
Display	Language	EN,CN,PT,RU,SP,FR,IT, GER, ARAB	R	RW (L)	RW (L) (D)	EN
	Output indication	level, OD	R	RW	RW (D)	Level
	Login timeout	1 - 120 min	R	RW	RW	10 min
	Backlight timeout	0 - 120 min	RW	RW	RW	2 min
	Password daily	3 -digit, 0 - 999	N/A	N/A	RW	100
	Password service	3 -digit, 0 - 999	N/A	N/A	RW	200
	Password commission	3 -digit, 0 - 999	N/A	N/A	RW	300
IO config	System configuration	ICAD+NC, ICAD, AKV/A+NC, AKV/A, NC only	R	R	RW (L)	ICAD + NC
	Level signal setup	AKS 4100, AKS 41, Current, Voltage	R	R	RW (L)	AKS4100
	Voltage at low liquid level	0-10V	R	RW	RW (D)	0 V
	Voltage at high liquid level	0-10V	R	RW	RW (D)	10 V
	Current at low liquid level	0-20 mA	R	RW	RW (D)	4 mA
	Current at high liquid level	0-20 mA	R	RW	RW (D)	20 mA
	Valve position setup	Not used, Current, Voltage	R	R	RW (L)	Not used
	Voltage at closed valve position	0-10V	R	RW	RW (D)	0 V
	Voltage at open valve position	0-10V	R	RW	RW (D)	10 V
	Current at closed valve position	0-20 mA	R	RW	RW (D)	4 mA
	Current at open valve position	0-20 mA	R	RW	RW (D)	20 mA
	Common alarm setup	D04, High alarm, D03, Disp only	R	R	RW (L)	High alarm
	Multiple valve setup	Not used, 2 same cap, 2 dif cap, 3 same cap, 3 dif cap	R	R	RW (L)	Not used
	Multiple valve pattern	Parallel,Sequence	R	R	RW (D)	Parallel
	Valve A capacity	0-100 %	R	R	RW (L) (D)	50%
	Valve B capacity	0-100 %	R	R	RW (L) (D)	50%
	Valve C capacity	0-100 %	R	R	RW (L) (D)	30%
	ICAD takeover OD	0-100%	R	RW	RW (D)	80%
	IO module setup	Used, Not used	R	R	RW (L) (D)	Not used
Communication	CAN ID	1 - 127	R	R	RW	1
	CAN baudrate	20k, 50k, 125k, 250k, 500k, 1M	R	R	RW	500k
	Modbus ID	0 - 120	R	R	RW	1
	Modbus baudrate	0, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400	R	R	RW	19200
	Modbus mode	8N1, 8E1, 8N2	R	R	RW	8E1
	Modbus mapping	Operation, Setup	R	R	RW	Operation
	Valve B CAN ID	1 - 127	R	R	RW (D)	2
	Valve C CAN ID	1 - 127	R	R	RW (D)	3
	IO Mod. CAN ID	1 - 127	R	R	RW (D)	4

RW = Read & Write R = Read only N/A = Not shown (L) = Locked by Mainswitch (Switch OFF Mainswitch for change of setting)

(D) = Parameter is hidden if not active in the selected application

ENGLISH

Setup & service menu (Requires Log-In. Password to be assigned in Commisioning menu) - Continued

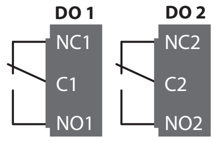
Parameter		Options	User level - access			Default values
			Daily	Service	Commissioning	
Service	Controller state		R	R	R	-
	Actual level		R	R	R (D)	-
	Actual referrence		R	R	R (D)	-
	Actual OD		R	R	R (D)	-
	Actual valve position		R	R	R (D)	
	Digital input status		R	R	R (D)	-
	Actual level signal voltage		R	R	R (D)	
	Actual level signal current		R	R	R (D)	-
	Actual position signal voltage		R	R	R (D)	
	Actual position signal current		R	R	R (D)	
	Actual OD A		R	R	R (D)	
	Actual OD B		R	R	R (D)	
	Actual OD C		R	R	R (D)	
	Manual Mode	On, Off	R	RW	RW (D)	Off
	Manual OD	0 - 100%	R	RW	RW (D)	50.0%
	Manual low alarm	Off-On	R	RW	RW (D)	Off
	Manual high alarm	Off-On	R	RW	RW (D)	Off
	Manual common alarm	Off-On	R	RW	RW (D)	On
	Apply defaults	None, Factory	N/A	N/A	RW (D)	None
Setup wizard	Setup wizard	Re-run Setup wizard	N/A	N/A	RW	-
I/O check	Main switch EKE act:	Off - On	R	R	R	Off
	AKS 4100 EKE act:	0 - 20 mA	R	R	R (D)	-
	ICAD EKE act:	4 - 20 mA	R	R	R (D)	-
	Nor. Close (NC) EKE act:	Off - On	R	R	R (D)	-
	Upper lvl (alarm) EKE act:	Off - On	R	R	R (D)	-
	Lower lvl (alarm) EKE act:	Off - On	R	R	R (D)	-
Controller name	Controller name	Type in controller name	RW	RW	RW	-

RW = Read & Write　　R = Read only　　N/A = Not shown　　(L) = Locked by Mainswitch (Switch OFF Mainswitch for change of setting)

(D) = Parameter is hidden if not active in the selected application

EKE 347 Alarm-Relay function

EKE 347 Power off

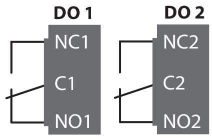


DO 1: Low Level Alarm
DO 2: Upper Level Alarm

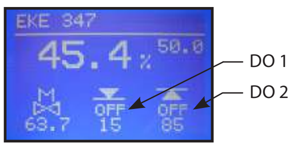
Black screen

Result:
(If PLC connected) PLC show Alarm(s) ON

EKE 347 Power on – no active alarms

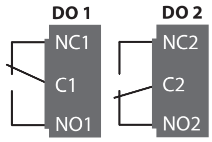


DO 1: Low Level Alarm
DO 2: Upper Level Alarm

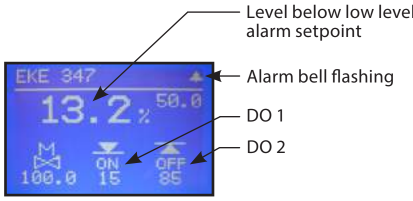


Result:
Alarm text showing OFF

EKE 347 Power on – active alarm(s) (shown example: low level alarm)



DO 1: Low Level Alarm
DO 2: Upper Level Alarm



Result:
Low level showing ON,
Upper level showing OFF

ENGLISH

First time start-up (Setup wizard)

When all connections to the controller have been made, the first time start-up can be performed.

After switching power on, the Danfoss logo will appear for 5 seconds

The setup wizard will start.

During the setup wizard following sequence must be repeated for all parameter settings:

a) Parameter name + 1st option
b) Press to highlight 1st option
c) Scroll with / to your desired option.
d) Press to set your choice xxxxxx
e) Scroll with to next parameter (repeat sequence a to e)

1. Language
You can select any of these 9 languages:
English, Chinese, Portuguese, Russian, Spanish, French, Italian, German, Arabic

2. System configuration
Select any of these 5 predefined configurations:
ICAD + NC(solenoid)
NC(solenoid)
AKV/A
AKV/A + NC(solenoid)
ICAD

3. Operation mode
Select any of these 3 predefined modes:
Master (EKE 347 as Master controller)
IO (EKE 347 as In/Out module)
Slave (EKE 347 as slave for another Master

4. Regulating principle
Select one of these 2 principles
Low
High

5. Liquid level setpoint
Type in any level setpoint from 0% to 100% (default is 50.0%)
50.0%

6. Lower level limit
Type in any limit from 0% to 100% (default is 15%)
15%

7. Upper level limit
Type in any limit from 0% to 100% (default is 85%)
85%

8. Level signal setup
Select one of these 4 predefined signal setup:
AKS 4100
Voltage
Current
AKS 41

9. Valve feedback setup
Select one of these 3 predefined feedback setup (valve feedback is only possible with ICAD):
Not used
Voltage
Current

10. Common alarm setup
Select one of these 4 predefined methods:
High Alarm
D04
Disp only (only Bell symbol flashing)
D03

11. Apply wizard settings
Press to confirm all inputs
or
Press to return to last menu

Once data entry has been confirmed, the controller has sufficient data to do a qualified regulation of your system.

You are now asked to select one of these menus.
Main menu
Main switch
I/O check

Press for reaching the Setup & service menu or press 2 times for reaching the Home display image.

If for some reason it is needed to run the setup wizard again, this is possible by log in to the setup & service menu with commissioning authority.

Alarm and error codes:
When detecting an alarm from external sources or the flashing bell in the display, the alarm description can be found as a text message in the Status menu under Active alarms.

Both alarms and errors will be shown here. If more alarms/errors occur simultaneously, they will be shown as subsequent text lines.

Alarms:

Upper level
Lower level
Standby mode
Valve B CAN ID conflict
Valve C CAN ID conflict
IO module CAN ID conflict
IO module communication
Communication to master lost
Min/max OD conflict
Common alarm HW conflict
Control method conflict
Multiple valve setup conflict
Valve C alarm
Valve B alarm
Oscillation in level signal
Valve position
Multiple valve capacity
Valve C communication
Valve B communication

Errors:

Internal error
Level signal out of range
Valve position signal out of range
Sensor supply overload
AKS 4100 error
Too much current AI3
Too much current AI4
DO4 overload

ENGINEERING
TOMORROW

User Guide

Liquid level controller
EKE 347

The EKE 347 controller is used for regulation of the liquid level in:

- Pump reservoirs
- Separators
- Intermediate coolers
- Economisers
- Condensers
- Receivers

The controller is communicating with a transmitter that continuously measures the liquid level in the actual reservoir.

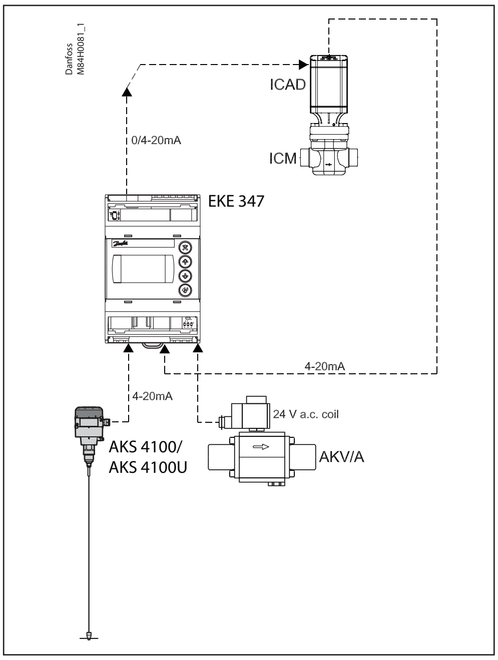
By comparing the measured value with the level setpoint entered by the customer, the controller dictates the valve to increase or decrease the liquid flow to or from the reservoir.

Features

- Liquid level control
- Alarm if the set alarm limits are exceeded
- Relay outputs for upper and lower level limits and for alarm level
- User friendly and easy setup Wizard for first time configuration
- PI control
- Low or High side control
- When AKV/A is selected, a MASTER/SLAVE system can run up to 3 AKV/A with distributed Opening Degree
- Manual control of output
- Limitation of Opening degree possible
- ON/OFF operation with hysteresis
- Programming menu with 3 access levels and separate passwords
- Connection to other EKE 347 controllers possible
- Wired remote display possible
- BUS communication:
  - CAN Bus (Danfoss internal only)
  - MODBUS RTU RS485 for communication with e.g. PLC

Signaltransmitter

With the guided micro wave rod AKS 4100/4100U it is possible to set the refrigerant level within a wide range.



EKE 347

The controller receive a signal which enable it to contol low or high side applications (see page 3).

EKE 347 does support 2 types of Danfoss expansion valves. (see below)
One analog input is available as feed back from ICM in order to indicate opening degree of the ICM.

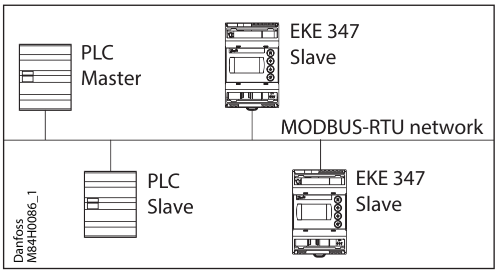
Expansions valve

Two types of Danfoss expansion valves can be used

- *ICM*
  ICM are direct operated motorized valves driven by digital stepper motor type ICAD
- *AKV/A*
  AKVA or AKV are pulse-width modulating expansion valves.

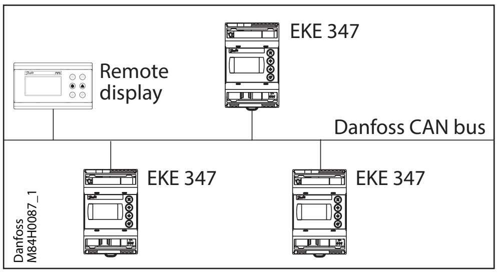
MODBUS communication

EKE 347 include as standard RS 485 based MOD-BUS-RTU bus communication interface to third party equipment like PLC.
Via the MODBUS it is possible to read and write parameters to the EKE 347
Operation, monitoring and data collection can then be performed via PLC from a SCADA system.



Remote Display - option

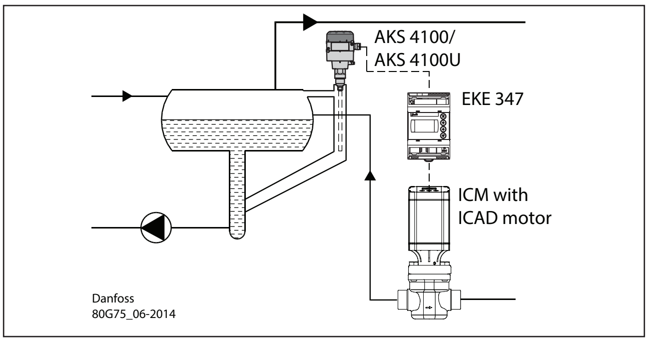
A remote display for panel mounting is available. From the remote display a full overview and access is possible to all individual EKE 347 controllers connected to the internal Danfoss CAN bus.



Application examples

Pump reservoir

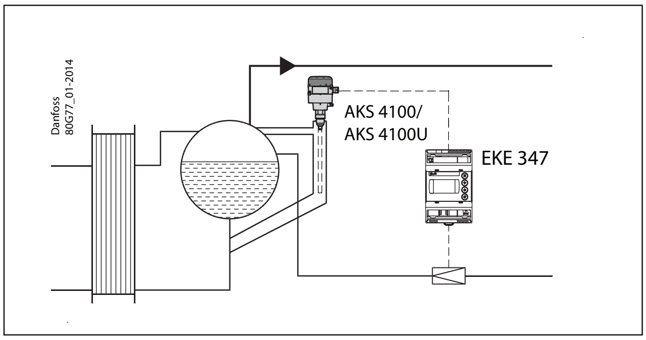
Modulating control of injection for a more stable liquid level and suction pressure.



System configuration ICAD
Regulating principle: Low
Level Signal setup: AKS 4100/U

Separator on flooded evaporator

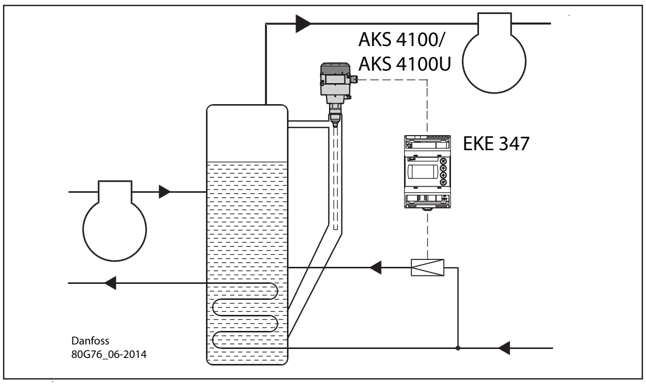
Modulating control and the valve's large capacity range ensure a stable level - even under conditions of quickly changing loads.



System configuration AKV/A
Regulating principle: Low
Level Signal setup: AKS 4100/U

Intermediate cooler

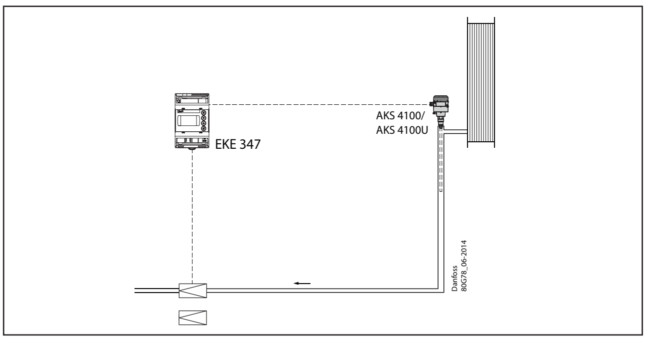
The level transmitter's wide measuring range enables it to monitor the liquid at all levels of the reservoir - and hence to use the signal for safety functions in connection with the max. permissible level



System configuration AKV/A
Regulating principle: Low
Level Signal setup: AKS 4100/U

Receiver / condenser

The control system's short reaction time makes it very suited for high-pressure float systems with small refrigerant charges.



System configuration AKV/A
Regulating principle: High
Level Signal setup: AKS 4100/U

Control Panel

The user interface of the control panel consists of a multiline display and 4 individual push buttons: Enter button, Scroll up button, Scroll down button and Back button.

The figure shows the Home display image, which give the actual overview. This is the starting point for entering into menus, and you will revert to this image by pushing ⊗ 1 – 3 times (depending on actual position).

Display

The display itself show the state of **Liquid level, Controller Mode** (controller On/Off), **Valve opening degree, Lower level alarm** (off = no alarm present) and **Upper level alarm** (off = no alarm present).

Additional to the external connected alarm audio/video sources, a Bell symbol will flash in the upper right corner in case of an alarm.

To see more details on system performance and setting of parameters, 2 different main menu levels can be reached by operation of the push buttons.

From Home image the **Status menu** can be reached by **1 push** on Enter.
From Home image the **Setup & service menu** can be reached by **1 push and hold** on Enter.
For entrance a Log In is required by the pass-word given during Commisioning.

Menus

Status menu

To enter Status menu from Home image:
Push once.

The Status menu is an open menu accessible for all. Therefore only 1 parameter can be changed from here. A selection of other parameters can be seen from the status menu.

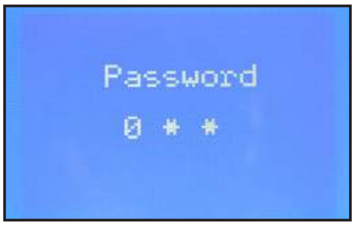
Status menu (Open menu)

	Options
Setpoint	
Liquid level setpoint	0 - 100%
Active alarms Example of alarm content. The list will be empty in normal operation as no alarm is active.	
Level signal out of range	hours minutes
Standby mode	hours minutes
Detailed status	
Controller state	Stop, Manual, Auto, Slave, IO
Actual level	0.0 - 100%
Actual reference	0.0 - 100%
Actual OD	0.0 - 100%
Digital input status	On / Off
Actual level signal current	mA
Oscillation amplitude	0.0 - 100%
Oscillation period	sec
Controller Info	
Type	
Name (Controller name)	
SW (Software version)	
Bios (Bios version)	
Adr (Controller address)	
SN (Serial Number)	
PV (Product version)	
Site (Production site)	
QR code	
Code	

(white)	Read & Write
(grey)	Read only

Setup & service menu
(Requires log-in password assigned in Commisioning menu)

To enter Setup and service menu from Home image:
Push and hold .



Maneuvering in the Status menu and the Setup and service menu's are done by use of the 4 push buttons shown on page 4.

The Setup & service menu is divided into 3 access levels, where personnel have individual authority.

Most advanced level is **Commissioning**, where you have access to change all allowable parameters, including password issuing and re-run of Setup wizard.

Service level is for service personnel and has fewer rights than commissioning.

The lowest level is for **Daily** use, and allows only a few changes.

The table on the next page shows authority given to the Commisioning level.

Default password **300**
gives full access

Setup & service menu - COMMISSIONING

Parameter		Options	Default values
Reference	Main switch	On, Off	Off
	Liquid level setpoint	0 - 100%	50.0%
	Operation mode	Master, IO, Slave	Master
Alarm setup	Lower level limit	0 - 100%	15%
	Upper level limit	0 - 100%	85%
	Level alarm mode	Time, Hysteresis	Time
	Lower delay	0 - 999 sec	10 sec
	Upper delay	0 - 999 sec	50 sec
	Lower level hysteresis	0-20 %	3%
	Upper level hysteresis	0-20 %	5%
	Function common alarm	Not follow; Follow up; Follow low; Follow all	Not follow
	Oscillation detect band	0 - 100%	100%
	Oscillation detect timeout	2 - 30 min	20 min
	Force pump OFF in stop mode	Yes / No	No
	IO Lower level limit	0 - 100%	5%
	IO Upper level limit	0 - 100%	95%
	IO Lower level hysteresis	0-20 %	3%
	IO Upper level hysteresis	0-20 %	3%
	IO Lower delay	0 - 999 sec	10 sec
	IO Upper delay	0 - 999 sec	50 sec
	IO Level limit	0 - 100%	50%
	IO Level delay	0 - 999 sec	10 sec
	IO Level hysteresis	0-20 %	3%
	IO Level action	Falling,Rising	Falling
Control	Control Method	On/Off ,P, PI	PI
	Regulating principle	Low, High	Low
	P-band	5 - 200%	30.0%
	Integration time Tn	60 - 600 sec	400 sec
	Neutral zone	0 - 25%	2.0%
	Difference	0,5-25%	2%
	Period time for AKV/AKVA	3-15 sec	6 sec
	Minimum OD	0 - 99%	0%
	Maximum OD	1 - 100%	100%
Display	Language	EN,CN,PT,RU,SP,FR,IT, GER, ARAB	EN
	Output indication	level, OD	Level
	Login timeout	1 - 120 min	10 min
	Backlight timeout	0 - 120 min	2 min
	Password daily	3 -digit, 0 - 999	100
	Password service	3 -digit, 0 - 999	200
	Password commission	3 -digit, 0 - 999	300
IO config	System configuration	ICAD+NC, ICAD, AKV/A+NC, AKV/A, NC only	ICAD + NC
	Level signal setup	AKS 4100, AKS 41, Current, Voltage	AKS4100
	Voltage at low liquid level	0-10V	0 V
	Voltage at high liquid level	0-10V	10 V
	Current at low liquid level	0-20 mA	4 mA
	Current at high liquid level	0-20 mA	20 mA
	Valve position setup	Not used, Current, Voltage	Not used
	Voltage at closed valve position	0-10V	0 V
	Voltage at open valve position	0-10V	10 V
	Current at closed valve position	0-20 mA	4 mA
	Current at open valve position	0-20 mA	20 mA
	Common alarm setup	D04, High alarm, D03, Disp only	High alarm
	Multiple valve setup	Not used, 2 same cap, 2 dif cap, 3 same cap, 3 dif cap	Not used
	Multiple valve pattern	Parallel,Sequence	Parallel
	Valve A capacity	0-100 %	50%
	Valve B capacity	0-100 %	50%
	Valve C capacity	0-100 %	30%
	ICAD takeover OD	0-100%	80%
	IO module setup	Used, Not used	Not used
Communication	CAN ID	1 - 127	1
	CAN baudrate	20k, 50k, 125k, 250k, 500k, 1M	500k
	Modbus ID	0 - 120	1
	Modbus baudrate	0, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400	19200
	Modbus mode	8N1, 8E1, 8N2	8E1
	Modbus mapping	Operation, Setup	Operation
	Valve B CAN ID	1 - 127	2
	Valve C CAN ID	1 - 127	3
	IO Mod. CAN ID	1 - 127	4

To be continued......

Setup & service menu - COMMISSIONING *(Continued)*

Parameter		Options	Default values
Service	Controller state		-
	Actual level		-
	Actual referrence		-
	Actual OD		-
	Actual valve position		
	Digital input status		-
	Actual level signal voltage		
	Actual level signal current		-
	Actual position signal voltage		
	Actual position signal current		
	Actual OD A		
	Actual OD B		
	Actual OD C		
	Manual Mode	On, Off	Off
	Manual OD	0 - 100%	50.0%
	Manual low alarm	Off-On	Off
	Manual high alarm	Off-On	Off
	Manual common alarm	Off-On	On
	Apply defaults	None, Factory	None
Setup wizard	Setup wizard	Re-run Setup wizard	-
I/O check	Main switch EKE act:		Off
	AKS 4100 EKE act:		-
	ICAD EKE act:		-
	Nor. Close (NC) EKE act:		-
	Upper lvl (alarm) EKE act:		-
	Lower lvl (alarm) EKE act:		-
Controller name	Controller name	Type in controller name	-

(white)	Read & Write
(grey)	Read only

Alarm and error codes:
When detecting an alarm from external sources or the flashing bell in the display, the alarm description can be found as a text message in the Status menu under Active alarms.

Both alarms and errors will be shown here.
If more alarms/errors occur simultaneously, they will be shown as subsequent text lines.

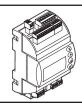
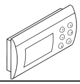
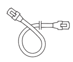
Alarms:

Upper level
Lower level
Standby mode
Valve B CAN ID conflict
Valve C CAN ID conflict
IO module CAN ID conflict
IO module communication
Communication to master lost
Min/max OD conflict
Common alarm HW conflict
Control method conflict
Multiple valve setup conflict
Valve C alarm
Valve B alarm
Oscillation in level signal
Valve position
Multiple valve capacity
Valve C communication
Valve B communication

Errors:

Internal error
Level signal out of range
Valve position signal out of range
Sensor supply overload
AKS 4100 error
Too much current AI3
Too much current AI4
DO4 overload

Ordering

Type		Description	Code No.
EKE 347		Liquid level controller	**080G5000**
MMIGRS2		Remote display, Panel, S	**080G0294**
-		Wire for display unit, L = 1.5 m, 1 pcs.	**080G0075**
-		Wire for display unit, L = 3 m, 1 pcs.	**080G0076**
-		EKE / EKC accessory for panel mounting	**027F0309**

Data

Supply voltage	24 V a.c. +/-20% 50/60 Hz or 24 V d.c. +/-20% (the supply voltage is galvanically separated from the input and output signals. Input/output are not individual galvanic isolated)	
Power consumption	Controller 20 W coil for AKV or AKVA	15 VA / 10W 55 VA
Input signal * Ri = 0(4)-20mA: 33 ohm 0(2)-10 V: 100 kohm	Level signal *	4-20 mA or 0-10 V
	ICM valve feedback signal *	From ICAD 0/4-20 mA
	Contact function start/stop of regulation	
Relay output	3 pcs. SPDT (Lower level alarm, Upper level alarm, Common alarm / NC Solenoid)	Normally Open: 3 A GP*, 2.2 FLA / 13.2 LRA, 1/6 hp, PD 220 VA, 250 V a.c. 100 k 3 FLA / 18 LRA, 1/10 hp, PD 150 VA, 125 V a.c. 100 k Normally Closed: 3 A GP*, 250 V a.c. 100 k (*GP = General purpose). Max 240 V a.c. or 24 V a.c./d.c. can be used, but same voltage type must be used on DO3 and DO2
Current output	0-20 mA or 4-20 mA Max. load: 500 ohm	
Valve connection	ICM - via current output AKV/A- via 24 a.c. Pulse-Width Modulating output	
Data communication	MODBUS RTU: Communication to system controller, MODBUS on RS485: galvanic isolation (500 V d.c.) CAN: Communication to other EKE controllers	
Supported Modbus Commands	Supported commands with max of 50 ms response time	03 (0x03) Read Holding Registers 04 (0x04) Read Input Registers 06 (0x06) Write Single Register
	Supported commands without defined max response time	08 (0x08) Diagnostics 16 (0x10) Write Multiple Registers (up to 20 registers) 43 (0x2b) Read Device Identification
Environments	–20 - 55°C, during operation –30 - 80°C, during storage	
	90% Rh, not condensed	
	No shock influence / vibrations	
Enclosure	IP 20 /IP 40 for the front mounted into a panel	
Weight	193 g	
Mounting	DIN rail	
Display	Graphical LCD display	
Terminals	plugs 1.5 or 2.5 mm^2 multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN61000-6-3 and EN 61000-6-2 UL file E31024	

Connection

Necessary connections

Terminals:

28-29 Supply voltage 24 V a.c. or d.c.

1-7 Signal from level transmitter type AKS 4100/4100U **or**

7-10 Signal from level transmitter type AKS 41

36-37 Expansion valve type AKV or AKVA **or**

23-24 Expansion valve type: ICM with ICAD

13-14 Switch function for start/stop of controller. If a switch is not connected, terminals 13 and 14 must be short-circuited.

See the figures on the next pages.

Application dependent connections

Terminals:

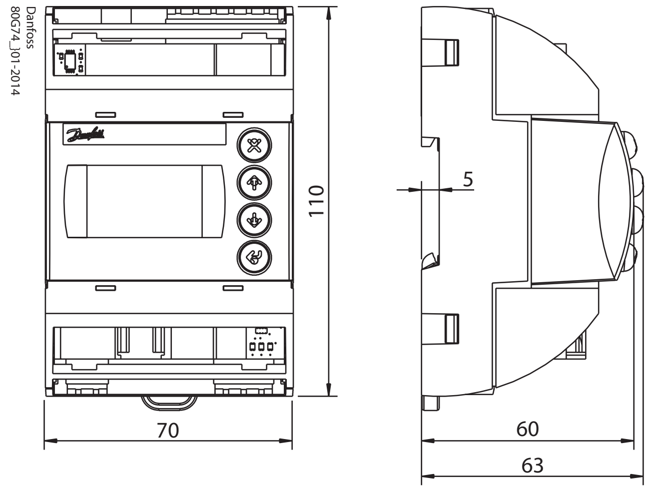
33-35 Relay for common alarm.
Installer can choose between Normally Open (33-34) or Normally Closed (34-35) circuits.
The relay will switch according to the programmed setting.

25-27 Relay for low level limit.
Installer can choose between Normally Open (26-27) or Normally Closed (25-26) circuits.
The relay will switch when the set value is passed.

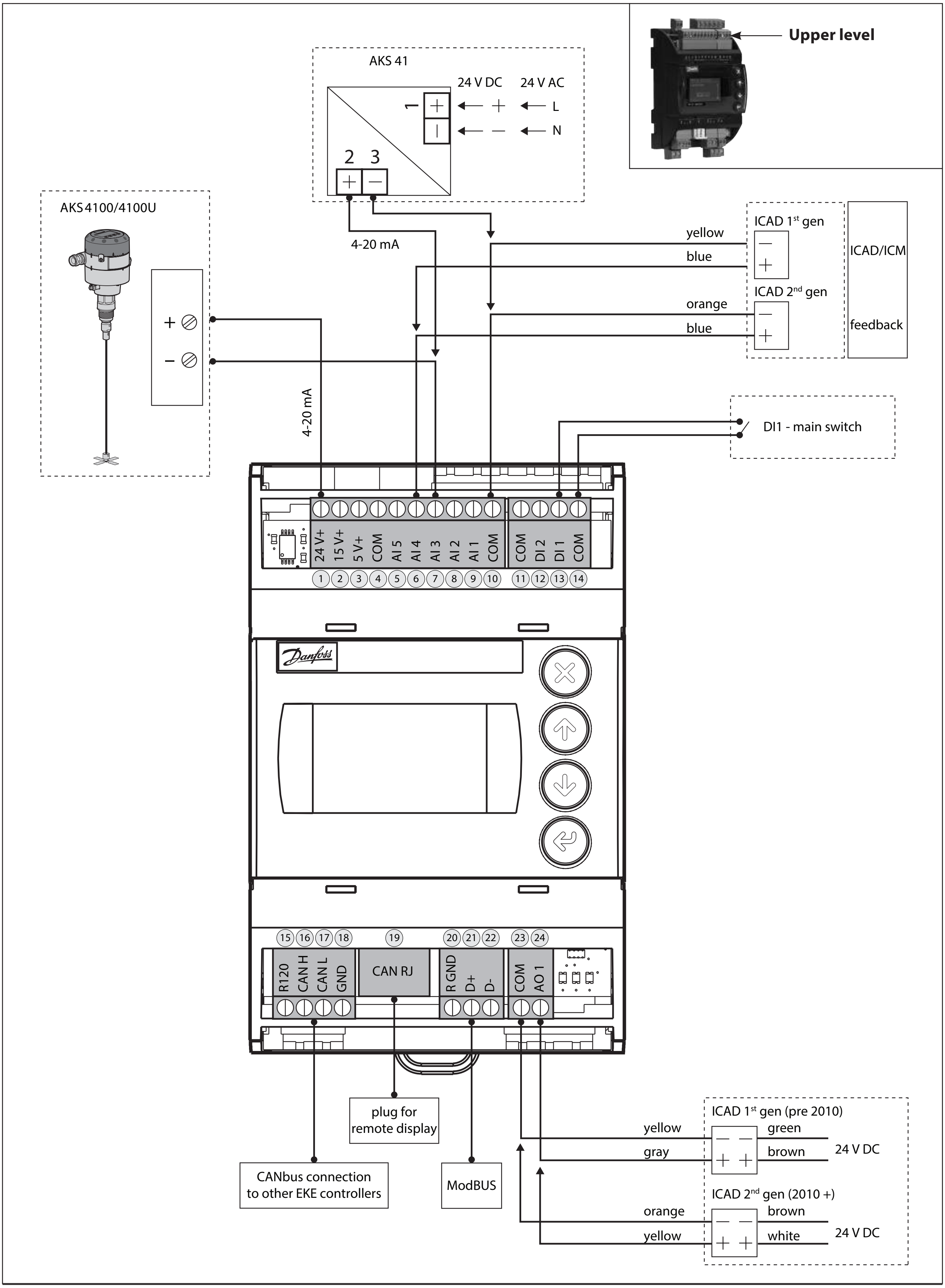
30-32 Relay for upper level limit.
Installer can choose between Normally Open (30-31) or Normally Closed (31-32) circuits.
The relay will switch when the set value is passed.

6-10 ICM valve feedback signal from ICAD 0/4-20 mA

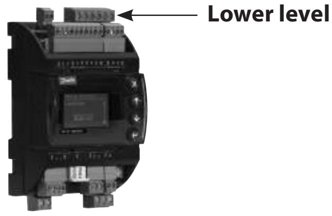
Dimensions

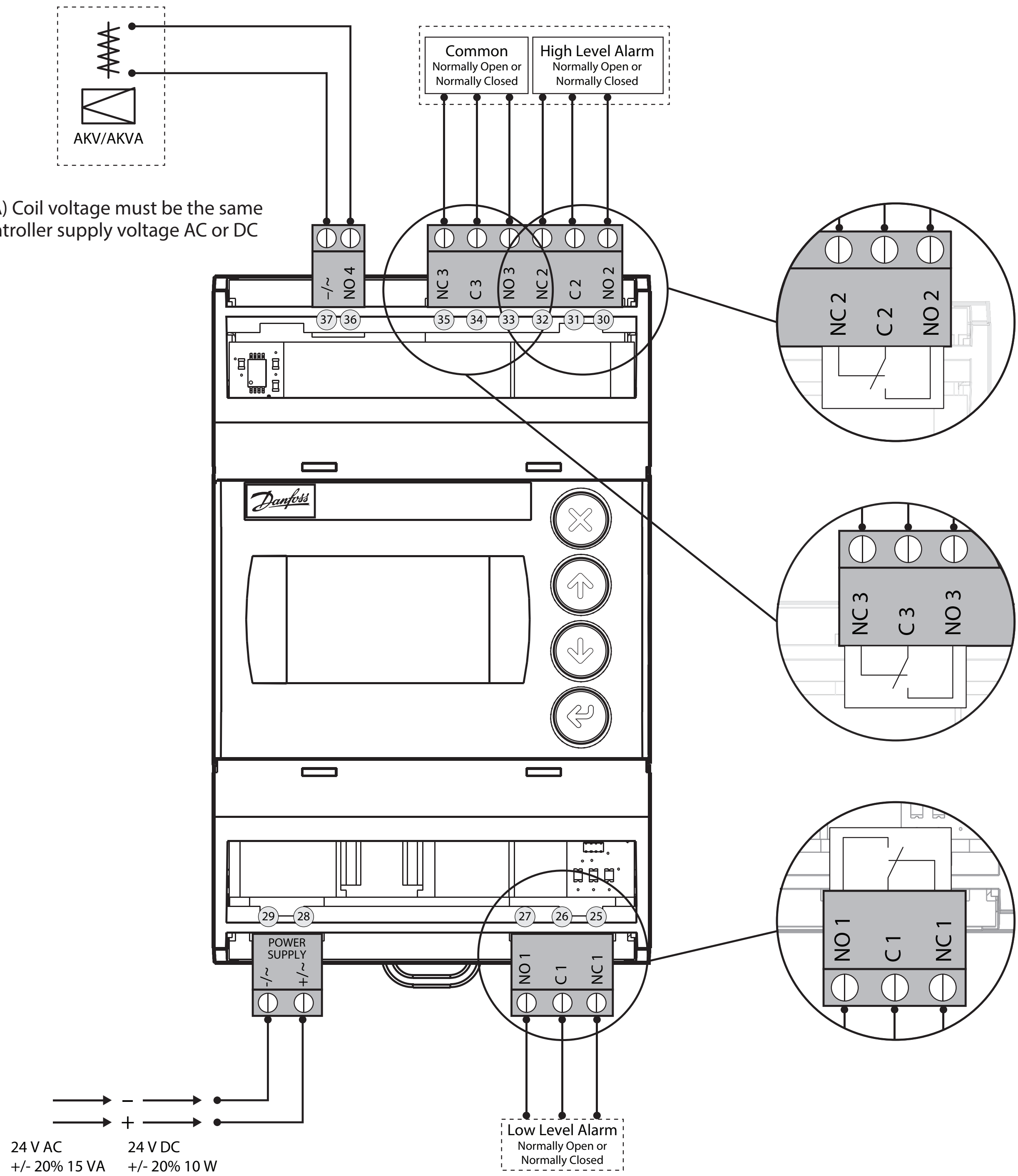


Connections - Upper level



Connections - Lower level

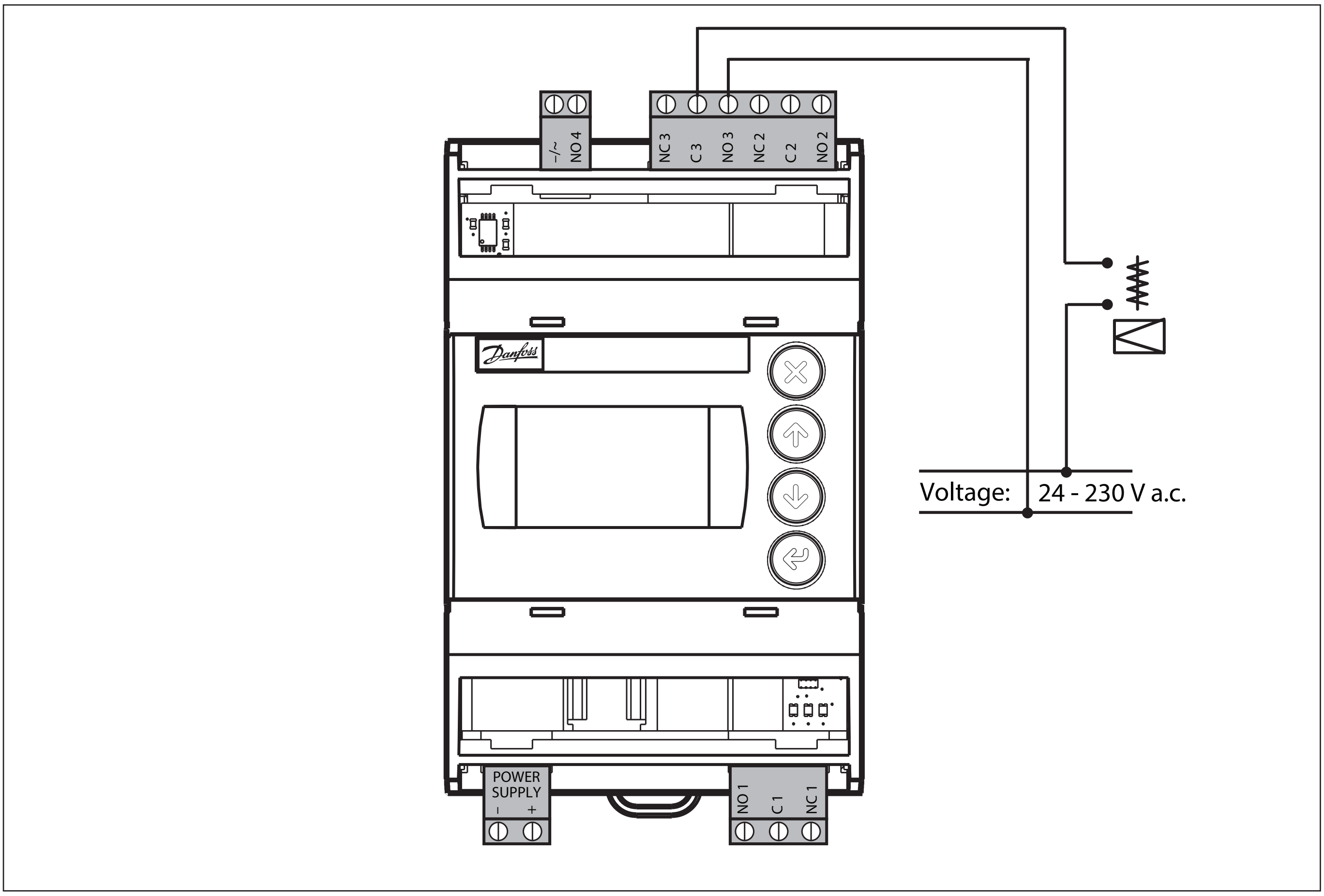




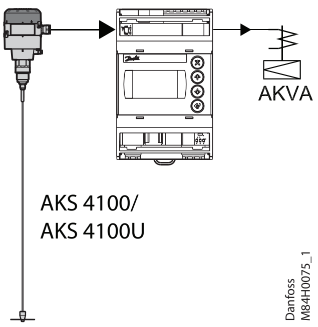
Note:
AKV(A) Coil voltage must be the same as controller supply voltage AC or DC

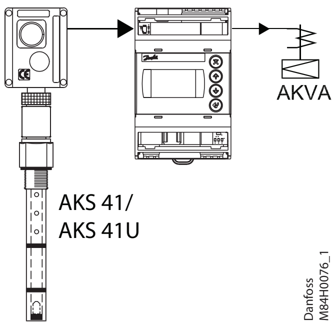
If AKV(A) is used, the power supply must cover the AKV(A) coil wattage additional

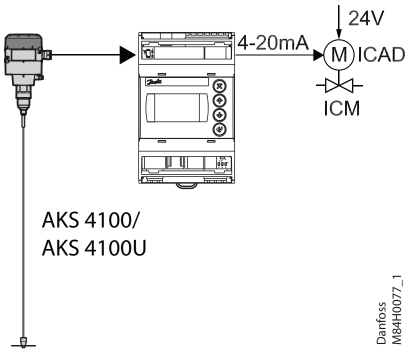
EKE 347 - ON/OFF Application.
Open/Close solenoid valve with coil 24 V - 230V

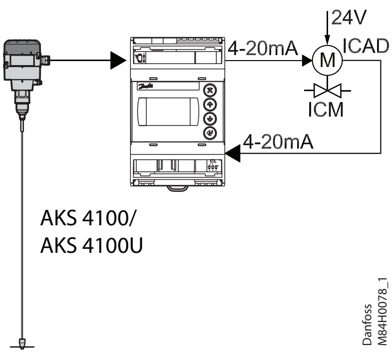


Connection examples

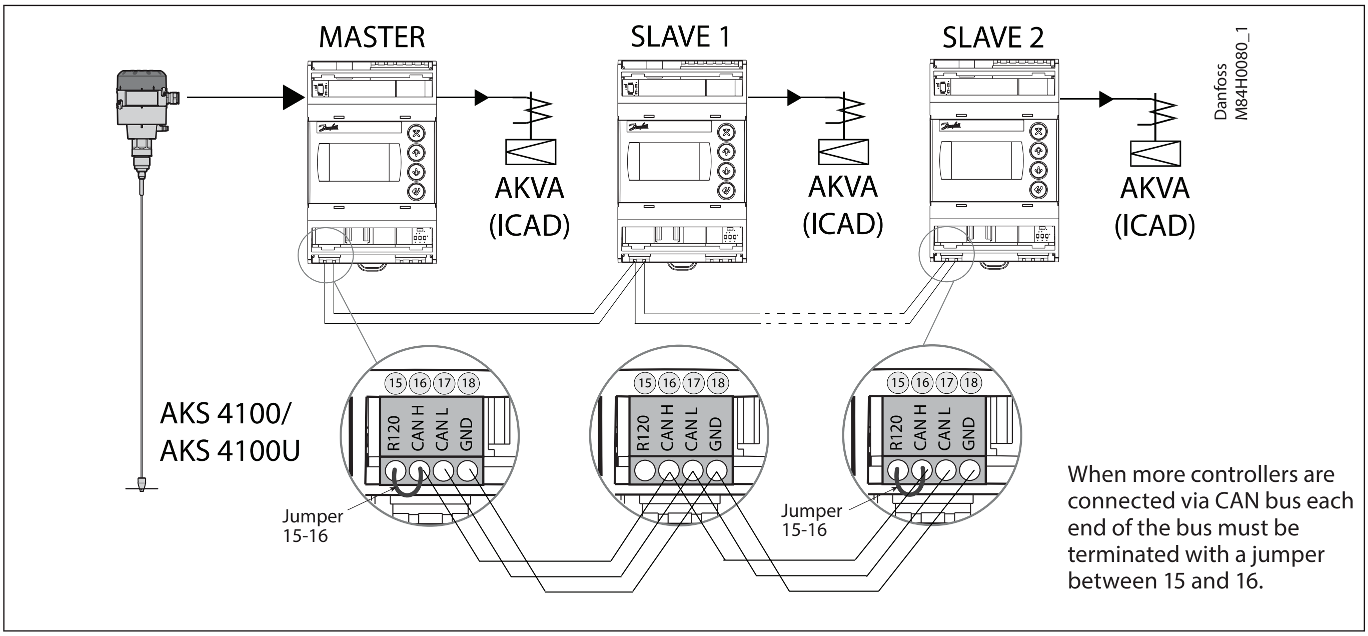








MASTER / SLAVE configuration



Multivalve

If the system capacity requires more than one control valve; up to three valves can be controlled simultaneously in a Master/Slave configuration, where the master and each slave controls one valve respectively.

The configuration is programmed in the master EKE 347 IO config menu - Multiple valve setup - with one of these options:

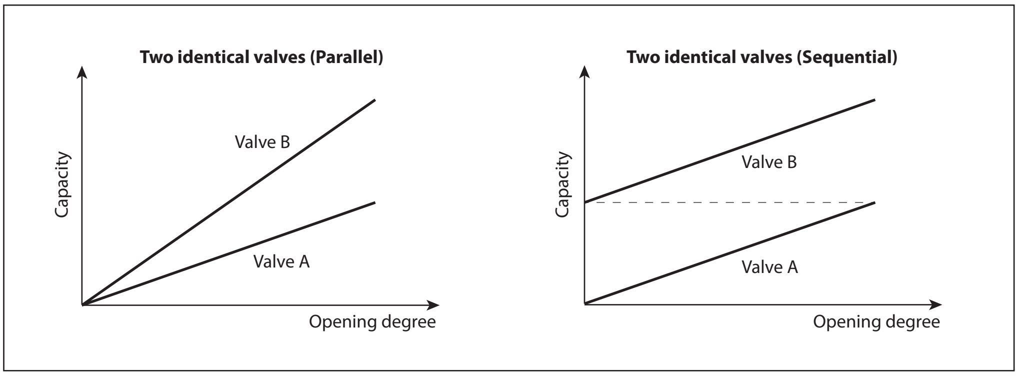
- 2 valves with same capacity
- 2 valves with different capacity
- 3 valves with same capacity
- 3 valves with different capacity

Additionally the master must be programmed in IO config menu - Multiple valve pattern - for either:

- **Valves in parallel**
  (valves regulate simultaneously)
  or
- **Valves sequential**
  (mainly one valve regulating at any time)

See principle below.

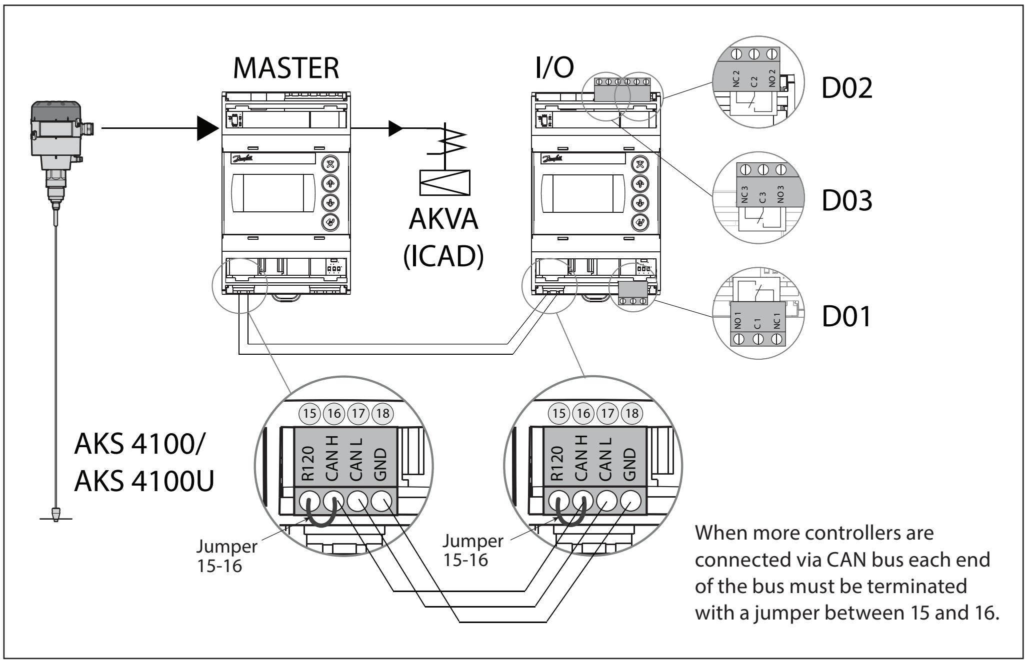
The slave EKE's only need identification of Slave and valve CAN ID (communication menu).



The default display of the master EKE will show the standard information together with a symbol of multiple valves and the actual total opening degree (see below).

The default display of the slave EKE will show the actual liquid level (as the master), symbol of multiple valves, actual total opening degree and the opening degree of the individual valves involved (see below).

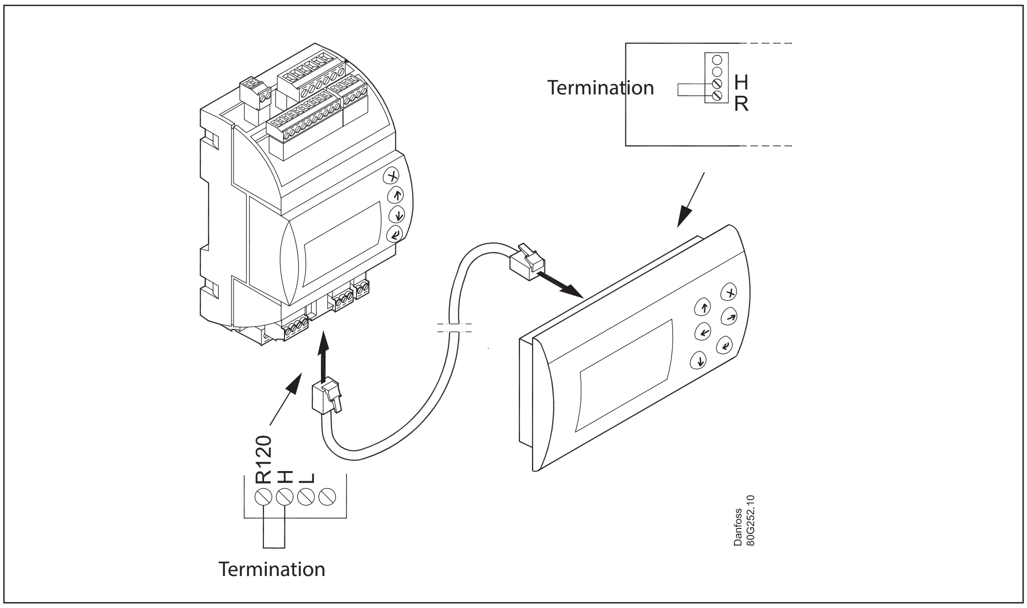
I/O configuration



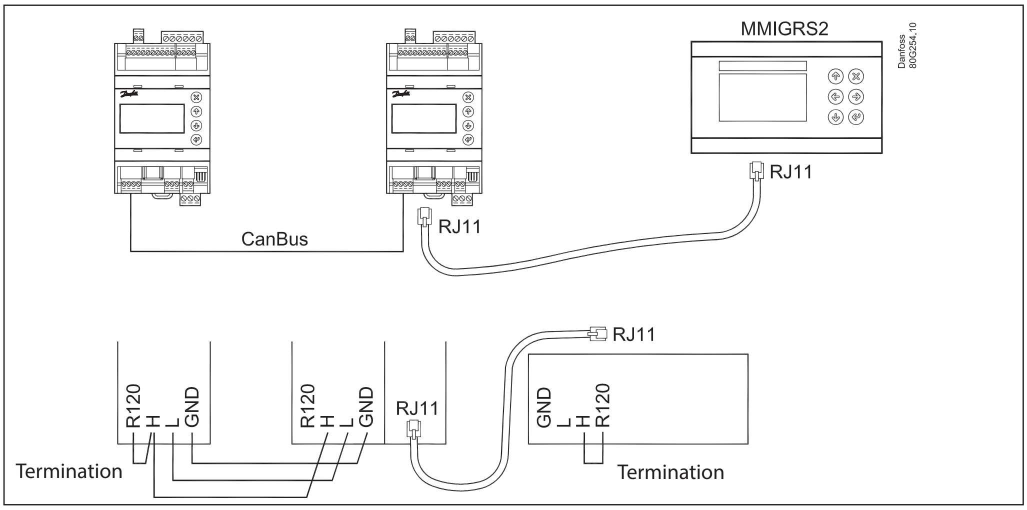
Remote display

The daily operation can be set up directly on the controller or via an external display device.

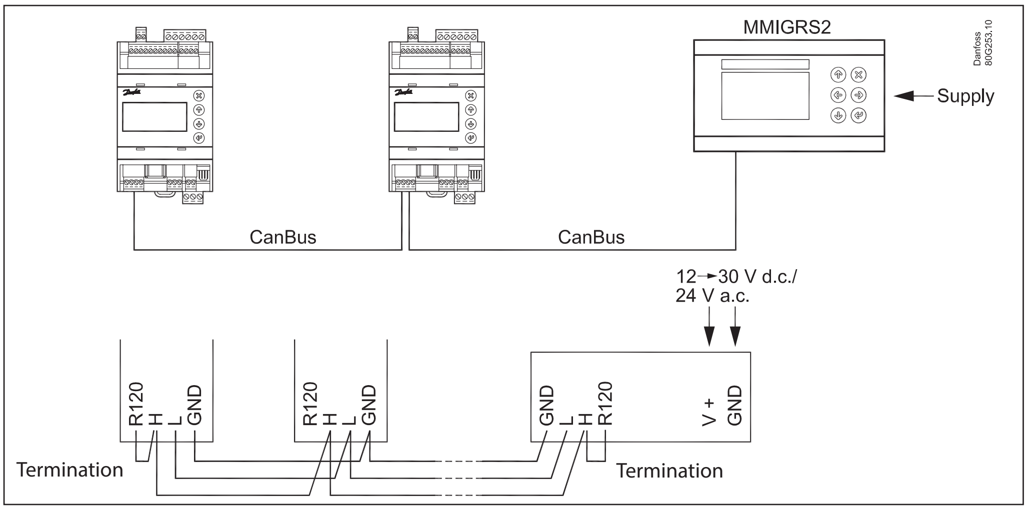
Example 1



Example 2



Example 3



ERR31

Alarm on the external display - MMIGRS2

If the communication to the display is not carried out correctly, it will send an "ERR31" error notification.
This may be caused by the displayed terminations not being installed, or that there have been interruptions in data communication during the time when the display retrieves the basic information from the controller.
Once the terminations have been inspected, you should then check the software version of the external display. This is done by holding down the Enter key and the X key for 5 seconds, until the Bios menu appears. Next, press the X key and read off the software version in the bottom right corner. The software version must be 1.13 or newer.

Once the display's software version has been checked, check the display's settings as follows:
1. Hold the Enter key and the X key down for 5 seconds, until the Bios menu appears.
2. Select the "MCX selection" menu
   - Select the "Clear UI" line and press Enter
   - Select the "Autodetect" line and press Enter
3. Press the X key to return to the Bios menu
4. Select the "COM selection" menu
   - Select the "CAN" line and press Enter
5. Press the X key to return to the Bios menu
6. Select the "Start up mode" menu
   - Select the "Remote application" line and press Enter
7. Press the X key to return to the Bios menu
8. Select the "CAN" menu
   - Select the "Baudrate" line and then select the "Autobaud" setting and press Enter
   - Select the "Node ID" line and set the value to 126 and press Enter
9. Press the X key to return to the Bios menu
10. Select the "Application" menu and press Enter.

The display will once again retrieve data from the controller. This process will take about 5 minutes.

Modbus parameters
Software version: 1.62.xx

Label	Parameter name	Min value	Max value	Default	Unit	Deci-mals	Modbus PNU	Locked by main switch	EEPROM	Enumeration
r12	Main switch	0	1	0		0	3001	NO	YES	0 = Off | 1 = On
R01	Liquid level setpoint	0	100	50	%	1	3002	NO	YES	
N07	Operation Mode	0	2	0		0	3003	YES	YES	0 = Master | 1 = Slave | 2 = IO
a02	Lower level limit	0	100	15	%	0	3004	NO	YES	
a01	Upper level limit	0	100	85	%	0	3005	NO	YES	
a07	Level alarm mode	0	1	0		0	3006	NO	YES	0 = Time | 1 = Hysteresis
a04	Lower delay	0	999	10	s	0	3007	NO	YES	
a03	Upper delay	0	999	50	s	0	3008	NO	YES	
a06	Lower level hysteresis	0	20	3	%	1	3009	NO	YES	
a05	Upper level hysteresis	0	20	5	%	1	3010	NO	YES	
a08	Function common alarm	0	3	0		0	3011	NO	YES	0 = Not follow | 1 = Follow up | 2 = Follow low | 3 = Follow all
a12	Oscillation detect band	0	100	100	%	0	3012	NO	YES	
a13	Oscillation detect timeout	2	30	20	min	0	3013	NO	YES	
a25	Force pump OFF in stopped mode	0	1	0		0	3117	NO	YES	0 = Off | 1 = On
a14	IO Lower level limit	0	100	5	%	0	3101	NO	YES	
a15	IO Upper level limit	0	100	95	%	0	3102	NO	YES	
a16	IO Lower level hysteresis	0	20	3	%	1	3103	NO	YES	
a17	IO Upper level hysteresis	0	20	3	%	1	3104	NO	YES	
a18	IO Lower delay	0	999	10	s	0	3105	NO	YES	
a19	IO Upper delay	0	999	50	s	0	3106	NO	YES	
a20	IO Level limit	0	100	50	%	0	3107	NO	YES	
a21	IO Level delay	0	999	10	s	0	3108	NO	YES	
a22	IO Level hysteresis	0	20	3		1	3109	NO	YES	
a23	IO Level action	0	1	0		0	3110	NO	YES	0 = Falling | 1 = Rising
N03	Control Method	0	2	2		0	3014	NO	YES	0 = On/off | 1 = P-ctrl | 2 = PI-ctrl
n35	Regulating principle	0	1	0		0	3015	NO	YES	0 = Low | 1 = High
n04	P-band	5	200	30	%	1	3016	NO	YES	
n05	Integration time Tn	60	600	400	s	0	3017	NO	YES	
n34	Neutral zone	0	25	2	%	1	3018	NO	YES	
N06	Difference	0,5	25	2	%	1	3019	NO	YES	
n13	Period time for AKV/AKVA	3	15	6	s	1	3020	NO	YES	
n33	Minimum OD	0		0	%	0	3021	NO	YES	
n32	Maximum OD	1	100	100	%	0	3022	NO	YES	
o11	Language	0	0	0		0	3023	YES	YES	0 = $ActiveLanguageList
o17	Output indication	0	1	0		0	3024	NO	YES	0 = Level | 1 = OD
K04	Login timeout	1	120	10	min	0	3025	NO	YES	
K06	Backlight timeout	0	120	2	min	0	3026	NO	YES	
o05	Password daily	0	999	100		0	3027	NO	YES	
K02	Password service	0	999	200		0	3028	NO	YES	
K03	Password commission	0	999	300		0	3029	NO	YES	
K05	Contrast	0	100	40	%	0	3030	NO	YES	
K01	Brightness	0	100	80	%	0	3031	NO	YES	
I09	System configuration	0	4	0		0	3032	YES	YES	0 = ICAD+NC | 1 = ICAD | 2 = AKV/A+NC | 3 = AKV/A | 4 = NC only
o31	Level signal setup	0	3	0		0	3033	YES	YES	0 = AKS4100 | 1 = AKS41 | 2 = Current | 3 = Voltage
o32	Voltage at low liquid level	0		0	V	1	3034	NO	YES	
o33	Voltage at high liquid level		10	10	V	1	3035	NO	YES	
I06	Current at low liquid level	0		4	mA	1	3036	NO	YES	
I07	Current at high liquid level		20	20	mA	1	3037	NO	YES	
o34	Valve position setup	0	2	0		0	3038	YES	YES	0 = Not used | 1 = Current | 2 = Voltage
I02	Voltage at closed valve position	0		0	V	1	3039	NO	YES	
I03	Voltage at open valve position		10	10	V	1	3040	NO	YES	
I04	Current at closed valve position	0		4	mA	1	3041	NO	YES	
I05	Current at open valve position		20	20	mA	1	3042	NO	YES	
I18	Common alarm setup	0	3	1		0	3043	YES	YES	0 = DO4 | 1 = High Alarm | 2 = DO3 | 3 = Disp only
I08	Multiple valve setup	0	4	0		0	3044	YES	YES	0 = Not used | 1 = 2 same cap | 2 = 2 dif cap | 3 = 3 same cap | 4 = 3 dif cap
I13	Multiple valve pattern	0	1	0		0	3045	NO	YES	0 = Parallel | 1 = Sequence
I10	Valve A capacity	0	100	50	%	0	3046	YES	YES	

I11	Valve B capacity	0	100	50	%	0	3047	YES	YES	
I12	Valve C capacity	0	100	33	%	0	3048	YES	YES	
I17	ICAD takeover OD	0	100	80	%	0	3052	NO	YES	
I19	IO module setup	0	1	0		0	3091	YES	YES	0 = Not used | 1 = Used
G01	CAN ID	1	127	1		0	4032	NO	NO	
G02	Can baudrate	0	5	4		0	4033	NO	NO	0 = 20k | 1 = 50k | 2 = 125k | 3 = 250k | 4 = 500k | 5 = 1M
G06	Modbus ID	0	120	1		0	3055	NO	YES	
G05	Modbus baudrate	0	8	6		0	3056	NO	YES	0 = 0 | 1 = 1200 | 2 = 2400 | 3 = 4800 | 4 = 9600 | 5 = 14400 | 6 = 19200 | 7 = 28800 | 8 = 38400
G08	Modbus mode	0	2	1		0	3057	NO	YES	0 = 8N1 | 1 = 8E1 | 2 = 8N2
G07	Modbus mapping	0	1	0		0	3058	NO	YES	0 = Operation | 1 = Setup
G09	Valve B CAN ID	1	127	2		0	3088	YES	YES	
G10	Valve C CAN ID	1	127	3		0	3089	YES	YES	
G11	IO Mod. CAN ID	1	127	4		0	3090	YES	YES	
B01	Controller state	0	6	0		0	4001	YES	NO	0 = Powerup | 1 = Stop | 2 = Auto | 3 = Manual | 4 = Slave | 5 = IO | 6 = Safe
u01	Actual level	0	100	0	%	1	4002	NO	NO	
u02	Actual reference	0	100	0	%	1	4003	YES	NO	
u24	Actual OD	0	100	0	%	1	4004	NO	NO	
u33	Actual valve position	0	100	0	%	1	4005	NO	NO	
u10	Digital input status	0	1	0		0	4006	NO	NO	0 = Off | 1 = On
u31	Actual level signal voltage	0	100	0	V	1	4007	NO	NO	
u30	Actual level signal current	0	24	0	mA	1	4008	NO	NO	
B02	Actual position signal voltage	0	100	0	V	1	4009	NO	NO	
u32	Actual position signal current	0	100	0	mA	1	4010	NO	NO	
B03	Actual OD A	0	100	0	%	1	4011	NO	NO	
B04	Actual OD B	0	100	0	%	1	4012	NO	NO	
B05	Actual OD C	0	100	0	%	1	4013	NO	NO	
o18	Manual Mode	0	1	0		0	4014	NO	NO	0 = Off | 1 = On
o45	Manual OD	0	100	50	%	1	3059	NO	NO	
B08	Manual low alarm	0	1	0		0	3060	NO	NO	0 = Off | 1 = On
B06	Manual high alarm	0	1	0		0	3061	NO	NO	0 = Off | 1 = On
B07	Manual common alarm	0	1	0		0	3062	NO	NO	0 = Off | 1 = On
B09	Apply defaults	0	1	0		0	3063	YES	NO	0 = None | 1 = Factory
B11	Oscillation amplitude	0	100	0	%	1	4028	YES	NO	
B10	Oscillation period	0	3600	0	s	0	4029	YES	NO	

Label	Alarm name	Modbus PNU	Bit number
A1	Upper level	1901	8
A2	Lower level	1901	9
A92	Oscillation in level signal	1901	10
A96	Valve position	1901	14
A97	Multiple valve capacity	1901	15
E1	Internal error	1901	0
E21	Level signal out of range	1901	1
E22	Valve position signal out of range	1901	2
E96	AKS 4100 error	1901	3
A45	Standby mode	1901	4
A99	Valve B communication	1901	5
A98	Valve C communication	1901	6
A85	Communication to master lost	1901	7
A91	Valve B alarm	1902	8
A90	Valve C alarm	1902	9
A88	Control method conflict	1902	10
A87	Common alarm HW conflict	1902	11
A86	Min/max OD conflict	1902	12
E95	Sensor supply overload	1902	13
E99	DO4 overload	1902	14
E97	Too much current AI3	1902	15
E98	Too much current AI4	1902	0
A89	Multiple valve setup conflict	1902	1
A80	Valve B CAN ID conflict	1902	2
A81	Valve C CAN ID conflict	1902	3
A82	IO module CAN ID conflict	1902	4
A83	IO module communication	1902	5

Manual

Liquid Level Controller EKC 347

The EKC 347 is a PI liquid level controller that can be used for regulation of refrigerant level in:

- Pump packages
- Economizers
- Separators
- Condensers
- Intermediate coolers
- Receivers

A signal transmitter constantly measures the refrigerant liquid level in the receiver. The controller receives the signal.

Its user-selected program controls the valve to regulate the refrigerant level to the user-specified setpoint.

Features

- Generates alarm when user-programmed limits are exceeded.
- 3 relay outputs for upper and lower level limits and for alarm level.
- Accepts analog input signal that can offset the liquid level setpoint.
- Controls liquid level on high or low pressure side of the system.
- When AKV/A is selected, a master-slave system can run up to 3 AKV/A valves with distributed opening degree.
- Manual control of output.
- Able to limit minimum and maximum valve opening degree.

Valve compatibility

The EKC 347 can control liquid level in systems with these valves:

- Type ICM motorized modulating valve with ICAD motor actuator.
- Types AKV or AKVA pulse width modulating expansion valve.
- Solenoid valve for on-off control.

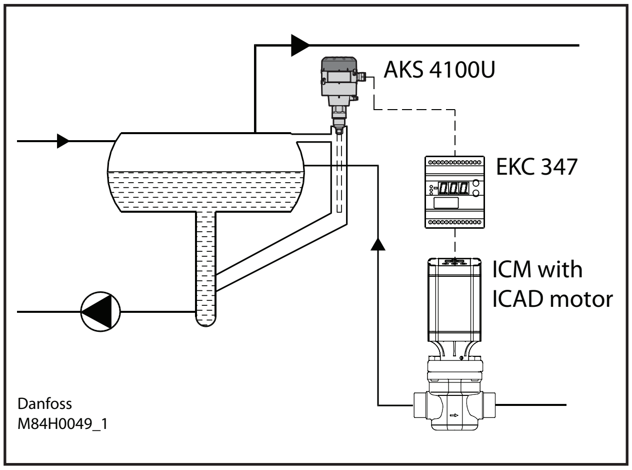
Ordering

Type	Function	Code No.
EKC 347	Liquid level controller	**084B7067**

Application examples

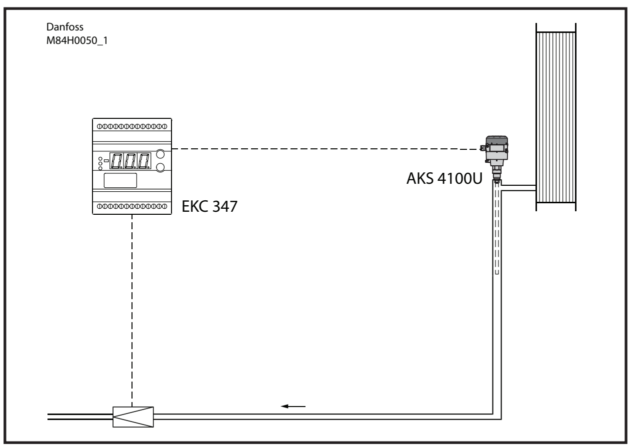
Pump package (liquid separator)

Modulating control of injection provides more stable liquid level and more stable suction pressure.



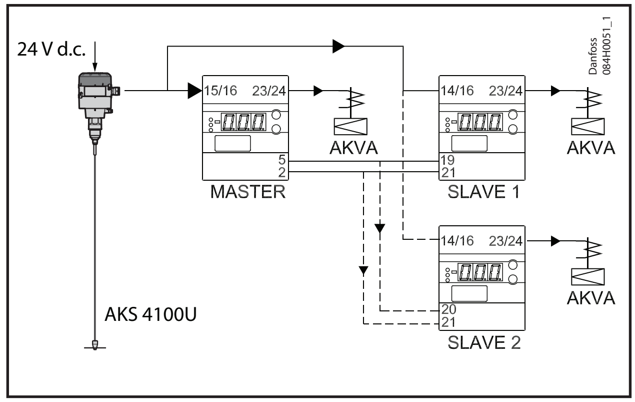
Receiver or condenser

The control system's short reaction time makes it well suited for high pressure float systems with small refrigerant charges.



Multiple AKV/A control in master-slave configuration

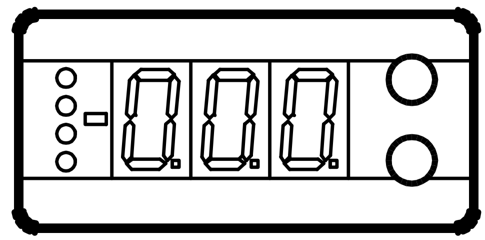
The schematic drawing below shows how multiple controllers can be used to control multiple AKV/A valves.



Operating the EKC 347

The Display

The EKC 347 has a three character digital display. Four status LEDs (Light Emitting Diodes) are to the left of the numerals. To the right of the display are two push buttons.



By default, the display normally shows the liquid level %, but user programming allows the valve's opening degree to be selected as the normal display. At any given time, depressing the lower pushbutton will change from the normal display to the other value (liquid level % or valve opening %), which will be displayed for 5 seconds.

The Front Panel LEDs

The upper LED indicates that a signal is being sent to open a pulse-width modulated valve type AKV/A or a solenoid valve that is being controlled for on-off applications. The upper LED will has no function when using the EKC 347 with a motorized valve type ICM/ ICAD.

The three lower LEDs are used to indicate an alarm or an error in regulation. The diagram to the right shows the meanings of the symbols. If, for example, alarm A3 is detected, or there is an error in regulation, all three LEDs will flash. In this situation, pushing the upper button for 1 second will cause "A3" or the error code to be displayed. If both an alarm and an error occur simultaneously, only the error code will be displayed.

When an alarm code is displayed by pushing the upper button, the alarm relay A3 will be cut out.

The error (prefix E), alarm (prefix A), and status (prefix S) codes that can be displayed are given in the table below, along with the meaning of each code.

Front panel LED's

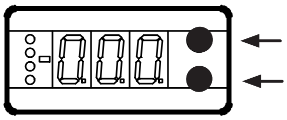
	Opening signal to valve
▲	Indication of upper level limit
▼	Indication of lower level limit
All	Indication of alarm level

Code	Description
E1	Errors in the controller
E12	Analog input value on terminals 19 & 21 or 20 & 21 is out of range
E21	No signal from the liquid level sensor, or the signal value is out of range*
E22	Valve position feedback on terminals 17 & 18 is out of range
A1	High level alarm A1 has been detected
A2	Low level alarm A2 has been detected
A3	Additional level alarm A3 has been detected
S10	Level regulation stopped by internal (parameter r12) or external (terminals 1 &2) start-stop
S12	High or low level alarm has been detected when not using alarm A3 as a common alarm

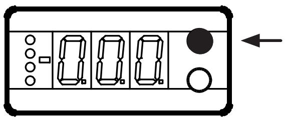
* If the signal is lost from the liquid level sensor, the controller will force the valve to the fully closed position if parameter n35 is 0 or, the controller will force the valve fully open if parameter n35 is 1. But if a maximum or minimum valve opening degree (parameters n32 and n33, respectively) has been set, then the valve will be forced to the set limits, not beyond.

Operating the EKC 347

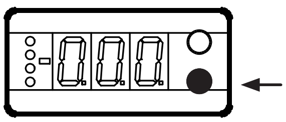
To view or change liquid level set point:



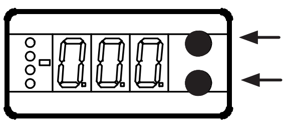
To enter change mode
Press both buttons simultaneously



To raise the setpoint
Press the upper button

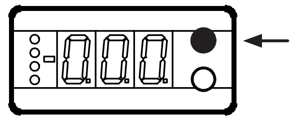


To lower the setpoint
Press the lower button

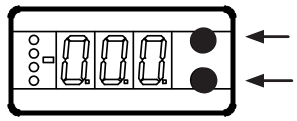


To save the change
Press both buttons simultaneously

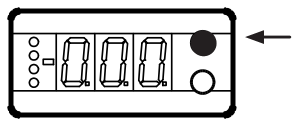
To change a parameter setting:



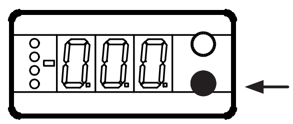
To access parameter menu
Press the upper button for 5 seconds, then
Use the upper and lower buttons to scroll through the parameter list



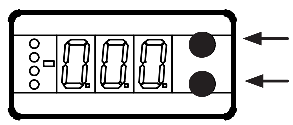
To enter change mode for a parameter you have scrolled to
Press the both buttons simultaneously



To increase the setting
Press the upper button



To decrease the setting
Press the lower button



To save the new setting and return to the parameter menu
Press both buttons simultaneously. You can then make other parameter changes or,
The EKC 347 will exit the parameter menu and return to its normal display when no buttons have been pressed for approximately 18-20 seconds.

To reset to factory default values:
1) Remove the supply voltage to the EKC 347
2) While pressing both buttons simultaneously, restore power. Factory settings will have been restored.

Quick setup guides

Quick setup guide when programming the EKC 347 for use with ICM Motorized valve with ICAD motor-actuator

The factory settings for the EKC 347 assume that it will be used on the low pressure side of the system to regulate an ICM motorized valve with ICAD motor-actuator, using a 4-20 mA signal, and a level probe type AKS 4100U. For most applications using these components, only the following settings will need to be changed:

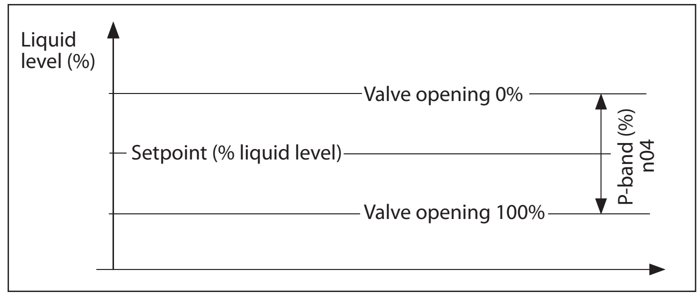
1) Set the user-defined liquid level percentage to be maintained. Note that this setting does not have a parameter and is accessed by pushing both EKC 347 buttons simultaneously when the controller is showing the standard display (not in programming mode).

2) Set user-defined parameter n04. This is the P-band in percent liquid level, the liquid level range around the liquid level setpoint in which the controller will try to regulate. See regulation example 1 at right for more details.

3) Change parameter o12 to 1 (for 60 Hz), the frequency of the controller power supply (unless the supply is 50 Hz).

4) Set user-defined alarm parameters. See the alarm section in "Alarm parameters."

Note that some applications will require that additional settings be changed. Review the settings and parameters on the following pages to ensure that the controller is completely set up for your application.



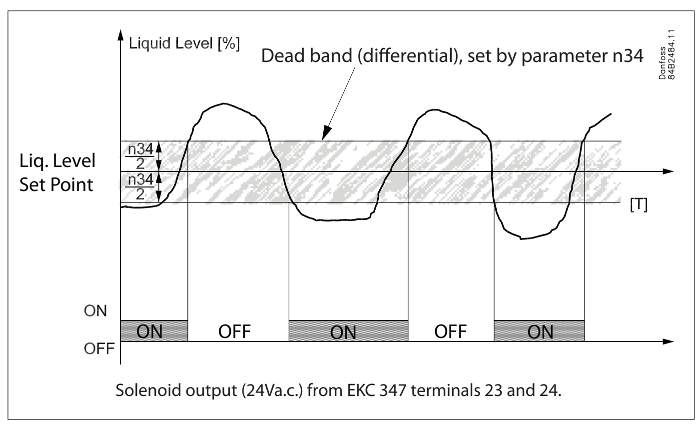
Regulation example 1. Valve opening percentage will modulate to maintain the setpoint liquid level percentage. The P-band defines the liquid level percentage range allowed.

Quick setup guide when using a solenoid on-off control on low pressure side of the system

For this application, the following settings must be programmed:

1. Parameter o09: 3 or 4, depending on the output on terminals 2 and 5
2. Enter the user-defined setpoint (the liquid level % to be maintained). Note that this setting does not have a parameter and is accessed by pushing both EKC 347 buttons simultaneously when the controller is showing the standard display (not in programming mode).
3. Set the user-defined differential (dead band), parameter n34, to the % liquid level around the setpoint that defines the dead band. The valve will be opened and closed as shown in the diagram at right.
4. Set the P-band (parameter n04) to 0%, which corresponds to OFF (parameter n04 = 0).
5. Change the frequency of the controller to 60 Hz (parameter o12 = 1).
6. Set user-defined alarm parameters according to your requirements and your application

Note that some applications will require that additional settings be changed. Review the settings and parameters on the following pages to ensure that the controller is completely set up for your application.



Regulation example 2. When the controller is set up for the low pressure side of a system, the solenoid valve will open and close as shown in the diagram above.

Level control settings

The parameter list in this technical leaflet is valid for software versions 1.1x .

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Liquid level setpoint This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously, then using the buttons individually to adjust the setpoint up and down. (see the section "Operating the EKC 347."	-	0 (%)	100 (%)	50 (%)	
Displacement of liquid level setpoint with an analog input to the EKC 347 from a PLC or other device With an analog input from a PLC or other device, the liquid level setpoint will be offset by this set percentage when the input is at its maximum. (See also parameter o10)	r06	-100 (%)	100 (%)	0%	
Start-Stop regulation This parameter allows you to stop the controller from regulating. When turned off, the controller will close the valve. This parameter works in series with the switch function on terminals 1 & 2 (see wiring section). Regulation is stopped if either there is no connection between terminals 1 & 2 or r12 is OFF.	r12	0 (OFF)	1 (ON)	1 (ON)	

Alarm parameters

High level alarm relay A1 This relay (terminals 9 and 10) will be cut in when the liquid level is higher than this parameter for the time set as parameter A03. This relay will always be cut out during power interruption.	A01	0 (%)	100 (%)	85 (%)	
Low level alarm relay A2 This relay (terminals 8 and 10) can be set to cut in or cut out when liquid level is lower than this parameter for the time set as parameter A15. Parameter A18 determines whether the relay is cut in or cut out. This relay will always be cut out during power interruption.	A02	0 (%)	100 (%)	15 (%)	
Time delay for high level alarm relay A1	A03	0 (sec)	999 (sec)	10 (sec)	
Time delay for low level alarm relay A2	A15	0 (sec)	999 (sec)	20 (sec)	
Additional alarm relay A3 This relay (terminals 12 and 13) can be used as an additional high (or low) level alarm that will cut in when the level is higher (or lower) than this parameter for the time set as parameter A17. Parameter A18 determines whether the alarm is for high or low level. By using parameter A19, this alarm can also be set to cut in with an A1 or A2 alarm (as a common alarm). This relay will always be cut in during power interruption, or if the controller loses the power signal from the level sensor.	A16	0 (%)	100 (%)	50(%)	
Time delay for additional alarm A3	A17	0 (sec)	999 (sec)	0 (sec)	
Defining the switching functions of alarms A2 and A3 Setting 0: A2 will cut in under alarm conditions A3 will be a high liquid level alarm Setting 1: A2 will cut in under alarm conditions A3 will be a low liquid level alarm Setting 2: A2 will cut out under alarm conditions A3 will be a high liquid level alarm Setting 3: A2 will cut out under alarm conditions A3 will be a low liquid level alarm	A18	0	3	0	
Additional alarm A3 used as a common alarm Setting 0: Alarm relay A3 is also a common alarm that will be cut in if an A1, A2, or A3 alarm occurs. Setting 1: Alarm relay A3 is cut in only when an A3 alarm occurs.	A19	0	1	0	

Regulating parameters

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
P-band (regulating range around setpoint) The P-band (proportional band) is a regulating range set around the liquid level setpoint. The factory setting of 30% will give a regulating range that is 15% above and 15% below the actual liquid level setpoint (see regulation example 2). For ON-OFF control with a solenoid valve, this parameter must be set to 0% (OFF)	n04	0 (OFF)	200 (%)	30 (%)	
Integration time T_n Decreasing integration time will result in faster regulation (faster response to changes in sensor value). Thus a lower integration time will result in more fluctuation in valve opening percentage.	n05	60 (sec)	600 (sec) (OFF)	400 (sec)	
Period time for AKV and AKVA pulse valves *In most cases, this parameter should not need to be changed.* This parameter determines the length of the control period. The valve is opened for a certain percentage of each successive period. For example, when full valve capacity is called for, the valve will be opened for the entire period. When 60% valve capacity is required, the valve will be opened for 60% of the period. The control algorithm computes the capacity required for each period.	n13	3 (sec)	10 (sec)	6 (sec)	
Maximum opening degree	n32	0 (%)	100 (%)	100(%)	
Minimum opening degree	n33	0 (%)	100 (%)	0 (%)	
Dead band or differential setting for ON-OFF control with solenoid valve Establishing a dead band prevents excessive control action when liquid level percentage is close to the setpoint and oscillating above and below the setpoint. Dead band is only active when using a motorized ICM valve with motor-actuator ICAD. Excessive valve movement is eliminated by preventing changes in valve open percentage until the change needed is greater than the dead band limit. Differential setting for ON-OFF control is only active when parameter n04=0. It is a differential set around the liquid level set point. See regulating examples 1 and 2 on page 6.	n34	2 (%)	25 (%)	2 (%)	
Definition of regulating principle Setting 0 (LOW): Regulation is on the low pressure side of the system. The valve will close on a rising liquid level. Setting 1 (HIGH): Regulation is on the high pressure side of the system. The valve will open on a rising liquid level.	n35	0 (LOW)	1 (HIGH)	0 (LOW)	

Miscellaneous parameters

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Define valve and AO (analog output) signal The controller can control 3 types of valves: motorized valve type ICM with ICAD motor-actuator; pulse-width modulation valve type AKV/A; or a solenoid valve for on-off control. 1. ICM/ICAD, AO is 4-20 mA for communications with valve 2. ICM/ICAD, AO is 0-20 mA for communications with valve 3. AKV/A or solenoid, AO is 4-20 mA for remote monitoring 4. AKV/A or solenoid, AO is 0-20 mA for remote monitoring The following settings are used only when multiple controllers are combined in master-slave strategy to control two or three AKV/A valves in parallel. Settings 5-11 will restrict AO to its minimum value (either 0 or 4 mA) whenever the DI is off (either r12 = OFF, or terminals 1 and 2 are not shorted). Settings 12-17 do not restrict the AO value. 5. AKV/A, controller is MASTER 6. AKV/A, SLAVE 1 of 1, AO is 4-20 mA for remote monitoring 7. AKV/A, SLAVE 1 of 1, AO is 0-20 mA for remote monitoring 8. AKV/A, SLAVE 1 of 2, AO is 4-20 mA for remote monitoring 9. AKV/A, SLAVE 1 of 2, AO is 0-20 mA for remote monitoring 10. AKV/A, SLAVE 2 of 2, AO is 4-20 mA for remote monitoring 11. AKV/A, SLAVE 2 of 2, AO is 0-20 mA for remote monitoring 12. AKV/A, SLAVE 1 of 1, AO is 4-20 mA continuous 13. AKV/A, SLAVE 1 of 1, AO is 0-20 mA continuous 14. AKV/A, SLAVE 1 of 2, AO is 4-20 mA continuous 15. AKV/A, SLAVE 1 of 2, AO is 0-20 mA continuous 16. AKV/A, SLAVE 2 of 2, AO is 4-20 mA continuous 17. AKV/A, SLAVE 2 of 2, AO is 0-20 mA continuous NOTE: the AO for remote monitoring (when ICM/ICAD is not used) corresponds to what is selected in parameter o17 to be shown in the normal display.	o09	1	17	1	
Input signal for offsetting the liquid level setpoint Defines the analog input connected to terminals 19 & 21 or 20 & 21 that will be used to offset the liquid level setpoint. 0: No signal (not used) 1: 4-20 mA 2: 0-20 mA 3: 2-10 V 4: 0-10 V NOTE: At minimum AI there will be no offset. At maximum AI, the offset will be as set in parameter r06.	o10	0	4	0	
Frequency Must be set to the frequency of the 24 Vac power source.	o12	0 (50 Hz)	1 (60 Hz)	0 (50 Hz)	
Selection of normal display contents and AO This parameter determines whether the normal display will show liquid level or the valve's opening degree. Regardless of which selection is made for the normal display, the other can be displayed for five seconds by pressing the lower pushbutton. When the controller is not being used with ICM/ICAD or AKV/A as MASTER (parameter o09 = 1, 2, or 5), then the AO (analog output) on terminals 1 & 2 will correspond to what is shown in the normal display. 0: Liquid level is shown in the normal display. 1: Valve opening degree is shown in the normal display NOTE: If the ICM/ICAD feedback signal is being used (parameter o34 = 1), then the opening degree will be based on the feedback signal and not on the opening degree the controller is sending.	o17	0	1	0	

Miscellaneous parameters (cont'd)

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Manual control of outputs The individual relay outputs can be manually switched when regulation has been stopped. 0: (OFF) Normal operation (no override) 1: Relay for upper level (terminals 9 & 10) manally set ON. 2: Relay for lower level (terminals 8 & 10) manually set ON. 3: AKV/A or Solenoid output (terminals 23 & 24) manually set ON. 4: Additional alarm relay (terminals 12 & 13) manually set ON.	o18	0 (OFF)	4	0	
Input signal from liquid level sensor Defines the liquid level input signal on terminals 14 & 16 or 15 & 16. 0: No signal 1: Current signal, 4-20 mA (signal from AKS 4100U level probe) 2: Voltage signal. Voltage range must be set in parameters o32 and o33. NOTE: If using an AKV/A valve in a master-slave system, and the signal to the master is 4-20 mA, then this parameter must also be set to 1 in each slave controller even if the signal is connected to the voltage input.	o31	0	2	1	
Voltage signal minimum value (only used if parameter o31 = 2)	o32	0.0 (V)	4.9 (V)	4.0 (V)	
Voltage signal maximum value (only used if parameter o31 = 2)	o33	5.0 (V)	10.0 (V)	6.0 (V)	
Valve position feedback When feedback is used, the displayed opening degree will be based on the ICM/ICAD position feedback signal (terminals 17 & 18). 0: Feedback not used 1: 4-20 mA feedback from ICM/ICAD is connected 2: This setting is obsolete and should no longer be used. It was used with the older (obsolete) position indicator type AKS 45.	o34	0	2	0	

The following parameters will only appear in the parameter list when a special data communication module has been installed in the controller and the connections to the module have been made.

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Controller's address: setting of 01 to 60 When the controller is in a network with data communications, the controller must have an address set, and this same address must be set in the master gateway of the data communications	o03	0	60	0	
Service pin message The address will be sent to the gateway when the setting is set to ON. The setting will automatically change back to OFF after a few seconds.	o04	0 (OFF)	1 (ON)	0 (OFF)	
Language The set language is the language that will be output to the AKM program. When the language is changed, parameter o04 must be set to 1 (ON) before the language setting will take effect. 0: English 1: German 2: French 3: Danish 4: Spanish 5: Italian 6: Swedish	o11	0	6	0	

Service Parameters for troubleshooting

Description of parameter to view	Parameter	Units
Liquid level (actual)	u01	%
Liquid level setpoint, including analog input offset (parameter r06)	u02	%
Analog input signal current (terminals 19 & 21). Used for offsetting the liquid level setpoint.	u06	mA
Analog input signal voltage (terminals 20 & 21). Used for offsetting the liquid level setpoint.	u07	V
Analog output signal current terminals (2 & 5)	u08	mA
Digital input status. Combination of parameter r12 and terminals 1 &2.	u10	ON-OFF
Valve opening degree	u24	%
Level sensor signal current (terminals 15 & 16)	u30	mA
Level sensor signal voltage (terminals 14 & 16)	u31	v
Valve position current feedback signal from ICM/ICAD (4-20 mA)	u32	mA
Valve position feedback signal from ICM/ICAD converted to %	u33	%

Technical Data

The supply voltage is galvanically isolated from the input and output signals, but the input and output signals are not galvanically isolated from each other.

Supply voltage:
24 V ac ± 15%, 50-60 Hz
60 VA maximum (5 VA for controller and additional 55 VA when the controllers powers the coil for a solenoid or for an AKV/A pulse valve).

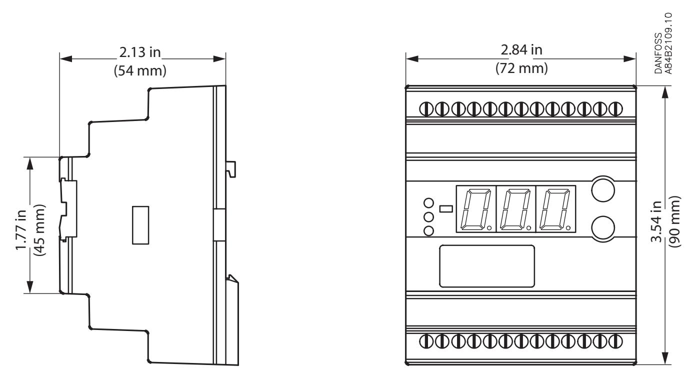
Input signals:
Liquid level sensor, 4-20 mA or 0-10 V
ICM/ICAD valve position feedback, 4-20 mA only
Digital input on terminals 1 & 2 for start-stop of regulation
Signal for offsetting the liquid level setpoint:
4-20 mA, 0-20 mA, 2-10 V, or 0-10 V

3 Relay Outputs:
SPST
AC-1: 4A (ohmic)
AC-15: 3A (Inductive)

Current Output (terminals 2 & 5):
0-20 mA or 4-20 mA, 500 Ω maximum load

Ambient temperature:
During operation: +14 to +131°F (-10 to 55°C)
During transport or storage: -40 to 158°F (-40 to 70°C)

Approvals:
EU Low Voltage Directive and EMC demands re CE-marking are complied with.
LVD-tested according to EN 60730-1 and EN 60730-2-9
EMC tested according to EN 50081-1 and EN 50082-2

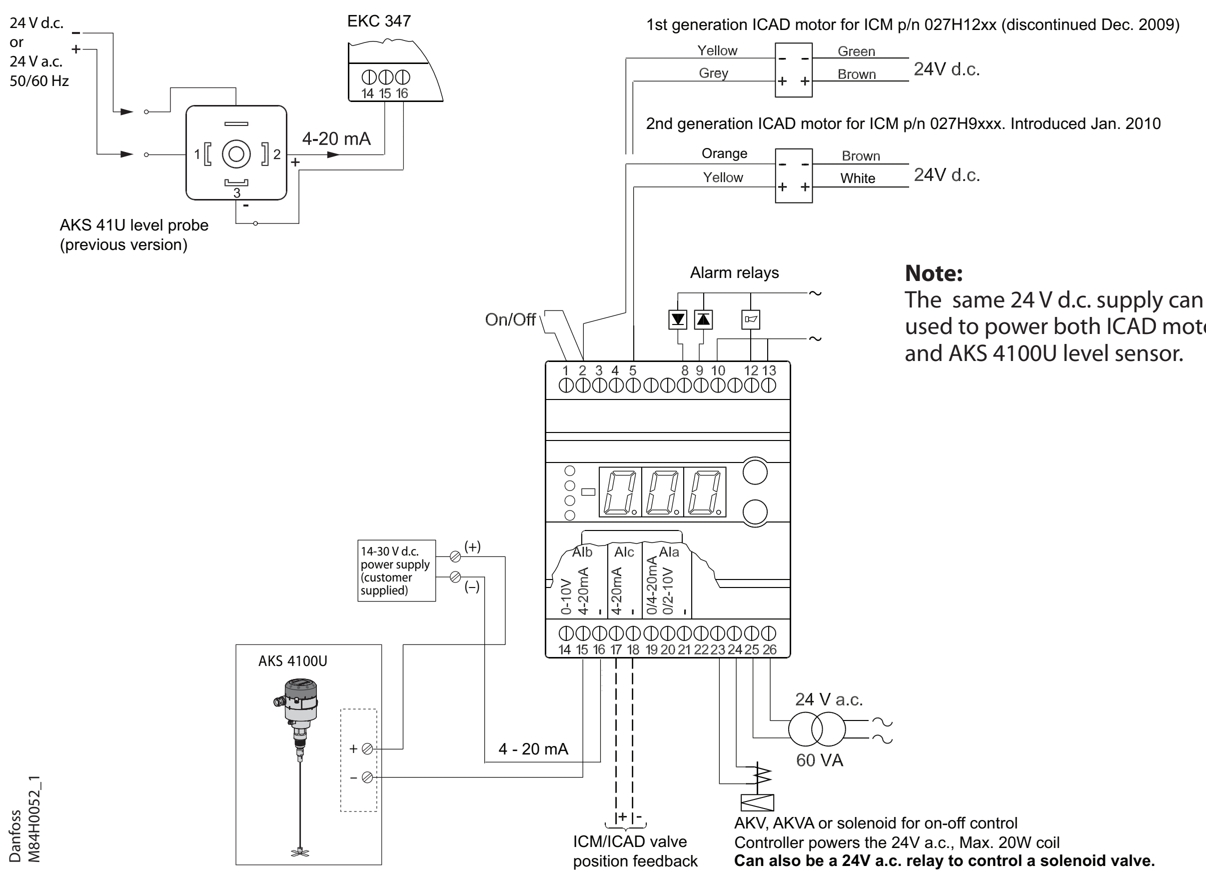


Mounting: DIN rail
Enclosure: IP 20
Weight: 0.66 lbs (300 g)
Display: LED, 3 digits
Terminals: Maximum 2.5 mm^2 multicore

Technical data (cont'd) : terminal functions

Terminal pairs	Description
1-2	Switch function for start-stop of regulation. When there is no connections between terminals 1 & 2, the controller will send a signal to close the valve. If not using a switch, terminals must be shorted with a jumper wire.
2-5	Current output that is used to control motorized valve type ICM with ICAD motor actuator. These terminals can also be used for remote monitoring when ICM/ICAD is not used (see parameter o09).
8-10	Low level relay A2. The relay can be set to cut in or cut out when the level is lower than the set limit (parameters A02). This relay will be cut out during any power interruption
9-10	High level relay A1. The relay will be cut in when the liquid level is higher than the set limit (see parameter A01). The relay will cut out during any power interruption.
12-13	Additional relay A3. The relay can be set to cut in on a rising liquid level or to cut in on a falling liquid level, or it can be set to cut in with any A1 or A2 alarm as a common alarm (see parameters A16, A18, and A19). This relay will be cut in during any power interruption, or if the controller loses the power input signal from the level sensor.

Terminal pairs	Description
14-16	Voltage input from level sensor (0 - 10 V d.c.)
15-16	Current input from level sensor (4 - 20 mA)
17-18	Optional current input from 4-20 mA ICM/ICAD valve position feedback.
19-21	Optional current input from PLC etc., for offsetting liquid level setpoint.
20-21	Optional voltage input from PLC etc., for offsetting liquid level setpoint.
23-24	Maximum 20W. 24 Vac output for control of solenoid valve for on-off control, or for control of pulse width modulated valve type AKV/A. Can also be for a 24 Vac relay to control a solenoid valve(not AKVA).
25-26	Supply voltage 24 Vac 60 VA maximum load when using 24 Vac output(terminals 23 & 24).
3-4	Optional data communication connection. Only valid when using an special data communication module.



Note:
The same 24 V d.c. supply can be used to power both ICAD motor and AKS 4100U level sensor.

ENGINEERING
TOMORROW

Compressor Discharge Valve
Type KDC (GVD)

KDC – Compressor Discharge Valve

Functions:

- Controls the discharge pressure of a compressor during start-up period to provide oil pressure for lubricating
- Works as a check valve in the discharge line of the compressor. It closes when the compressor is shut down and pressure has equalized through the compressor. The valve stays fully open during normal operation after the start-up sequence .

Note: Does not function as a shut-off valve

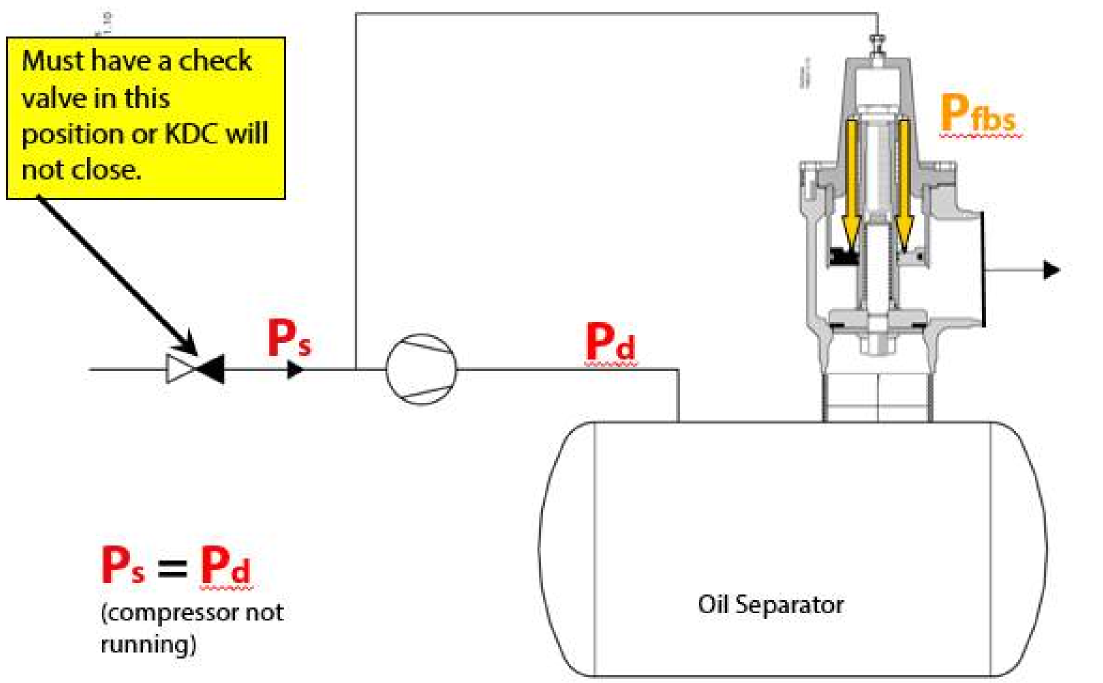
Advantages:

- Fast build-up of oil pressure in oil separator during start-up
- High closing force on the valve seat during standstill, even without differential pressure across the valve
- Very low pressure drop because differential pressure keeps valve completely open during normal operation.
- Low part-load without risk of valve chattering

KDC – Technical Features

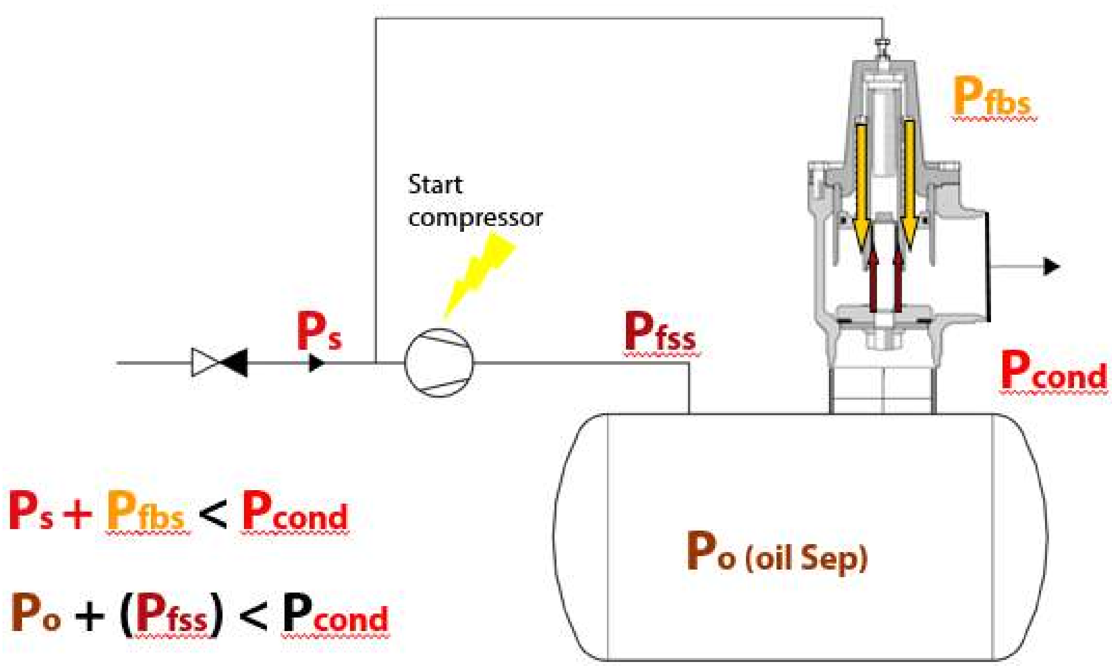
- Available in Angle configuration only
- Sizes: 2 ½″ to 8″
- Opening differential pressures:
  - 7.5 psi (0.5 bar) for booster compressor
  - 29 psi (2.0 bar) for high side compressor
  - 43.5 psi (3.0 bar) up to 5″ for high side compressor

KDC Function – Valve is Closed



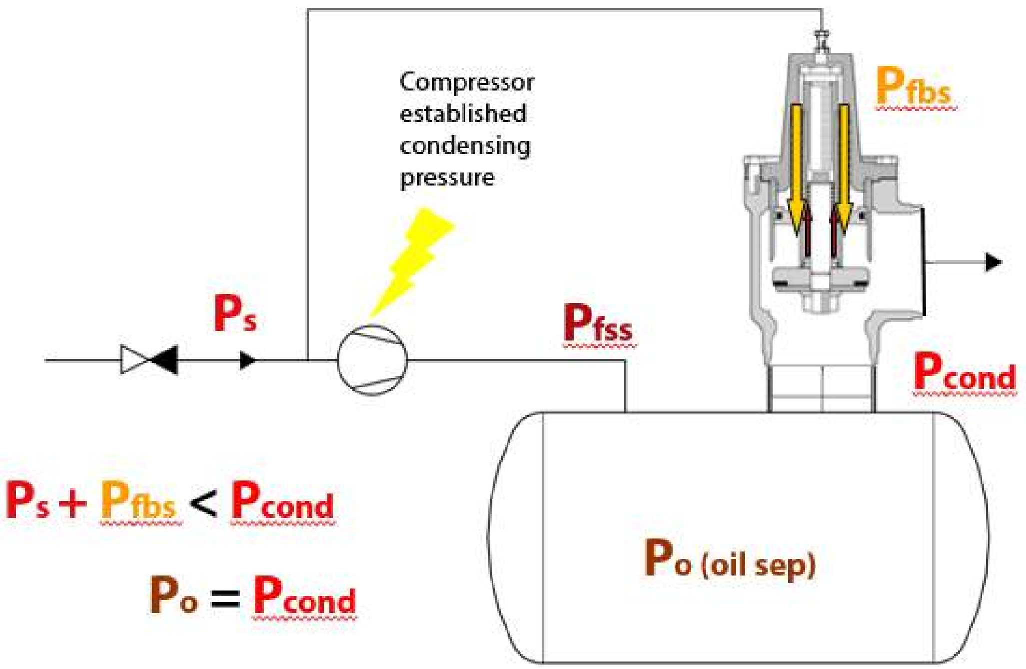
(compressor not running, no pressure difference between suction and discharge lines).

KDC Function – Valve Opens



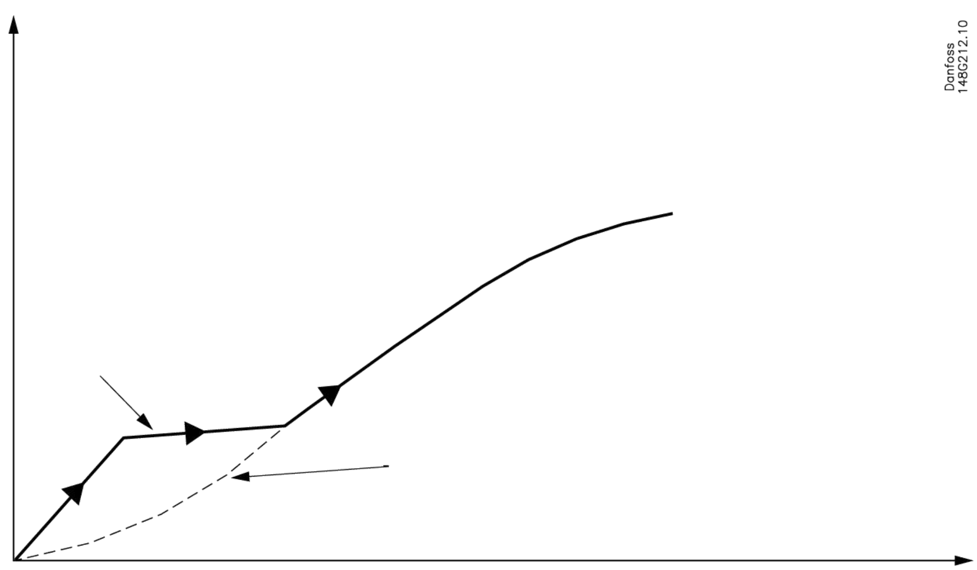
Condensing pressure > oil separator pressure; Differential pressure > spring force.

KDC Function – Valve Fully Open



Condensing pressure = oil separator pressure Differential pressure > spring force

KDC Function

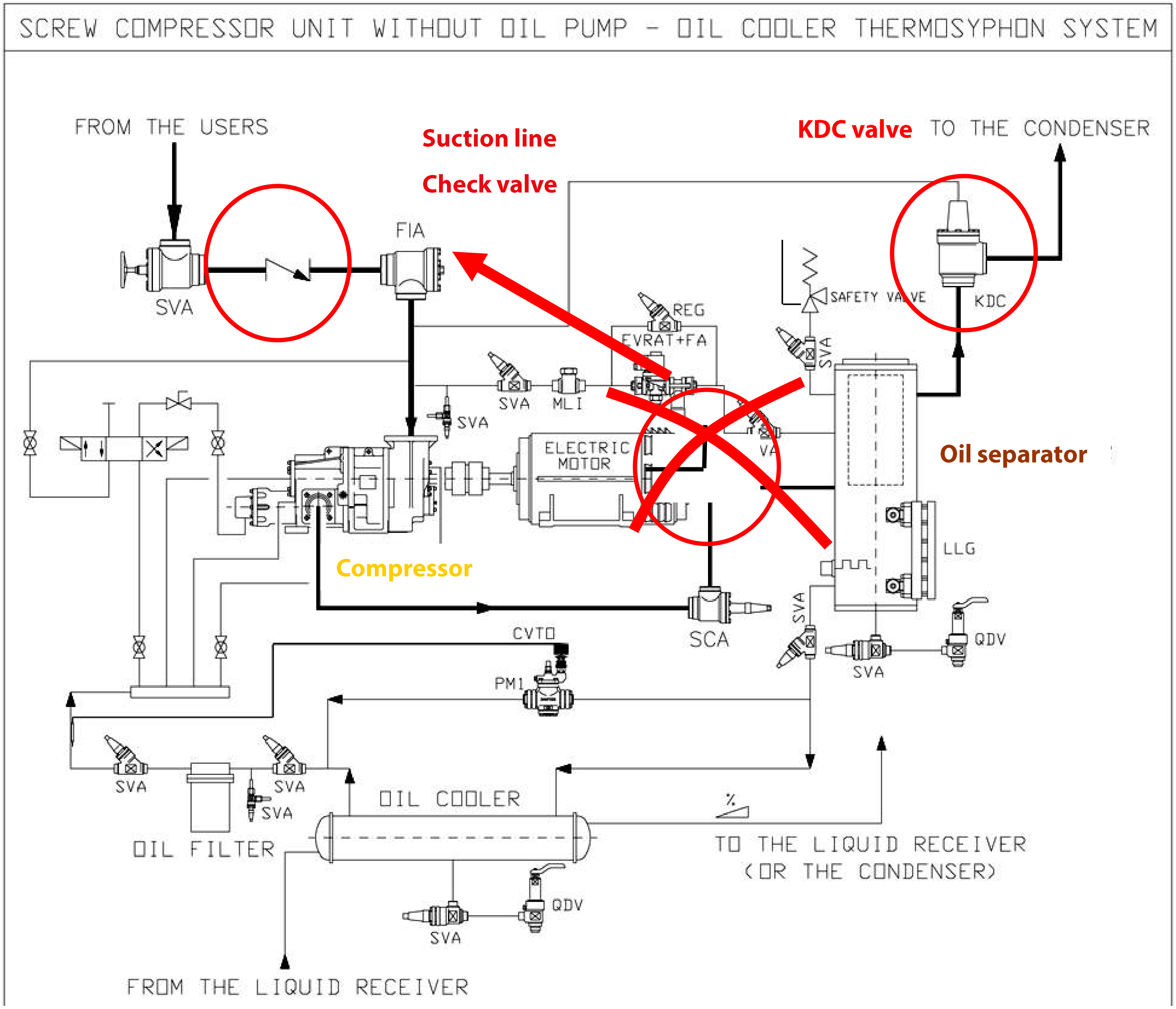


Attention!

The KDC valve cannot be used on compressor units where a check valve is placed between compressor and oil separator instead of on the suction side of the compressor.

It is important the suction line check valve is fast closing when the compressor is shut down, so equalization takes place quickly.

KDC – Application Example



KDC Installation and Service

- Remove the **disassembly bolt** after mounting the bonnet with the bonnet bolts tightened.
  - The purpose of the **disassembly bolt** is to secure the insert from falling out during disassembly and to avoid damage of the Teflon seat when bonnet is mounted.
- Disassemble valve before welding it in to the system
- Use ¼″ or 3/8″ steel pipe (tubing) for a pilot line. It could be either connected directly to the valve using NPT ¼″ thread or using adapter for a compression fitting.
- For service, always drain out refrigerant before disassembling the valve. This must be done via access port on side of the valve.

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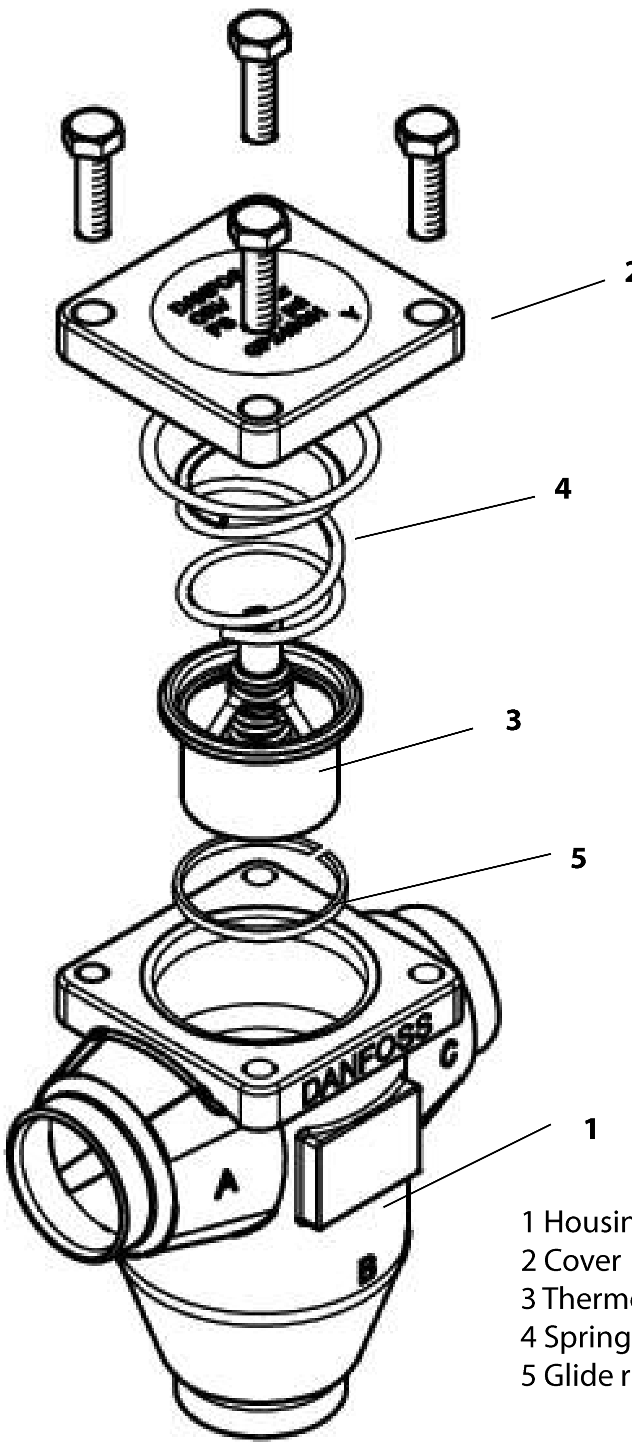
Oil Regulating Valve
Type ORV

ORV - Design

ORV is a 3-way valve for maintaining a constant oil temperature in compressor systems (ex. screw compressor), by mixing hot and cold oil in the lubricating system.



1 Housing
2 Cover
3 Thermostatic element
4 Spring
5 Glide ring

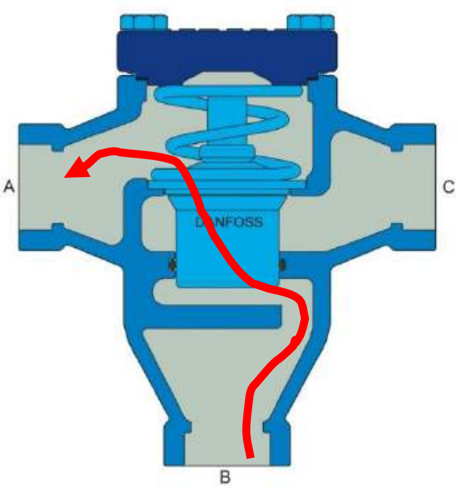
3 housing (body) sizes

- H1 housing
  - ○ ORV 25-40 (1″ – 1-1/2″)
  - ○ 1 pcs. small H1 element
- H2 housing
  - ○ ORV 40-50 (1-1/2″ – 2″)
  - ○ 1 pcs. large H2 element
- H3 housing
  - ○ ORV 65-80 (2-1/2″ – 3″)
  - ○ 2 pcs. large H2 element

Recommended pressure drop for mixing: 3 to 12 psi (0.2 to 0.8 bar)

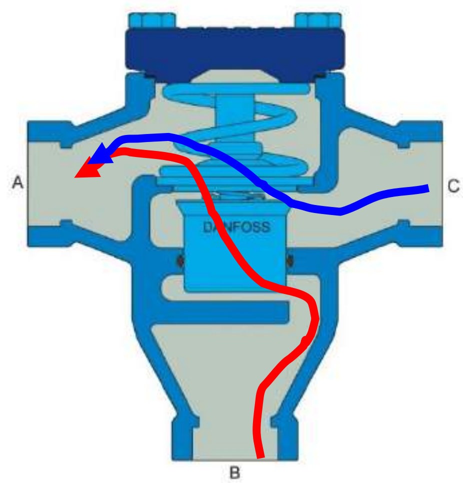
Mixing Operation

Fully closed position during cold start-up (full flow from port B)



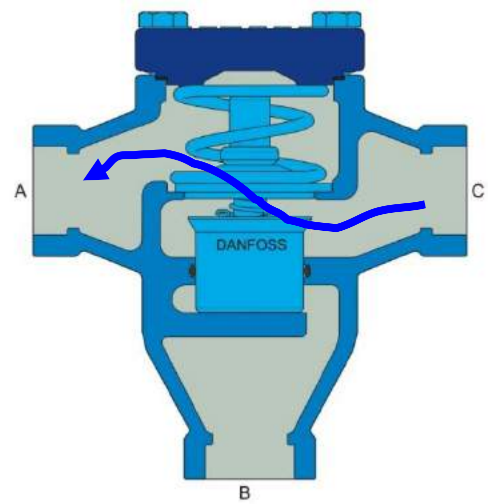
Element will start to open when the temperature is about 10°F less than nominal temperature rating

Mixing Position (flow from port B & C)



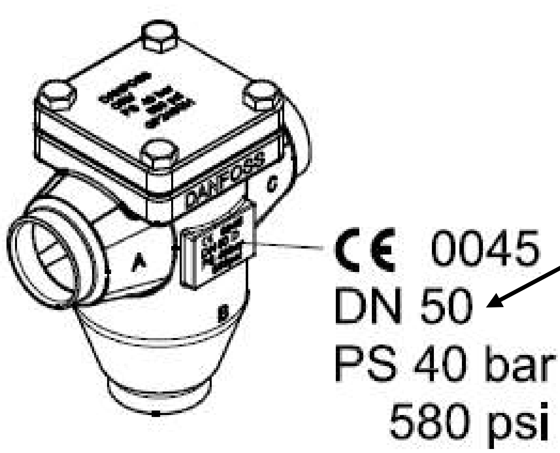
About half open position when nominal temperature is reached

Fully open position (full flow from port C)



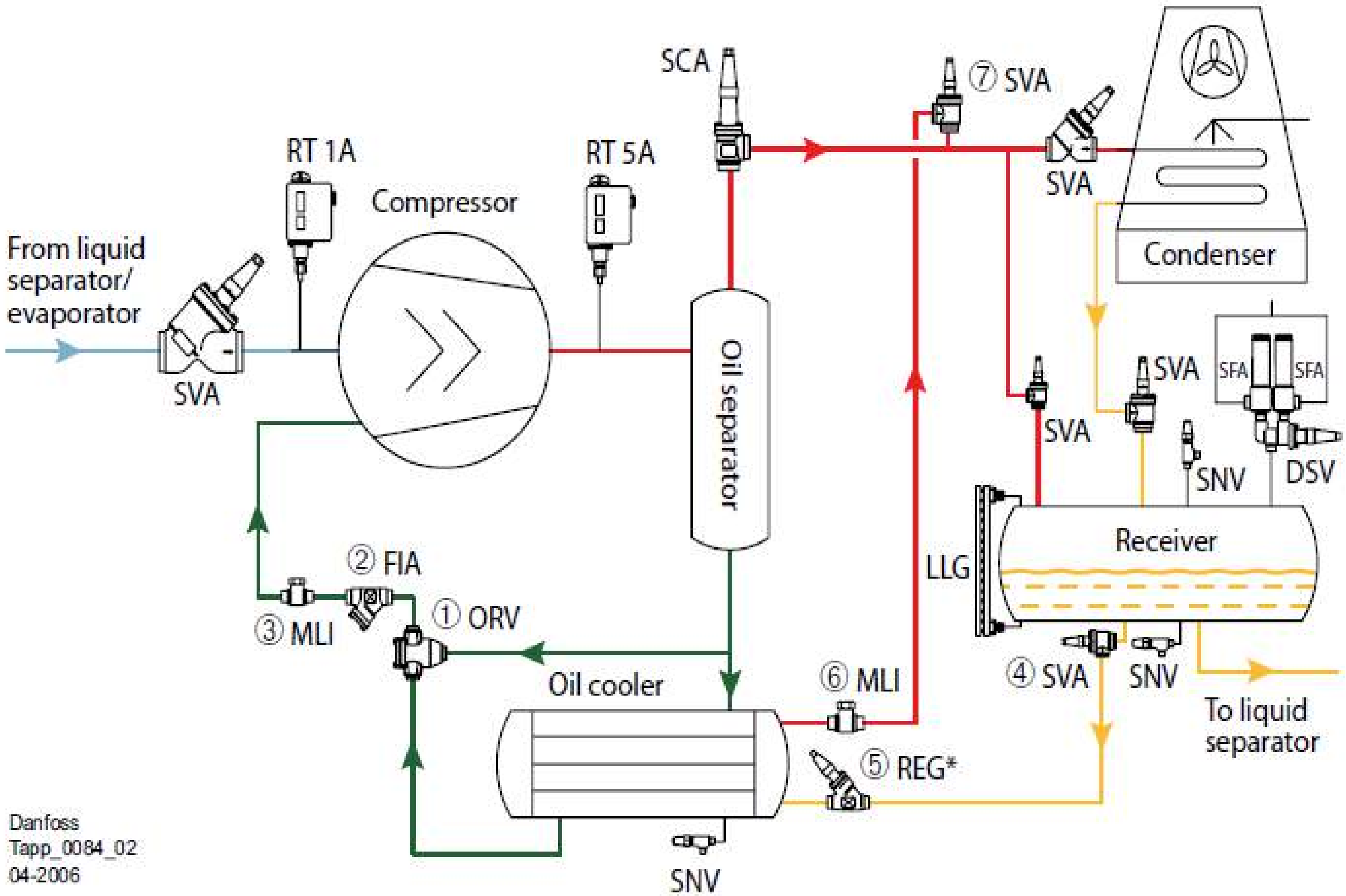
Element will be fully open when the temperature is about 10°F above the nominal temperature rating

Identification Example

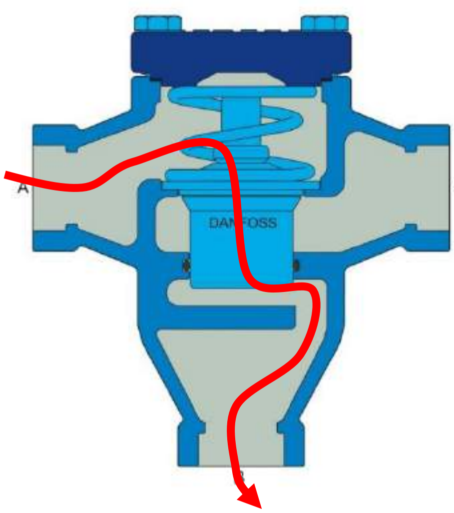


This number is what is needed when ordering replacement parts as it is the **D**iameter **N**ominal size in mm which is ORV size. The other info is just casting numbers, pressure rating, etc. The temperature range of the element will also be needed and this should be also on the valve and on element if removed.

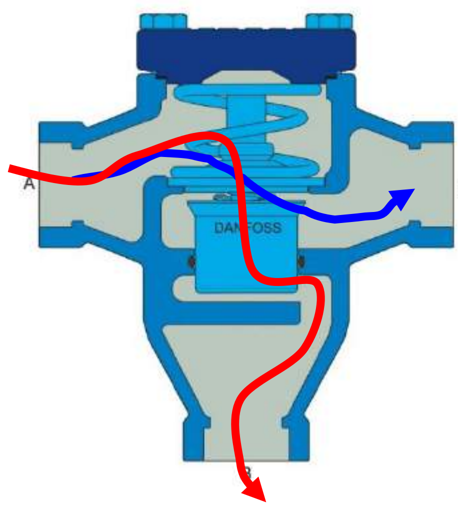
Application with Mixing Operation



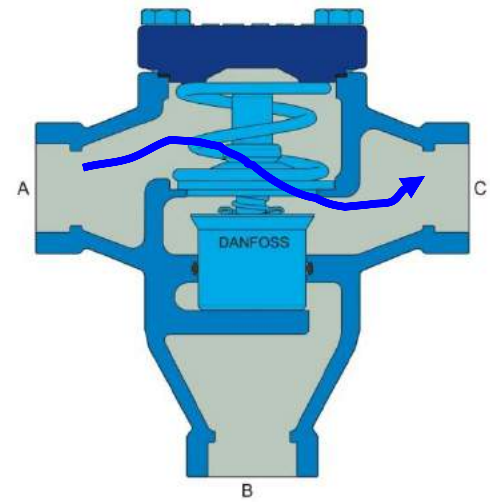
Diverting Operation



Element will start to open when the temperature is about 10°F less than nominal temperature rating

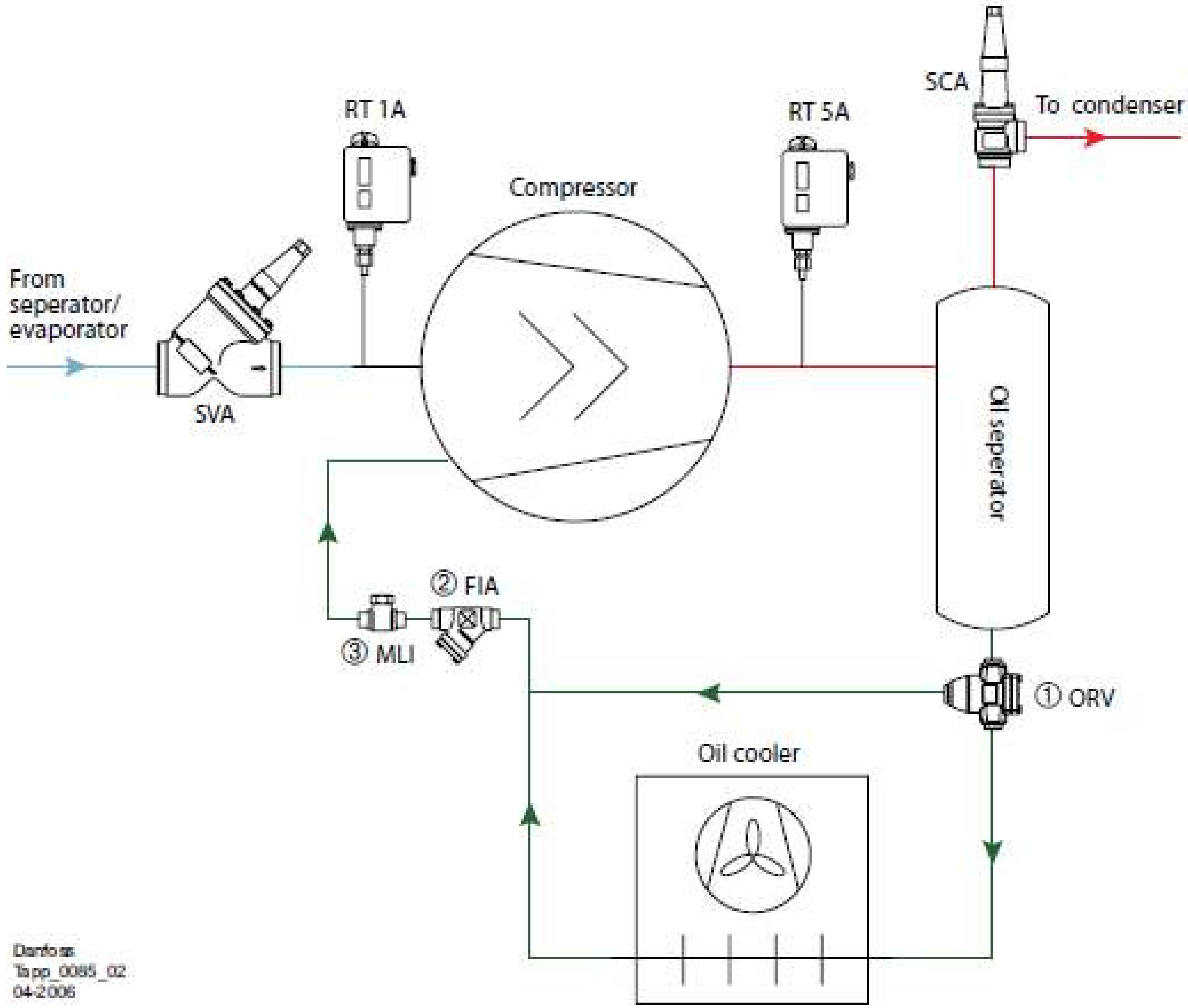


About half open position when nominal temperature is reached



Element will be fully open when the temperature is about 10°F above the nominal temperature rating

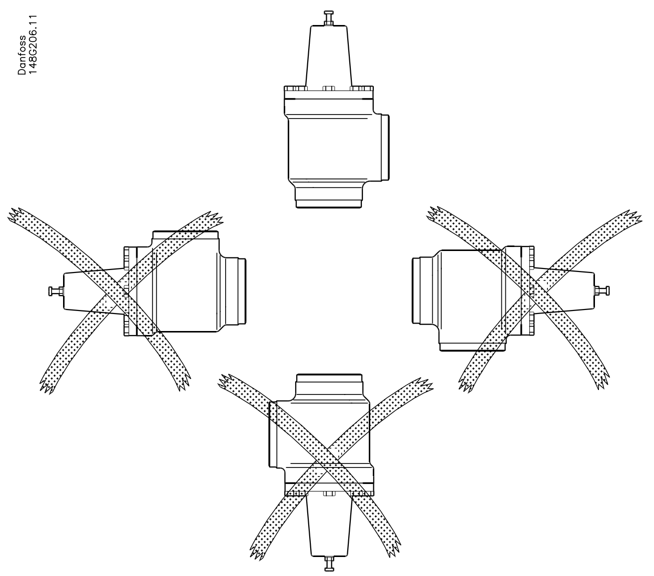
Application with Diverting Operation



148R9533

Installation Guide

Pressure control valve
KDC/GVD 65 - 200 (2½ - 8 in.)



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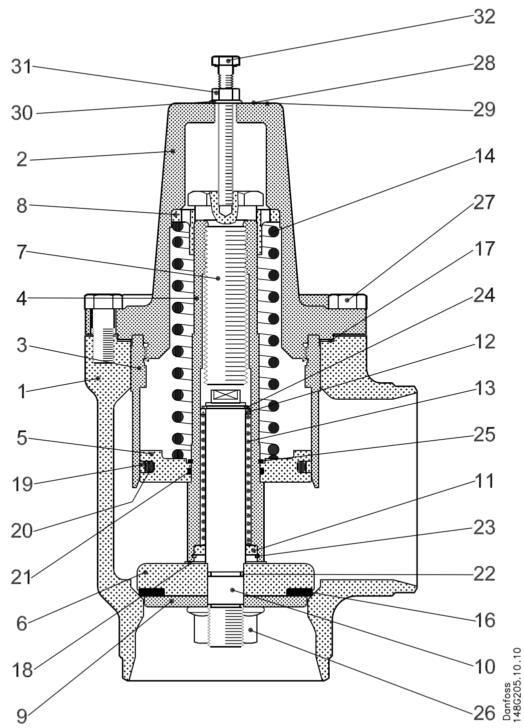

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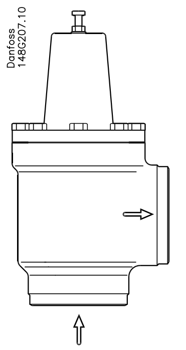

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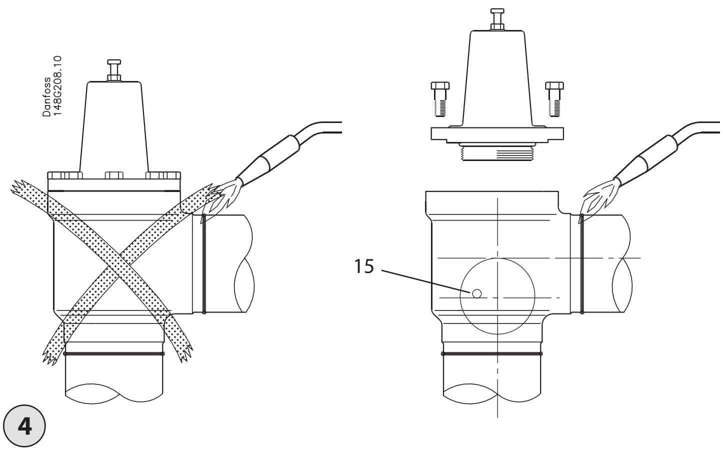

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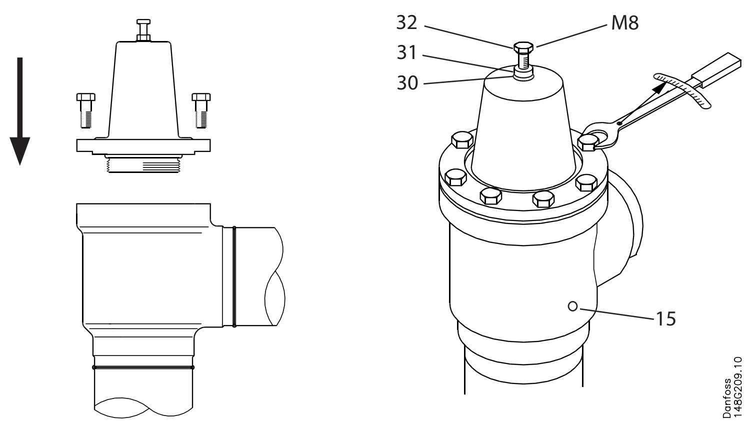


	Nm	LB-feet
DN 65	75	53
DN 80	44	32
DN 100	75	53
DN 125-150	183	135
DN 200	370	272

5

148R9533

ENGLISH

Installation

Refrigerants
Applicable to HCFC, HFC, R717 (Ammonia) and R744 (CO_2).
Flammable hydrocarbons are not recommended. The valve is only recommended for use in closed circuits. For further information please contact Danfoss.

Temperature range
KDC/GVD: –50/+150°C (–58/+302°F).

Pressure range
The valves are designed for a max. working pressure of 40 bar g (580 psi g).

Installation (Fig. 1)
The valve must be installed with the spindle vertically upwards (fig. 1).

The valve is designed to withstand a high internal pressure. However, the piping system should be designed to avoid liquid traps and reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like "liquid hammer" in the system.

Flow direction (Fig. 3)
Important: The flow direction must be from the cone side towards the branch.

Welding (Fig. 4)
Remove the actuator before welding to prevent damage to the gasket between the valve body and bonnet, as well as the teflon gasket in the valve seat. Only materials and welding methods, compatible with the valve housing material, must be welded to the valve housing. The valve should be cleaned internally to remove welding debris on completion of welding and before the valve is reassembled.

Avoid welding debris and dirt in the threads of the housing and the bonnet.

The valve housing must be free from stresses (external loads) after installation.

KDC/GVD valves must not be mounted in systems where the outlet side of the valve is open to atmosphere. The outlet side of the valve must always be connected to the system or properly capped off, for example with a welded-on end plate.

Remove welding debris and any dirt from pipes and valve body before assembly. Remove disassembly bolt (pos. 32) after mounting the bonnet and the bonnet bolts have been tightened. The purpose of the bolt is to secure insert from falling out during disassembly and avoid damage of the Teflon seat when bonnet is mounted.

Note! Always pull the valve seat back in open position before assembling the valve.

Use DN10 steel pipe for a pilot line. It could be either connected directly to the valve using NPT ¼" thread or using adapter for cutting ring.

Tightening (Fig. 5)
Tighten the bonnet with a torque wrench, to the values indicated in the table (fig. 5).

Colours and identification
The KDC/GVD valves are painted with a red oxide primer in the factory. Precise identification of the valve is made via the ID ring at the top of the bonnet, as well as by the stamping on the valve body. The external surface of the valve housing must be prevented against corrosion with a suitable protective coating after installation and assembly. Protection of the ID ring when repainting the valve is recommended.

Maintenance

Dismantling the valve (Fig. 4 and fig. 5)
Do not remove the bonnet while the valve is still under pressure.

Evacuate the pipe system in which the valve is installed. Remember to evacuate refrigerant from both sides of the valve (inlet and outlet). Use service port (pos. 15) on the valve to evacuate refrigerant from above the cone.

Mount the dismantling bolt (pos. 32), the hexagon flange nut (pos. 31) and the nylon ring (pos. 30) as shown on fig. 5, and tighten the nut (pos. 31) a few rounds in order to redraw the valve cone from the seat. Remove the bolts. Remove the valve top (actuator).

- Check that the O-ring has not been damaged.
- Check that the Teflon seat is free of scratches and impact marks.

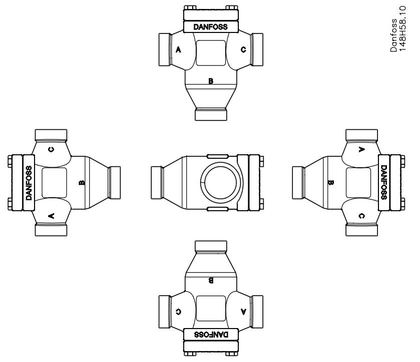
Assembly (Fig. 5)
Remove welding debris and any dirt from pipes and valve body before assembly. Mount the hexagon screw (pos. 32), the hexagon flange nut (pos. 31) and the nylon ring (pos. 30) as shown on fig. 5, and tighten the nut (pos. 31) a few rounds in order to redraw the valve cone from the seat. Remove disassembly bolt after mounting the bonnet and the bonnet bolts have been tightened. The purpose of the bolt is to secure insert from falling out during disassembly and avoid damage of the Teflon seat when bonnet is mounted.

Note! Always pull the valve seat back in open position before assembling the valve.

Installation Guide

Temperature regulating valve
ORV 25 - 80 (1 - 3 in.)

Installation



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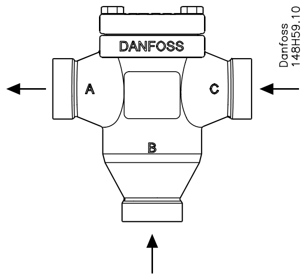

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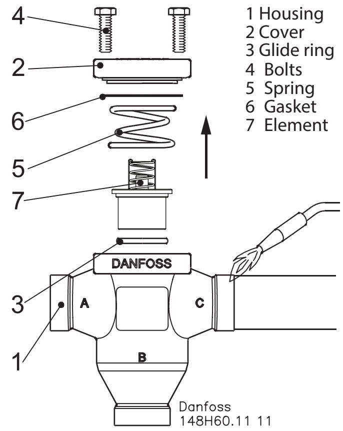

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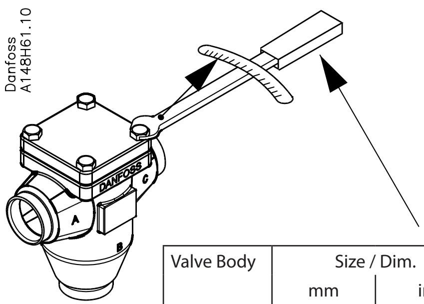
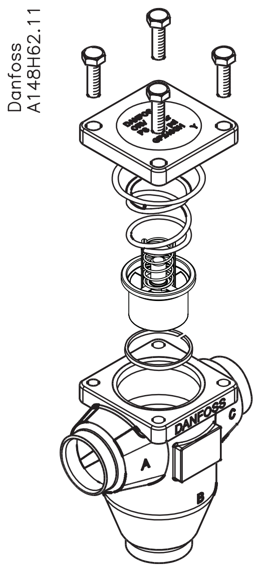


Valve Body Type	Size / Dim. mm	in.	Nm	ft lbs / pi / lb
H1	25-40	(1 - 1½ in.)	30	22
H2	40-50	(1½ - 2 in.)	50	37
H3	65-80	(2½ - 3 in.)	80	59

4



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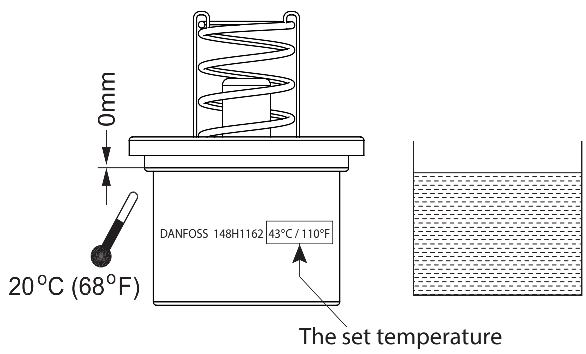
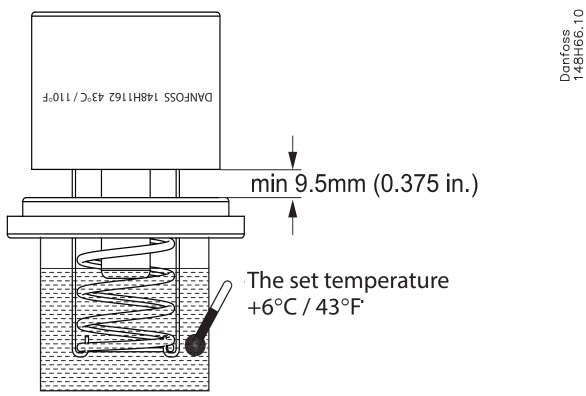


6a



6b

ENGLISH

Installation

Oils
Applicable to all common refrigeration oils.

Refrigerants
Applicable to all common refrigerants, including R717 and non-corrosive gases/ liquids dependent onsealing material compatibility.
The valve is only recommended for use in closed circuits.

For further information please contact Danfoss.

Temperature range
Minimum operating temperature:

≥ **−10ºC (14ºF)**

Max. temperature limit based on the element temperature settings:

Types	Max limit
43°C / 110°F	77°C / 170°F
49°C / 120°F	82°C / 180°F
60°C / 140°F	93°C / 200°F
77°C / 170°F	110°C / 230°F

Pressure range
The valves are designed for a max. working pressure of 40 bar g (580 psi g.)

Installation (Fig. 1)
The valve can be installed in any position (fig. 1), however, oil spills can be avoided when servicing, if the top is mounted vertically upwards. The valve is designed to withstand a high internal pressure. However, the piping system should be designed to reduce the risk of hydraulic pressure caused by thermal expansion. It must be ensured that the valve is protected from pressure transients like accelerated liquid in the system.

Recommended flow direction (Fig. 2)
To achieve correct flow direction and function, the letter designations, A, B and C on the valve housing must be followed as shown in fig. 2. Refer to the technical leaflet to find application example.

Welding (Fig. 3)
The top cover (2), gasket (6), spring (5), and thermostatic element (7), must be removed before welding (fig. 3), to prevent damage to the thermostatic element sensor (7). (This must be done if the valve has not been ordered from the parts program. When ordering from the parts program the element is not mounted in the valve).
The teflon glide ring (3), in the housing (1), should be removed if the temperature will exceed 240°C (460° F). Only materials and welding methods, compatible with the valve housing material, should be used. The valve should be cleaned internally to remove weld debris on completion and before the valve is reassembled.
Weld debris and dirt in the interior of the housing and on the glide ring should be avoided. Temperature during welding can be limited to the required limit depending on welding method and any cooling applied to the valve body. (Cooling can be ensured by, for example, wrapping a wet cloth around the valve body). Damage to the teflon glide ring should be avoided. The valve housing must be free from stresses (external loads) after installation.

Assembly (Fig. 5)
Remove weld debris and any dirt from pipes and valve body before assembly. Check that the Teflon glide ring is free from damage prior to mounting the thermostatic element (fig. 5).

Tightening (Fig. 4)
Tighten the top cover bolts using a torque wrench, to the values indicated in the table (fig. 4). Over tightening can cause damage to the gasket.

Colours and identification
The ORV valves are painted with a red oxide primer from the factory. Precise identification of the valve is made via the cast text on the valve body and top. The external surface of the valve housing must be treated with a suitable protective coating after installation and assembly.

Maintenance

Servicing
The ORV will fail if the thermostatic element is worn out.
It is recommended that the thermostatic element is function tested if the temperature control is not responding as designed.

Test of thermostatic element (Fig. 6)
After dismounting of the thermostatic element observe the element position. If the temperature of the actuator is approx. 20°C (68°F), the element should look as shown in fig. 6a.
Insert the active part of the element into water. Make sure that the water temperature is equal to "the set temperature" added 6ºC / 43 ºF (see fig. 6b).
The set temperature can be read from the ingraving on the thermostatic element (see fig. 6a).
Observe the element open into a position as shown in fig. 6b. The difference between fully open and fully closed should be approx. 9.5 mm (0.375 in.). The element must be replaced if this stroke cannot be achieved.

Glide ring
The surface of the glide ring must be inspected to ensure that no damage has occurred. Scratch marks and the like can cause oil flow to bypass the element making the temperature regulation less accurate.

Assembly (Fig. 5)
Remove any dirt from the body before the valve is assembled. Check that the thermostatic element and top gasket are in position.
Lubricate the glide ring for ease of fitting of the thermostatic element. Excessive force can damage the glide ring. Only apply moderate force.
Reposition and secure top.

Tightening (Fig. 4)
Tighten the top bolts with a torque wrench, to the values indicated in the table (fig. 4). Over tightening can cause damage to the gasket.

Use only original Danfoss parts, including thermostatic elements, gaskets and glide rings for replacement. Materials of new parts are certified for the relevant refrigerants and oils.

In cases of doubt, please contact Danfoss.

Danfoss accepts no responsibility for errors and omissions. Danfoss Industrial Refrigeration reserves the right to make changes to products and specifications without prior notice.

ENGINEERING
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Electronic Superheat Control
Type EKC 315A

Superheat Control Using the EKC 315A Controller

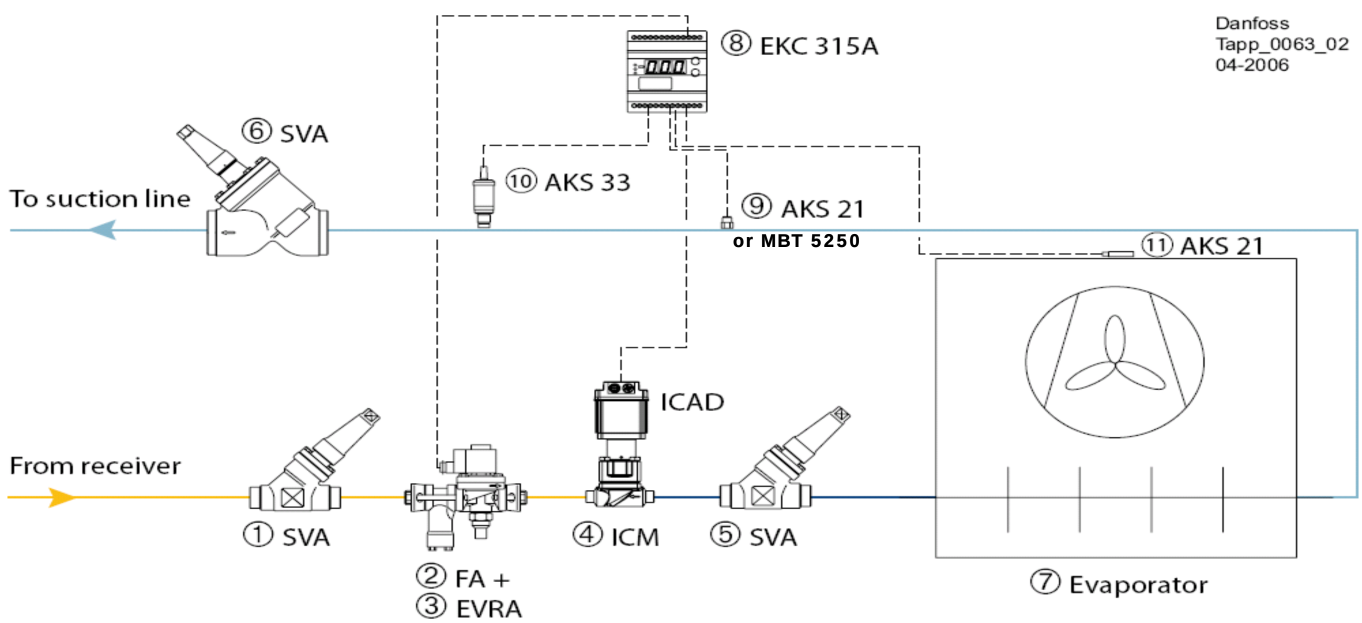
- What is superheat?
  - The temperature difference between the **measured** temperature of refrigerant exiting the evaporator and the saturation temperature of the refrigerant which corresponds to the evaporator pressure.
- Why is superheat important?
  - **In theory**, the presence of superheat ensures that all liquid in the evaporator has vaporized thereby preventing liquid from reaching the compressor.
- Traditional Superheat Control vs. Electronic Control
  - Superheat control with a thermostatic expansion valve relies on a special charge of "refrigerant" which expands and contracts based on the **actual** temperature (which implies, but does not measure a value of superheat) sensed by the bulb or power head of the valve.
  - Superheat control with an electronic expansion valve is based on the actual superheat

Benefits: Electronic Control vs. Mechanical TXV

- Electronic control offers the probability of making more efficient use of the evaporator by minimizing superheat.
  - Superheat ranges are typically under 10°F
  - It is not practical to try to obtain superheat values under 3°F
- Electronically controlled expansion valves typically do not require the high pressure differentials required by mechanical expansion valves.
  - This can help to reduce compressor discharge pressure which translates to energy savings.
- Electronic control offers much faster response to changing conditions.
  - Process control is significantly enhanced.
  - Energy utilization (and efficiency) is improved.

Principles of Operation

- Pressure reading sent to controller via 4 to 20 mA signal
- Controller determines saturation temperature through internal tables
- Temperature is sensed by controller and actual superheat is calculated by subtracting saturation temperature from actual temperature.
- Valve setting is changed based on current superheat, past superheat, and projected superheat – this is the result of the PID logic built into the controller software

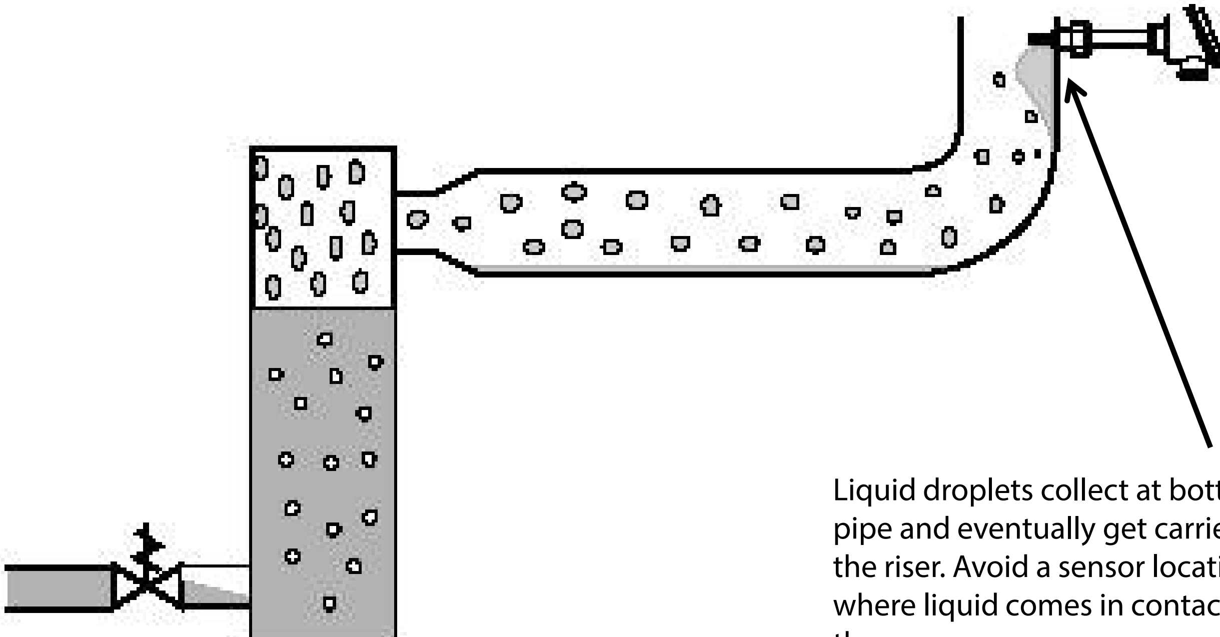


Superheat Control is Dependent on Good System Design

Successful control relies largely on:

- Good piping practices
- Proper distribution with distributor
- Pure liquid at electronic expansion valve
- Sensor location. Note: Danfoss has no recommendations on temperature sensor location as every application can be different.

Uneven distribution or low velocities in the suction may lead to liquid pockets creating disturbances at temperature sensor making superheat control very unstable



Liquid droplets collect at bottom of pipe and eventually get carried up the riser. Avoid a sensor location where liquid comes in contact with the sensor.

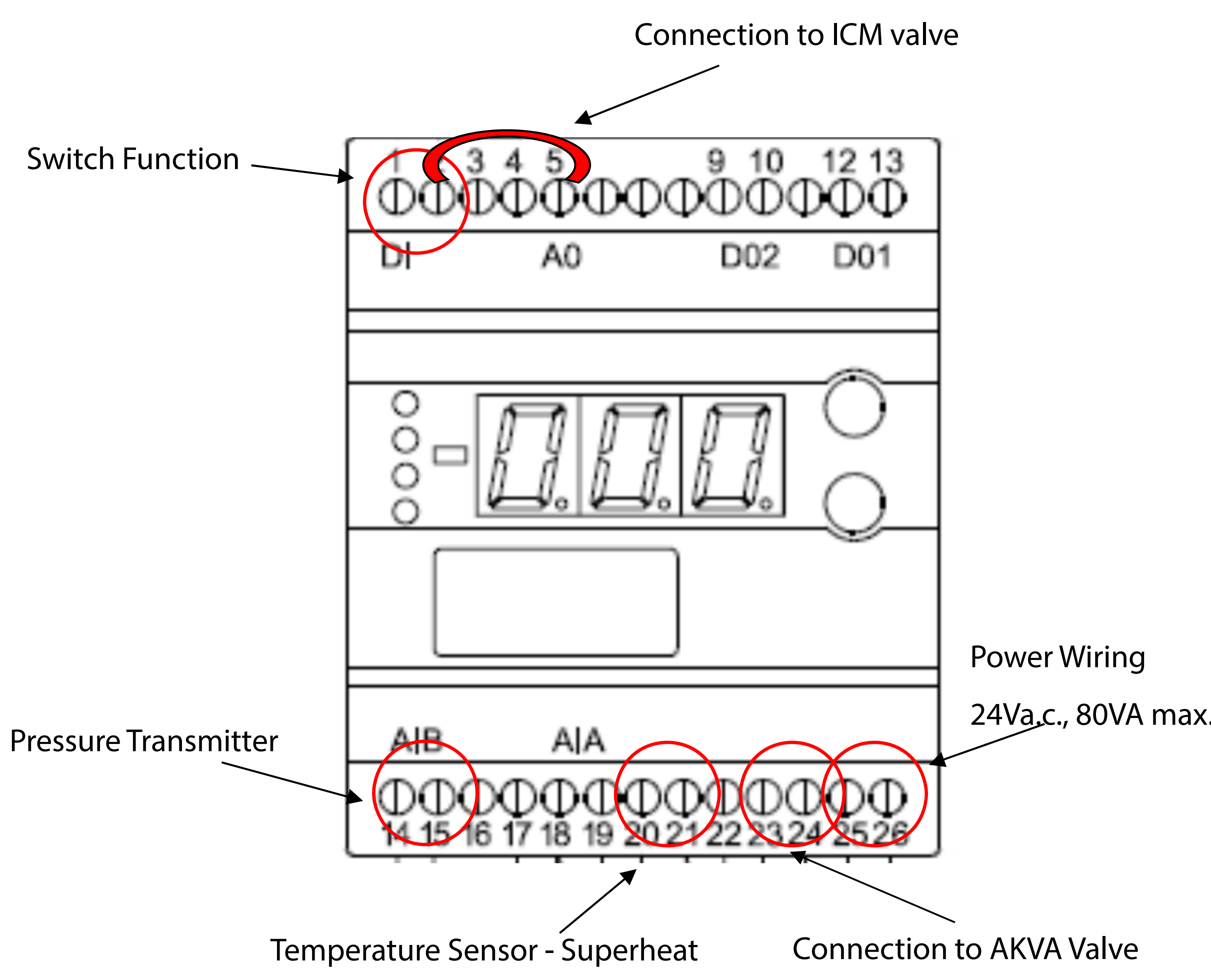
Note: It is important to have true DX evaporators. Superheat control in retrofitted recirculated evaporators furnished with liquid distributors will not perform as flow dynamics and required velocities for full evaporation may not be achieved.

Features of EKC 315A Controller

- Superheat control
  - PID Control
  - Choice of 2 Algorithms
- Optional thermostat function
- Alarms & Relay Outputs
- External Start/Stop of Regulation via digital input

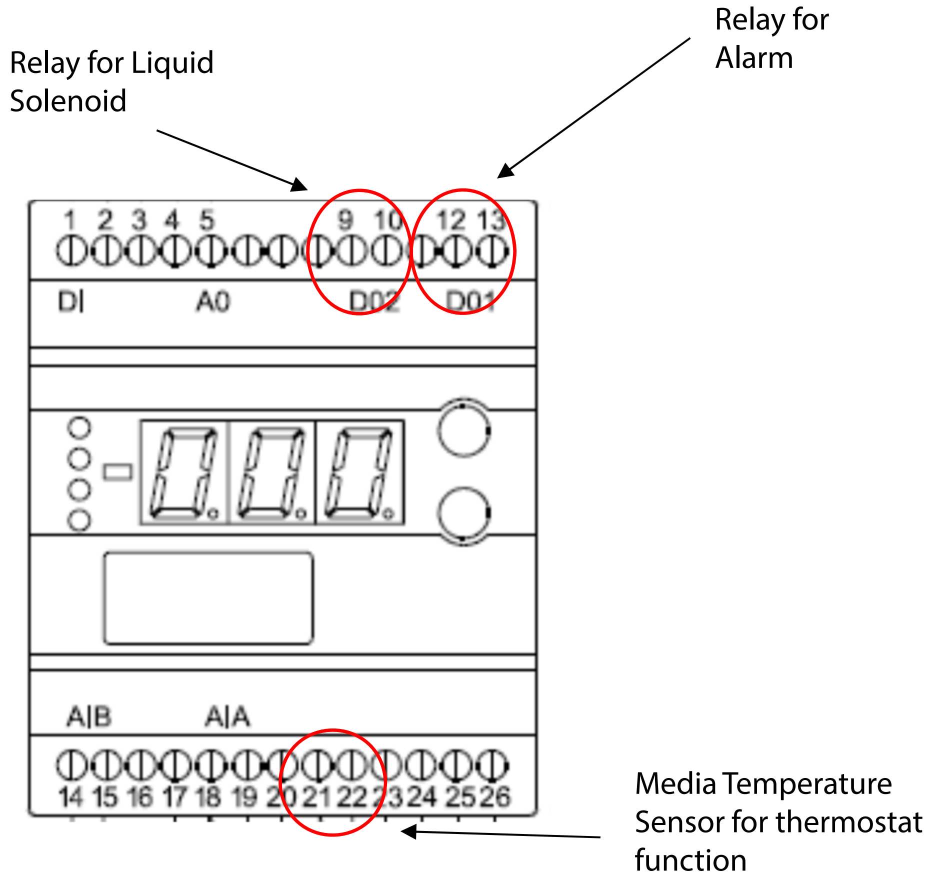
Wiring the EKC 315A Controller

Required Connections



Wiring the EKC 315A Controller

Optional Connections



EKC 315A Controller Display

Normal Display

Usually represents the current value of superheat
This can be changed to valve opening degree or media temperature if thermostat function is in use.

Auxiliary Display

Accessed by giving the top button a brief push
Will display alarm or error code, if present. Otherwise, this will usually represent the valve opening degree.

LED's on front panel

- Opening signal to valve
- Controller in refrigeration mode
- Indicates an alarm, or a controller error
- Indicates an alarm, or a controller error

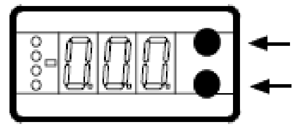
EKC 315A Controller
Display – Set Point

Main Set Point

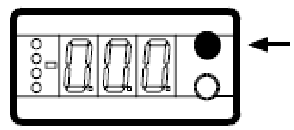
The main set point is not the desired superheat value.

This setting is for the optional thermostat function.

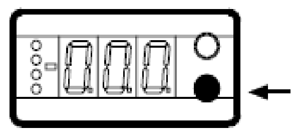
Changing the Set Point



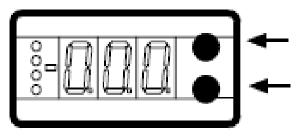
To enter change mode
Press both buttons simultaneously



To raise the setpoint
Press the upper button



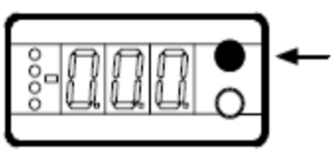
To lower the setpoint
Press the lower button



To save the change
Press both buttons simultaneously

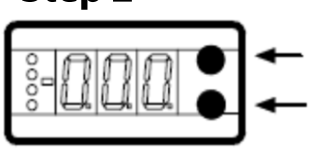
EKC 315A Controller
Making Changes to the Parameters

Step 1



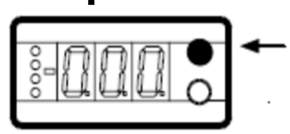
To access parameter menu
Press the upper button for 5 seconds, then
Use the upper and lower buttons to scroll through the parameter list

Step 2

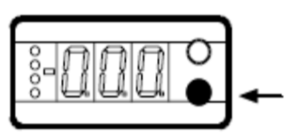


To enter change mode for a parameter you have scrolled to
Press the both buttons simultaneously

Step 3

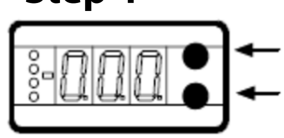


To increase the setting
Press the upper button



To decrease the setting
Press the lower button

Step 4



To save the new setting and return to the parameter menu
Press both buttons simultaneously. You can then make other parameter changes
or,
The EKC 347 will exit the parameter menu and return to its normal display when no buttons have been pressed for approximately 18-20 seconds.

Programming the EKC 315A Controller

Note: For most applications, only the below parameters need to be reviewed and possibly changed. After going through the quick start procedure below, you should review the complete parameter list to ensure all needed changes have been done for your application.

Essential settings that must be made before others will take effect:

1) If the controller is already wired it may be best to put the controller into standby by setting parameter r12 to OFF. This way the controller will not try to regulate while setting up the parameters. If this is done, parameter r12 must be changed back to ON for the controller to regulate.
2) The desired units must be set prior to programming any settings. For the units to be entered and displayed in °F and psig, parameter r05 must be changed to F-P (the default units are °C and bar pressure).
3) Change parameter o12 to 60 Hz unless the supply is 50 Hz.

Setting up the controller for superheat regulation

1) Select the valve that is being used, parameter o09. Typical settings are par. o09=4 when using the pulse-width expansion valve type AKVA or par. o09=7 when using the ICM motor valve with ICAD motor actuator's default settings input setting.
2) Enter the pressure transmitters working range in parameters o20 (min value) and o21 (max. value). Note: These settings must be entered in gauge pressure and most transmitter ranges are listed in absolute pressure which will need converted to gauge pressure before entered.
3) Select the refrigerant that is being used, parameter o30. For R717 (ammonia) that setting would be par. o30=5.
4) Set the superheat regulation method, parameter n21. For industrial refrigeration systems, it is best to try load-defined superheat regulation which would be par. n21=2.
5) The controller will regulate superheat based on a user-defined superheat range in parameters n09 and n10. It is best to leave these at the default settings and later fine tune them if needed. *Note: parameter n10 must be set higher than parameter n22.*
6) For most applications the shaded parameters in the parameter list should not be changed.
7) Verify that parameter r12 is ON.

Setting up the thermostat function for controlling a liquid line solenoid valve

The additional temperature sensor S3 must be installed for use of the thermostat function. The controller will then control the solenoid relay and alarm relay based on the sensor S3 reading and the user defined setpoints.

1) Set the thermostat set point. This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously.
2) Set the differential for the thermostat function, parameter r01.
3) Turn on the thermostat function with parameter r14 (r14=1 for ON).
4) If desired, set up the alarm parameters A1, A2 and A3.
5) Verify that parameter r12 is ON.

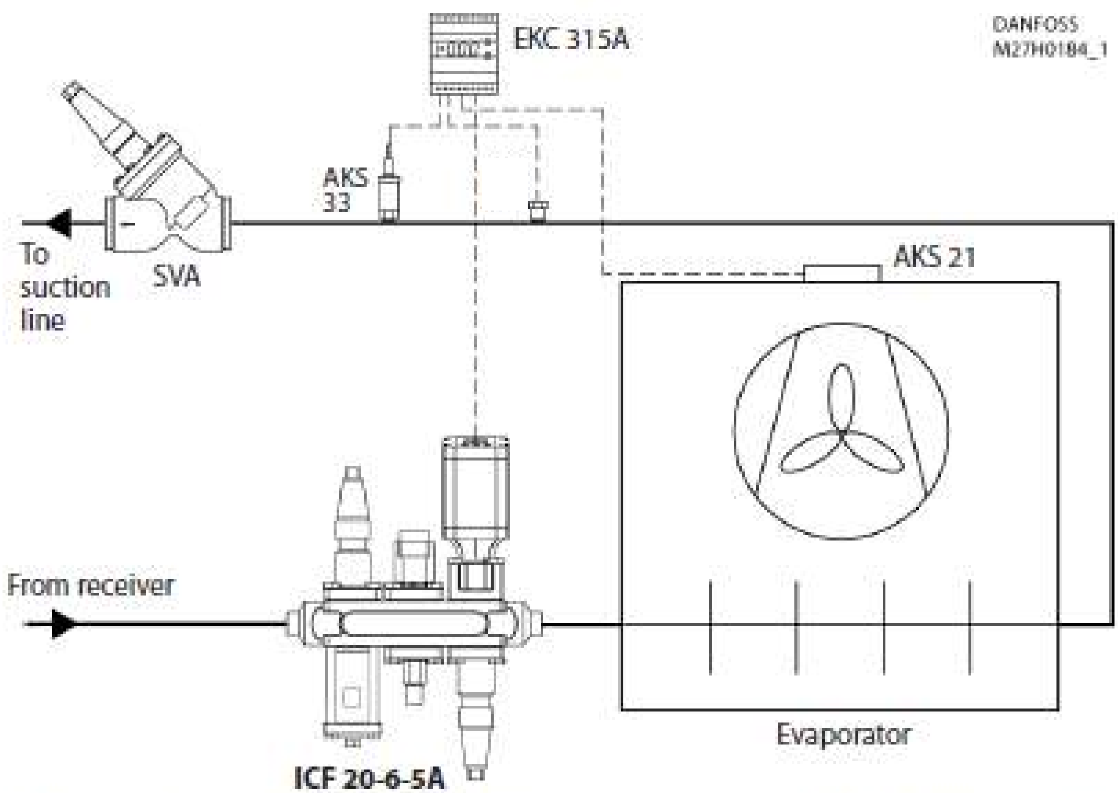
Electronic Expansion Valves
The AKVA Pulse Width Valve

- The AKVA valve is essentially a solenoid valve which has been constructed for very high cycle service and with a special cone which precisely controls the expansion of liquid refrigerant.
- Unlike the ICM modulating valve, the pulse valve does not control the mass flow of the refrigerant as it is passing through the valve. Rather, it controls the flow through an on/off pulsing action. This is a very important characteristic to understand.
- In applications where the internal volume of the evaporator is limited (such as in plate and frame evaporators), the flow from the pulse width valve can "overwhelm" the evaporators ability to manage the amount of liquid refrigerant within it.
- Pulse width valves are highly applicable in low tonnage coils.
- Pulse width valves must be sized for the pressure drop that is going to occur across the valve. It is essential that the distributor pressure drop is subtracted from the available pressure differential.

Electronic Expansion Valves
The ICM Motorized Valve

- The ICM valve is a true modulating valve which controls the flow of refrigerant by continuously varying orifice size.
- The drive mechanism is magnetically coupled to the ICAD motor.
- The ICM valve is controlled with a 24 VDC digital stepper motor. The position of the valve is determined by the number of steps sent by the ICAD through the magnetic coupling.
- The rate at which the valve opens and closes is determined by the settings on the ICAD motor.

DX Evaporator, Electronic Expansion
With ICF Control Solution



Note: The evaporator must be designed for DX. Adequate subcooling is required.

Superheat Control

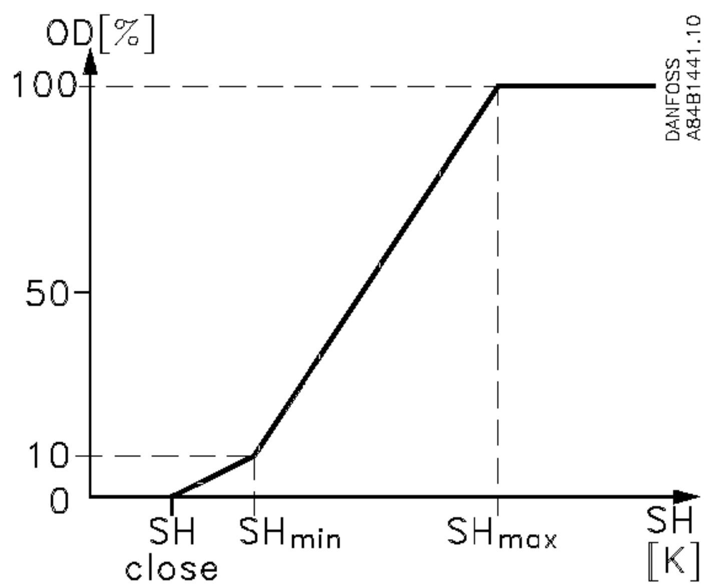
EKC 315A –

Advanced control of Superheat by using electronic Expansion Valve.

LOADAP (n21 = 2)

Best for Industrial Refrigeration Superheat Control

LOADAP Control technology for AKV/A

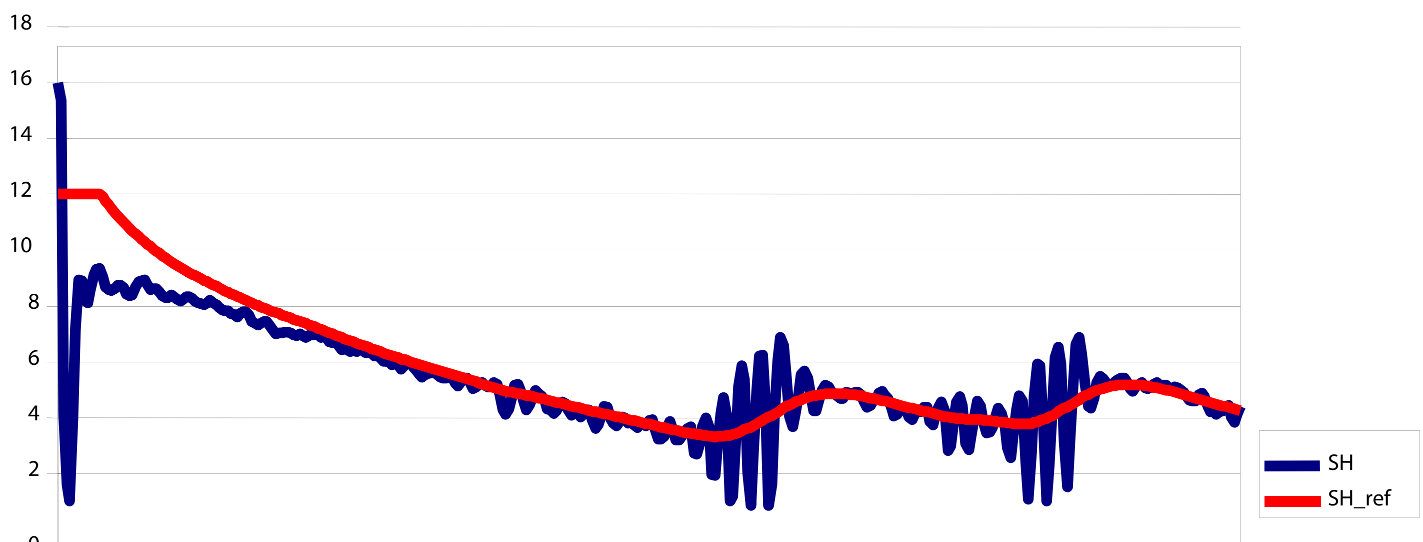


EKC 315A –

Advanced control of Superheat by using electronic Expansion Valve.

MSS Control Technology

The control algorithmhm continually seeks the **M**inimum **S**table **S**uperheat.
Paramenter n21=1



Error, Alarm and Status Codes

Code	Description
E1	Errors in the controller
E11	TQ valve's actuator temperature outside its range (discontinued valve)
E15	Temperature sensor S2 (for superheat calculation) has a bad connection
E16	Temperature sensor S2 (for superheat calculation) is shortcircuited
E17	Temperature sensor S3 (air temperature sensor) has a bad connection
E18	Temperature sensor S3 (air temperature sensor) is shortcircuited
E19	The analog input signal on terminals 18 & 19 is outside the range
E20	The pressure transmitter signal on terminals 14 & 15 is outside the range
A1	High temperature alarm A1 has been detected (sensor S3)
A2	Low temperature alarm A2 has been detected (sensor S3)
A11	No refrigerant has been selected in parameter o30
S10	Regulation stopped by internal (par. r12) or external (terminals 1and 2) start/stop
S11	Thermostat relay is cut out

Trouble-Shooting Superheat Controlled Systems
Function Issues

Use Service Parameters!

- They can help determine whether there is a problematic input
- They can help determine if the controller and valve are communicating properly
- They can help determine if there is a problem somewhere else in the system.

Service Parameters for Troubleshooting (view only)

Description of parameter	Parameter	Units*
Current TQ valve's (discontinued valve) actuator temperature	u04	°F or °C
Reference for TQ valve's (discontinued valve) actuator temperature	u05	°F or °C
Analog input current signal (terminals 18 & 19) from PLC, etc.	u06	mA
Analog output current signal on terminals 2 & 5	u08	mA
Digital input status. Combination of parameter r12 and terminals 1 & 2	u10	ON-OFF
Ongoing cut-in time for thermostat or duration of last completed cut-in	u18	minutes
Temperature of S2 temperature sensor (used for superheat)	u20	°F or °C
Current calculated superheat	u21	°F or °K
Controller's superheat reference (target superheat controller is trying to achieve)	u22	°F or °K
Valve's opening degree	u24	%
Evaporating pressure based on pressure transmitter	u25	psig or bar
Evaporating temperature based on pressure transmitter and selected refrigerant	u26	°F or °C
Temperature of S3 temperature sensor (used for thermostat function for solenoid valve)	u27	°F or °C
Control reference (setpoint + any offset provided by an input signal from a PLC or other source)	u28	°F or °C
Pressure transmitter current signal (terminals 14 & 15)	u29	mA

Trouble-shooting Superheat Controlled Systems
Things to Look For

Superheat value appears to be extremely high

- Pressure transmitter wired correctly?
- Liquid solenoid energized?
- Is valve large enough?
- Is thermostat keeping solenoid from energizing?
- What is the position of the ICAD?
- Does the superheat eventually drop?

Evaporator can't seem to get enough refrigerant

- Is valve large enough?
- Is there flash gas before the valve? Check sub-cooling
- Is strainer clogged?
- Are coil circuits being fed evenly?

Superheat controller EKC 315A

REFRIGERATION AND
AIR CONDITIONING

Manual

Contents

The parameter list in this technical leaflet is valid for software versions 1.3x .

Introduction

The EKC 315A controller can be applied where there is a need for accurate control of superheat and temperature in refrigeration systems, for example:

- Air coolers
- Process water chillers
- Air conditioning systems

Advantages

- The evaporator is optimally charged, even when there are great variations in load and suction pressure.
- Energy savings -- adaptive regulation of refrigerant injection ensures optimum utilization of the evaporator, resulting in a higher suction pressure.
- Using adaptive control, superheat is maintained at the minimum stable level -- an energy-efficient way to optimize the evaporator while at the same time, media temperature is thermostatically controlled

Valve Compatibility

The EKC 315A can control evaporator superheat by means of one pressure transmitter and one temperature sensor using either an ICM motorized modulating valve with ICAD motor actuator or an AKV or AKVA pulse-width-modulating expansion valve.

In systems where there is one evaporator, one compressor, and one condenser, and a relatively small refrigerant charge, the type ICM valve is recommended.

In systems with an AKV/A valve, the capacity can be distributed by using up to three valves in parallel. When using more than one AKV/A per evaporator, an EKC 347 controller is required for each additional AKV/A in the master-slave configuration. The controller will generate pulses to the multiple valves in such a way that they will not be pulsed simultaneously.

Features and Functions

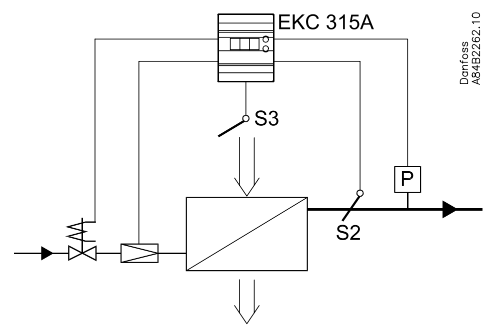
- Superheat regulation
- Temperature control via thermostat function
- MOP function (limits valve opening degree as long as evaporating pressure is higher than user-set value)
- ON-OFF input for start-stop of regulation
- Input signal that can offset the superheat reference or the temperature reference.
- Capable of generating alarms if user-set limits are exceeded
- Relay output for solenoid valve control
- PID regulation
- Analog output to either (a) control an ICM motorized valve; or (b) to monitor superheat, valve opening degree of an AKVA, or air temperature.

Ordering

Type	Function	**Code No.**
EKC 315A	Industrial evaporator controller	**084B7086**

Operation

Superheat control with thermostat function
The superheat is controlled by pressure transmitter P and temperature sensor S2. The temperature is controlled by the solenoid valve, the thermostat setting, and the temperature sensor S3 in the return air.

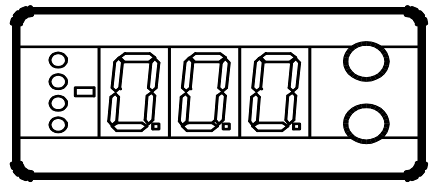


Operating the EKC 315A

The Display
The EKC 315A has a three character digital display. Four status LEDs (Light Emitting Diodes) are to the left of the numerals. To the right of the display are two push buttons.

By default, the display normally shows the superheat but user programming allows the valve's opening degree or air temperature to be selected as the normal display. At any given time, depressing the lower pushbutton will change from what was selected to be in the normal display to one of the other values depending on the setting in parameter o17, which will be displayed for 5 seconds.

The default setting is for °C and bar to be shown in the display, but the units can easily be changed to °F and psig. See parameter r05.



The Front Panel LEDs
The upper LED (next to the valve symbol) lights to indicate the valve's opening degree. A short pulse indicates a small liquid flow and a long pulse a heavy liquid flow.

The LED next to the snowflake symbol lights to indicate that the controller is calling for refrigeration.

The three lowermost LED's will flash, if there is an alarm or an error in regulation. In this situation, pushing the upper button for 1 second will cause the alarm or error code to be displayed.

When an alarm code is displayed by pushing the upper button, the alarm relay will be cut out.

The error (prefix E), alarm (prefix A), and status (prefix S) codes that can appear, along with the meaning of each code, are given in the table below.

LED's on front panel

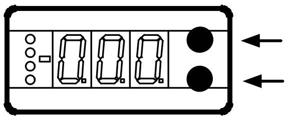
- ⊳ O Opening signal to valve
- ❄ O Controller in refrigeration mode
- O Indicates an alarm, or a controller error
- O Indicates an alarm, or a controller error

Error, Alarm, and Status Codes

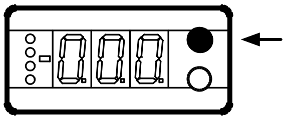
Code	Description
E1	Errors in the controller
E11	TQ valve's actuator temperature outside its range (discontinued valve)
E15	Temperature sensor S2 (for superheat calculation) has a bad connection
E16	Temperature sensor S2 (for superheat calculation) is shortcircuited
E17	Temperature sensor S3 (air temperature sensor) has a bad connection
E18	Temperature sensor S3 (air temperature sensor) is shortcircuited
E19	The analog input signal on terminals 18 & 19 is outside the range
E20	The pressure transmitter signal on terminals 14 & 15 is outside the range
A1	High temperature alarm A1 has been detected (sensor S3)
A2	Low temperature alarm A2 has been detected (sensor S3)
A11	No refrigerant has been selected in parameter o30
S10	Regulation stopped by internal (par. r12) or external (terminals 1and 2) start/stop
S11	Thermostat relay is cut out

Operating the EKC 315A

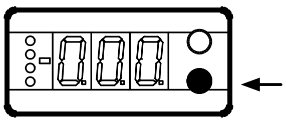
To view or change the thermostat setpoint:



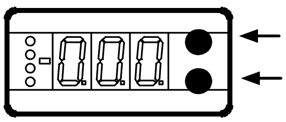
To enter change mode
Press both buttons simultaneously



To raise the setpoint
Press the upper button

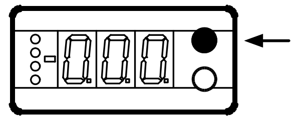


To lower the setpoint
Press the lower button

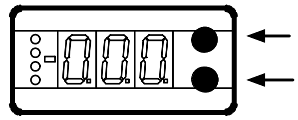


To save the change
Press both buttons simultaneously

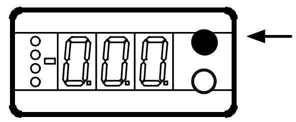
To change a parameter setting:



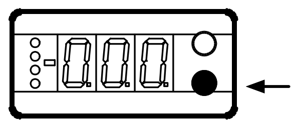
To access parameter menu
Press the upper button for 5 seconds, then
Use the upper and lower buttons to scroll through the parameter list



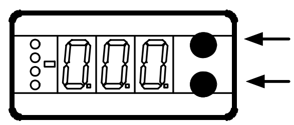
To enter change mode for a parameter you have scrolled to
Press the both buttons simultaneously



To increase the setting
Press the upper button



To decrease the setting
Press the lower button



To save the new setting and return to the parameter menu
Press both buttons simultaneously. You can then make other parameter changes or,
The EKC 315A will exit the parameter menu and return to its normal display when no buttons have been pressed for approximately 18-20 seconds.

To reset to factory default values:
1) Remove the supply voltage to the EKC 315A
2) While pressing both buttons simultaneously, restore power. Factory settings will have been restored.

Quick Setup Guide

NOTE: For most applications, only the below parameters need to be reviewed and possibly changed. For each parameter, record your setting and other pertinent settings if any, in the "Field Settings" column provided in each parameter table on the following pages. After going through the quick start procedure below, it is best to review the complete parameter list to ensure all needed changes have been done for your application.

Essential settings that must be made before others will take effect:

1) If the controller is already wired it may be best to put the controller into standby by setting parameter r12 to OFF. This way the controller will not try to regulate while setting up the parameters. If this is done, parameter r12 must be changed back to ON for the controller to regulate.
2) The desired units must be set prior to programming any settings. For the units to be entered and displayed in °F and psig, parameter r05 must be changed to F-P (the default units are °C and bar pressure).
3) Change parameter o12 to 60 Hz unless the supply is 50 Hz.

Setting up the controller for superheat regulation

1) Select the valve that is being used, parameter o09. Typical settings are par. o09=4 when using the pulse-width expansion valve type AKVA or par. o09=7 when using the ICM motor valve with ICAD motor actuator's default settings input setting.
2) Enter the pressure transmitters working range in parameters o20 (min value) and o21 (max. value). Note: These settings must be entered in gauge pressure and most transmitter ranges are listed in absolute pressure which will need converted to gauge pressure before entered.
3) Select the refrigerant that is being used, parameter o30. For R717 (ammonia) that setting would be par. o30=5.
4) Set the superheat regulation method, parameter n21. For industrial refrigeration systems, it is best to try load-defined superheat regulation which would be par. n21=2.
5) The controller will regulate superheat based on a user-defined superheat range in parameters n09 and n10. It is best to leave these at the default settings and later fine tune them if needed. *Note: parameter n10 must be set higher than parameter n22.*
6) For most applications the shaded parameters in the parameter list should not be changed.
7) Verify that parameter r12 is ON.

Setting up the thermostat function for controlling a liquid line solenoid valve

The additional temperature sensor S3 must be installed for use of the thermostat function. The controller will then control the solenoid relay and alarm relay based on the sensor S3 reading and the user defined setpoints.

1) Set the thermostat set point. This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously.
2) Set the differential for the thermostat function, parameter r01.
3) Turn on the thermostat function with parameter r14 (r14=1 for ON).
4) If desired, set up the alarm parameters A1, A2 and A3.
5) Verify that parameter r12 is ON.

Survey of functions, settings, and parameters

Regulating settings

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Setpoint for thermostat function for controlling a liquid line solenoid valve Not used for superheat function. Used only for thermostat function. Regulation is based on this user-set value unless there is a displacement of setpoint by an analog signal (see parameter 010). This setting is not changed by entering the parameter list, but by pushing both buttons simultaneously, then using the buttons individually to adjust the setpoint up and down (see the section "Operating the EKC 315A.")	-	-76°F (-60°C)	122°F (50°C)	50°F (10°C)	
Differential for thermostat function When temperature is higher than reference plus this user-set differential, the solenoid valve's relay will be energized. It will be de-energized when the temperature drops below the setpoint.	r01	0.2°F (0.1°K)	36°F (20°K)	3.6°F (2.0°K)	
Units Setting 0: °C and bar Setting 1: °F and psig	r05	C - b (0)	F- P (1)	C - b (0)	
Maximum displacement of thermostat setting or superheat reference by an analog signal from a PLC or other external device. Determines how great a displacement will be added when the input signal is maximum (20 mA). (See parameter o10.)	r06	-90°F (- 50°K)	90°F (50°K)	0°F (0°K)	
Offset of temperature sensor S2 signal To calibrate the sensor reading, or to compensate, for example, for loss due to a long sensor cable.	r09	-18°F (-10°K)	18°F (10°K)	0°F (0°K)	
Offset of temperature sensor S3 signal To calibrate the sensor reading, or to compensate, for example, for loss due to a long sensor cable.	r10	-18°F (-10°K)	18°F (10°K)	0°F (0°K)	
Start-stop of refrigeration Using this setting, refrigeration can be started or stopped. Start and stop can also be accomplished with the external switch function on terminals 1 & 2 (see wiring section).	r12	0 (OFF)	1 (ON)	1	
Thermostat function for controlling a liquid line solenoid valve 0: No thermostat function. Only superheat is regulated. 1: Thermostat function enabled in addition to superheat regulation.	r14	0 (OFF)	1 (ON)	0 (OFF)	

Alarms

The controller is capable of generating alarms. When there is an alarm, the three lower LEDs on the front panel will flash and the alarm relay will cut in.

Alarm for high temperature (sensor S3). When S3 temperature exceeds reference plus this differential temperature setting, the alarm is activated. Note that there may be an alarm delay (A03). Reference can be seen in u28.	A01	5.4°F (3°K)	36°F (20°K)	9°F (5.0°K)	
Alarm for low temperature (sensor S3). When S3 temperature is lower than reference minus this differential temperature setting, the alarm is activated. Note that there may be an alarm delay (A03). Reference can be seen in u28.	A02	1.8°F (1°K)	18°F (10°K)	5.4°F (3.0°K)	
Alarm delay If this parameter is set, a timer is activated when one of the two alarm settings is exceeded. The alarm is generated only after the time delay has passed.	A03	0 (min.)	90 (min.)	30 (min.)	

Regulating parameters

NOTE: Only a trained Danfoss technician should adjust settings given in the gray blocks. Misadjustment could cause serious system malfunction.

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
P: Amplification factor, K_p Increasing proportional factory Kp leads to larger changes in controller output for a given input (regulation becomes faster). Too high a K_p can cause the valve to hunt.	n04	0.5	20	3.0	
I: Integration time T_n Decreasing T_n results in faster response to sensor value changes.	n05	30 (sec)	600 (sec)	120 (sec)	
D: Differentiation time T_d This setting can be turned off by setting its value to minimum (0). Increasing Td increases controller output changes, but can lead to instability.	n06	0 (sec)	90 (sec)	0 (sec)	
Maximum value for superheat reference	n09	4°F (2°K)	90°F (50°K)	10.8°F (6°K)	
Minimum value for superheat reference WARNING: Due to the risk of liquid floodback, the setting should not be lower than approximately 4 - 7°F (2 -4°K).	n10	2°F (1°K)	22°F (12°K)	7°F (4°K)	
MOP If MOP function is not desired, adjust to maximum setting. MOP function limits valve opening degree as long as evaporating pressure is higher than user-set value.	n11	0 psig (0 bar)	870 psig (60 bar)	870 psig (60 bar)	
Period time for AKV and AKVA pulse valves *In most cases, this parameter should not need to be changed.* This parameter determines the length of the control period. The valve is opened for a certain percentage of each successive period. For example, when full valve capacity is called for, the valve will be opened for the entire period. When 60% valve capacity is required, the valve will be opened for 60% of the period. The control algorithm computes the capacity required for each period.	n13	3 (sec)	10 (sec)	6 (sec)	
Stability factor for superheat regulation *This value should only be changed by specially trained service technicians.* A higher value will allow greater superheat fluctuation before the reference is changed.	n18	0	10	5	
Damping of amplification near the reference value *This value should only be changed by specially trained service technicians.* This setting damps Kp near the reference value. A setting of 0.5 will reduce Kp by half.	n19	0.2	1.0	0.3	
Amplification factor for superheat (only in 1:1 systems) This setting determines the ICM or AKV valve's opening degree as a function of the change in evaporating pressure. An increase in evaporating pressure will result in a lower opening degree. When there is a drop-out on the low pressure thermostat during start-up, the value must be raised. If there is pendling during start-up, the value must be reduced a small amount. This value should only be changed by specially trained service technicians.	n20	0.0	10.0	0.4	
Defines superheat regulation (see Appendix 2**)** 1) Minimum stable superheat (MSS). Adaptive regulation. 2) (Works best for industrial refrigeration systems) Based on Load-defined superheat. The reference is established based on the line formed by the three points: n09, n10, and n22.	n21	1	2	1	
Value of minimum superheat reference for loads under 10% The value must be less than n10. The controller will force the valve closed when superheat is below this set value.	n22	2°F (1°K)	27°F (15°K)	4°F (2°K)	
Standby TQ valve (discontinued valve) temperature when valve closed The TQ actuator is kept warm when the valve closes. As the closing point can not be defined exactly due to tolerances and pressure variations, the setting can be changed as needed to affect valve closing tightness.	n26	-27°F (-15°K)	36°F (20°K)	0°F (0°K)	
Standby TQ valve (discontinued valve) temperature when valve open The TQ actuator's temperature is kept low when the valve reaches its fully open position. This parameter sets the number of degrees that the temperature is to be above the expected open temperature when the valve is completely open. A greater value ensures that the valve is open, but a greater value will also result in slower closing.	n27	-27°F (-15°K)	126°F (70°K)	36°F (20°K)	
Maximum opening degree The ICM or AKV valve's opening degree can be limited. The value is set in %. This value should only be changed by specially trained service technicians.	n32	0 (%)	100 (%)	100 (%)	
Minimum opening degree *This value should only be changed by specially trained service technicians.* The ICM or AKV valve's opening degree can be set to a minimum valve that disables full closure.	n33	0 (%)	100 (%)	0 (%)	

Miscellaneous parameters

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Define valve and AO (analog output) signal The controller can control 3 types of valves: pulse-width modulation valve AKVA, motorized valve type ICM with ICAD motor-actuator, and discontinued valve type TQ. 0: No valve selected 1: TQ valve (discontinued), AO is 0-20 mA for remote monitoring 2: TQ valve (discontinued), AO is 4-20 mA for remote monitoring 3: AKV/A valve, AO is 0-20 mA for remote monitoring 4: AKV/A valve, AO is 4-20 mA for remote monitoring 5: AKV/A valve, AO is signal for another controller. See appendix 3. 6: ICM/ICAD, AO is 0-20 mA for communication with valve 7: ICM/ICAD, AO is 4-20 mA for communication with valve (this is the default setting in ICAD) Note: the AO for remote monitoring (when ICM/ICAD is not used) corresponds to the selection made in parameter o17 for what is to appear in the normal display.	o09	0	7	0	
Input signal from PLC, etc., for offsetting the thermostat setpoint or superheat reference **Definition of function and input signal current range** 0: No signal 1. Displacement of temperature reference with 0-20 mA 2. Displacement of temperature reference with 4-20 mA 3. Displacement of superheat reference with 0-20 mA 4. Displacement of superheat reference with 4-20 mA NOTE: At minimum AI, there will be no offset. At maximum AI, the offset will be as set in parameter r06.	o10	0	4	0	
Frequency Must be set to the frequency of the 24 Vac power source.	o12	0 (50 Hz)	1 (60 Hz)	0 (50 Hz)	
Selection of normal display contents and AO This parameter determines what will be shown in the normal display. While viewing the normal display, briefly pushing the lower button will temporarily display the following: if 1 has been selected, media temperature (S3); if 2 has been selected, superheat; or, if 3 has been selected, temperature reference. When the controller is not being used with ICM/ICAD or AKV/A as MASTER (parameter o09=5, 6, or7), then the AO (analog output) on terminals 1 & 2 will correspond to what is shown in the normal display. 1: Superheat 2: Valve's opening degree 3: Media temperature (S3 sensor)	o17	1	3	1	
Manual control of outputs For service purposes, the individual relay outputs and the AKV/A output can be overridden (forced ON), but only when regulation has been stopped. When this setting is OFF, there is no override. 1) Relay to the solenoid valve is ON 2) AKV/A output is ON 3) Alarm relay is activated (shorts terminals 12 & 13	o18	0FF	3	OFF	
Minimum of pressure transmitter range The working range of the pressure transmitter must be entered in gauge pressure. The minimum value is set by this parameter and the maximum value by the next. Example: A transmitter with the specified range of 0 to 200 psia, must be entered as -14.5 and 185 psig.	o20	-14.5 psig (-1 bar)	870 psig (60 bar)	-14.5 psig (-1.0 bar)	
Maximum of pressure transmitter value range (see above explanation)	o21	-14.5 psig (-1 bar)	870 psig (60 bar)	174 psig (12 bar)	

Miscellaneous parameters (continued)

Description of setting	Parameter	Minimum	Maximum	Factory setting	Field setting
Value of analog output at minimum current (terminals 2 & 5) (only applicable to AKV/A or TQ) Lower end of temperature or opening degree range that will yield a current output of 0 mA or 4 mA, depending on the selection made for parameter o09 (only if AKV/A is used)	o27	-94°F (-70°C)	320°F (160 °C)	-31 °F (-35 °C)	
Value of analog output at maximum current (terminals 2 & 5) (only applicable to AKV/A or TQ) Upper end of temperature or opening degree range that will yield a current output of 20 mA.	o28	-94°F (-70 °C)	320°F (160 °C)	59°F (15 °C)	
Refrigerant Setting The refrigerant must be defined before startup. ***Failure to select the correct refrigerant may result in compressor damage.*** 1 = R-12 2 = R-22 3 = R-134a 4 = R-502 5 = R-717 6 = R-13 7 = R-13b1 8 = R-23 9 = R-500 10 = R-503 11 = R-114 12 = R-142b 13 = user defined 14 = R-32 15 = R-227 16 = R-401A 17 = R-507 18 = R-402A 19 = R-404A 20 = R-407C 21 = R-407A 22 = R-407B 23 = R-410A 24 = R-170 25 = R-290 26 = R-600 27 = R-600a 28 = R-744 29 = R-1270	o30	0	29	0	

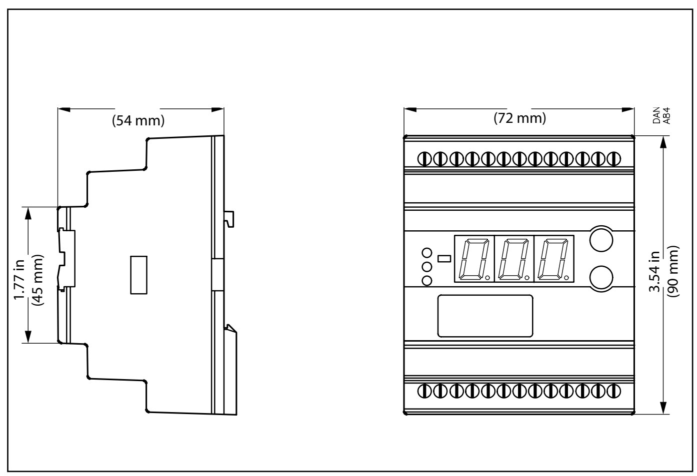
Service Parameters for Troubleshooting (view only)

Description of parameter	Parameter	Units*
Current TQ valve's (discontinued valve) actuator temperature	u04	°F or °C
Reference for TQ valve's (discontinued valve) actuator temperature	u05	°F or °C
Analog input current signal (terminals 18 & 19) from PLC, etc.	u06	mA
Analog output current signal on terminals 2 & 5	u08	mA
Digital input status. Combination of parameter r12 and terminals 1 & 2	u10	ON-OFF
Ongoing cut-in time for thermostat or duration of last completed cut-in	u18	minutes
Temperature of S2 temperature sensor (used for superheat)	u20	°F or °C
Current calculated superheat	u21	°F or °K
Controller's superheat reference (target superheat controller is trying to achieve)	u22	°F or °K
Valve's opening degree	u24	%
Evaporating pressure based on pressure transmitter	u25	psig or bar
Evaporating temperature based on pressure transmitter and selected refrigerant	u26	°F or °C
Temperature of S3 temperature sensor (used for thermostat function for solenoid valve)	u27	°F or °C
Control reference (setpoint + any offset provided by an input signal from a PLC or other source)	u28	°F or °C
Pressure transmitter current signal (terminals 14 & 15)	u29	mA

** The displayed units will depend on the units setting parameter r05.*

Technical Data

The supply voltage is galvanically isolated from the input and output signals, but the input and output signals are not galvanically isolated from each other.



Supply voltage
24 V ac ± 15%, 50-60 Hz
80 VA maximum (5 VA for controller and additional 55 VA when the controllers powers the coil for an AKV/A pulse valve or an additional 75 VA when used with the discontinued TQ valve).

Input signals
Current input signal on terminals 18 & 19, 4-20 mA or 0-20 mA
Pressure transmitter, 4-20 mA from AKS 33
Digital input on terminals 1 and 2 for start-stop of regulation
Temperature sensor input, 2 PT 1000

Analog output (terminals 2 and 5)
Current signal: 4-20 mA or 0-20 mA
Load: 200Ω maximum

2 Relay outputs
each SPST, AC-1/4A resistive or AC-15: 3A inductive

Ambient temperature
During operation: +14°F to 131°F (-10 °C to 55°C)
During transport: -40°F to 158°F (-40°C to 70°C)

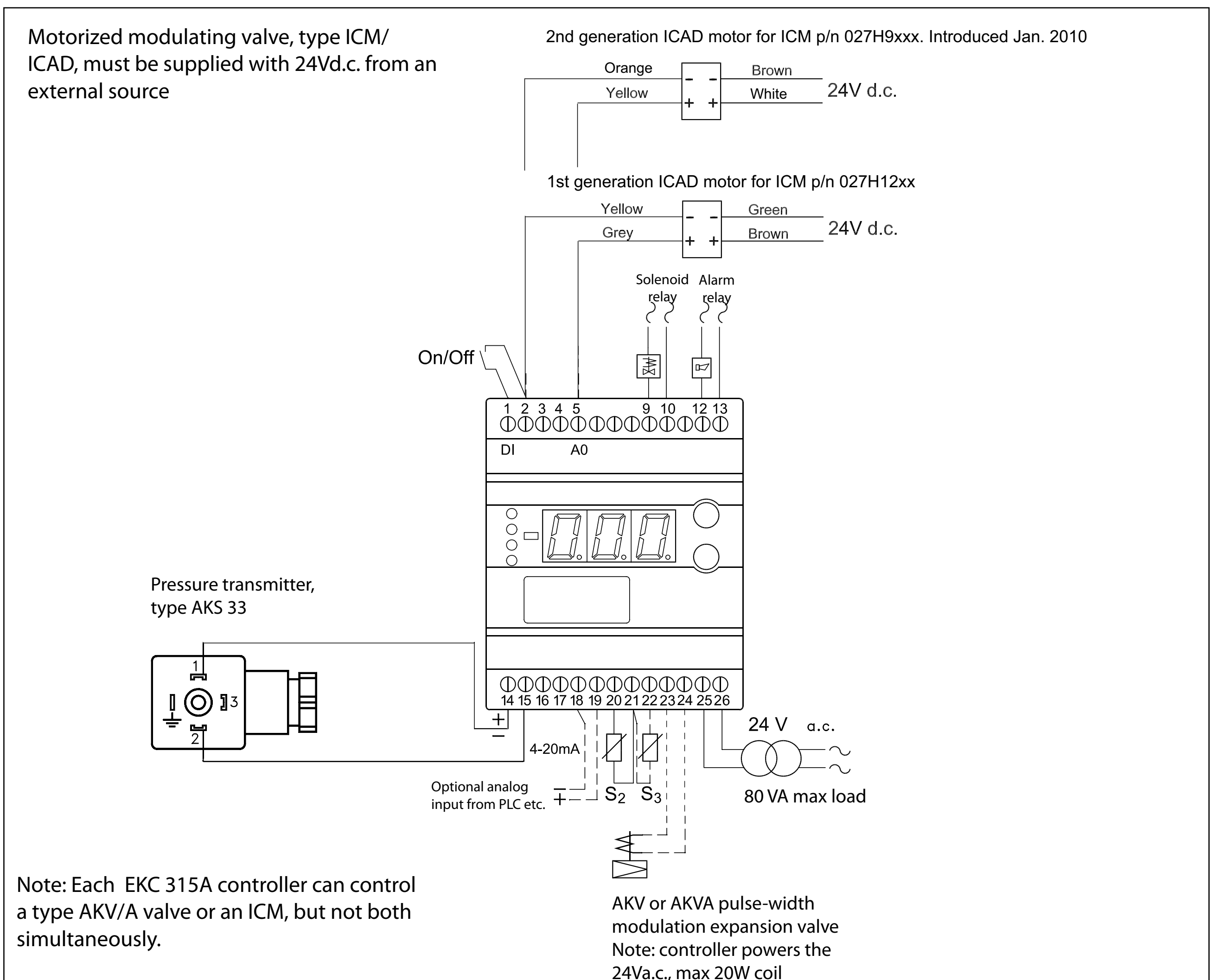
Approvals
EU Low Voltage Directive complied and EMC demands re CE-marking complied with
LVD tested according to EN 60730-1 and EN 60730-2-9
EMC tested according to EN50081-1and EN 50082-2

Mounting: DIN rail
Enclosure: IP 20 (approximately NEMA 1)
Weight: 0.66 lbs (300 g)
Display: LED, 3 digits
Terminals: Maximum 2.5 mm² multicore

Wiring diagram and terminal functions

Terminal pairs	Description
1-2	Switch function for start-stop of regulation. When there is no connections between terminals 1 & 2, the controller will send a signal to close the valve. ***If not using a switch, terminals must be shorted with a jumper wire.***
2-5	Current output that is used: 1. To control a motorized valve type ICM with ICAD motor actuator, or 2. For remote monitoring when the ICM/ICAD is not used (see parameter o09).
9-10	Optional relay output for control of a liquid line solenoid valve. Control is based on thermostat setting. The relay is closed on power failure.
12-13	Alarm relay. There is no connection between 12 and 13 during alarm conditions or when the controller is not functioning.
14-15	Pressure transmitter, type AKS 33 or equivalent. Note: controller powers the 4-20 mA loop (no additional power source needed.

Terminal pairs	Description
17-18	Signal from TQ (discontinued valve actuator. See Appendix 1 for TQ wiring diagram).
18-19	Optional current input from PLC or other source, for offsetting the thermostat setting or superheat reference.
20-21	Temperature sensor S2 (PT 1000) at evaporator outlet for superheat.
21-22	Temperature sensor S3 (PT 1000) for thermostat function controlling a liquid line solenoid valve.
23-24	24 Vac output for control of pulse width modulated valve type AKV/A (Maximum 20Ws coil). Can also be used to power the discontinued type TQ valve (see Appendix 1 for TQ wiring diagram.
25-26	Supply voltage 24 Vac. 80 VA maximum load depending on valve



Troubleshooting

Failure to regulate after Setup

If, after setting up according to the Quick Setup Guide on page 6, the valve will not regulate, the cause may be one of the following:
1. There is no connection (either a closed switch or a jumper wire) between terminals 1 & 2.
2. The internal start-stop parameter (r12) has been set to OFF.
3. No valve has been selected by parameter o09.
4. The thermostat function is being used and the thermostat is satisfied.

If superheat fluctuates excessively

Once the refrigeration system is stable, the controller's factory settings will usually provide fast reaction to changes in load. If, however, the superheat fluctuates excessively, there are two possible causes: Either superheat parameters are set too low, or regulation parameters need some adjustment.

Adjustment of superheat parameters:
First, try to solve the problem by increasing the superheat parameters as follows:
it is likely that superheat parameters should be adjusted to higher values. This is accomplished as follows:

If adaptive superheat has been selected:
Adjust: n09, n10 and n18.

If load-defined superheat has been selected:
Adjust: n09, n10 and n22.

Adjustment of regulating parameters:
These adjustments should only be undertaken by specially trained technicians using data monitoring equipment. If superheat parameter adjustment does not result in stability, Adjust regulation parameters using the following procedures:

If the oscillation time (T_p) is longer than the integration time (T_n, parameter n05) time:
($T_p > T_n$, (T_n is, say, 240 seconds))
1. Increase T_n to 1.2 times T_p
2. Wait until the system is in balance again
3. If there is still oscillation, reduce K_p (initially by about 20%)
4. Wait until the system is in balance
5. If it continues to oscillate, repeat 3 and 4, reducing K_p by smaller amounts.

If the oscillation time is shorter than the integration time:
($T_p < T_n$, (T_n is, say, 240 seconds))
1. Reduce K_p by, say, 20% of the scale reading
2. Wait until the system is in balance
3. If hunting continues, repeat steps 1 and 2, decreasing K_p by a smaller amount.

If the superheat has excessive underswing during start-up

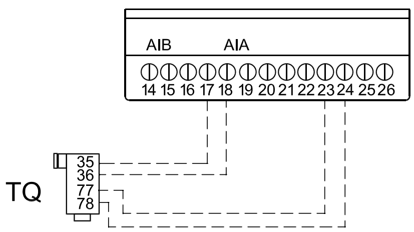
If regulation is by valve type ICM with ICAD motor or by AKV/A pulse-width modulation valve:
Increase n22 slightly, or decrease n04 slightly, or both.

If you regulate with discontinued valve type TQ:
Decrease n26 slightly.

Appendices

These appendices are referenced in various parts of the text.

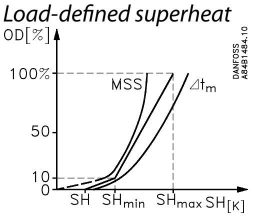
Appendix 1: Wiring diagram for discontinued TQ valve



Appendix 2

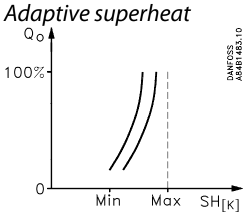
The two types of superheat regulation, load-defined control and adaptive control are shown below. For industrial refrigeration applications, load-defined control should be tried first.

Load-defined superheat



The reference follows a defined curve. This curve is defined by three values: the superheat value that will close the expansion valve (parameter n22), the minimum superheat reference value (parameter n10), and the maximum superheat reference value (parameter n09). These three values must be selected in such a way that the curve is situated between the minimum stable superheat (MSS) curve and the curve for average temperature difference ΔTm (temperature difference between media temperature and evaporating temperature).

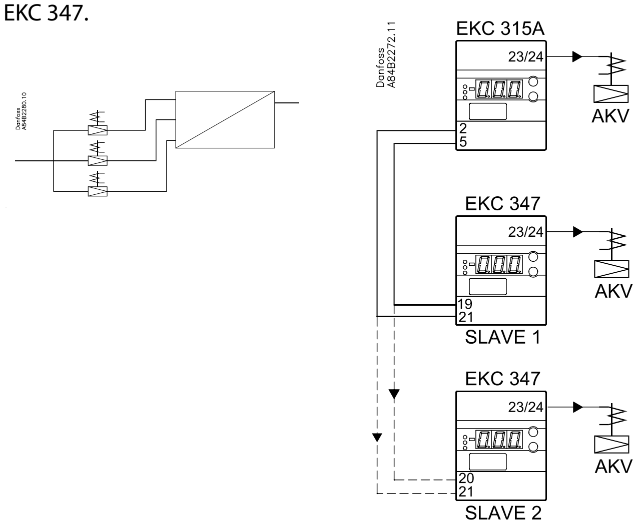
Adaptive superheat



Regulation is based on evaporator load by establishing minimum stable superheat (MSS). The superheat reference is lowered to the exact point where instability begins.
The superheat is limited by the settings for minimum and maximum superheat.

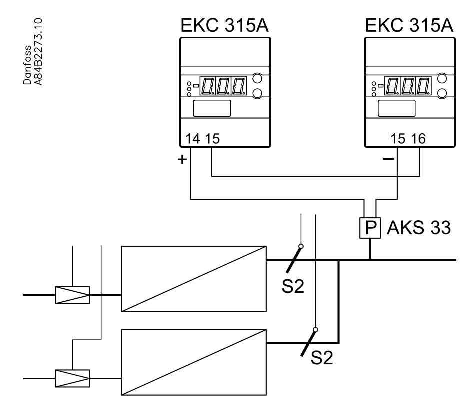
Appendix 3

Wiring diagram for applications that use more than one AKV/A pulse width modulating expansion valve in parallel to control the refrigerant flow to a single evaporator. This strategy is used in situations where the evaporator to be controlled exceeds the capacity of a single expansion valve.
Remember to set parameter o09 in both the EKC 315A and the EKC 347.



Appendix 4

If there are two evaporators sharing the same suction line, the signal from the pressure transmitter can be used by up to two controllers.



ENGINEERING
TOMORROW

EKC 361
Electronic Media Temperature controller

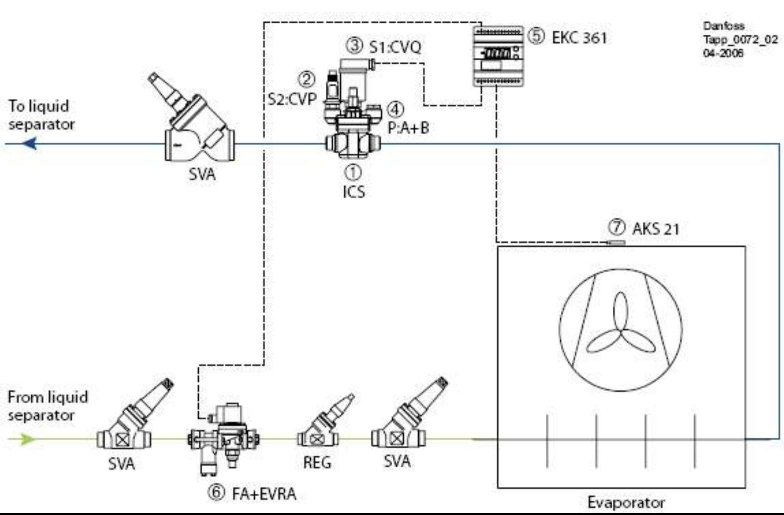
Electronic Media Temperature Controller
Type EKC 361

Functions

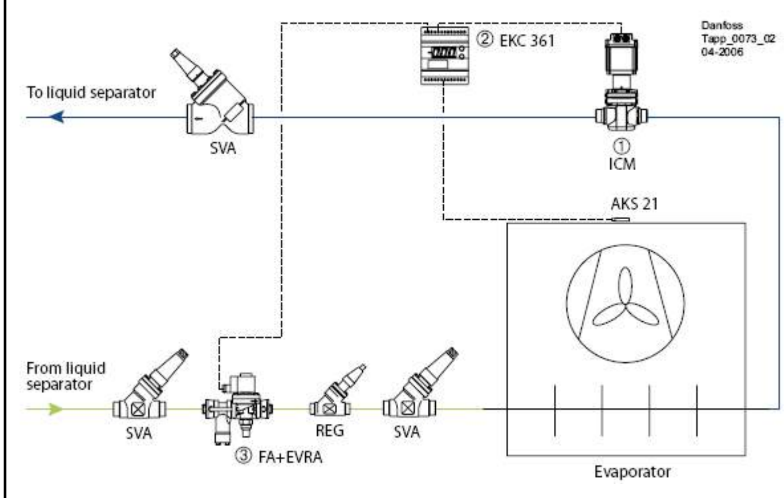
- Gives a very accurate modulating temperature control (within ½ °F or better after transient phenomenon) by sending a signal to a CVQ or CVE pilot that is mounted on an ICS (or old PM) pilot regulating valve. Also controls an ICM/ICAD motorized valve.
- Relay output to control a solenoid valve with the DI or during a low temperature alarm
- Relay output to control fans with the DI
- Alarm relay when set limits are exceeded
- Gives a 4-20 mA analog output that follows the temperature shown in the display (when ICM valve is not used)

Application examples with CVQ pilot and ICM/ICAD:

ICS Pressure Regulator with CVQ Pilot.



ICM motorized valve

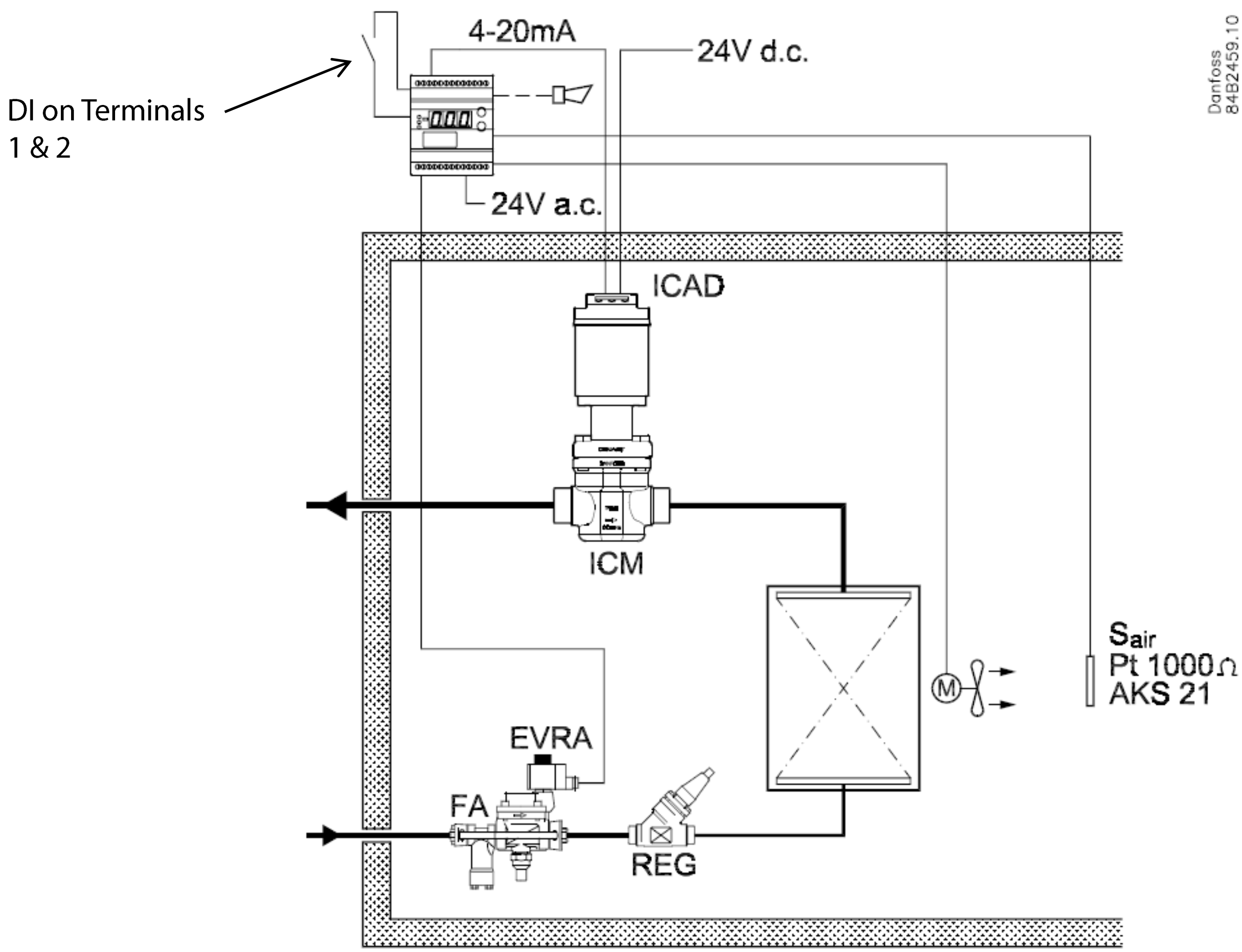


Electronic Media Temperature Controller
Type EKC 361

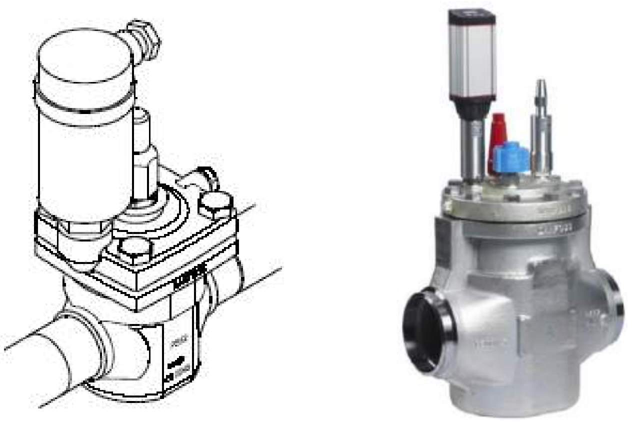
Application examples with ICM/ICAD and controlling solenoid/fans

When there is no connection between the digital input terminals 1 & 2 the controller will be in standby and the relay outputs for solenoid and fan will be off. When there is a connection the controller will regulate and the relay outputs for solenoid and fan will be on unless there is a low temperature alarm which will turn off the solenoid relay.

This solenoid output can also be used to control a solenoid function on a pilot operated suction regulator to force the valve to regulate on the mechanical pilot.



Comparison: Regulators vs. Motorized Valves



ICS with CVQ or CVE pilot

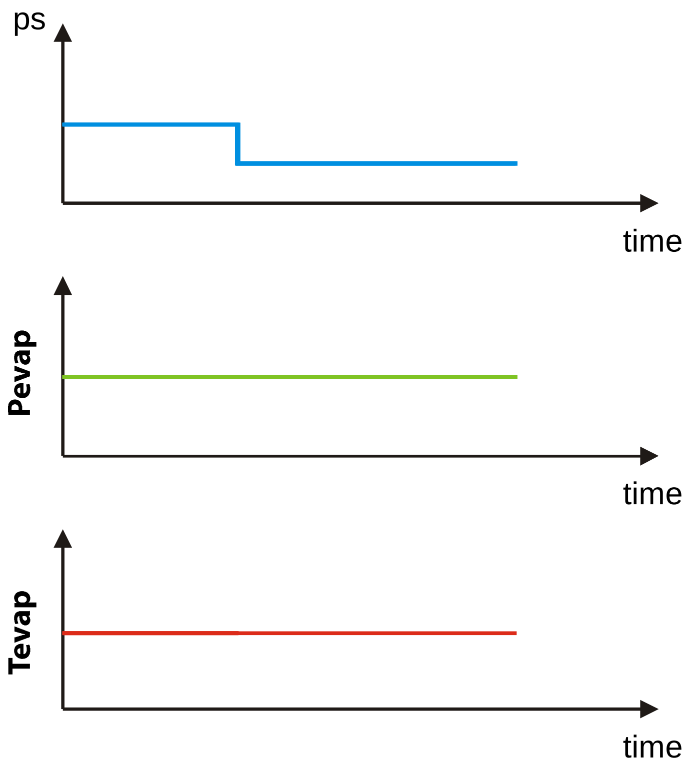
- Control is suction pressure **independent**
- EKC 361 controls the **evaporator pressure** based on temperature input
- **Ability to limit** the pressure/temperature working range of the evaporator
- **No indication** of valve opening degree

ICM with ICAD motor

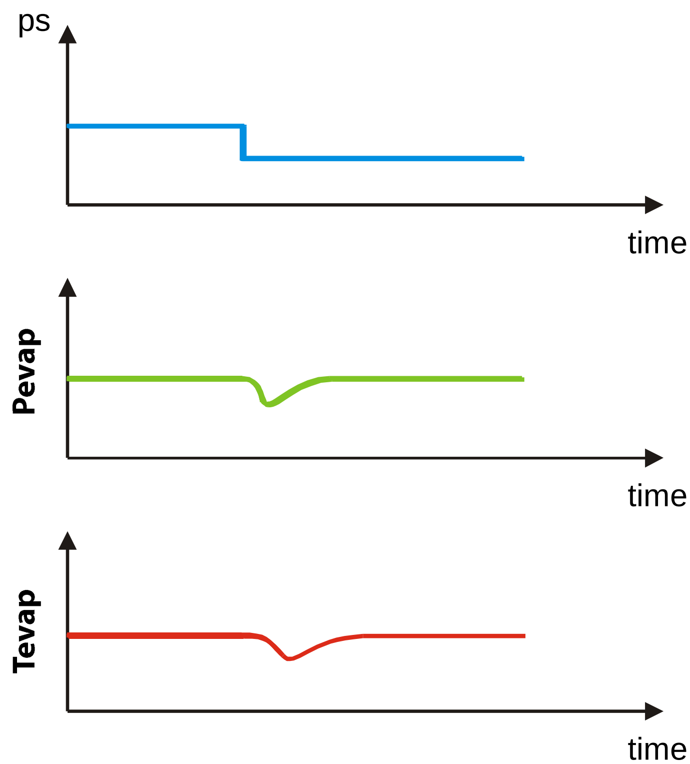
- Control is suction pressure **dependent**
- EKC 361 controls **valve opening degree** based on temperature input
- **Not able to limit** the pressure/temperature working range of the evaporator
- **Direct indication** of valve opening degree

Comparison: Constant Load with a Drop In Suction Pressure

ICS with CVE or CVQ pilot



ICM with ICAD motor



Advantages of Each Control Approach

Pressure Regulator

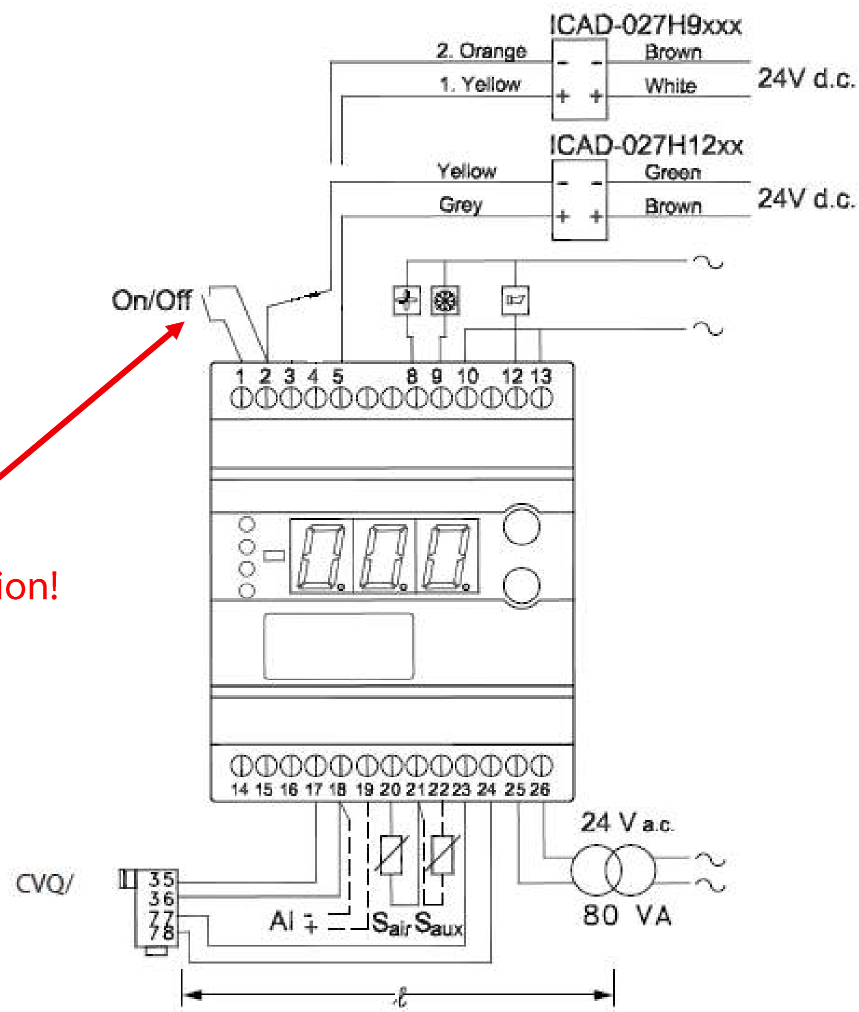
- Can control evaporator pressure range to avoid freeze-up in water chillers.
- Excellent for systems with stable loads and varying suction pressure.

Motorized Valve

- Performs very well in systems with varying loads.
- Can operate with lower pressure drops than that of a pressure regulator
- Works well at low loads

Wiring the EKC 361

- 24 VAC Power supply must be at least 100 VA
- EKC361 is capable of running an ICAD motor that controls and ICM motorized valve or CVE pilot valve in ICS regulator. It can also control an electronic CVQ pilot in ICS valve.
- Two digital output relays terminals 8 & 10 and 9 & 10 can operate a liquid feed solenoid valve or solenoid feature on suction regulator if necessary. Max 2.0 amps. 115Vac



On/off function switch (terminals 1 & 2) enables/disables regulation!

Must have a jumper wire installed if not used with switch etc.

EKC 361 Main Parameters when Running with ICAD motor

To set main temperature setting, push both buttons at same time from main screen. Make change by using either button, then both buttons to save.

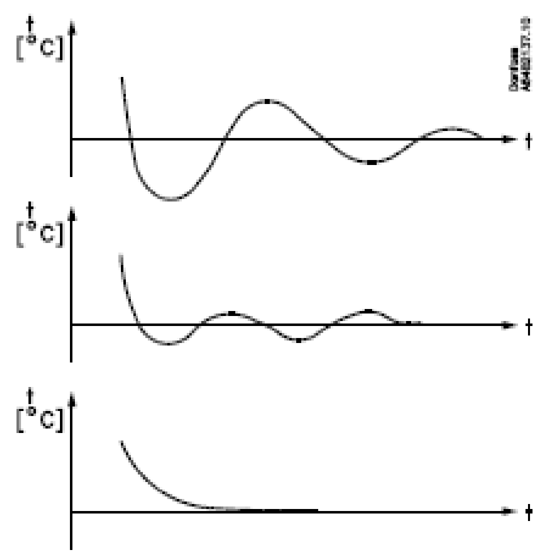
To access parameter setting, press upper button for a few seconds until parameter list appears. Use either button to find the parameter you want to change, then push both buttons at same time to change setting and both buttons to save when done.

- Parameter n03 = 6 Selects output for ICAD motor (Factory setting = 2). Note if ICAD is used with CVE pilot parameter n32 and n33 needs set per CVE instructions to limit pressure regulating range by limiting ICAD opening degree.
- Parameter o12 = 1 (60 Hz, Factory setting = 0)
- Parameter n07 = see below and select 0, 1 or 2 based on control method needed
- Optional alarm parameters A01, A02 & A03

Explanation of parameter n07 setting

Temperature is quickly attained
With the built-in PID control and the possibility of choosing be-tween three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant. See parameter (n07).

- **Fastest** possible cooling Setting=1
- Cooling with **less** underswing Setting=0
- Cooling where underswing is **unwanted.** Setting=2 (default setting)



EKC 361 Main Parameters when Running ICS/PM Valves with CVQ Electronic Pilot

To set main temperature setting, push both buttons at same time from main screen. Make change by using either button, then both buttons to save.

To access parameter setting, press upper button for a few seconds until parameter list appears. Use either button to find the parameter you want to change, then push both buttons at same time to change setting and both buttons to save when done.

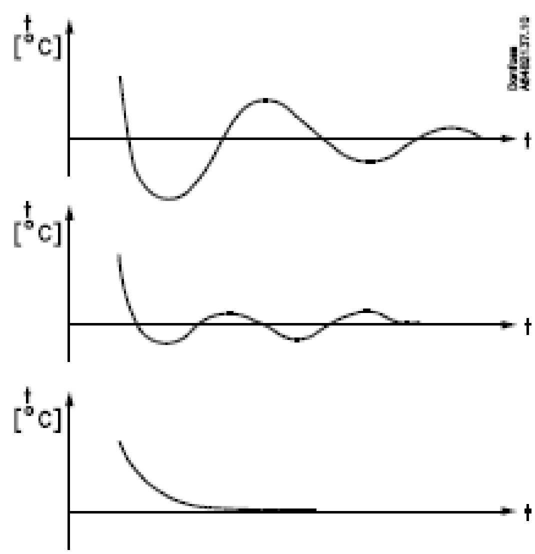
- n01 = Max Evap temp (See chart on next page)
- n02 = Min Evap temp (see chart on next page)
- n03 = must set this based on the CVQ range you have. Default is range: 0 to 87 psig
- o12 = 1 (60 Hz, Factory setting = 0)
- n07 = see below and select 0, 1 or 2 based on control method needed

Explanation of parameter n07 setting

Temperature is quickly attained

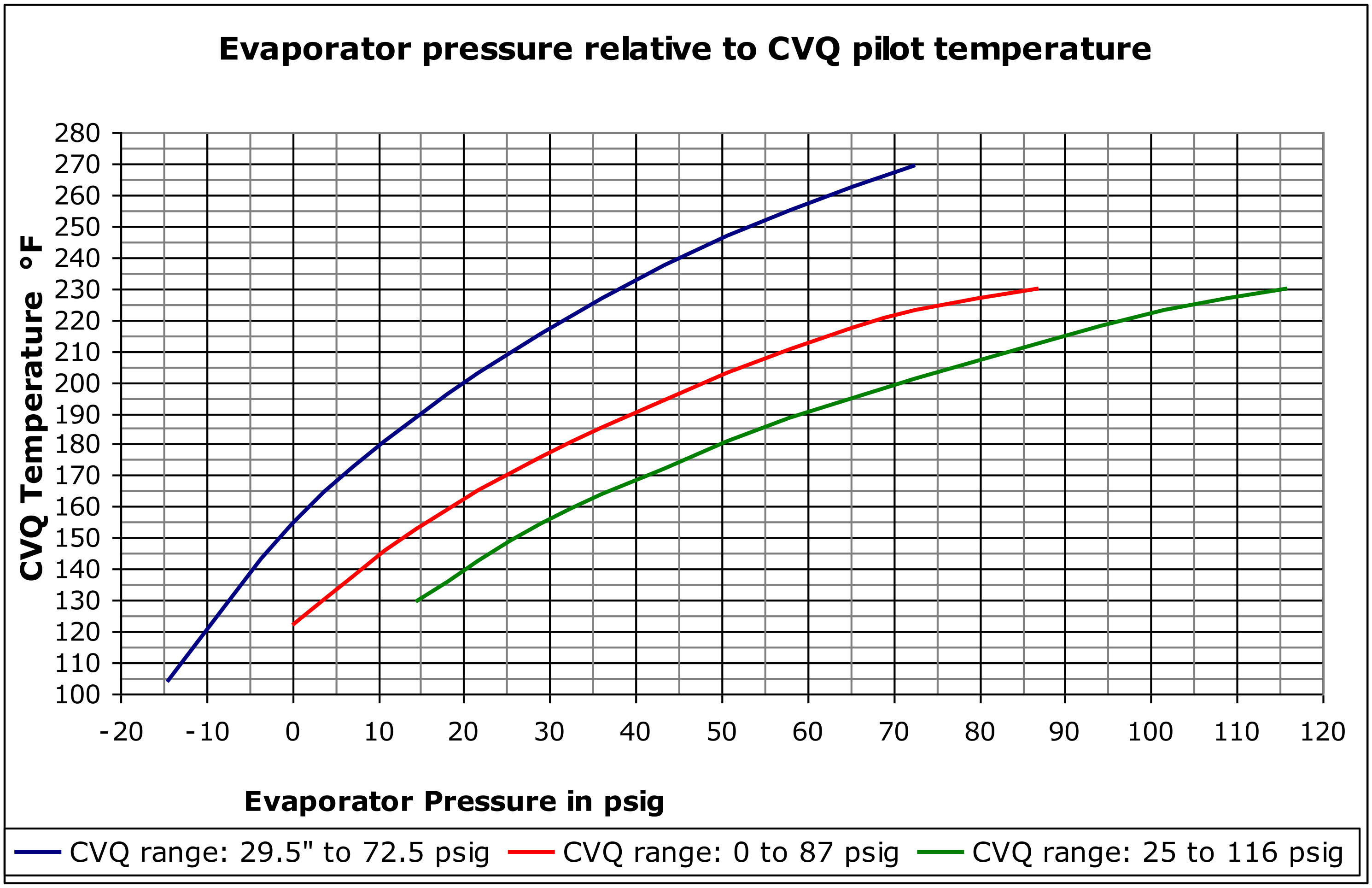
With the built-in PID control and the possibility of choosing between three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant. See parameter (n07).

- **Fastest** possible cooling Setting=1
- Cooling with **less** underswing Setting=0
- Cooling where underswing is **unwanted.** Setting=2 (default setting)



Graph in °F and PSIG

This graph indicates the evaporator temp./press. that the ICS or PM valve will maintain when the CVQ pilot is at its corresponding temperature.



Electronic Interface Module
Type EKC 366

When do you use the EKC 366?

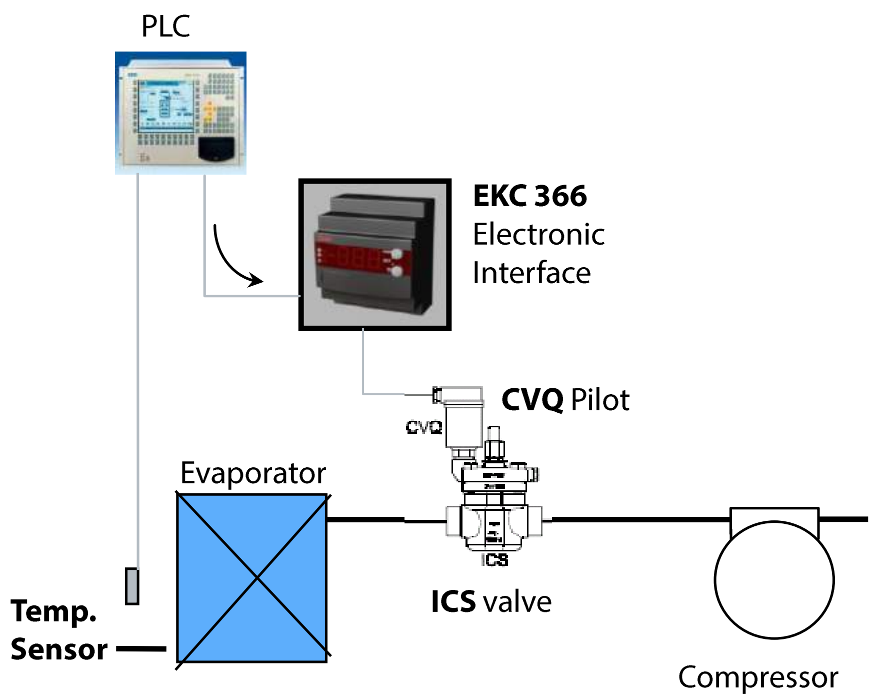
If the facility wants to control the function from a central system, such as a PLC or computer the EKC 366 interface controller is required to interpret the central systems information and then send the proper signal to the CVQ pilot .

The interface controller receives a variable signal from a PLC or similar device and will subsequently regulate a CVQ pilot combined with the ICS or PM regulator so the refrigerating temperature is as accurate as possible

Application example

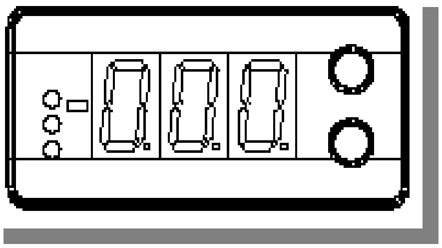
EKC 366 tries to maintain a set temperature inside the CVQ pilot which will correspond to an evaporator pressure.

A 0-20mA, 4-20mA, 0-10V or 2-10V input signal form a PLC etc. can offset the CVQ temperature set point which will offset the evaporator pressure by the amount set in the controller.



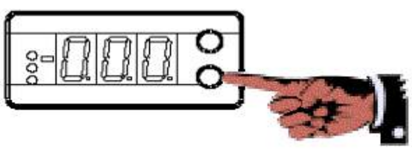
Electronic Interface Module
Type EKC 366

EKC 366



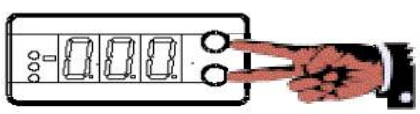
The temperature that is normally displayed on the controller is the current temperature that is being read inside the CVQ pilot (not the evaporator or media temperature).

Note: The EKC 366 will not display an evaporator temperature

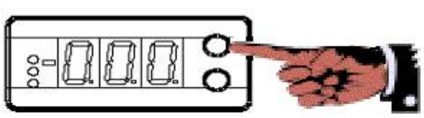


By pressing the bottom pushbutton during normal operation you will see the temperature that the EKC 366 is trying to reach inside the CVQ pilot. This corresponds to the temperature set point + any temperature offset (Parameter r06)

Changing the CVQ temperature set point

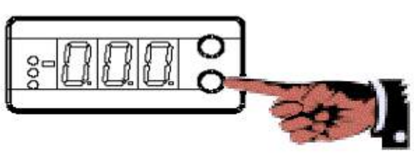


Gives access to change set point

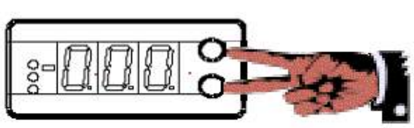


Increase setting

OR



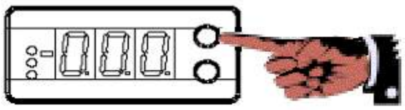
Decrease setting



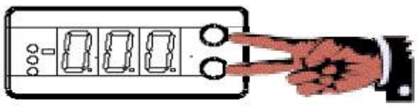
Saves new set point

Electronic Interface Module
Type EKC 366

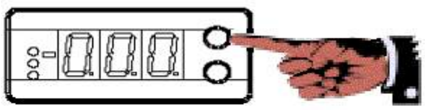
Changing a parameter setting



Gives access to parameter menu
(must hold for 5 sec)

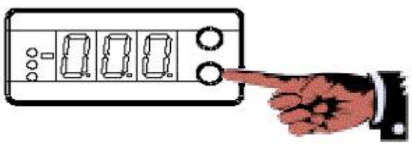


Gives access to change parameter setting

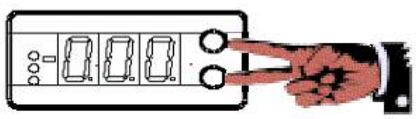


Increase setting

OR



Decrease setting

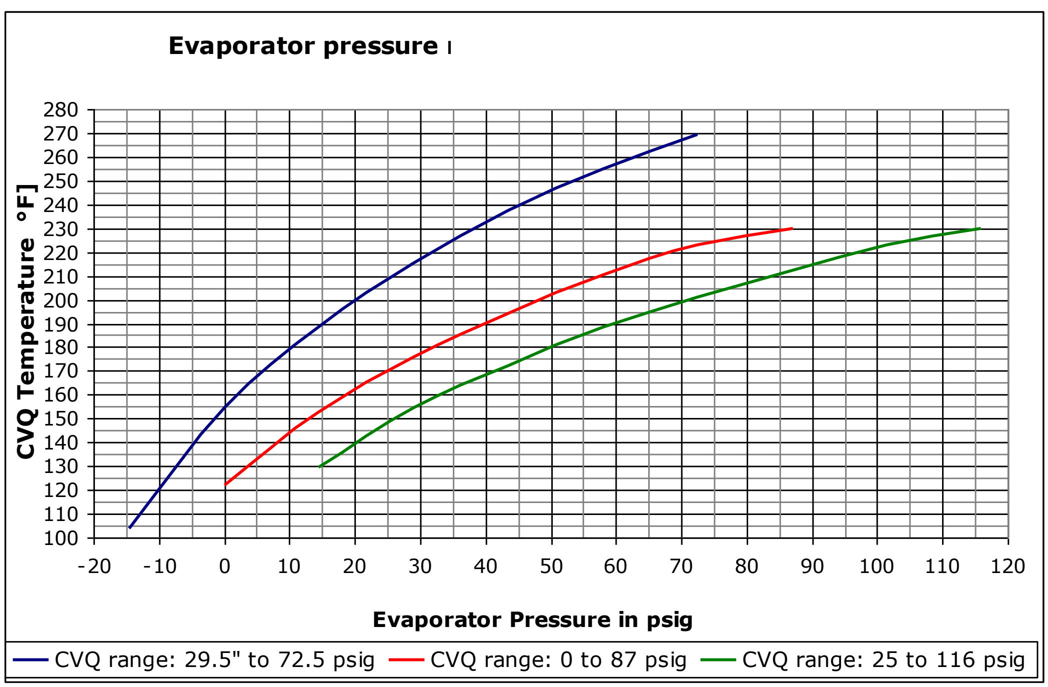


Saves new set point

Parameter r06 in the controller is the set amount of temperature offset that the CVQ pilot temperature will have from the main pilot temperature set point, when the external input signal from a PLC is at its maximum (ex. 20mA). This change in temperature in the pilot will either increase or decrease the evaporator pressure according to the graph below.

Temp. in CVQ vs. Evaporator press. / temp

The curves represent the pressure range of the CVQ pilot that is being used to control ICS and PM valves



User Guide

Media temperature controller
EKC 361

The controller and valve can be used where there are stringent requirements to accurate temperature control in connection with refrigeration.

E.g.:
- Cold room for fruits and food products
- Refrigerating systems
- Work premises in the food industry
- Process cooling of liquids

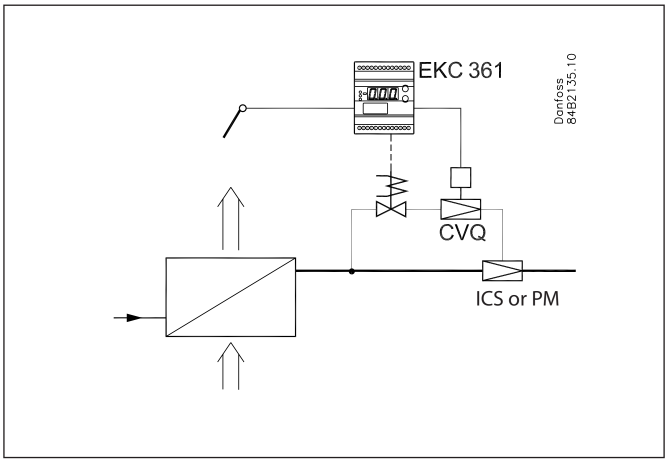
Features

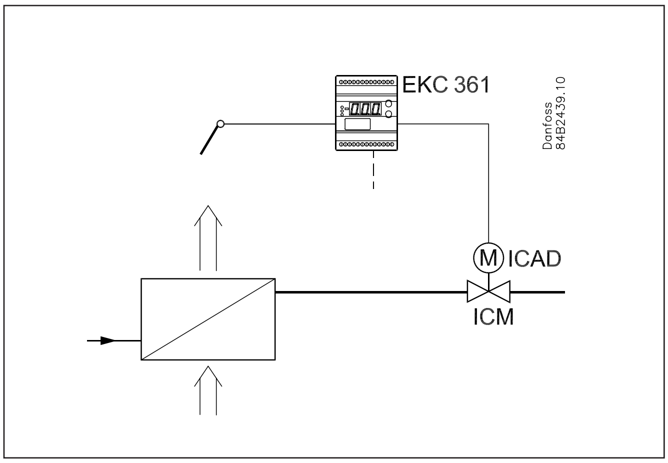
- The temperature is kept within an accuracy of ±0.25°C or better after a transient phenomenon.
- The evaporator's temperature is kept as high as possible, so that the air humidity is kept high and waste is limited.
- A transient phenomenon can be controlled with the adaptive function. Select either:
  - Fast build-up where underswings are allowed
  - Not quite so fast build-up where under swings are less pronounced
  - Build-up without underswings
- PID regulation
- p_0 limitation

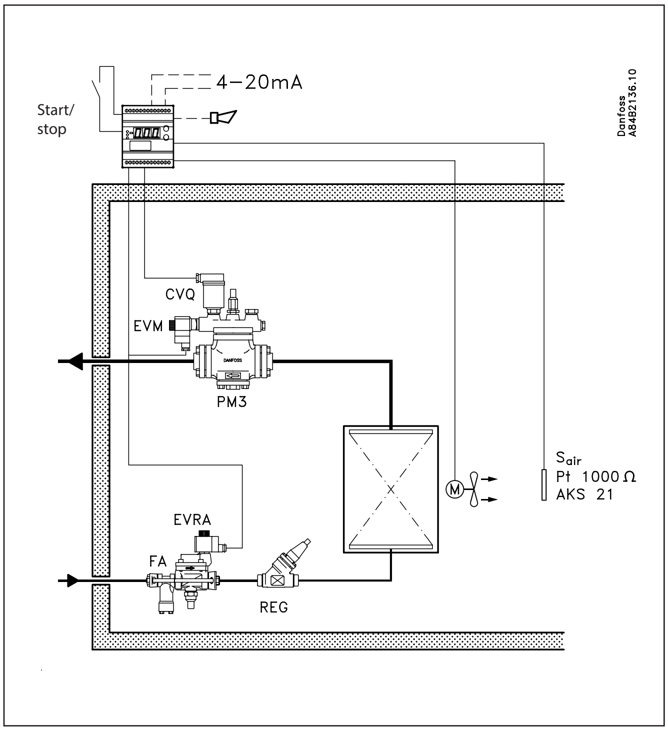
Introduction

Functions

- Modulating temperature control
- Digital ON/OFF input for start/stop of regulation ICS/PM or forced closing of ICM
- Alarm if the set alarm limits are exceeded
- Relay output for fan
- Relay output for solenoid valves
- Analog input signal that can displace the temperature reference
- Analog Output signal corresponding to selecting temperature as running display value. Please observe : Not possible if ICM is selected as valve

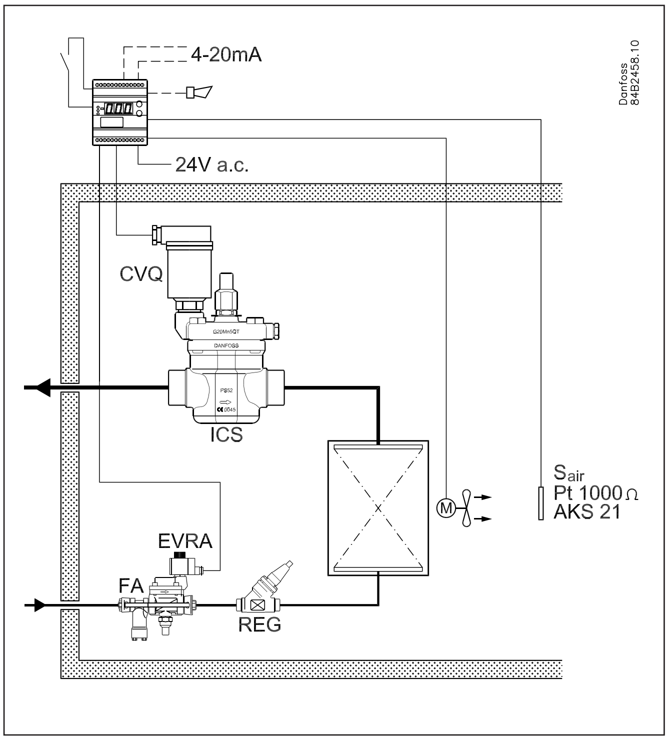




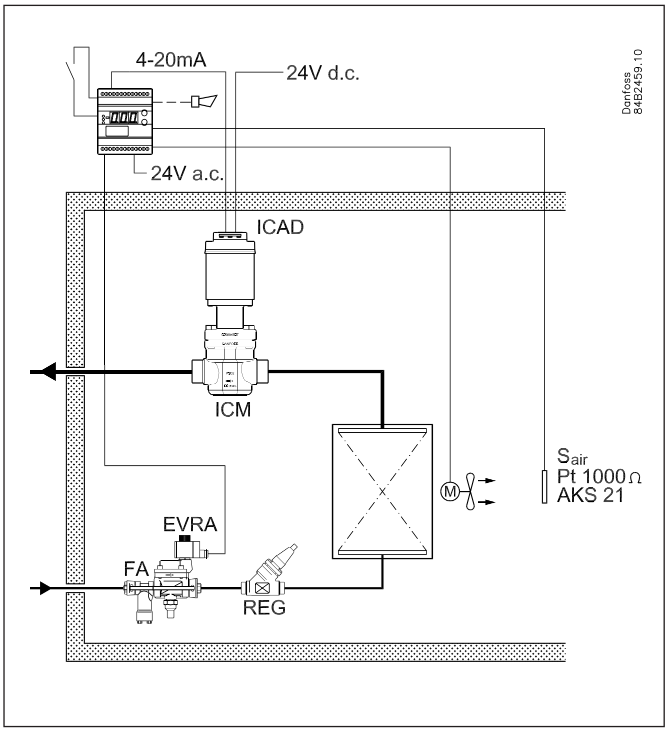


Application examples

ICS/PM
ISC/PM with CVQ is a pilot-operated and pressure-dependent valve for controlling media temperature.
The ICS or PM must be equipped with a CVQ pilot valve in order to position ICS or PM. The CVQ valve is operated by the EKC 361 controller.
Please notice that a power failure will cause the CVQ pilot valve to fully open ICS/PM. If it is required that ICS/PM must close at power failure, the pilot valve type EVM-NC can be installed.
If the Digital Input is ON, it releases the ICS/PM for controlling temperature. If the Digital Input is OFF, if stops controlling PM/ICS, but EKC 361 will maintain a CVQ minimum temperature. (Parameter n02)
Please see separate literature for ICS/PM
ICS : DKRCI.PD.HS0.A-
PM : DKRCI.PD.HL0.A-



ICM
ICM is a direct activating and pressure independent valve for controlling media temperature.
When ICM is selected, the ICM is positioned directly via the analog output 0/4-20mA output from the EKC 361.
If the Digital Input is ON, it releases the ICM for controlling temperature. If the Digital Input is OFF, the ICM is forced to close.
The opening degree OD 0-100 % can be limited by parameter n32 and n33.
Please see separate literature for ICM
ICM : DKRCI.PD.HT0.A-

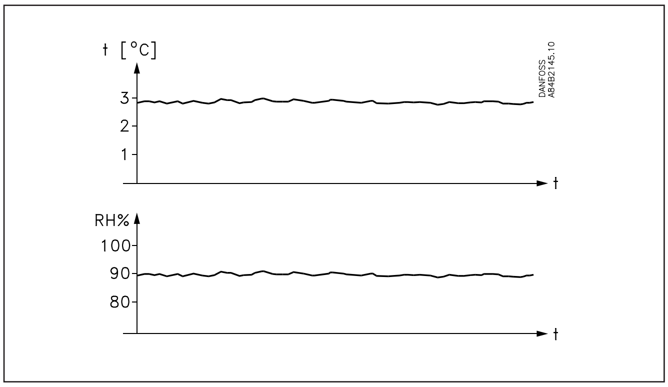


General for ICS/PM and ICM
The EKC 361 can also operate a solenoid valve in the liquid line (Digital output on terminal 9 and 10). It will follow the status of Digital Input, however if a low temperature alarm is detected (A2 alarm) the solenoid valve in the liquid line will be closed.
The EKC 361 can also operate a fan (Digital output on terminal 8 and 10). It will follow the status of Digital Input.
The Parameter (r12) must be ON in order to ensure general operation. If Parameter (r12) is OFF, EKC 361 will operate corresponding to if Digital Input is OFF
As media temperature sensor is S_{air} is used. Please observe that S_{air} can also be used to control liquid.
As option an auxiliary temperature sensor Saux can be installed but only for monitoring.
S_{air}/S_{aux} can both be shown as running display value selected by parameter o17. The selected sensor (S_{air} or S_{aux}) will be sent out on the Analog Output as 0/4-20 mA.
Temperature scaling with parameter o27 and o28. Please observe by ICM the Analog Output is not available for sending temperature signals (S_{air} or S_{aux}).
It is normally recommended, on a aircooler, to install S_{air}, at the evaporator air outlet side.

Extra options
• PC operation
The controller can be provided with data communication, so that it may be hooked up with other products in the ADAP-KOOL® range of refrigeration controls. Operation, monitoring and data collection can then be performed from a PC - either in situ or at a service company.

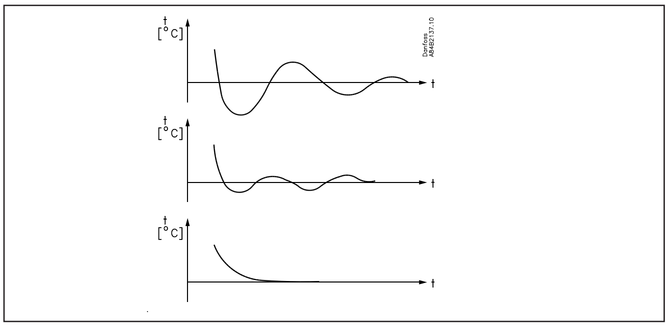
Function

Very accurate temperature control
With this system where controller, pilot valve and main valve have been adapted for optimum use in the refrigerating plant, the refrigerated products may be stored with temperature fluctuations of less than ±0.25°C.

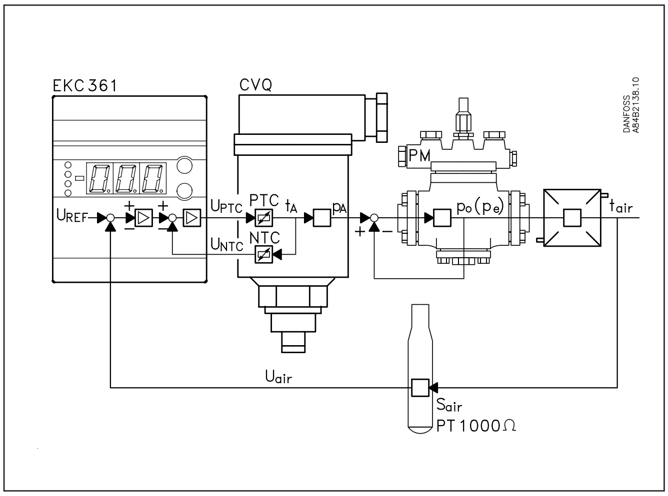


High air humidity
As the evaporating temperature is constantly adapted to the refrigeration needs and will always be as high as possible with a very small temperature fluctuation, the relative air humidity in the room will be kept at a maximum.
Drying-out of the products will in this way be reduced to a minimum.

Temperature is quickly attained
With the built-in PID control and the possibility of choosing between three transient phenomena, the controller can be adapted to a kind of temperature performance that is optimum for this particular refrigerating plant. See parameter (n07).
- **Fastest** possible cooling
- Cooling with **less** underswing
- Cooling where underswing is **unwanted.**

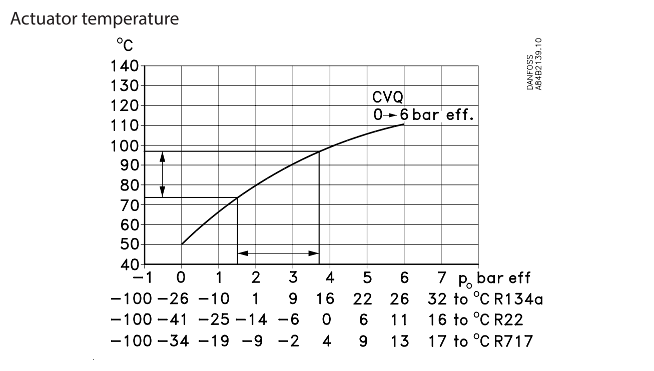


Regulation ICS/PM with CVQ
The controller receives signals from room sensor S_{air}. This room sensor must be placed at the air outlet from the evaporator to obtain the best possible regulation. The controller sees to it that the required room temperature is maintained.
Built-in between the controller and the actuator is a so-called inner control loop which constantly checks the temperature (pressure) in the actuator's pressure vessel. In this way a very stable control system is obtained.
If there is a deviation between the required and the registered temperature the controller will immediately send more or fewer pulses to the actuator to counteract the error. A change of the number of pulses will act on the temperature and hence the pressure in the pressure vessel. As the charging pressure and the evaporating pressure p_0 follow each other, a changed charging pressure will produce the effect that the valve's opening degree is also changed. The ICS/PM with CVQ system maintains the pressure in the evaporator whatever pressure changes there may be on the suction side (on the ICS/PM valve's outlet).



Evaporating pressure limitation (p_0 limitation)
The inner control loop mentioned above also causes the evaporating pressure to stay within a fixed limit. In this way the system is safeguarded against a too low supply air temperature.
It offers the following advantages:
- High-temperature systems can be connected to low-temperature compressor units
- Protection against icing on evaporator
- Frost protection of liquid coolers

The allowed temperature in the actuator determines the evaporating pressure



Regulation with ICM
When using ICM as selected valve the system will still control ICM in order to maintain S_{air} according to entered setpoint.
This system does not include any inner control loop.
It is a direct operating and pressure independent valve for controlling media temperature. (S_{air}).

Survey of functions

Function	Para-meter	Parameter by operation via data communication
Normal display		

Normally S_{air} (017=Air) will be shown as running display value. If lower button is activated S_{aux} will be displayed for 5 sec, and then return to S_{air}
 	
If (017=Au) Saux will be shown as running display value. If lower button is activated Sair will be displayed for 5 sec, and then return to Saux
 	
If ICM has been selected (n03=6)
If (017=Air) S_{air} (017=Air) will be shown as running display value. If lower button is activated OD (u24) will be displayed for 5 sec, and then return to S_{air}.
If (017=Au) OD (u24) will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to OD (u24)
		Air temp.

Reference		
Setpoint Regulation is performed based on the set value provided that there is no external contribution (o10). (Push both buttons simultaneously to set the setpoint).	-	SP Temp.
Temperature unit Here you select whether the controller is to indicate the temperature values in °C or in °F. If indication in °F is selected, other temperature settings will also change over to Fahrenheit, either as absolute values or as delta values.	r05	Temp unit °C=0, °F=1 (In AKM only °C is displayed whatever the setting)
External contribution to the setpoint This setting determines how large a contribution (in °C/°F) is to be added to the set setpoint when the input signal is max. (20 mA).	r06	Ext. Ref.off set (°C/°F)
Correction of signal from S_{air} (Compensation possibility through long sensor cable).	r09	Adjust S_{Air} (°C/°F)
Correction of signal from S_{aux} (Compensation possibility through long sensor cable).	r10	Adjust S_{Aux} (°C/°F)
Start/stop of refrigeration With this setting refrigeration can be started and stopped. Start/stop of refrigeration can also be accomplished with the external switch function. See also appendix 1.	r12	Main Switch
Alarm		
The controller can give alarm in different situations. When there is an alarm all the light-emitting diodes (LED) will flash on the controller front panel, and the alarm relay will cut in.		
Alarm for upper deviation The alarm for too high S_{air} temperature is set here. The value is set in Kelvin. The alarm becomes active when the S_{air} temperature exceeds the actual reference plus A01. (The actual reference (SP + r06) can be seen in u02).	A01	Upper deviation
Alarm for lower deviation The alarm for too low S_{air} temperature is set here. The value is set in Kelvin. The alarm becomes active when the S_{air} temperature drops below the actual reference minus A02. If a low temperature alarm is detected (A2 alarm) the solenoid valve in the liquid line (Digital output on terminal 9 and 10) will be closed	A02	Lower deviation
Alarm delay If one of the two limit values is exceeded, a timer function will commence. The alarm will not become active until the set time delay has been passed. The time delay is set in minutes.	A03	Temp alarm delay
		With data communication the importance of the individual alarms can be defined. Setting is carried out in the "Alarm destinations" menu. See also page 10.
Control parameters		
Actuator's max. temperature Set the temperature (°C) the actuator is to have at the limit of the regulating range. The setting ensures that the actuator will not become superheated and work itself away from the regulating range. Due to tolerances in the actuator the value must be set 10K higher than indicated in the curves on page 11.	n01	Q-max. temp.
Actuator's min. temperature Set the temperature (°C) the actuator will have at the limit of the regulating range. The setting ensures that the actuator will not become too cold and work itself away from the regulating range. Due to tolerances in the actuator the value must be set 10K lower than indicated in the curves on page 11.	n02	Q-min. temp.

Actuator type Here you define the actuator mounted in the system: 1: CVQ -1-5 bar 2: CVQ 0-6 bar 3: CVQ 1.7-8 bar 4: CVMQ 5: KVQ 6: ICM	n03	Valve type
P: Amplification factor Kp If the Kp value is reduced the regulation becomes slower.	n04	Kp factor
I: Integration time Tn The I-setting can be cancelled by setting the value to max. (600s). If it is set to 600s, parameter n07 must be set to "0". (If the Tn value is increased the regulation becomes slower).	n05	Tn sec.
D: Differentiation time Td The D-setting can be cancelled by setting the value to min. (0).	n06	Td sec.
Transient phenomenon If the refrigeration requires a very fast transient phenomenon or must not have an underswing or temperature shift, this function can be used. (see page 4) 0: Ordinary regulating technique 1: Fast building-up where a minor underswing is allowed 2: Not quite so fast building-up, but without underswing	n07	Q-ctrl. mode
OD - Opening degree Max. Limitation - ICM only When ICM has been selected (n03=6) the Maximum OD can be entered. ICM will never go above this value. (If n32=n33, ICM is forced to this value)	n32	ICM OD Max.
OD - Opening degree Min. Limitation - ICM only When ICM has been selected (n03=6) the Minimum OD can be entered. ICM will never go below this value. (If n32=n33, ICM is forced to this value)	n33	ICM OD Min.
Miscellaneous		

Output signal
The controller can transmit a current signal via the analog output (terminal 2 and 5). Range of current signal can be selected below:
If (017=Air) Sair will send out to the analog output.
If (017=Au) Saux will send out to the analog output
S_{air}/S_{aux} min. value (0 or 4 mA) will correspond to the setting in "o27"
S_{air}/S_{aux} max. value (20 mA) will correspond to the setting in "o28"
 	
If ICM has been selected (n03=6)
OD (u24) to control ICM, is send out to the analog output
(o27) and (o28) is not active
 	
Range for current signal:
0: No output signal
1: 4-20 mA
2: 0-20 mA
	o09	AO type

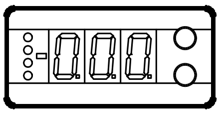
Input signal If you wish to connect a signal that is to displace the controller's control reference, the signal must be defined in this menu. 0: No signal 1: 4-20 mA 2: 0-20 mA (4 or 0 mA will not give a displacement. 20 mA will displace the reference by the value set in menu r06).	o10	AI type
Data communication If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be made when a data communication module has been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC8AC".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	-
The address is sent to the gateway when the menu is set in pos. ON (The setting will automatically change back to Off after a few seconds.)	o04	-
Language This setting is only required if data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish and 6=Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Frequency Set the net frequency.	o12	50 / 60 Hz (50=0, 60=1)

Selection of running display value
If S_{air} (017=Air) will be shown as running display value. If lower button is activated S_{aux} will be displayed for 5 sec, and then return to S_{air}
S_{air} will send out to the analog output. See also (o09),(o27),(o28)
 	
If (017=Au) S_{aux} will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to S_{aux}
S_{aux} will send out to the analog output. See also (o09),(o27),(o28)
 	
If ICM has been selected (n03=6)
If (017=Air) S_{air} (017=Air) will be shown as running display value. If lower button is activated OD (u24) will be displayed for 5 sec, and then return to S_{air}
 	
If (017=Au) OD (u24) will be shown as running display value. If lower button is activated S_{air} will be displayed for 5 sec, and then return to OD (u24)
	o17	Display Aux/Air
		Aux =0
		Air = 1

(Setting for the function o09) Set the temperature value where the output signal must be minimum (0 or 4 mA)	o27	Temp. at AO min.
(Setting for the function o09) Set the temperature value where the output signal must be maximum (20 mA). (With a temperature range of 50°C (differential between the settings in o27 and o28) the dissolution will be better than 0.1 °C. With 100°C the dissolution wil be better than 0.2°C.)	o28	Temp. at AO max.
Service		
A number of controller values can be printed for use in a service situation		
Read the temperature at the S_{air} sensor (calibrated value)	u01	Air temp.
Read the control reference (Setpoint + any contribution from external signal)	u02	Air reference
Read temperature at the S_{aux} sensor (calibrated value) (This showing can also be uploaded from the normal display, if you push the lowermost button for almost a second)	u03	Aux. temp.
Read valve's actuator temperature	u04	Actuator temp.
Read reference for valve's actuator temperature	u05	Actuator Ref.
Read value of external current signal	u06	AI mA
Read value of transmitted current signal	u08	AO mA
Read status of input DI (start/stop input)	u10	DI
ICM opening degree. Only active if (n03)=6	u24	OD%
	--	DO1 Alarm Read status of alarm relay
	--	DO2 Cooling Read status of relay for solenoid valve
	--	DO3 Fan Read status of relay for fan
Operating status		
Operating status of the controller can be called forth in the display. Push briefly (1s) the upper button. If there is a status code, it will be shown on the display. (Status codes have lower priority than alarm codes. In other words, you cannot see a status code, if there is an active alarm). The individual status codes have the following meanings:		EKC State (0 = regulation)
S10: Refrigeration stopped by the internal or external start/ stop		10
S12: Refrigeration stopped due to low S_{air}		12

Operation

Display
The values will be shown with three digits, and with a setting you can determine whether the temperature is to be shown in °C or in °F.



Light-emitting diodes (LED) on front panel
There are LED's on the front panel which will light up when the corresponding relay is activated.
The three lowest LED's will flash, if there is an error in the regulation.
In this situation you can upload the error code on the display and cancel the alarm by giving the uppermost button a brief push.

The controller can give the following messages:		
E1	**Error message**	Errors in the controller
E7		Cut-out S_{air}
E8		Short circuited S_{air}
E11		Valve's actuator temperature outside its range
E12		Analog input signal is outside the range
A1	**Alarm message**	High-temperature alarm
A2		Low-temperature alarm

The buttons
When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

Gives access to the menu (or cutout an alarm)

Gives access to changes

Saves a change

Examples of operations

Set set-point
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW =1.5x

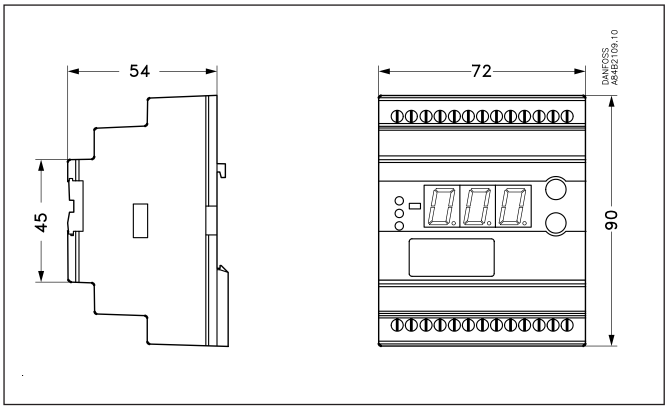
Function	Parameter	Min.	Max.	Fac. setting
Normal display				
Shows the temperature at the selected sensor At ICM valve OD also can be selected	-		°C	
Reference				
Set the required room temperature	-	-70°C	160°C	10°C
Temperature unit	r05	°C	°F	°C
Input signal's temperature influence	r06	-50°C	50°C	0.0
Correction of the signal from S_{air}	r09	-10,0°C	10,0°C	0.0
Correction of the signal from S_{aux}	r10	-10,0°C	10,0°C	0.0
Start/stop of refrigeration	r12	OFF/0	On/1	On/1
Alarm				
Upper deviation (above the temperature setting)	A01	0	50 K	5.0
Lower deviation (below the temperature setting)	A02	0	50 K	5.0
Alarm's time delay	A03	0	180 min	30
Regulating parameters				
Actuator max. temperature	n01	41°C	140°C	140
Actuator min. temperature	n02	40°C	139°C	40
Actuator type (1=CVQ-1 to 5 bar, 2=CVQ 0 to 6 bar, 3=CVQ 1.7 to 8 bar, 4= CVMQ, 5=KVQ, 6= ICM)	n03	1	6	2
P: Amplification factor Kp	n04	0,5	50	3
I: Integration time Tn (600 = off)	n05	60 s	600 s	240
D: Differentiation time Td (0 = off)	n06	0 s	60 s	10
Transient phenomenon 0: Ordinary control 1: Underswing minimised 2: No underswing	n07	0	2	2
OD - Opening degree - max. limit - ICM only	n32	0%	100%	100
OD - Opening degree min limit - ICM only	n33	0%	100%	0
Miscellaneous				
Controller's address (0-120)	o03*	0	990	0
ON/OFF switch (service-pin message)	o04*	-	-	
Define output signal of analog output: 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o09	0	2	0
Define input signal of analog input 0: no signal, 1: 4 - 20 mA, 2: 0 - 20 mA	o10	0	2	0
Language (0=english, 1=German, 2=French, 3=Danish, 4=Spanish and 6=Swedish.)When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11*	0	6	0
Set supply voltage frequency	o12	50 Hz/0	60 Hz/1	0
Select of running display value	o17	Au/0	Air/1	Air/1
(Setting for the function o09) Set the temperature value where the output signal must be minimum (0 or 4 mA)	o27	-70°C	160°C	-35
(Setting for the function o09) Set the temperature value where the output signal must be maximum (20 mA)	o28	-70°C	160°C	15
Service				
Read temperature at the S_{air} sensor	u01		°C	
Read regulation reference	u02		°C	
Read temperature at the S_{aux} sensor	u03		°C	
Read valve's actuator temperature	u04		°C	
Read reference of the valve's actuator temperature	u05		°C	
Read value of external current signal	u06		mA	
Read value of transmitted current signal	u08		mA	
Read status of input DI	u10		on/off	
ICM opening degree. (only at ICM)	u24		%	

*) This setting will only be possible if a data communication module has been installed in the controller.

Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 80 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller Actuator	5 VA 75 VA
Input signal	Current signal	4-20 mA or 0-20 mA
	Digital input from external contact function	
Sensor input	2 pcs. Pt 1000 ohm	
Output signal	Current signal	4-20 mA or 0-20 mA Max. load: 200 ohm
Relay output	2 pcs. SPST	AC-1: 4 A (ohmic) AC-15: 3 A (inductive)
Alarm relay	1 pcs. SPST	
Actuator	Input	Temperature signal from sensor in the actuator
	Output	Pulsating 24 V a.c. to actuator
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm² multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN50081-1 and EN 50082-2	



Capacitive load

The relays cannot be used for the direct connection of capacitive loads such as LEDs and on/off control of EC motors.

All loads with a switch mode power supply must be connected with a suitable contactor or similar.

Ordering

Type	Function	Code No.
EKC 361	Evaporating pressure controller	**084B7060**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

Temperature sensor Pt 1000 ohm:..........Kindly refer to catalogue RK0YG...

Valves: DKRCI.PD.HT0.A

Connections

Necessary connections

Terminals:

25-26 Supply voltage 24 V a.c.

17-18 Signal from actuator (from NTC)

23-24 Supply to actuator (to PTC)

20-21 Pt 1000 sensor at evaporator outlet

1-2 Switch function for start/stop of regulation. If a switch is not connected, terminals 1 and 2 must be short circuited.

Application dependent connections

Terminal:

12-13 Alarm relay
There is connection between 12 and 13 in alarm situations and when the controller is dead

8-10 Relay switch for start/stop of fan

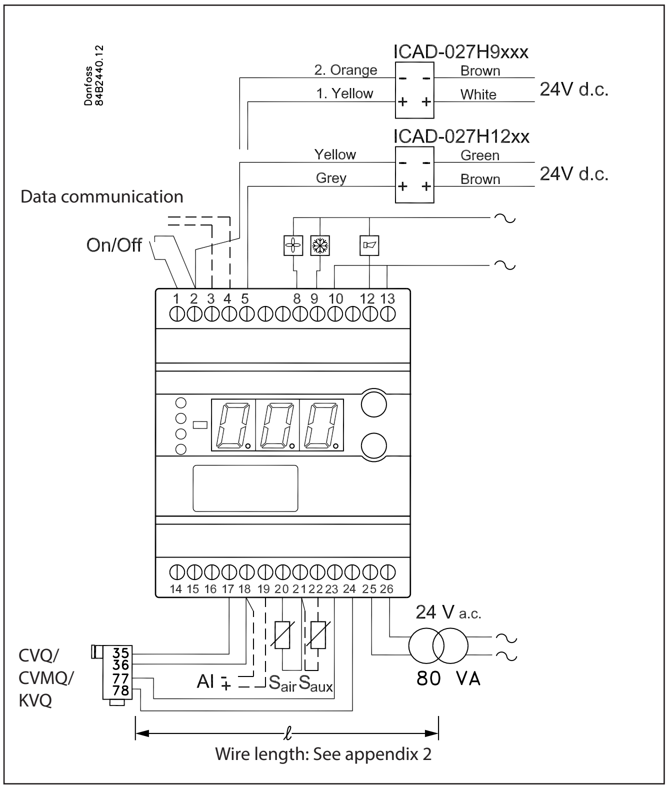
9-10 Relay switch for start/stop of solenoid valves

18-19 Current signal from other regulation (Ext.Ref.)

21-22 Pt 1000 sensor for monitoring

2-5 Current output for Sair/Saux temperature or ICAD actuator for ICM valve

3-4 Data communication
Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC..



Appendix 1

Interaction between internal and external start/stop functions and active functions.

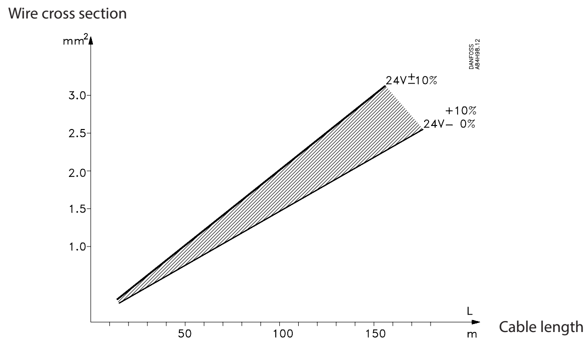
Internal Start/stop	Off	Off	On	On
External Start/stop	Off	On	Off	On
Refrigeration	Off			On
Actuator	Stand-by			Regulating
Actuator temperature	"n02"			"n02" to "n01"
Fan relay	Off			On
Expansion valve relay	Off			On
Temperature monitoring	No			Yes
Sensor monitoring	Yes			Yes

Appendix 2

Cable length for the CVQ actuator

The actuator must be supplied with 24 V a.c. ± 10%.

To avoid excessive voltage loss in the cable to the actuator, use a thicker cable for large distances.



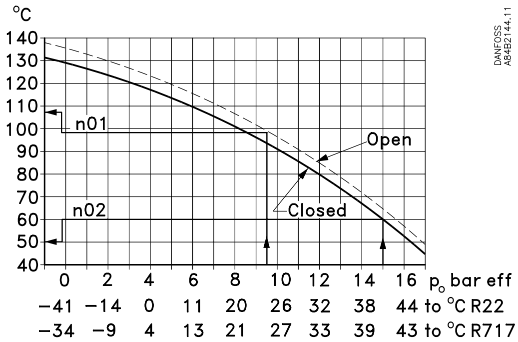
Appendix 3

Connection between the evaporating temperature and the actuator's temperature (the values are approximate).

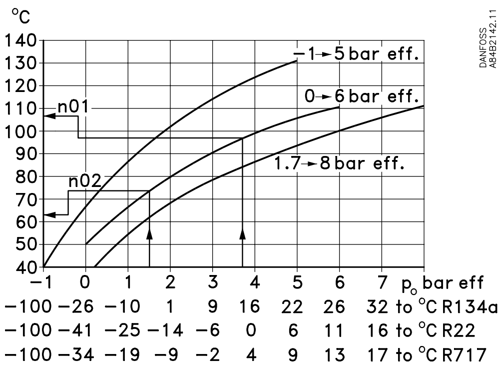
n01: The highest regulated room temperature will have a belonging t_o value which in turn indicates the value of the n01 setting. Due to tolerances in the actuator, the setting value must be 10 K **higher** than shown in the curve.

n02: The lowest occurring suction pressure will have a belonging t_o value which in turn indicates the value of the n02 setting. Due to tolerances in the actuator, the setting value must be 10 K **lower** than shown in the curve.

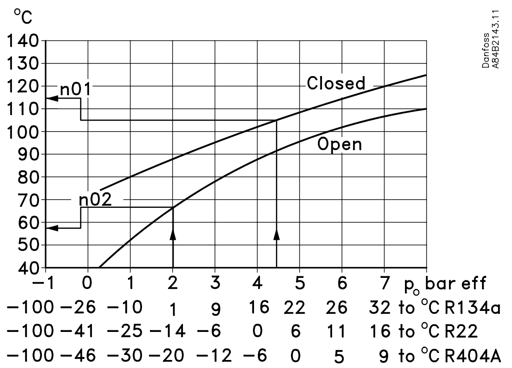
CVMQ



CVQ



KVQ



Start of controller

When the electric wires have been connected to the controller, the following points have to be attended to before the regulation starts:

1. Switch off the external ON/OFF switch that starts and stops the regulation.
2. Follow the menu survey on page 7, and set the various parameters to the required values.
3. Switch on the external ON/OFF switch, and regulation will start.
4. If the system has been fitted with a thermostatic expansion valve, it must be set to minimum stable superheating. (If a specific T0 is required for the adjustment of the expansion valve, the two setting values for the actuator temperature (n01 and n02) can be set to the belonging value while the adjustment of the expansion valve is carried out. Remember to reset the values).
5. Follow the actual room temperature on the display. (On terminals 2 and 5 a current signal can be transmitted which represents the room temperature. Connect a data collection unit, if applicable, so that the temperature performance can be followed).

If the temperature fluctuates

When the refrigerating system has been made to work steadily, the controller's factory-set control parameters should in most cases provide a stable and relatively fast regulating system.
If the system on the other hand oscillates, you must register the periods of oscillation and compare them with the set integration time T_n, and then make a couple of adjustments in the indicated parameters.

If the time of oscillation is longer than the integration time:
($T_p > T_n$, (T_n is, say, 4 minutes))
1. Increase T_n to 1.2 times T_p
2. Wait until the system is in balance again
3. If there is still oscillation, reduce K_p by, say, 20%
4. Wait until the system is in balance
5. If it continues to oscillate, repeat 3 and 4

If the time of oscillation is shorter than the integration time:
($T_p < T_n$, (T_n is, say, 4 minutes))
1. Reduce K_p by, say, 20% of the scale reading
2. Wait until the system is in balance
3. If it continues to oscillate, repeat 1 and 2

Trouble shooting - ICS/PM with CVQ

In addition to the error messages transmitted by the controller, the table below may help identifying errors and defects.

Symptom	Defect	Confirmation of defect
Media temperature too low. Actuator feels cold.	Short-circuited NTC resistor in actuator.	If less than 100 ohm is measured across terminals 17 and 18 (disassemble the lead), the NTC or the leads are short-circuited. Check the leads.
	Defective PTC resistor (heating element) in actuator.	If more than 30 ohm or 0 ohm is measured across terminal 23 and 24 (disassemble the lead), either the PTC or the leads are defective. Check the leads.
Media temperature too low. Actuator fells warm.	Undersized cable to CVQ.	Measure voltage across terminals 77 and 78 (min. 18 V a.c.). Measure resistance in power cables to CVQ (max. 2 ohm)
	Undersized 24 V transformer.	Measure voltage across transformer output terminals (24 V a.c. +10/ -15%) under all working conditions. If voltage drops under some working conditions the transformer is undersized.
	Loss of charge in actuator.	Replace actuator.
Media temperature too high. Actuator feels cold.	Fault in refrigerant plant.	Examine plant for ther defects.
Media temperature too high. Actuator feels warm.	Cut out NTC resistor in actuator.	If more than 200 kohm is measured across terminals 17 and 18 (disassemble the lead), either the NTC or leads are disconnected. Check the leads.

Fine adjustments

When the system has been operating for a while, it may be required for some systems to optimise some of the adjustments. Below we have a look at settings having an influence on the speed and accuracy of the regulation.

Adjustment of the actuator's min. and max. temperatures
At the first setting these values were set to 10 K outside of the expected temperature in order to eliminate the tolerances in the actuator. By adjusting the two values to the values where the valve is exactly in mesh, the valve will all the time remain active in its regulation.
If the actuator is replaced at a later date, this procedure must be repeated for the new actuator.

Min.
By adjusting the actuator's min. temperature you obtain a limit for how low a pressure can occur in the evaporator (the point is where the valve starts a limitation of the refrigerant flow).
The system must be put in an operating situation where max. capacity is called for (large refrigeration need).
The min. temperature must now be changed upwards step by step, at the same time as the evaporating pressure is read on the system's manometer.
When a change of the evaporating pressure is registered, this is the point where the valve is exactly in mesh. (If frost protection is required for the system, the value can be raised to the belonging value).

Max.
By adjusting the actuator's max. temperature you obtain a limit for how high a pressure can occur in the evaporator (the refrigerant flow is blocked completely).
The system is put in an operating situation where there is no call for refrigeration capacity (no refrigerant flow).
The max. temperature is now changed downwards step by step, at the same time as the evaporating pressure is read on the system's manometer.
When a change of the evaporating pressure is registered, this is the point where the valve opens. Adjust the setting a little upwards, so that the valve will again close completely for the refrigerant flow. (If the actual application has a requirement regarding max. evaporating pressure, a lower setting may of course be selected, so that the pressure is limited).

Method for fixing Kp, Tn and Td
Described below is a method (Ziegler-Nichols) for fixing Kp, Tn and Td.

1. The system is made to regulate the temperature at the required reference with a typical load. It is important that the valve regulates, and that it is not fully open.
2. Parameter u05 is read. The actuator's min. and max. setting is adjusted, so that the average of the min. and max. values is equal to the read u05.
3. The controller is set, so that it will regulate as a P-controller. (Td is set to 0, Tn in pos. OFF (600), and Q-Ctrl.mode is set at 0).
4. The stability of the system is examined by stopping the system for, say, one minute (using the start/stop setting or the switch). Now check how the building-up of the temperature proceeds. If the building-up peters out, raise Kp a little and repeat the start/stop operation. Continue with this until you obtain a building-up which does **not** peter out.
5. Kp is in this case the critical amplification ($Kp_{critical}$) and the building-up time for the continued oscillation is the critical building-up time ($T_{critical}$).
6. Based on these values, the regulating parameters can now be calculated and subsequently set:
   - If PID regulation is required:
     $Kp < 0.6x\ Kp_{critical}$
     $Tn > 0.5x\ T_{critical}$
     $Td < 0.12x\ T_{critical}$
   - If PI regulation is required:
     $Kp < 0.45x\ Kp_{critical}$
     $Tn > 0.85x\ T_{critical}$
7. Reset the values for the controller's min. and max. temperatures and Q-Ctrl.mode.

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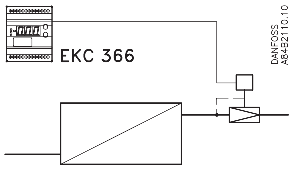
User Guide

Interface
EKC 366

The controller is used for regulating a valve in a refrigerating system - for example in connection with:

- Long-term storage of fruits and vegetables
- Refrigerating plant
- Brewery systems
- Processing plant

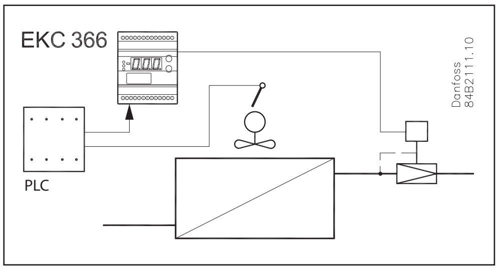


Application

Here the controller has been specially designed for the following functions:

Maintenance of a constant evaporating pressure
A temperature sensor in the valve's actuator will regulate its temperature. This temperature is an indication of the pressure in the valve, and the interface module will keep this temperature constant.

The media temperature is regulated by a PLC or similar device
Here the interface module receives a variable signal from the PLC and will subsequently regulate the valve, so that the refrigeration will be as accurate as possible.



System

The controller must always be used in conjunction with a pilot valve of the types shown here.
The most commonly used one is pilot valve CVQ in conjunction with main valve PM3 (sketched out above).

Valve types:
- CVQ + PM
- KVQ
- TQ
- PHTQ
- TEAQ
- CVMQ

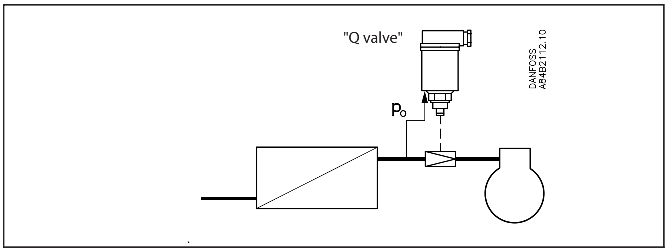
Function

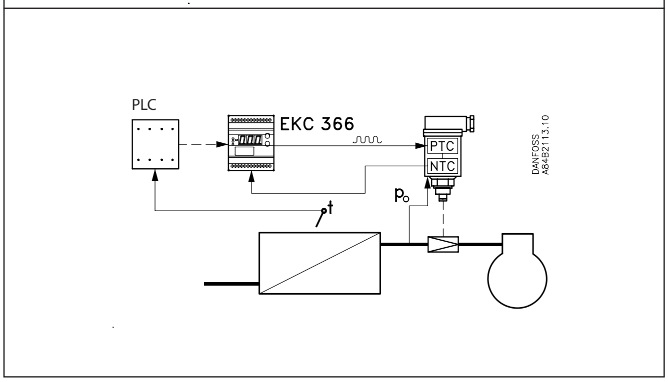
The valve constantly receives feedback of the pressure in the evaporator. Whatever the variations in the suction pressure from the compressor, this feedback will produce the result that the evaporating pressure is kept constant.

In conjunction with the controller, an electronic constant-pressure valve is thus obtained.

Inserted between the controller and the actuator is a so-called inner regulating loop. This loop will - via an NTC resistance - constantly control the temperature in the actuator.

In an application where a PLC or similar device is used for regulating a media temperature, the regulating system will in this way be supplied with an outer regulating loop - which will result in great regulating accuracy.





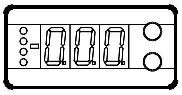
Survey of functions

Function	Para-meter	Parameter by operation via data communication
Temperature **regulation**		**Actuator temperature**
Display of valve temperature The display constantly shows the valve's temperature. The display is filtered over a period of approx. 10 seconds	-	Actuator temp.
Valve's basic temperature reference This temperature setting is the valve's basic setting. At this value no signal must be received from an external regulation. The setting value is taken from one of the curves shown and may be fine-adjusted later when the valve has reached the temperature (read the manometer in the system). (Push both buttons simultaneously to set the menu)	-	SP Temp.
Temperature **unit** Set here whether the controller is to show the temperature values in °C or in °F. If indication in °F is selected, other temperature settings will also change over to Fahrenheit, either as absolute values or as delta values.	r05	Temp. unit (°C=0, °F=1) (In AKM only °C is displayed, whatever the setting).
Input signal's temperature influence This setting determines how much the input signal has to raise the temperature in the valve. You should aim at selecting the value, so that the valve can close at the highest occurring evaporating pressure when the input signal is maximum (value to be set in Kelvin)	r06	Ext.Ref.offset K
Reference The valve's temperature is regulated on the basis of the basic setting plus the signal from the external regulation. (Reference = SP Temp + percentage of "r06".) The reference can be seen when you push the lower of the two buttons	-	Actuator Ref.
Sundry configurations		**Miscellaneous**
External signal Here you set the signal that is to be connected to the controller. 0: no signal 1: 4-20 mA 2: 0-20 mA 3: 0-10 V 4: 2-10 V	o10	AI Type
Frequency Set network frequency	o12	50 / 60 Hz (50=0, 60=1)
Data communication If the controller is built into a network with data communication, it must have an address, and the master gateway of the data communication must then know this address. These settings can only be made when a data communication module has been mounted in the controller and the installation of the data communication cable has been completed. This installation is mentioned in a separate document "RC.8A.C".		Following installation of a data communication module, the controller can be operated on a par with the other controllers in ADAP-KOOL® refrigeration controls.
The address is set between 1 and 60	o03	
The address is sent to the gateway when the menu is set in pos. ON	o04	
Language This setting is only required when data communication is connected to the controller. Settings: 0=English, 1=German, 2=French, 3=Danish, 4=Spanish, and 6= Swedish When the controller is operated via data communication, the texts in the right-hand column will be shown in the selected language. When you change the setting to an other language you must activate o04 before "the new language" can be visible from the AKM program.	o11	Language
Service		
The signal will be constantly updated. If you wish to follow the signal beyond the 20 seconds, the time-out period, push one of the two buttons before the time-out period expires		
External current signal Here you can read the value of the current signal received by the controller at its input	u06	AI mA
External voltage signal Here you can read the value of the voltage signal received by the controller at its input	u07	AI Volt

Operation

Display

The values will be shown with three digits, and with a setting you can determine whether they are to be shown in °C or in °F.



LED's on the front panel

There is one LED on the front panel which will light up when power is sent to the pilot valve.
There are furthermore three LED's which will flash if there is an error in the regulation. In this situation you can show the error code on the display and cut out the alarm by giving the upper button a brief push.

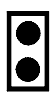
The controller can give the following messages:	
E1	Errors in the controller
E11	Valve's actuator temperature outside its range
E12	Input signal outside its range

The buttons

When you want to change a setting, the two buttons will give you a higher or lower value depending on the button you are pushing. But before you change the value, you must have access to the menu. You obtain this by pushing the upper button for a couple of seconds - you will then enter the column with parameter codes. Find the parameter code you want to change and push the two buttons simultaneously. When you have changed the value, save the new value by once more pushing the two buttons simultaneously.

 Gives access to the menu

 Gives access to changes

 Saves a change

Examples of operations

Set the valve's basic temperature reference
1. Push the two buttons simultaneously
2. Push one of the buttons and select the new value
3. Push both buttons again to conclude the setting

Read the valve's regulating reference
1. Push the lower button
   (After approx. 20 seconds the controller automatically returns to its setting, and it again shows the valve's actual temperature)

Set one of the other menus
1. Push the upper button until a parameter is shown
2. Push one of the buttons and find the parameter you want to change
3. Push both buttons simultaneously until the parameter value is shown
4. Push one of the buttons and select the new value
5. Push both buttons again to conclude the setting

Menu survey

SW =1.2x

Function	Parameter	Min.	Max.
Read valve's actual temperature (standard display)	-		°C
Set valve's basic temperature reference	-	40.0°C	140°C
Read valve's regulation reference	-		°C
Select temperature unit (°C/°F)	r05	°C	°F
Input signal's temperature influence	r06	-99.9 K	99.9 K
Controller's address	o03*	1	60
ON/OFF switch (service-pin message)	o04*	-	-
Define input signal 0: no signal 1: 4 - 20 mA 2: 0 - 20 mA 3: 0 - 10 V 4: 2 - 10 V	o10	0	4
Language (0=English, 1=German, 2=french, 3=Danish, 4=Spanish, 6=Swedish). When you change this setting you must also activate o04.	o11*	0	6
Set supply voltage frequency	o12	50 Hz	60 Hz
Service information			
Read value of external current signal	u06		mA
Read value of external voltage signal	u07		V

*) This setting will only be possible if a data communication module has been installed in the controller.

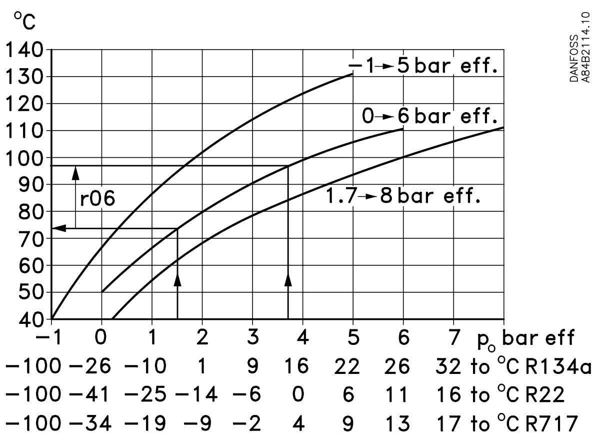
Factory setting
If you need to return to the factory-set values, it can be done in this way:
- Cut out the supply voltage to the controller
- Keep both buttons depressed at the same time as you reconnect the supply voltage

Valve's working temperature

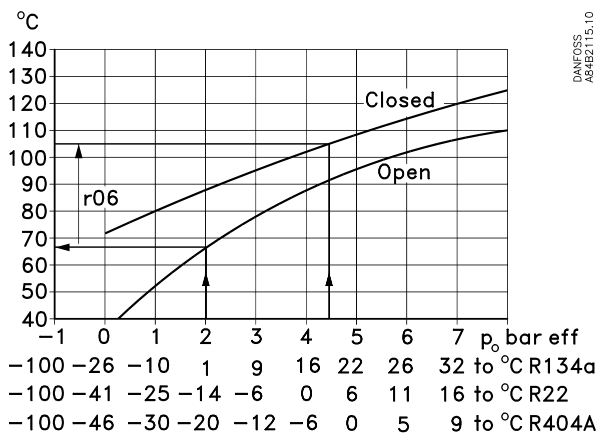
Without external signal
The working temperature must be set on the basis of one of the following curves. Find the actuator temperature corresponding to the required evaporating temperature (push). Set the value in the controller as mentioned under "Set the valve's basic temperature reference".

With external signal
If the valve is to be operated with an external signal, two settings have to be made. One is as mentioned to the left, and the other determines how much the signal must be able to raise the temperature in the valve. This value is also read on one of the following curves.
Set the value in the r06 menu.
If the set value is too low, the valve will not be able to close/open fully.

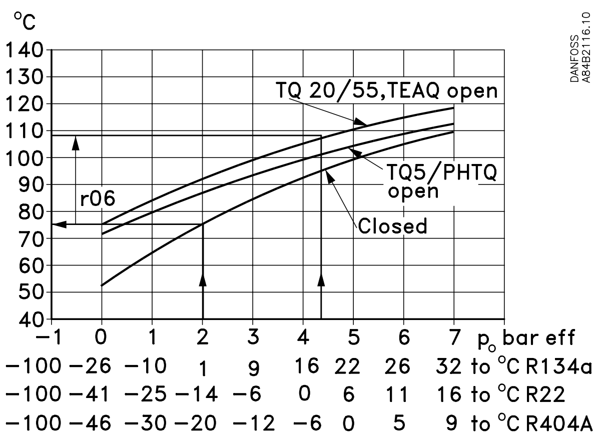
CVQ



KVQ

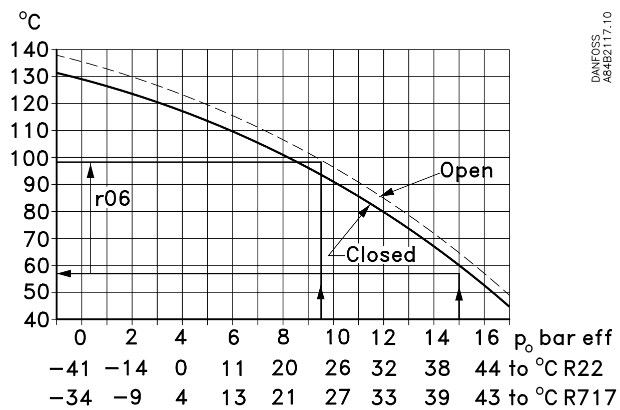


TQ



All the curves shown are approximate.

CVMQ



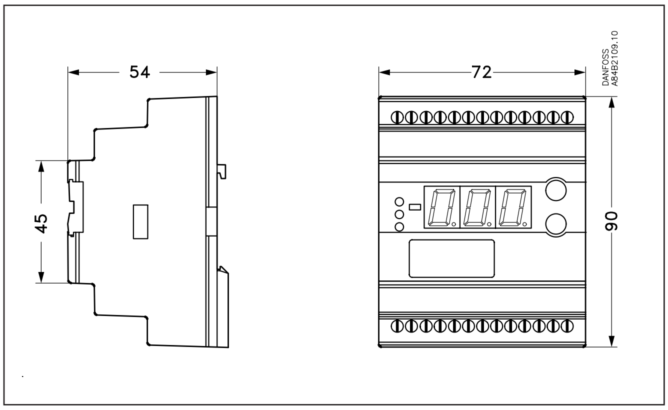
The two curves are shown with the valve's spring setting equal-ling the factory setting. If the spring setting is changed to a higher pressure, the curve will be displaced correspondingly to a higher temperature.

Example
CVQ type = 0-6 bar
Refrigerant = R_{717}
A constant evaporating temperature or input pressure to the valve of -9°C (2 bar) is required.
According to the CVQ curve this will require a temperature in the actuator of 80°C.
Set the valve's basic temperature reference at 80°C.

When the valve has reached its working temperature, it may be necessary to fine-adjust the setting from the system's manometer.

Data

Supply voltage	24 V a.c. +/-15% 50/60 Hz, 80 VA (the supply voltage is galvanically separated from the input and output signals)	
Power consumption	Controller Valve	5 VA 75 VA
Input signal	4-20 mA, 0-20 mA, 0-10V d.c. or 2-10 V d.c.	
Actuator	Input	Temperature signal from sensor in actuator
	Output	Pulsating 24 V a.c. to actuator
Data communication	Possible to connect a data communication module	
Ambient temperature	During operation During transport	-10 - 55°C -40 - 70°C
Enclosure	IP 20	
Weight	300 g	
Mounting	DIN rail	
Display	LED, 3 digits	
Terminals	max. 2.5 mm^2 multicore	
Approvals	EU Low Voltage Directive and EMC demands re CE-marking complied with. LVD-tested acc. to EN 60730-1 and EN 60730-2-9 EMC-tested acc. to EN 50081-1 and EN 50082-2	



Ordering

Type	Function	Code No.
EKC 366	Interface module	**084B7076**
EKA 173	Data communication module (accessories), (FTT 10 module)	**084B7092**
EKA 174	Data communication module (accessories), (RS 485 module) with galvanic separation	**084B7124**

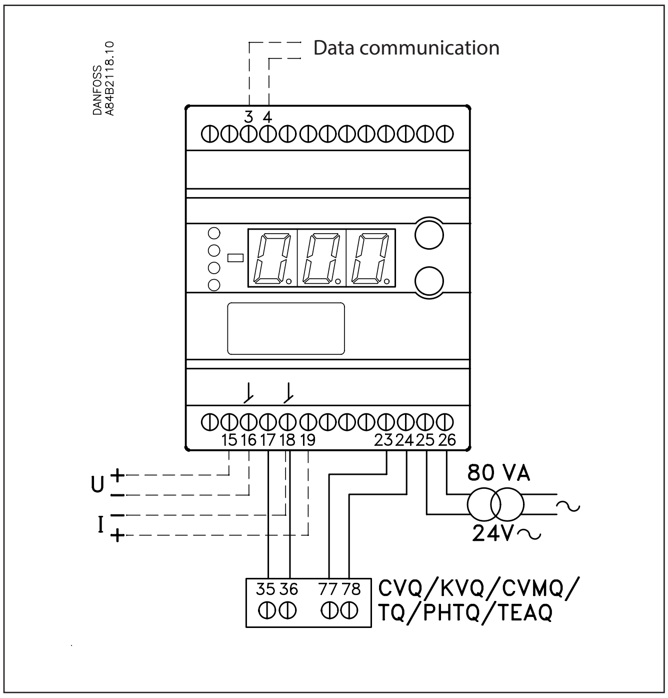
Valves: Kindly refer to catalogue RK0YG

Connections

Necessary connections
Terminals:
25-26 Supply voltage 24 V a.c. 80 VA
17-18 Signal from NTC sensor in valve
23-24 Supply to valve's PTC resistance

Control signal, if applicable (see also o10)
Either terminals:
15-16 Voltage signal
or
18-19 Current signal

Data communication, if applicable
Terminals:
3-4 Mount only, if a data communication module has been mounted.
It is important that the installation of the data communication cable be done correctly. Cf. separate literature No. RC8AC...



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AKS 38 Liquid Level Switch

Design

The AKS 38 is an electro-mechanical float switch. The design is based on a mechanical float, which will operate in the refrigerant. When the set level is reached an electrical volt free micro (SPDT) switch will be activated.

The micro-switch is located in the switch box which has a clear front cover and allows viewing of the switch position. The micro- switch is fully isolated from the refrigeration system and operates by means of a magnet. AKS 38 is supplied with a DIN plug for the electrical connections.

The micro-switch provides volt free contacts to open/close solenoid valves or energize/de-energize contactors for the starting/stopping refrigerant pumps/ compressors. Can be used as a device for acoustic alarms/ switches for visual indication when there is a danger of high or low liquid level.

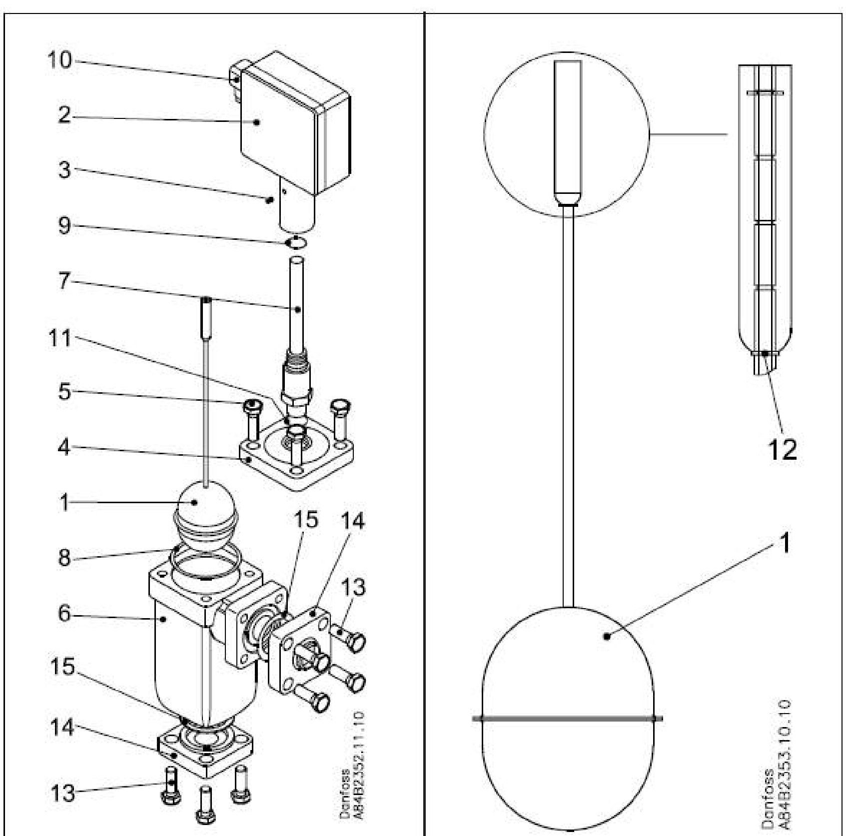
The switch box can be rotated 360° on top of the float housing for ease of installation and can be replaced without any interference with the refrigeration system.

Function

AKS 38 incorporates an internal float assembly (1), which will operate directly in accordance with the refrigerant level.

- The internal float will follow the liquid level vertically up and down.
- The upper part of the internal float assembly moves within the pressure tube (7).
- At a specific switch point the upper part of the internal float assembly will via a magnet activate the electrical microswitch in the switch box (2).
- A volt free signal can be detected by wiring to terminals at the DIN-plug (10).

By moving the location of the locking ring, 12, the float switch point can be adjusted to your requirements. More information about the function of the AKS 38.

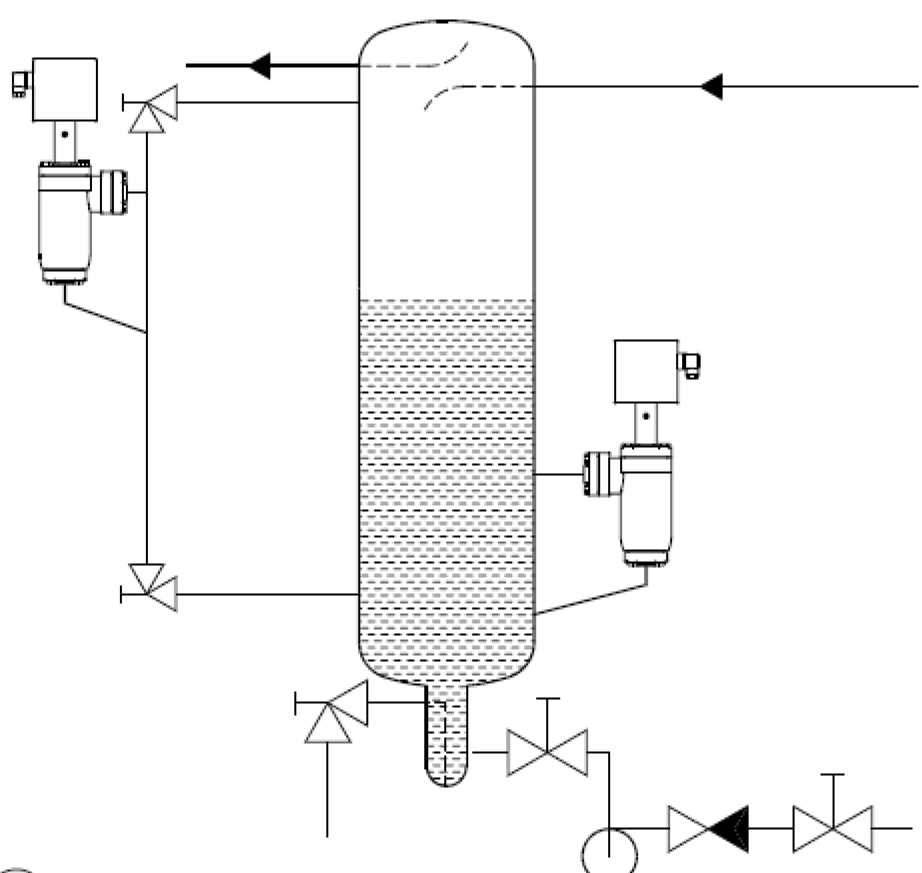


1 Internal float assembly
2 Switch box
3 M4x8 pinol tailstock screw
4 Top cover
5 4 pcs M12x35 stainless steel bolts
6 AKS 38 housing
7 Pressure tube
8 Top cover gasket
9 O-ring for pressure tube
10 DIN-plug for electrical connection
11 Aluminium gasket
12 Locking ring for internal float
13 Stainless steel bolts
14 Flanges
15 Flange gaskets

Installation

General

- *Refrigerants* Applicable to HCFC, non flammable HFC and R717 (Ammonia). Flammable hydrocarbons are not recommended.
- *Max. working pressure for* AKS 38 is 406 psig (28 barg). **IMPORTANT** If the system needs pressure tested higher than 406 psig (28 barg) then the internal float assembly can be removed allowing a maximum test pressure of 609 psig (42 barg).
- To avoid oil from collecting in the AKS 38 float housing the pipe connected to the bottom should be installed at a downward angle as shown in the below diagram. If not oil can affect the proper operation of the switch.

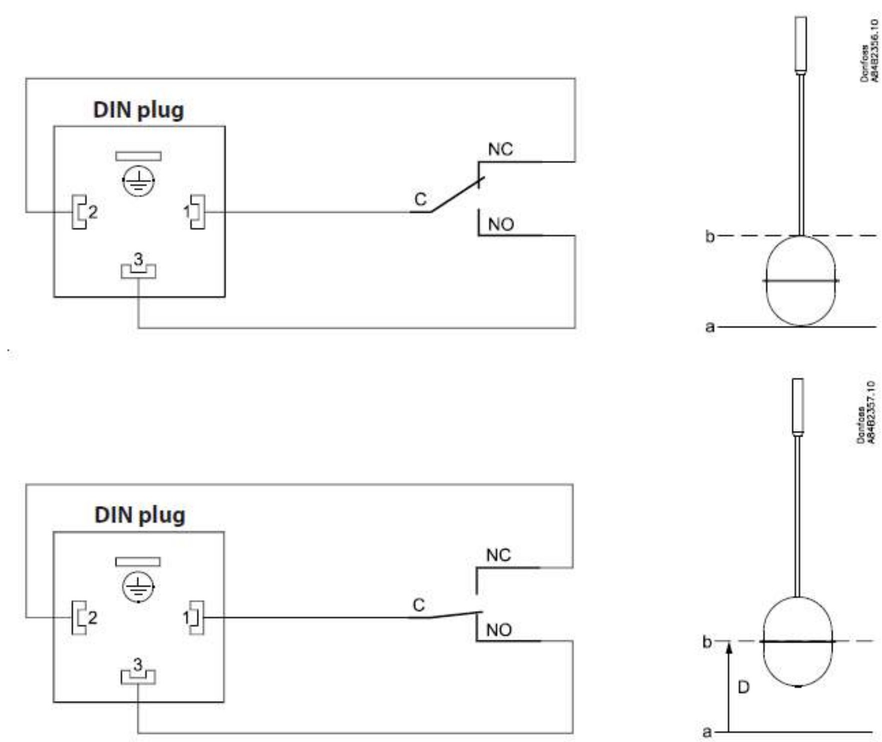


Wiring

DIN connector terminal numbers:

1. Common (C)
2. Normally Closed (NC)
3. Normally Open (NO)

The switch will sit in a *Normally Closed* position. Upon liquid rising and reaching the switch point, the state will change to *Normally Open*.

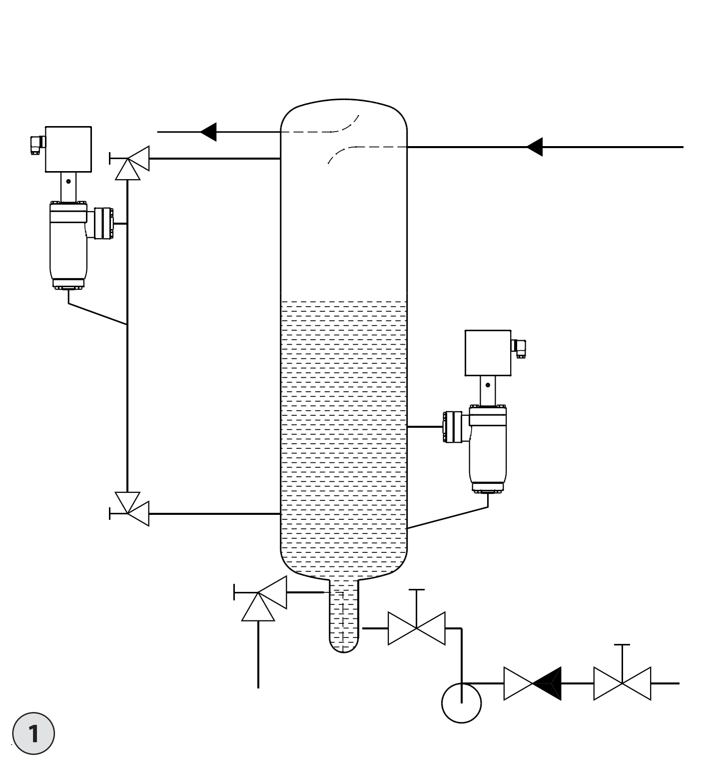


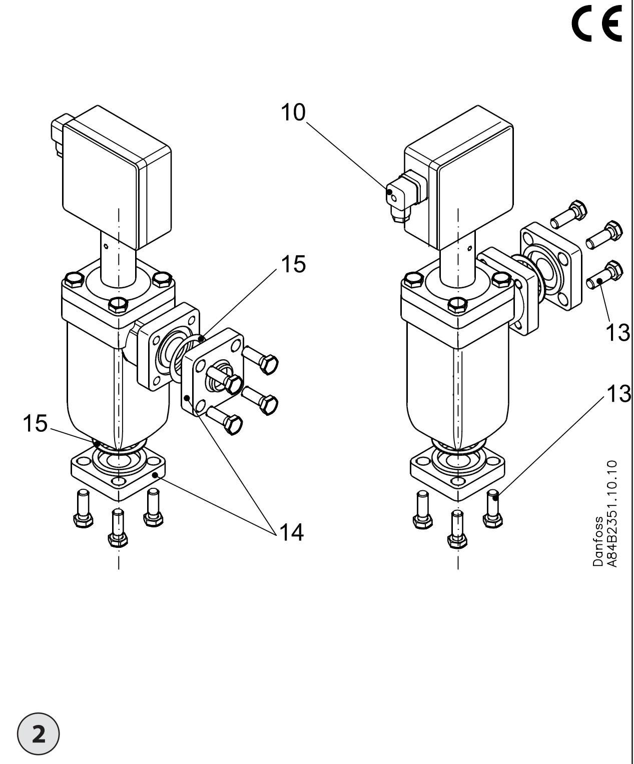
Differential (D) = Variable between 12.5 mm (½") to 50 mm (2") in 12. 5 mm (½") increments.

Installation Guide

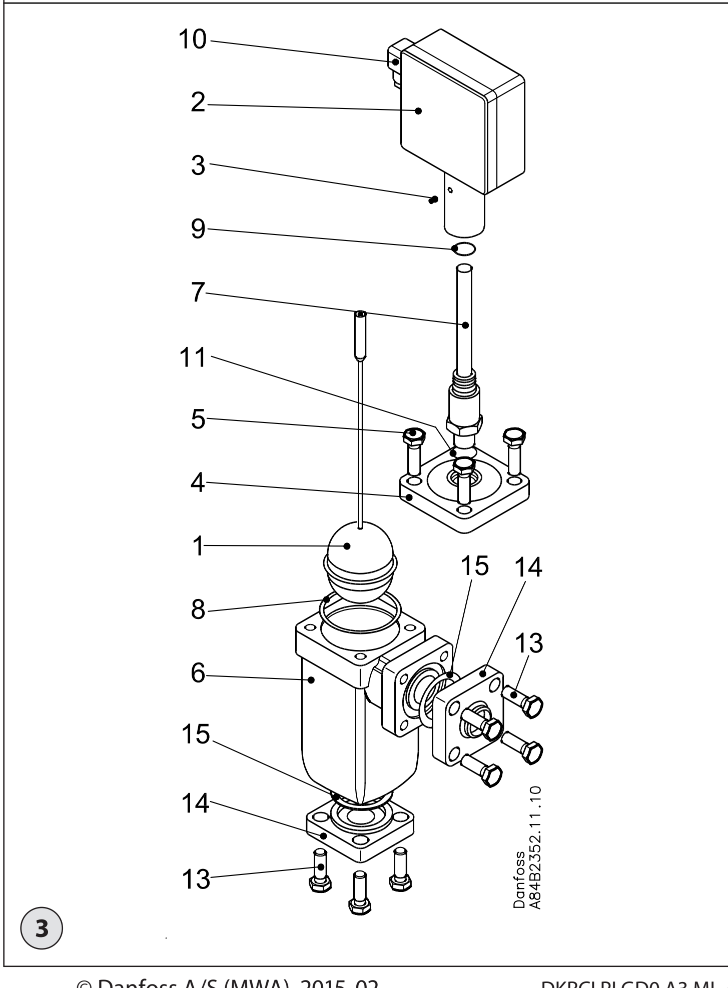
Liquid level switch
AKS 38

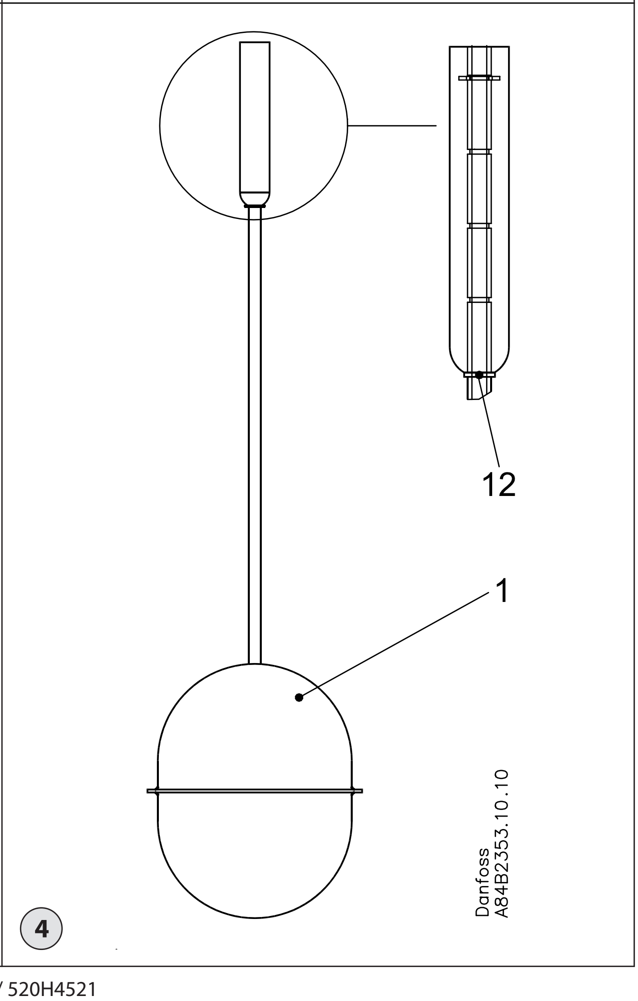
148R9524



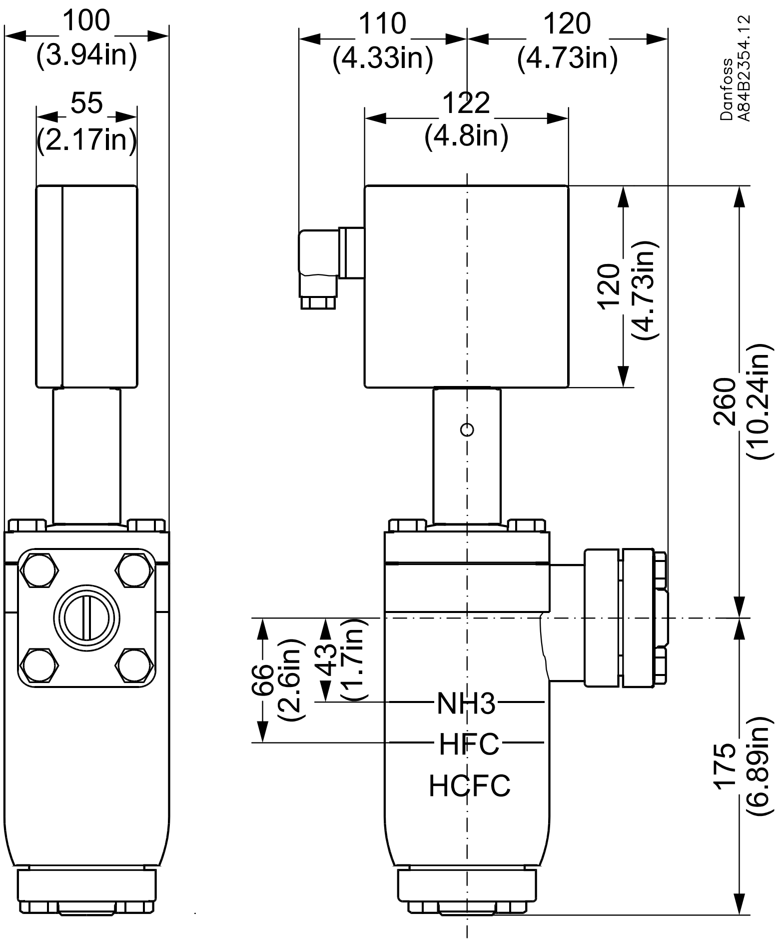


148R9524

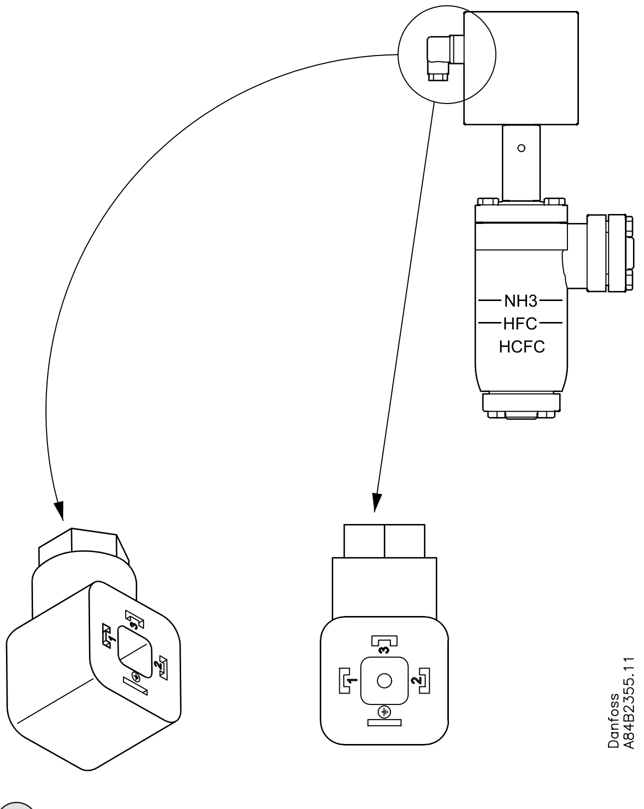




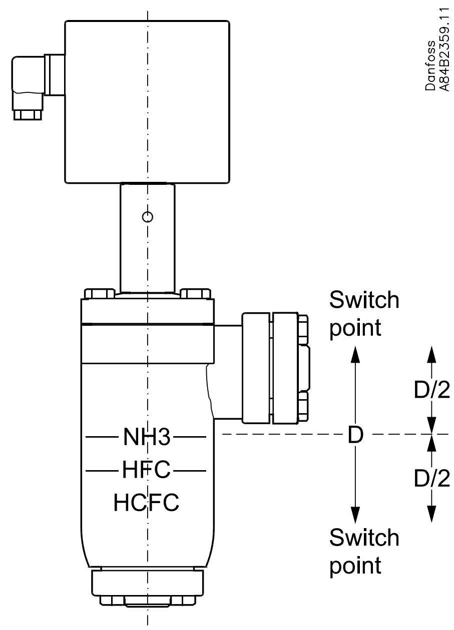
DKRCI.PI.GD0.A3.ML / 520H4521


100
(3.94in)
55
(2.17in)
110
(4.33in)
120
(4.73in)
122
(4.8in)
Danfoss
A84B2354.12
120
(4.73in)
260
(10.24in)
66
(2.6in)
43
(1.7in)
NH3
HFC
HCFC
175
(6.89in)

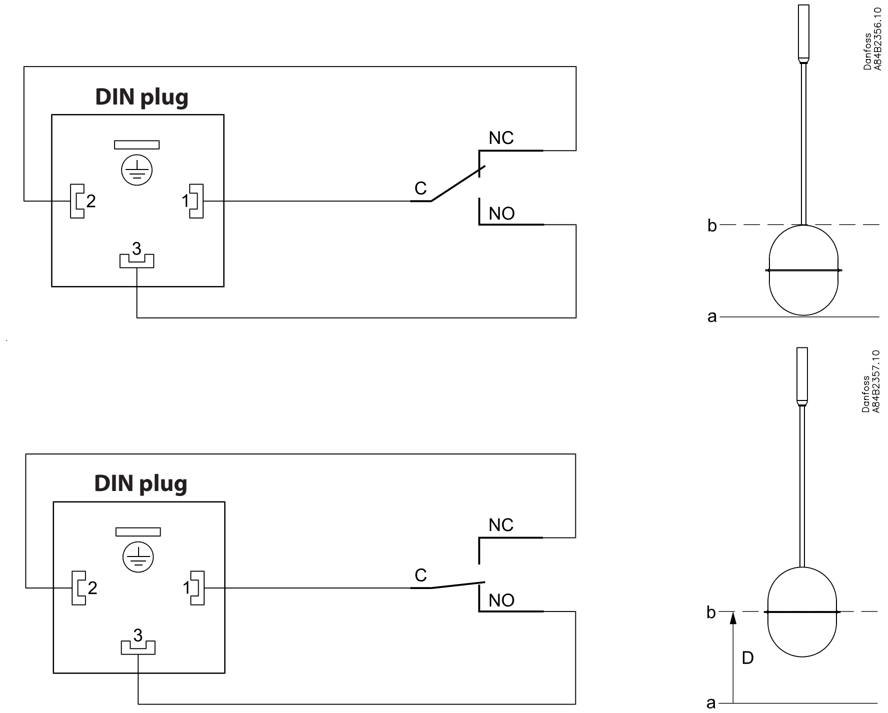
5


NH3
HFC
HCFC
Danfoss
A84B2355.11

6


Danfoss
A84B2359.11
Switch
point
D/2
NH3
HFC
HCFC
D
D/2
Switch
point

7



DK Differens (D) = Variabel mellem 12,5 mm (1/2”) og 50 mm (2”) i trin à 12,5 mm (1/2”).

GB Differential (D) = Variable between 12.5 mm (½") to 50 mm (2") in 12. 5 mm (½") increments.

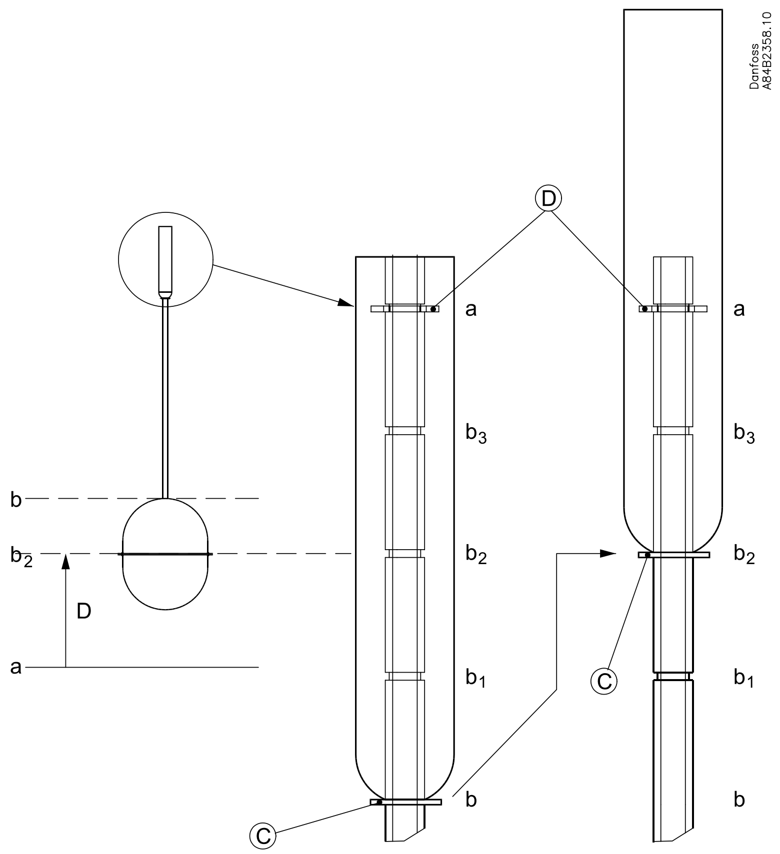
D Differenzial (D) = variabel zwischen 12,5 mm (½”) und 50 mm (2”) in Stufen von 12,5 mm (½”).

F Différentiel (D) = Variable de 12,5 mm (½”) à 50 mm (2”) par pas de 12,5 mm (½”).

E Diferencial (D) = Variable entre 12mm y 50 mm (½” a 2”) con incrementos de 12 mm (½”).

I Differenziale (D) = variabile tra 12.5 mm e 50 mm (da ½” a 2”) con incrementi di 12 mm (½”)

8



9

DANSK

Kølemidler
Anvendelig til HCFC, ikke-brændbar HFC og R717 (ammoniak).

Temperaturområde
–50°C/+65°C (–58°F/149°F)

Trykområde
AKS 38 er beregnet til et maks. arbejdstryk på 28 bar g (406 psi g).

VIGTIGT!
Hvis der kræves et prøvetryk på mere end 28 bar g (406 psi g), skal den indvendige svømmerenhed fjernes, hvilket muliggør et maks. prøvetryk på 42 bar g (609 psi g)

Elektriske data
- **Mikroomskifter (SPDT)**
- 250 V a.c / 10 A
- 30 V d.c / 5 A
- **DIN-stik**
- DIN 43650 tilslutning
- PG 11, 8-10 mm (0.31" - 0.39")
- Klemskrue 1.5 mm^2 (16 AWG)
- 3+PE

Væskestandsdifferens
Variabel mellem 12,5 mm og 50 mm (½" til 2") i trin à 12,5 mm (½"). Væskestandsdifferensen bør indstilles til den ønskede værdi før montering. Fabriksindstilling er 50 mm (2").

Kapsling
IP 65

Montering

VIGTIGT!
AKS 38 skal altid installeres i vertikal position (fig. 1 og 2).

AKS 38 leveres komplet med flanger (fig. 2, pos. 14). Når flangerne er monteret, skal deres udvendige overflade beskyttes mod korrosion med et velegnet antikorrosionsmiddel.

For at undgå, at der dannes en olielomme, som kan påvirke bevægelsen af den indvendige svømmerenhed, skal tilslutningsrøret i bunden skråne nedad mod væskeseparatoren. Afspærringsventiler bør af servicehensyn installeres så tæt som muligt på svømmerenheden (fig. 1).

Koblingspunkt
Koblingspunktet er relativt i forhold til den faktiske væskestandsmarkering på AKS 38's hus. Se fig. 7.

Det øverste koblingspunkt er reelt (D : 2) højere end den faktiske væskestands-markering.

Det nederste koblingspunkt er i reelt (D : 2) lavere end den faktiske væskestands-markering.

Hvor D = differens.

Justering af koblingspunkt for væskestandsdifferens (se fig. 9)
Svømmerenheden er fra fabrikken indstillet til en differens på 50 mm (2") med den nederste låsering C i position b. For at indstille en lavere differens skal positionen for den nederste låsering C ændres til b_1 = 37.5 mm (1½"); (b_2 = 25 mm (1"); b_3 = 12.5 mm (½"). (b_2 = 25 mm (1"); b_3 = 12.5 mm (½").
Placeringen af den øverste låsering D i position a bør ikke justeres eller ændres.

VIGTIGT!
Justeringen skal foretages, før AKS 38 installeres i kølesystemet. Brug fingrene til at ændre låseringenes position. Der skal ikke bruges værktøj.

Demontering af AKS 38's elskab (fig. 3, pos. 2)
- Løsn pinolskruerne M4 × 8 (fig. 3, pos. 3) ved hjælp af en unbrakonøgle.
- Fjern elskabet ved langsomt at lirke det opad.

Demontering af topdæksel fra AKS 38's hus (fig. 3, pos. 4).
- Løsn de rustfrie stålbolte 4 × M12×35 (fig. 3, pos. 5).
- Fjern hele topdækslet samt trykslangen (fig. 3, pos. 7).

Demontering af hele svømmerenheden (fig. 3, pos. 1 og fig. 4, pos. 1) fra AKS 38's hus (fig. 3, pos. 6).
- Flyt den nederste låsering til den ønskede differensindstilling.
- Se fig. 8 og 9.

Genmontering
- Genmonter svømmerenheden i AKS 38's hus (fig. 3, pos. 6).
- Genmonter hele topdækslet (fig. 3, pos. 4), og spænd boltene 4 × M12×35 (fig. 3, pos. 5). Maks. tilspændingsmoment 74 Nm (100 ft-lb). Max. tightening torque: 74 Nm (100 ft-lb).
- Genmonter elskabet (fig. 3, pos. 2) ved langsomt at trykke det ned på trykslangen (fig. 3, pos. 7).
- Placer elskabet (fig. 3, pos. 2) i den ønskede position, og spænd pinolskruen M4 × 8 (fig. 3, pos. 3) med en unbrakonøgle.

Elektrisk installation
Elektrisk tilslutning til DIN-stik sker ved hjælp af et kabel med maks. 4 kerner i overensstemmelse med ledningsdiagram (fig. 8).
1. Normal
2. Normalt lukket
3. Normalt åben
   Jordklemme

Vedligeholdelse

VIGTIGT!
Før AKS 38 kommer i kontakt med luft, skal den tømmes for kølemedium.

Udskiftning af indvendig svømmerenhed (fig. 3, pos.1)
- Løsn de rustfrie stålbolte 4 × M12x35 (fig. 3, pos. 5).
- Fjern topdækslet (fig. 3, pos. 4), trykslangen (fig. 3, pos. 7) og elskabet (fig. 3, pos. 2).
- Fjern den indvendige svømmerenhed (fig. 3, pos. 1).
- Monter den nye svømmerenhed.

Udskiftning af flangetætninger (fig. 2, pos. 15)
- Løsn de rustfrie stålbolte 4 × M12×35 på siden af flangen (fig. 2, pos. 13).
- Løsn de rustfrie stålbolte 4 × M12×35 i den nederste flange (fig. 2, pos. 13).
- Fjern begge tætninger (fig. 2, pos. 14).
- Monter de nye tætninger.
- Spænd de rustfrie stålbolte 4 × M12×35 i hver flange. Maks. tilspændingsmoment 74 Nm (100 ft-lb).

Udskiftning af tætning i topdæksel (fig. 3, pos. 8)
- Løsn de rustfrie stålbolte 4 × M12×35 (fig. 3, pos. 5).
- Fjern topdækslet (fig. 3, pos. 4), trykslangen (fig. 3, pos. 7) og elskabet (fig. 3, pos. 2).
- Fjern tætningen (fig. 3, pos. 8).
- Monter den nye tætning.
- Spænd de rustfrie stålbolte 4 × M12×35 (fig. 3, pos. 5).
  Maks. tilspændingsmoment 74 Nm (100 ft-lb).

Udskiftning af aluminiumstætning (fig. 3, pos. 11)
- Løsn pinolskrue M4 × 8 (fig. 3, pos. 3) med en unbrakonøgle.
- Fjern elskabet (fig. 3, pos. 2) ved langsomt at lirke det opad.
- Løsn trykslangen (fig. 3, pos. 7) med en 32 mm skruenøgle.
- Fjern aluminiumstætningen (fig. 3, pos. 11).
- Monter den nye tætning.
- Genmonter trykslangen.
- Genmonter elskabet.

Udskiftning af elskab (fig. 3, pos. 2)
- Fjern DIN-stikket (fig. 6).
- Løsn pinolskruen M4 × 8 (fig. 3, pos. 3) med en unbrakonøgle.
- Fjern elskabet (fig. 3, pos. 2) ved langsomt at lirke det opad.
- Monter det nye elskab.

Udskiftning af O-ring ved trykslange (fig. 3, pos. 9)
- Løsn pinolskruen M4 × 8 (fig. 3, pos. 3) med en unbrakonøgle.
- Fjern elskabet (fig. 3, pos. 2) ved langsomt at lirke det opad.
- Fjern O-ringen.
- Monter den nye O-ring.
- Genmonter elskabet.

ENGLISH

Refrigerants
Applicable to HCFC, non flammable HFC and R717 (Ammonia).

Temperature range
–50°C/+65°C (–58°F/149°F)

Pressure range
AKS 38 is designed for a max. working pressure of 28 bar g (406 psi g)

IMPORTANT
Should pressure testing in excess of 28 bar g (406 psi g) be necessary then the internal float assembly must be removed, thus allowing a maximum test pressure of 42 bar g (609 psi g)

Electrical data
- **Change-over Micro (SPDT) switch**
- 250 V a.c / 10 A
- 30 V d.c / 5 A
- **DIN Plug**
- DIN 43650 connection
- PG 11, 8-10 mm (0.31" - 0.39")
- Screw terminal 1.5 mm^2 (16 AWG)
- 3+PE

Liquid level differential
Variable between 12.5 mm to 50 mm (½" to 2") in 12.5 mm (½") increments. Required differential setting should be made prior to installation.
Factory set at 50 mm (2").

Enclosure
IP 65

Installation

IMPORTANT
AKS 38 must always be installed in a vertical position (fig. 1 and 2).

AKS 38 is supplied complete with flanges (fig 2, pos. 14). The external surfaces of the flanges must be prevented against corrosion with a suitable protective coat after installation.

To avoid an oil seal forming which would affect the movement of the internal float the bottom connecting pipe must have an incline towards the liquid separator.
Shut-off valves should be mounted as close as possible to the float for service (fig. 1).

Switch point
The switch point is relative to the actual liquid level marking on the AKS 38 housing. See fig 7.

The upper switch point is actually (D : 2) higher than the actual liquid level marking.

The lower switch point is actually (D : 2) lower than the actual liquid level marking.
Where D = differential.

Adjusting the liquid level differential switch point (see fig. 9)
The float comes factory set with a differential setting of 50 mm (2") with the lower locking ring C in position b. To acheive smaller differential settings reposition the lower locking ring C at b_1 = 37.5 mm (1½");
(b_2 = 25 mm (1"); b_3 = 12.5 mm (½").

The upper locking ring D in position a should not be adjusted or repositioned.

IMPORTANT
The adjustment must be made before AKS 38 is installed in the refrigeration system. Use two thumbs for repositioning the locking rings. Do not use any tools.

Remove the AKS 38 switch box (fig. 3, pos. 2).
- Unfasten the M4 × 8 (fig. 3, pos. 3) pinol tailstock screw with a Allen key.
- Remove the switch box by slowly easing upwards.

Remove the AKS 38 housing top cover (fig. 3, pos. 4).
- Unfasten the 4 × M12 × 35 stainless steel bolts (fig. 3, pos. 5).
- Remove the complete top cover including installed pressure tube (fig. 3, pos. 7).

Remove the complete float assembly (fig.3, pos. 1 and fig. 4, pos. 1) from the AKS 38 housing (fig. 3, pos. 6).
- Reposition the lower locking ring at the required differential setting.
- See fig. 8 and fig. 9.

Reassembly
- Refit the float assembly back into the AKS 38 housing (fig. 3, pos. 6).
- Reinstall the complete top cover (fig. 3, pos. 4) and fasten the 4 × M12 × 35 bolts (fig. 3, pos. 5).
  Max. tightening torque: 74 Nm (100 ft-lb).

- Reinstall the switch box (fig. 3, pos. 2) by slowly forcing it down over the pressure tube (fig. 3, pos. 7).
- Position the switch box (fig. 3, pos. 2) as required and fasten the M4 × 8 pinol tailstock screw (fig. 3, pos. 3) with a Allen key.

Electrical installation
Make electrical connection to DIN plug using cable with maximum 4 cores and wire in accordance with wiring diagram (fig. 8).
1. Common
2. Normally Closed
3. Normally Open
   Earth terminal

Maintenance

IMPORTANT
The AKS 38 must be evacuated before opening to air.

Replacing the internal float assembly (fig. 3, pos.1)
- Unscrew the stainless steel bolts 4 × M12×35 (fig. 3, pos. 5).
- Remove the top cover (fig. 3, pos. 4) including installed pressure tube (fig. 3, pos. 7) and switch box (fig. 3, pos. 2).
- Remove the internal float assembly (fig 3, pos. 1).
- Install the new float assembly.

Replacing the flange gaskets (fig. 2, pos. 15)
- Unscrew the 4 × M12×35 stainless steel bolts on the side flange (fig. 2, pos. 13).
- Unscrew the 4 × M12×35 stainless steel bolts on the bottom flange (fig. 2, pos. 13).
- Remove both gaskets (fig. 2, pos. 14).
- Install the new gaskets.
- Fasten 4 × M12×35 stainless steel bolts in each flange. Max. tightening torque: 74 Nm (100 ft-lb).

Replacing the top cover gasket (fig. 3, pos. 8)
- Unscrew the 4 × M12××35 stainless steel bolts (fig. 3, pos. 5).
- Remove the top cover (fig. 3, pos. 4) including installed pressure tube (fig. 3, pos. 7) and switch box (fig. 3, pos. 2).
- Remove the gasket (fig. 3, pos. 8).
- Install the new gasket.
- Fasten 4 × M12×35 stainless steel bolts (fig. 3, pos. 5).
  Max. tightening torque: 74 Nm (100 ft-lb).

Replacing the aluminium gasket (fig. 3, pos. 11)
- Unscrew the M4 × 8 pinol tailstock screw (fig. 3, pos. 3) with a Allen key.
- Remove the switch box (fig. 3, pos. 2) by slowly easing upwards.
- Unscrew the pressure tube (fig. 3, pos. 7) with a 32 mm wrench.
- Remove the aluminium gasket (fig. 3, pos. 11).
- Install the new gasket.
- Reinstall the pressure tube.
- Reinstall the switch box.

Replacing the switchbox (fig. 3, pos 2)
- Remove the DIN-plug (fig. 6).
- Unscrew the M4 × 8 pinol tailstock screw (fig. 3, pos. 3) with a Allen key.
- Remove the switch box (fig. 3, pos. 2) by slowly easing upwards.
- Install the new switch box.

Replacing the O-ring at the pressure tube (fig. 3, pos. 9)
- Unscrew the M4 × 8 pinol tailstock screw (fig. 3, pos. 3) with a Allen key.
- Remove the switch box (fig. 3, pos. 2) by slowly easing upwards.
- Remove the O-ring.
- Install the new O-ring.
- Reinstall the switch box.

DEUTSCH

Kältemittel
Geeignet für H-FCKW, nicht brennbares HFKW, und R717 (Ammoniak).

Temperaturbereich
–50°C/+65°C (–58°F/149°F)

Druckbereich
AKS 38 ist für einen max. Arbeitsdruck von 28 bar (406 psi) ausgelegt.

WICHTIG!
Ist ein Prüfdruck größer 28 bar (406 psi) erforderlich, ist die interne Schwimmereinheit zu entfernen, was einen maximalen Prüfdruck von 42 bar (609 psi) erlaubt.

Elektrische Daten
- **Mikroumschalter (SPDT)**
- 250 V a.c / 10 A
- 30 V d.c / 5 A
- **DIN-Stecker**
- DIN43650-Anschluss
- PG 11, 8-10 mm (0.31" - 0.39")
- Schraubklemme 1.5 mm² (16 AWG)
- 3+PE

Flüssigkeitspegeldifferenzial
Variabel zwischen 12,5 mm und 50 mm (½" to 2") in Stufen von 12,5 mm (½"). Die erforderliche Differenzialeinstellung sollte vor der Installation vorgenommen werden.
Werkseits auf 50 mm (2") eingestellt.

Kapselung
IP 65

Installation

WICHTIG!
AKS 38 muss immer in vertikaler Position installiert werden (Abb. 1 und 2).

AKS 38 wird komplett mit Flanschen geliefert (Abb. 2, Pos. 14). Die Außenflächen der Flansche müssen nach der Installation mit einer passenden Schutzschicht gegen Korrosion geschützt werden.

Um die Bildung eines die Bewegung der internen Schwimmereinheit beeinträchtigenden Öleinschlusses zu verhindern, muss das Anschlussrohr am Boden ein Gefälle zum Flüssigkeitsabscheider aufweisen.
Absperrventile für Servicezwecke müssen möglichst nahe am Schwimmer montiert werden (Abb. 1).

Schaltpunkt
Die Abhängigkeit des Schaltpunkts von der aktuellen Flüssigkeitsstandanzeige am AKS-38-Gehäuse ist relativ. Siehe Abb. 7.
Der obere Schaltpunkt ist aktuell (D : 2) höher als die aktuelle Flüssigkeitsstand- anzeige.
Der untere Schaltpunkt ist aktuell (D : 2) tiefer als die aktuelle Flüssigkeitsstand-anzeige. Wobei D = Differenz.

Justierung des Flüssigkeitspegel-Differenzschaltpunkts (siehe Abb. 9)
Der Schwimmer wird werkseits mit einer Differenz von 50 mm (2") mit dem unteren Klemmring C in Position b geliefert. Um eine kleinere Differenz einzustellen, ist der untere Klemmring C auf b_1 = 37,5 mm (1½") umzuplatzieren; (b_2 = 25 mm (1"); b_3 = 12,5 mm (½").
Der obere Klemmring D in Position a darf nicht verstellt oder umplatziert werden.

WICHTIG!
Die Justierung muss vor der Installation von AKS 38 in der Kälteanlage vorgenommen werden.
Die Klemmringe sind mit zwei Fingern umzuplatzieren. Keine Werkzeuge benutzen.

Den Klemmenkasten vom AKS 38 entfernen (Abb. 3, Pos. 2).
- Die M4 × 8 mm Reitstockschraube (Abb. 3, Pos. 3) mit einem Innensechskantschlüssel lösen.
- Den Klemmenkasten langsam nach oben entfernen.

Den Deckel des AKS-38-Gehäuses entfernen (Abb. 3, Pos. 4).
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben (Abb. 3, Pos. 5) lösen.
- Den kompletten Deckel einschließlich des installierten Druckrohrs (Abb. 3, Pos. 7) entfernen.

Die komplette Schwimmereinheit (Abb. 3, Pos. 1 und Abb. 4, Pos. 1) vom AKS-38-Gehäuse (Abb. 3, Pos. 6) entfernen.
- Den unteren Klemmring auf die erforderliche Differenzeinstellung umplatzieren.
- Siehe Abb. 8 und Abb. 9.

Wiederzusammenbau
- Die Schwimmereinheit wieder in das AKS 38-Gehäuse (Abb. 3, Pos. 6) einbauen.
- Den kompletten Deckel (Abb. 3, Pos. 4) wieder einbauen, und die 4 Stück M12 × 35 mm Maschinenschrauben (Abb. 3, Pos. 5) anziehen.
  Max. Anzugsmoment: 74 Nm (100 ft-lb).

- Den Klemmenkasten (Abb. 3, Pos. 2) wieder langsam über das Druckrohr (Abb. 3, Pos. 7) schieben.
- Den Klemmenkasten (Abb. 3, Pos. 2) wie erforderlich anbringen, und die M4 × 8 mm Reitstockschraube (Abb. 3, Pos. 3) mit einem Innensechskantschlüssel anziehen.

Elektroinstallation
Der elektrische Anschluss an den DIN-Stecker hat mit Kabeln mit maximal 4 Leitern und in Übereinstimmung mit dem Schaltplan (Abb. 8) zu erfolgen.
1. Common
2. Normally geschlossen
3. Normally offen
   Erdklemme

Instandhaltung

WICHTIG!
AKS 38 muss vor einem Kontakt mit der Luft evakuiert werden.

Austausch der internen Schwimmereinheit (Abb. 3, Pos. 1)
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben (Abb. 3, Pos. 5) lösen.
- Den Deckel (Abb. 3, Pos. 4) einschließlich installiertem Druckrohr (Abb. 3, Pos. 7) und den Klemmenkasten (Abb. 3, Pos. 2) entfernen.
- Die interne Schwimmereinheit (Abb. 3, Pos. 1) entfernen.
- Die neue Schwimmereinheit installieren.

Die Flanschdichtungen (Abb. 2, Pos. 15) austauschen.
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben am seitlichen Flansch (Abb. 2, Pos. 13) lösen.
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben am unteren Flansch (Abb. 2, Pos. 13) lösen.
- Beide Dichtungen (Abb. 2, Pos. 14) entfernen.
- Neue Dichtungen installieren.
- Die 4 Stück M12 × 35 mmEdelstahl-Maschinenschrauben auf jedem Flansch (Abb. 2, Pos. 13) anziehen. Max. Anzugsmoment: 74 Nm (100 ft-lb).

Austausch der Deckeldichtung (Abb. 3, Pos. 8)
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben (Abb. 3, Pos. 5) lösen
- Den Deckel (Abb. 3, Pos. 4) einschließlich installiertem Druckrohr (Abb. 3, Pos. 7) und den Klemmenkasten (Abb. 3, Pos. 2) entfernen.
- Die Dichtung (Abb. 3, Pos. 8) entfernen.
- Neue Dichtung installieren.
- Die 4 Stück M12 × 35 mm Edelstahl-Maschinenschrauben (Abb. 3, Pos. 5) lösen. Max. Anzugsmoment: 74 Nm (100 ft-lb).

Austausch der Aluminiumdichtung (Abb. 3, Pos. 11)
- Die M4 × 8 mm Reitstockschraube (Abb. 3, Pos. 3) mit einem Innensechskantschlüssel lösen.
- Den Klemmenkasten (Abb. 3, Pos. 2) langsam nach oben entfernen.
- Das Druckrohr (Abb. 3, Pos. 7) mit einem 32-mm-Schlüssel herausschrauben.
- Die Aluminiumdichtung (Abb. 3, Pos. 11) entfernen.
- Neue Dichtung installieren.
- Das Druckrohr wieder installieren.
- Den Klemmenkasten wieder installieren.

Austausch des Klemmenkastens (Abb. 3, Pos. 2)
- DIN-Verschlusskappe (Abb. 6) entfernen.
- Die M4 × 8 mm Reitstockschraube (Abb. 3, Pos. 3) mit einem Innensechskantschlüssel lösen.
- Den Klemmenkasten (Abb. 3, Pos. 2) langsam nach oben entfernen.
- Neuen Klemmenkasten installieren.

Austausch des O-Rings am Druckrohr (Abb. 3, Pos. 9)
- Die M4 × 8 mm Reitstockschraube (Abb. 3, Pos. 3) mit einem Innensechskantschlüssel lösen.
- Den Klemmenkasten (Abb. 3, Pos. 2) langsam nach oben entfernen.
- Den O-Ring entfernen.
- Neuen O-Ring installieren.
- Den Klemmenkasten wieder installieren.

FRANÇAIS

Fluides frigorigènes
Applicable au HCFC, HFC non inflammable, et R717(ammoniac).

Plage de température
– 50 °C / + 65 °C (– 58 °F / 149 °F)

Plage de pression
L'AKS 38 est conçu pour fonctionner à une pression de service maximale de 28 bars g (406 psi g).

IMPORTANT !
Si le test de pression doit dépasser 28 bars g (406 psig), enlever le flotteur interne complet afin d'atteindre la pression d'épreuve maximale de 42 bars g (609 psig).

Caractéristiques électriques
- Microcommutateur (UPBD)
- 250 V c.a / 10 A
- 30 c.d. / 5 A
- Prise DIN
- Raccord DIN 43650
- PG 11, 8-10 mm (0,31"-0,39")
- Borne à vis 1,5 mm2 (16 AWG)
- 3+PE

Différentiel de niveau liquide
Variable de 12,5 mm à 50 mm (½" à 2") par pas de 12,5 mm (½"). Le réglage différentiel requis doit être pratiqué avant toute installation. Réglé en usine à 50 mm (2").

Protection
IP 65

Installation

IMPORTANT !
L'AKS 38 doit toujours être installé en position verticale (figures 1 et 2).

L'AKS 38 est livré complet avec brides (figure 2, rep. 14). Les surfaces externes des brides doivent être protégées contre la corrosion par application d'une couche protectrice adéquate réalisée après l'installation.

Incliner le tuyau de raccordement inférieur vers le séparateur de liquide pour éviter la formation d'une poche d'huile qui affecterait le mouvement du flotteur interne.
Monter des vannes de sectionnement le plus près possible du flotteur afin de pouvoir pratiquer aisément l'entretien nécessaire (figure 1).

Point de contact
Le point de contact est fonction du marquage du niveau de liquide réel sur le corps de l'AKS 38. Voir figure 7.

Le point de contact supérieur est en réalité (D : 2) plus haut que le marquage du niveau de liquide réel.
Le point de contact inférieur est en réalité (D : 2) plus bas que le marquage du niveau de liquide réel.
Où D = différentiel.

Réglage du point de contact différentiel de niveau de liquide (voir figure 9).
Le flotteur est réglé en usine sur un différentiel de 50 mm (2"), la bague de blocage inférieure C étant en position b. Pour obtenir des points de réglage différentiels inférieurs, repositionner la bague de blocage inférieure C sur b_1 = 37,5 mm (1½") ; (b_2 = 25 mm (1") ; b_3 = 12,5 mm (½").
Ne pas régler ou repositionner la bague de blocage supérieure D en position.

IMPORTANT !
Effectuer ce réglage avant d'installer l'AKS 38 dans le système frigorifique. Utiliser deux doigts pour repositionner les bagues de blocage. N'utiliser aucun outil.

Enlever le boîtier de commutation de l'AKS 38 (figure 3, rep. 2).
- Débloquer la vis pointeau M4 × 8 (figure 3, rep. 3) à l'aide d'une clé allen.
- Enlever le boîtier de commutation en le dégageant lentement vers le haut.

Enlever le couvercle supérieur du corps de l'AKS 38 (figure 3, rep. 4).
- Débloquer les 4 boulons en acier inoxydable M12 × 35 (figure 3, rep. 5).
- Enlever le couvercle supérieur complet, y compris la conduite de pression installée (figure 3, rep. 7).

Enlever le flotteur complet (figure 3, rep. 1 et figure 4, rep. 1) du corps de l'AKS 38 (figure 3, rep.6).
- Repositionner la bague de blocage inférieure sur le réglage différentiel requis.
- Voir figures 8 et 9.

Remontage
- Replacer le flotteur complet dans le corps de l'AKS 38 (figure 3, rep. 6).
- Réinstaller le couvercle supérieur complet (figure 3, rep. 4) et bloquer les 4 boulons × M12 × 35 (figure 3, rep. 5). Couple de serrage maxi. : 74 Nm (100 ft-lb).

- Réinstaller le boîtier de commutation (figure 3, rep. 2) en l'enfonçant doucement sur la conduite de pression (figure 3, rep. 7).
- Positionner correctement le boîtier de commutation (figure 3, rep. 2) et bloquer la vis pointeau M4 × 8 (figure 3, rep. 3) à l'aide d'une clé allen.

Installation électrique
Pratiquer les raccordements électriques sur la prise DIN en utilisant un câble à 4 fils au maximum, conformément au schéma électrique (figure 8).
1. Commun
2. Normalement fermé
3. Normalement ouvert
   Borne de terre

Entretien

IMPORTANT !
Vidanger l'AKS 38 avant de l'ouvrir à l'air.

Remplacement du flotteur interne complet (figure 3, rep. 1)
- Débloquer les 4 boulons en acier inoxydable M12 × 35 (figure 3, rep. 5).
- Enlever le couvercle supérieur (figure 3, rep. 4), y compris la conduite de pression installée (figure 3, rep. 7) et le boîtier de commutation (figure 3, rep. 2).
- Enlever le flotteur interne complet (figure 3, rep. 1).
- Installer le nouveau flotteur complet.

Remplacement des joints d'étanchéité de bride (figure 2, rep. 15)
- Débloquer les 4 boulons en acier inoxydable M12 × 35 sur la bride latérale (figure 2, rep. 13).
- Débloquer les 4 boulons en acier inoxydable M12 × 35 sur la bride inférieure (figure 2, rep. 13).
- Enlever les deux joints d'étanchéité (figure 2, rep. 14).
- Installer les nouveaux joints d'étanchéité.
- Bloquer les 4 boulons en acier inoxydable M12 × 35 sur chacune des brides. Couple de serrage maxi. : 74 Nm (100 ft-lb).

Remplacement du joint d'étanchéité du couvercle supérieur (figure 3, rep. 8)
- Débloquer les 4 boulons en acier inoxydable M12 × 35 (figure 3, rep. 5).
- Enlever le couvercle supérieur (figure 3, rep. 4), y compris la conduite de pression installée (figure 3, rep. 7) et le boîtier de commutation (figure 3, rep. 2).
- Enlever le joint d'étanchéité (figure 3, rep. 8).
- Installer le nouveau joint d'étanchéité.
- Bloquer les 4 boulons en acier inoxydable M12 × 35 (figure 3, rep. 5).
  Couple de serrage maxi. : 74 Nm (100 ft-lb).

Remplacement du joint d'étanchéité en aluminium (figure 3, rep. 11)
- Débloquer la vis pointeau M4 × 8 (figure 3, rep. 3) à l'aide d'une clé allen.
- Enlever le boîtier de commutation (figure 3, rep. 2) en le dégageant lentement vers le haut.
- Débloquer la conduite de pression (figure 3, rep. 7) à l'aide d'une clé de 32 mm.
- Enlever le joint d'étanchéité en aluminium (figure 3, rep. 11).
- Installer le nouveau joint d'étanchéité.
- Réinstaller la conduite de pression.
- Réinstaller le boîtier de commutation.

Remplacement du boîtier de commutation (figure 3, rep. 2)
- Enlever la prise DIN (figure 6).
- Débloquer la vis pointeau M4 × 8 (figure 3, rep. 3) à l'aide d'une clé allen.
- Enlever le boîtier de commutation (figure 3, rep. 2) en le dégageant lentement vers le haut.
- Installer le nouveau boîtier de commutation. Remplacement du joint torique de la conduite de pression (figure 3, rep. 9)
- Débloquer la vis pointeau M4 × 8 (figure 3, rep. 3) à l'aide d'une clé allen.
- Enlever le boîtier de commutation (figure 3, rep. 2) en le dégageant lentement vers le haut.
- Enlever le joint torique.
- Installer le nouveau joint torique.
- Réinstaller le boîtier de commutation.

ESPAÑOL

Refrigerantes
Apto para HCFC, HFC no inflamable y R-717 (amoníaco).

Rango de temperatura
–50°C/+65°C (–58°F/149°F)

Rango de presión
El AKS 38 está diseñado para una presión de trabajo máx. de 28 bar g (406 psi g)

IMPORTANTE
Si fuera necesario realizar una prueba de presión a más de 28 bar (406 psi g), se deberá desmontar el flotador y con esto se alcanzará una presión de prueba máx. de hasta 42 bar (609 psi g).

Datos eléctricos
- **Contacto de conmutación (SPDT)**
- 250 V c.a / 10 A
- 30 V c.c / 5 A
- **Clavija DIN**
- Conexión DIN 43650
- PG 11, 8-10 mm (0.31” - 0.39”)
- Terminal roscar 1.5 mm^2 (16AWG)
- 3+PE

Diferencial de nivel de líquido
Diferencial (D) = Variable entre 12mm y 50 mm (½” a 2”) con incrementos de 12 mm (½”). El ajuste del diferencial deseado deberá realizarse antes de la instalación.
Ajuste de fábrica a 50 mm (2”).

Protección
IP 65

Instalación

IMPORTANTE
El AKS 38 siempre deberá montarse en posición vertical (figs. 1 y 2.)

El AKS 38 se suministra completo con bridas (fig. 2, pos. 14). Para evitar la corrosión, se deberán tratar las superficies externas de las bridas tras el montaje con un protector anticorrosivo adecuado.

Para evitar la presencia de aceite que pudiera afectar el movimiento del flotador, el tubo de conexión inferior deberá estar inclinado hacía el separador de aceite (formar un ángulo con el separador).
Las válvulas de cierre deberán estar montadas lo más próximos al flotador para facilitar posibles trabajos de mantenimiento (Fig. 1).

Punto de conmutación
El punto de conmutación del contacto está en función del nivel de líquido real marcado en el cuerpo del AKS 38. (Ver fig. 7).
El punto de conmutación superior (D: 2) es en realidad más alto que la marca del nivel de líquido actual.

El punto de conmutación inferior (D: 2) es en realidad más bajo que la marca de nivel de líquido actual. Donde D = diferencial.

Ajuste del punto de conmutación del diferencial de nivel de líquido (ver fig. 9)
El flotador se suministra con un ajuste del diferencial de fábrica de 50 mm (2”) con el anillo de bloqueo C en pos. B. Para reducir el punto de ajuste del diferencial, cambiar la posición del anillo de bloqueo inferior:
b_1 = 37,5 mm(1½”); b_2 =25 mm (1”);
b_3 = 12,5 mm (½”).
El anillo de bloqueo superior D en pos. “a” no deberá ser reajustado o modificado.

IMPORTANTE
El ajuste siempre deberá efectuarse antes de instalar el AKS 38 en la instalación de refrigeración. Los ajustes de los anillos de bloqueo deberán realizarse con los dedos, sin la utilización de ningún tipo de herramientas.

Desmontar la caja eléctrica del AKS 38 (fig. 3, pos. 2)
- Aflojar el tornillo de fijación M4 × 8 (fig. 3, pos. 3) con una llave Allen.
- Quitar la caja eléctrica levantándola suavemente hacia arriba.

Desmontar la tapa superior del cuerpo del AKS 38. (fig. 3, pos. 4)
- Aflojar los 4 × M12×35 tornillos de acero inoxidable (fig. 3, pos. 5)
- Quitar toda la cubierta superior incluyendo el tubo de presión (fig. 3, pos. 7).

Desmontar el flotador completo (fig. 3, pos. 1 y fig. 4, pos. 1) del cuerpo del AKS 38 (fig. 3, pos. 6)
- Ajuste el anillo de bloqueo al ajuste del diferencial deseado
- Ver figs. 8 y 9.

Montaje
- Acoplar nuevamente el flotador en el cuerpo del AKS 38 (fig. 3, pos. 6).
- Montar nuevamente la tapa superior (fig. 3, pos. 4) y fijar los 4 × M12×35 tornillos. (fig. 3, pos. 5). Máx. par de apriete: 74 Nm (100 ft-lb).
- Volver a montar la caja eléctrica presionándola suavemente al tubo de presión (fig. 3, pos. 7).
- Situar la caja eléctrica (fig. 3, pos. 2) en la posición deseada y apretar el tornillo de fijación M4 × 8 (fig. 3, pos.3) con una llave Allen.

Conexionado eléctrico
Efectuar la conexión eléctrica a la clavija DIN mediante un cable de máx. 4 hilos siguiendo el esquema de conexionado eléctrico (fig. 8).
1. Común
2. Normalmente cerrado
3. Normalmente abierto
   Conexión a tierra

Mantenimiento

IMPORTANTE
Antes de entrar en contacto con aire, el AKS 38 deberá vaciarse de refrigerante.

Sustitución del flotador (fig. 3, pos 1)
- Desatornillar los tornillos de acero inoxidable 4 × M12×35 (fig. 3, pos. 5).
- Quitar la tapa superior (fig. 3, pos. 4) incluyendo el tubo de presión (fig. 3, pos. 7) y la caja eléctrica (fig. 3, pos. 2).
- Quitar el flotador (fig. 3, pos. 1).
- Montar el nuevo flotador.

Sustitución de las juntas de bridas (fig. 3, pos.8)
- Desatornillar los 4 × M12×35 tornillos de acero de la brida lateral (fig. 2, pos.13).
- Desatornillar los 4 × M12×35 tornillos de acero de la brida inferior (fig. 2, pos.13).
- Quitar ambas juntas (fig. 2, pos.14).
- Montar las nuevas juntas.
- Fijar los tornillos de acero 4 × M12×35 en cada brida. Máx. par de apriete: 74 Nm (100 ft-lb).

Sustitución de la junta de la tapa superior (fig.3, pos. 8).
- Desatornillar los tornillos de acero inoxidable 4 × M12×35 (fig. 3, pos. 5).
- Quitar la tapa superior (fig. 3, pos. 4) incluyendo el tubo de presión (fig. 3, pos. 7) y la caja eléctrica (fig. 3, pos. 2).
- Quitar la junta (fig. 3, pos. 8).
- Montar la nueva junta
- Fijar los tornillos 4 × M12×35 de acero inoxidable (fig. 3, pos. 5).
  Máx. par de apriete: 74 Nm (100 ft-lb).

Sustitución de la junta de aluminio (fig. 3, pos. 11)
- Desatornillar el tornillo de fijación M4 × 8 (fig. 3, pos. 3) con una llave Allen.
- Quitar la caja eléctrica (fig. 3, pos. 2) levantándola suavemente hacia arriba.
- Desatornillar el tubo de presión (fig. 3, pos 7) con una llave inglesa de 32 mm.
- Quitar la junta de aluminio (fig. 3, pos.11).
- Montar la nueva junta
- Montar nuevamente el tubo de presión.
- Montar nuevamente la caja eléctrica.

Sustitución de la caja eléctrica (fig. 3, pos.2)
- Quitar la clavija DIN (fig. 6)
- Desatornillar el tornillo de fijación M4 × 8 (fig. 3, pos. 3) con una llave Allen.
- Quitar la caja eléctrica (fig. 3, pos. 2) levantándola suavemente hacia arriba.
- Montar la nueva caja eléctrica.

Sustitución de la junta tórica del tubo de presión (fig. 3, pos. 9)
- Desatornillar el tornillo de fijación M4 × 8 (fig. 3, pos. 3) con una llave Allen.
- Quitar la caja eléctrica (fig. 3, pos. 2) levantándola suavemente hacia arriba.
- Quitar la junta tórica
- Montar la nueva junta tórica
- Volver a montar la caja eléctrica.

ITALIANO

Refrigeranti
Applicabile a HCFC, HFC non infiammabili ed R717 (ammoniaca).

Campo di temperatura
– 50 °C / + 65 °C (– 58 °F / 149 °F)

Campo di pressione
L'AKS 38 è progettato per una max. pressione di esercizio di 28 bar g (406 psi g)

IMPORTANTE
Nel caso debba essere effettuato un test ad una pressione superiore a 28 bar g (406 psi g) è necessario smontare il galleggiante, ciò permette di raggiungere una pressione di prova di 42 bar g (406 psi g)

Dati elettrici
- Contatto in commutazione (SPDT)
- 250 V a.c./10 A
- 30 V d.c./5 A
- Plug DIN
- Attacco DIN 43650
- PG 11, 8-10 mm (0.31" - 0.39")
- Morsetto da 1.5 mm2 (16 AWG)
- 3+PE

Differenziale livello liquido
Variabile tra 12.5 mm e 50 mm (da 1/2" a 2") con incrementi di 12 mm (1/2").
Il settaggio del differenziale deve essere eseguito prima dell'istallazione.
Impostazione di fabbrica 50 mm (2")

Protezione
IP 65

INSTALLAZIONE

IMPORTANTE
L'AKS 38 deve essere installato sempre verticalmente. (fig. 1 e 2).

L'AKS 38 è fornito completo di flange (fig. 2, pos. 14). La superficie esterna delle flange deve essere trattata dopo l'istallazione per prevenirne la corrosione.

Per evitare che la presenza di olio possa alterare il movimento del galleggiante, la tubazione inferiore deve essere inclinata nella direzione del separatore. I rubinetti di intercettazione devono essere installati il più vicino possibile per agevolare eventuali interventi di manutenzione (fig. 1).

Punto di commutazione
Il punto di commutazione del contatto è relativo al livello di liquido effettivo segnato sul corpo dell'AKS 38. Vedere fig. 7.

Il punto di commutazione superiore è più alto (D/2) del livello marchiato.
Il punto di commutazione inferiore è più basso (D/2)del livello marchiato.
Dove D= Differenziale
Regolazione del differenziale D (vedere fig.9)
Il galleggiante arriva dalla fabbrica con un differenziale settato di 50 mm con l'anello di blocco C in posizione "b". Per ridurre il differenziale spostare l'anello di blocco C in posizione b_1 = 37,5 mm (1½") ; (b_2 = 25 mm (1") ; b_3 = 12,5 mm (½").

L'anello di blocco D in posizione "a" non deve essere riposizionato.

IMPORTANTE
La regolazione deve essere effettuata prima che l'AKS 38 venga installato nell'impianto frigorifero. Procedere manualmente al riposiziona-mento degli anelli di blocco, senza utilizzare strumenti.

Rimuovere la scatola contatti dell'AKS 38 (fig. 3, pos. 2)
- svitare la vite di blocco M4 × 8 (fig.3 pos. 3) con una chiave Allen.
- rimuovere la scatola contatti sfilandola lentamente verso l'alto.

Rimuovere il coperchio superiore del corpo dell'AKS 38 (fig. 3, pos. 4).
- allentare i bulloni di acciaio inossidabile 4 × m12-35 (fig. 3, pos. 5)
- rimuovere completamente il coperchio superiore con il tubo attaccato (fig. 3, pos. 6)

Rimuovere il galleggiante (fig.3, pos. 1 e fig. 4, pos.1) dal corpo dell'AKS 38 (fig. 3, pos. 6).
- riposizionare l'anello di blocco inferiore in considerazione del differenziale voluto
- vedere fig. 8 e fig. 9

Rimontaggio
- Reinstallare il galleggiante nel corpo dell'AKS 38 (fig. 3, pos. 6)
- Reinstallare il coperchio superiore (fig. 3, pos. 4) e fissare i bulloni 4 × M12 × 35 (fig. 3, pos.5)
  Coppia di serraggio massima:
  74 Nm (100 ft-lb)
- Reinstallare la scatola contatti (fig. 3, pos. 2) forzando leggermente sul tubo di fig. 3, pos. 7.
- Posizionare correttamente la scatola contatti e fissare la vite di blocco (fig. 3, pos. 3) con una chiave Allen.

Collegamenti elettrici
effettuare il collegamento elettrico alla spina DIN utilizzando un cavo di max 4 fili e cablare seguendo il diagramma di fig.8.
1. Comune
2. Normalmente chiusa
3. Normalmente aperta
   Terminale di terra

Manutenzione

IMPORTANTE
L'AKS 38 deve essere evacuato prima di aprirlo.

Sostituzione del galleggiante (fig.3, pos. 1)
- svitare i bulloni di acciaio inossidabile 4 × M12 × 35 (fig. 3, pos.5)
- rimuovere il coperchio superiore (fig. 3, pos.4) incluso il tubo (fig. 3, pso. 7) e scatola contatti (fig. 3, pos. 2)
- rimuovere il galleggiante interno (fig. 3, pos. 1)
- installare il nuovo galleggiante

Sostituzione delle guarnizioni delle flange (fig. 2, pos. 15)
- svitare i bulloni in acciaio inossidabile 4 × M12 × 35 sulla flangia laterale (fig. 2, pos. 13)
- svitare i bulloni in acciaio inossidabile 4 × M12 × 35 sulla flangia inferiore (fig. 2, pos. 13)
- rimuovere entrambe le guarnizioni (fig. 2, pos. 14)
- installare le nuove guarnizioni
- fissare i bulloni in acciaio inossidabile 4 × M12 × 35 in ciascuna flangia. Massima coppia di serraggio: 74Nm (100 ft-lb)

Sostituzione della guarnizione del coperchio superiore (fig. 3, pos. 8)
- svitare i bulloni in acciaio inossidabile 4 × M12 × 35 (fig. 3, pos. 5)
- rimuovere il coperchio superiore (fig. 3, pos. 4) incluso il tubo (fig. 3, pos. 7) e la scatola contatti (fig. 3, pos. 2)
- rimuovere la guarnizione (fig. 3, pos. 8)
- installare la nuova guarnizione
- fissare i bulloni in acciaio inossidabile 4 × M12 × 35 (fig. 3, pos. 5)
  Massima coppia di serraggio : 74Nm (100 ft-lb)

Sostituzione della guarnizione in alluminio (fig.3, pos. 11)
- svitare la vite di blocco M4 × 8 (fig. 3, pos. 3) con una chiave Allen.
- rimuovere la scatola contatti (fig. 3, pos.2) sfilandola lentamente verso l'alto.
- svitare tubo (fig. 3, pos. 7) con una chiave da 32 mm.
- rimuovere la guarnizione in alluminio (fig. 3 pos. 11)
- installare la nuova guarnizione
- reinstallare il tubo
- reinstallare la scatola contatti

Sostituzione della scatola contatti (fig. 3, pos. 2)
- rimuovere la spina DIN (fig. 6)
- svitare la vite di blocco M4 × 8 (fig. 3, pos. 3) con una chiave Allen.
- rimuovere la scatola contatti (fig. 3, pos. 2) sfilandola lentamente verso l'alto.
- installare la nuova scatola contatti.

Sostituzione dell'O-ring (fig. 3, pos. 9)
- svitare la vite di blocco M4 × 8 (fig. 3, pos. 3) con una chiave Allen.
- rimuovere la scatola contatti (fig. 3, pos.2) sfilandola lentamente verso l'alto.
- rimuovere l'O-ring
- installare il nuovo O-ring
- reinstallare la scatola contatti.

PORTUGUÊS

Refrigerantes
Aplicável para HCFC, HFC não inflamável e R717 (Amônia).

Faixa de temperatura
–50 °C/+65 °C (–58 °F/149 °F)

Faixa de pressão
O AKS 38 é projetado para uma pressão máx. de funcionamento de 28 bar g (406 psi g).

IMPORTANTE
Caso seja necessária uma pressão de teste que exceda os 28 bar g (406 psi g), então o conjunto do flutuador interno tem que ser removido, sendo assim permitida uma pressão de teste máxima de 42 bar g (609 psi g)

Dados elétricos
- **Comutador (SPDT)**
- 250 V c.a/10 A
- 30 V c.c/5 A
- **Plugue DIN**
- Conexão DIN 43650
- PG 11, 8-10 mm (0,31” - 0,39”)
- Terminal parafuso 1,5 mm² (16 AWG)
- 3+PE

Diferencial de nível de líquido
Variável entre 12,5 mm e 50 mm (½” e 2”) em incrementos de 12,5 mm (½”). A configuração do diferencial necessário deve ser feita antes da instalação.
Configuração de fábrica é 50 mm (2”).

Carcaça
IP65

Instalação

IMPORTANTE
O AKS 38 tem que ser sempre instalado em uma posição vertical (fig. 1 e 2).

O AKS 38 é fornecido completo com flanges (fig. 2, pos. 14). As superfícies externas das flanges têm que ser protegidas contra a corrosão com um revestimento protetor adequado após a instalação.

Para evitar a formação de uma camada de óleo que afetaria o movimento do flutuador interno, o tubo de conexão inferior tem que ter uma inclinação na direção do separador de líquido. As válvulas de bloqueio devem ser montadas tão perto quanto possível do flutuador, para assistência (fig. 1).

Ponto do interruptor
O ponto do interruptor é relativo à marca atual de nível de líquido no corpo do AKS 38. Consulte fig. 7.

O ponto do interruptor superior é de fato (D : 2) superior à marca atual de nível de líquido.

O ponto do interruptor inferior é de fato (D : 2) inferior à marca atual de nível de líquido.
Onde D = diferencial.

Ajuste do ponto do interruptor do diferencial de nível de líquido (consulte fig. 9)
O flutuador vem de fábrica com uma configuração de diferencial de 50 mm (2”) com o anel de bloqueio inferior Ⓒ na posição b. Para conseguir configurações de diferencial menores reposicione o anel de bloqueio inferior Ⓒ em b_1 = 37,5 mm (1½”);
(b_2 = 25 mm (1”); b_3 = 12,5 mm (½”).
O anel de bloqueio superior Ⓓ na posição a não deve ser ajustado ou reposicionado.

IMPORTANTE
O ajuste tem que ser feito antes do AKS 38 ser instalado no sistema de refrigeração. Use os dois polegares para reposicionar os anéis de bloqueio. Não use quaisquer ferramentas.

Remova a caixa do interruptor do AKS 38 (fig. 3, pos. 2).
- Desaperte o parafuso M4 × 8 (fig. 3, pos. 3) com uma chave Allen.
- Remova a caixa do interruptor puxando lentamente para cima.

Remova a tampa superior do corpo do AKS 38 (fig. 3, pos. 4).
- Desaperte os parafusos de aço inoxidável 4 × M12 × 35 (fig. 3, pos. 5).
- Remova toda a tampa superior, incluindo o tubo de pressão instalado (fig. 3, pos. 7).

Remova o conjunto completo do flutuador (fig.3, pos. 1 e fig. 4, pos. 1) do corpo da AKS 38 (fig. 3, pos. 6).
- Reposicione o anel de bloqueio inferior na configuração de diferencial pretendida.
- Consulte fig. 8 e fig. 9.

Montar novamente
- Recoloque novamente o conjunto do flutuador no corpo do AKS 38 (fig. 3, pos. 6).
- Reinstale toda a tampa superior (fig. 3, pos. 4) e aperte os parafusos 4 × M12 × 35 (fig. 3, pos. 5). Máx. torque de aperto: 74 Nm (100 pés-lb).
- Reinstale a caixa do interruptor (fig. 3, pos. 2), forçando-a lentamente pelo tubo de pressão abaixo (fig. 3, pos. 7).
- Posicione a caixa do interruptor (fig. 3, pos. 2) como requerido e aperte o parafuso M4 × 8 (fig. 3, pos. 3) com uma chave Allen.

Instalação elétrica
Faça a conexão elétrica ao plugue DIN usando cabo no máximo com 4 núcleos e fio, de acordo com o diagrama de cabeamento (fig. 8).
1. Comum
2. Normalmente fechado
3. Normalmente aberto

⏚ Terminal de aterramento

Manutenção

IMPORTANTE
O AKS 38 tem que ser esvaziado antes de ser exposto ao ar.

Substituição do conjunto do flutuador interno (fig. 3, pos.1)
- Desparafuse os parafusos de aço inoxidável 4 × M12×35 (fig. 3, pos. 5).
- Remova a tampa superior (fig. 3, pos. 4) incluindo o tubo de pressão instalado (fig. 3, pos. 7) e a caixa do interruptor (fig. 3, pos. 2).
- Remova o conjunto do flutuador interno (fig 3, pos. 1).
- Instale o novo conjunto flutuador.

Substituir as juntas da flange (fig. 2, pos. 15)
- Desparafuse os parafusos de aço inoxidável 4 × M12×35 da flange lateral (fig. 2, pos. 13).
- Desparafuse os parafusos de aço inoxidável 4 × M12×35 da flange inferior (fig. 2, pos. 13).
- Remova ambas as juntas (fig. 2, pos. 14).
- Instale as novas juntas.
- Aperte os parafusos de aço inoxidável 4 × M12×35 em cada flange. Máx. torque de aperto: 74 Nm (100 pés-lb).

Substituir a junta da tampa superior (fig. 3, pos. 8)
- Desparafuse os parafusos de aço inoxidável 4 × M12×x35 (fig. 3, pos. 5).
- Remova atampa superior (fig. 3, pos. 4) incluindo o tubo de pressão instalado (fig. 3, pos. 7) e a caixa do interruptor (fig. 3, pos. 2).
- Remova a junta (fig. 3, pos. 8).
- Instale a nova junta.
- Aperte os parafusos de aço inoxidável 4 × M12×35 (fig. 3, pos. 5).
  Máx. torque de aperto: 74 Nm (100 pés-lb).

Substituir a junta de alumínio (fig. 3, pos. 11)
- Desparafuse o parafuso M4 × 8 (fig. 3, pos. 3) com uma chave Allen.
- Remova a caixa do interruptor (fig. 3, pos. 2) puxando lentamente para cima.
- Desparafuse o tubo de pressão (fig. 3, pos. 7) com uma chave inglesa de 32 mm.
- Remova a junta de alumínio (fig. 3, pos. 11).
- Instale a nova junta.
- Reinstale o tubo de pressão.
- Reinstale a caixa do interruptor.

Substituir a caixa do interruptor (fig. 3, pos. 2)
- Remova o plugue DIN (fig. 6).
- Desparafuse o parafuso M4 × 8 (fig. 3, pos. 3) com uma chave Allen.
- Remova a caixa do interruptor (fig. 3, pos. 2) puxando lentamente para cima.
- Instale a nova caixa do interruptor.

Substituir o O-ring no tubo de pressão (fig. 3, pos. 9)
- Desparafuse o parafuso M4 × 8 (fig. 3, pos. 3) com uma chave Allen.
- Remova a caixa do interruptor (fig. 3, pos. 2) puxando lentamente para cima.
- Remova o O-ring.
- Instale o novo O-ring.
- Reinstale a caixa do interruptor.

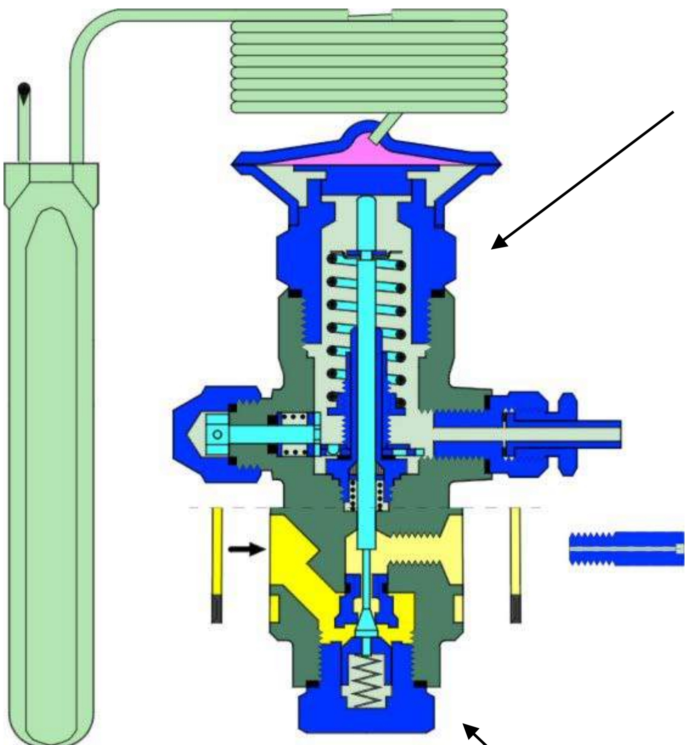
ENGINEERING
TOMORROW

Thermostatic Expansion Valve for Ammonia
Type TEA

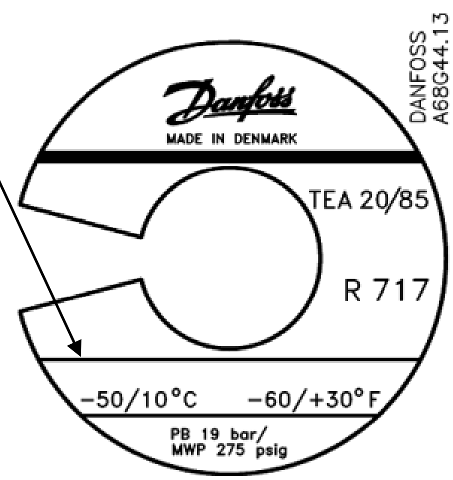
TEA Overview

- Nominal capacity ratings of 1 to 85 TR, R717
- External equalized
- Adjustable superheat
- 16.5 ft (5 m) Capillary tube length
- Available with 2 evaporator temperature ranges:
  - -58 to 32 °F (-50 to 0 °C)
  - -4 to 86 °F (-20 to 30 °C)

TEA Cut-away and Identification



Replaceable thermostatic element. It is important to provide the temperature range on label when ordering.

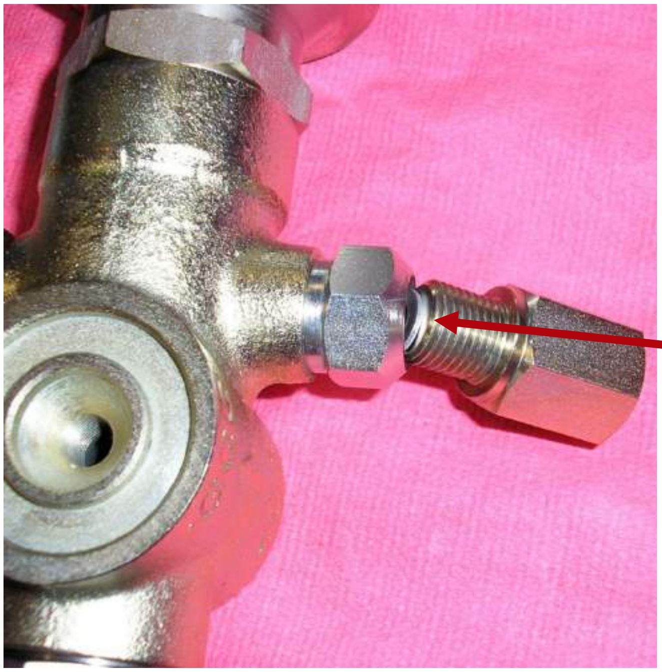


Replaceable orifice assembly.

It is important to provide orifice size when ordering a replacement which is stamped on the bottom of the orifice.

TEA External Equalization Connection

The equalization connection is ¼″ BSP (European thread) and needs an aluminum gasket to seal connection. A weld nipple is supplied with the TEA valve but it is more common to use our ICS pressure gauge adapter p/n 027B2062 which is for an ICS valve but can be used in TEA if the aluminum gasket that comes with the weld nipple is used instead of the gasket that comes with the adapter. See below.



Weld nipple
shipped with TEA

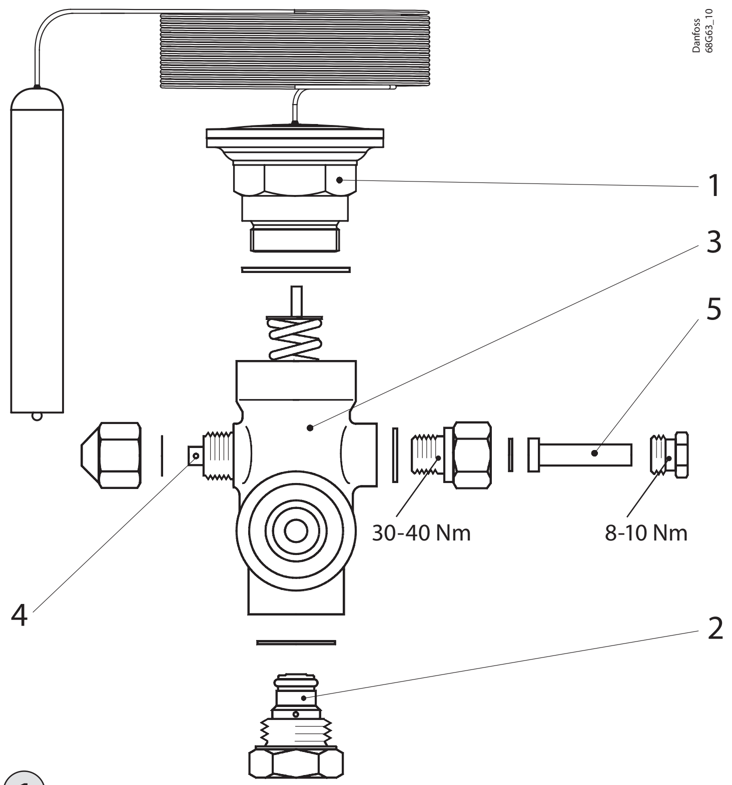
¼″ BSP to ¼″ FPT ICS
adapter p/n 027B2062

Danfoss

Installation Guide

Expansion valves
TEA 20, 85

068R9511

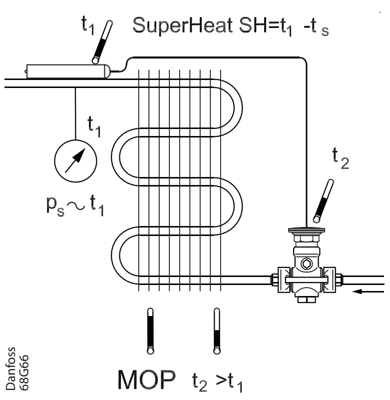


1. Power element
2. Orifice assembly
3. Valve body
4. Regulating spindle
5. Pressure equalizing connection

	TR [tons]	kcal/h	Nr./No./N°
TEA 20	1	3.000	**068G2050**
	2	6.000	**068G2051**
	3	9.000	**068G2052**
	5	15.000	**068G2053**
	8	24.000	**068G2054**
	12	36.000	**068G2055**
	20	60.000	**068G2056**
TEA 85	33	99.000	**068G2057**
	55	165.000	**068G2058**
	85	255.000	**068G2059**

Table

1



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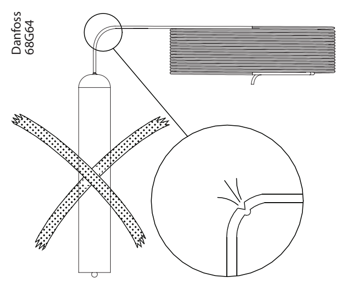

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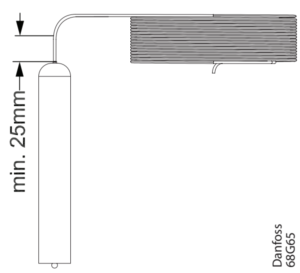

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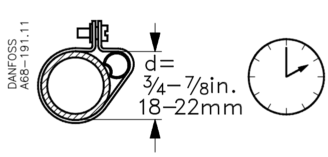

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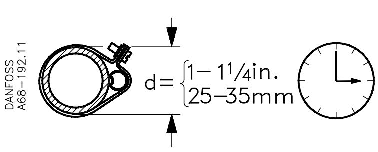

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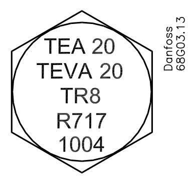


7

068R9511

ENGLISH

Technical data

Maximum bulb temperature:
+212°F (+100°C)

Maximum test pressure:
p' = 398 psig (28 bar) (P_e)

Max. working pressure:
PS/MWP = 270 psig (19 bar) (P_e)

Refrigerant:
R717 (NH_3)

Capillary tube length:
16.5 ft (5 m)

Fitting

The valve can be fitted in any position, but the valve body must always be warmer than the bulb (fig. 2).

Note !
The capillary tube must not be bent closer than 25 mm /1 in. from the sensor shown in fig. 3 and 4. Otherwise the capillary tube will crack and the filling will get lost. As consequence the valve will not function.

TEA 20-1 only is equipped with a separate discharge orifice (code No. 006-0466); TEA 20-2 has the same orifice assembly but is without a separate discharge orifice.

The valve can only operate if the external pressure equalising line is connected. The equalising line should be connected to the upper side of the suction line after the bulb.

Connection is through a $^1/_4$ in or 6 mm steel tube which is welded to the nipple on the valve pressure equalising connection. The equalising line can also be connected to the valve by an 8 mm Ermeto screwed connection.

The bulb must not be fitted in or after liquid pockets, near pipe joints or solid iron parts, nor should it be fitted in places where it may be exposed to fluctuating temperature effects such as in the air flow from a fan or an open door.

The best place to fit the bulb is on a horizontal suction line, using a clip as shown in Fig, 5 if the outside pipe diameter is $^7/_8$ in or less. If the outside pipe diameter is more than $^7/_8$ in, the bulb should be fitted on the pipe side as shown in Fig. 6.

If it should become necessary for the valve capacity to be altered, orifice assemblies with different rated capacities can be obtained by quoting the code Nos. specified in table 1. Orifice assemblies are marked as shown in Fig, 7.

Torque

for power element approx. 100 Nm
for orifice assembly approx. 50 Nm

Adjustment

Factory setting: 9°F (5°C) superheat at a bulb temperature of +32°F (0°C).

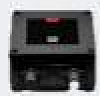
This setting can be altered by rotating the spindle (see Fig. 1, pos. 4) – clockwise rotation increases the superheat, and vice versa. One revolution in the appropriate direction increases or decreases the superheat by about 1°F (0.5°C).

It is possible to return to the factory setting by clockwise rotation through about 10 revolutions, starting from the completely slack spring condition.

ENGINEERING
TOMORROW

Danfoss GD
Gas Detection Units

GD Gas Detection Unit Portfolio

	Basic		Premium						Heavy Duty
									
Name	**Basic**	**Basic+**	**Premium**	**Premium+**	**Premium Flex**	**Premium Duplex**	**Premium Remote**	**Premium Uptime**	**Heavy Duty**
Features			3 Relays						2 Relays
		Buzzer and light function		Buzzer and light function				Buzzer and light function	
					LCD display	LCD display	LCD display	LCD display	LCD display
						2 different sensors	Remote sensor (5 meters)	UPS	Explosion proof (ATEX/IEC)
Protection	IP 65								
Communication	Analog (4-20 mA) and RS 485 Modbus communication								
Power supply	24 V AC/DC		24 V DC					90-240 V AC	24 V DC
Ammonia	X	X	X	X	X	X	X	X	X
CO2					X				
Fluorinated	X	X	X	X	X				
Hydrocarbons			X	X	X				

GD Gas Detector Accessories

GD Controller and system accessories

Controller Solution

Controller unit

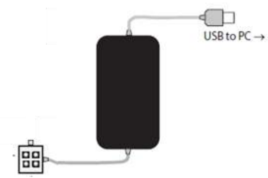
Wire breaking warning module

Controller Expansion module

Gateway

Service and calibration accessories

Service tool



PC tool

Magnetic Pen

Calibration adapter
Heavy duty/ remote

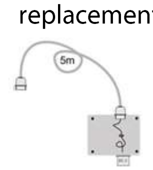
Calibration adapters
Basic/premium

Other accessories

Buzzer and light replacement

Duct adapter

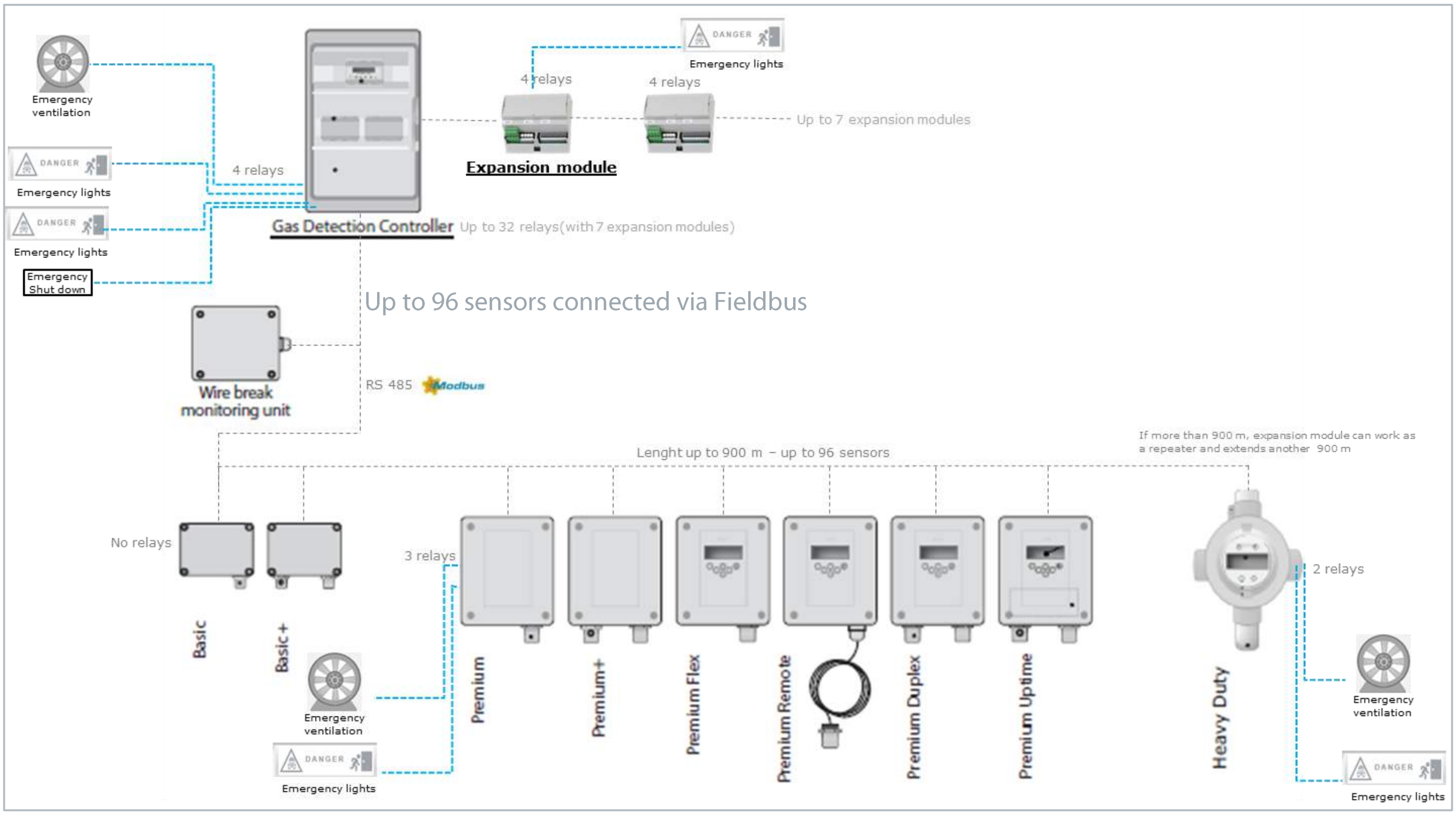
Seal cap
(Only remove before commissioning)



Remote kit

Splash guard
(do not remove)

Danfoss Gas Detection – System Overview

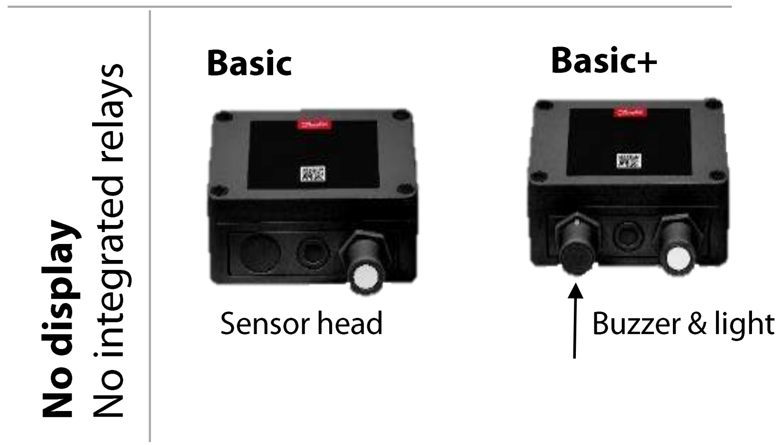


Gas Detecting Units
GD Basic Platform

Characteristics
Intended to be connected to a central system like Gas Detection Controller Unit, or a PLC (no integrated relays)
Factory default set-up: 2 alarm set-points ready for use
Adjustment, calibration or maintenance via the dedicated Service tool or the PC tool (no display)
Non-keypad versions for freezers Cost effective solution

Specifications
24V AC/DC (19-29 V), Max. 250 mA
IP65
Analog output 4-20 mA (2-10V)
Serial RS 485 interface (Modbus RTU and GD controller protocol)
LED status signals and alarm; 3 color light (green, yellow, red)

GD Basic

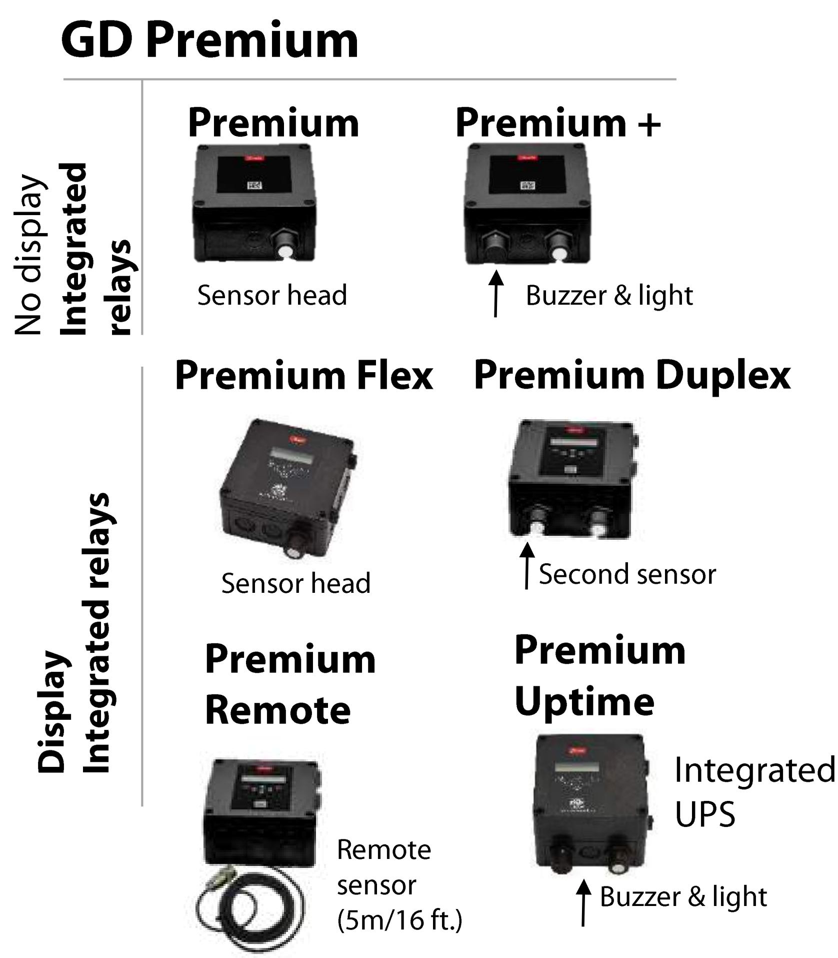


Documentation on gas detectors are accessible directly by the QR code on the units

Gas Detecting Units
GD Premium Platform

Characteristics
Intended as stand-alone or connected to a central system like Gas Detection Controller Unit, or a PLC
3 integrated relays for activation of alarm devices
Analog or RS485 Modbus connection to a central system allows additional centralized monitoring and alarm activation
Up to 4 alarm set-points possible. Factory default setting is with 2 alarm set-points ready for use.

Specifications
24V DC (19-29 V), Max. 210 mA (Premium uptime 90-240 AC)
IP65
Analog output 4-20 mA (2-10V)
Serial RS 485 interface (Modbus RTU and GD controller protocol)
3 relays included (SPDT 250V AC, 5 A)



Gas Detecting Units
GD Sensors

Characteristics
Offering the most common types of sensors used for detection of refrigerants:
• **Electrochemical sensors (EC)**
• **Semi-conductor sensors (SC)** (also named solid state)
• **Pellistor (P) sensors** (also named catalytic-bead sensor)
• **Infra-red (IR) sensors**
Easily exchangeable, plug and play sensors
Hermetically sealed, pre-calibrated and certified from the factory Temperature compensated (EC, P, IR)

Selection guideline of sensor types given refrigerant

Refrigerant	Sensor type
CO_2	IR – Infra-red sensors
Fluorinated (synthetic) refrigerants	SC – Semiconductor sensors/solid state
R290	P - Pellistor sensor/catalytic-bead
Ammonia	Three different type of sensors: EC, SC, P. Selection should be based on the criteria below:

Selection criteria - sensor types for Ammonia detection

Sensor	PPM range	Cross-sensitivity	Temperature range	Expected life time
EC	<5000 ppm	Low	-45 to 50 °C (-49 to 122 °F)	>2 years
SC	1000 ppm-10,000 ppm	High	-45 to 50 °C (49 to 122 °F)	>5 years
P	>10,000 ppm	Low	-45 to 60 °C (-49 to 140 °F)	>3 years

Gas Detecting Units
GD Controllers

Characteristics

For a centralized monitoring and warning of hazardous gas concentrations.

Input signals for the controller are collected from the local gas detection units - Basic, Premium and/or Heavy Duty - via RS485 Fieldbus or Analog communication.

For connection of up to 96 gas detection sensors.
Fieldbus wiring: Wire length up to 2953 ft. (900 meters) per segment.
Up to 7 Expansion modules possible; allows additional 7 segments with a total of 23,622 ft. (7200 meters) wiring and a total of 32 relays for alarm device circuits.

Automatic self-diagnostics to ensure correct communication and operation

Password protected settings allowing authorized access only
Product variant with integrated UPS in case of power failure possible (Controller Solution Uptime)

Specifications

24 V DC ± 20 %, 4W, 150mA
Alarm relay (4): 250 V AC, 5 A, potential-free, change-over (SPDT)
Fault relay: 250 V AC, 5 A, potential-free, normally open contact (SPST)
LCD & Status LED (4)
6 language menu (D, UK, NL, USA, F, S)
IP40

GD Controller and System Accesories


Controller Solution


Controller unit


Wire breaking monitoring module


Controller Expansion module


Gateway

GD Sensors
Danfoss GD Sensor Range Overview

All sensor heads on the gas detector units can be replaced by factory calibrated sensor replacements with a plug & play procedure. Either to fulfil calibration requirements or at the end of life of the sensor.

Danfoss part number	Danfoss description	Refrigerant	Sensor type	Sensor – ppm range	Sensors
148H6200	Sensor Ammonia EC 100	Ammonia	Electrochemical	0-100	
148H6201	Sensor Ammonia EC 300	Ammonia	Electrochemical	0- 300	
148H6202	Sensor Ammonia EC 1000	Ammonia	Electrochemical	0-1000	
148H6203	Sensor Ammonia SC 1000	Ammonia	Semiconductor	0-1000	
148H6204	Sensor Ammonia EC 5000	Ammonia	Electrochemical	0-5000	
148H6205	Sensor Ammonia SC 10000	Ammonia	Semiconductor	0-10.000	
148H6206	Sensor Ammonia P LEL	Ammonia	Pellistor	0-100% LEL	
148H6207	Sensor CO2 IR 20000	CO_2	Infrared	0-20.000	
148H6208	Sensor CO2 IR 50000	CO_2	Infrared	0-50.000	
148H6209	Sensor HCFC R123 SC 2000	R123	Semiconductor	0-2000	
148H6210	Sensor HFC R404A, R507 SC 2000	R404A, R507	Semiconductor	0-2000	
148H6211	Sensor HFC R134A SC 2000	R134A	Semiconductor	0-2000	
148H6212	Sensor HC R290 / Propane P 5000	R290	Pellistor	0-5000	
148H6213	Remote Sensor Ammonia EC 100	Ammonia	Electrochemical	0-100	
148H6214	Remote Sensor Ammonia EC 1000	Ammonia	Electrochemical	0-1000	
148H6215	Remote Sensor Ammonia EC 5000	Ammonia	Electrochemical	0-5000	
148H6216	Remote Sensor Ammonia SC 10000	Ammonia	Semiconductor	0-10.000	
148H6217	Heavy Duty Sensor Ammonia EC 1000	Ammonia	Electrochemical	0-1000	
148H6218	Heavy Duty Sensor Ammonia EC 5000	Ammonia	Electrochemical	0-5000	
148H6219	Heavy Duty Sensor Ammonia SC 10000	Ammonia	Semiconductor	0-10.000	
148H6220	Heavy Duty Sensor Ammonia P LEL	Ammonia	Pellistor	0-100% LEL	

Sensor Capabilities and Limitations
Danfoss GD Sensor Overview

	Danfoss Portfolio								
Sensor technology	**Ammonia**	**CO2**	**HCFCs HFCs**	**R290**	**Temperature compensated**	**Accuracy**	**Selective** (Low cross-sensitivity)	**Life time**	**Limitations**
Electrochemical	🟢				🟢	🟢	🟢	🟡	Lifetime affected by constant presence of target gas
Semiconductor	🟢		🟢		🔴	🟡	🔴	🟢	Prone to poisoning/Affected by humidity changes
Pellistor (catalytic bead)	🟢			🟢	🟢	🟡	🟡	🟢	Prone to poisoning
Infrared		🟢			🟢	🟢	🟢	🟢	Not suitable for dusty places

Temperature compensation:

- The ppm reading is not affected by temperature changes within the operational temperature range.
- This is achieved either by compensating the reading or by heating the media to a stable temperature.

Accuracy:

- It is given by multiple factors (sensitivity, repeatability, ambient conditions).
- Electrochemical sensors can be accurate down to 2% of the measuring range, while semiconductor sensors can vary up to 10%.

Cross sensitivity:

- It refers to the sensor being reactive to other gases apart from the target gas.

Danfoss GD Gas Detection Portfolio
GD Complete Units Overview - Part Numbers

Type	Refrigerants	Sensor	PPM range	Alarm	Basic	Basic+	Premium	Premium+	Premium Flex	Premium Duplex	Premium Remote	Premium Uptime	Heavy Duty
GDA	Ammonia	EC 100	0-100	25/35	148H6000	148H6001	148H6002	148H6003	148H6006	148H6004	148H6005	148H6007	
		EC 300	0-300	25/150	148H6008	148H6009	148H6010	148H6011	148H6013	148H6012			
		EC1000	0-1000	500/900	148H6014	148H6015	148H6016	148H6017	148H6020	148H6018	148H6019	148H6021	148H6022
		SC1000	0-1000	500/900	148H6023	148H6024	148H6025	148H6026	148H6027	148H6037			
		EC 5000	0-5000	1000/4500				148H6028			148H6029	148H6030 (w/rem 5 m)	148H6031
		SC 10000	0-10000	5000/9000			148H6032	148H6033			148H6034		148H6035
		P LEL	0-100% LEL	21% (30000 PPM)				148H6036	148H6038				148H6039
GDC	CO2	IR 20000	0-20000	5000/9000					148H6040				
		IR 50000	0-50000	10000/18000					148H6041				
GDHC	HCFC R123a	SC2000	0-2000	500/900			148H6042	148H6043	148H6044				
GDHF	HFC R404A, R507	SC2000	0-2000	500/900	148H6045	148H6046	148H6047	148H6048	148H6049				
	HFC R134A	SC2000	0-2000	500/900			148H6050	148H6051	148H6052				
GDH	R290	P 5000	0-5000	800/2500			148H6053	148H6054	148H6055				

Benefits of GD Gas Sensors

Plug & Play Gas Detection

- All GD gas detection units come factory pre-configured to match refrigerant and typical PPM settings required. Note: Depending on national regulations PPM settings may be subject to change.
- Once connected and powered up the GD unit is ready for addressing and you are good to go
- Automatic self-diagnostics for correct communication and operation
- Easy configuration via intuitive user-interface - no potentiometers or multimeters required
- Communication error if unit configuration and sensor type do not match

Pre-calibrated, Factory Certified Replacement Sensors

- All sensor heads are pre-calibrated and factory certified - no need for adjustment
- Replacement of the sensor heads is an easy procedure: Simply unplug the sensor and plug-in the new sensor.
- To guarantee the proper functioning of the units and to prevent human error, the sensor head can only be replaced by the same type and ppm range
- If a different sensor head (to the original) is installed, the unit will show a communication error (exact match required on refrigerant and ppm configuration)
- All sensors heads come with a RED protection cap (airtight) to prevent premature exposure (or poisoning) during installation. The seal cap must be removed prior to commissioning
- To protect sensor heads during wash-down cleaning and rinsing operations, a dedicated Splash Guard is available. It protects the sensor head against water exposure.

Benefits of GD Gas Sensors

Easy and Quick Calibration

- Integrated calibration routine - calibration with gas no longer involves the use of potentiometers and multimeters
- Calibration routine executed from the menu in the GD units
    - If GD unit with display, it can be performed directly from the unit
    - If GD unit without display, it must be performed via the dedicated Service tool or PC tool
- Generic calibration gas and valve/flow regulator with adjustable flow (ml/min.) required (not provided by Danfoss) + Danfoss Calibration Adapter

The integrated calibration routine reduces calibration time, requires less calibration gas per calibration, and provides significant cost savings potential. Total cost savings up to 75% compared to traditional (analog) solutions

Optimize Service and Maintenance Planning

- Service alerts (on unit, controller, or both) to indicate service due - based on number of days in operation). Visual signal depending on product variant
- The GD Controller (Solution or Unit) will provide information on when each of the GD units have service due. This helps you to optimize your service and maintenance planning.
- During the calibration procedure, using the dedicated PC tool enables you to print a field calibration report to support your safety and maintenance documentation.

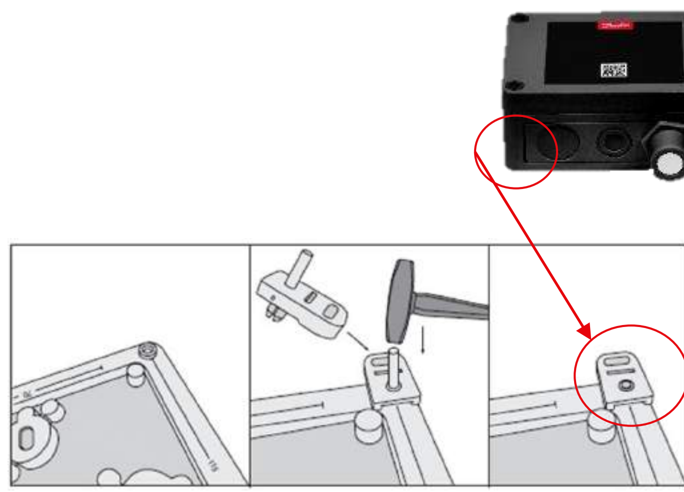
Service due information and service alerts support optimized maintenance planning

Installation
Mounting

Mounting

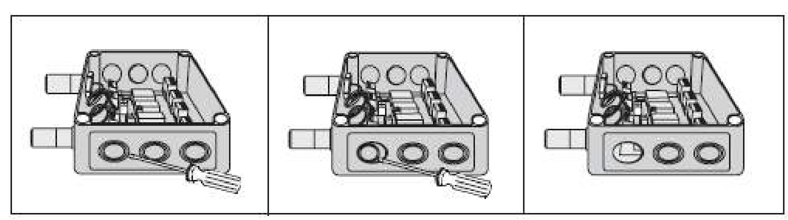
For easier installation, the basic and premium units, come with 4 mounting ears that can be used when temperatures are above 14 ºF (-10 ºC). They are easily installed as show in the picture.

Heavy duty units have fixed mounting ears for easy mounting.



Cable Gland

To allow flexibility at the installation, the cable glands of the units are not installed, so the customer can decide at the installation the side they want to use for the wiring. Two cable glands are included with the gas detector.



RED Protection Cap

The units come with a seal cap on top of the sensor that **should not be remove** until installation is finished and the unit is going to be powered up. This is to protect the lifetime of the sensor while not in use.

Installation of Basic Version
Electrical Connection

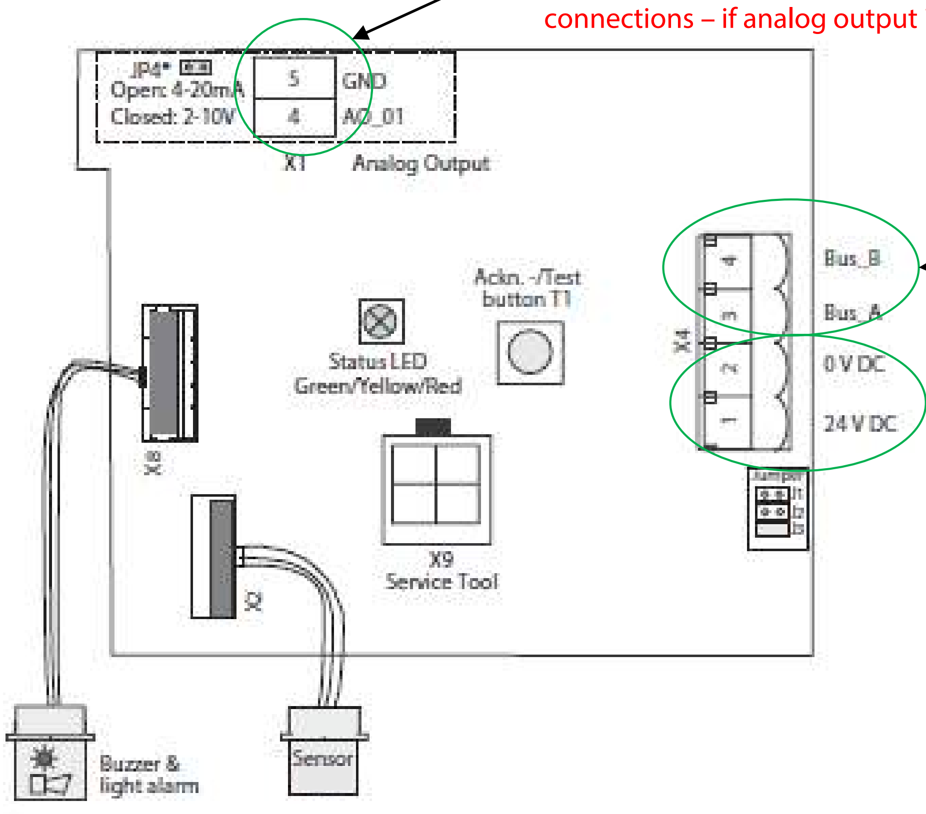
Documentation on gas detectors are accessible directly by the QR code on the units

Basic

Note: The RED protective cap on sensor should not be removed until the system is ready to be started up.

Analog output: 4-20mA (default) or 2-10V

Note: A resistor comes installed on the analog output connections – if analog output is used, remove the resistor.



RS 485 / Field bus communication

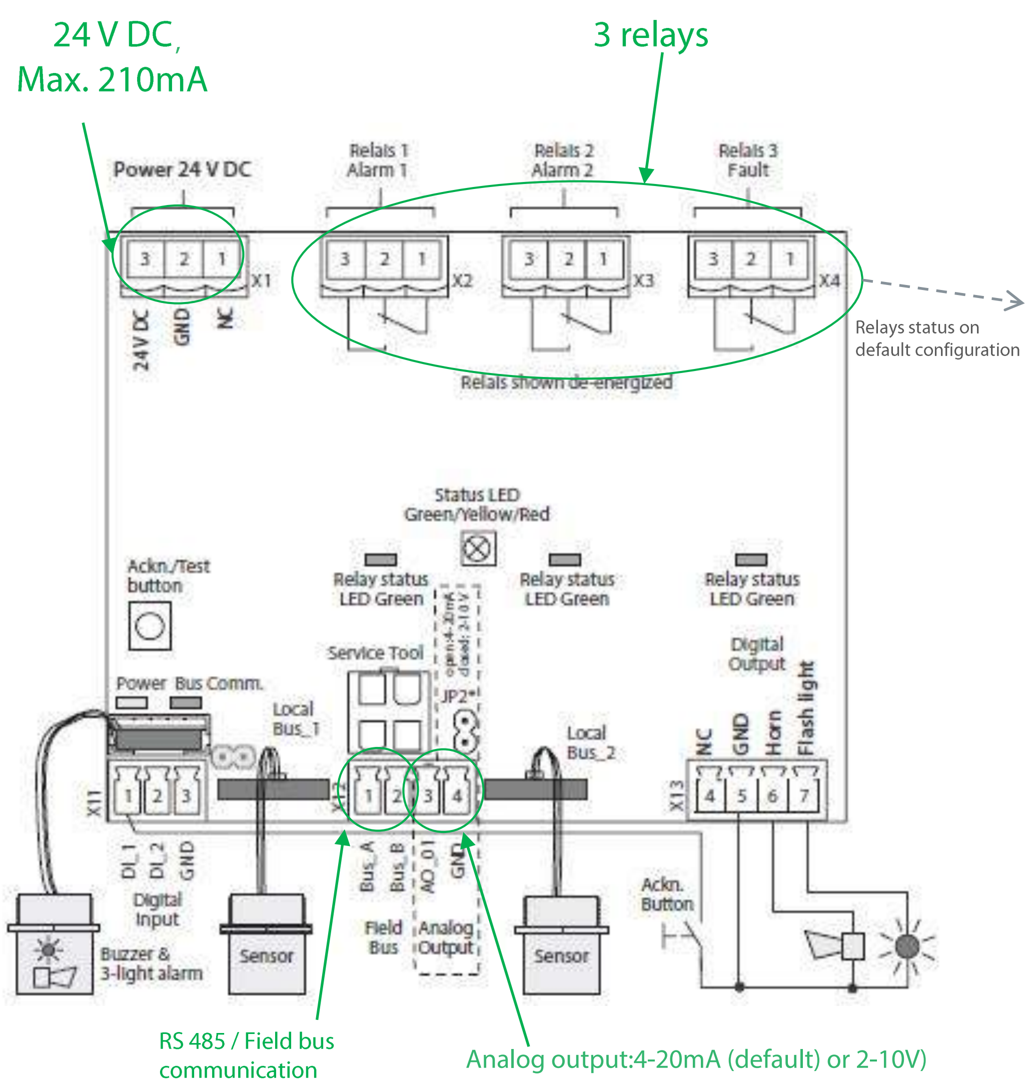
24 V DC or AC
Max.: 250 mA / 6 VA

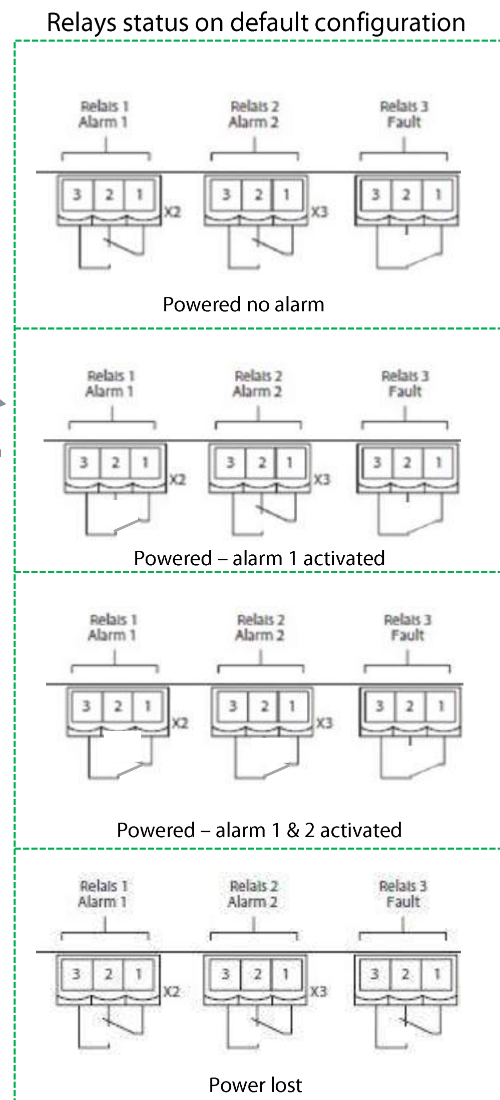
Installation of Premium Version

Electrical Connection

Premium

Note: The RED protective cap on sensor should not be removed until the system is ready to be started up.



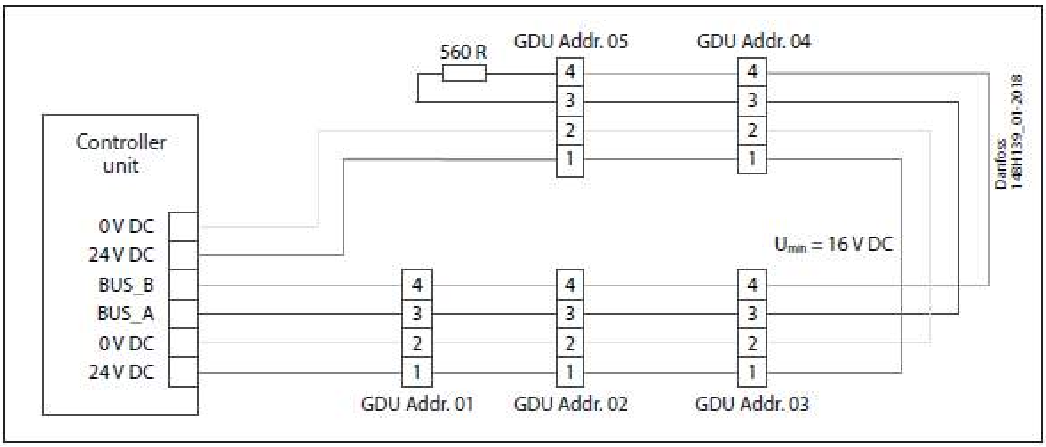


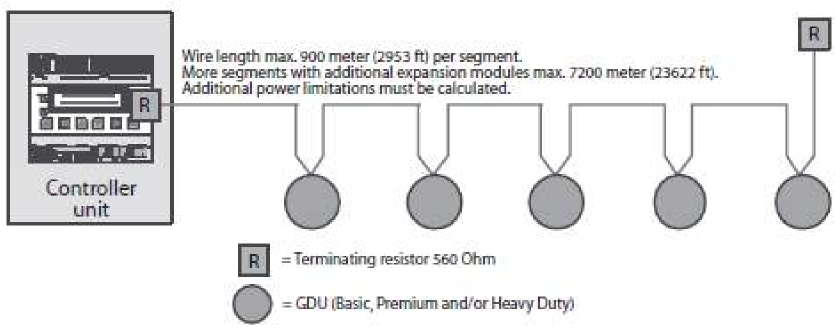
Relay status and alarms can re-configured

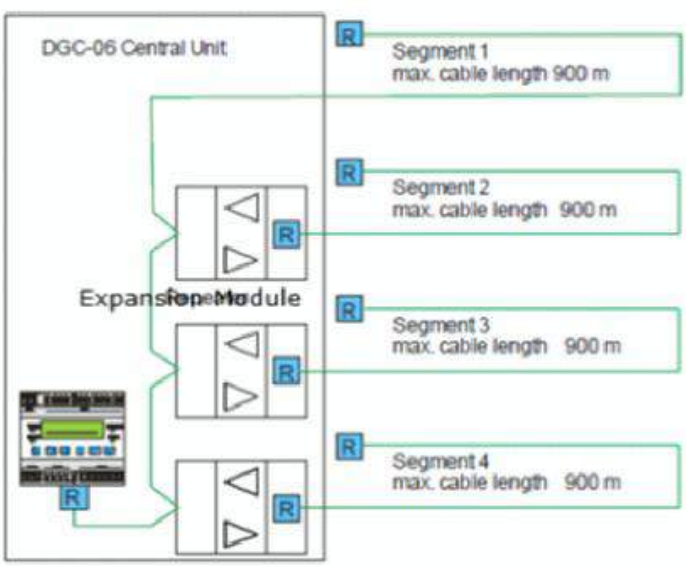
Note: A resistor comes installed on the analog output connections – if analog output is used, remove the resistor.

Installation
Field Bus Wiring with GD Controller

- Max. wire length per segment is 2953 ft. (900 meter)
- Expansion module can used as a repeater to create another segment
- Up to 96 sensors can be connected







Use of expansion module as repeater to create additional segments

Installation

Display and How to Access the Menu

- All units have menu options that can be accessed by the display if it has one and if not by the service tool or PLC

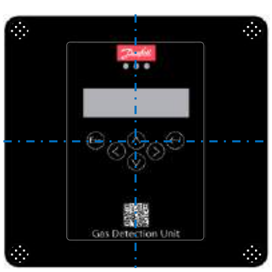
- The service tool and the PC tool are connected directly to the Board of the units.

- To read the measurements and values there is no password needed, but for changing parameters a password is needed:

- **Password is 1234** by default from factory (changeable)

- **Password 5468** gives full access to change parameters and can not be changed.

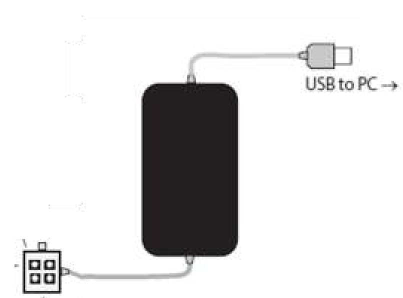
Identical Menu of options



Display on premium

Display on Heavy duty

Service tool

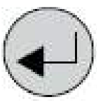


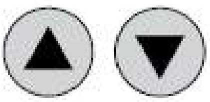
PC tool

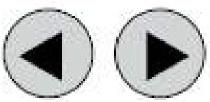
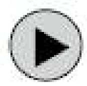
Installation
Display and How to Access the Menu

How to Navigate the Menu:

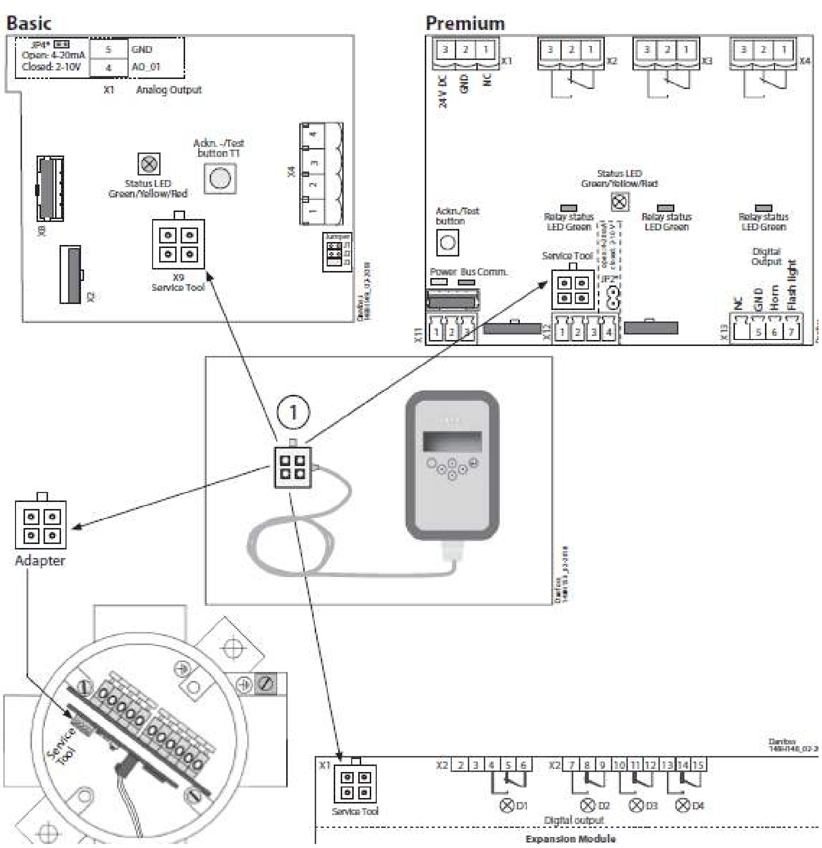
Exits programming, returns to the previous menu level.

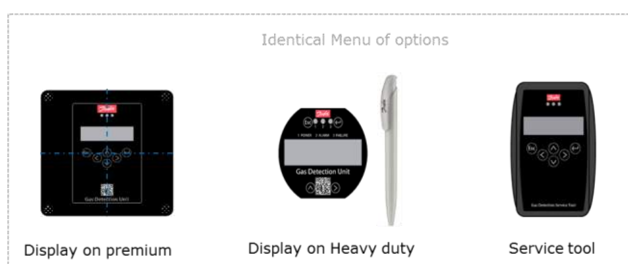

Enters sub menus, and saves parameter settings.


Scrolls up & down within a menu, changes a value. Basic only: 


Change of cursor position. Basic only: 

How to connect the service tool and the PC tool:





Installation
Addressing Sensor When Connected By Modbus

When the system is connected via Modbus, there is a need to assign addresses to all the units in the system (From 1 to 96)

The adressing is done via the Menu, so it can be done either by the display on the unit(if it has one), with the service tool or with the PC tool.

The steps to address a unit are the following with the display:

Enter the menu

Go to : Installation and calibration   Installation & Calibration

Change service mode: OFF → ON (password will be required)

Go to : Addressing   Addressing

Set address

Select address 1 to 96

Exit and save ESC / "do you want to save the changes?" :

Exit Service mode : ESC ESC

Display on premium   Display on Heavy duty   Service tool

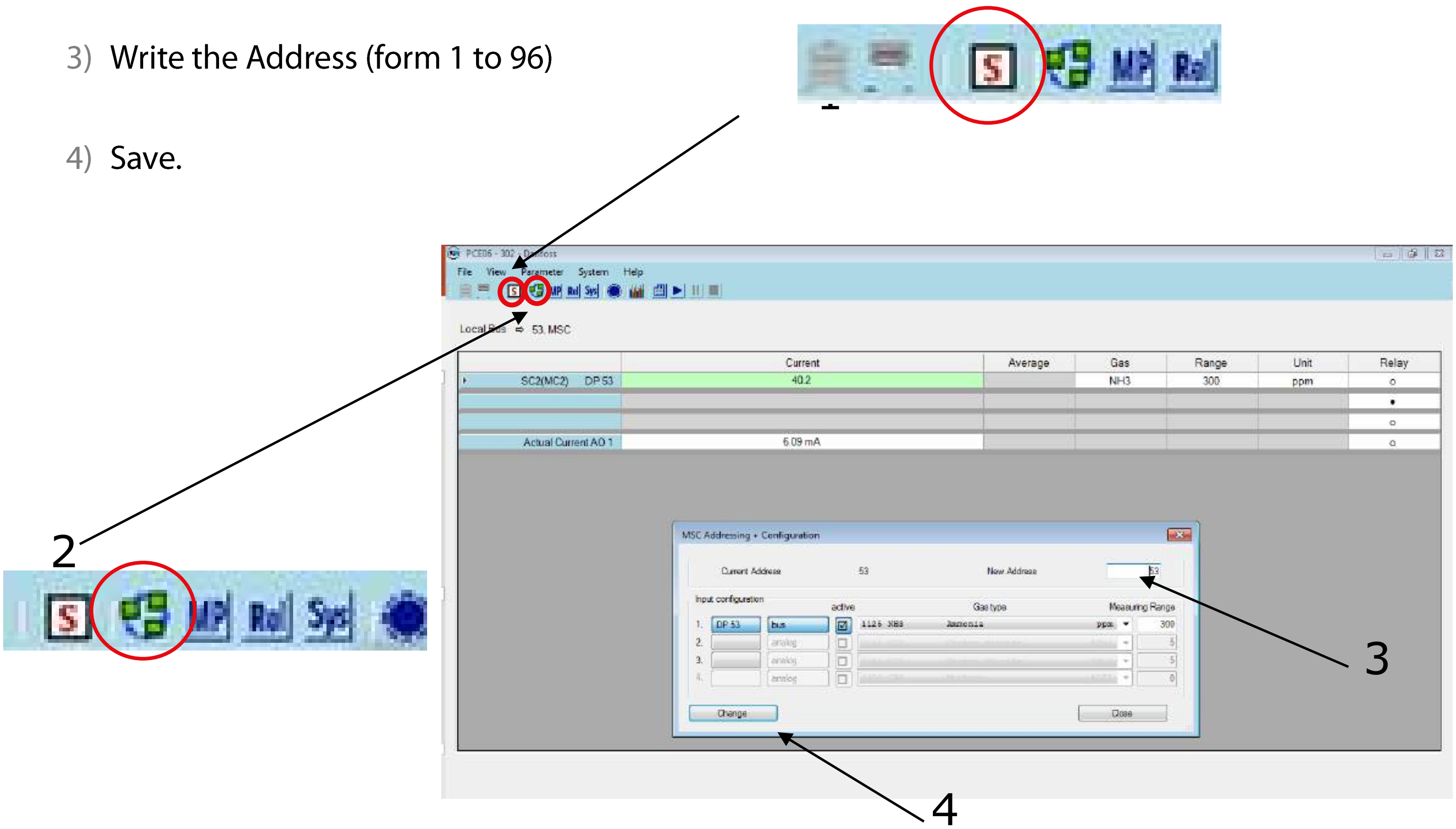
Installation
Addressing Unit with PC Tool

1) Set the unit to service mode (S)

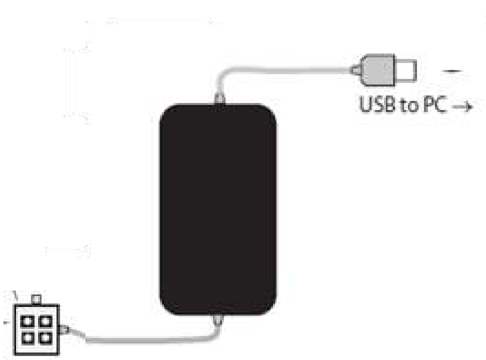
2) Go to Adress

3) Write the Address (form 1 to 96)

4) Save.



To install the software in the PC, you simply connect it to it and let the driver run, it will automatically install and open.



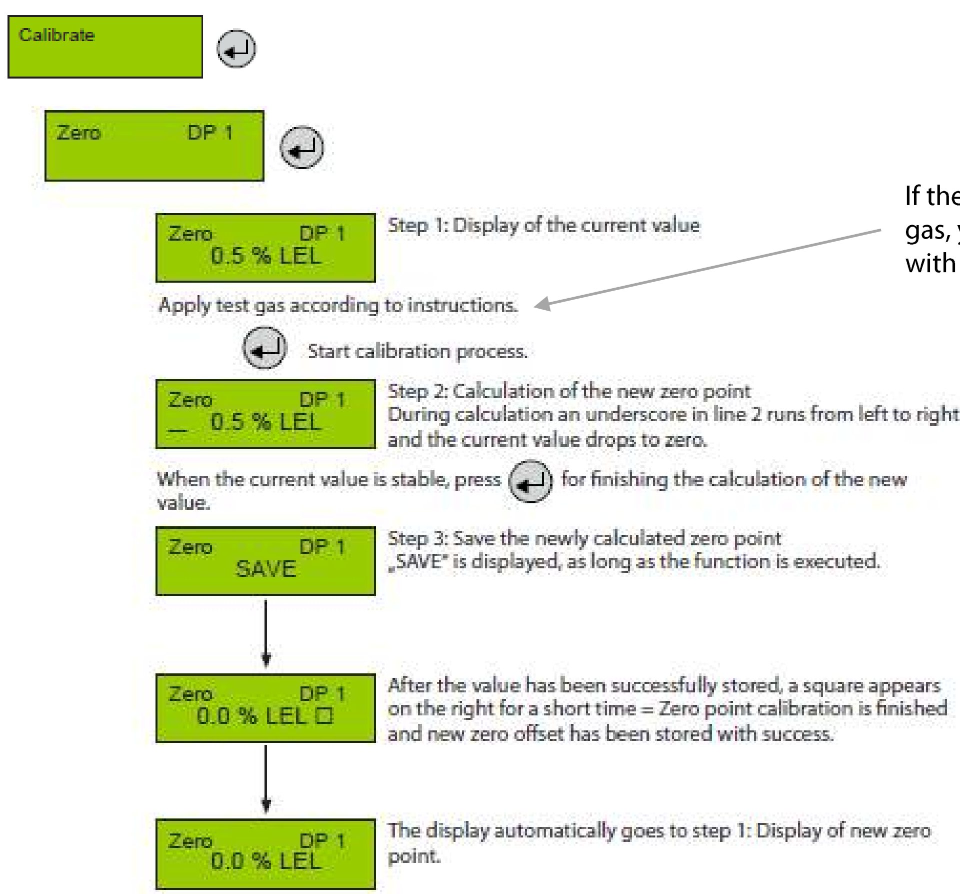
Installation
Zero Adjustment

Due to the environmental conditions at the installation site (Temperature, Humidity, pressure) the zero reading (no presence of refrigerant) of the unit can have a small drift and show 0 to 5 % of the span when no gas is present. Thanks to the temperature compensation the sensors have, this drift is reduced to almost zero and in most of the cases the unit will actually read zero at installation.

However, if the reading is something different than zero and you are certain there is no gas present, an adjustment can be made to set the unit to zero.

- The unit needs to be in service mode(as shown previously)

- Go to calibration:



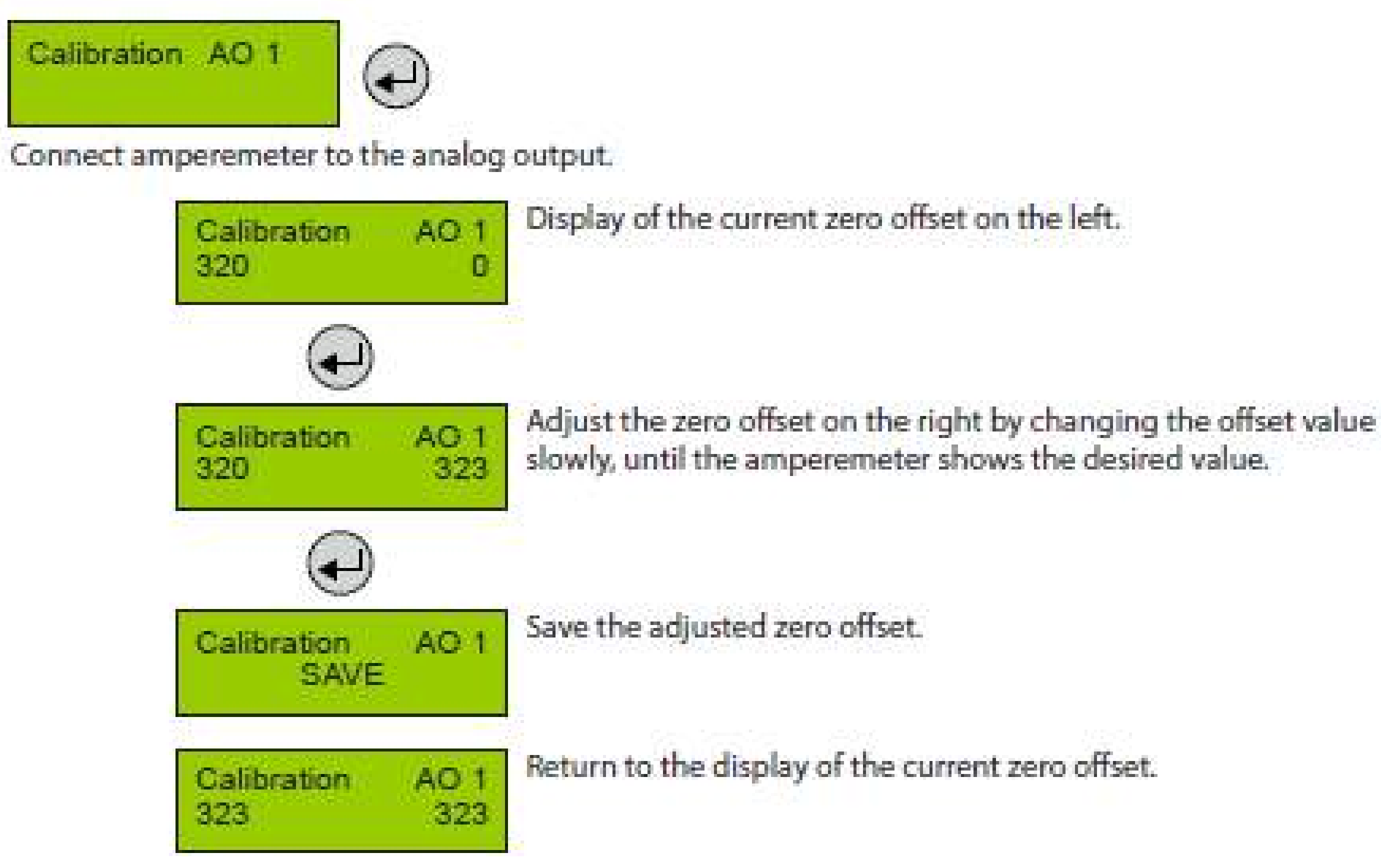
If there is no certainty of no presence of target gas, you will need to use Zero air calibration gas, with a calibration adapter.

Installation
Adjustment to the Analog Output

In a similar case to the previous one, the analog output of the unit can be slightly affected by the environmental conditions. In case the analog output is being used to monitor the ppm level and it has a drift after installation, it can also be adjusted to the right value.

An amperemeter should be connected to the analog output to measure the current value that the unit is giving, after zero calibration and with no target gas present , the unit should be delivering 4 mA. If the value is different the adjustment is done as follows:

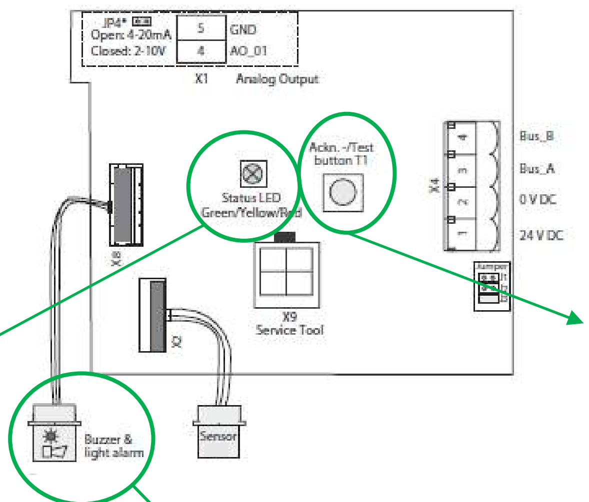
- Set the unit to service mode
- Go to calibration
- Go to calibration AO1 (Analog output)



Operation
Signals and Alarms

The different signals and alarms for the basic units are described below:

Basic



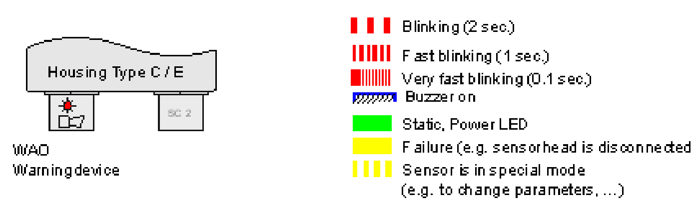
Ackn. -/ Test button
Test: The button must be pressed for 20 sec.
> Alarm1 and Alarm2 is simulated, stop on release

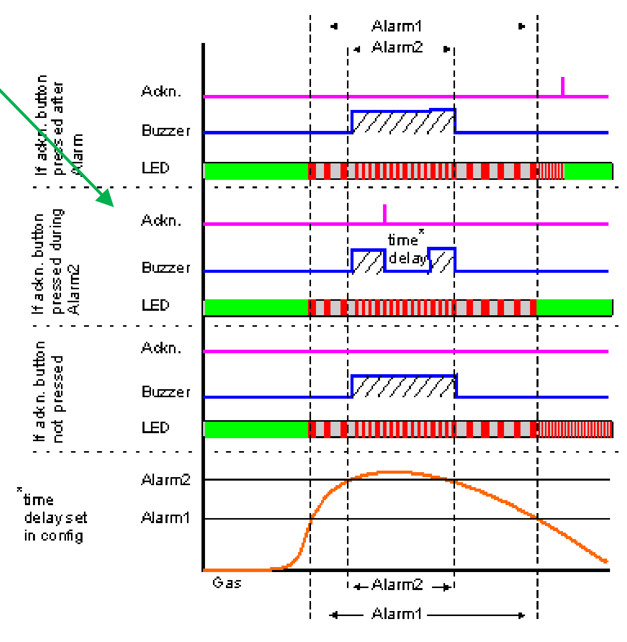
Ackn.: Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active.

LED:
Green is power on
> blinking if maintenance needed

Yellow is an indicator of failure.
> when the sensorhead is disconnected or not the expected type
> AO is activated but nothing connected
> blinking during sensor is in special mode (to change parameters, ...)

RED on alarm, similar like the WAO



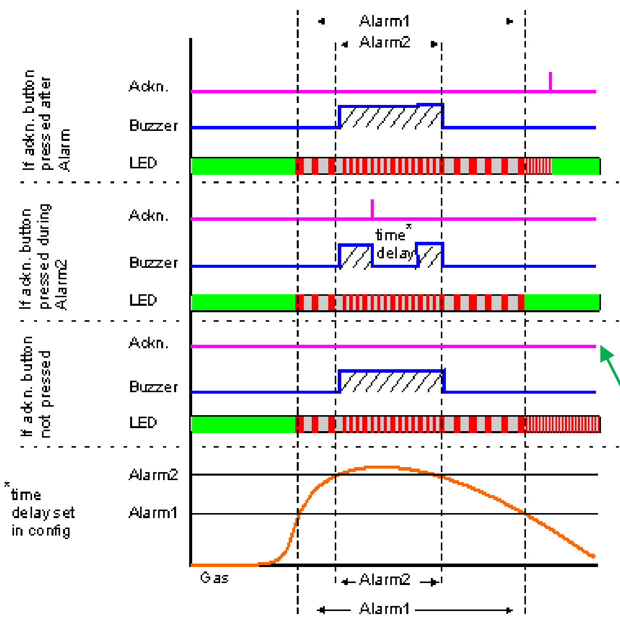


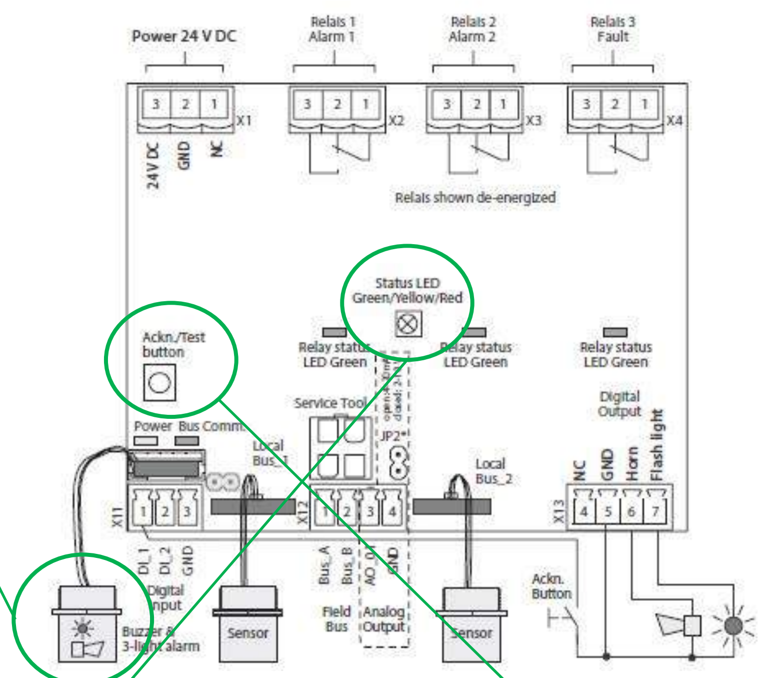
Operation
Signals and Alarms

The different signals and alarms for the Premium units are described below:

Premium

- Blinking (2 sec.)
- Fast blinking (1 sec.)
- Very fast blinking (0.1 sec.)
- Buzzer on
- Static, Power LED
- Failure (e.g. sensorhead is disconnected)
- Sensor is in special mode (e.g. to change parameters, ...)





On board LED:

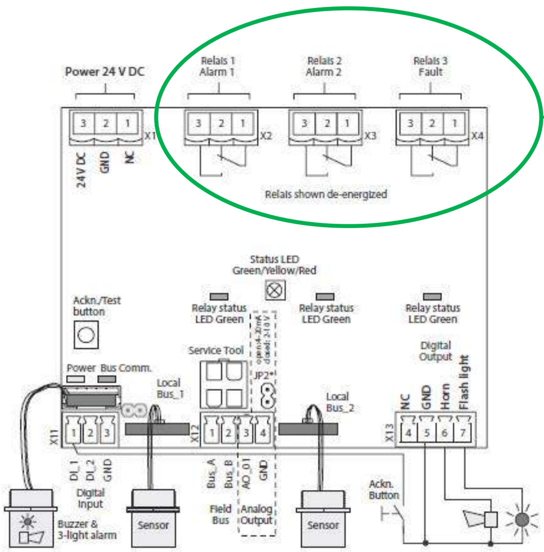
Green means power on
> blinking during bus communication
Yellow is an indicator of failure.
> when the sensor head is disconnected or not the expected type
> AO is activated but nothing connected
RED on alarm, similar like the WAO

On board Ackn. -/ Test button:

Test: The button must be pressed for 20 sec.
> Alarm1 and Alarm2 is simulated, stop on release
Ackn.: Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active.

Operation
Signals and Alarms

Premium



Action	Reaction Relay 1 (Alarm1)	Reaction Relay 2 (Alarm2)	Reaction Flashlight X13-7	Reaction Horn X13-6	Reaction Relay 3 (fault)	Reaction LED
Gas signal < alarm threshold 1	OFF	OFF	OFF	OFF	ON	GREEN
Gas signal > alarm threshold 1	ON	OFF	OFF	OFF	ON	RED Slow blinking
Gas signal > alarm threshold 2	ON	ON	ON	ON	ON	RED Fast blinking
Gas signal ≥ alarm threshold 2, but ackn. button pressed	ON	ON	ON	OFF after delay ON		RED Fast blinking
Gas signal < (alarm threshold 2 - hysteresis) but >= alarm threshold 1	ON	OFF	OFF	OFF	ON	RED Slow blinking
No alarm, no fault	OFF	OFF	OFF	OFF	ON	GREEN
No fault, but maintenance due	OFF	OFF	OFF	OFF	ON	GREEN Slow blinking
Internal error	OFF	OFF	OFF	OFF	OFF	YELLOW

Units with Display will present different information during operation, the following table describes the most important values.

In case of alarm, the display on the unit goes red

Symbol	Description	Function
DP 1	Meas. Point No.	Digital measuring point 1 = 1 - X
CH4	Gas type	Display of gas type (must comply with gas type of sensor head)
% LEL	Gas unit	Unit
51.0 C 48.0 A	Measured value	Current measured value (current value) of the gas concentration Arithmetic average of the gas concentration (only if average is active)
A!	Alarm indication	At least one alarm has been released at this MP.
#	Maint. info	Sensor head: maintenance due (maintenance date exceeded)
?	ConfigError	Gas type or meas. range doesn't agree with sensor head.
Comm. err.	Fault MP	Communication error, sensor head <> I/O board
Underrange Overrange	Meas. range monitoring	Meas. signal < admissible range (< zero point – 6 %) Meas. signal > admissible range (> full scale value + 6 %)
Locked	MP locked	MP was temporarily locked by the operator.
Warm-up	Warm-up time	Warm-up time of the sensor active

Maintenance and Servicing
Calibration

Calibration / test of gas detectors is extremely important to ensure and document the proper accuracy, responsiveness and operation of the unit.

Gas detectors are subject to changes in the measurement properties in dependence of the operation time and/or exposure time, therefore regular calibration is needed

Calibration frequency depends on various factors, however the following four are of particular importance:

- Requirements of national legislation
- Recommended calibration interval
- Lifetime of the sensors

		Estimated life time (years)	Min. recommended calibration interval [years]	Recommended test interval (years)**
SC	Semi-conductor	>5	1	1
EC	Electrochemical	>2*	1	1
P	Pellistor	3-5	6 months	1
IR	Infrared	15	5	1

If the sensor is exposed to high or constant ammonia concentrations, the life time will considerably be reduced. A sensor remain functional above 30% of sensitivity.

**If calibration is performed, test is not required. However, when calibration interval is longer than the test interval, a “bump” test must be performed.

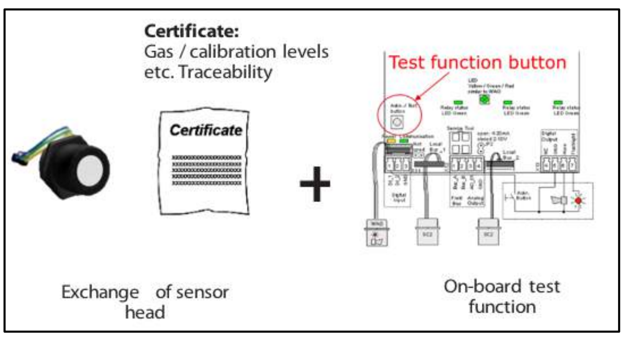
Maintenance and Servicing
Calibration

For Danfoss Gas detector units there are two different Methods to fulfill the calibration requirements:

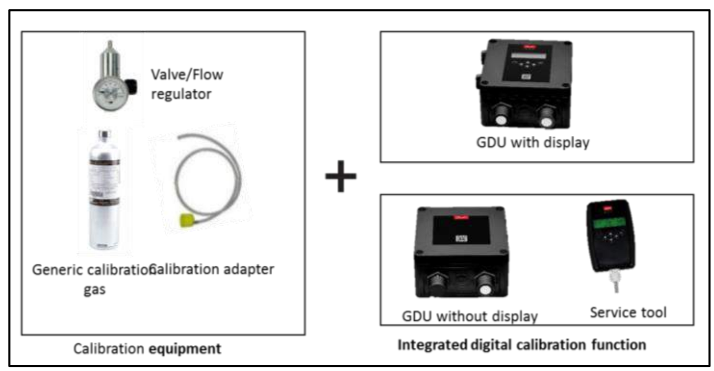
1) By replacing the Sensor head (sensor cartridge) with a new factory calibrated sensor head.

2) By performing a calibration to the sensor using calibration gas (gas mixture with known target gas concentration)

Sensor Replacement



Calibration with Gas

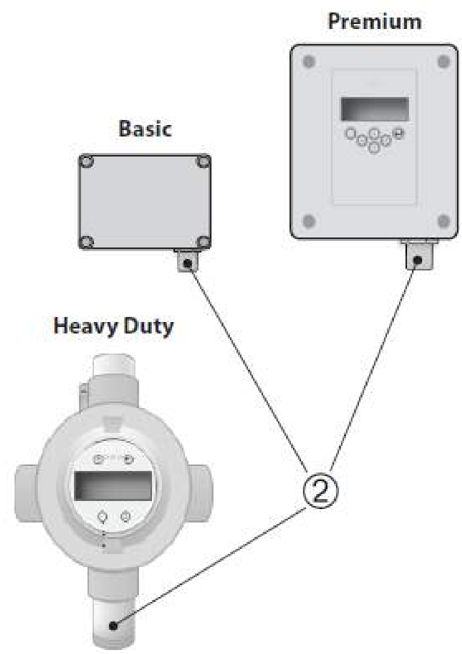


*Calibration with gas can be done either on site(at sensor location) or by collecting sensors and perform calibration at a dedicated location.

Maintenance and Servicing
Sensor Replacement

The replacement of the sensor heads is an easy procedure. The sensor replacements are delivered factory calibrated, so there is no need of adjustment; it is a plug and play replacement.

The procedure is as follows:



1. Unplug the sensor

LED will go yellow and the screen(if included) will show a communication error)

2. Plug the new sensor

Wait for the LED to turn green again, once it becomes green, the replacement has been completed.

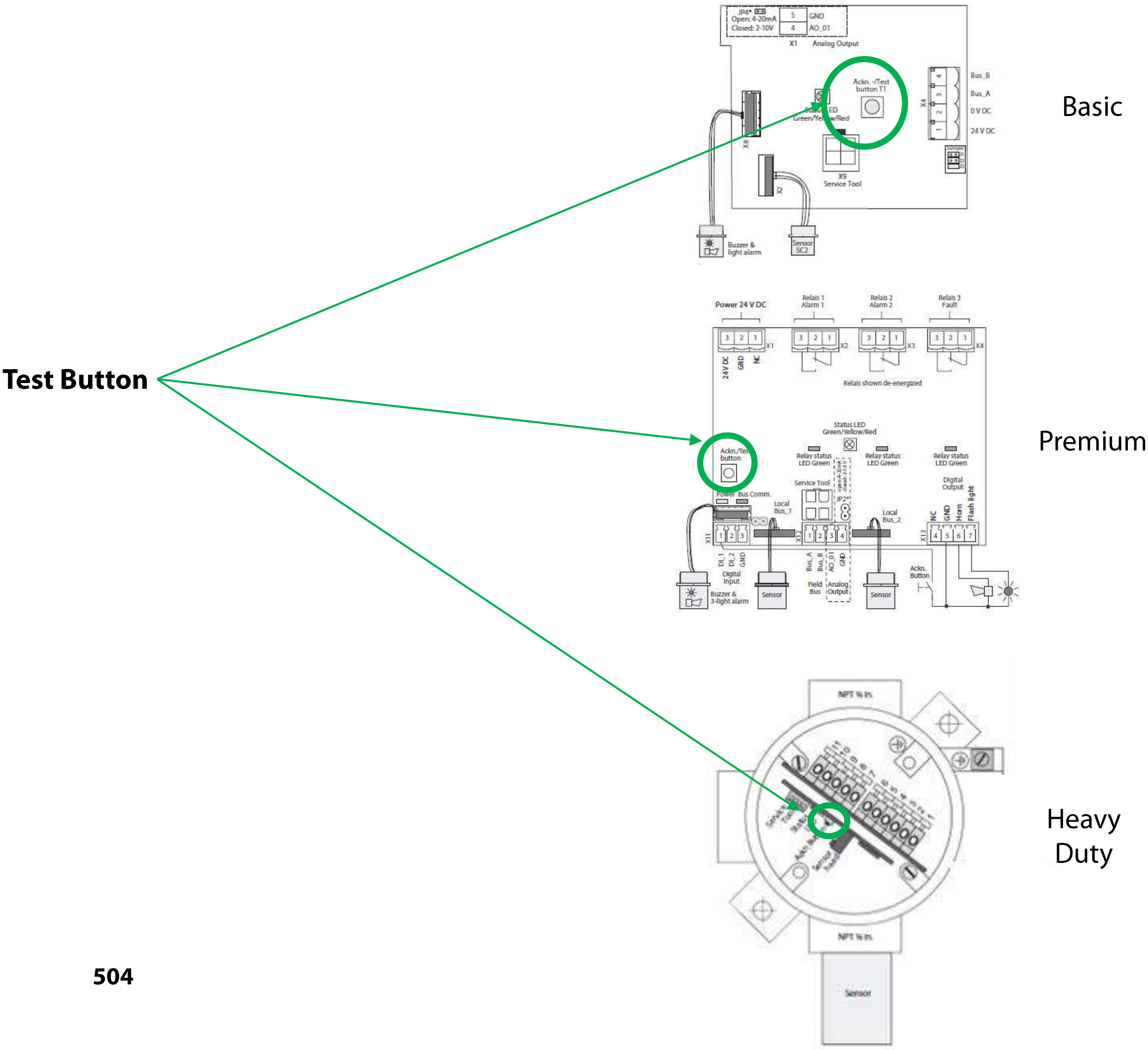
In order to guarantee the proper functioning of the units and to prevent human mistakes; the sensor head can only be replaced by the same type and ppm range(exact replacement). If a different sensor head (to the original) is installed, the unit will show a communication error.

It is possible to make a change to a different sensor, but it requires further changes to the configuration of the unit and the acknowledgment that the sensor is being changed.

Maintenance and Servicing
Sensor Replacement

When replacing a sensor, a test to the operation of the relays and alarms should also be performed, to guarantee the functionality of the unit. The Danfoss gas detector units include a function that performs this test.

In order to perform this test, just press the test button inside unit and hold it for 20 seconds. At 20 seconds the alarms will go on and the relays will activate as configured. To end the test simply release the button.



Maintenance and Servicing
Calibration with Gas

The calibration of gas detectors by means of calibration gas has been traditionally made with the use of amperemeters and adjustment of potentiometers, which makes the process relatively complicated, time consuming and expensive.

Danfoss gas detection units have an integrated calibration routine that makes the calibration process easier, cheaper and faster. Even though the calibration is a simple procedure, it still requires test equipment and basic competence in calibration

Calibration Equipment

Calibration gas
Recommended to be between 30-90% of the full span of the sensor- close to alarm setpoint (not provided by Danfoss)

Valve/Flow regulator
Adjustable Flow with min flow indicated below. (not provided by Danfoss)

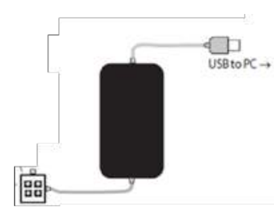
Calibration adapter
Required for connecting the calibration gas to the sensor head. There are 2 variants, one for Basic and Premium plastic sensor heads (148H6232); one for Heavy Duty and Premium remote Steel sensor heads like vent line sensor (148H6233).

The calibration routine is executed from the menu in the units, if the unit has a display it can be performed directly from the unit; if the unit does not have a display, you will need either the service tool or the PC tool.

Display on premium

Display on Heavy duty

Service tool



PC tool

Calibration flow required for the different type of sensors

Basic and Premium plastic sensor head	Electrochemical, Semiconductor and Pellistor	0.15 l/min
	Infrared	1.5 l/min
Heavy duty and Remote stainless sensor steel head	Electrochemical, Semiconductor and Pellistor	0.5 l/min

Note: The above flow rates are min. required flow rates so it is okay if flow is greater than listed.

Maintenance and Servicing
Calibration with Gas

The calibration of gas detectors by means of calibration gas has been traditionally made with the use of amperemeters and adjustment of potentiometers, which makes the process relatively complicated, time consuming and expensive.

However, the Danfoss gas detection units have an integrated calibration routine that makes the calibration process easier, cheaper and faster. Even though the calibration is a simple procedure, it still requires test equipment and basic competence in calibration

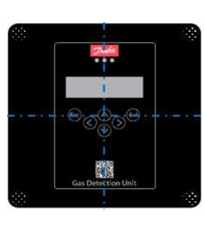
Calibration Equipment

Calibration Gas
Recommended to be between 30-90% of the full span of the sensor- close to alarm setpoint (not provided by Danfoss)

Valve/Flow Regulator
Adjustable Flow ml/min (not provided by Danfoss)

Calibration Adapter
Danfoss Accessory

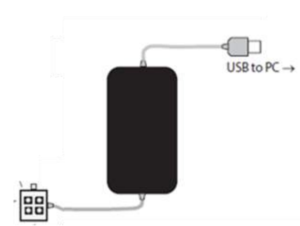
The calibration routine is executed from the menu in the units, if the unit has a display it can be performed directly from the unit; if the unit does not have a display, you will need either the service tool or the PC tool.



Display on premium

Display on Heavy duty

Service tool



PC tool

Maintenance and Servicing
Calibration with Gas

The calibration procedure is as follows:

- Connect the calibration gas to the sensor head using the correct calibration adapter and set the Flow to 150 ml/min.
- Put the gas detector in service mode.
- Go to: calibration
- Select the sensor to be calibrated (in case you have two)
- Select the test gas concentration

Test Gas XX.X % LEL	Enter concentration of the test gas used. This value isn't cleared when exiting the menu, therefore before calibratin always check the value if correct.
Gain DP 1	
Gain DP 1 48.0 % LEL 89.0%	Step 1: Display of the current value and of the sensitivity from the last calibration

Apply test gas according to instructions.

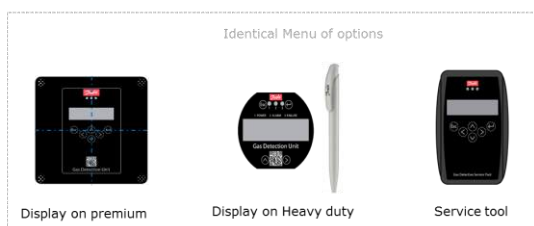
Start calibration process.

Gain DP 1 50.1 % LEL 82%	Step 2: Calculation of the new gain During calculation an underscore in line 2 runs from left to right and the current value converges to the set test gas concentration. The sesitivity is recalucated, too.

When the current value is stable, press for finishing the calculation of the new value.

Gain DP 1 SAVE	Step 3: Save the newly calculated gain ‚SAVE' is displayed as long as the function is executed.
Gain DP 1 50.1 % LEL 89%□	After the value has been successfully stored, a square appear: on the right for a short time.= Gain calibration is finished and new gain offset has been stored with success.
Gain DP 1 50.1 % LEL 89%	The display automatically goes to step 1: Display

Password 5468 gives full access to change parameters and can not be changed.



Maintenance and Servicing
Calibration with Gas

During the calculation phase, the following messages may occur:

Message	Description
Current value too high	Test gas concentration > than set value Internal error → Replace sensor head
Current value too low	No test gas or wrong test gas applied to the sensor
Test gas too high Test gas too low	The set test gas concentration must be between 30% and 90% of the measuring range.
Current value unstable	Appears when the sensor signal does not reach the zero point within the target time. Disappears automatically when the sensor signal is stable.
Time too short	The message "value unstable" starts an internal timer. Once the timer has run out and the current value is still unstable, the text is displayed. The process starts over again. If the value is stable, the current value is displayed and the calibration procedure is continued. If the cycle is repeated several times, an internal error has occurred. Stop the calibration process and replace the sensor head.
Sensitivity <	Sensitivity of the sensor head < 30%, calibration no longer possible → Replace sensor head.
Internal error	Internal , unrecoverable error → Replace sensor head.

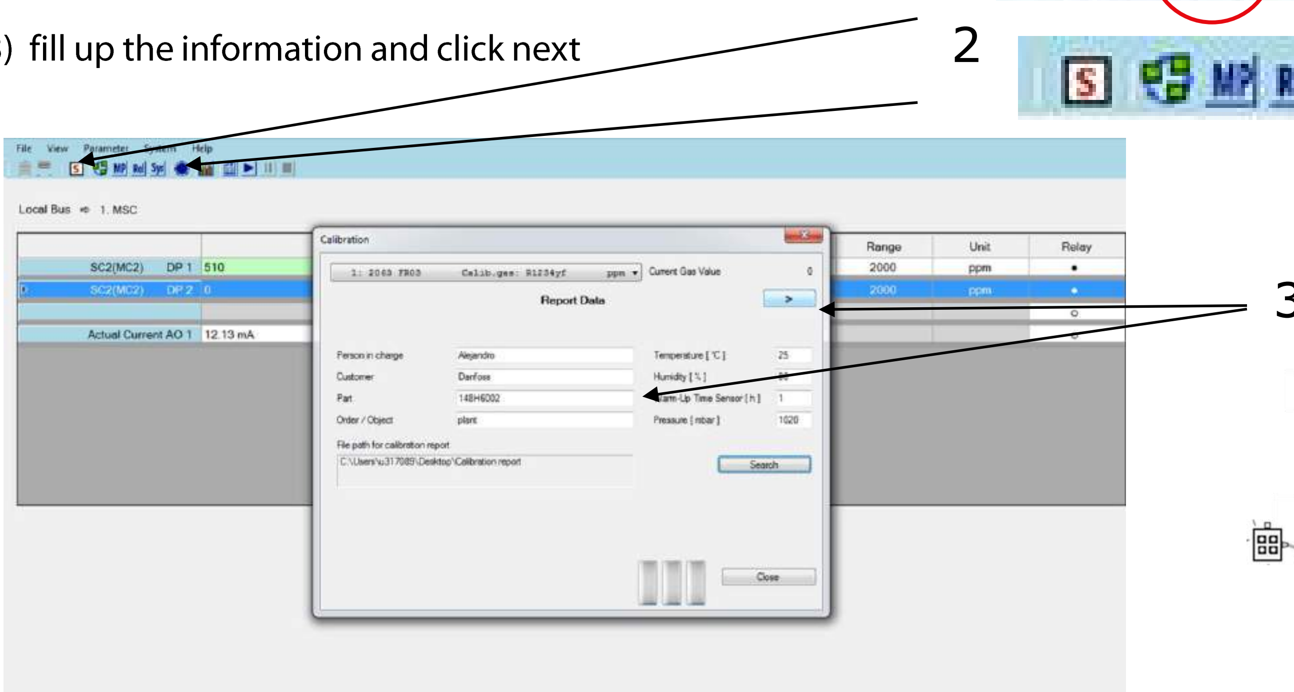
The calibration with the PC tool allows the user to print a calibration report for documentation.

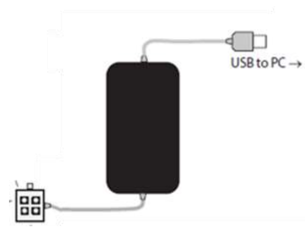
The procedure for the calibration is the following:

1) Select the sensor and put the sensor in Service mode (S)

2) Select calibration and

3) fill up the information and click next





PC tool

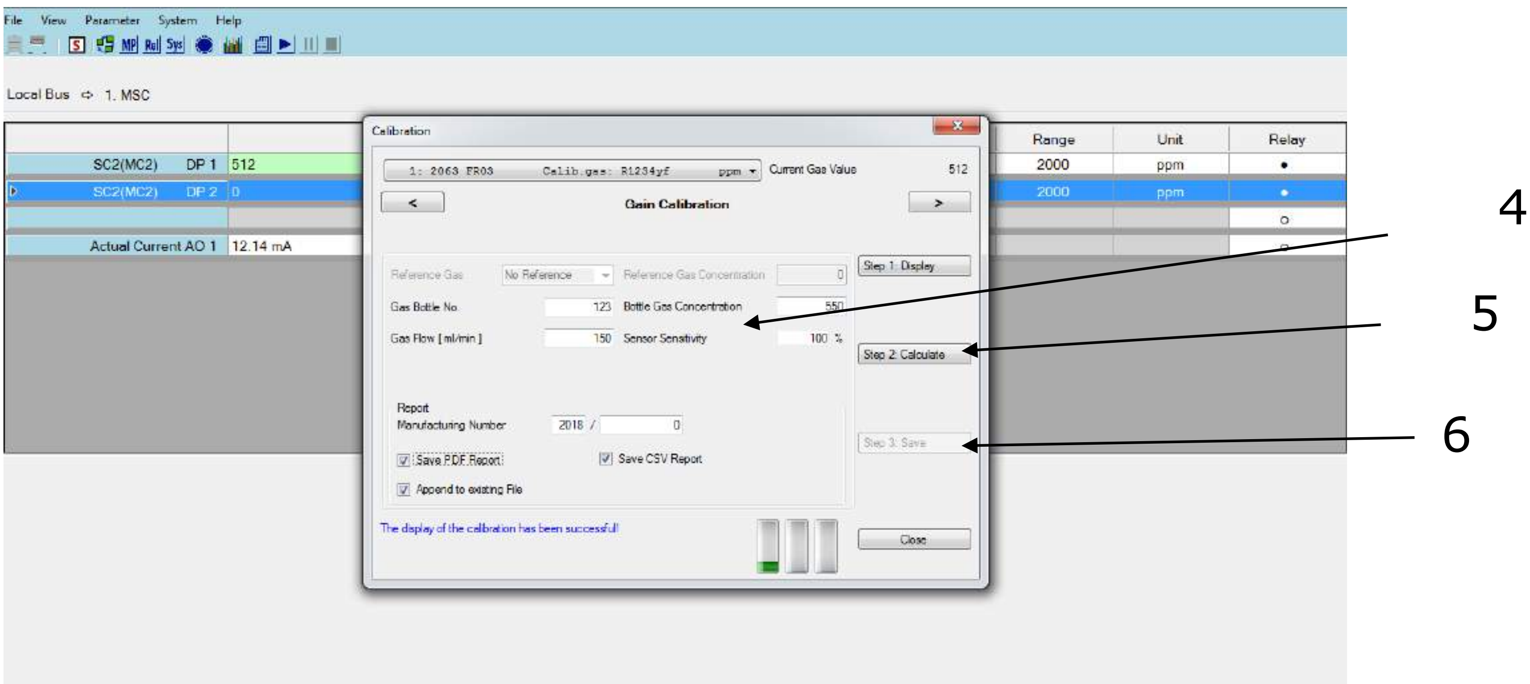
Maintenance and Servicing

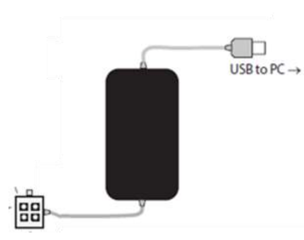
Calibration with Gas

4) Fill information regarding Calibration gas

5) Calculate (executes calibration) – start flow of calibration gas before clicking execute.

6) After calibration is executed, the Save option will enable to save the calibration.





PC tool

Installation Guide

Gas Detection Unit (GDU)
GDA, GDC, GDHC, GDHF, GDH

148R9631

ENGLISH

148R9631

Technician use only!
This unit must be installed by a suitably qualified technican who will install this unit in accordance with these instructions and the standards set down in their particular industry/country.

Suitably qualified operators of the unit should be aware of the regulations and standards set down by their industry/country for the operation of this unit.

These notes are only intended as a guide and the manufacturer bears no responsibility for the installation or operation of this unit.

Failure to install and operate the unit in accordance with these instructions and with industry guidelines may cause serious injury including death and the manufacturer will not be held responsible in this regard.

It is the installer’s responsibility to adequately ensure that the equipment is installed correctly and set up accordingly based on the environment and the application in which the products are being used.

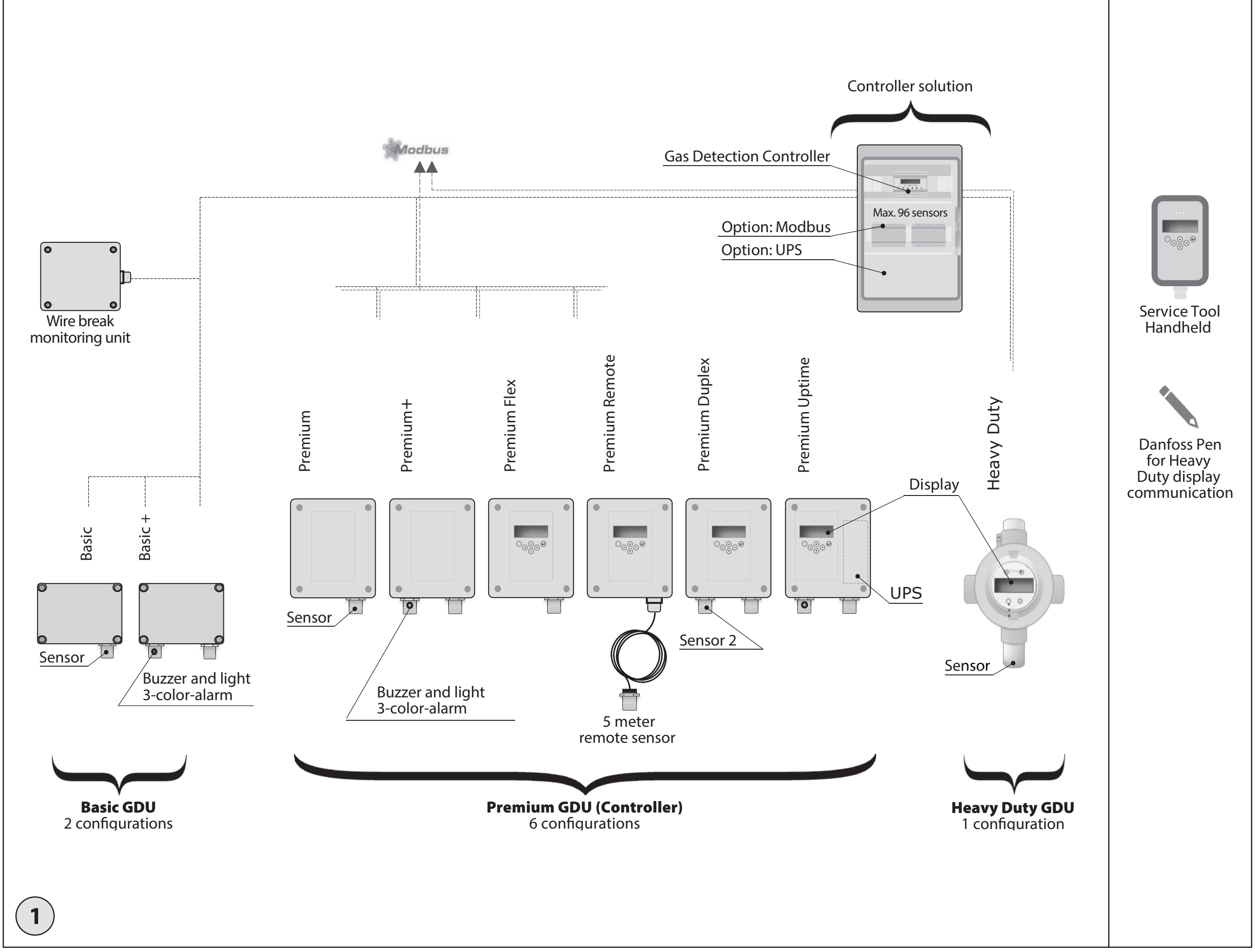
Please observe that a Danfoss GDU works as a safety device securing a reaction to a detected high gas concentration. If a leakage occur, the GDU will provide alarm functions, but it will not solve or take care of the leakage root cause itself.

Annual Test
To comply with the requirements of EN378 and the F GAS regulation sensors must be tested annually. Danfoss GDU's are provided with a test button that should be activated once a year for testing of the alarm reactions.
Additional the sensors must be tested for functionality by either Bump test or Calibration. Local regulations should always be followed

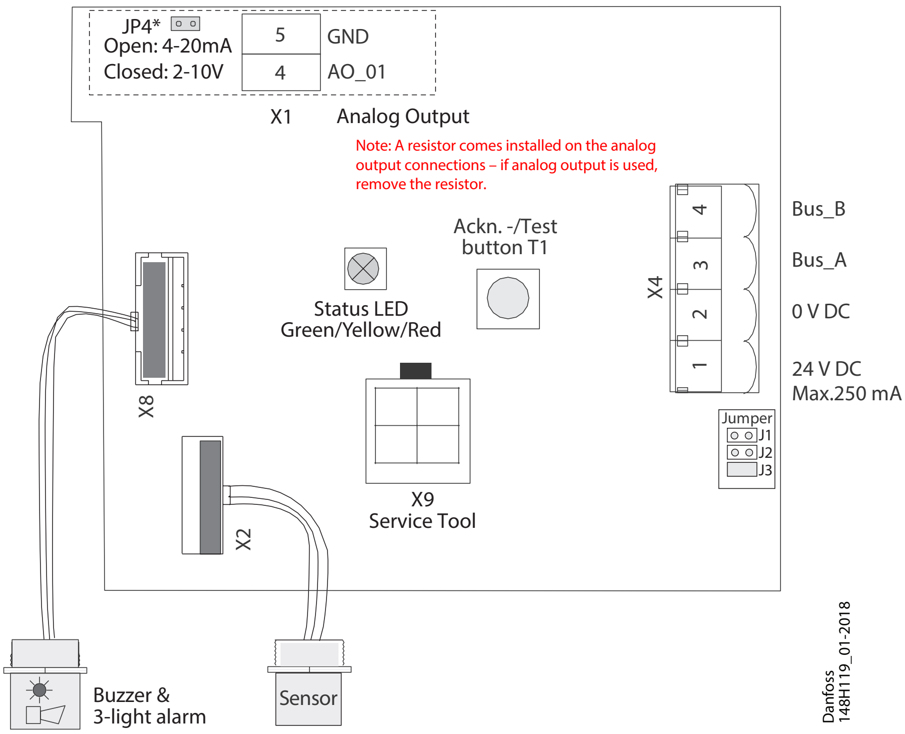
After exposure to a substantial gas leak, sensor should be checked and replaced if necessary.
Check local regulations on calibration or testing requirements.

Configurations and Wiring: All 3 types of Gas Detection Units (GDU)

Service tools



Danfoss Basic GDU



2

Status LED:

GREEN is power on.
- flashing if maintenance needed

YELLOW is an indicator of Error.
- when the sensor head is disconnected or not the expected type
- AO is activated but nothing connected
- flashing when sensor is in special mode (e.g. when changing parameters)

RED on alarm, similar to the Buzzer & light alarm.

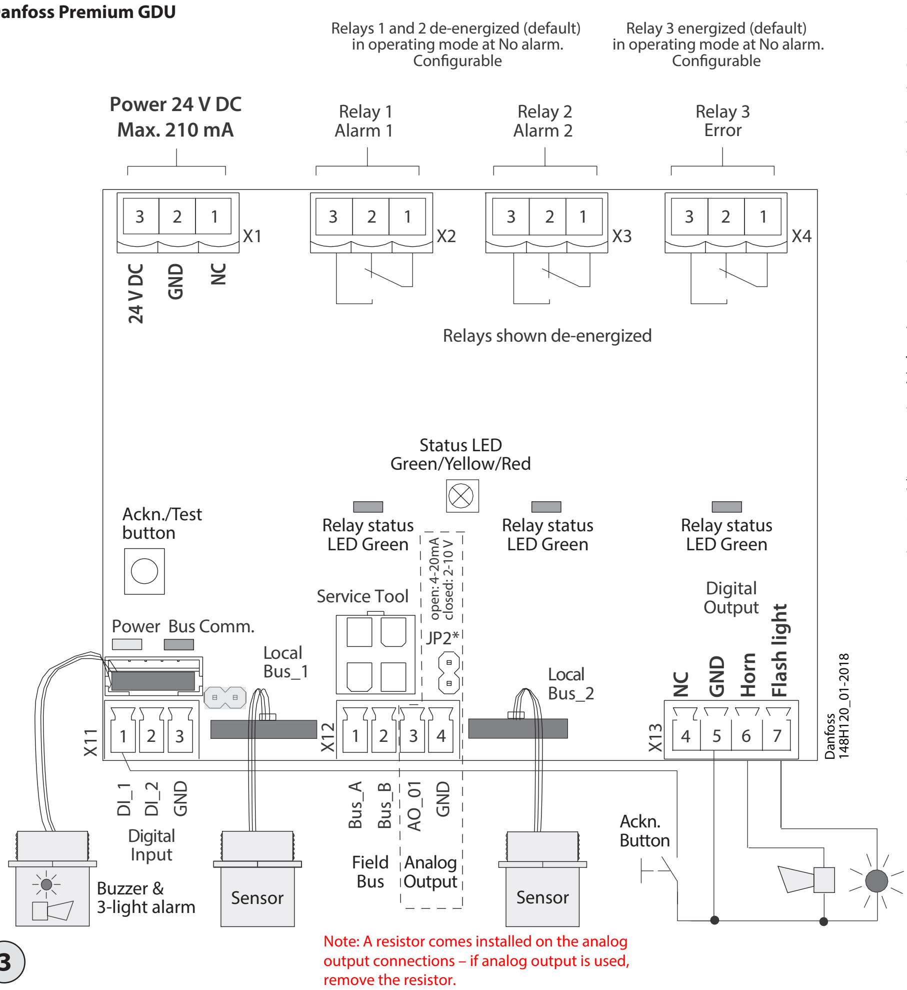
Ackn. -/Test button:

TEST - The button must be pressed for 20 sec.
- Alarm1 and Alarm2 is simulated, stop on release

ACKN. - Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active.

* JP4 open → AO 4-20 mA
JP4 closed → AO 2-10 Volt

Danfoss Premium GDU



3

Status LED:

GREEN is power on.
- flashing if maintenance needed

YELLOW is an indicator of Error.
- when the sensor head is disconnected or not the expected type
- AO is activated but nothing connected

RED on alarm, similar to the Buzzer & light alarm.

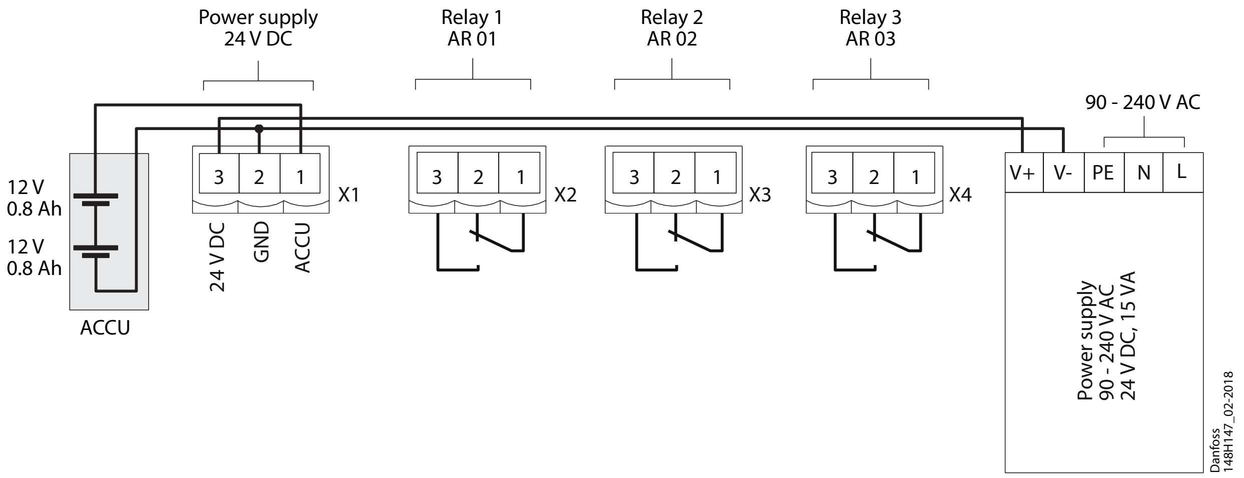
Ackn. -/Test button:

TEST - The button must be pressed for 20 sec.
- Alarm1 and Alarm2 is simulated, stop on release

ACKN. - Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active.

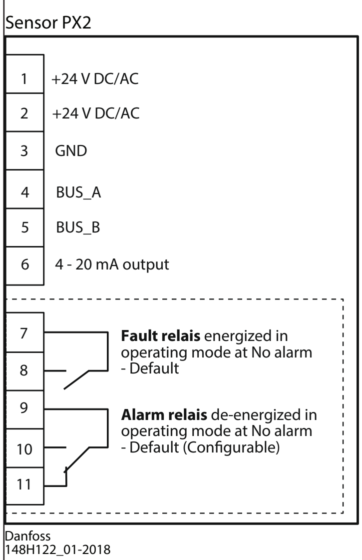
* JP2 open → AO 4-20 mA
JP2 closed → AO 2-10 Volt

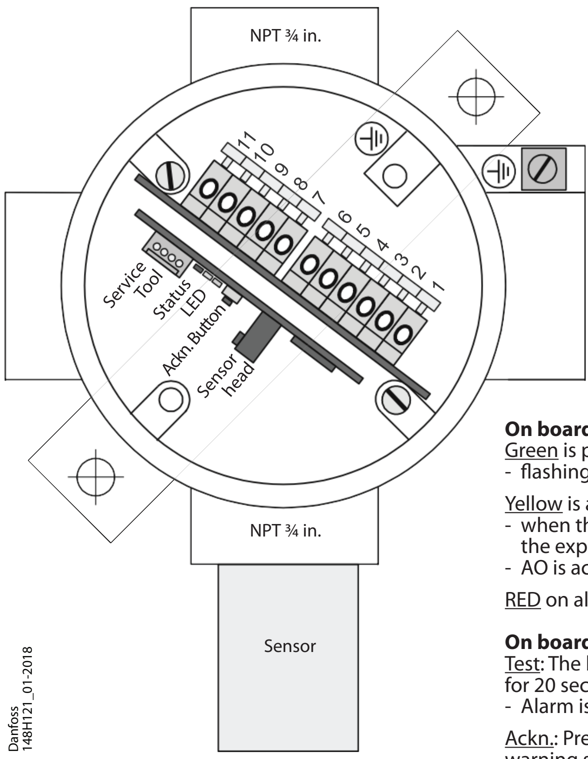
Danfoss Premium Uptime GDU



4

Danfoss Heavy Duty GDU (Atex, IEC approved)





On board LED is similar to the display LED:
Green is power on
- flashing during bus communication

Yellow is an indicator of Error
- when the sensor head is disconnected or not the expected type
- AO is activated but nothing connected

RED on alarm

On board Ackn. -/Test button:
Test: The button must be pressed for 20 sec.
- Alarm is simulated, stop on release

Ackn.: Pressed while Alarm2, the audible warning switches off and goes back on after 5 min. when the alarm situation is still active (also possible over ESC button (use the magnetic Pen).

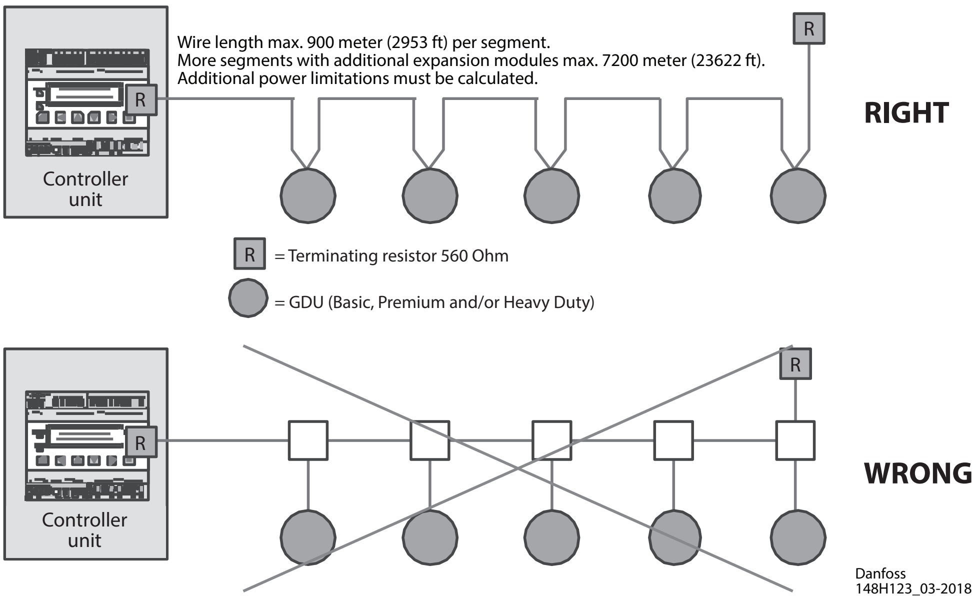
5

Location of Sensors

Gas type	Relative density (Air = 1)	Recommended sensor location
R717 Ammonia	<1	Ceiling
R744 CO_2	>1	Floor
R134a	>1	Floor
R123	>1	Floor
R404A	>1	Floor
R507	>1	Floor
R290 Propane	>1	Floor

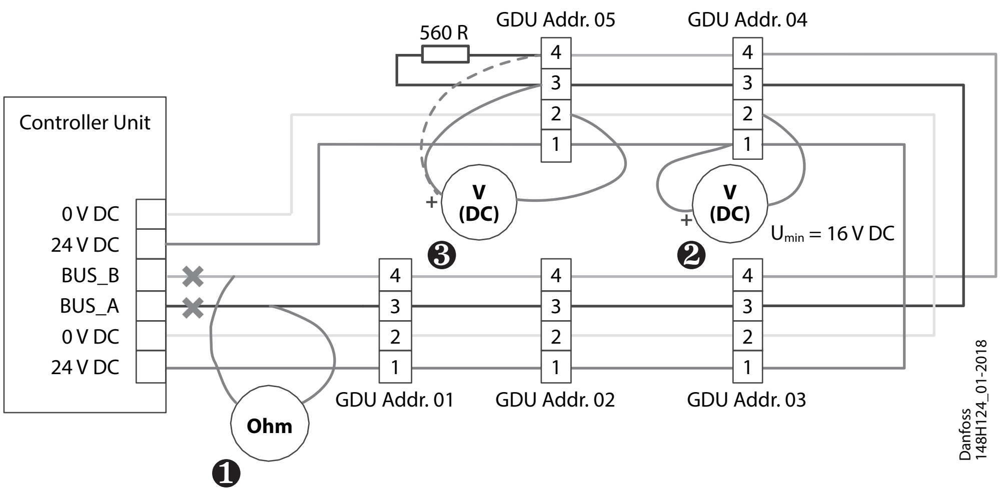
6

Gas Detection Controller: Fieldbus wiring - max 96 sensors in total i.e. up to 96 GDU (Basic, Premium and/or Heavy Duty)



7

Check of loop completion. Example: 5 x Basic in return loop



❶ Check of loop resistance: See section: Controller unit multiple GDU commissioning 2. **NOTE**: Remember to disconnect the wire from the board during measuring.

❷ Check of power polarity: See section: Controller unit multiple GDU commissioning 3.

❸ Check of BUS polarity: See section: Controller unit multiple GDU commissioning 3.

Individual Addresses for the GDU's are given at commisioning, see Controller Unit multiple GDU's commisioning, according to a predetermined "BUS address plan"

8

Attachment of suspension ears (Basic and Premium)

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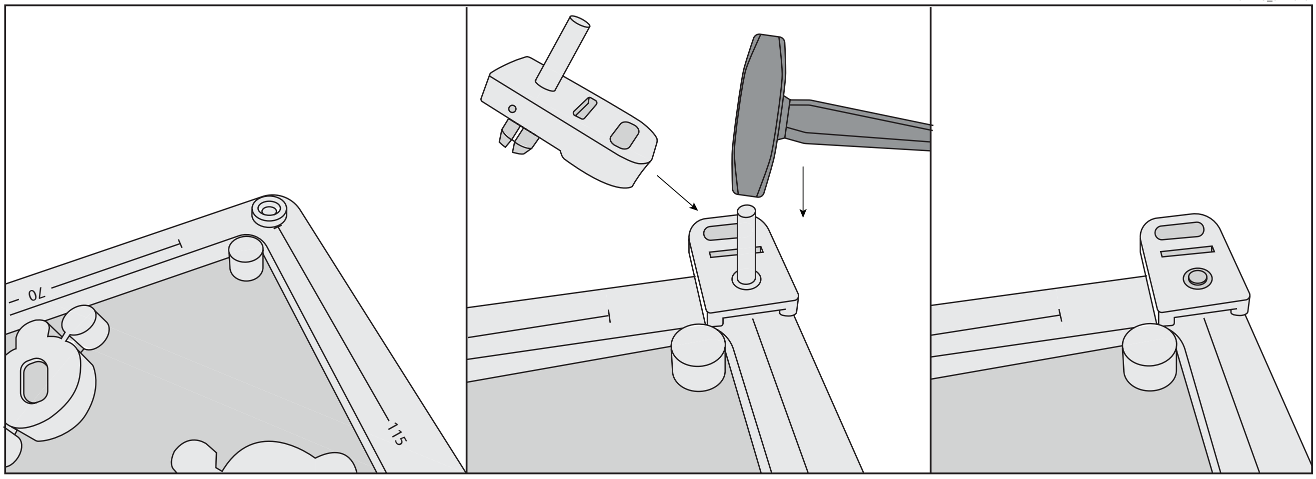
148H125_01-2018



9

Cable Gland opening

Danfoss
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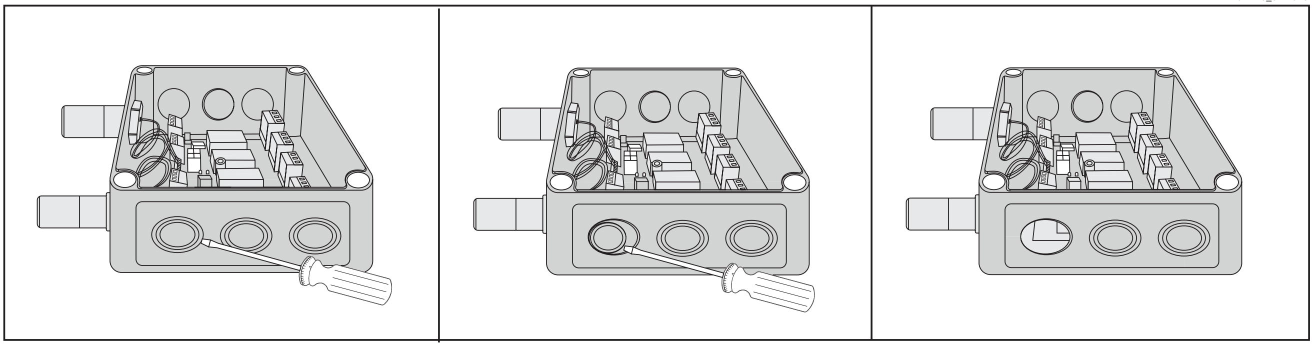


Hole punching for Cable gland:
1. Select the location for the safest cable entry.
2. Use a sharp screwdriver and a small hammer.
3. Place the screwdriver and hammer with precision while moving the screwdriver within a small area until the plastic is penetrated.

Continue precision punching with small movements until the round piece can be pulled out by your fingers.

Remove potential burrs and secure flat surfaces. Install the Cable gland according to the enclosed guide.

10

Ambient conditions - Sensor dependency (Any GDU with below sensor type must not be installed outside given Temp. and rel. Humidity Range)

Gas Type	Type	Measuring Range	Temp. Range C*	Temp. Range F*	rel. Hum range
NH3 0-100ppm	EC	0-100ppm	-30°C to +50°C	-22°F to 122°F	15-90% r.H.
NH3 0-300ppm	EC	0-300ppm	-30°C to +50°C	-22°F to 122°F	15-90% r.H.
NH3 0-1000ppm	EC	0-1000ppm	-30°C to +50°C	-22°F to 122°F	15-90% r.H.
NH3 0-5000ppm	EC	0-5000ppm	-30°C to +50°C	-22°F to 122°F	15-90% r.H.
NH3 0-1000ppm	SC	0-10000ppm	-10°C to +50°C	14°F to 122°F	15-90% r.H.
NH3 0-10000ppm	SC	0-10000ppm	-10°C to +50°C	14°F to 122°F	15-90% r.H.
NH3 0-100% LEL, 0-140000ppm	P	0-100% LEL (0-140000 ppm)	-25°C to +60°C	-13°F to 140°F	15-90% r.H.
CO2 0-2%VOL (20000ppm)	IR	0,04% - 2% VOL	-35°C to +40°C	-31°F to 104°F	0-85% r.H.
CO2 0-5%VOL (50000ppm)	IR	0-5% VOL	-35°C to +40°C	-31°F to 104°F	0-85% r.H.
Refrigerants like R134a 0-2000ppm	SC	0-2000ppm	-10°C to +50°C	14°F to 122°F	15-90% r.H.
HC R290 / Propane 0-5000ppm	P	0-5000 ppm (0-30% LEL)	-30°C to +60°C	-22°F to 140°F	15-90% r.H.

* Please observe lowest (highest) temperatur allowed for the specific GDU

General GDU Mounting / Electrical wiring

- All GDU's are for wall mounting
- Supporting ears are installed like shown in fig. 9
- Cable entry is recommended on box side. See fig. 10
- Sensor position downwards
- Observe possible constructors instruction
- Leave the red protection cap (seal) on the sensor head until commisioning

When choosing the mounting site please pay attention to the following:
- The mounting height depends on the relative density of the gas type to be monitored, see fig 6.
- Choose mounting location of the sensor according to the local regulations
- Consider ventilation conditions. Do not mount the sensor close to airflow (air passages, ducts etc.)
- Mount the sensor at a location with minimum vibration and minimum temperature variation (avoid direct sunlight)
- Avoid locations where water, oil etc. may influence proper operation and where mechanical damage might be possible
- Provide adequate space around the sensor for maintenance and calibration work.

Wiring
The technical requirements and regulations for wiring, electrical security, as well as project specific and environmental conditions etc. must be observed when mounting.

We recommend the following cable types1
- Power supply for controller 230V at least
  NYM-J 3 x 1.5 mm²
- Alarm message 230 V (also possible together with power supply)
  NYM-J X x 1.5 mm²
- Signal message, bus connection to Controller Unit, warning devices 24 V
  J-Y(St)Y 2x2 x 0.8
- Possibly connected external analog transmitters
  J-Y(St)Y 2x2 x 0.8
- Cable for Heavy Duty: 7 - 12 mm diameter round cable

[1] The recommendation does not consider local conditions such as fire protection etc.

The alarm signals are available as potential-free change-over contacts. If required the voltage supply is available at the power terminals.

The exact position of the terminals for the sensors and alarm relays is shown in the connection diagrams (see figures 3 and 4).

Basic GDU
The Basic GDU is designed for the connection of 1 sensor via local bus.

The GDU provides the power supply of the sensor and makes the measured data available for digital communication. Communication with the Controller Unit takes place via the RS 485 fieldbus interface with Controller Unit protocol. Other communication protocols for direct connection to superordinate BMS are available as well as Analog Output 4-20 mA.

The sensor is connected to the local bus via a plug connection enabling simple sensor exchange instead of an on-site calibration. The internal X-Change routine recognizes the exchanging process and the exchanged sensor and starts the measurement mode automatically.
The internal X-change routine examines the sensor for actual type of gas and actual measuring range. If data does not match the existing configuration, the build in status LED indicates an error. If everything is OK the LED will light up green.

For convenient commissioning, the GDU is pre-configured and parameterized with factory-set defaults.
As an alternative, the on-site calibration via the Controller Unit Service Tool can be performed with the integrated, userfiendly calibration routine.

For Basic units with Buzzer & Light, alarms will be given according to following table:

Digital outputs

Action	Reaction Horn	Reaction LED
Gas signal < alarm threshold 1	OFF	GREEN
Gas signal > alarm threshold 1	OFF	RED Slow blinking
Gas signal > alarm threshold 2	ON	RED Fast blinking
Gas signal ≥ alarm threshold 2, but ackn. button pressed	OFF after delay ON	RED Fast blinking
Gas signal < (alarm threshold 2 - hysteresis) but >= alarm threshold 1	OFF	RED Slow blinking
Gas signal < (alarm threshold 1 - hysteresis) but not acknowledged	OFF	RED Very fast blinking
No alarm, no fault	OFF	GREEN
No fault, but maintenance due	OFF	GREEN Slow blinking
Communication error	OFF	YELLOW

Alarm thresholds can have the same value, therefore the relays and/or Buzzer and LED can be triggered simultaniously.

Premium GDU (Controller)
The Premium GDU is designed for the connection of max. two sensors via local bus. The controller monitors the measured values and activates the alarm relays if the set alarm thresholds for pre-alarm and main alert are exceeded. In addition, the values are provided for direct connection to the monitoring system (Controller Unit) via an RS-485 interface. Other communication protocols for direct connection to superordinate BMS are available as well as Analog Output 4-20 mA.

The SIL 2 compliant self-monitoring function in the Premium GDU and in the connected sensor activates the error message in case of an internal error as well as in case of an error in the local bus communication.

The sensor is connected to the local bus via a plug connection enabling simple sensor exchange instead of an on-site calibration. The internal X-Change routine recognizes the exchanging process and the exchanged sensor and starts the measurement mode automatically.
The internal X-change routine examines the sensor for actual type of gas and actual measuring range and if data does not match the existing configuration, the build in status LED indicates an error. If everything is OK the LED will light up green.

For convenient commissioning, the GDU is pre-configured and parameterized with factory-set defaults.

As an alternative, the on-site calibration via the Controller Unit Service Tool can be performed with the integrated, userfriendly calibration routine.

Digital outputs with three relays

Action	Reaction Relay 1 (Alarm1)	Reaction Relay 2 (Alarm2)	Reaction Flashlight X13-7	Reaction Horn X13-6	Reaction Relay 3 (Fault)	Reaction LED
Gas signal < alarm threshold 1	OFF	OFF	OFF	OFF	ON	GREEN
Gas signal > alarm threshold 1	ON	OFF	OFF	OFF	ON	RED Slow blinking
Gas signal > alarm threshold 2	ON	ON	ON	ON	ON	RED Fast blinking
Gas signal ≥ alarm threshold 2, but ackn. button pressed	ON	ON	ON	OFF after delay ON		RED Fast blinking
Gas signal < (alarm threshold 2 - hysteresis) but >= alarm threshold 1	ON	OFF	OFF	OFF	ON	RED Slow blinking
Gas signal < (alarm threshold 1 - hysteresis) but not acknowledged	OFF	OFF	OFF	OFF	ON	RED Very fast blinking
No alarm, no fault	OFF	OFF	OFF	OFF	ON	GREEN
No fault, but maintenance due	OFF	OFF	OFF	OFF	ON	GREEN Slow blinking
Communication error	OFF	OFF	OFF	OFF	OFF	YELLOW

Note 1:
Status OFF = Relay is configured "Alarm ON = Relay" or the Premium Multi-Sensor-Controller is free from tension.

Note 2:
Alarm thresholds can have the same value, therefore the relays and/or the horn and flashlight can be triggered together.

Relay Mode
Definition of the relay operation mode. The terms energized / de-energized come from the terms energized / de- energized to trip principle (open-circuit / closed circuit principle) used for safety circuits. The terms refer to the activation of the relay coil, not to the relay contacts (as they are executed as a changeover contact and available in both principles).

The LEDs attached to the modules show the two states in analogy (LED off -> relay de-energized)

ENGLISH

Heavy Duty GDU (Atex, IEC approved)

The Heavy Duty GDU is designed for the connection of 1 sensor via local bus.

The GDU provides the power supply of the sensor and makes the measured data available for digital communication. Communication with the Controller Unit takes place via the RS 485 fieldbus interface with Controller Unit protocol. Other communication protocols for direct connection to superordinate BMS are available as well as Analog Output 4-20 mA.

The sensor is connected to the local bus via a plug connection enabling simple sensor exchange instead of an on-site calibration. The internal X-Change routine recognizes the exchanging process and the exchanged sensor and starts the measurement mode automatically.

The internal X-change routine examines the sensor for actual type of gas and actual measuring range. If data does not match the existing configuration, the build in status LED indicates an error. If everything is OK the LED will light up green.

For convenient commissioning, the GDU is pre-configured and parameterized with factory-set defaults.

As an alternative, the on-site calibration via the Controller Unit Service Tool can be performed with the integrated, userfriendly calibration routine.

Installation Work

Assembly work must only be carried out under gas-free conditions. The housing must neither be drilled nor be drilled through.

The orientation of the GDU should always be horizontal, with the sensor head pointing downwards.

The mounting is done without opening the housing by using the two holes (D = 8 mm) of the fastening strap with suitable screws.

The Heavy duty GDU must only be opened under gas-free and voltage-free conditions.

The enclosed cable gland has to be checked for admissibility for the requested requirements before installation in position "Entry 3". If the Heavy duty GDU is supplied without cable gland, a special cable gland approved for Ex protection class EX d and for the requirements of the application has to be mounted there.

When inserting the cables you have to strictly follow the instructions enclosed to the cable glands.

No insulating sealing material must be poured into the NPT ¾ "threads of the cable gland and blanking plugs because the potential equalization between housing and cable gland / blind plugs is via the thread.

The cable gland must be tightened firmly with a suitable tool. Only when doing so you can ensure the required tightness.

After completion of work, the GDU must be closed again. The cover has to be completely screwed in and secured with the locking screw against inadvertent loosening.

General Notes

- The terminals of the Heavy duty GDU are located behind the display.
- Only a professional should perform the wiring and the connection of the electrical installation according to the wiring diagram in compliance with the relevant regulations and only when de-energized!
- When connecting cables and conductors, please observe minimum length of 3 m according to EN 60079-14.
- Connect the housing to the equipotential bonding via the external ground terminal.
- All terminals are Ex e type with spring contact and push actuation. The permissible conductor cross section is 0.2 to 2.5 mm^2 for single wires and multi-wire cables.
- Use cables with a braided shield for compliance with the interference immunity. The shield must be connected to the inside connection of the housing with a maximum length of about 35 mm.
- For the recommended cable types, cross sections and lengths please refer to the table below.
- To comply with the requirements of servicing or operating the device without opening it (EN 60079-29- 1 4.2.5) it is possible to calibrate or operate the device remotely via the central bus. For this it is necessary to lead the central bus out to the safe area via a cable.

	Cross-section (mm^2)	Max. length for 24 V DC[1] (m)
With P, freon sensor heads		
Operating voltage with 4-20 mA signal	0.5	250
	1.0	500
Operating voltage with central bus[2]	0.5	300
	1.0	700
With SC, EC sensor heads		
Operating voltage with 4-20 mA signal	0.5	400
	1.0	800
Operating voltage with central bus[2]	0.5	600
	1.0	900

[1] The max. cable lengths and our recommendation don't consider any local conditions, like fire protection, national regulations etc.

[2] For the central bus we recommend using the cable JE-LiYCY 2x2x0.8 BD or 4 x2x0.8 BD.

Commissioning

For sensors that can be poisoned by e.g. silicones like all semiconductor and catalytic bead sensors, it is imperative to remove the protective (seal) cap supplied only after all silicones are dry, and then energize the device.

For fast and comfortable commissioning we recommend proceeding as follows. For digital devices with self-monitoring all internal errors are visible via the LED. All other error sources often have their origins in the field, because it is here where most of the causes for problems in the field bus communication appear.

Optical Check
- Right cable type used.
- Correct mounting height according to definition in Mounting.
- Led status

Comparing sensor gas type with GDU default settings
Each sensor ordered is specific and must match the GDU default settings.

The GDU software automatically reads the specification of the connected sensor and compares with the GDU settings.

If other gas sensor types are connected, you have to adjust them with the configuration tool, because otherwise the device will respond with an error message.

This feature increases the user and operating security.

New sensors are always delivered factory-calibrated by Danfoss. This is documented by the calibration label indicating date and calibration gas. A repeated calibration is not necessary during commissioning if the device is still in its original packaging (air-tight protection by the red protective cap) and the calibration doesn't date back more than 12 months.

Functional test (for initial operation and maintenance)
The functional test should be carried out during each service, but at least once a year.

Functional test is done by pressing the test button for more than 20 sec and observing all connected outputs (Buzzer, LED, Relay connected devices) working properly. After deactivation all outputs must automatically return to its initial position

Zero-point test with fresh outdoor air
Zero-point test with fresh outdoor air. (If prescribed by local regulations) A potential zero offset can be read out by use of the Service tool.

Trip test with reference gas (If prescribed by local regulations)
The sensor is gassed with reference gas (for this you need a gas bottle with pressure regulator and a calibration adapter).

In doing so, the set alarm thresholds are exceeded, and all output functions are activated. It is necessary to check if the connected output functions are working correctly (e.g. the horn sounds, the fan switches on, devices shut down). By pressing the push-button on the horn, the horn acknowledgment must be checked. After removal of the reference gas, all outputs must automatically return to its initial position.

Other than the simple functional testing, it is also possible to perform a functional test by means of calibration. For further information, please refer to the User Manual.

Controller Unit multiple GDU commisioning

For fast and comfortable commissioning we recommend proceeding as follows. Especially the given specifications of the field bus cable have to be checked carefully, because it is here where most of the causes for problems in the field bus communication appear.

1. Optical Check
- Right cable type used (JY(St)Y 2x2x0.8LG or better).
- Cable topology and cable length.
- Correct mounting height of the sensors
- Correct connection at each GDU according to fig. 8
- Termination with 560 ohm at the beginning and at the end of each segment.
- Pay special attention so that the polarities of BUS_A and BUS_B are not reversed!

2. Check Short-circuit / Interruption / Cable Length of the Field Bus (see fig. 8.1)
This procedure has to be executed for each single segment.
The field bus cable must be laid at the connector terminal block of the GDU for this testing. The plug, however, is not yet plugged into the GDU.

Disconnect the field bus leads from the Controller Unit central control. Connect ohmmeter to the loose leads and measure the total loop resistance. See fig. 8.1 The total loop resistance is calculated as follows:
- R (total) = R (cable) + 560 Ohm (terminating resistance)
- R (cable) = 72 Ohm / km (loop resistance) (cable type JY(St)Y 2x2x0.8LG)

R (total) (ohm)	Cause	Troubleshooting
< 560	Short-circuit	Look for short-circuit in the field bus cable.
infinite	Open-circuit	Look for interruption in the field bus cable.
> 560 < 640	Cable is o.k.	--

The allowed cable length can be calculated in a sufficiently exact way according to the following formula.

Total cable length (km) = (R (total) – 560 Ohm) / 72 Ohm

If the field bus cable is OK, reconnect it to the central unit.

3. Check Voltage and Bus Polarity of the Field Bus (see fig. 8.2 and 8.3)
- Bus connector to be plugged into each GDU.
- Switch operating voltage on at the Controller Unit central unit.
- The green LED at the GDU lights up weakly when operating voltage is applied (voltage indicator).
- Check operating voltage and bus polarity at each GDU according to fig. 7.1 and 7.2. U_{min} = 16 V DC
- Bus polarity:
  Measure tension BUS_A against 0 V DC and BUS_B against 0 V DC. U BUS_A = ca. 0.5 V > U BUS_B
  U BUS_B = ca. 2 – 4 V DC (depending on the number of GDU and on the cable length)

4. Addressing of the GDU
After having checked the field bus successfully, you have to assign a basic communication address to each GDU via the display on the unit, the service tool or the PC tool. With this basic address, the data of the Sensor Cartridge assigned to input 1 are sent via the field bus to the gas controller. Any further sensor connected / registered on the GDU automatically gets the next address.
Choose the menu Address and enter the predetermined Address according to the Bus Address Plan.
If this connection is OK, you can read the current GDU address in the menu “Address“ either at the display on the unit or by plugging in the service tool or the PC tool.

0 = Address of new GDU
XX = Current GDU address (permissible address range 1 – 96)

The detailed description of the addressing can be taken from the user manual of the Controller unit or the Controller unit service tool.

Further documentation:

ENGINEERING
TOMORROW

User Guide

Danfoss Gas Detection Units
Type Basic, Premium and Heavy Duty
Direct display or Service Tool display operation

GDIR.danfoss.com

Contents **Page**

Contents **Page**

1
Intended use

The display of the Premium and Heavy Duty detection units and the display of the Service Tool is used as interface for operation, commissioning and calibration of the Basic, Premium and Heavy Duty gas detection units.

2
Content

This user guide contains the maximum possible functionality of concerned display devices.

Depending on the version some features described here are not possible and therefore the menu items may be hidden.

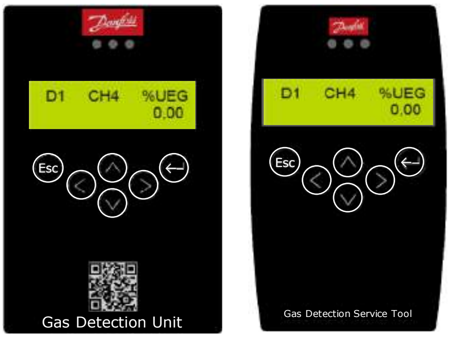
Heavy Duty software contain all menu items except for 4.1.1 Error Memory.

3
Operation

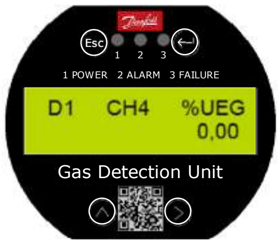
The complete configuration and service is made via operating keys in combination with the LC display screen.

Security is provided via four password levels against unauthorized intervention.

Premium GD Unit/ Service Tool:
Operation is done via 6 buttons.



Heavy Duty:
The display is located behind a glass panel and is operated from the outside by a light touch of the control symbols using the magnetic pen.



3.1
Function of the keys and LEDs on the keypad

Exits programming, returns to the previous menu level.

Enters sub menus, and saves parameter settings.

Scrolls up & down within a menu, changes a value.

Change of cursor position.

The status LEDs indicate the operating state.

- **Green**
  Continuous = Operating voltage
  Flashing = Maintenance message
- **Yellow**
  Continuous = Failure
  Slowly flashing = Warming-up
  Fast flashing = Special mode
- **Red** = Alarm

The backlight of the display changes from green to red when an alarm is active.

3.2
Setting / changing of parameters and set points

Open desired menu window.
Code input field opens automatically, if no code is approved.

After input of valid code the cursor jumps onto the first position segment to be changed.

Push the cursor onto the position segment, which has to be changed.

Set the desired parameter / set point with the keys.

Save the changed value, confirm storage (ENTER).

Cancel the save / close editing / return to a higher menu level (ESCAPE function).

3.3 Password Levels

All inputs and changes are protected by a four-digit numeric code (= password) against unauthorized intervention according to the regulations of all national and international standards for gas warning systems. The menu windows of status messages and measuring values are visible without entering a code.

The access to a code level is cancelled if no button is pushed within 15 minutes.

The password levels are classified in order of priority: Priority 1 has top priority.

Priority 1: (code 5468, not changeable)
Code level priority 1 is intended for the service technician or the installer to change parameters and set-points. This password allows working on all settings. For opening the parameter menus you must first activate the service mode after code release.

Priority 2: (code 4009, not changeable)
With code level 2, it is possible to lock / unlock sensors temporarily. This password is only given to the end user by the installer in problem situations. In order to lock / unlock the sensors you must first activate the service mode after code release.

Priority 3: (code 4321, is settable in the maintenance information menu)
It is only intended to use the test functions of the alarm relays and analog outputs. Normally the code is only known by the service technician who has last changed it since it can be changed individually via priority 1.
- Manual test function of the alarm relays (functional test of the connected units),
- Manual test function of the analog outputs (functional test of the connected units).

Priority 4: (password 1234) (code not changeable)
Code level priority 4 allows the operator after activation of the operation mode "Service Mode":
- to read all parameters.

4 Menu Overview

Menu operation is done via a clear, intuitive and logical menu structure. The operating menu contains the following levels:
- Starting menu with indication of the device type if no MP is registered, otherwise scrolling display of the gas concentrations of all registered sensors in 5-second intervals. If alarms are active, only the values of the sensors currently in alarm status are displayed.
- Main menu
- Submenu 1 to 3

Power On Time 19s	Power On Time of the basic device Second counter counts down, when communication display <> basic device is OK. In case of communication error the count-down will stop.

↓ Seconds indicator = 0

Danfoss – Electronic Device Type	PX2 = Heavy Duty MSC2 = Premium SB2 = Basic

↓ After about 5 seconds

D1 CH4 % LEL Warm-up Time	"Warm-up Time" is displayed. As soon as the sensor warm-up time has expired, the measured value is displayed = measuring mode.

4
Menu Overview
(Continued)

Starting menu

Main menu	Chapter #
Error Status	Reading and acknowledgement of errors See chapter 4.1
Alarm Status	Display of the status of active alarms See chapter 4.2
Relay Status	Display of the relay status See chapter 4.3
Measuring Values	Display of measuring values See chapter 4.4
Maintenance Information	Maintenance information about connected devices See chapter 4.5
Display Parameters	General display parameters without safety relations See chapter 4.6
Installation & Calibration	Reading and change of the relay, measuring point and system parameters as well as test and calibration functions

4
Menu Overview
(Continued)

Starting menu

Main menu	Chapter #
Service OFF	

The following menu items are only accessible with Service ON (password protected)
!! Service ON = Special mode = Fault message is active!!

Main menu	Chapter #
Relay Parameters	See chapter 4.7
MP Parameters	See chapter 4.8
System Parameters	See chapter 4.9
Operating Data	See chapter 4.10
Relay Test Function	See chapter 4.11
Analog Output Test Function	See chapter 4.12
Calibration	See chapter 4.13
Addressing	See chapter 4.14

4.1
Fault Management

A pending fault activates the yellow LED (Fault). The integrated fault management records the first 99 occurred faults with time stamps in the menu „System Errors".

Additionally a record of the faults occurs in the "Error memory", which can only be read and reset by the service technician (code level 1).

4.1.1
Error Memory

The menu „Error Memory" in the main menu "Error Status" can only be opened via the code level priority 1.

In the error memory, the first 99 faults that have occurred and have already been acknowledged in the menu "Error Status" are listed for the service technician in a power failure safe way.

Attention:
This memory should always be read during maintenance, relevant faults should be tracked and entered in the service logbook, and finally the memory should be emptied.

4.1.2
System Messages and System Errors

For details about the error messages please refer to the Installation Guide.

4.2
Alarm Status

Display of the currently pending alarms in plain text in the order of their arrival. Only those measuring points are displayed, where at least one alarm is active.

Alarms in latching mode can be acknowledged in this menu (only possible if the alarm isn't active).

Alarm Status → DP 1 "A1 → DP 1 Acknowledge?

Symbol	Description	Function
DP 1	Measuring Point No.	Digital measuring point X = 1 - X, where an alarm is pending
'A1 "A1	Alarm status	'A1 = Alarm 1 active "A1 = Alarm 1 in latching mode, can be acknowledged

4.3
Relay Status

Reading of the current status of alarm relays.

The actual relay status is displayed, depending on the relay mode (energized <> de-energized).

Selection of the alarm relay 1 – X

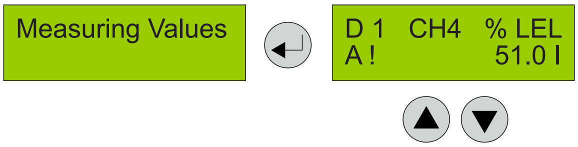
Alarm Relay Status → Alarm Relay 1 Status OFF

Selection of the next alarm relay

Symbol	Description	Function
1	Alarm Relay	Alarm relay = 1 - X
OFF	Relay Status	Relay OFF
ON	Relay Status	Relay ON

4.4
Menu Measuring Values

In this menu, the display shows the measuring value with gas type and unit. If the alarm evaluation is defined via the average, the display additionally shows the average value (A) to the left of the current value (C).

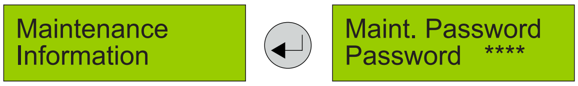


Selection of the next measuring point

Symbol	Description	Function
DP 1	Meas. Point No.	Digital measuring point 1 = 1 - X
CH4	Gas type	Display of gas type (must comply with gas type of sensor head)
% LEL	Gas unit	Unit
51.0 C 48.0 A	Measured value	Current measured value (current value) of the gas concentration Arithmetic average of the gas concentration (only if average is active)
A!	Alarm indication	At least one alarm has been released at this MP.
#	Maint. info	Sensor head: maintenance due (maintenance date exceeded)
?	ConfigError	Gas type or meas. range doesn't agree with sensor head.
Comm. err.	Fault MP	Communication error, sensor head <> I/O board
Underrange Overrange	Meas. range monitoring	Meas. signal < admissible range (< zero point – 6 %) Meas. signal > admissible range (> full scale value + 6 %)
Locked	MP locked	MP was temporarily locked by the operator.
Warm-up	Warm-up time	Warm-up time of the sensor active

4.5
Maintenance Information

Definition of an individual service password in the display for the execution of test functions: Changes are only possible if the code level 1 is released.



4.6
Display Parameters

In the menu Display Parameters you can find the general, security irrelevant parameters of the display. These parameters can be changed in operating mode.

4.6.1
Software Version

Software version of the display and of the basic board (factory set).

Symbol	Description	Function
XXXXX	Software Version of the displays	XXXXX Software Version
YYYYY	Software Version of the basic board	YYYYY Software Version

4.6.2
Language

Language
English

Selection of the menu language (code level 4)

Symbol	Description	Default	Function
English	Language	English	English USA English German French

4.6.3
Service Phone Number

Service TEL:

The service phone no. can be individually defined.

Symbol	Description	Default	Function
0853....	Phone No.		Definition of the individual service phone no.

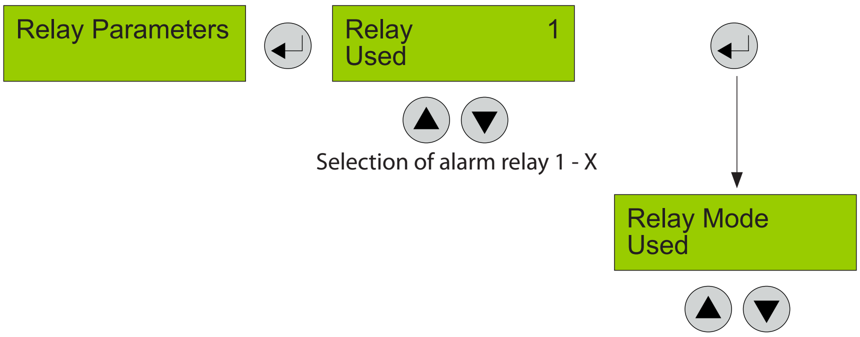
4.6.4
Error Time Delay

Error Time Delay
120s

Symbol	Description	Default	Function
s	Delay	120s	Definition of a delay time after a communication error Display <> Basic Board has occured (only fault indication on the display, no effect on the function or outputs)

4.7
Menu Relay Parameters

Reading and changing of the parameters separately for each relay. Changes only possible via code level priority 1.



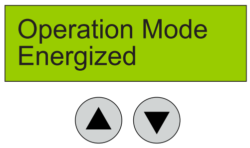
4.7.1
Relay Mode

Symbol	Description	Default	Function
Used	Mode	Used	Used = Relay is registered and can be assigned to an alarm Not Used = Relay is not registered

4.7.2
Relay Operation Mode

The terms energized / de-energized come from the terms energized / de-energized to trip principle (open-circuit / closed circuit principle) used for safety circuits. The terms refer to the activation of the relay coil, not to the relay contacts (as they are executed as a changeover contact and available in both principles).

The LEDs at the modules show the state in analogy. (LED off -> relay coil current-free).



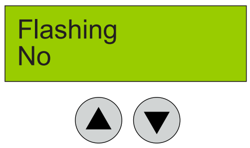
Symbol	Description	Default	Function
De-energ.	Mode	De-energ.	De-energ. = Alarm OFF= Relay (and LED) current-free Alarm ON = Relay (and LED) energized Energ. = Alarm OFF = Relay (and LED) permanently energized Alarm ON = Relay (and LED) current-free

4.7.3
Relay Function Static / Flashing

The function "Flashing" offers a connection option for warning devices to improve visibility. The frequency is about 1 second with an impulse / pause rate of 1:1.

If "Flashing" is set, the output circuit mustn't be used as a safe output any more.

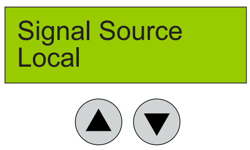
The combination of relay mode energized with flashing operation makes no sense and is therefore suppressed.



Symbol	Description	Default	Function
No	Function	No	Yes = Relay function flashing when alarm No = Relay function static when alarm

4.7.4
Signal Source

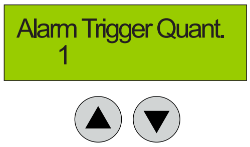
The signal source determines whether the relay is triggered by an alarm in the I/O board (local) or from the central (remote).



Symbol	Description	Default	Function
Local	Signal Source	Local	Local = The relay activation is based on local settings and alarms. Remote = The relay is activated by the central unit.

4.7.5
Alarm Trigger Quantity

In some applications it is necessary that the relay switches only at the nth alarm. Here you can set the number of active alarms necessary for relay tripping. For security applications, the relay must always switch on the 1st alarm.

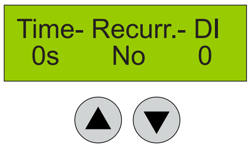


Symbol	Description	Default	Function
1	No. of Alarms	1	1 = Number of pending alarms for triggering the alarm relay

4.7.6
Horn Function

The horn function of the alarm relay is activated if at least one of the two parameters (time or assignment to digital input) is set. The horn function retains its functionality even for alarms in latching mode.

This feature is not allowed for safety-related alarm messages because the output is resettable.



Symbol	Description	Default	Function
Recurrence	Mode	No	No = Automatic reset of the relay after time has expired. Yes = Recurrence function
Time		120	Enter time for automatic reset function or recurrence function in s 0 = No reset function
DI		0	0 – X = Assignment, which digital input resets the relay

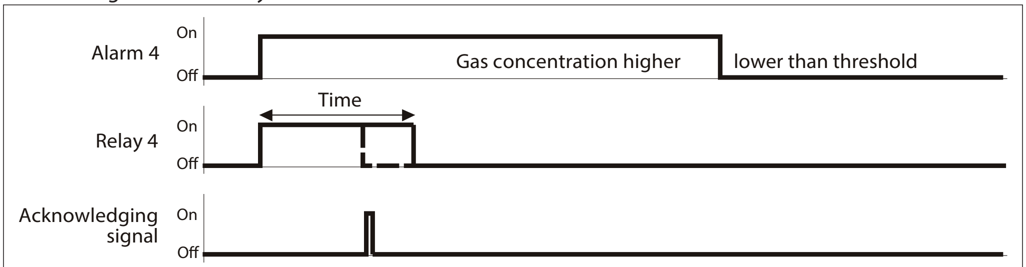
Horn function resettable:
The activated horn can be permanently reset with this function.
The following possibilities to acknowledge are available for the alarm relay as horn relay:

- By pressing the left button (ESC). Only available in starting menu.
- Automatic reset at the end of the preset time (active, if value > 0).
- By an external pushbutton (assignment of the appropriate digital input DI: 1-n).

Due to fixed polling cycles, external buttons must be pressed for a few seconds before the reaction occurs.

After successful acknowledgment the horn remains permanently reset until all assigned alarms for this relay function are inactive again. Only then it is triggered a new in case of an alarm.

Acknowledge the horn relay

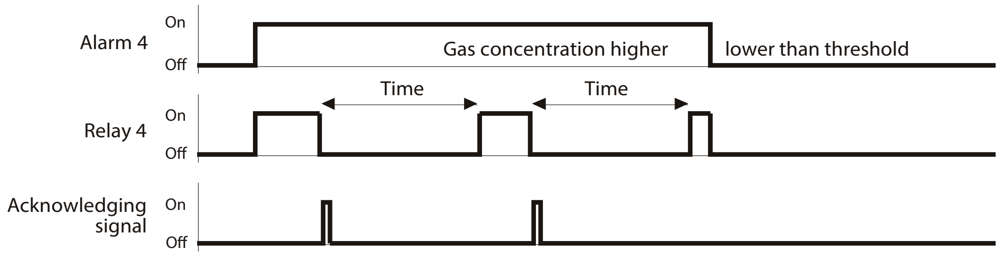


Reset command by timer, external push-button or one of the operating keys.

4.7.6
Horn Function
(Continued)

Recurrence of the horn relay
After an alarm has been triggered, the horn will remain active until a reset action is done. After acknowledgment of the horn relay/s (clicking a button or via external input) a timer starts. When this time has run out and the alarm is still active, the relay is set again.

This process is repeated endlessly as long as the associated alarm remains active.



Reset command by timer, external push-button or one of the operating keys.

4.7.7
External Override

This menu (function) is not available for Heavy Duty device series.

External function
↗ DI 0 ↘ DI 0

Symbol	Description	Default	Function
↗ DI 0	External ON	0	As long as DI 1-X is closed, relay switches ON
↘ DI 0	External OFF	0	As long as DI 1- X is closed, relay switches OFF.

Manual operation of the alarm relays via DI does not start the "special mode", as this is a deliberate and configured functionality. The use of the override should be used with caution, particularly the function of setting "External OFF".

Assignment of a digital input (DI) for the external switching on and off of the alarm relay. This function has priority to gas alarm.

If External ON and External OFF are configured simultaneously to the same relay and both are active at the same time, so in this state, only the External OFF command is executed. In this mode, too, the relays work respecting the parameter settings "Static / Flashing" and "Energized / De-energized".

4.7.8
Delay Mode of Alarm Relay

Definition of the time for switch-on and switch-off delay of the alarm relays. The menu (function) of switch-on delay is not available for Heavy Duty device series.

On Delay Time
0 s

Off Delay Time
0 s

Symbol	Description	Default	Function
0 sec.	Switch-ON Delay Time	0	Alarm relay is only activated at the end of the defined time. 0 = No delay
0 sec.	Switch-OFF Delay Time	0	Alarm relay is only deactivated at the end of the defined time. 0 = No delay

4.7.9
Assignment to Fault

In case of a device fault the alarm relay is triggered in addition.

Exceptions are all errors of the measurement point because the MPs can be assigned to each alarm separately in the menu MP Parameters.

This relay output must not be used as a Safe Error Output.

Fault → Active
No

Symbol	Description	Default	Function
No	No assignment	No	Alarm relay is not activated in case of a device fault.
Yes	Assignment to fault	Yes	Alarm relay is activated in case of a device fault.

4.7.10
Assignment to Maintenance Message

In case of a pending maintenance the alarm relay is triggered in addition.

Maintenance → Active
No

Symbol	Description	Default	Function
No	No assignment	No	Alarm relay is not activated in case of a maintenance message.
Yes	Assignment to fault	Yes	Alarm relay is activated in case of a maintenance message.

4.8
MP Parameters

Reading and changing (only via code level 1) of the parameters for each measuring point.

Selection of measuring point (1 – X)

MP Parameters

MP 1
Active

4.8.1
Activate – Deactivate MP

The physically present sensor head is registered at the basic device for its evaluation. After activation the measured gas signal is evaluated and the sensor head specifications are monitored. Existing alarms and faults are cleared with deactivation of the sensor.

Attention: Deactivation of a sensor head does not cause a fault message.

MP Mode
Active

Symbol	Description	Default	Function
Active	MP Mode	Not active	Active = Measuring point activated in the controller. Not active = Measuring point not activated in the controller.

4.8.2
Lock MP

This menu (function) is not available for Heavy Duty device series.

In the temporary Lock Mode, the function of the registered sensors is put out of service, which means that there is no alarm or fault message at this measuring point. Existing alarms and faults are cleared with the locking. The message "Locked" appears in the menu Measuring Values.

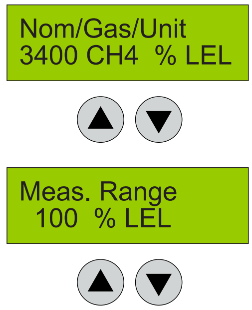
When the sensor is unlocked, the controller starts the measuring operation again.

Temporary Mode
Active

Symbol	Description	Default	Function
Unlocked	Lock mode	Unlocked	Unlocked = MP free, normal measuring operation Locked = MP locked, special mode

4.8.3
Selection of Gas Type and Measuring Range

The gas type to be monitored and the range are set in the two menus. The basic unit continuously checks the set gas type and the measuring range if they match with the gas type and the measuring range of the connected digital sensor head. If they don't match, an error messages is output.



Symbol	Description	Default	Function
E1125-A	Internal type	----	Selection of gas type from internal list (must correspond with the sensor head)
NH_3	Formula of gas type	----	Formula (gas type) is firmly assigned to the type
ppm	Unit of gas type	----	Unit is definitely assigned to the type
100	Measuring range	----	Set measuring range (must correspond with the sensor head)

Select the internal type; then the type of gas and the associated unit will appear on the right next to it.

It should be noted that for some gases there are various sensor technologies and units, therefore the associated sensor head types are listed in the table column.

The presentation of measured values, alarm thresholds and hysteresis depends on the measuring range. If the measuring range is <10, there are three, if <100, two, if <1000, there is one decimal place. If => 1000, the display is without decimal place. The resolution and accuracy of the calculation is not affected by the different measuring ranges.

Sensor	Internal type	Measuring range	Unit
Basic and Premium			
Ammonia EC 100	E1125-A	0-100	ppm
Ammonia EC 300	E1125-B	0-300	ppm
Ammonia EC 1000	E1125-D	0-1000	ppm
Ammonia SC 1000	S2125-C	0-1000	ppm
Ammonia EC 5000	E1125-E	0-5000	ppm
Ammonia SC 10000	S2125-F	0-10000	ppm
Ammonia P LEL	P3408-A	0-100	% LEL
CO2 IR 20000	I1164-C	0-2	% Vol
CO2 IR 50000	I1164-B	0-5	% Vol
HCFC R123 SC 2000	S2064-01-A	0-2000	ppm
HFC R404A, R507 SC 2000	S2080	0-2000	ppm
HFC R134a SC 2000	S2077	0-2000	ppm
HC R290 / Propane P 5000	P3480-A	0-5000	ppm
Premium remote			
Ammonia EC 100	E1125-A	0-100	ppm
Ammonia EC 1000	E1125-D	0-1000	ppm
Ammonia EC 5000	E1125-E	0-5000	ppm
Ammonia SC 10000	S2125-F	0-10000	ppm
Heavy Duty			
Ammonia EC 1000	E1125-D	0-1000	ppm
Ammonia EC 5000	E1125-E	0-5000	ppm
Ammonia SC 10000	S2125-F	0-10000	ppm
Ammonia P LEL	P3408-A	0-100	% LEL

4.8.4
Alarm Thresholds / Hysteresis

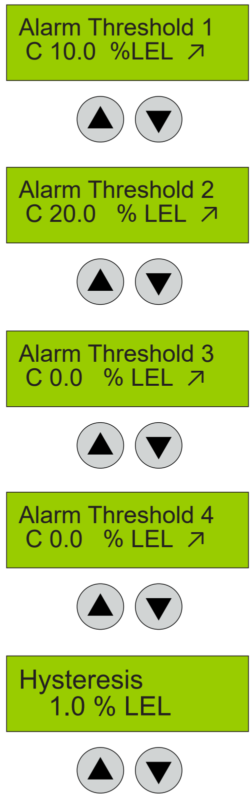
For each measuring point four alarm thresholds are available for free definition. If the gas concentration is higher than the set alarm threshold, the associated alarm is activated. If the gas concentration falls below the alarm threshold inclusive hysteresis the alarm is reset again. In the mode "Alarm at falling" the corresponding alarm is set in case of falling below the set alarm threshold and reset again when exceeding the threshold plus hysteresis.

The presentation of the alarm thresholds depends on the set measuring range: see chapter Gas Type and Measuring Range.

Unused alarm thresholds have to be defined with 0, in order to avoid undesired alarms.
Higher-level alarms automatically activate the lower-level alarms.

Lowest hysteresis: 12% of the lowest alarm threshold

Highest hysteresis: 50% of the lowest alarm threshold

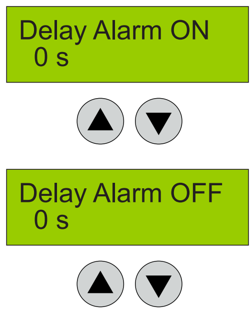


Symbol	Description	Default	Function
C	Evaluation	C	C = Alarm evaluation with current value of MP A = Alarm evaluation with average value of MP
10 % LEL	Threshold 1 Threshold 2 Threshold 3 Threshold 4 Hysteresis	XX XX XX XX XX	Gas concentration > Threshold 1 = Alarm 1 Gas concentration > Threshold 2 = Alarm 2 Gas concentration > Threshold 3 = Alarm 3 Gas concentration > Threshold 4 = Alarm 4 Gas concentration < (Threshold X –Hysteresis) = Alarm X OFF
↗		↗	↗ = Alarm release at increasing concentrations ↘ = Alarm release at falling concentrations

4.8.5
Delay for Alarm ON and/or OFF

Menu (function) Delay for Alarm ON not available for Heavy Duty series.

Function only active in Current Value Mode.

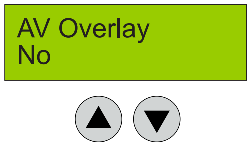


Symbol	Description	Default	Function
0 s	Delay Alarm	0 sec.	Gas concentration > alarm threshold + set time = Alarm ON Gas concentration < alarm threshold – hysteresis + set time = Alarm OFF

4.8.6
Average Overlay

Menu (function) average overlay not available for Heavy Duty device series.

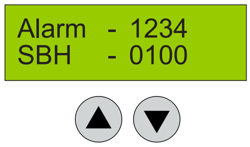
The alarm evaluation of the operation mode "Average" is overridden by the current value, if this one exceeds the alarm threshold and delay time defined in the menu "System Parameters AV Overlay". The overlay is delayed by the time factor entered in the local menu. The function of the average overlay is only activated for the gas type CO.



Symbol	Description	Default	Function
No	Overlay of alarm release by current value	No	No = Average overlay not active. Yes = Average overlay active

4.8.7
Latching Mode Assigned to Alarm

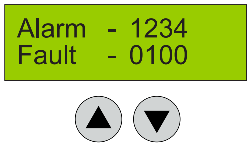
In this menu you can assign the latching mode to each alarm.



Symbol	Description	Default	Function
Alarm			Presentation of the alarms 1 to 4; under each alarm you can activate the latching with 1.
SBH	Assignment of latching function yes/no	0 0 0 0	0 = no latching; alarm resets automatically if gas concentration again < alarm threshold 1 = latching; alarm remains active, if gas concentration < alarm threshold and must be reset by the operator

4.8.8
MP Fault Assigned to Alarm

In this menu you can define, which alarms should be activated by a fault at the measuring point. If the fault is remedied, the alarm is automatically reset.



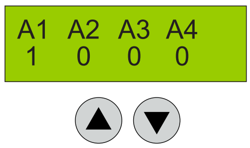
Symbol	Description	Default	Function
Alarm			Presentation of the alarms 1 to 4; you can define with 1 for each alarm that the alarm should be activated in case of MP fault.
Fault	Assignment of MP fault to alarm	0 0 0 0	0 = Alarm isn't activated in case of MP fault. 1 = Alarm is activated in case of MP fault.

4.8.9
Alarm Assigned to Alarm Relay

Each of the four alarms can be assigned to any alarm relay 1 – X registered in the menu Relay Parameters by entering the relay address right under the alarm. One alarm relay can be assigned to multiple alarms. Unused alarms are not assigned.

The number of physically present alarm relays depends on the device type. For Heavy Duty devices there is only one alarm relay (address 1).

The fault relay can also be used for alarm message (address 2). The fault message function, however, remains unaffected.

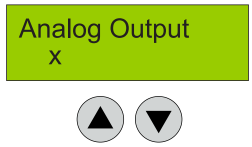


Symbol	Description	Default	Function
Alarm	A1 A2 A3 A4		Presentation of the alarms 1 to 4; you can assign an alarm relay to each alarm by setting a relay address.
	Assignment of alarm relay	A1 = X A2 = X A3 = X A4 = X	X = Assignment of an alarm relay (relay address) to an alarm

4.8.10
MP Assigned to Analog Output

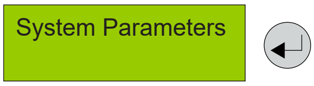
The measuring signal can be assigned to an analog output by entering the address of the analog output instead of x.

The analog output are configured in the menu System Parameters, AO Function.



Symbol	Description	Default	Function
x	Address AO		X = Assignment of an analog output by entering the AO address

4.9
Menu System Parameters



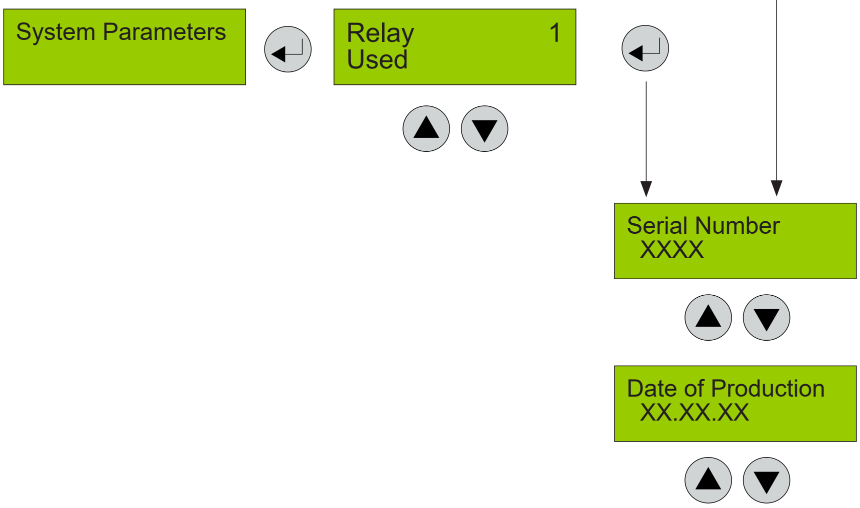
Selection of the device, the sensor head or the basic device whose data should be processed.

SB2 - Basic
MSC - Premium
PX2 - Heavy Duty

SC - Sensor head basic and premium
SX1 - Sensor head Heavy duty

The display automatically recognized the connected basic unit.

If more than one SC are connected to the basic unit,
the selection is done at X.

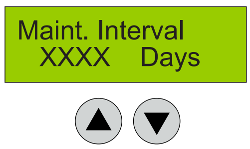


4.9.1
System Information

Symbol	Description	Default	Function
XXXX	Serial Number		Serial number (factory set)
XX.XX.XX	Date of Production		Date of production (factory set)

4.9.2
Maintenance Interval

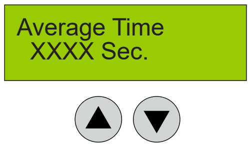
Input of the maintenance interval in days
The maintenance interval can be entered individually in the basic unit and in each sensor head. Therefore the complete unit can have multiple maintenance messages.

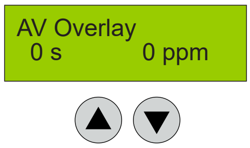


Symbol	Description	Default	Function
XXXX	Days	365	Maintenance interval

4.9.3
Average Function

Menu (function) not available for Heavy Duty devices.





In the menu "Average Time" you can define the time base for the calculation of the arithmetic average value (30 measurements within the time base). This average value can be used for alarm evaluation as an alternative to the current value. The selection which value should be used for evaluation is defined separately for each alarm in the menu "Alarm Threshold X". In the average mode, the average value is indicated in the menu "Measuring Values" next to the current value.

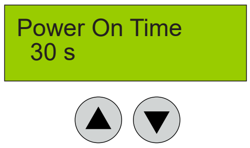
Symbol	Description	Default	Function
XXXX	Seconds	900	Time base for average calculation
0 s	Seconds	120	Delay time in case of overlay by the current value
0 ppm	Alarm Threshold	100	Alarm threshold that triggers the overlay by the current value

The alarm evaluation of the operating mode "Average Value" is superimposed by the current value, when the current value exceeds the alarm threshold defined in the menu "AV-Overlay". The overlay is delayed by the time factor defined in this menu. The average overlay function is only available for the gas type CO.

Both menus are available and operable in the basic device. The menu "Average Time" is also available in the sensor head for reading the time base.

4.9.4
Power On Time

Gas sensors need a running-in period, until the chemical process of the sensor reaches stable conditions. During this running-in period the sensor signal can lead to an unwanted triggering of a pseudo alarm. Therefore the Power On time is started at each basic unit and each sensor head after power-on or voltage recovery. While this time is running out, the device is in special mode and doesn't activate alarms.



The Power On time appears in the starting menu. During this phase the sensor head transmits "Warm-up time" instead of the measured value.

Symbol	Description	Default	Function
XX	Seconds	30	Power On time

The Power On Time of the individual components may be different. Only when the longest time has expired, the system starts the measuring operation.

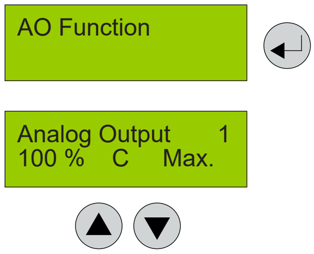
4.9.5
AO Function

This menu is for the configuration of the analog outputs.

After registration each analog output checks the current signal for plausibility. Signal deviations of more than 5% from the nominal value will entail an error message (causes: short circuit or interruption of cable, actuator not connected).

The analog output can be activated by the local device as well as by a higher-level controller. The steepness of the current signal can be adjusted in the range of 10 to 100% in case of local control.

If a plurality of measuring points is assigned, you can define whether the minimum, the maximum or the average of all the assigned signals is output. It is likewise possible to define which signal of the measuring points (source) is output.



Symbol	Description	Default	Function
Analog Output 1	Selection of channel		Selection of the analog output 1 - X
0 1 10-100 %	Selection of output signal	100 %	0 = Analog output is not used, no monitoring of the feedback 1 = Control by central controller ≥ 10 = Local control and definition of the signal slope 10 = 10 % gas signal = 20mA (high sensitivity) 100 = 100 % gas signal = 20mA (standard signal)
C	Selection of source	A	C = Source is current value A = Source is average value CF = Source is current value and additional fault message at AO AF = Source is average value and additional fault message at AO
Max.	Selection of mode	Max.	Min. = Displays the minimum value of all assigned MP Max. = Displays the maximum value of all assigned MP Average = Displays the average value of all assigned MP

4.10
Operating Data

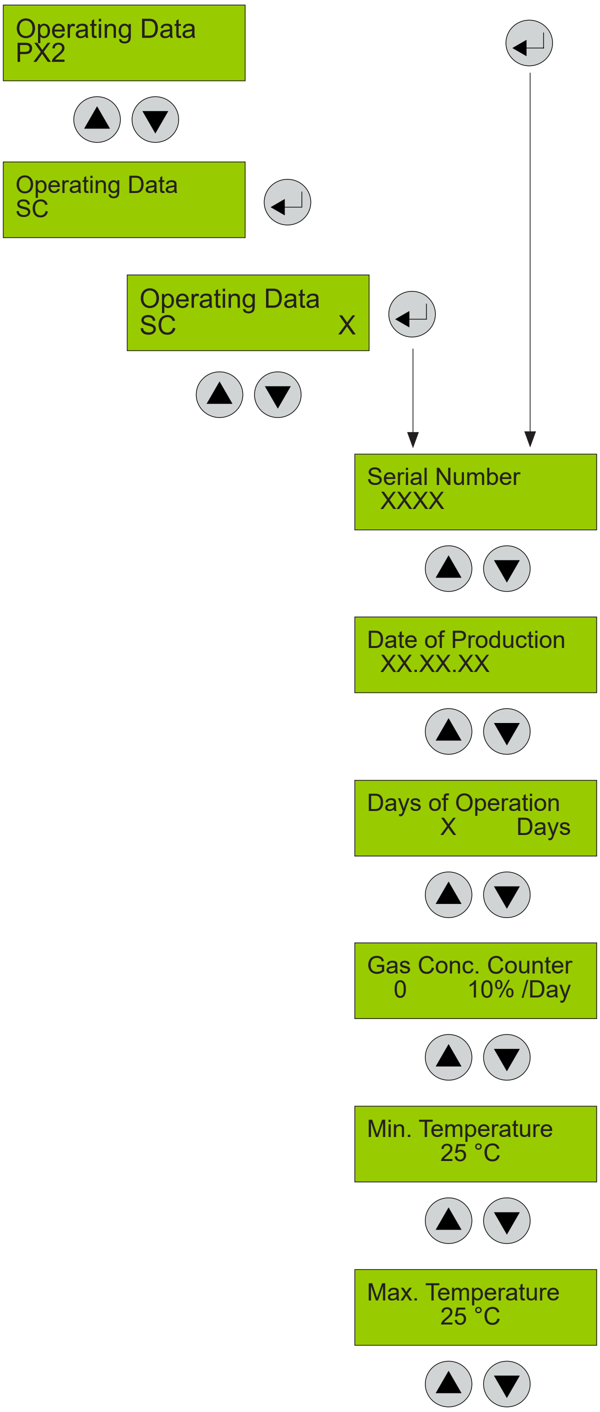
This menu is for retrieving relevant operational data of the sensor head and the basic unit.
No changes or modifications are possible.

Selection of the device, sensor head or basic device the data should be read from.

SB2 - Basic
MSC - Premium
PX2 - Heavy Duty

SC - Sensor head basic and premium
SX1 - Sensor head Heavy duty

The display recognizes the connected basic unit automatically.



Serial number of the device

Date of production of the device

Current days of operation

Gas concentration counter (only for SC)
Counting the gas concentration
Unit: 10 % of measuring range per day

Display of the lowest temperature
detected at the device

Display of the highest temperature
detected at the device

4.10
Operating Data
(Continued)

Display	Description
Last Tool No.	Displays the tool number the last access was performed with
Analog Outp. 1 Offset 295	Display of the zero offset of analog output 1 (internal value)
Analog Outp. 2 Offset 295	Display of the zero offset of analog output 2 (if available)
MP 1	
Number of Calibr. 1	Number of calibrations performed
Zero Gain xxxxx yyyyy	Current zero offset and gain
Sensitivity 100%	Sensitivity of the sensor at the last calibration compared to new sensor
Maintenance Days Last xxx	Display of the days differing from the nominal maintenance date at the last maintenance / calibration (fixed value)
Days of operation Last xxx	Days of operation at the last calibration (fixed value)
Maintenance Days Currently xxx	Current remaining days until next maintenance date (down counter)
Max. Current Value 0	Maximum measured current value of the sensor head

4.11
Test Function for Alarm Relays

In this menu, the alarm relays can be manually turned on and off in order to test their function.

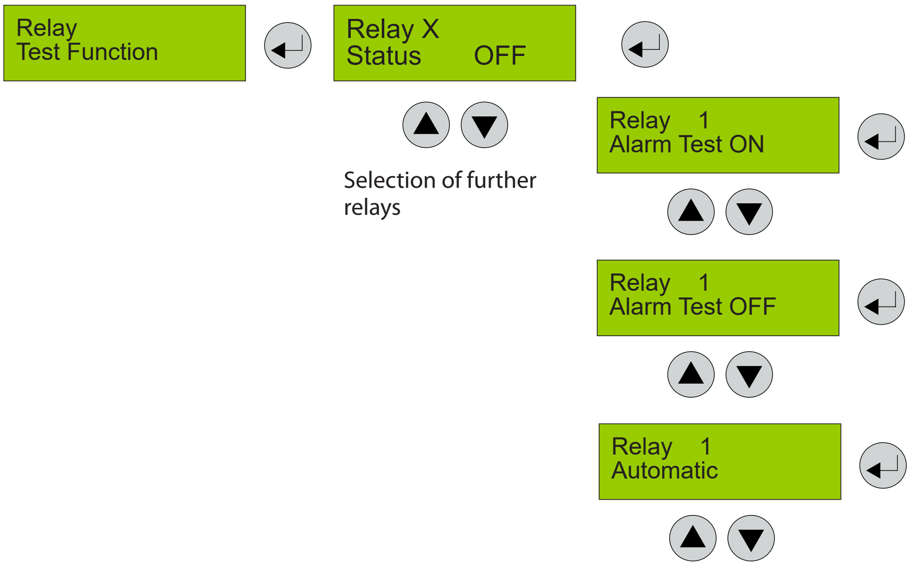
This manual intervention is reset automatically 15 minutes after the last menu entry; therefore don't use this feature for safe disconnection of equipment for repair work. During the test phase the device is in Special Mode.

The manual operation has priority over activation by a gas alarm. However, the external activation of the alarm relays via a digital input has priority over the manual test function.

The test mode simulates an alarm for the relay and the relay accepts the alarm status.

Changes are only possible via code level 3.

Selection of the relay 1 - X



Symbol	Description	Default	Function
Status	Relay No. X		X = 1 – X Select the relay
OFF	Relay Status	OFF	Status OFF = Relay off (no gas alarm) Status ON = Relay on (alarm)
Test ON	Test of the alarm message	Autom	Alarm Test ON = Relay manually set in alarm status Alarm Test OFF = Relay manually set in "no alarm" status Automatic = Reset of manual intervention, relay in automatic mode

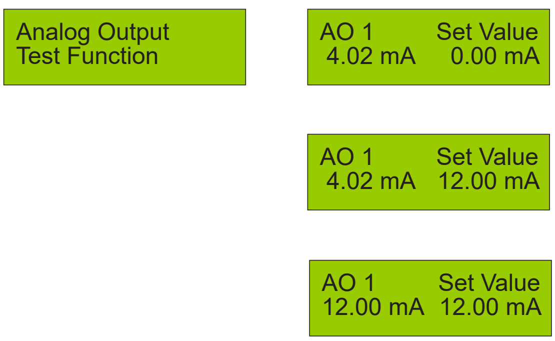
4.12
Test Function for Analog Output

In this menu, you can define a desired value in mA for the analog output in order to test the function. This value then is directly available at the output. During the test phase the device is in Special Mode. The manual intervention is reset automatically 15 minutes after the last menu entry or when exiting the menu.

The manual operation has priority over the activation by the gas concentration.

Changes are only possible via code level 3.

The test function is only possible for an active analog output.



On the left you can see the current set-point as calculated from the gas concentration.

Enter the required current under „Set Value", e.g. 12 mA

The set value is accepted as set-point (by displaying it on the left) and is physically output.

4.13
Calibration

On this page there is the menu overview of the calibration.
The calibration description can be found on the following pages.

Calibrate

Password 5468 gives full access to change parameters and can not be changed.

DP 1
3400 CH4 % LEL

Selection of the measuring point to be calibrated

Zero DP 1
XX.X % LEL

Zero calibration

Test gas
X.X % LEL

Set the test gas concentraion

Gain DP 1

Gain calibration

Burn clean

Calibration AO 1

Display only if an AO is available.

Credit Menu

Credit Menu.

4.13.1
Zero Calibration

The gas application with the defined calibration adapter, the allowable gas pressure and flow rate and the zero gas to be used can be found in the operating instructions of the sensor head. The specified warm-up times etc. must be strictly observed.

Zero DP 1

Password 5468 gives full access to change parameters and can not be changed.

Zero DP 1
0.5 % LEL

Step 1: Display of the current value

Apply test gas according to instructions.

Start calibration process.

Zero DP 1
_ 0.5 % LEL

Step 2: Calculation of the new zero point
During calculation an underscore in line 2 runs from left to right and the current value drops to zero.

When the current value is stable, press for finishing the calculation of the new value.

Zero DP 1
SAVE

Step 3: Save the newly calculated zero point
„SAVE" is displayed, as long as the function is executed.

Zero DP 1
0.0 % LEL □

After the value has been successfully stored, a square appears on the right for a short time = Zero point calibration is finished and new zero offset has been stored with success.

Zero DP 1
0.0 % LEL

The display automatically goes to step 1: Display of new zero point.

During the calculation phase, the following messages may occur:

Message	Description
Current value too high	Wrong gas for zero point calibration
Current value unstable	Appears when the sensor signal does not reach the zero point within the target time. Disappears automatically when the sensor signal is stable.
Time too short	The message "value unstable" starts an internal timer. Once the timer has run out and the current value is still unstable, the text is displayed. The process starts over again. If the value is stable, the current value is displayed and the calibration procedure is continued. If the cycle is repeated several times, an internal error has occurred. Stop the calibration process and replace the sensor head.

When aborting the zero-offset calibration, the offset value there will not be updated.
The sensor head continues to use the "old" zero offset.

4.13.2
Gain Calibration

The gas application with the defined calibration adapter, the allowable gas pressure and flow rate and the test gas to be used can be found in the operating instructions of the sensor head. The specified warm-up times etc. must be strictly observed.

```
Test Gas
    XX.X % LEL
```

Enter concentration of the test gas used.
This value isn't cleared when exiting the menu, therefore before calibrating always check the value if correct.

```
Gain          DP 1
```

```
Gain              DP 1
48.0 %  LEL   89.0%
```

Step 1: Display of the current value and of the sensitivity from the last calibration

Apply test gas according to instructions.

Start calibration process.

```
Gain              DP 1
50.1 %  LEL     82%
```

Step 2: Calculation of the new gain
During calculation an underscore in line 2 runs from left to right and the current value converges to the set test gas concentration. The sesitivity is recalucated, too.

When the current value is stable, press for finishing the calculation of the new value.

```
Gain              DP 1
       SAVE
```

Step 3: Save the newly calculated gain
‚SAVE' is displayed as long as the function is executed.

```
Gain              DP 1
50.1 %  LEL   89%□
```

After the value has been successfully stored, a square appears on the right for a short time.= Gain calibration is finished and new gain offset has been stored with success.

```
Gain              DP 1
50.1 %  LEL     89%
```

The display automatically goes to step 1: Display

During the calculation phase, the following messages may occur:

Message	Description
Current value too high	Test gas concentration > than set value Internal error → Replace sensor head
Current value too low	No test gas or wrong test gas applied to the sensor
Test gas too high Test gas too low	The set test gas concentration must be between 30% and 90% of the measuring range.
Current value unstable	Appears when the sensor signal does not reach the zero point within the target time. Disappears automatically when the sensor signal is stable.
Time too short	The message "value unstable" starts an internal timer. Once the timer has run out and the current value is still unstable, the text is displayed. The process starts over again. If the value is stable, the current value is displayed and the calibration procedure is continued. If the cycle is repeated several times, an internal error has occurred. Stop the calibration process and replace the sensor head.
Sensitivity <	Sensitivity of the sensor head < 30 %, calibration no longer possible → Replace sensor head.
Internal error	Internal , unrecoverable error → Replace sensor head.

4.13.3
Zero-point Calibration of Analog Output

With this menu item you can adjust the zero-point of the analog output (4mA). The zero-point correction is only possible when the analog output is in active mode.

The error message of the output monitoring is suppressed as long as the menu Calibration AO is open. Therefore, connect the amperemeter (measuring range 20 mA DC) to the analog output only after having opened the menu.

```
Calibration   AO 1
```

Connect amperemeter to the analog output.

```
Calibration      AO 1
320                 0
```

Display of the current zero offset on the left.

```
Calibration      AO 1
320               323
```

Adjust the zero offset on the right by changing the offset value slowly, until the amperemeter shows the desired value.

```
Calibration      AO 1
        SAVE
```

Save the adjusted zero offset.

```
Calibration      AO 1
323               323
```

Return to the display of the current zero offset.

4.13.4
Addressing

Addressing

Assignment of the basis slave address of the device for field bus operation

Set Address
4

Define the basis slave address

The data of the sensor head assigned at input 1 are sent with this basis slave address to the gas controller via the fieldbus.

The base unit requires / occupies a slave address for each connected sensor head. In the next menu, you can enter the number of occupied addresses. When the number is > 1, the address(es) following the basis address is / are automatically occupied.

Number of Addr.
1

Define the number of occupied slave addresses.

Symbol	Description	Default	Function
4	Basis Slave Address	0	0 = Device is not addressed, bus not used. The admissible address range depends on the device to be addressed. Basic, Premium, Heavy Duty = 1 – 96 Expansion module = 1 – 7
1	Number of Occupied Addresses	1	The number of addresses depends on the number of connected sensor heads. Permitted number max. Basic = 1 Premium = 2 Heavy Duty = 1 Expansion module = 4

Example:
Premium with two sensor heads (sensor xxxx at Input 1 and sensor yyyy at Input 2).

Slave address 4 was assigned to the Premium Board. The number of occupied addresses is 2. Thus, the sensor xxxx occupies Address 4 and sensor yyyy Address 5. The next available address of the system is Address 6.

No intervention is possible for devices with fixed number of occupied addresses (e.g. Basic with only one sensor head).

The system doesn’t prevent the addresses to be assigned twice.

4.13.4
Addressing
(Continued)

Registration of the sensor head at the basic device and defintion of the communication (bus or analog)

Config. DP 1
active

This menu appears for each set address.
From example above: DP4 = Sensor xxxx
DP5 = Sensor yyyy

MP Mode
active bus

Define the MP mode.

Symbol	Description	Default	Function
active	MP mode	inactive	active = Measuring point is activated on the device. inactive = Measuring point is not activated on the device.
bus	Connection mode	bus	bus = Measured value comes from the connected SC. analog = Measured value comes from 4 – 20mA input.

Selection gas type and range (see also chapter 4.8.3)

MP Mode
active bus

Define the MP mode.

Meas. Range
300 ppm

Define measuring range.
See 4.7.9.5

Config. DP 1
not available

If the number of addresses is less than the number of possible measurement points, the remaining measuring points are displayed as 'not available". No intervention is possible here.

5 Notes and General Information

For the installation and the use, it is important to read the respective user manual carefully. The Basic, Premium and Heavy Duty System (further mentioned as system) may only be used for applications in accordance to the intended use.

The appropriate operating and maintenance instructions and recommendations must be strictly followed.

Due to permanent product developments, Danfoss reserves the right to change specifications without notice. The information contained herein is based on data considered to be accurate. However, no guarantee or warranty is expressed or implied concerning the accuracy of these data.

5.1 Intended Product Application

The system is designed and manufactured for monitoring specific gas concentrations in ambient air and react with alarm when predefined thresholds are exceeded.

5.2 Installer's Responsibilities

It is the installer's responsibility to ensure that the system is installed in compliance with all national and local regulations and OSHA requirements. All installation shall be executed only by technicians familiar with proper installation techniques and with codes, standards and proper safety procedures for control installations and the latest edition of the National Electrical Code (ANSI/NFPA70).

The equipotential bonding required (also e.g. secondary potential to earth) or grounding measures must be carried out in accordance with the respective project requirements. It is important to ensure that no ground loops are formed to avoid unwanted interference in the electronic measuring equipment.
It is also essential to follow strictly all instructions as provided in the user manual.

5.3 Maintenance

We recommend checking the system regularly. Due to regular maintenance differences in efficiency can easily be corrected. Re-calibration and replacement of parts can be realised on site by a qualified technician with the appropriate tools.

ENGINEERING
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Danfoss

User Guide

Danfoss Gas Detection
Controller unit and Expansion module

GDIR.danfoss.com

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1 Intended use

The Danfoss gas detection controller unit is controlling one or multiple gas detectors, for monitoring, detection and warning of toxic and flammable gases and vapours in the ambient air. The controller unit meets the requirements according to EN 378 and the guidelines "Safety requirements for ammonia (NH3) refrigeration systems".

The intended sites are all areas being directly connected to the public low voltage supply, e.g. residential, commercial and industrial ranges as well as small enterprises (according to EN 5502). The controller unit may only be used in ambient conditions as specified in the technical data.

The controller unit must not be used in potentially explosive atmospheres.

2 Description

The controller unit is a warning and control unit for the continuous monitoring of different toxic or flammable gases and vapours as well as of HFC and HFO refrigerants. The controller unit is suitable for the connection of up to 96 digital sensors via the 2-wire bus. Up to 32 analog inputs for the connection of sensors with 4 to 20 mA signal interface are available in addition. The controller unit can be employed as pure analog controller, as analog/digital or as digital controller. The total number of connected sensors, however, may not exceed 128 sensors.

Up to four programmable alarm thresholds are available for each sensor. For binary transmission of the alarms there are up to 32 relays with potential-free change-over contact and up to 96 signal relays.

Comfortable and easy operation of the controller unit is done via the logical menu structure. A number of integrated parameters enables the realisation of various requirements in the gas measuring technique. Configuration is menu-driven via the keypad. For fast and easy configuration, you can use the PC based configuration software, included in the PC tool.

Prior to commissioning please consider the guidelines for wiring and commissioning of the hardware.

2.1 Normal Mode

In normal mode, the gas concentrations of the active sensors are continuously polled and displayed at the LC display in a scrolling way. In addition, the controller unit continuously monitors itself, its outputs and the communication to all active sensors and modules.

2.2 Alarm Mode

If the gas concentration reaches or exceeds the programmed alarm threshold, the alarm is started, the assigned alarm relay is activated and the alarm LED (light red for alarm 1, dark red for alarm 2 + n) starts to flash. The set alarm can be read from the menu Alarm Status.

When the gas concentration falls below the alarm threshold and the set hysteresis, the alarm is automatically reset. In latching mode, the alarm must be reset manually directly at the alarm triggering device after falling below the threshold.

This function is obligatory for flammable gases detected by catalytic bead sensors generating a falling signal at too high gas concentrations.

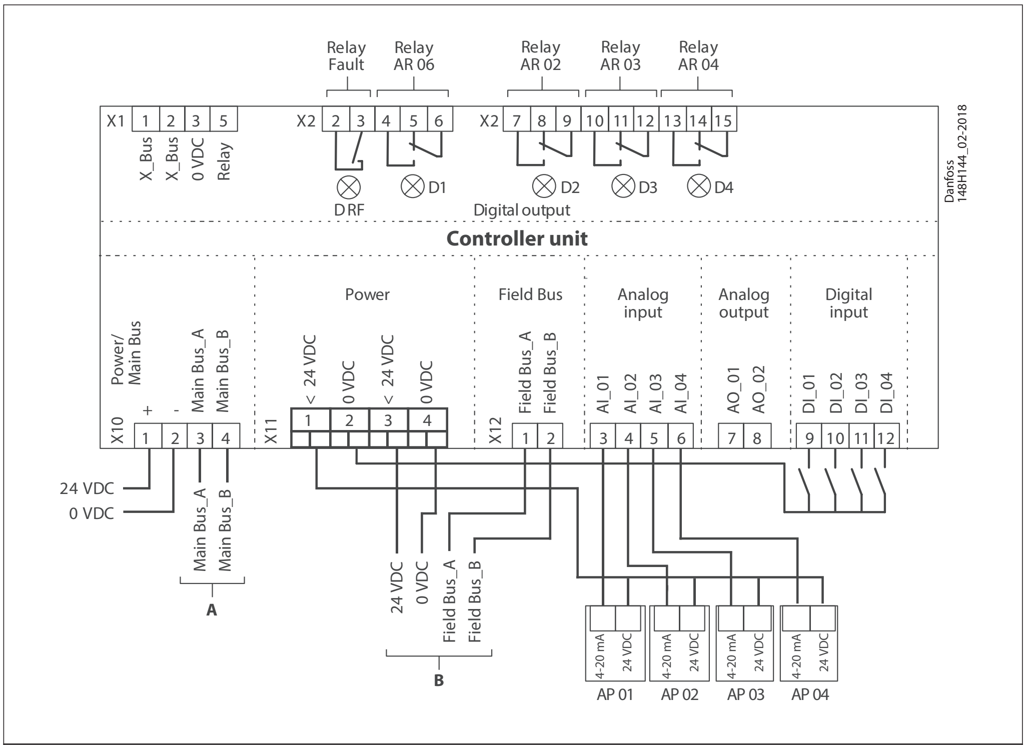
2.3 Special Status Mode

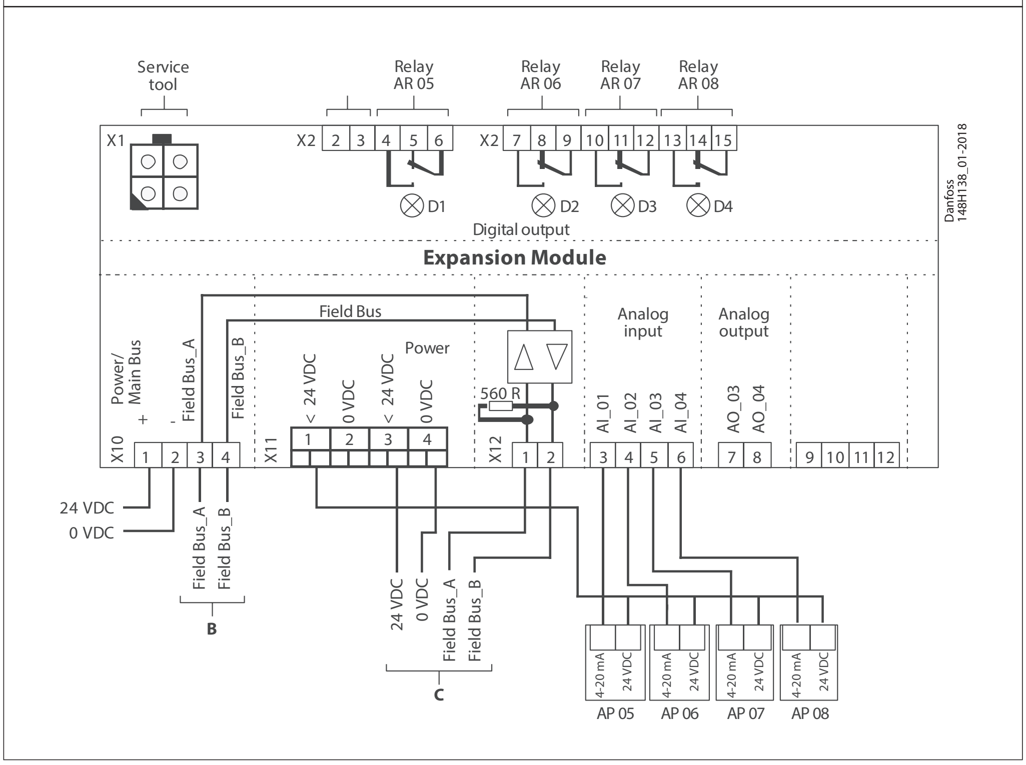
In the special status mode there are delayed measurements for the operation side, but no alarm evaluation. The special status is indicated on the display and it always activates the fault relay.

The controller unit adopts the special status when:
- faults of one or more active devices occur,
- the operation starts up after return of voltage (power on),
- the service mode is activated by the user,
- the user reads or changes parameters,
- an alarm or signal relay is manually overridden in the alarm status menu or via digital inputs.

2.3.1 *Fault Mode*	If the controller unit detects an incorrect communication of an active sensor or module, or if an analog signal is outside the admissible range (< 3.0 mA > 21.2 mA), or if there are internal function errors coming from the self-control modules incl. watchdog and voltage control, the assigned fault relay is set and the error LED starts to flash.	The error is displayed in the menu Error Status in clear text. After removal of the cause, the error message must be acknowledged manually in the menu Error Status.
2.3.2 *Restart Mode* *(Warm-up Operation)*	Gas detection sensors need a running-in period, until the chemical process of the sensor reaches stable conditions. During this running-in period the sensor signal can lead to an unwanted release of a pseudo alarm. Depending on the connected sensor types, the longest warm-up time must be entered as power-on time in the controller. This power-on time is started at the controller unit after switching on the power supply and/or after the return of voltage.	While this time is running out, the gas controller unit does not display any values and does not activate any alarms; the controller system is not yet ready for use. The power-on status occurs on the first line of the starting menu.
2.3.3 *Service Mode*	This operation mode includes commissioning, calibration, testing, repair and decommissioning. The service mode can be enabled for a single sensor, for a group of sensors as well as for the complete system. In active service mode pending alarms for the concerned devices are held, but new alarms are suppressed.	
2.3.4 *UPS Functionality*	The supply voltage is monitored in all modes. When reaching the battery voltage in the power pack, the UPS function of the controller unit is enabled and the connected battery is charged. If the power fails, the battery voltage drops down and generates the power failure message. At empty battery voltage, the battery is separated from the circuit (function of deep discharge protection).	When the power is restored, there will be an automatic return to the charging mode. No settings and therefore no parameters are required for the UPS functionality.

3
Wiring configuration





4 Operation

The complete configuration and service are made via keypad user interface in combination with the LC display screen. Security is provided via three password levels against unauthorized intervention.

4.1 *Function of the keys and LEDs on the keypad*

ESC Exits programming, returns to the previous menu level.

Enters sub menus, and saves parameter settings.

Scrolls up & down within a menu, changes a value.

Moves the cursor position.

LED light red:	Flashes when alarm one or more alarms are active.
LED dark red:	Flashes when alarm two and alarms of higher priority are active.
LED yellow:	Flashes at system or sensor failure or when maintenance date exceeded or in voltage-free status with the option power failure flashing light.
LED green:	Power LED

4.2 *Setting / changing of parameters and set points*

Open desired menu window.
Code input field opens automatically, if no code is approved.

After input of valid code the cursor jumps onto the first position segment to be changed.

Push the cursor onto the position segment, which has to be changed.

Set the desired parameter / set point with the keys.

Save the changed value, confirm storage (ENTER).

ESC Cancel storage / close editing / go back to next higher menu level (ESCAPE function).

4.3
Password Levels

According to the regulations of national and international standards for gas warning systems, all inputs and changes are protected by a four-digit numeric code (= password) against unauthorized intervention. The menu windows of status messages and measuring values are visible without entering a code.

The release of a code level is canceled if no button is pushed within 15 minutes.

The password levels are classified in order of priority: Priority 1 has top priority.

Priority 1: (code 5468, not changeable)
Code level priority 1 is intended for the service technician of the installer to change parameters and set-points. This password allows working on all settings. For opening the parameter menus you must first activate the service mode after code release.

Priority 2: (code 4009, not changeable)
With code level 2, it is possible to lock / unlock transmitters temporarily. This password is only given to the end user by the installer in problem situations. In order to lock / unlock the sensors you must first activate the service mode after code release.

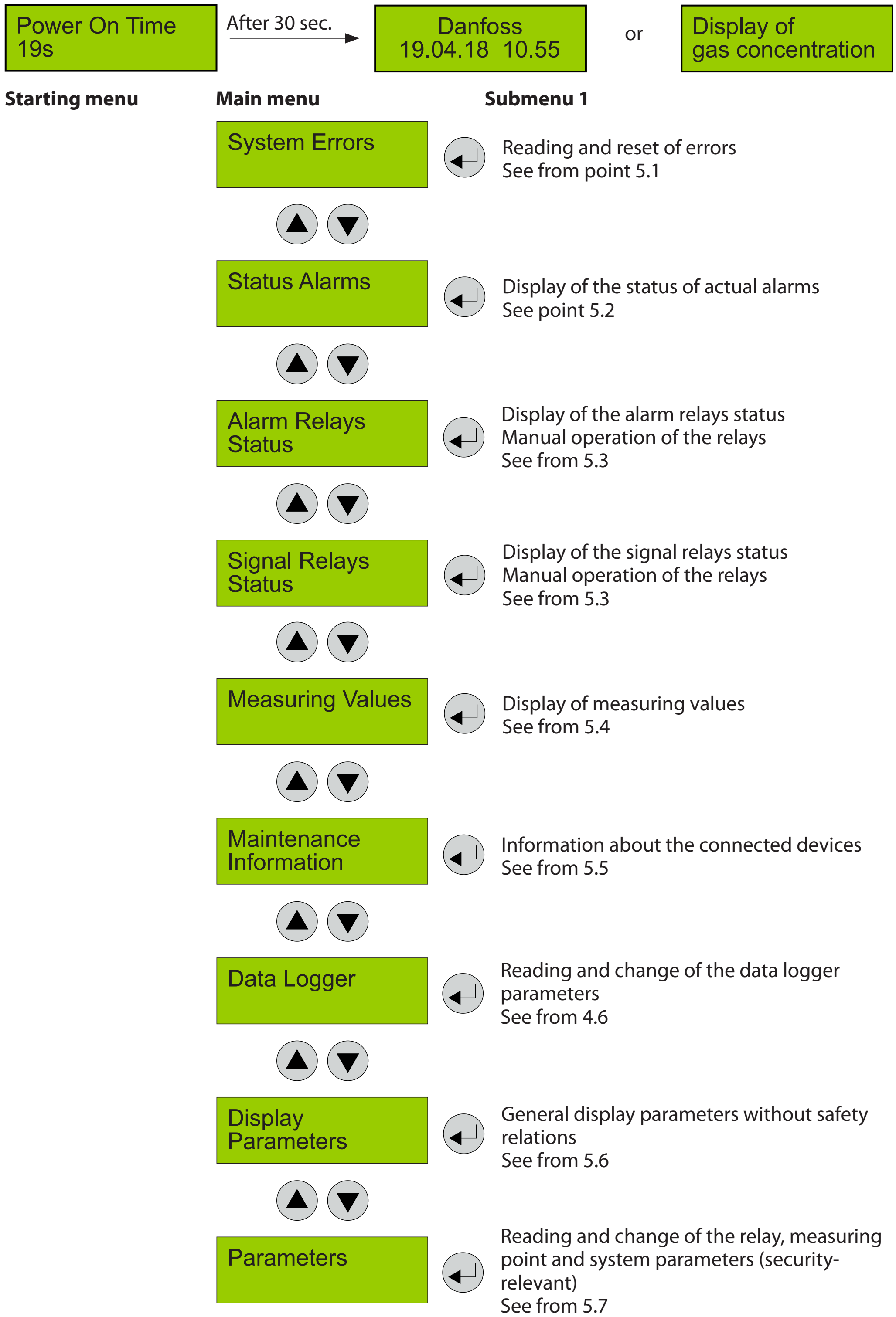
Priority 3: (code 4321, is settable in the maintenance information menu)
It is only intended to update the maintenance date. Normally the code is only known by the service technician who has last changed it since it can be changed individually via priority 1.

Priority 4: (password 1234) (code not changeable)
Code level priority 4 allows the operator:
- to acknowledge faults,
- to set date and time,
- to configure and to operate the data logger option, after activation of the operation mode “Service Mode”:
- to read all parameters,
- to manually operate test function of the alarm relays (functional test of the connected units),
- to manually operate test function of the analog outputs (functional test of the connected units).

5 Menu Overview

Menu operation is done via a clear, intuitive and logical menu structure. The operating menu contains the following levels:

- Starting menu with indication of the device type if no MP is registered, otherwise scrolling display of the gas concentrations of all registered sensors in 5-second intervals. If alarms are active, only the values of the sensors currently in alarm status are displayed.
- Main menu
- Submenu 1 to 3



5.1
Fault Management

The integrated fault management records the first 100 faults with date and time stamps in the menu „System Errors". Additionally a record of the faults occurs in the "Error memory", which can only be read and reset by the service technician.

A pending fault activates the fault indication relay. The yellow LED (Fault) starts to flash; the fault is displayed in plain text with date and time in the starting menu.

In case of the fault of a connected sensor the alarms defined in the menu "MP Parameter" are activated in addition.

5.1.1
Acknowledge a Fault

According to the directives of the gas measuring technique, accumulated errors are allowed to be acknowledged automatically. The automatic acknowledgment of a fault is only possible after having removed the cause!

5.1.2
Error Memory

The menu „Error Memory" in the main menu "System Error" can only be opened via the code level priority 1.

In the error memory, the first 100 faults that have occurred and have already been acknowledged in the menu "System Error" are listed for the service technician in a power failure safe way.

Attention:
This memory should always be read during maintenance, relevant faults should be tracked and entered in the service logbook, and finally the memory should be emptied.

Display	
Error Memory	Select menu "Error Memory"
DP1 Error 05.02 10:38	Example: Communication error DP01 Error
DP1 Error Reset?	Acknowledge the fault message?
	Fault message acknowledged
DP1 Error cancelled	

Fault acknowledged

5.1.3
System Messages and Errors

The devices connected via the analog interface can only report their malfunction by signal underrange or overrange. The reason for signal underrange mostly comes from bad, wrong or missing signal wiring that is the reason for the error.

The following system error messages of the analog interface are detected and recorded.

"AP 0X Overrange"	Current signal at analog input > 21.2 mA
Cause:	Short-circuit at analog input, analog sensor not calibrated, or defective.
Solution:	Check cable to analog sensor, make calibration, replace sensor.
"AP Underrange"	Current signal at analog input < 3.0 mA
Cause:	Wire break at analog input, analog sensor not calibrated, or defective.
Solution:	Check cable to analog sensor, make calibration, replace sensor.

Any device with microprocessor and digital communication - such as digital heads, sensor boards, expansion modules and even the controller - is equipped with extensive self-monitoring systems and diagnostic functions.

They enable detailed conclusions about the error causes and help the installers and operators to quickly determine the cause, and/or to arrange an exchange.

These errors can only be transmitted when the connection to the central (or tool) is intact.

"DP 0X Sensor Element"	(0x8001) Sensor element at the sensor head – diagnostic function reports an error.
Cause:	Sensor pins broken, mechanical or electrical damage
Solution:	Exchange sensor head.
"DP 0X ADC Error"	(0x8002) Monitoring of the amplifier and AD converter circuits at the input device reports an error.
Cause:	Mechanical or electrical damage of the amplifiers
Solution:	Replace device.
"DP 0X Voltage"	(0x8004) Monitoring of the sensor and/or process power supply, device reports an error.
Cause:	Mechanical or electrical damage of the power supply
Solution:	Measure tension if too low, replace device.
"DP 0X CPU Error"	(0x8008) Monitoring of the processor function – reports an error.
Cause:	Mechanical or electrical damage of the processor
Solution:	Replace device.
"DP 0x EE Error"	(0x8010) Monitoring of the data storage – reports an error.
Cause:	Electrical damage of the memory or configuration error
Solution:	Check configuration, replace device.
"DP 0X I/O Error"	(0x8020) Power ON or monitoring of the in/outputs of the processor - reports an error.
Cause:	During restart, electrical damage of the processor or of circuit elements
Solution:	Wait until Power On is over, replace device.
"DP 0X Overtemp."	(0x8040) Ambien temperature too high; the sensor outputs the measurement value for a determined period and switches to error state after 24 h.
Cause:	Too high ambient temperature
Solution:	Protect the device from direct sunlight or check climatic conditions.
"DP 0X Overrange"	(0x8200) Signal of sensor element at the sensor head is out of range.
Cause:	Sensor not calibrated correctly (e.g. wrong calibration gas), defective
Solution:	Recalibrate sensor, replace it.
"DP 0X Underrange"	(0x8100) Signal of sensor element at the sensor head is out of range.
Cause:	Wire break at sensor element input, sensor drift too high, defective.
Solution:	Recalibrate sensor, replace it.

5.1.3
Error Memory
(continued)

The controller monitors the communication between request and response. If the reply is too late, incomplete or incorrect, the controller recognizes the following errors and reports them.

"SB 0X Error"	(0x9000) Communication error from central unit to SB (sensor board)
Cause:	Bus line interrupted or short circuit, DP 0X registered at the controller, but not addressed. SB 0X defective.
Solution:	Check line to SB 0X, check SB address or MP parameters, replace sensor.
"DP 0X Error"	(0xB000) Communication error of SB to DP 0X sensor
Cause:	Bus line between SB and head interrupted or short circuit, DP 0X registered at the controller, but not configured at SB, wrong gas type, DP 0X defective.
Solution:	Check line to DP 0X, check sensor address or parameters, replace sensor.
"EP_06 0X Error"	(0x9000) Communication error to EP_06 0X module (expansion module)
Cause:	Bus line interrupted or short circuit, EP_06 0X registered at the controller, but not addressed or addressed incorrectly, EP_06 0X module defective
Solution:	Check line to EP_06 0X, check module address, replace module.
"Maintenance"	(0x0080) System maintenance is due.
Cause:	Maintenance date exceeded.
Solution:	Perform the maintenance.
"DP XX locked" **"AP XX locked"**	This MP input is locked (MP is physically present, but locked by the operator)
Cause:	Operator intervention.
Solution:	Eliminate the cause of a possible fault and then unlock the MP.
"UPS Error"	(0x8001) UPS doesn't work correctly, can only be signaled by the GC.
Cause:	Defective UPS – too high or too low voltage
Solution:	Replace UPS.
"Power Failure"	(0x8004) can only be signaled by the GC.
Cause:	Power failure or fuse tripped.
Solution:	Check power supply or fuses.
"XXX FC: 0xXXXX"	Occurs, if there are several errors from one measuring point.
Cause:	Several causes
Solution:	See the specific errors.

5.2
Status Alarm

Display of the currently pending alarms in plain text in the order of their arrival. Only those measuring points are displayed, where at least one alarm is active. The alarms are generated either in the controller (alarm) or directly on site in the sensor / module (local alarm).

Interventions are possible in this menu item only for the acknowledgment of latching alarms. Pending alarms cannot be acknowledged.

Main menu | **Submenu 1**

Alarm Status ↵ DP 1 “A1 ↵ DP 1 Acknowledge?

Symbol	Description	Function
AP X	Measuring Point No.	Analog measuring point X = 1 - 32, where an alarm is pending.
DP X	Measuring Point No.	Digital measuring point X = 1 - 96, where an alarm is pending.
‘A1 “A1	Alarm status	‘A1 = Local alarm 1 active (generated in the sensor / module) A1 = Alarm 1 active (generated in the central control)

5.3
Relay Status

Reading of the current status of alarm and signal relays.
The manual operation (test function) of the alarm and signal relays is done in the menu Parameters.

Main menu | **Submenu 1**

Selection of the alarm relay 1 – 32

Alarm Relay Status ↵ Alarm Relay 1 Status OFF

▲ ▼

Selection of the signal relay 1 - 96

Signal Relay Status ↵ Signal Relay 1 Status OFF

5.4
Menu Measuring Values

In this menu, the display shows the measuring value with gas type and unit. If the alarm evaluation is defined via the average, the display shows the current value (C) and additionally the average value (A).

Main menu | **Submenu 1**

↵ D 1 CO ppm A! 120,0A 150,0C | D 1 CO ppm #! 120,0A 150,0C

▲ ▼ | A 1 CO ppm ?! 132,7A 162,7C

Symbol	Description	Function
DX	Measured value	Measured value from bus sensor with MP address with X = 1 - 96
AX	Measured value	Measured value from analog sensor at analog input with AX = 1 - 32
CO	Gas type	See 4.7.3
ppm	Gas unit	See 4.7.3
A	Average value	Arithmetic average (30 measured values within the time unit)
C	Current value	Current value of gas concentration
A!	Alarm	MP has triggered an alarm
#	Maint. info	Device has exceeded maintenance date
?	ConfigError	MP configuration not compatible
$	Local mode	Local special mode is active
Error	Fault MP	Communication error, or signal out of the measuring range
Locked	MP locked	MP was temporarily locked by the operator.

The information ConfigError has priority to maintenance information.
Alarm information is always displayed with „!“, even if ConfigError or maintenance information are active.

5.5
Maintenance Information

A control of the maintenance intervals required by law (SIL) or by the customer is integrated in the Controller system. When changing the maintenance intervals, you have to observe legal and normative regulations and the manufacturer's specifications! Always after that, a calibration must be performed so that the change can take effect.

System maintenance message:
At commissioning or after successful maintenance, the date (battery backed) for next due maintenance of the whole system has to be entered. When this date has been reached, the maintenance message is activated.

Sensor maintenance message:
Sensors need regular calibration for complying with the specified accuracy and reliability. In order to avoid complex manual documentation, the sensors store their run time between the calibration intervals continuously and permanently. If the run time since the last calibration exceeds the sensor maintenance interval stored in the sensor, a maintenance message is sent to the central control.

The maintenance message is reset during calibration and the running time since the last calibration is set to zero.

Device reaction with pending maintenance message:
The maintenance signal can be ORed to each of the active relays in the menu Relay Parameters. In this way, one or more relays can be activated in case of maintenance (see 4.8.2.9).

In case of a pending maintenance message, the phone no. of the service company appears in the main menu instead of the time / date information and the yellow LED on the display starts to flash.

The maintenance message can only be cleared by removing the cause - changing the maintenance date or calibration or replacement of the sensors.

In order to distinguish between the sensor maintenance messages and the system maintenance message and to get a quick allocation of the serviceable sensors, the measured value in the menu item Measured Values gets the maintenance prefix "#".

As additional information, a separate window displays the time (in days) when the next sensor is due for maintenance. If several sensors are connected, the shortest time is always displayed. In the submenu, you can scroll through the display of all active measuring points to determine the sensors where the maintenance is due soon.

The largest representable number is 889 days (127 weeks / 2.5 years). If the next maintenance is due in an even longer period, the time display is still limited to 889 days.

Main menu

Maintenance
Information

Submenu 1
Information about the connected sensors

Next maintenance
In: 365 days

Maint. date
DP X: 365 days

Scrolling through all active sensors and display of the related days remaining until next maintenance.

Maint. date
XX.XX.XXXX

Maintenance date, stored in the display; after expiry, only message in the display, no other external reporting.

Maint. password
Password ****

Maintenance password, stored in the display, allows you your individual maintenance password for adaptation of the maintenance date, enables execution of test functions.

5.6
Display Parameter

In the menu Display Parameter you can find the general, security irrelevant parameters of the gas controller.

These parameters can be changed during the operation mode of the controller.

Main menu	Submenu 1	
Display Parameter	Software Version XXXXX - YYYYY	See 5.6.1, no intervention possible
	Language English	See 5.6.2
	Service TEL:	See 5.6.3
	Time System EU	See 5.6.4
	Time hh:mm:ss	See 5.6.4
	Date TT.MM.JJ	See 5.6.4
	Error time delay 120s	See 5.6.5
	X Bus Slave Adr. 1 MODBUS	See 5.6.6

5.6.1
Software Version

Symbol	Description	Function
XXXXX YYYYY	Software Version of the displays Software Version of the basic board	XXXXX Software Version YYYYY Software Version

5.6.2
Language

Selection of the menu language.

Symbol	Description	Default	Function
English	Language	English	English USA English German French

5.6.3
Service Phone Number

The service phone no. can be entered individually in the next menu.

Symbol	Description	Default	Function
	Phone No.		Input of the individual service phone no.

5.6.4
System Time, System Date

Input and correction of time and date. Selection of time and date format

Symbol	Description	Default	Function
EU	Time format	EU	EU = Display of time and date in EU format US = Display of time and date in US format
hh.mm.ss	Time		hh.mm.ss = Input of the correct time (EU format) hh.mm.ss pm = Input of the correct time (US format)
TT.MM.JJ	Date		TT.MM.JJ = Input of the correct date (EU format) MM.TT.JJ = Input of the correct date (US format)

5.6.5
Error Time Delay

Symbol	Description	Default	Function
s	Delay	120s	Definition of a delay time when a communication error is shown on the display. (A delay on the fault output is not allowed, therefore not used.)

5.6.6
X Bus Slave Address

(only existing, if X Bus function is available)

Symbol	Description	Default	Function
Address	Slave address at the X Bus interface	1	Input of the slave address at the X bus. In addition to the address, the available option appears. Currently only Modbus available (pay attention to the additional documentation of the protocol)

5.7
Parameters

In the menu Parameters you can find the parameter functions of the gas controller.

Main menu

Parameters

Submenu 1

Service
OFF

See 5.7.1 (password protected)

You can activate the following parameters only with Service ON.

Submenu 1	
Alarm Relay Parameters	See 5.7.2
Signal Relay Parameters	See 5.7.2
Digital meas. value Parameters	See 5.7.3
Analog meas. value Parameters	See 5.7.3
System Parameters	See 5.7.4
Alarm Relay Test function	See 5.7.5
Signal Relay Test function	See 5.7.5
Analog Outputs Test function	See 5.7.6

5.7.1
Display Parameter

Service and maintenance work mustn't be executed when the gas controller is in the normal measuring mode for it isn't sure that all response times and functions can be observed correctly.

For calibration and service work you first have to activate the special status mode on the controller. Only then you are allowed to change the safety related parameters. The special operating mode is activated by, among others, the function Service ON.

Further parameters menu items are therefore only accessible in the Service ON state. The Service ON state is reset to normal operation mode either automatically 15 minutes after the last key press or manually in the menu by the operator.

Sensors can't be switched into the "special mode" from the controller. It can only be done directly at the sensor using the tool. Sensors in the "special mode" are not included in the alarm evaluation.

Symbol	Description	Default	Function
OFF	Service	OFF	OFF = No reading and changing of parameters. ON = Controller in Special status mode, parameters can be read and changed.

5.7.2
Menu Relay Parameter

Reading and changing of the parameters separately for each relay.

5.7.2.1
Relay Mode

Definition of the relay mode

Symbol	Description	Default	Function
Used	Mode	Used	Used = Relay is registered on the controller and can be used Not Used = Relay is not registered on the controller

5.7.2.2
Relay Operation Mode

Definition of the relay operation mode
The terms energized / de-energized for this item come from the terms open-circuit and closed-circuit principle used for safety circuits. Here, however, not the relay contact circuit is meant (as a changeover contact, optionally available in the two principles), but the activation of the relay coil.

The LEDs attached to the modules show the two states in analogy. (LED off -> relay de-energized)

Symbol	Description	Default	Function
De-energ.	Mode	De-energ.	De-energ. = Relay (and LED) de-energized, if no alarm active Energized = Relay (and LED) permanently energized, if no alarm active

5.7.2.3
Relay Function Static / Flash

Definition of the relay function
The function "Flashing" represents a connection option for warning devices to improve visibility. If "Flashing" is set, this mustn't be used as a safe output circuit any more.

A combination of relay mode energized with flashing operation makes no sense and is therefore suppressed.

Symbol	Description	Default	Function
ON	Function	ON	ON = Relay function flashing at alarm (= time fixed 1 s) impulse / break = 1:1 OFF = Relay function static ON at alarm

5.7.2.4
Alarm Trigger Quantity

In some applications it is necessary that the relay switches only at the nth alarm. Here you can set the number of alarms necessary for relay tripping.

Symbol	Description	Default	Function
Quantity	Function	1	Only if this quantity is reached, the relay trips.

5.7.2.5
Horn Function (not safe output circuit because resettable)

The horn function is considered active if at least one of the two parameters (time or assignment to digital input) is set. The horn function retains its functionality even for alarms in latching mode.

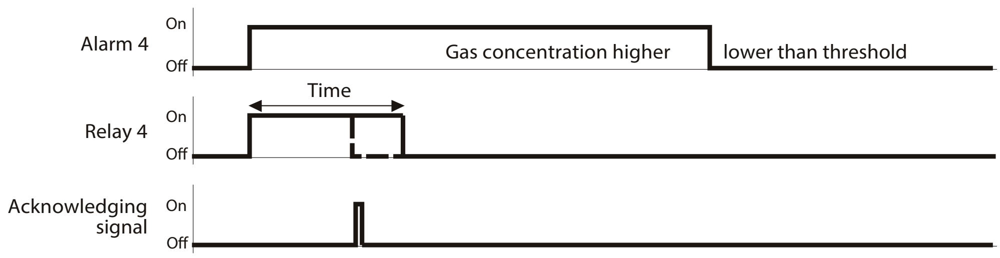
Symbol	Description	Default	Function
Recurrence	Reset mode	0	0 = Reset of the relay after time having run out via DI (external) or by pushbuttons 1 = After reset of the relay, time starts. At the end of the set time, the relay is activated again (recurrence function).
Time		120	Enter time for automatic reset function or recurrence function in s 0 = no reset function
DI		0	Assignment, which digital input resets the relay.

Horn function resettable:
The activated horn can be permanently reset with this function.
The following possibilities to acknowledge are available for the alarm relay as horn relay:
- By pressing the left button (ESC). Only available in starting menu.
- Automatic reset at the end of the preset time (active, if value > 0).
- By an external pushbutton (assignment of the appropriate digital input DI: 1-n).

Due to fixed polling cycles, external buttons must be pressed for a few seconds before the reaction occurs.

After successful acknowledgment the horn remains permanently reset until all assigned alarms for this relay function are inactive again. Only then it is triggered anew in case of an alarm.

Acknowledge the horn relay

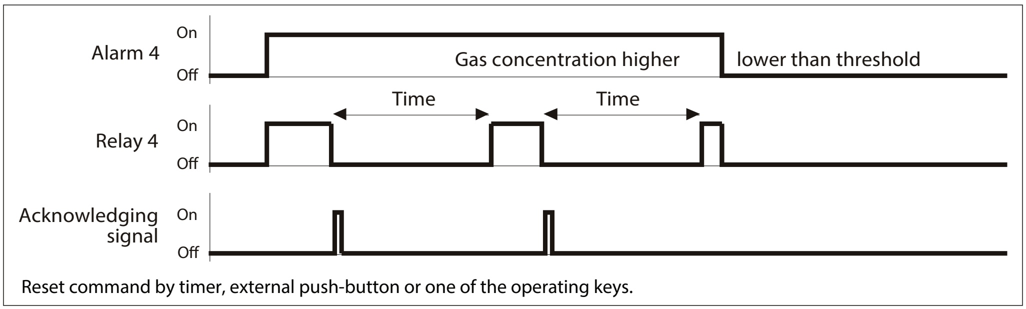


Reset command by timer, external push-button or one of the operating keys.

5.7.2.5
Horn Function (not safe output circuit because resettable) (Continued)

Recurrence of the horn relay
After an alarm has been triggered, the horn will remain active until a reset action is done. After acknowledgment of the horn relay/s (clicking a button or via external input) a timer starts. When this time has run out and the alarm is still acting, the relay is set again.

This process is repeated endlessly as long as the associated alarm remains active.



5.7.2.6
External Override of Alarm / Signal Relay via DI

Manual operation of the alarm relays via DI does not trigger the "special mode", as this is a deliberate and configured functionality. The use of the override should be used with caution, particularly the function of setting "external OFF".

Assignment of a digital input (DI) for the external switching on and off of the alarm relay. This function has priority to gas alarm.

If External ON and External OFF are configured simultaneously to the same relay and both are active at the same time, so in this state, only the External OFF command is executed.

In this mode, too, the relays work respecting the parameter settings "Static / Flash" and "energized / de-energized".

Symbol	Description	Default	Function
↗ DI 0	External ON	0	As long as DI 1-X is closed, relay switches ON
↘ DI 0	External OFF	0	As long as DI 1- X is closed, relay switches OFF.

5.7.2.7
External Override of Alarm / Signal Relay via DI

Definition of the switch-on and switch-off delay of the relays.
If the latching mode is set for this relay, the respective switch-off delay is without effect.

Symbol	Description	Default	Function
0 s	Switch-ON Delay Time	0	Alarm / Signal Relay is only activated at the end of the defined time. 0 sec. = No delay
0 s	Switch-OFF Delay Time	0	Alarm / Signal Relay is only deactivated at the end of the defined time. 0 sec. = No delay

5.7.2.8
OR Operation of Fault to Alarm / Signal Relay

Enables or disables the Fault OR operation of the current alarm / signal relay.
If the OR operation for this relay is set to active = 1, all device faults will activate the output in addition to the alarm signals.

In practice, this ORing will be used if, for example, fans should run or warning lights should be activated in case of device malfunction, since the fault message of the central control is not permanently monitored.

Note:
Exceptions are all errors of the measurement point because the MPs can be assigned to each alarm separately in the menu MP Parameters. This exception is used to build up targeted zone related signaling in case of MP errors, which should not affect other zones.

Symbol	Description	Default	Function
0	No assignment	0	Alarm and/or signal relay isn't affected if a device fault occurs.
1	Activated assignment	0	Alarm and/or signal relay turns on if a device fault occurs.

5.7.2.9
OR Operation of Maintenance to Alarm / Signal Relay

Enables or disables the Maintenance OR operation of the current alarm / signal relay.
If the OR operation for this relay is set to active = 1, the output will be activated in addition to the alarm signals when at least one maintenance message is pending.

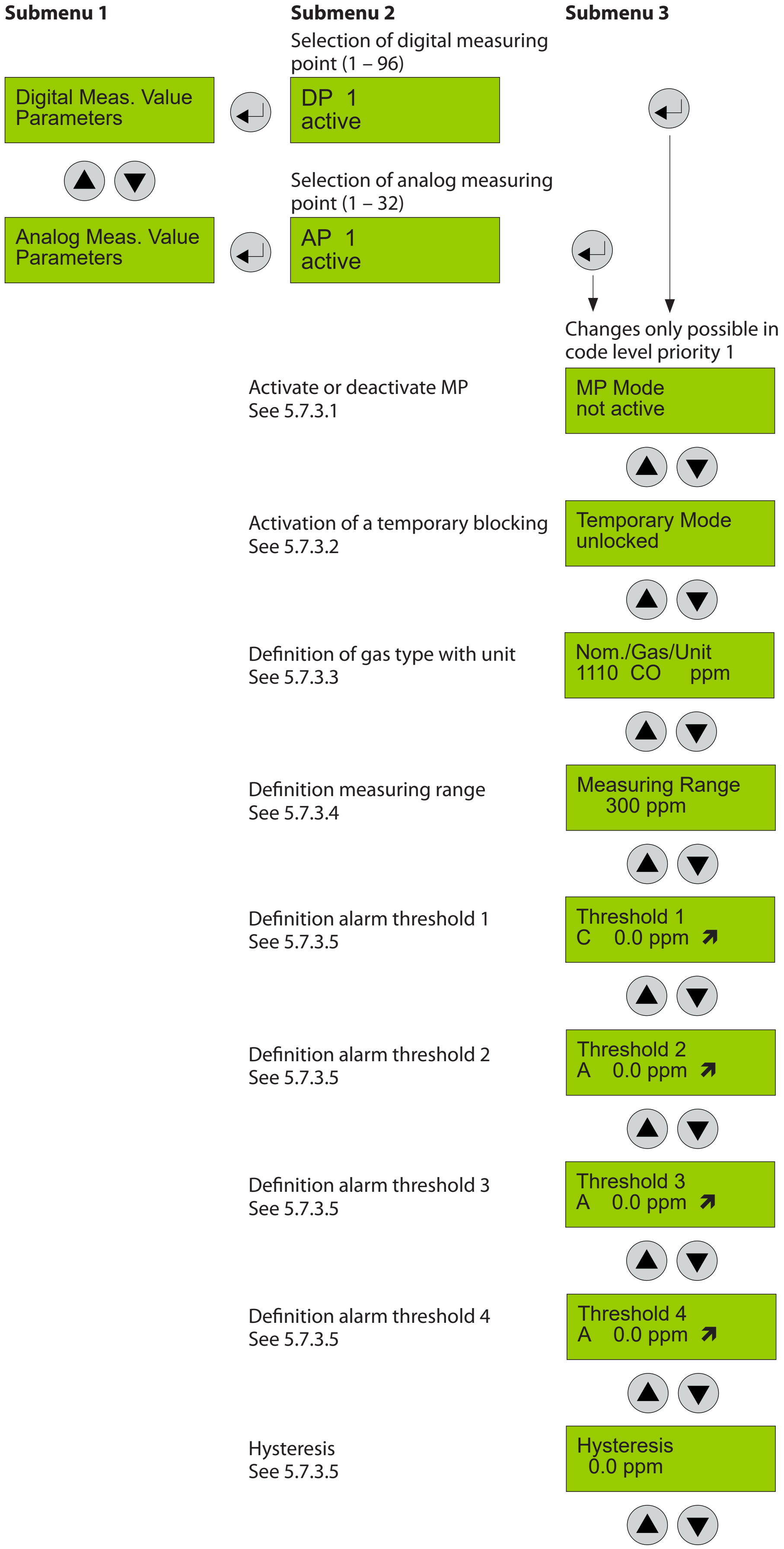
In practice, this ORing will be used if, for example, fans should run when the sensor accuracy isn't ensured anymore because of missing calibration (therefore pending maintenance message) or warning lights should be activated, since the maintenance information of the central control is not permanently monitored.

Note:
Resetting of the activated maintenance message is only possible by calibration of the sensors or by disabling this OR function.

Symbol	Description	Default	Function
0	No assignment	0	Alarm and/or signal relay isn't affected if a maintenance message occurs.
1	Activated assignment	0	Alarm and/or signal relay turns on if a maintenance message occurs.

5.7.3
Menu MP Parameters

For reading and changing measuring point parameters for each bus and analog sensor including registration of MP and assignment of the alarm relays.



5.7.3
Menu MP Parameters
(Continued)

Submenu 3

Delay time for alarm ON
See 5.7.3.6

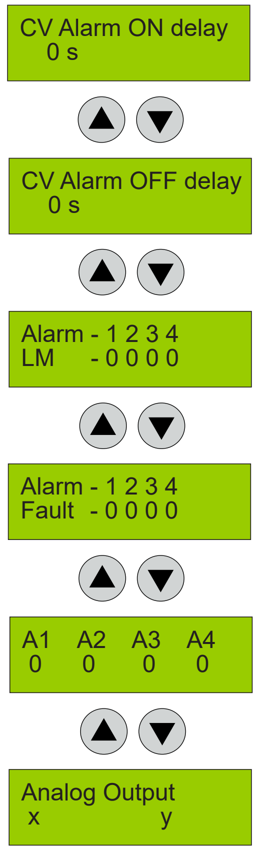
Delay time for alarm OFF
See 5.7.3.6

Definition of latching mode
See 5.7.3.7

Assign MP fault to alarm
See 5.7.3.8

Assign alarm to alarm relay
See 5.7.3.9

Assign MP signal to analog output X or/and Y
See 5.7.3.10



5.7.3.1
Activate – Deactivate MP

Deactivation shuts the registered / not registered sensor down in its function, which means that there is no alarm or fault message at this measurement point. Existing alarms and faults are cleared with deactivation. Deactivated sensors do not output a collective fault message.

Symbol	Description	Default	Function
active	MP Mode	Not active	active = Measuring point activated at the controller. not active = Measuring point not activated at the controller.

5.7.3.2
Lock or Unlock MP

In the temporary Lock Mode, the function of the registered sensors is put out of service, which means that there is no alarm or fault message at this measuring point. Existing alarms and faults are cleared with the locking. If at least one sensor is blocked in its functionality, the collective fault message is activated after expiry of the internal fault delay time, the yellow fault LED is flashing and a message appears in the menu System Errors.

Symbol	Description	Default	Function
unlocked	Lock mode	unlocked	unlocked = MP free, normal operation locked = MP locked, SSM (collective fault message) active

5.7.3.3
Selection Gas Type with Unit

Selection of the desired and connected gas sensor type (connection possible as digital sensor cartridge Basic, Premium or Heavy Duty).

The selection contains all necessary information for the controller, and is also used for comparing the real, digital data with the settings.

This feature increases the user and operating security.
There is an entry available per gas type for each unit.

Sensor	Internal type	Measuring range	Unit
Ammonia EC 100	E1125-A	0-100	ppm
Ammonia EC 300	E1125-B	0-300	ppm
Ammonia EC 1000	E1125-D	0-1000	ppm
Ammonia SC 1000	S2125-C	0-1000	ppm
Ammonia EC 5000	E1125-E	0-5000	ppm
Ammonia SC 10000	S2125-F	0-10000	ppm
Ammonia P LEL	P3408-A	0-100	% LEL
CO2 IR 20000	I1164-C	0-2	% Vol
CO2 IR 50000	I1164-B	0-5	% Vol
HCFC R123 SC 2000	S2064-01-A	0-2000	ppm
HFC R404A, R507 SC 2000	S2080	0-2000	ppm
HFC R134a SC 2000	S2077	0-2000	ppm
HC R290 / Propane P 5000	P3480-A	0-5000	ppm

5.7.3.4
Measuring Range Definition

The measurement range must be adapted to the working range of the connected gas sensor.

For additional control by the installer, the settings in the controller must mandatorily match with the used sensors. If the types of gas and/or measurement ranges of the sensor don't agree with the settings of the controller, the error "EEPROM / configuration error" is generated, and the collective fault message is activated.

The range also affects the display of the measured values, alarm thresholds and hysteresis. For measuring ranges <10 three decimals places, <100 two decimal places, <1000 one decimal place are displayed. For measuring ranges => 1000, the display is without decimal place. The resolution and accuracy of the calculation is not affected by the different measuring ranges.

5.7.3.5 Threshold / Hysteresis

For each measuring point four alarm thresholds are available for free definition. If the gas concentration is higher than the set alarm threshold, the associated alarm is activated. If the gas concentration falls below the alarm threshold inclusive hysteresis the alarm is again reset.

In the mode "Alarm at falling" the corresponding alarm is set in case of falling below the set alarm threshold and reset again when exceeding the threshold plus hysteresis. The display depends on the set measuring range: see 4.8.3.4. Unused alarm thresholds have to be defined at measuring range end point, in order to avoid undesired alarms. Higher-level alarms automatically activate the lower-level alarms.

Symbol	Description	Default	Function	Symbol
A	Evaluation	A	A C	A = Alarm evaluation with average value of MP C = Alarm evaluation with current value of MP
80 ppm	Alarm threshold	40 80 100 120 15	Threshold 1 Threshold 2 Threshold 3 Threshold 4 Hysteresis	Gas concentration > Threshold 1 = Alarm 1 Gas concentration > Threshold 2 = Alarm 2 Gas concentration > Threshold 3 = Alarm 3 Gas concentration > Threshold 4 = Alarm 4 Gas concentration < (Threshold X –Hysteresis) = Alarm X OFF
↗		↗		↗ = Alarm release at increasing concentrations ↘ = Alarm release at falling concentrations

5.7.3.6 Delay for Alarm ON and/or OFF for Current Value Evaluation

Definition of delay time for alarm ON and/or alarm OFF. The delay applies to all alarms of an MP, not with average value overlay, see 5.7.3.7.

Symbol	Description	Default	Function
0 s	CV Alarm ON delay	0	Gas concentration > Threshold: Alarm is only activated at the end of the fixed time (sec.). 0 sec. = No delay
0 s	CV Alarm OFF delay	0	Gas concentration < Threshold: Alarm is only deactivated at the end of the fixed time (sec.). 0 sec. = No delay

5.7.3.7 Latching Mode Assigned to Alarm

In this menu you can define, which alarms should work in latching mode.

Symbol	Description	Default	Function
Alarm - 1 2 3 4 SBH - 0 0 0 0	Latching MP	0 0 0 0	0 = No latching 1 = Latching

5.7.3.8 MP Fault Assigned to Alarm

In this menu you can define, which alarms should be activated by a fault at the measuring point.

Symbol	Description	Default	Function
Alarm - 1 2 3 4 SBH - 0 0 0 0	Fault MP	1 1 0 0	0 = Alarm not ON at MP fault 1 = Alarm ON at MP fault

5.7.3.9 Alarm Assigned to Alarm Relay

Each of the four alarms can be assigned to any physically existing alarm relay 1 to 32 or signal relay R1 to R96. Unused alarms aren't assigned to an alarm relay.

Symbol	Description	Default	Function
0	A1 A2 A3 A4	0 0 0 0	RX = Assignment of the alarms A1 - A4 to the signal relays R1-R96 X = Assignment of the alarms A1 - A4 to the alarm relays 1-32

5.7.3.10 MP Signal Assigned to Analog Output

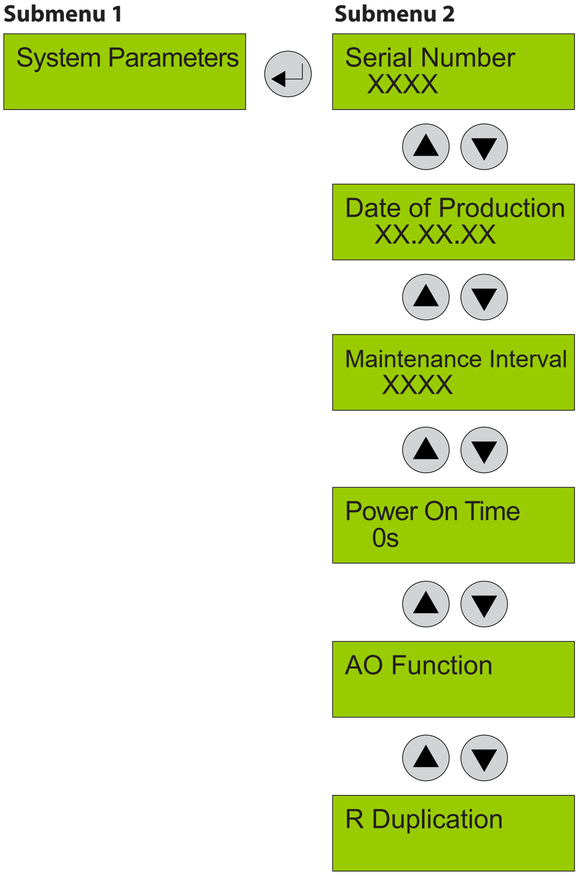
The measuring point signal (current or average value) can be assigned to one of the max. 16 analog outputs. The same assignment to different outputs (8) generates a functional duplication. This is often used to control remote devices in parallel (supply fan in the basement, exhaust fans on the roof).

If several assignments are made to one analog output, the output signal is output WITHOUT fault information. It should be noted that a mixture of different types of gas often makes no sense. In the case of a single assignment = additional analog output 1:1, the signal is output WITH fault information.

Analog output see also: 5.7.4.4.

Symbol	Description	Default	Function
x y	Analog Output	x y	x = MP Signal is assigned to analog output x (activates output control -> signal can be used) y = MP Signal is assigned to analog output y (activates output control -> signal can be used) 0 = MP Signal isn't assigned to any analog output or no release in the System Parameters (no active output control)

5.7.4
Menu System Parameters



Serial Number: No intervention possible, see 5.7.4.1

Date of Production: No intervention possible, see 5.7.4.1

Maintenance Interval: Definition of the maintenance interval
See 5.7.4.2

Power On Time: Definition of power on time in sec.
See 5.7.4.3

AO Function: Selection of analog output function
See 5.7.4.4

R Duplication: Selection of the relay duplication
See 5.7.4.5

5.7.4.1
System Information

Symbol	Description	Default	Function
XXXX	Serial Number	0	Serial number
XX.XX.XX	Date of Production	0	Date of production

5.7.4.2
Maintenance Interval

The description of the maintenance concept is shown in 4.5.
The maintenance interval of the controller is set here. If 0 is set, this function is disabled.

Symbol	Description	Default	Function
XXXX	Maintenance Interval		Entry of the interval between two services in days

5.7.4.3
Power On Time

Gas sensors need a running-in period, until the chemical process of the sensor reaches stable conditions. During this running-in period the current signal can lead to an unwanted triggering of a pseudo alarm. Therefore the Power On time is started at the Gas Controller after you have switched on the power supply. While this time is running out, the Gas Controller doesn't activate alarms or UPS relays. The Power On status occurs on the first line of the starting menu.

Attention:
During the Power On phase the controller is in "Special Mode" and doesn't perform further functions beside the starting diagnostic procedures. A count-down Power On time in seconds is shown on the display.

Symbol	Description	Default	Function
30s	Power On time	30s	XXX = Definition of the power On time (sec.)

5.7.4.4
Analog Output

The Gas Controller Module as well as the expansion modules 1 to 7 have got two analog outputs (AO) with 4 to 20 mA signal each. The signal of one or more measuring points can be assigned to each of the analog outputs; in this case, the signal control becomes active and the output is current monitored. The signal monitoring is self-healing and therefore mustn't be acknowledged. The assignment is done in the menu "MP Parameter" for each MP. The measuring point sends the current value signal to the analog output.

Out of the signals of all assigned measuring points the Gas Controller determines the minimum, the maximum or the average value and transmits it to the analog output. The definition, which value is transmitted, is done in the menu "Analog Output X".

To allow flexible air volume regulation of speed-controlled motors, the slope of the output signal can be adapted to the on-site conditions and varied between 10 - 100%.

As an alternative to the activation via the controller (defined by the number 1), the analog inputs can be assigned to the analog outputs of the same expansion module (menu in the expansion module). For this purpose, the number 10 - 100% has to be entered on the expansion module.

Symbol	Description	Default	Function
Analog Output 1	Selection of channel		Selection of the analog output 1-16
0 1 10-100 %	Selection of output signal	100 %	0 = Analog output is not used (therefore always de-activated response monitoring) 1 = Local use (not used in the central control) Selection of signal slope- permitted range 10 – 100 % 100 % gas signal control = 20 mA 10 % gas signal control = 20 mA (high sensitivity)
A	Selection of source	A	C = Source is current value A = Source is average value CF = Source is current value and additional fault message at AO AF = Source is average value and additional fault message at AO
Max.	Selection of output mode	Max.	Min. = Displays the minimum value of all assigned MP Max. = Displays the maximum value of all assigned MP Average = Displays the average value of all assigned MP

AO Function

Analog Output 1
100% A Max.

5.7.4.5
Relay Multiplication

With the relay multiplication table, it is possible in the controller system to assign additional relay functions to an alarm. This corresponds in the end to one multiplication of the source alarm situation per entry.

The additional relay follows the alarm status of the source, but uses its own relay parameters to allow different needs of the doubled relay. So the source relay can be configured, for example, as safety function in de-energized mode, but the doubled relay can be declared with flashing function or as horn function.

There is a maximum of 20 entries for IN relays and OUT relays. Thus it is possible, for example, to expand one relay to 19 others or to double max. 20 relays.
In the column IN (source), you can set the relay assigned to an alarm in the menu MP Parameter.
In the column OUT (target), you can enter the relay needed in addition.

Note:
Manual intervention in the menu Relay Status or override in external ON or OFF by external DI do not count as alarm status, so they do only affect the IN relay. If this is also desired for the OUT relay, it has to be configured separately for each OUT relay.

Number	Description	Default Status	Function
0-30 0-96	IN AR Relay IN SR Relay	0	0 = Function off X = Relay X should be multiplied (information source).
0-30 0-96	OUT AR Relay OUT SR Relay	0	0 = Function off X = Relay X (target) should switch together with IN relay.

Example 1:
3 relay contacts are needed with the same effect of relay 3, (see assignment of the relays in chapter MP Parameters.)
Entry: 1: IN AR3 OUT AR7
Entry: 2: IN AR3 OUT AR8

IN OUT
1: AR 3 AR 7.

IN OUT
2: AR 3 AR 8.

If relay 3 is activated via an alarm, relays AR3, AR7 and AR8 switch at the same time.

Example 2:
2 relay contacts each are needed from 3 relays (for ex. AR7, AR8, AR9).
Entry: 1: IN AR7 OUT AR12 (Relay 12 switches at the same time with relay 7)
Entry: 2: IN AR8 OUT AR13 (Relay 13 switches at the same time with relay 8)
Entry: 3: IN AR9 OUT AR14 (Relay 14 switches at the same time with relay 9)

IN OUT
1: AR 3 AR 7.

IN OUT
2: AR 3 AR 8.

This means that relay AR7 switches with AR12;
AR8 with AR13; AR9 with AR14.
The two examples can be mixed up, too.

5.7.5
Test Function of the Alarm and Signal Relays

Submenu 1

Alarm Relay
Test function

Signal Relay
Test function

For changes password needed
(only possible in Special Mode!)

Submenu 2

Selection of alarm relay 1 – 32

Alarm Relay x
Status OFF

Selection of signal relay 1-96

Signal Relay x
Status OFF

Select function

Alarm Test ON	=	Relay manual ON
Alarm Test OFF	=	Relay manual OFF
Automatic	=	Cancel manual operation

Signal Relay 1
Alarm Test ON

Signal Relay 1
Alarm Test OFF

Signal Relay 1
Automatic

Alarm Relay 1
Alarm Test ON

Alarm Relay 1
Alarm Test OFF

Alarm Relay 1
Automatic

Take function over with

The test function sets the target device (selected relay) in Special Mode and activates a timer that re-establishes the normal measurement mode after 15 minutes and ends the test function.

Therefore the yellow LED on the controller is on in the manual ON or OFF status.

The external operation of the relays via an assigned digital input has priority to the manual test function in this menu item.

Symbol	Description	Default	Function
AR Status	Relay Nr. X		X = 1 – 32 Select alarm relay
SR Status	Relay Nr. X		X = 1 – 96 Select signal relay
OFF	Relay Status	OFF	Status OFF = Relay OFF (no gas alarm) Status ON = Relay ON (gas alarm) Manual OFF = Relay manual OFF Manual ON = Relay manual ON Automatic = Relay in automatic mode

5.7.6
Test Function of the Analog Outputs

This feature is only available in Special Mode.
With the test function you can enter the value (in mA) that should be physically output.
The test function via the controller can only be applied when the analog outputs are overridden (configuration 1 of analog outputs in the system parameters of the associated device, see 5.7.4.4).

Submenu 1

Analog Outputs
Test Function

Submenu 2

AO 1 Set Value
4,02mA 0,00mA

AO 1 Set Value
4,02mA 12,00mA

AO 1 Set Value
12,00mA 12,00mA

On the left, the current set point of the AO is shown. On the right, there is the pre-set value entered by the operator.

After confirming the AO accepts the predetermined value and outputs it physically. As the current set point is transmitted again and again, the confirmation appears in the display at the left.

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Common IR Products that use Adapters

Common IR Products that use Adapters

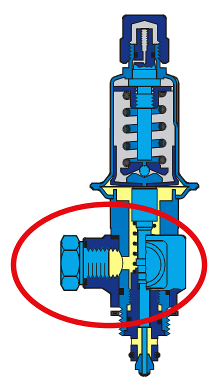
ICS pilot operated regulators and solenoids

Aluminum gasket must be installed
at the end of the adapter as shown.

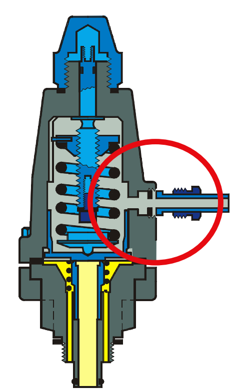
CVC-L
CVC-M

CVPP-L
CVPP-M

Old Version
CVC-LP
CVC-XP



Old Version
CVPP-HP

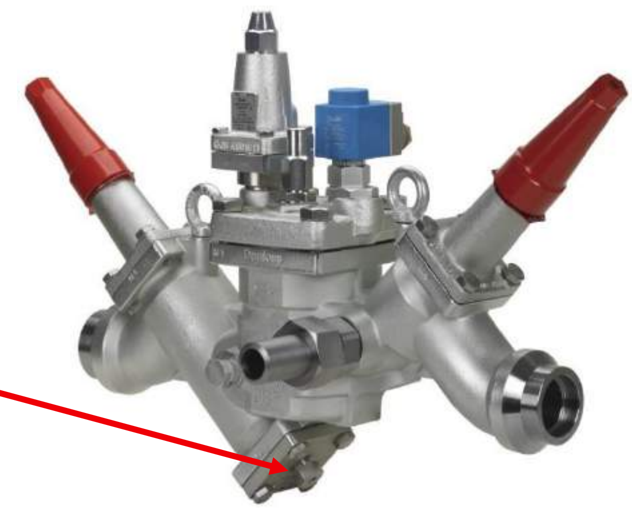


The pressure gauge connection in ICS valve cover, the pressure connections on CVC outlet pressure regulating pilots and CVPP differential pressure regulating pilots circled in pictures are all G ¼" metric straight thread. Typically the SNV-ST gauge valve and adapter p/n 148B4772 is used when installing gauges but just the adapter to convert to ¼" FPT p/n 027B2062 can be ordered. 1 adapter for each CVC or CVPP comes with assembled ICS valves for connecting the pressure reference line.

Common IR Products that use Adapters

ICF 50 valve station

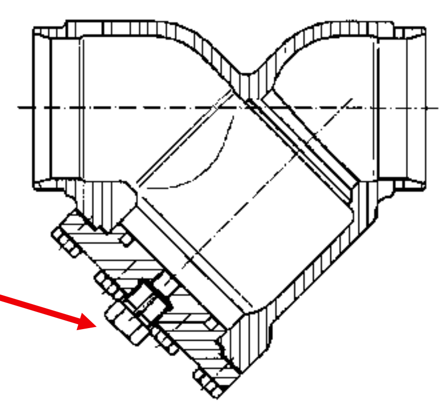
Uses FIA 50 cover which has G ½" metric purge connection that needs an aluminum gasket to seal plug or adapter.



When FIA 50 to 200 are ordered with strainer insert the valve will come with the adapter p/n 148H3461 in the box that converts the connection to ¼" FPT. For ICF 50 strainer cover the SNV-ST ¼" MPT x FPT purge valve and adapter p/n 027X0153 is typically ordered (shown to the left).

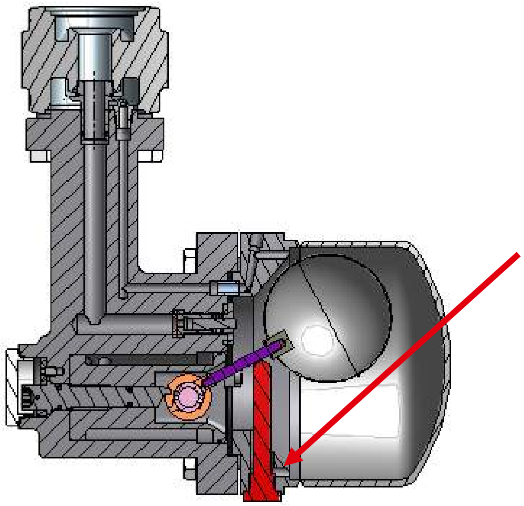
FIA 50 to 200 (2" to 8") Strainers/Filters

Has G ½" metric purge connection that needs an aluminum gasket to seal plug or adapter. Note: FIA 15-40 comes with ¼" NPT connection in cover so does not need an adapter.



Common IR Products that use Adapters

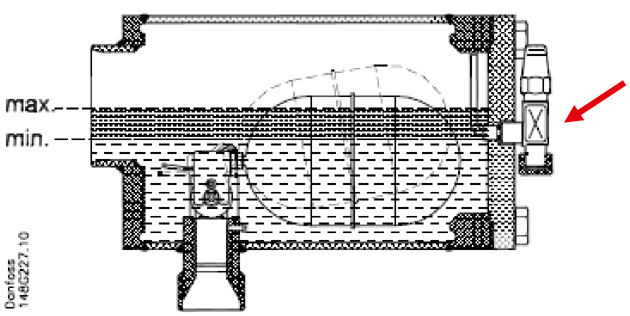
ICFD Float Drain Module for ICF 15/20 Valve Station



The purge connection on ICFD is G ¼" metric straight thread. A transportation plug is installed at factory and needs removed after installation in system and replaced with aluminum gasket and plug that comes with ICFD or with the purge valve and adapter kit p/n 148B6607 which also needs the aluminum gasket to seal between adapter and ICFD connection. The adapter for ICS gauge connection 027B2062 will work to convert to ¼" FPT but it is recommended to use the ICFD drain kit so SNV-ST is mounted horizontally.

SNV-ST 3/8" NPT purge valve and adapter p/n 148B6607 for ICFD drain connection

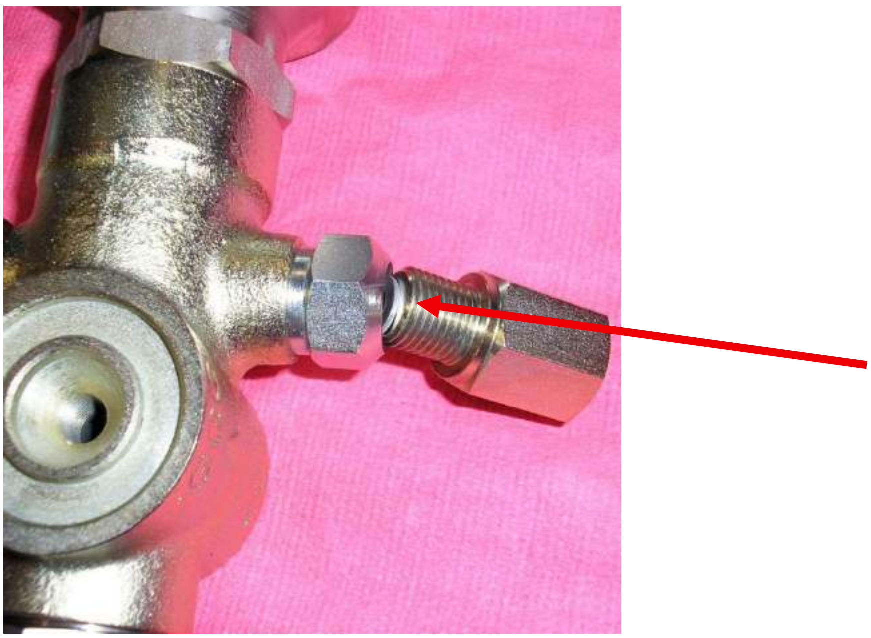
HFI Float Valve



The purge on HFI cover is G ½" metric straight thread. The HFI comes with a purge valve type SNV-ST with G ½" metric connections and a cap with metric threads that is installed as shown. If wanting to connect something to this by NPT thread an adapter p/n 148B3860 can be ordered to convert the male G ½" metric thread on SNV-ST outlet to ¼" FPT. Another option would be to order the gauge valve and adapter kit for FIA 50-200 p/n 027X0153 to mount directly in HFI but with this option the SNV-ST ¼" MPT x FPT would be mounted horizontally and stick out a few inches.

Common IR Products that use Adapters
TEA Ammonia TXV - External Equalization Connection

The equalization connection is G ¼" (metric straight thread) and needs an aluminum gasket to seal connection. A weld nipple is supplied with the TEA valve but it is more common to use our ICS pressure gauge adapter p/n 027B2062 which is for an ICS valve but can be used in TEA if the aluminum gasket that comes with the weld nipple is used instead of the gasket that comes with the adapter. See below.



Weld nipple shipped with TEA

¼" BSP to ¼" FPT ICS adapter
p/n 027B2062

Notes

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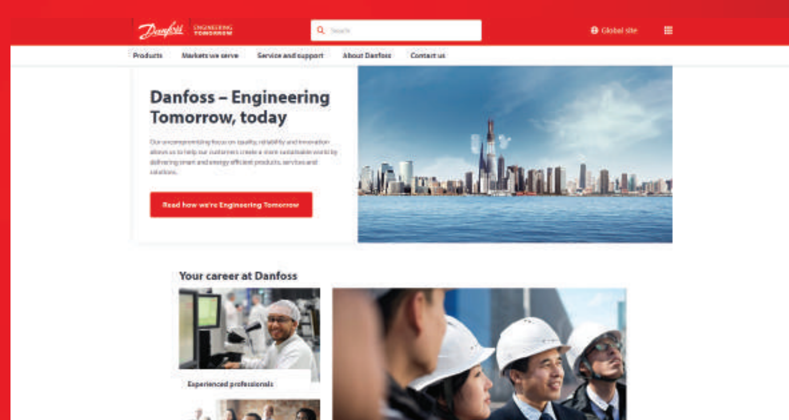

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