

Service manual

SIGMA AIR MANAGEMENT SYSTEM

SAM 2

No.: 901735 00 E

Manufacturer:

KAESER KOMPRESSOREN SE

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1 Regarding this document

1.1 Using this document

The operating manual contains important information to the entire life cycle of SAM 2 .

The operating manual is a component of the product.

- Keep the manual in a safe place throughout the life of SAM 2 .
- Pass the manual on to the next owner or user of the equipment.
- Ensure that any amendments received are inserted in the manual.

1.2 Copyright

This operating manual is protected by copyright. Any queries regarding the use or duplication of this documentation should be referred to KAESER. Correct use of information will be fully supported.

1.3 Approvals

The product with the SAM 2 type designation has the following approvals:

- This product is MIC approved. The approval number is: AC-xxxx. The radio waves used for this product may affect medical devices such as pacemakers.
- This device complies with part 15 of the FCC rules and with RSS-210 of Industry Canada. The operation is subject to the following two conditions:
 - (1) this device may not cause harmful interference, and
 - (2) this device must accept any interference received, including interference that may cause undesired operation.
- This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/TV technician for help.

1.4 Software

The software used in SAM 2 contains copyright-protected software which is licensed by GNU General Public License in versions 2 and 3. A copy of these licenses is contained in SAM 2. Display the licenses by pointing your browser to the "COPYING" file in the root directory of SAM 2.

URL:

[http:// <Hostname> SAM 2 COPYING](http://<Hostname> SAM 2 COPYING)

The licenses can be also found under this address:

<http://www.gnu.org/licenses/gpl-2.0.txt>

<http://www.gnu.org/licenses/gpl.txt>

Within three years from receipt of SAM 2, you may obtain the complete source code by sending a corresponding order to the following address:

Technisches Büro Elektrokonstruktion

KAESER KOMPRESSOREN SE

96450 Coburg, Postfach 2143

Germany.

This offer is made to everybody receiving this information.

1.5 Licensed brands and trademarks

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1.6 Symbols and labels

- Please note the symbols and labels used in this document.

1.6.1 Warnings

Warning notices indicate dangers that may result in injury when disregarded.

Warning notices indicate three levels of danger identified by the corresponding signal word:

Signal term	Meaning	Consequences of non-compliance
DANGER	Warns of an imminent danger	Will result in death or severe injury
WARNING	Warns of a potentially imminent danger	May result in death or severe injury
CAUTION	Warns of a potentially dangerous situation	May result in a moderate physical injury

Tab. 1 Danger levels and their definitions (personal injury)

Warning notices preceding a chapter apply to the entire chapter, including all sub-sections.

Example:



DANGER

These show the kind of danger and its source.

The possible consequences of ignoring a warning are shown here.

If you ignore the warning notice, the "DANGER" signal word indicates a lethal or severe injury will occur.

- The measures required to protect yourself from danger are shown here.

Warning notes referring to a sub-section or the subsequent action are integrated into the procedure and numbered as an action.

Example:



1. **WARNING!**

These show the kind of danger and its source.

The possible consequences of ignoring a warning are shown here.

If you ignore the warning notice, the "WARNING" signal word indicates that a lethal or severe injury may occur.

- The measures required to protect yourself from danger are shown here.

2. Always read and comply with warning instructions.

1.6.2 Potential damage warnings

Contrary to the warnings shown above, damage warnings do not indicate a potential personal injury.

Warning notices for damages are identified by their signal term.

Signal term	Meaning	Consequences of non-compliance
NOTE	Warns of a potentially dangerous situation	Damage to property is possible

Tab. 2 Danger levels and their definition (damage to property)

Example:



NOTICE

These show the kind of danger and its source.

Potential effects when ignoring the warning are indicated here.

- The protective measures against the damages are shown here.

- Carefully read and fully comply with warnings against damages.

1.6.3 Other alerts and their symbols



This symbol identifies particularly important information.

Material Here you will find details on special tools, operating materials or spare parts.

Precondition Here you will find conditional requirements necessary to carry out the task.
The conditions relevant to safety shown here will help you to avoid dangerous situations.

- This symbol denotes lists of actions comprising one stage of a task.
Operating instructions with several steps are numbered in the sequence of the operating steps.



Information referring to potential problems are identified by a question mark.

The cause is named in the help text ...

➤ ... as is a solution.



This symbol identifies important information or measures regarding the protection of the environment.

Further information Further subjects are introduced here.

2 Technical Specifications

2.1 System information

➤ Enter the system information for SAM 2 in the following table.

System information	Value
Material no.	
Serial no.	

Tab. 3 System information



The nameplate indicates the material no. and serial no.

2.2 Electrical Data

Model	SAM 2 – 100-240 V AC	SAM 2 – 24 V DC
Rated voltage [V]	100–240, 50–60 Hz	24
Rated current [A]	1.25-0.65	2.5
User's fusing [A]	16	
Power cable core cross-section [mm ²]	3x1.5	
Equipotential bond connection [mm ²]	1x16	
Enclosure protection	IP54 (IEC 529)	
Buffer battery		
Buffer battery [V]/[Ah]	3/0.12	
Life of buffer battery without power supply [years]	3	
Life of buffer battery with power supply [years]	10	

Tab. 4 Electrical Data

2.3 Versions and Options

SAM 2 is available in diverse variants and options:



- In principle, every input and output is freely assignable.
- The number of inputs and outputs can be increased using SBU (see chapter 4)
- Details on assignable and assigned inputs and outputs can be found in the circuit diagrams in the annex.

Model	SAM 2-4	SAM 2-8	SAM 2-16
Basic configuration			
Digital inputs (DI) for floating relay signals	6	6	6
Digital relay contact outputs (DOR) (as changeover contacts, 230 V, 3 A)	5	5	5
Analog inputs (AI) 0(4)-20 mA	4	4	4
Free SIGMA NETWORK -Ports	7	7	7/13 ²⁾
Sequenced machines			
Maximum	4	8	16
Via SIGMA NETWORK	4	7	13 2) 3)
I/O directly to SAM 2	4	4	4
Options			
E1: PROFIBUS master ⁴⁾	Complete SAM PROFIBUS network can be connected		
E2: 7 SIGMA NETWORK -Ports.	Factory-equipped with 7 SIGMA NETWORK ports		
E3: 13 SIGMA NETWORK -Ports ⁴⁾	additional 6 SIGMA NETWORK -Ports.		
E9: Network section control	Network section control		
E10: PROFINET IO ⁵⁾	PROFINET IO communication module		
E11: ModbusTCP ⁵⁾	Modbus TCP communication module		
E12: PROFIBUS DP ⁵⁾	PROFIBUS DP communication module		
¹⁾ PROFIBUS master only once (SAM 2 or SBU). ²⁾ with option E3: 13 SIGMA NETWORK -Ports. ³⁾ Expandable to 16 with SBU , see chapter 4. ⁴⁾ Either option E1 or E3 possible. ⁵⁾ Only one communication module possible.			

Tab. 5 Versions and Options

2.4 Components within the control cabinet

2.4.1 I/O modules (SAM 2 and SBU)

The following technical data apply to the I/O block and the individual I/O modules used in SAM 2 and SBU :

- I/O block 6DI&6DOT&4AI
- Module 6DI – X20DI6371
- Module 6DOT – X20DO6322
- Module 4AI – X20AO2632

Technical data, all I/O modules

Feature	Value
Connection terminals	Push-in terminal
Connection diameter	Copper wires
<ul style="list-style-type: none"> ■ Wire/single-core [mm²] ■ Flex/fine-core [mm²] ■ Wire end ferrule [mm²] ■ Double wire-end ferrule [mm²] 	<ul style="list-style-type: none"> ■ 0.08-2.5 / AWG 28-14 ■ 0.25-2.5 / AWG 24-14 ■ 0.25-1.5 / AWG 24-16 ■ 2x (0.25–0.75)
Display elements	Status LEDs

Tab. 6 Technical data, all I/O modules

Technical data I/O-block and individual modules

Feature	Value
Bus Controller	X20BC0087-C01
Bus	KAESER SIGMA NETWORK
Transfer rate [MBit/s]	10/100
Characteristics	Auto crossing (Auto-MDI(X)), Auto negotiation
Connections	2 x SIGMA NETWORK -socket RJ45, 10/100Base-TX
Max. length of the line between two components [m]	100
Electrical isolation SIGMA NETWORK -I/O-module	Yes
24 V DC power supply	X20PS9400
Power supply [V DC], [A]	24 (-15 % / +20 %), max. 0.7
Potential separation	—
<ul style="list-style-type: none"> ■ Supply - internal bus ■ Supply - I/O module 	<ul style="list-style-type: none"> ■ Yes ■ No
Digital inputs (DI)	Module 6DI – X20DI6371
Input voltage [V DC]	24 (-15 % / +20 %)
Model. Input current at 24 V DC [mA]	3.75
Switching threshold [V DC]	Low <5 , High >15
Insulation voltage between channel and bus [V _{eff}]	500
Digital outputs (DOT)	Module 6DOT – X20DO6322
Output voltage [V DC]	24
Output current per output maximum (overvoltage and short-circuit proof) [A]	0.5
Output protection	Thermal shut-down at overvoltage or short-circuit, integrated protection for switching inductive loads

2 Technical Specifications

2.4 Components within the control cabinet

Digital outputs (DOT)	Module 6DOT – X20DO6322
Insulation voltage between channel and bus [V _{eff}]	500
Analogue Inputs (All)	Module 4All – X20AO2632
Measuring range [mA]	0-20
Resolution [bit]	15
Connection type	Active and passive possible (2 conductor and 4 conductor technology)
Ohmic resistance (internal) [Ohm]	< 400
Input protection	Protection against supply voltage wiring
Maximum error in 25 °C range from currently measured value [%]	0.08
Maximum error in 25 °C offset from final value of measuring range [%]	0.02
Distribution 24 VDC	Module 6x 24 VDC - X20PD2113
Nominal output voltage [V DC]	24, Ground
Output current, total [A]	6.0
Fusing (internal, replaceable) [A], [mm]	T6.3, 5x20

Tab. 7 Technical data I/O-block and individual modules

2.4.2 I/O Modules (only SBU)

The following technical data apply to the individual I/O modules used only in SBU :

Feature	Value
Connection terminals	Push-in terminal
Connection diameter	Copper wires
<ul style="list-style-type: none"> ■ Wire/single-core [mm²] ■ Flex/fine-core [mm²] ■ Wire end ferrule [mm²] ■ Double wire-end ferrule [mm²] 	<ul style="list-style-type: none"> ■ 0.08-2.5 / AWG 28-14 ■ 0.25-2.5 / AWG 24-14 ■ 0.25-1.5 / AWG 24-16 ■ 2x (0.25-0.75)
Display elements	Status LEDs

Tab. 8 Technical data, all I/O modules

2.4.2.1 Module 4AIR – X20AT4222

Feature	Value
Analogue inputs for PT100 IEC/EN 60751	4
Range [°C]	-200 – +850
Resolution [Bit]	16
Connection type	Two-wire and three-wire technology
Measuring current [µA]	250

Feature	Value
Maximum error in 25 °C range from current measured value [%]	0.037
Maximum error in 25 °C offset from final value of measuring range [%]	0.0015
Isolation voltage input–internal bus [V_{eff}]	500

Tab. 9 Data, 4AIR module

2.4.2.2 Module 4AOI – X20AO2632

Feature	Value
Analogue outputs 0–20 mA	2
Output range [mA]	0-20
Resolution [bit]	15
Max. ohmic resistance [Ohm]	500
Output protection	Short-circuit-proof, current-limiting 40 mA
Maximum error in 25 °C range from current measured value [%]	0.045
Maximum error in 25 °C offset from final value of measuring range [%]	0.025
Isolation voltage output–internal bus [V_{eff}]	500

Tab. 10 Data, 4AOI module

2.4.2.3 Module 4AIP – X20AP3121

Feature	Value
Voltage, analogue inputs	3
<ul style="list-style-type: none"> ■ Nominal voltage phase–phase max. [V AC], [Hz] ■ Nominal voltage phase–N max. [V AC] ■ Maximum overload voltage 	<ul style="list-style-type: none"> ■ 480 at 50/60 ■ 277 ■ $1.5 \times U_N$ permanent, $2 \times U_N$ for 1 minute
Current, analogue inputs	4
<ul style="list-style-type: none"> ■ Maximum overload current ■ Resistance [mOhm] 	<ul style="list-style-type: none"> ■ $8 \times I_N$ for 0.5s ■ 500
Measuring accuracy	—
<ul style="list-style-type: none"> ■ U_{RMS} and I_{RMS} [%] ■ Power [%] 	<ul style="list-style-type: none"> ■ < 0.5 ■ < 0.5
Potential separation	—
<ul style="list-style-type: none"> ■ Inputs–internal bus ■ Input–input 	<ul style="list-style-type: none"> ■ Yes ■ No

Feature	Value
Isolation voltage	—
<ul style="list-style-type: none"> ■ Inputs–Internal bus [V DC] ■ Inputs–earth [V DC] 	<ul style="list-style-type: none"> ■ 5500 ■ 5500

Tab. 11 Data module 4AIP

2.4.3 Relay block

The relay block comprises 5 relays (SAM 2) or 6 relays (SBU) with the following technical data:

Feature	Value
Connection terminals	Push-in terminal
Connection diameter	Copper wires
<ul style="list-style-type: none"> ■ Wire/single-core [mm²] ■ Flex/fine-core [mm²] ■ Wire end ferrule [mm²] ■ Double wire-end ferrule 	<ul style="list-style-type: none"> ■ 0.14-1.5 / AWG 26-16 ■ 0.14-1.5 / AWG 26-16 ■ 0.14-1.5 / AWG 26-16 ■ not possible
Stripping length [mm]	8
Display elements	Status LED
Coil voltage [V DC]	24
Output contact	1 changeover contact
<ul style="list-style-type: none"> ■ Switching voltage [V] ■ Min. switching current [mA] (at 12 V) ■ Max. constant current [A] ■ Switching capacity IEC 60947/DIN VDE 0660 24 V DC13 [A] 230 V AC15 [A] 	<ul style="list-style-type: none"> ■ 5 (at 100 mA) – 250 V AC/DC ■ 10 ■ 6 ■ — 1 3
Inductive loads (e.g., auxiliary contact, solenoid valve)	to be connected with RC elements
Rated isolation voltage [V AC]	250

Tab. 12 Relay block data

2.4.4 SIGMA NETWORK Switch 8 port

Feature	Value
KAESER SIGMA NETWORK ports	8
Transfer rate [Mbps]	10/100
Transfer mode	Store-and-forward switching mode
Characteristics	Auto crossing (Auto-MDI(X)), Auto negotiation, Auto sensing
Connections	RJ45, 10/100Base-TX
Max. conduit length between two components [m]	100

Feature	Value
Power supply [V DC]	9–48, @ 24 V DC/200 mA
Display elements	Status LEDs for voltage and every port

Tab. 13 Data switch

2.4.5 Protocol converter SIGMA NETWORK / PROFIBUS master

Feature	Value
SIGMA NETWORK	—
<ul style="list-style-type: none"> ■ Transfer rate ■ Properties 1 ■ Properties 2 ■ Max. conduit length between two components [m] 	<ul style="list-style-type: none"> ■ 10/100 ■ Auto crossing ■ Auto negotiation ■ 100
PROFIBUS DP	Master
<ul style="list-style-type: none"> ■ Transfer rate [kBit/s] ■ Interface ■ Connections ■ Max. conduit length for the entire bus length [m] 	<ul style="list-style-type: none"> ■ 187.5 ■ RS486 floating ■ 9-pole SUB-D socket ■ 800
Power supply [V DC]	24 +/-25 %, typ. @ 130 mA
Display elements	Status LED
Service interfaces	Mini USB, slot for MMC memory card, rotary switch

Tab. 14 Data, SNW/DP bus controller

2.4.6 SAM 2 -Terminal

2.4.6.1 Industrial computer

- Industrial computer with Quad core processor
- 2 GB RAM
- 16 GB flash memory
- Buffer battery for real-time clock
- Voltage and temperature monitoring
- Update-capable with SD memory card

2.4.6.2 Interfaces

The positions of the interfaces X1–X5 are marked on the rear of the SAM 2 terminal.

Interface	Connection	Marking
Com modules ¹⁾	Slot for KAESER communication modules	X1
Battery ²⁾	For additional buffer battery	X2
SD card	Slot for SD/SDHC/SDXC memory card	X3
USB 2.0 ¹⁾	For service purposes only	X4
USB 3.0 ¹⁾	For service purposes only	X5
SIGMA NETWORK	RJ485 socket (10/100Base T)	X6
Ethernet 1 Gb	RJ485 socket (1000Base T)	X7
24 V DC	Power supply, protected against polarity reversal	X8
FE	Equipotential bonding 6.3 mm flat plug	X9

¹⁾ Slot/interface covered: Remove the cover if a communication module is installed.

²⁾ Slit covered: Remove the cover if an additional buffer battery is installed (see chapter 10.2).

Tab. 15 Interfaces SAM 2

Identification with RFID Equipment Card

Feature	Value
Integrated hardware	RFID write/read device
Hardware (external)	KAESER Equipment Card
Recognition in maximal distance [m]	0.05
Frequency [MHz]	13.56

Tab. 16 RFID

2.4.6.3 Display

Feature	Value
Display model	Colour display with touch screen
Display resolution [px ¹⁾]	1280 x 800
Format	12,1"; 16:10
Background lighting	LED
Model	LCD; industrial version
Touch operation	Capacitive
Sensor keys	4

¹⁾ px ≙ Pixel

Tab. 17 Display data

2.4.6.4 Software

SAM 2 terminal:

- Operating system: Linux
- KAESER controller software
- KAESER user interface

2.5 Control cabinet

Terminal and control cabinet

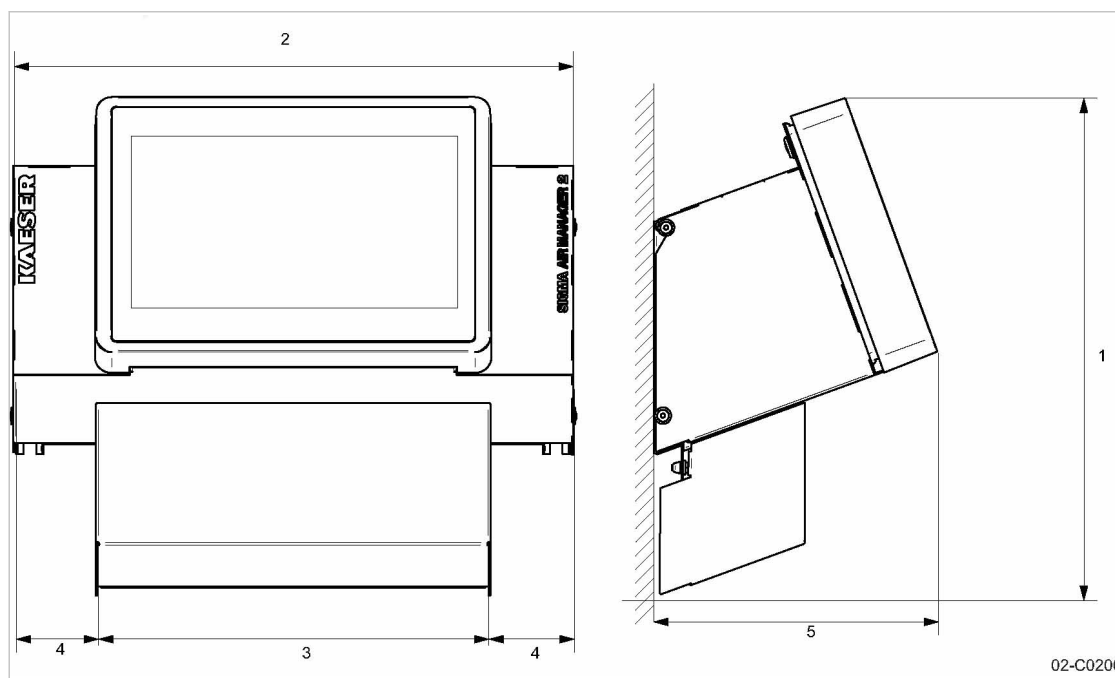


Fig. 1 Control cabinet dimensions

- | | |
|----------|----------|
| ① 483 mm | ④ 80 mm |
| ② 540 mm | ⑤ 284 mm |
| ③ 380 mm | |

Model	SAM 2-4	SAM 2-8	SAM 2-16
Material	Enclosure: Sheet metal, painted RAL 9007 grey Cover: Plastic, RAL 7016, anthracite grey		
Mass [kg]	15		
Enclosure protection	IP54		

Tab. 18 Control cabinet data

2.6 Pressure transducer

Models I and II pressure transducers

Model	I	II
Measurement range [bar]	0-1	0-6/10/16/20/32/45
Overload limit [bar]	3.5	double final pressure
Deviation of characteristic from final value Limit setting [%]	≤ 0.5	≤ 0.5 (0.25 typical)
Air connection, male thread	G 1/2 B DIN 16288 Stainless steel	G 1/4 A DIN 3852 Stainless steel Viton seals
Nominal temperature range [°C]	-20...+80	-25...+85
Nominal temperature range [K]	253-353	248-358
Fluid temperature range [°C]	-30...+100	-40...+100
Fluid temperature range [K]	243-373	233-373
Storage temperature range [°C]	-40...+100	-40...+100
Storage temperature range [K]	233-373	233-373
Temperature influence / 10 K over the range [%]	± 0.2	± 0.15
Temperature influence / 10 K over the range [%]	± 0.2	± 0.15
Output signal (two-wire technique) [mA]	4-20	4-20
Power supply connection (plug to EN 175301-803)	PG 11	PG 9
Enclosure	Stainless steel	Stainless steel
Enclosure protection	IP 65	IP 65
Tightening torque [Nm]	17-20	17-20

Tab. 19 Models I and II pressure transducers

Pressure transducer model III and vacuum

Model	III	Vacuum pump
Measurement range [bar]	0-16	-
Measurement range, absolute [bar]	-	0-1
Overload limit [bar]	32	3
Deviation of characteristic from final value Limit setting [%]	≤ 1 (0.5 typical)	≤ 1 (0.5 typical)
Air connection, male thread	G 1/2 A	G 1/2 A
Air connection, male thread	G 1/8 A	G 1/8 A
Rated temperature range [°C]	-25...+85	-25...+85
Rated temperature range [K]	248-358	248-358
Fluid temperature range [°C]	-30...+125	-30...+125
Fluid temperature range [K]	243-373	243-373
Storage temperature range [°C]	-50...+100	-50...+100

Model	III	Vacuum pump
Storage temperature range [K]	233-373	233-373
Temperature influence / 10 K over the range [%]	± 0.4	± 0.4
Temperature influence / 10 K over the range [%]	± 0.4	± 0.4
Output signal (two-wire technique) [mA]	4-20	4-20
Power supply connection (plug to EN 175301-803)	PG 9	PG 9
Enclosure	brass	brass
Enclosure protection	IP 65	IP 65
Tightening torque [Nm]	17-20	17-20

Tab. 20 Pressure transducer model III and vacuum

3 Safety and Responsibility

3.1 Basic instructions

**DANGER**

Disregarding these instructions can result in serious injury.

- To operate the product SAM 2 safely, read the service manual carefully and take notice of its contents.

The product SAM 2 is manufactured to the latest engineering standards and acknowledged safety regulations. Nevertheless, dangers can arise through the operation:

- danger to life and limb of the operator or third parties,
 - impairments to the SAM 2 and other material assets.
- Therefore, observe the following:
- Use the product SAM 2 only if it is in a technically perfect condition and only for the purpose for which it is intended; observe all safety measures and the instructions in the service manual.
 - In particular, immediately rectify (have rectified) any faults that could be detrimental to safety.

3.2 Intended use



Specified use also includes compliance with the instructions in this manual.

The product SAM 2 is intended exclusively for the operation of compressors, blowers and vacuum systems in industrial fields and may only be operated within its associated control cabinet. Any other use is considered incorrect. The manufacturer is not liable for any damages that may result from incorrect use. The user alone is liable for any risks incurred.

- Comply with the instructions in this operating manual.
- Operate the product only within its performance limits and under the permitted ambient conditions.

3.3 Improper use



Specified use also includes compliance with the instructions in this manual.

Converting or changing the SAM 2 constitutes improper use. The manufacturer's warranty is made invalid in such cases.

Improper usage can cause damage to property and/or (severe) injuries.

1. Use SAM 2 only as intended.
2. Do not use SAM 2 to control other machines or products for which SAM 2 is not intended.
3. Do not allow conversions or changes.

3.4 User's Responsibilities

3.4.1 Observe statutory and universally accepted regulations

This is, for example, nationally applied European directives and/or valid national legislation, safety and accident prevention regulations.

- Observe relevant statutory and accepted regulations during installation, operation and maintenance of the equipment.

3.4.2 Qualified personnel

These are people who, by virtue of their training, knowledge and experience as well as their knowledge of relevant regulations can assess the work to be done and recognise the possible dangers involved.

Authorised operators possess the following qualifications:

- are of legal age,
- are conversant with and adhere to the safety instructions and sections of the service manual relevant to operation,
- have received adequate training and authorisation to operate electrical and compressed air devices.

Authorised installation and maintenance personnel have the following qualifications:

- are of legal age,
 - have read, are conversant with and adhere to the safety instructions and sections of the service manual applicable to installation and maintenance,
 - are fully conversant with the safety concepts and regulations of electrical and compressed air engineering,
 - are able to recognise the possible dangers of electrical and compressed air devices and take appropriate measures to safeguard persons and property,
 - have received adequate training and authorisation for the safe installation and maintenance on this equipment.
- Ensure that operating, installation and maintenance personnel are qualified and authorised to carry out their tasks.

3.5 Dangers

The general safety instructions in this chapter describe possible dangers and how to deal with them. Special safety instructions are found in this service manual at the beginning of each chapter or directly before a task instruction.

- Take full heed of all safety instructions.

3.5.1 Safely dealing with sources of danger

Electricity

- Disconnect the machine from all power supply phases.
- Switch off any external power sources.



Voltage is still present on the marked terminals (orange or labelled) in the SAM 2 when the power supply is switched off.

- Check and ensure that no power is present.
- Before switching on again make sure that
 - no maintenance personnel are working,
 - all panels are in place,
 - all access doors are closed.
- Allow only qualified electricians or trained personnel under the supervision of a qualified electrician to carry out work on electrical equipment according to electrical engineering regulations.
- Observe all accepted safety regulations and national legislation applicable to all work carried out on the SAM 2 .
- Use fusing according to current draw (see chapter 2).
- Make electrical connections only with power removed and check regularly for tightness and condition.
- Use only electrical cables that are suitable and approved for the surroundings and electrical loads applied.
- Before every start-up by the user of machines that are linked to the master controller, make sure there is adequate protection against electric shock from direct or indirect contact and check regularly.

3.5.2 Safe SAM 2 operation

Pay attention to the following points to avoid damage to the SAM 2 :

- Do not remove any plugs on the SAM 2 while the compressed air system is in operation.
- Operate the SAM 2 only when all supplies are connected.



1. **WARNING!**

A short circuit can cause irreversible damage to the PROFIBUS interface.

- Avoid short-circuits.
- 2. Avoid short circuits on the power supply pins in the PROFIBUS interface for PROFIBUS/ SIGMA NETWORK converter.
 - Never modify, bypass or disable safety devices.
 - Do not remove or obliterate labels and notices.
 - Use only spare parts approved by the manufacturer for use in SAM 2 .

3.6 Warranty

This service manual does not contain any independent warranty commitment. Our general terms and conditions apply with regard to warranty.

Prerequisite for granting warranty is the intended and proper use of the product in compliance with the specific application conditions.

In view of the multitude of potential applications, it is the duty of the operator to verify that the product is suitable for the actual application.

Furthermore, we do not assume any warranty obligation for damages caused by:

- the use of unsuitable parts or operating materials,
- arbitrary modifications,

- incorrect maintenance,
- incorrect repair.

Correct maintenance and repair means the use of genuine Kaeser spare parts.

- Obtain confirmation from KAESER that your specific operating conditions are suitable.

4 Design and Function

4.1 Overview

The SAM 2 is used for the control, regulation and monitoring of stations comprising multiple compressors, blowers or vacuum machines in a commercial environment. SAM 2 reacts flexibly to fluctuating compressed air demand and thus reduces energy consumption. The system takes into account machine run times and deployment priorities. Important parameters are clearly represented as coloured graphic elements. The high-resolution touch screen enables user-friendly settings.

SAM 2 is offered as:

- SAM 2-4
- SAM 2-8
- SAM 2-16

They differ in the number of controllable machines (see chapter 2 "Design variants and options"). Using the SBU , you can flexibly expand the number of interfaces.

SAM 2 comprises the following components:

- The central pressure transducer measures the pressure in the air network and passes the value to SAM 2 .
- The processing unit of the SAM 2 decides according to default parameters, which machines are switched to load to keep the pressure in the air main constant. All data are clearly graphically represented. You can analyse and archive the data provided.
- The display and control panel of the touch screen provides information on current pressure and other parameter values and offers various possibilities for individual settings.

Compressors with SIGMA CONTROL and SIGMA CONTROL 2 as well as those with conventional controllers can be linked to SAM 2 .



Fig. 2 SAM 2 – Standard design of a compressed air station

- | | |
|-------------------|--|
| ① SAM 2 | ⑤ I/O lines to machines and sensors |
| ② SIGMA CONTROL 2 | ⑥ SIGMA NETWORK |
| ③ SIGMA CONTROL | ⑦ PROFIBUS |
| ④ SBU | ⑧ Analogue input for pressure transducer |

4.2 Operating panel

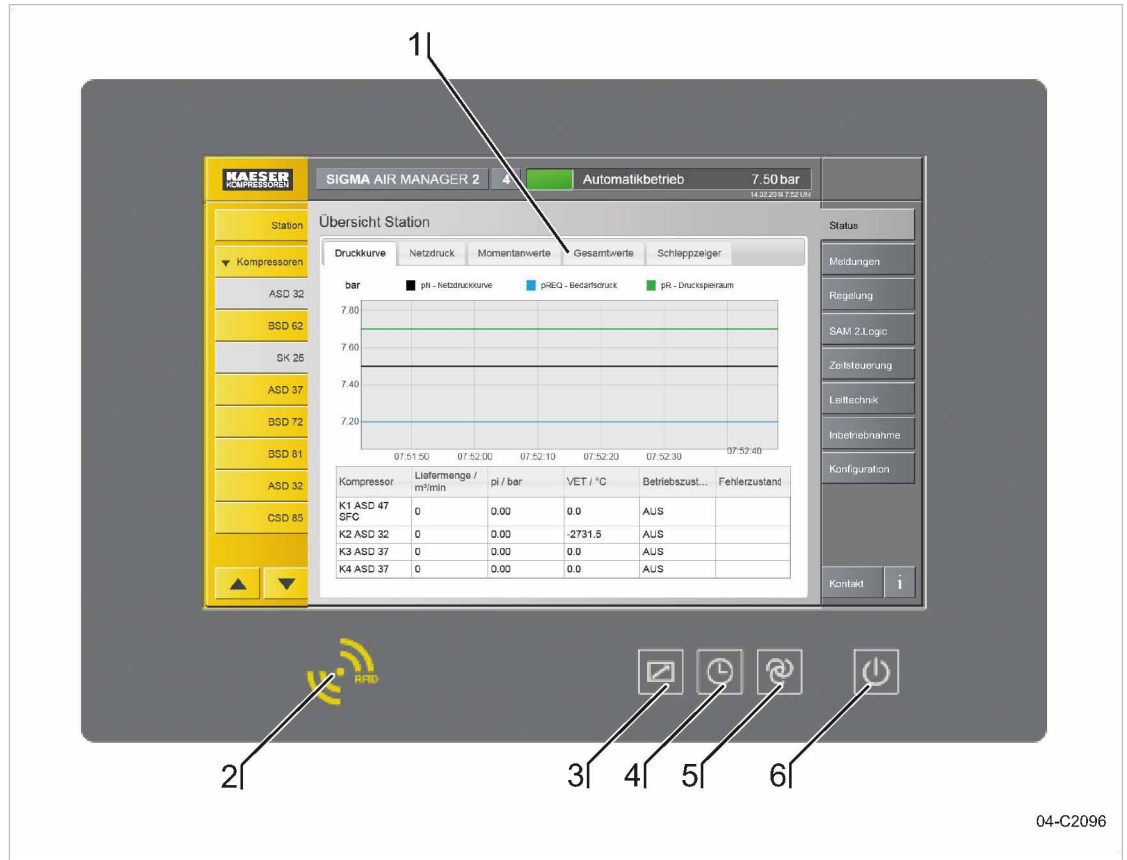







Fig. 3 Operating panel SAM 2

No.	Sign	Operating element	Key illumination	Function	Description
1	—	Touch screen	—	Operation of SAM 2 functions	Chapter 4.3 "Touch screen"
2		RFID write/read device	—	Log-on with RFID Equipment Card	Chapter 4.4 "User log-on"
3		Button remote control	Green	Activation and deactivation of the remote operation.	
4		Button time control	Green	Switch the clock on or off	
5		Button automatic	Green	Switch the station between manual and automatic mode.	
6		Button station On/Off	Green/red	Compressed air station activation (air supply) or deactivation (ATTENTION: no air supply!)	Chapter 7.2 8.1 Switch on "SAM 2"

Tab. 21 Operating panel SAM 2

4.3 Touch screen

The touch screen menu is arranged as follows:

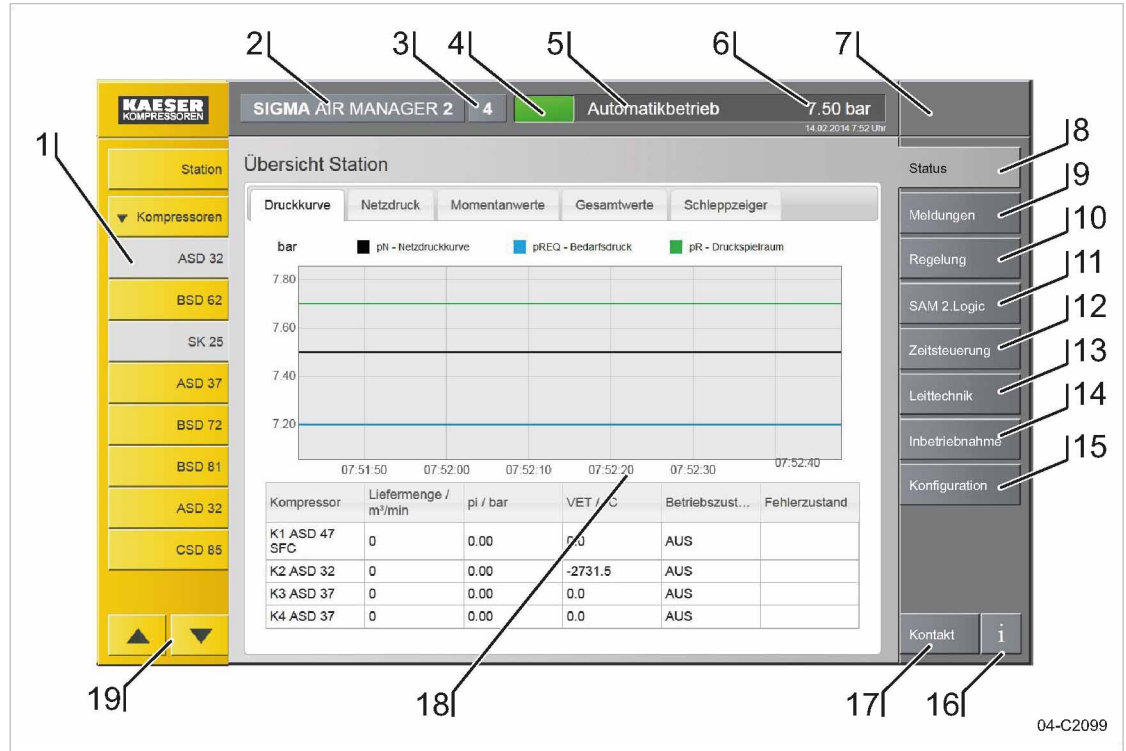


Fig. 4 Touch screen menu

No.	Menu element	Function	Description
1	Device selection list	Selection of machines, individually or by groups	—
2	Product designation	—	—
3	SAM 2 model	e.g., SAM 2-4	—
4	System status	Traffic lights function: green: Operation yellow: Maintenance/warning red: Fault (air supply is endangered!)	—
5	Operating mode	Display of the set operating mode	—
6	Pressure chart	Display of current system pressure	—
7	Access mode	Display of current access mode: <ul style="list-style-type: none"> ■ — (logged out) ■ Operating ■ Monitoring 	Chapter 7.4 "User log-on"
8	Status	Call up Status menu	Chapter 8.3.1 "Main menu"
9	Messages	Call up Messages menu	Chapter 9.2 "Messages"

No.	Menu element	Function	Description
10	Control	Call up Control menu	Chapter 7.12 "Control"
11	SAM 2.Logic	Logic functions are programmed here	
12	Time control	Call up Timer menu	
13	Process control	Call up Control technology menu	
14	Start-up	Menus for commissioning the compressed air station	Chapter 7 "Initial Start-up"
15	Configuration	Configuration menus for SAM 2	Chapter 7 "Station"
16	Info	Call up Help menu	Chapter 8.2 "Help function"
17	KAESER Service Support	Call up Contact menu	—
18	Display	Touch screen display for graphics, messages and data	—
19	Device selection UP/DOWN	Device selection list; scrollbar provided for more than 10 devices	—

Tab. 22 Touch screen menu elements

4.4 User log-on with RFID

The KAESER Equipment Cards provide various functionalities:

- Switch between three operating modes:
 - Logged out
 - Monitoring
 - Operating
- Encryption ensures security
- Different access levels for the customer (Equipment Card) and Service (Key)

The system records which user is when logged on at SAM 2 . You can thus determine who was logged on when specific messages or other events have occurred.

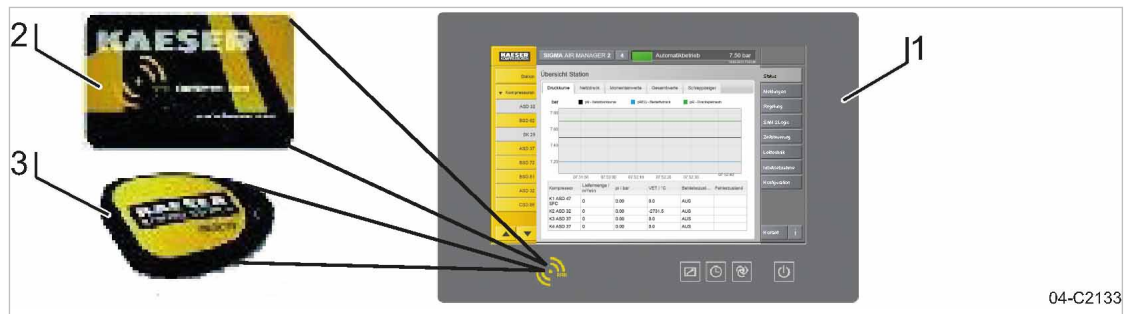


Fig. 5 User management with RFID

- ① SAM 2
- ② KAESER Equipment Card
- ③ KAESER Key

4.5 Main menu

The menu has the following sub-menus:

- "Net pressure station"
- "Net pressure"
- "Current values"
- Total values
- "Drag Indicator"
- "View station"

If the menu page displayed has several sub-menus, touch one of the tabs to open the corresponding sub-menu.

4.5.1 Menu tree



The menu elements and sub-menus available from the main menu depend in part on the selected machine or the multiple machines selected at once.

Main menu element	Sub-menu element
Status	■ Chapter 8.3.1 "Overview"
	■ Chapter 8.3.5 "View station"
Messages	■ Chapter 9.2 "Unacknowledged messages"
	■ Chapter 9.2 "Current reports"
	■ Chapter 9.2 "Message history"
Control	■ Chapter 7.12 Settings
	■ Chapter 7.12 Pressure parameters
SAM 2.Logic	■ Chapter "Editor"
Time control	■ Chapter Status
	■ Chapter Editor
Process control	■ Chapter Status
	■ Chapter Editor
Start-up	■ Chapter 7.3 Station
	■ Chapter 7.11 "P+I diagram"
	■ Chapter 7.10 SIGMA NETWORK
	■ Chapter 7.10 PROFIBUS
Configuration	■ Chapter 7.7 "E-Mail"
	■ Chapter 7.6 "Unit settings"
	■ Chapter "User management"
	■ Chapter 11.4 "Software versions"
	■ Chapter 7.5 "Date and time"
	■ Chapter 7.9 "Data recording"
	■ Chapter 7.3 "Language"

Main menu element	Sub-menu element
	■ Chapter 7.10 "Peripherals"

Tab. 23 Menu tree

4.6 Operation and function

SAM 2 has been developed for a multitude of possible applications. Generally, most of the default settings can be kept or have to be changed only slightly.

4.6.1 Adaptive 3D control

The adaptive 3D control minimises the energy requirements of the compressed air station by automatically adapting to the operating conditions.

It automatically adapts the selection of the machines to be activated and deactivated as well as the cut-out and cut-in pressures for the selected machines to the current operating conditions of the compressed air station.

4.6.2 Base load sequencing

The controller will equally use machine of the same size. The standard for comparison is the number of operating hours. The machine with the least number of operating hours is used the most.

4.6.3 Time control

The compressed air system can be operated via an integrated timer. There are 32 switching points per week available.

4.6.4 Power limiting

If the power limiting function is activated, the system will add machines only to the point where the overall load capacity of the running machines exceeds the specified power limit. The nominal pressure and the maximum speed are used for calculating the overall load capacity.

4.6.5 Air main charging

After the activation of the compressed air station, the air network is charged at the specified network charging speed.

4.6.6 EMERGENCY operation

A compressed air station can run in EMERGENCY operation if each machine has its own system pressure switch or presser control system. This is always the case with KAESER rotary screw compressors. Compressed air systems with rotary blowers or reciprocating compressors may or may not have machines provided with their own system pressure switches. Stations with machines without system pressure switches **cannot** operate in EMERGENCY mode. These compressed air systems cannot deliver compressed air without SAM 2 .

Compressor stations with EMERGENCY mode (manual mode)

EMERGENCY mode can cause large pressure swings in the air main.

The connected machines are automatically switched to EMERGENCY mode:

- When the voltage supply of SAM 2 fails in activated state
- When the connection to the pressure transducer is interrupted
- When SAM 2 itself fails

The machines then run under their internal pressure regulation, independent of SAM 2 . The machines can be manually switched to EMERGENCY operation (manual mode) for test purposes.

Compressor stations without EMERGENCY mode (manual mode)

No compressed air is delivered without SAM 2 .

The output relays switch off:

- When the voltage supply of SAM 2 fails
- When the connection to the pressure transducer is interrupted
- When SAM 2 itself fails

This causes the connected machines to switch to idle or off. The compressed air system no longer delivers compressed air.

4.6.7 Visualisation at external devices

The user interface of SAM 2 can be represented at an external computer (PC, laptop, tablet). For this purpose, SAM 2 must be connected to the external computer via the Gigabit Ethernet connection X7, directly via a network cable or indirectly (network). A web browser is used for the visualisation.

5 Installation and Operating Conditions

5.1 Environment

Temperature range

Ambient temperatures	
Min. ambient temperature	Maximum ambient temperature
0 °C	45 °C

Tab. 24 Ambient temperatures

Storage temperatures	
Minimum storage temperature	Maximum storage temperature
-20 °C	70 °C

Tab. 25 Storage temperatures

Comply with permissible ambient temperatures:

1. Check ambient temperature.
2. Adjust equipment location to suitable ambient temperature range.

Comply with the specified storage temperature:

1. Check temperature of storage location.
2. Determine the storage location according to a suitable temperature range.

5.2 Installation conditions

SAM 2 is designed for the operation in an industrial environment with proprietary supply network separated from the public supply by a transformer or generator.

- Install SAM 2 as appropriate.

6 Installation

6.1 Installation

Connection	SIGMA CONTROL and SIGMA CONTROL 2	Conventional	Description
Ensuring safety	x	x	Chapter 6.2 "Ensuring safety"
Reporting transport damage	x	x	Chapter 6.3 "Reporting transport damage"
Compressed air supply during installation	x	x	Chapter 6.4 "Compressed air supply during installation"
Scope of delivery	x	x	Chapter 6.5 "Scope of delivery"
Installing the control cabinet	x	x	Chapter 6.6 "Installing the control cabinet"
Identifying the machines	x	x	Chapter 6.7 "Identifying the machines"
Connecting the pressure transducer	x	x	Chapter 6.8 "Connecting the pressure transducer"
Planning the wiring	x	x	Chapter 6.9 "Planning the wiring"
Laying cables	x	x	Chapter 6.10 "Laying cables"
Creating SIGMA NETWORK	x	–	Chapter 6.10.1 Creating "SIGMA NETWORK"
Creating the PROFIBUS network	x	–	Chapter 6.10.2 "Creating the Profibus network"
Setting up the compressor station via floating relay contacts	–	x	Chapter 6.10.3 "Setting up the compressor station via floating relay contacts"
Connecting the cables to SAM 2	x	x	Chapter 6.11 Connecting the cables to "SAM 2"
Setting up the machines	x	x	Chapter 6.12 "Setting up the machines"

Tab. 26 Installation overview

6.2 Ensuring safety

Follow the instructions below for safe installation.

Warning instructions are located before a potentially dangerous task.



Disregard of warning instructions can cause serious injuries!

Complying with safety notes

Disregard of safety notes can cause unforeseeable dangers!

- Comply with the instructions in chapter 3 Safety and Responsibility .
- This product may only be installed by a qualified person. See chapter 3, "Assigning personnel".

When working on live components

Touching voltage carrying components can result in electric shocks, burns or death.

- Work on electrical equipment may only be carried out by authorised electricians.
- Switch off and lock out the power supply disconnecting (isolating) device and check that no voltage is present.
- Check that there is no voltage on potential-free contacts.

6.3 Reporting transport damage

1. Check the product for visible and hidden transport damage.
2. Immediately notify the carrier and the manufacturer in writing of any damage.

6.4 Compressed air supply during installation

- Check the compressor station's EMERGENCY mode characteristics.
 - Station with emergency operating mode: Chapter 6.4.1
 - Stations without emergency operating mode: Chapter 6.4.2

6.4.1 Station with emergency operating mode

It is possible to install and commission SAM 2 without shutting down the complete air system.



DANGER

Mortal danger from electric current

- The machine must be free of voltage before work commences.

1. Isolate the machine from all sources of voltage.
2. Make sure the machine is voltage-free.
3. Connect the machine to SAM 2 (chapters 6.9 to 6.10).
4. Put the machine back into operation.
5. Repeat steps 1 to 3 for any further machines.
6. Perform the commissioning and setting as detailed in chapter 7.

7. Do not switch SAM 2 from manual to automatic mode until these settings have been completed.

SAM 2 subsequently assumes control of the machines.

Further information For EMERGENCY mode, see chapter "EMERGENCY mode".

6.4.2 Stations without emergency operating mode

SAM 2 is required for the supply of compressed air. The compressed air system is not operational until initial start-up of SAM 2 is completed.

- Switch on the compressor station after commissioning SAM 2 .

Further information For EMERGENCY mode, see chapter "EMERGENCY mode".

6.5 Scope of delivery

This product comprises at least the following components (depending on the selected configuration, additional components may be provided):

Item	Material	Name
10	SAM2.1	SAM 2 (SAM 2-4, SAM 2-8 or SAM 2-16)
20	"Pressure-dependent"	Pressure transducer
30		2x KAESER Equipment Cards
40	—	This instruction

Tab. 27 Standard scope of delivery

6.6 Installing the control cabinet

A solid, vibration-free and load-bearing wall is required for the control cabinet.



Take the following criteria into consideration when selecting the installation location and the installation of the control cabinet:

- The mounting aids must be compatible with the type of wall and the weight of the control cabinet (chapter 2).
- The control cabinet must be fully accessible.
- Fully opening control cabinet door.
- A free escape route must be maintained (also with the control cabinet door fully open).
- Protection from direct sunlight, rain, splashed water or excessive dust build up must be provided.



WARNING

Overheating from insufficient ventilation

- The space between the wall and the rear of SAM 2 must remain clear to support ventilation!

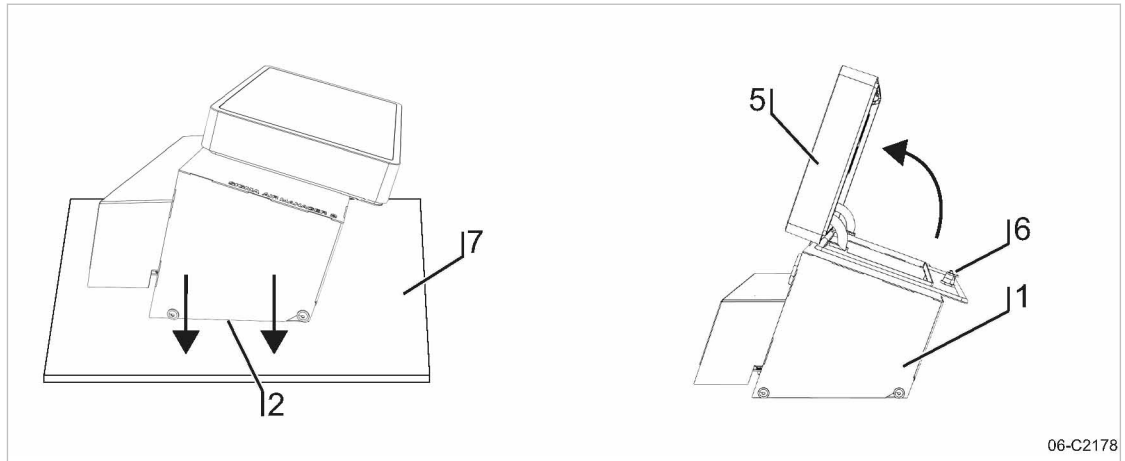


Fig. 6 Open the SAM 2 cover

- | | |
|-----------------------------|-------------|
| ① Control cabinet cover | ⑥ Spagnolet |
| ② Base plate | ⑦ Base |
| ⑤ Cover with SAM 2 terminal | |

- Carefully unpack the control cabinet. Protect the sensitive surfaces (e.g., cover ⑤ with touch screen terminal) from damage.
- Place the entire control cabinet onto a suitable surface ⑦ (protected from dirt and scratching) with the base plate ② pointing downward.
- Use the control cabinet key (two-way key, 3 mm) to unlock the spagnolet ⑥ at the control cabinet ①.
- Open the cover ⑤ (in arrow direction).
- Remove the cables which are connected from the modules on the base plate ② with the terminal ⑤.

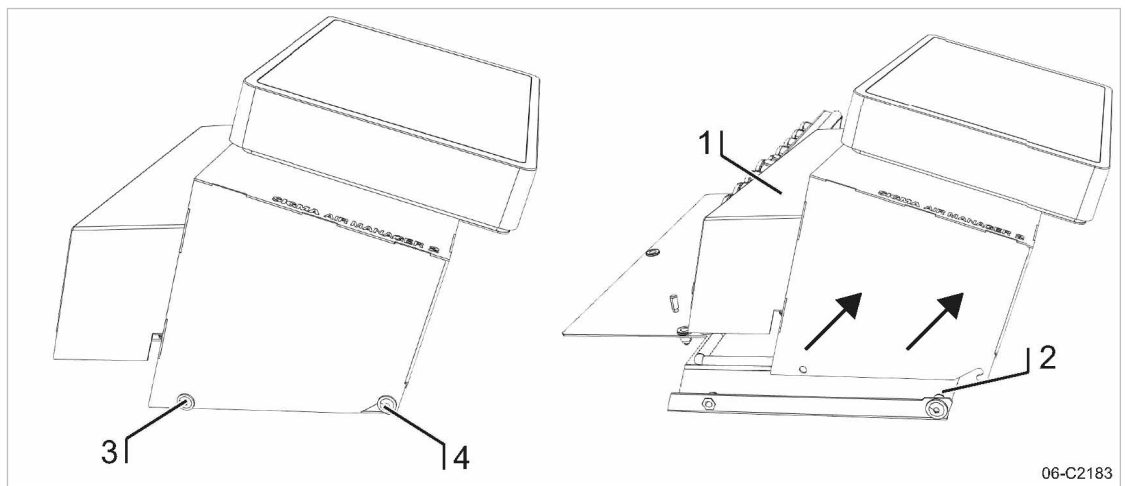





Fig. 7 Removing the control cabinet cover

- | | |
|-------------------------|--|
| ① Control cabinet cover | ③ Flat mushroom-head screw M 6x16, SW4 |
| ② Base plate | ④ Flat mushroom-head screw M 6x16, SW4 |

- Separate the control cabinet cover ① (enclosure cover with SAM 2 terminal) from the base plate ② as follows.
- First, use the SW4 wrench to unscrew the two screws ③, then loosen the two screws ④ and carefully lift the control cabinet cover ① in arrow direction (see Fig. 7).

8. Place the control cabinet cover  onto a suitable surface  (protected from dirt and scratching).
9. Properly attach the base plate  to the wall. A template for the bore holes is provided in the annex (see chapter 13.1).
10. Wire the control cabinet as described in chapter 6.11.

6.7 Identifying the machines



Same model machines have to be identified as well, because the internal pressure regulation can be set differently.

- Clearly identify or number the machines.

The alarm and service messages displayed on SAM 2 can thus be allocated to the correct machine.

Identification (machine and SAM 2) for remote control



The machines and SAM 2 must carry a warning notice when they are in remote mode.

- Warning notice to indicate the machines.
 - "WARNING": This machine is remotely controlled and can start automatically at any time.
- Warning notices for identification at SAM 2 .
 - Before starting, make sure that no one is working on the machines and that they can be started safely.

Place the notices so they are highly visible.

1. Place warning notices on the machine.
2. Attach a warning notice at SAM 2 .

6.8 Connecting the pressure transducer

Precondition The connection point is not under pressure.



NOTICE

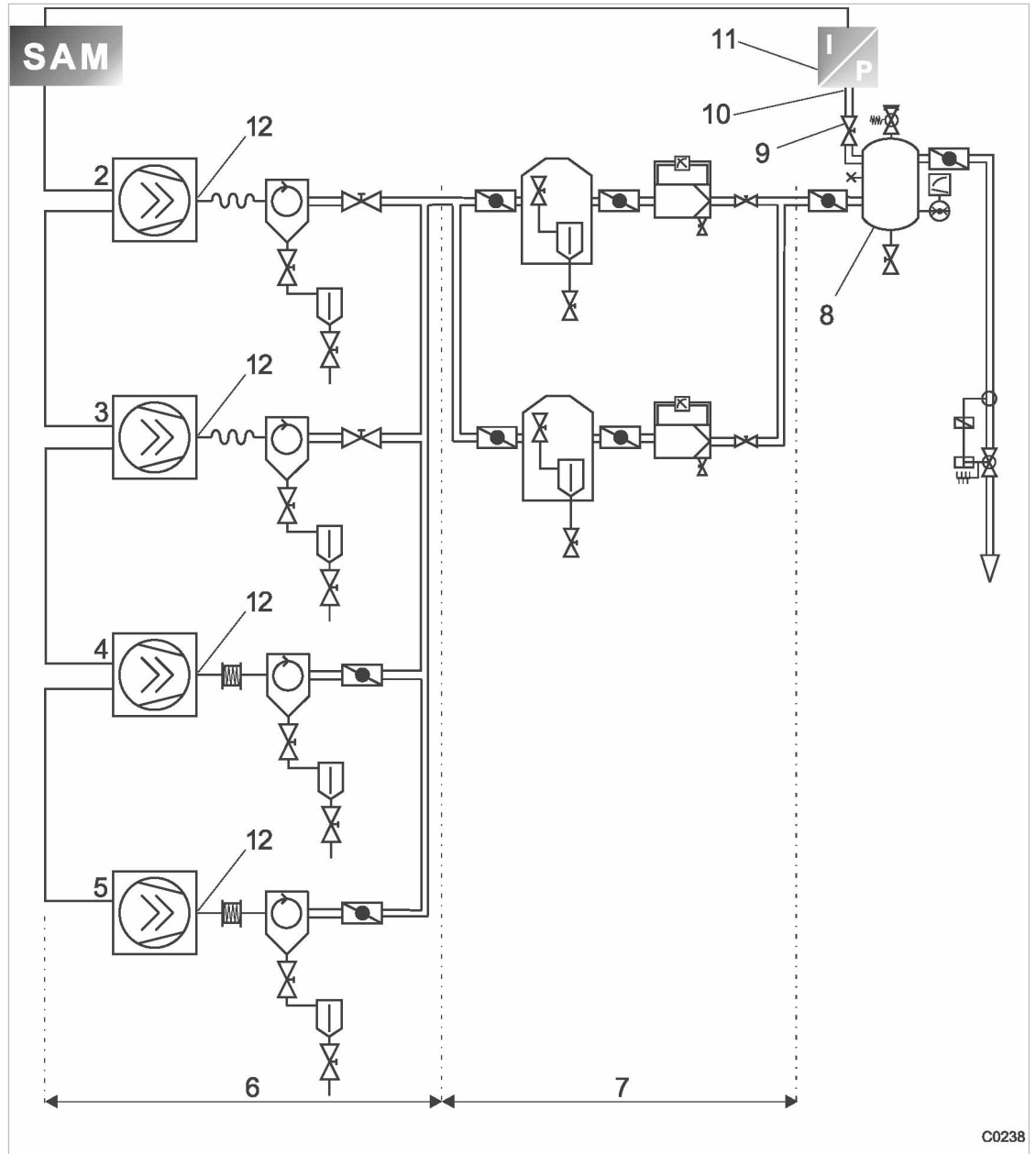
Network pressure too high
 Damage to the pressure transducer

- Never connect the pressure transducer to a pressurised network with a maximum pressure exceeding the nominal pressure of the pressure transducer.

1. Check the maximum working pressure of the compressed air network.
2. Check the nominal pressure of the pressure transducer.

6.8.1 Mechanical connection

The "pressure transducer position" graphic (illustration 8) shows the correct position for the transducer:



C0238

Fig. 8 Pressure transducer position

- | | |
|-----------------------------|--|
| ① SAM 2 | ⑦ Air Treatment |
| ② Machine 1 | ⑧ Air receiver |
| ③ Machine 2 | ⑨ Shut-off valve |
| ④ Machine 3 | ⑩ Pressure transducer connection point |
| ⑤ Machine 4 | ⑪ Pressure transducer |
| ⑥ Compressed air generation | ⑫ Main compressed air outlet |

- Note the following when connecting the pressure transducer:
 - Connect the pressure transducer either to the side or the top of the air receiver so that no condensate can settle.
 - If the pressure transducer is connected to the main collector pipe, fit a small, additional air receiver (item 8) order separately, see chapter 13.6 for the material number).
 - Fit the pressure transducer downstream of the air treatment components because pressure losses caused by air treatment components or pipework can occur between the machine and the point of measurement.
 - The airflow at the point of measurement must not pulsate.
 - Note the installation depth of the pressure transducer.
 - Install a shut-off valve between the air receiver and the pressure transducer. This allows replacement of the pressure transducer without having to vent the air receiver. Ensure that the shut-off valve cannot be closed during operation.
 - A kit of parts for the air connection is available separately (see chapter 13.6 for the material number).

6.8.2 Electrical connection



Avoid signal distortion by using suitable wiring and screening.

1. Use two conductor screened cable with minimum section 0.75 mm².
2. The pressure transducer must be earthed.
 - Earth by metallic contact with the air receiver or
 - Use a separate equipotential bonding conductor with a minimum cross-section 1 x 10 mm² (with, for example, an earth clamp (G 3/4) on the transducer housing).
3. Connect SAM 2 and the pressure transducer at the same equipotential bonding conductor. The potential difference between both earthing points must be zero.
4. Connect the conductor screen at the pressure transducer to earth.

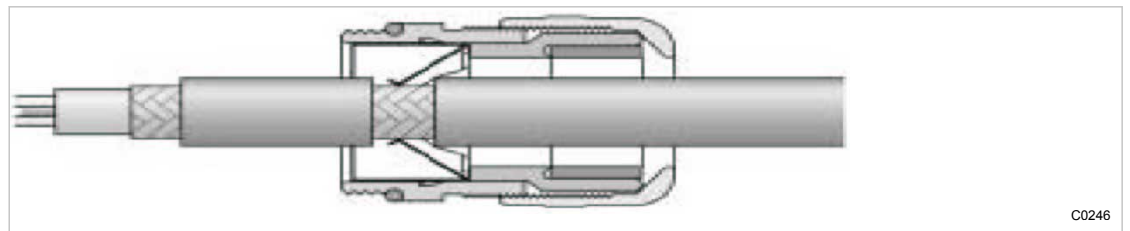


Fig. 9 Connecting the screening

5. Feed the conductor through an EMC cable gland into the control cabinet.
6. Maintain a distance of at least 10 cm between the connecting cable and power cables.

6.9 Planning the wiring

There are several methods of linking the machines to SAM 2 or SBU :

- Using SIGMA NETWORK
 (for machines with SIGMA CONTROL 2), see chapter 6.10.1.
 Prerequisites: A SIGMA NETWORK port is provided for every machine.

- PROFIBUS
(when replacing a SIGMA AIR MANAGER with SAM 2 or for machines with SIGMA CONTROL 2), see chapter 6.10.2.
Prerequisites: The PROFIBUS master option is available.
- Using floating relay contacts
(for conventional machines without SIGMA CONTROL or SIGMA CONTROL 2 ; see chapter 6.10.3).
Prerequisites: At least one I/O Port DI and DOR is available for every machine.

6.9.1 SIGMA NETWORK

The SIGMA NETWORK subscribers are linked in a star pattern. All SIGMA NETWORK wires start from SIGMA NETWORK hub installed in SAM 2 or SBU .

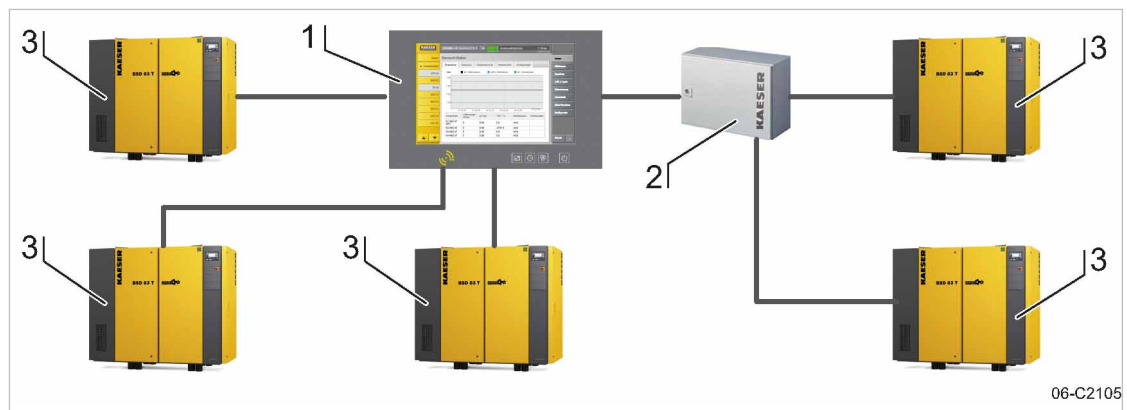


Fig. 10 SIGMA NETWORK design

- ① SAM 2
- ② SBU with option SIGMA NETWORK ports
- ③ Machine with SIGMA CONTROL 2

6.9.2 PROFIBUS network

PROFIBUS wiring is used when a SIGMA AIR MANAGER is replaced by SAM 2 in machines with SIGMA CONTROL or SIGMA CONTROL 2 with a PROFIBUS communication module. The PROFIBUS subscribers are connected in series, that is, one after another. SAM 2 or SBU are located at the end of the bus.

A terminating resistor can be activated in every PROFIBUS plug. At the start and at the end of the bus cable, this resistor must be set to ON. In all other PROFIBUS plugs within the network, you must set the terminating resistors to OFF.

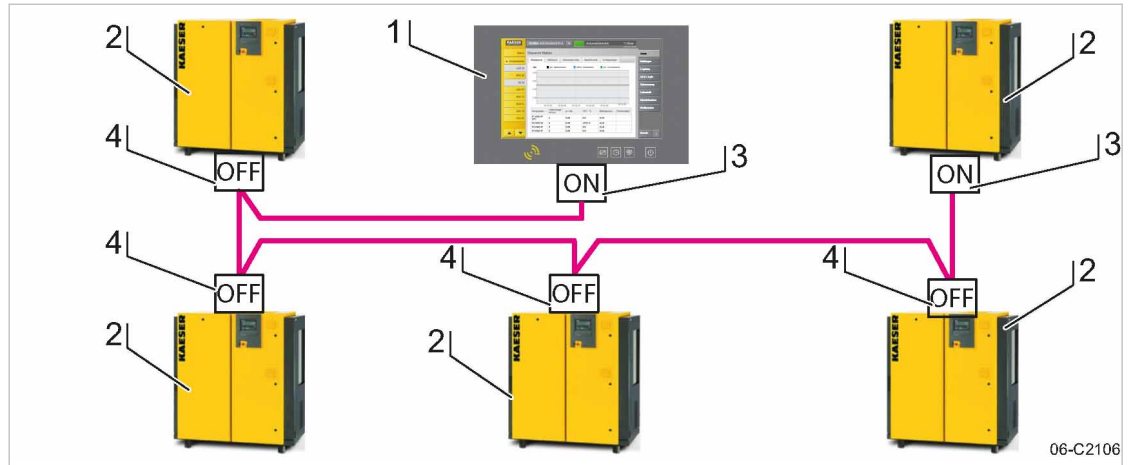


Fig. 11 Structure of a PROFIBUS network – SAM 2 with Option E1: PROFIBUS master

- | | |
|---|---|
| ① SAM 2 | ③ PROFIBUS plug with terminating resistor position: ON |
| ② Machine with SIGMA CONTROL or SIGMA CONTROL 2 | ④ PROFIBUS plug with terminating resistor position: OFF |

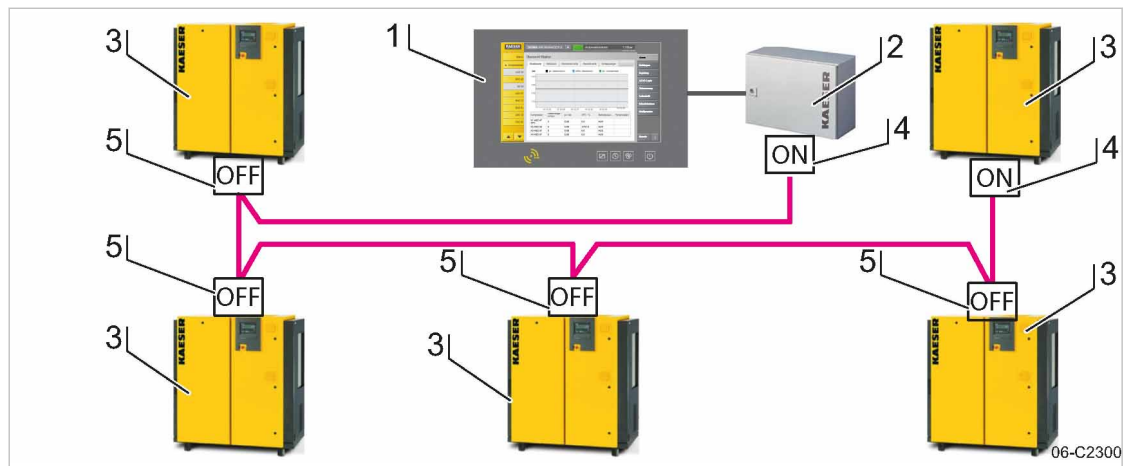


Fig. 12 Structure of a PROFIBUS network – SBU with Option E1: PROFIBUS master

- | | |
|---|---|
| ① SAM 2 | ④ PROFIBUS plug with terminating resistor position: ON |
| ② SBU | ⑤ PROFIBUS plug with terminating resistor position: OFF |
| ③ Machine with SIGMA CONTROL or SIGMA CONTROL 2 | |

6.9.3 Floating contacts

The connection of conventional machines without SIGMA CONTROL or SIGMA CONTROL 2 via floating contacts is realised in star pattern, that is, each machine is directly connected to SAM 2 or SBU if more I/O conductors are required.

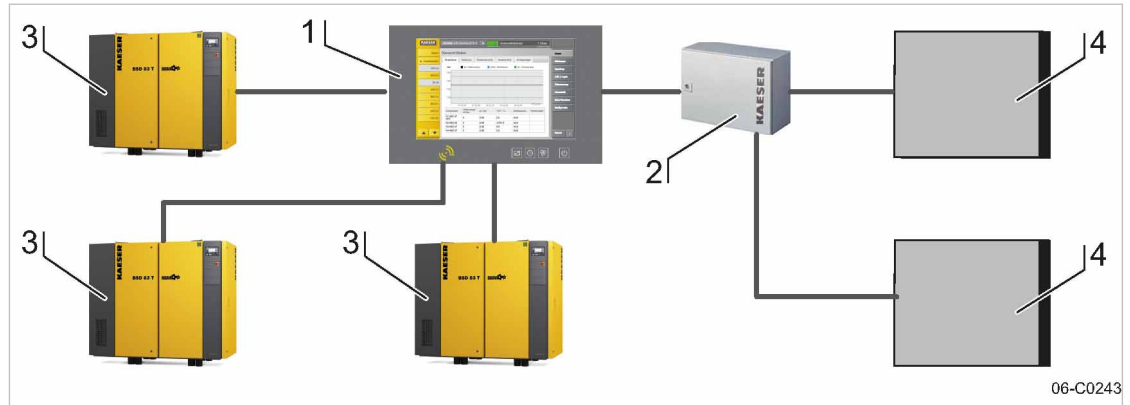


Fig. 13 Configuration of the network with floating relay contacts

- ① SAM 2
- ② SBU
- ③ Machine with SIGMA CONTROL or SIGMA CONTROL 2
- ④ Machine connected via floating relay contacts

6.9.4 Instructions on the electrical installation

- A supply disconnecting device to EN 60204 must be installed by the user.
- Do not exceed the following maximal values for the cable lengths:

Model	Maximum cable length [m]	Remark
SIGMA NETWORK	100	Maximum cable length between two SIGMA NETWORK components.
Digital transistor outputs	30	
Digital relay outputs	100	
Digital inputs	30	
Analogue inputs	30	screened
PROFIBUS	800	Maximum cable length of the entire PROFIBUS.

Tab. 28 Maximum cable lengths

- Use galvanic isolation on cables laid outside the building to ensure increased lightning protection (preferably fibre optic cable).
- See chapter 2 for conductor types and cross-sections and the wiring diagram in chapter 13.8 for cable selection. We recommend to use flexible stranded wires wherever possible.
- This suppressor is suitable for inductive loads connected to the relay outputs.

6.9.5 Prerequisites and accessories required for connection with SIGMA NETWORK

Prerequisites: For each SIGMA NETWORK device (SIGMA CONTROL 2 machine, SBU) a SIGMA NETWORK port is provided.

The following accessories are required for the construction of a SIGMA NETWORK (see annex for material numbers):

- SIGMA NETWORK cable.
- For SAM 2 : One RJ45 bus connector for every SIGMA NETWORK to be connected.
- For SBU : One RJ45 bus connector for every SIGMA NETWORK to be connected.
- For every SIGMA CONTROL 2 machine: LAN RJ45 retrofit kit.

6.9.6 Prerequisites and accessories connection with PROFIBUS

Prerequisites: PROFIBUS master option



When replacing a SIGMA AIR MANAGER with a SAM 2 , you can connect the existing PROFIBUS to SAM 2 without additional equipment.

The following accessories are required for the wiring machines to SIGMA CONTROL 2 (see annex for material numbers):

- PROFIBUS cable
- For SAM 2 or SBU : PROFIBUS connector
- For every machine with SIGMA CONTROL: PROFIBUS plug set for SIGMA CONTROL

6.9.7 Requirements for connecting with floating relay contacts



Connect a floating output from SAM 2 or SBU in series with the existing pressure regulation (main pressure switch or electronic pressure regulation) of the machine.



Avoid overload of the electric supply caused by simultaneous starting of compressors connected by floating relay contacts. You can stagger the start times by installing a timing relay in some compressors.



In stations with EMERGENCY operation, compressors connected via floating relay contacts will start when the compressor pressure is below the compressor's cut-in pressure **and** one of the following conditions is met:

- The voltage supply at SAM 2 and the compressor fails and returns simultaneously.
- The voltage supply at SAM 2 fails but not at the compressor.
- SAM 2 fails.

Required equipment for machines to be connected to SAM 2

SAM 2 design	Equipment
Up to 4 machines are connected via floating relays contacts to SAM 2 or SBU :	
SAM 2-4/SAM 2-8	An "external load control" input. An additional "motor running" floating relay contact (normally open) is recommended.
More than 4 machines are connected via floating relays contacts to SAM 2 or SBU :	

SAM 2 design	Equipment
SAM 2-16	<p>A "manual/automatic mode" / "LOAD/IDLE" control input with a system pressure switch in manual mode (-B1.1).</p> <p>A "pressure switch in series with SAM 2" (-B1) or a pressure switch blow-off protection pressure relief valve (-B6).</p>
	A "motor running" floating relay contact (normally open).
	A "ON and no alarm" floating relay contact (normally open).

Tab. 29 Required equipment

If a machine is not prepared for connection to SAM 2, it can be retrofitted. Documents and parts for the retrofit are available separately.

6.10 Laying cables



DANGER

Contact with live electric components can cause serious injury or death.

- De-energise SAM 2 / SBU and external power sources.

1. Switch off all phases of SAM 2 / SBU and external power sources.
2. Lock against reactivation.
3. Observe all accepted safety regulations and national legislation applicable to all work carried out on the SAM 2 / SBU.
4. Have SAM 2 / SBU connected to the power supply by an authorised and qualified electrician to national legislation and the regulations of the electricity company concerned.



The terminals of SAM 2 / SBU must be identified with one of the following alternatives as they may carry voltage even when the power supply is shut off.

- Orange
- Label

5. Create the connections to the power supply, the individual machines and the component as detailed in the circuit diagrams.

6.10.1 Creating SIGMA NETWORK

1. Lay SIGMA NETWORK cables.
 - For details to create SIGMA NETWORK, see Fig. 10.
 - For details of the connection at the machine, see the description for "LAN retrofit kit SIGMA CONTROL 2".
 - For details of the connection at SAM 2 or SBU, see chapter 6.11.
2. For maximal cable lengths, see chapter 6, "Notes to the electrical installation".

6.10.1.1 Installing the RJ45 bus connector

To connect to SIGMA NETWORK , you must connect the network subscribers according to the SIGMA NETWORK conduit.

- Feed the network cable to the SIGMA NETWORK devices on both sides through one EMC screw fitting.
- Use an RJ45 bus connector at both ends of the network cable.

Installing the RJ plug

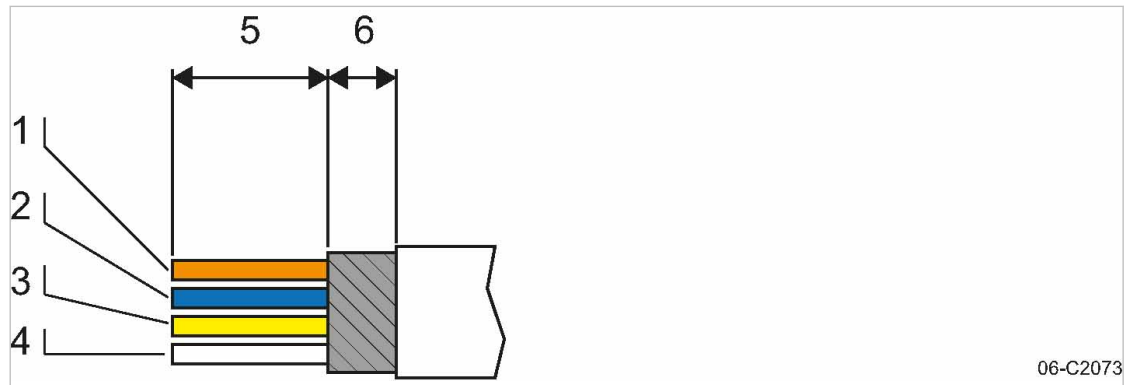


Fig. 14 Strip the isolation from the network cable.

- | | |
|----------|---------|
| ① Orange | ④ White |
| ② Blue | ⑤ 18 mm |
| ③ Yellow | ⑥ 5 mm |

1. Stripping the network cable isolation (see Fig. 14).



The RJ45 plug and the network cable can be damaged if unlocked under strain.
➤ Always release strain on the RJ45 plug prior to unlocking.

2. Spread the conductors according to the colour coding of the contact element of the RJ45 connector (see Fig. 14).

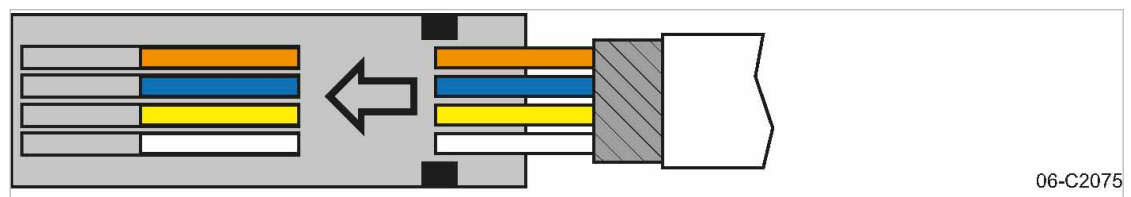
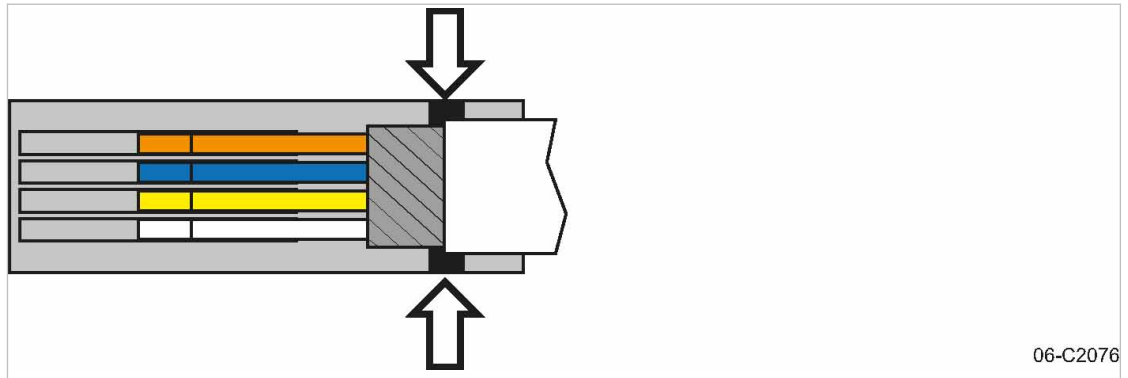


Fig. 15 Inserting the network cable conductors

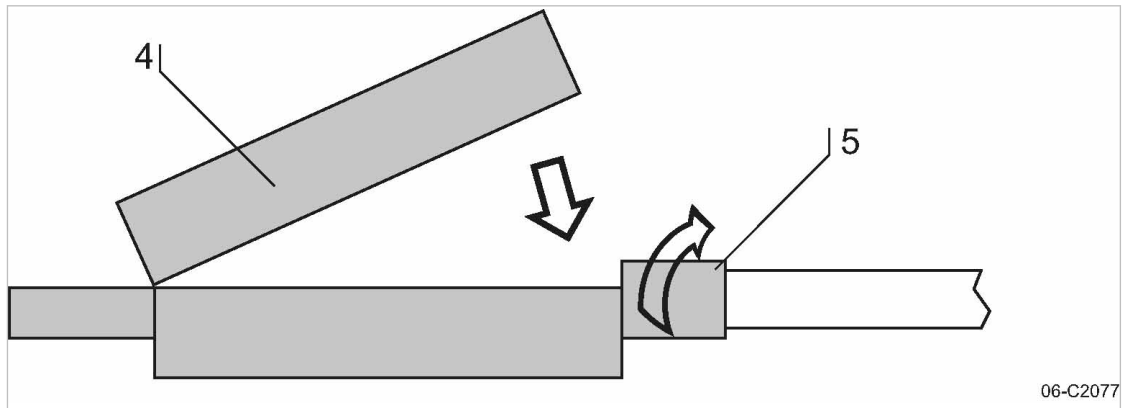
3. Insert the conductors into the contact elements up to the end stop.



06-C2076

Fig. 16 Positioning the network cable

4. Position the network cable as shown (arrows, see Fig. 16).

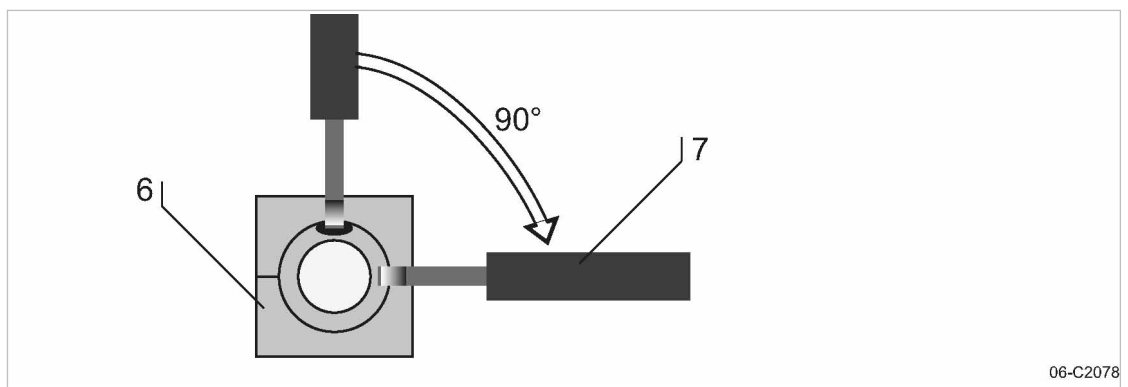


06-C2077

Fig. 17 Close the lid of the RJ45 plug.

- ④ RJ45 plug lid
- ⑤ Rotatable locking piece

5. Close the lid and manually rotate the locking piece clockwise as far as possible.



06-C2078

Fig. 18 Rotating the locking piece to the stop

- ⑥ RJ45 plug (view from cable end)
- ⑦ Screwdriver

6. Insert a screwdriver with 2.5 mm blade width into the bore and rotate the locking piece clockwise up to the end stop.



Contact issues with conductor ends after multiple contact creation.
➤ Cut off contacted conductor ends and again strip the conductors.



The insulation displacement contacts of the plug may be disconnected and re-contacted up to 10 times.

Result The plug is correctly locked when the opening of the locking piece is facing sideways and the side surfaces are flush with the plug.

6.10.2 Creating the PROFIBUS network



When replacing a SIGMA AIR MANAGER with a SAM 2 , you can connect the existing PROFIBUS to the SAM 2 .

1. Install PROFIBUS cables.
 - See Fig. 11 for details about the creation of a PROFIBUS network.
 - See the installation instructions for the "PROFIBUS retrofit kit" for details about the machine integration.
2. Switch the terminating resistor ③ (see Fig. 11) at both ends of the PROFIBUS to the ON position.
3. See the wiring diagrams in the annex for cable types, cross-sections and maximum cable lengths.

6.10.2.1 Connecting the PROFIBUS cable

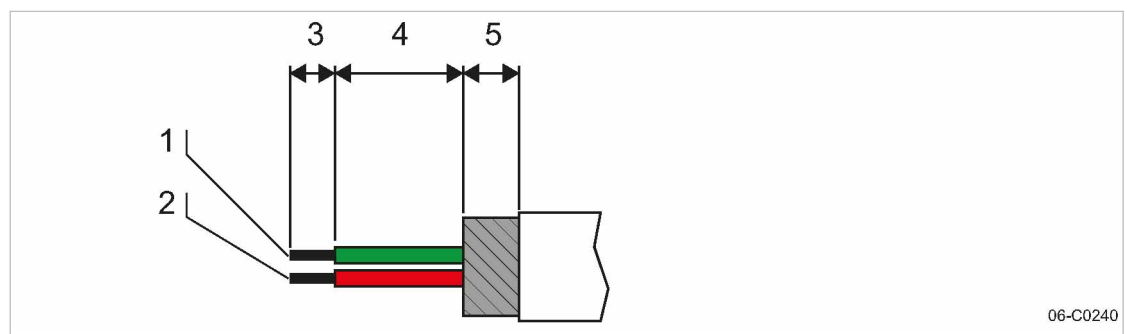


Fig. 19 Stripping the isolation from the PROFIBUS cable

- | | | | |
|---|-----------------|---|-------|
| ① | Green conductor | ④ | 13 mm |
| ② | Red conductor | ⑤ | 6 mm |
| ③ | 5 mm | | |

1. Strip the isolation from the PROFIBUS cable as shown.
2. Connect the green conductor ① to the green terminal "A" of the PROFIBUS plug.
3. Connect the red conductor ② to the red terminal "B" of the PROFIBUS plug.

6.10.2.2 Installing the PROFIBUS plug



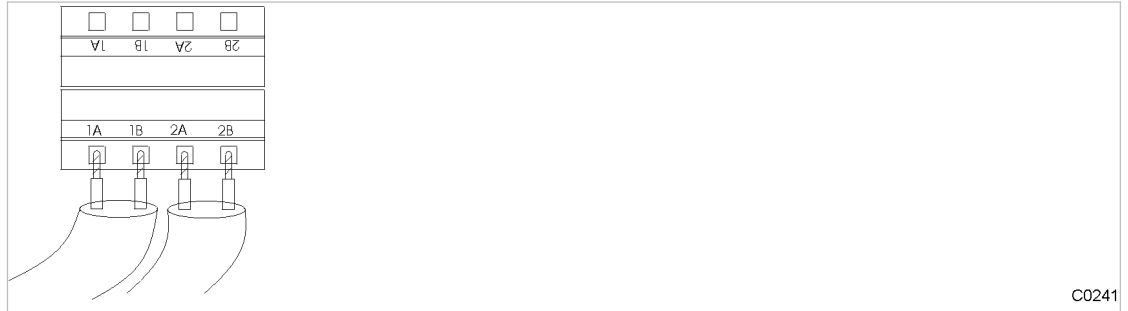
NOTICE

Too tight a bend radius can cause a defect in the PROFIBUS cables.

- Do not bend the PROFIBUS cable.

Subscribers in the middle of a PROFIBUS network:

Install the PROFIBUS plug at one of the inline subscribers to the PROFIBUS network:



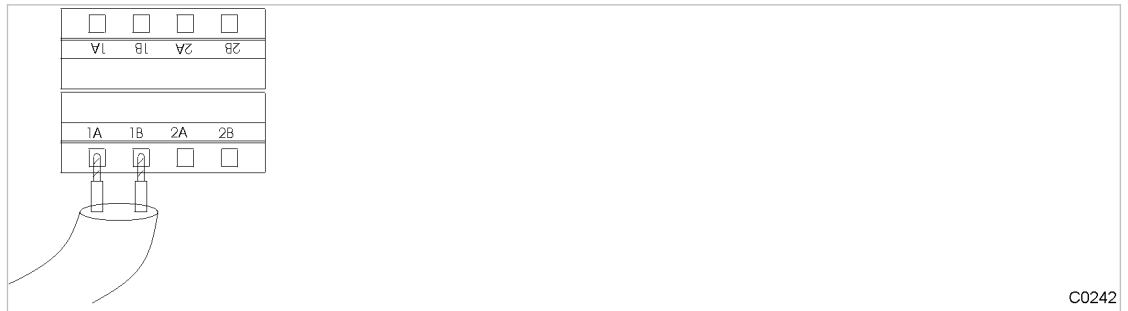
C0241

Fig. 20 Connection of an inline plug

1. Connect two PROFIBUS cables (input and output)
2. Set the terminating resistor in the PROFIBUS plug to OFF.

Subscribers at the end of the PROFIBUS network

Install the PROFIBUS plug at a terminating subscriber and at the SAM 2 :



C0242

Fig. 21 Installation of a terminating PROFIBUS plug

1. Connect one PROFIBUS cable (input only).
2. Set the terminating resistor in the PROFIBUS plug to ON.

6.10.3 Creating the compressor station via floating relay contacts

1. Use conventional wiring.
 - For details of creating a network with floating relay contacts, see Fig. 13.
2. Directly connect each machine with SAM 2 or SBU .

6.10.3.1 Wiring modifications to the machine



Interruptions to the air supply caused by unsuppressed inductive loads connected to the relay outputs of SAM 2 or SBU , such as auxiliary contactors or solenoid valves.

1. Suppress inductive loads with an RC interference suppressor.
2. Connect the interference suppressor in parallel directly at the coil (connections A1–A2). If the connections are inaccessible, in solenoid valves for example, the suppressor can also be connected to the corresponding terminals on the terminal strip.
3. Use an RC interference suppressor suited to the coil voltage and apparent holding power, see chapter 13.6.

Machine with "external load signal" control input

KAESER machines from 1990 onwards with terminal 32W:

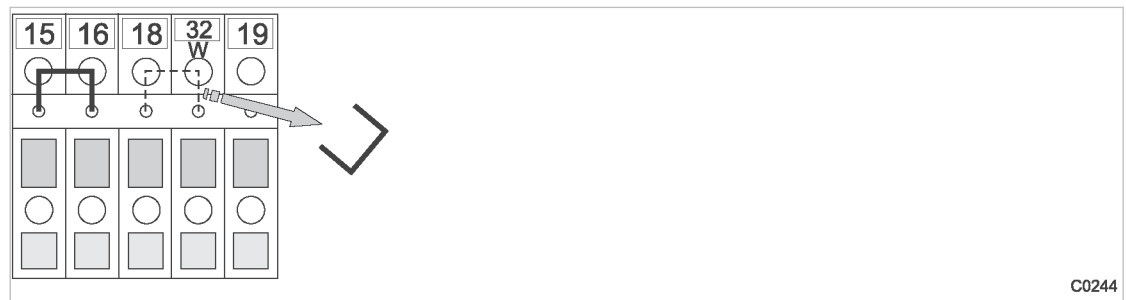


Fig. 22 Remove the wire jumper.

- Remove the jumper between the terminals (terminals 32W and 21 or 18) to allow sequencing.

Machines without terminal 32W

1. Fit terminal 32W in the terminal strip.
2. Disconnect the conductor (A) of the mains pressure switch cable connected to terminal 18.
3. Disconnect the conductor (A) of the mains pressure switch cable connected to terminal 21.
4. Connect the conductor (A) to terminal 32W.

6.10.3.2 Machine with one control input for "Operating mode Manual/Automatic" / LOAD/IDLE

KAESER machines from 1990 onwards:

If a jumper is connected between the terminals for manual operation [-X1 (W) 20 or 17 and -X1 (W) 24 (W)] on the terminal strip for connection of SAM 2 or SBU, then it must be removed. A more precise designation of the terminals is given in the electrical diagrams for the machine.

- Remove wire jumper if necessary.

6.11 Connecting lines

6.11.1 Wiring the control cabinet

Precondition The control cabinet is properly attached to the wall as described in chapter 6.6. The base plate is freely accessible.

- Wire the control cabinet as described below.

6.11.2 Connecting the equipotential bond

1. Connect the enclosure with a user-supplied equipotential bond at the corresponding equipotential bond connection ③.
2. Keep the connection as short as possible.
3. Use an earth strap or cable with a cross-section of at least 16 mm².

6.11.3 Feeding cables and connecting the screening

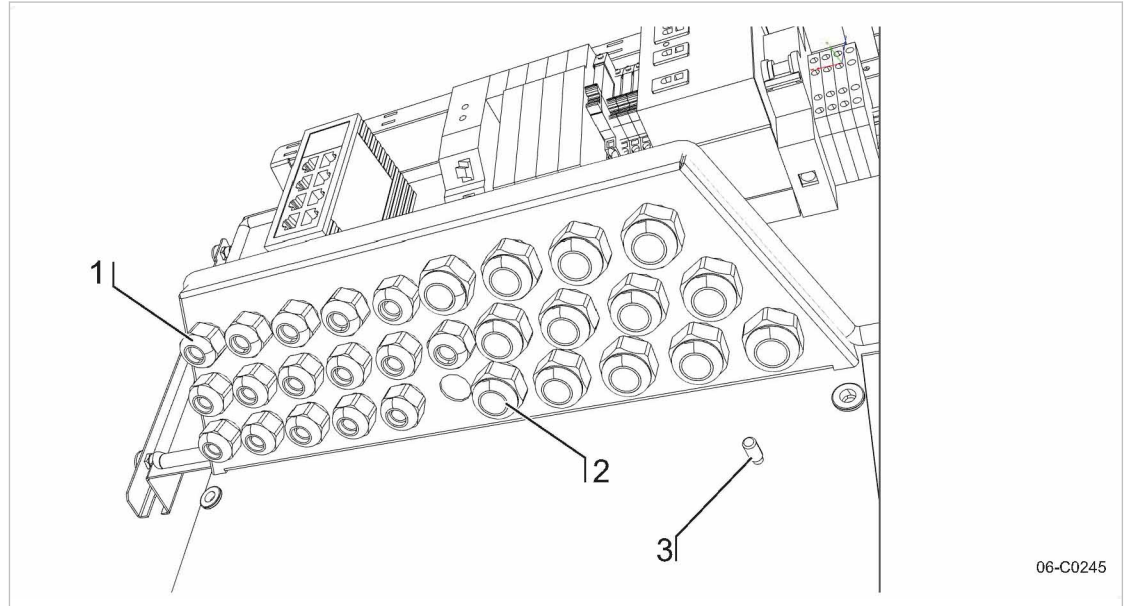


Fig. 23 Cable glands with and without ferrite suppressors

- ① Metallic cable glands for screened cables (analogue inputs, SIGMA NETWORK , PROFIBUS, cables to the COM module and the user's LAN)
- ② Plastic cable glands for unscreened cables (common supply line, digital inputs, digital outputs)
- ③ Equipotential bond connection (stud)

1. Feed screened cables (analogue inputs, SIGMA NETWORK , PROFIBUS, cables to the COM module and the user's LAN) through the metallic cable glands ①. Connect the screening as described below.
2. Feed unscreened cables (common supply line, digital inputs, digital outputs) through the plastic cable glands ②.

Connecting the screening

At the control cabinet:

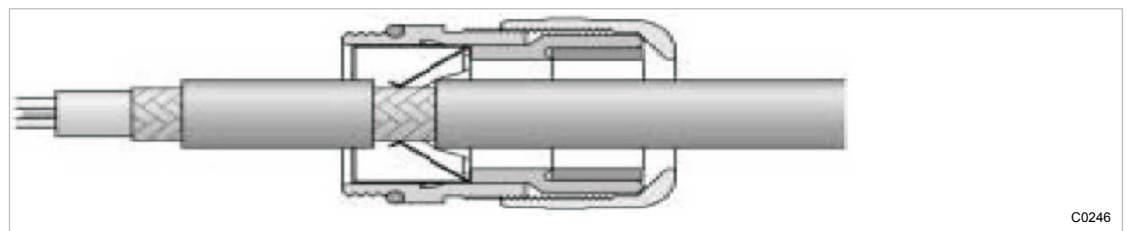


Fig. 24 Connecting the screening

1. Strip off the cable insulation by about 1 cm where the cable passes through the cable gland.
2. Push the cable through the metal cable gland on the control cabinet until the stripped section snaps in and contacts the earth clamp in the cable gland.

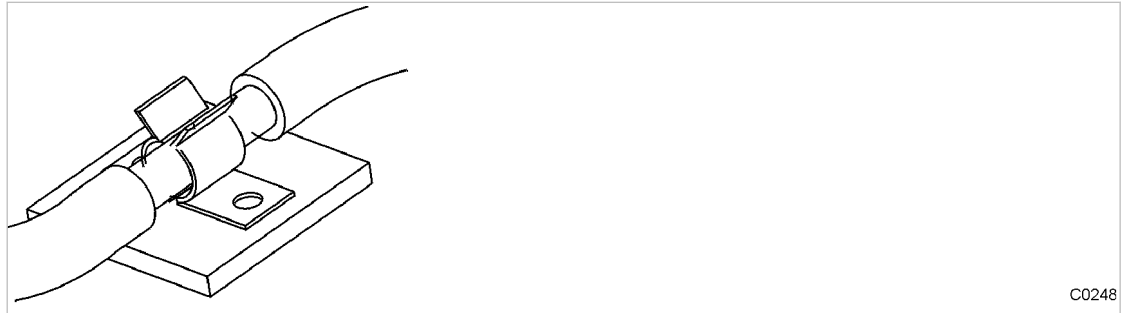
Connecting the screening for the user's LAN


Fig. 25 LAN conduit screening

1. Strip off the cable insulation by about 1 cm at the terminal.
2. Ensure electrical contact of the cable screening with the screening clamp.

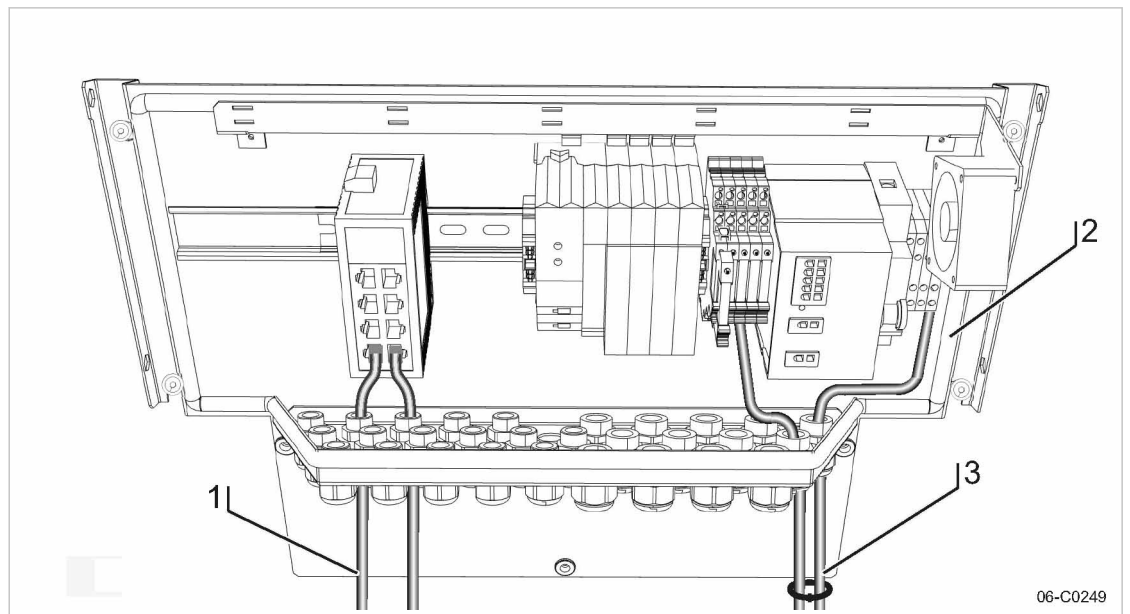
6.11.4 Laying the cables in the control cabinet


Fig. 26 Laying the cables in the control cabinet

- ① Cables with voltages up to 24 V (digital inputs, analogue inputs, SIGMA NETWORK , PROFIBUS, cables to the COM module and the user's LAN, relay outputs, if provided)
- ② SAM 2 control cabinet
- ③ Cables with 115/230 V AC voltage (common supply line, relay outputs, if provided)

1. Use cable ties to bundle all 115/230 V AC cables and keep them separate from all other cables.
2. Install the bus cables to the SAM 2 terminal so that they will not be kinked by opening and closing the cover.

6.11.5 Connecting the cables

1. Make the connections to terminals and interfaces as detailed in the attached wiring diagram.
2. Connect external sensors according to the wiring diagram in the annex.
3. For installing the RJ45 bus connector, see chapter 6.10.1.
4. For installing the the PROFIBUS plug, see chapter 6.10.2.

6.11.6 Installing the control cabinet

Precondition The base plate of the control cabinet is properly attached to the wall (see chapter 6.6).
The control cabinet is fully wired (see chapter 6.11.1).

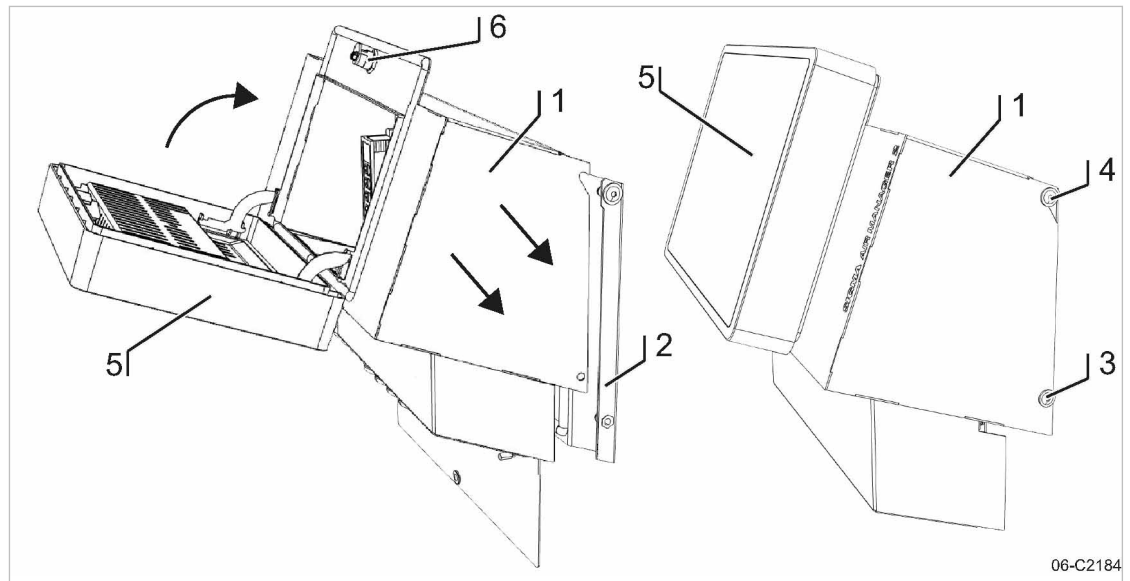


Fig. 27 Installing the control cabinet

- | | |
|-------------------------|---------------------|
| ① Control cabinet cover | ④ Screw M 6x16, SW4 |
| ② Base plate | ⑤ SAM 2 terminal |
| ③ Screw M 6x16, SW4 | ⑥ Spagnolet |

1. Mount the control cabinet cover ① on the base plate ②.
2. Install the control cabinet cover ①, using the four screws ③ and ④ on the base plate ②.
3. Connect the internal cables leading from the base plate ② to the SAM 2 terminal ⑤.
4. Close the SAM 2 terminal ⑤.
5. Lock the spagnolet ⑥ at the control cabinet cover ① with the control cabinet key (two-way type, 3 mm).

6.12 Setting up the machines



NOTICE

Damage to drive motors can occur when the permissible motor starting frequency is exceeded on machines without idle control (piston compressors, blowers).

- Set the SAM 2 pressure band to a width which ensures that the switching frequency is not exceeded.
- If necessary, increase the capacity of the air receiver.

Precondition The settings described in this section must be entered in full for every machine to ensure faultless operation. Make sure that the compressed air system remains in operation should the SAM 2 fail.

- Carry out settings as detailed in this manual.

6.12.1 Integration with SIGMA NETWORK



The prescribed procedure for the setting of SIGMA CONTROL 2 machines is described in the corresponding operating manuals.

Only use the current software version for SIGMA CONTROL 2 .

Set the IP address of the network subscribers as follows:

SAM 2 : IP address = 169.254.100.“Machine number +100“



SAM 2 does **not** automatically assign the IP addresses to the network users. Either the wrong machine or no machine at is controlled if an incorrect IP address is assigned.

1. Enter system pressure pB (p₂ and set as default for "Manual mode pressure".



Simultaneous activation of the machines in manual mode

- In manual mode, the pressure set point of each machine should be staggered by 0,3 bar to prevent all machines starting together. The stagger time for station operation must be set. Suggestions for these settings are found in the annex (see chapter 13.5.2).

2. Activate and setting up automatic restart after a power failure.
3. Configure the operation at the SIGMA NETWORK .

6.12.2 Integration with PROFIBUS



The correct procedure for setting up SIGMA CONTROL machines is described in the corresponding operating manuals.

Note the settings made in the appropriate form in the attachment.

Set the slave numbers of the PROFIBUS devices as follows:

- SIGMA CONTROL Slave No. = Machine number +2
- SIGMA CONTROL 2 : Slave No. = Machine number +102



Either the wrong machine or no machine at is controlled if an incorrect slave number is entered.

1. Enter system pressure pB (p₂ and set as default for "Manual mode pressure".



Simultaneous activation of the machines in manual mode

- In manual mode, the pressure set point of each machine should be staggered by 0,3 bar to prevent all machines starting together. The stagger time for station operation must be set. Suggestions for these settings are found in the annex (see chapter 13.5.2).

2. Activate and setting up automatic restart after a power failure.
3. Configure PROFIBUS operation.

The following settings are recommended as parameters for bus alarms:

Parameter	Value	Meaning
Start td:	40.0 s	Maximum period that the machine waits for a signal from the PROFIBUS after return of the power supplies. If no signal arrives before the period ends, the machine switches to self-control.

Parameter	Value	Meaning
Timeout	5.00 s	Period after which the machine switches to self-control if a fault occurs in SAM 2 .
Restart	Auto	Not at SIGMA CONTROL 2 . The machine automatically connects again when the PROFIBUS runs again after a bus alarm.
Restart	man.	Not at SIGMA CONTROL 2 . After a bus alarm the machine remains under its own internal control until it is connected to the bus again when the «remote» key is pressed.

Tab. 30 Parameter for bus alarm

- Repeat steps 1 to 3 for any further machines.

6.12.3 Linking via floating relay contact

Precondition The machines are provided with the relay contacts required and they are wired up (see chapter 6.9.7).

- Note the settings made here in the table in the annex (see chapter 13.5)



Rotary screw compressors always have an EMERGENCY mode. Piston compressors and blowers may or may not have this facility.

6.12.3.1 Stations with EMERGENCY mode facility

- In automatic mode, SAM 2 assumes the LOAD / IDLE regulation.
- In manual mode, the machines run under the control of their own internal pressure regulation.

Machine with "External load control" input

When the machine is linked, the machine pressure regulation (mains pressure switch (-B1) or electronic pressure control) remains in operation. The system automatically runs in emergency mode via these pressure switches if power to the SAM 2 fails or the SAM 2 itself malfunctions, ensuring a further supply of compressed air.

- Set the pressure control.

Further information For more information about the suggested settings for the pressure control, see Annex, chapter 13.5.1.

Machine with one control input for "Operating mode Manual/Automatic" / LOAD/IDLE

A "blow off protection pressure relief valve" pressure switch (-B6) or a "pressure switch in series to the SAM 2 load output" (-B1) is fitted in the machines to prevent one of the following:

- The machine is overloaded
- The pressure relief valve responds due to:
 - switching points set too high
 - defective master controller
 - excessive pressure loss between the machine and the pressure transducer of SAM 2 .

- Set the "pressure switch in series to the SAM 2 load output" (-B1). See chapter 13.5.1 for recommended settings.
- Set the "pressure switch for manual operation (-B1.1) **in sequence** to ensure that the machines cut in after another. See chapter 13.5.2 in the Annex for recommended settings.

6.12.3.2 Stations without emergency mode capability

Blowers and reciprocating compressors are not fitted with a pressure switch that could ensure EMERGENCY operation.

When these machines are connected, the IDLE switching is controlled by SAM 2 .



These stations will stop delivering compressed air if SAM 2 fails.

- Take suitable application-specific measures.

7 Initial Start-up

7.1 Commissioning – overview

SAM 2 has been designed and developed for a number of applications. The settings that can be made are correspondingly varied.



When shipped, SAM 2 is preconfigured with a standard configuration. Generally, most of these settings can be used for many applications or need only minor modifications. Thus, not all the steps listed below may be required for the initial start-up. This depends on the application involved.

topic	Description
Switch on SAM 2	Chapter 7.2 Switch on "SAM 2"
Setting the Language	Chapter 7.3 "Language"
User log-on	Chapter 7.4 "User log-on"
Setting the time zone, date and time	Chapter 7.5 "Date and time"
Setting the Unit settings	Chapter 7.6 "Unit settings"
Setting the E-Mail	Chapter 7.7 "E-Mail"
Setting up the display	Chapter 7.8 "Display"
Data recording	Chapter 7.9 "Data recording"
SAM 2 Upgrade	Chapter "Upgrade"
Peripherals	Chapter 7.10 "Peripherals"
P+I diagram	Chapter 7.11 "P+I diagram"
Control	Chapter 7.12 "Control"
SAM 2.Logic	Chapter "SAM 2.Logic"
Time control	Chapter "Time control"
Process control	Chapter "Process control"
Activating the controller	Chapter 7.13 "Activating the controller"

Tab. 31 Commissioning – overview

7.2 Switching on SAM 2

Precondition Nobody works at the machines.

All maintenance doors and removable panels are properly installed, closed and secured.


All installation tasks and wiring as described in chapter 6 "Installation" are properly completed.

The ambient conditions as described in chapter 5 "Installation and Operating Conditions" are met.







1. **NOTICE!**



There is risk of damage to the compressed air supply through premature changeover to automatic mode.

- Press Automatic mode  only when all settings required for commissioning (see chapter 7 "Initial Start-up") have been made.

- Switch on the power supply for SAM 2 at the user's power supply isolating device.
SAM 2 starts. The machine is switched on when the "Main menu" appears (after 2 minutes approximately).

Symbol	Operating element	Key illumination
	Button remote control	Green
	Button time control	Green
	Button automatic	Green
	Button station On/Off	Green/red

Tab. 32 Keys on the SAM 2 operating panel


- Ensure that SAM 2 is set to *Manual mode* mode. The  key does **not** illuminate.
- If the  key illuminated green, press again this key for the illumination to extinguish.



- Stations without EMERGENCY operation will not deliver compressed air (see chapter 6.4 "Installation").
- In compressed air systems with EMERGENCY operation capability, the machines run under their own internal pressure control (see chapter 6.4 "Installation").

7.3 Setting the language

You can choose and set the user interface language for the SAM 2 .

- Press **Configuration** → **Language** .
The *Language* menu displays the currently set language.
- Touch the  symbol.
The available languages are displayed in a list.
- Select the desired "Language (country)" combination.
SAM 2 loads and automatically displays the selected language.

7.4 User log-on

Together with your SAM 2 , you received two KAESER Equipment Cards. They authorise the user to log on to SAM 2 and make or change settings.

The KAESER Equipment Cards provide various functionalities:

- Switch between three operating modes:
 - Logged out
 - Monitoring
 - Operating
- Encryption ensures security
- Different access levels for the customer (Equipment Card) and Service (Key)

The system records which user is when logged on at SAM 2 . You can thus determine who was logged on when specific messages or other events have occurred.

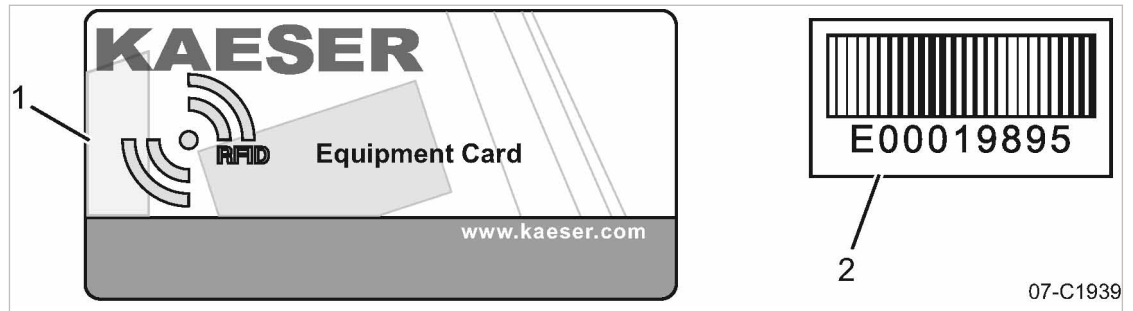


Fig. 28 KAESER Equipment Card

- ① KAESER Equipment Card
- ② Number on the back of the KAESER Equipment Card

1. Remove the Equipment Card from the plastic sleeve.
2. Record the number shown on the back of the Equipment Card and keep it at a secure location.

7.4.1 Log on with Equipment Card

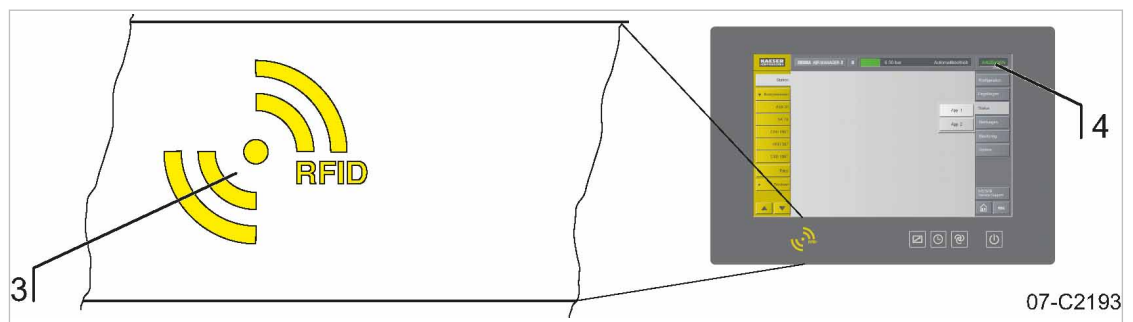


Fig. 29 RFID reader

- ③ RFID reader
- ④ ACCESS MODE menu element

1. Hold the Equipment Card ① directly in front of RFID reader ③. The log-on data are read.
If the system recognises the Equipment Card, it returns a message ⑤. The message comprises information about User name and Access level .

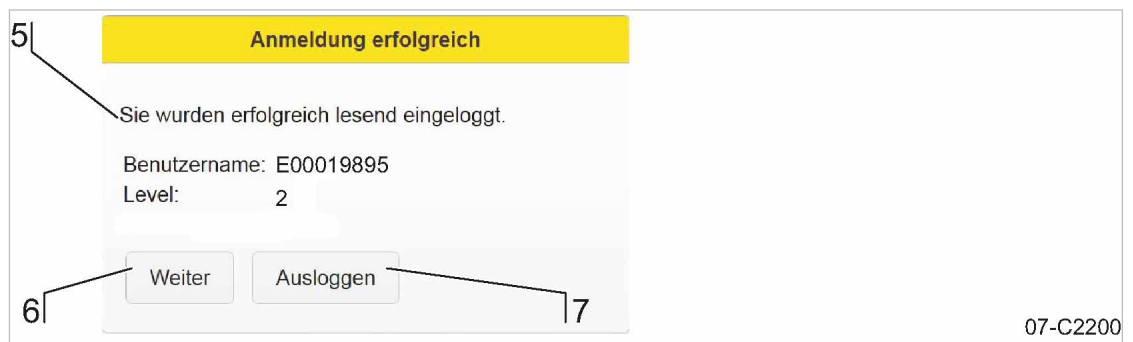


Fig. 30 Logged on

2. Press **Continue** (6) to confirm the message.
The message window closes.
The user is now logged on with *Monitoring* access level. This shown in the *ACCESS MODE* (4) menu element.
3. To switch to "Operating", repeat this procedure from Step 1.
The user is now logged on with *Operating* access level. This shown in the *ACCESS MODE* (4) menu element.

7.4.2 User log-out

1. To log out from the system, hold the Equipment Card (1) directly in front of the RFID reader (3).
If the system recognises the Equipment Card, it returns a message (5).
2. Press **Logout** (7) to log out.



The access level will automatically return to "Logged out" after 10 minutes without user intervention.

7.5 Date and time

You must set the time zone in which the SAM 2 is operated and the current date and time. This is required to ensure proper functioning of the machine controller, messages, logs and evaluations.

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").

- Enter the settings in the sequence described below:

7.5.1 Setting the time zone

Set the time zone for the SAM 2 to ensure the timely automatic conversion from standard time to daylight savings time, for example.

1. Press **Configuration** → **Date and time** .
The *Date and time settings* menu is displayed.
2. Press the **Time zone** key.
3. Use the scroll wheel to move up or down to set the time zone. The display value in the centre is saved as the setting.
Use the scroll wheel to move up or down to set the time zone for the device.
4. Press OK to apply the set time zone.

7.5.2 Setting date and time

1. Press **Configuration** → **Date and time** .
The *Date and time settings* menu is displayed.
2. Press the **Current** key.

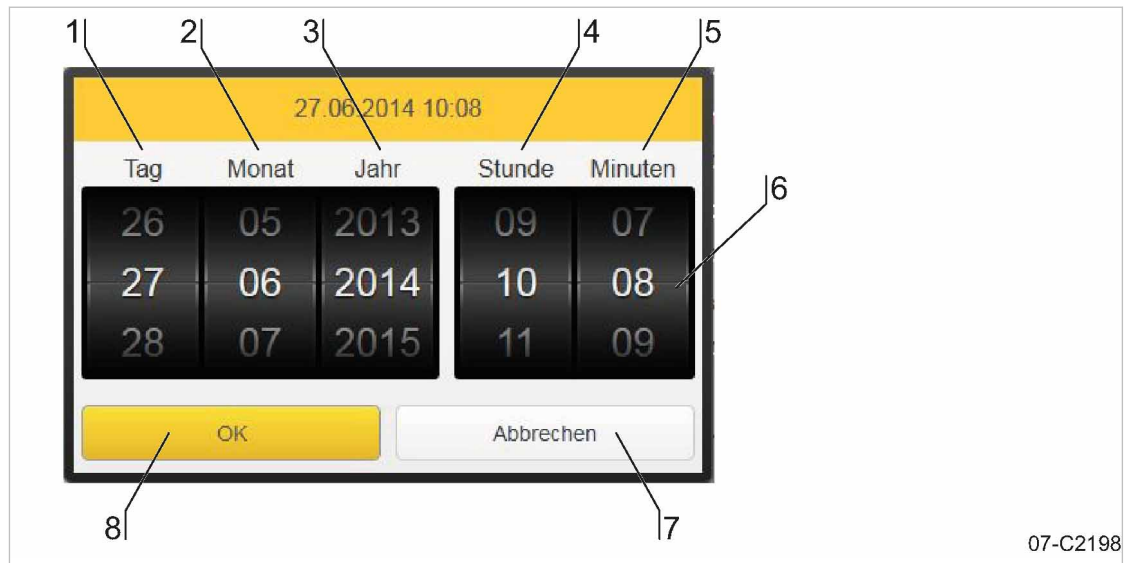


Fig. 31 Setting date and time

- | | |
|---------|----------------|
| ① Day | ⑤ Minute |
| ② Month | ⑥ Scroll wheel |
| ③ Year | ⑦ Cancel |
| ④ Hour | ⑧ OK |

3. You can the scroll wheels ⑥ up or down to change the setting values for date and time. The display value in the centre is saved as the setting. Use the scroll wheels ⑥ to set each value for:

- ① Day
- ② Month
- ③ Year
- ④ Hour
- ⑤ Minute

to the current date and current time.

4. Press OK ⑧ to apply the set date and time.

The display field *Current* : displays the set date and time for verification



- Regularly (at least once a year) check the time for deviations and adjust, of necessary.
- The change between daylight savings time and standard time is automatic and follows the rules for the set time zone.

7.6 Setting the Unit settings

You can adjust the units for some parameters in SAM 2 to the standards in the country of installation. The system automatically calculates and displays the correct units.

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").


1. Press Configuration → Unit settings .

The *Unit settings* menu displays the currently set units.

Parameter	Unit settings
Pressure	bar, psi, M Pa, mbar

Parameter	Unit settings
Free air delivery	m ³ /min, CFM
Volume	m ³ , cft
Power	kW, W
Specific power	kWmin/m ³ , kWmin/cft
Temperature	°C, °F
The factory-set units depend on the "language" set.	

Tab. 33 Unit settings

2. Touch the  symbol in the line of the parameter to be changed.
The available units are displayed in a list.
3. Select the desired unit.
SAM 2 saves the selected unit and uses it for all display values referenced.

7.7 Setting up E-Mail

You can set up the sending of messages via e-mail in SAM 2 . The *E-Mail* menu has the following sub-menus:

- Send options
- Basic settings

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").

7.7.1 Send options

Use the *Send options* menu to set the parameters required for sending messages via e-mail.

1. Press **Configuration** → **E-Mail** .
Select the *Send options* sub-menu.

The *Send options* sub-menu displays the following e-mail parameters:

Parameter	Meaning
Send message	Touch the option box <i>Active</i> to set a check mark and activate the e-mail sending of messages. Remove the check mark and e-mail sending is deactivated.
Sender's name	In this field, enter the name to appear as the sender of e-mails. Touch the input field to display a virtual keyboard. Confirm with Accept to apply the entry.
Contact's phone number	In this field, enter a telephone number under which the system operator can be reached. This telephone number is indicated with the e-mail.
Repeated send suppression time	The repeat lock time specifies the time interval during which a message cannot be resent if the same message has already been sent by e-mail. This prevents multiple sending operations of the same e-mail if a message trigger (e.g., a loose contact) occurs several times in a short period of time.
Send-attempt interval	In this field, enter the time in seconds to be waited after a failed e-mail sending operation before the system again attempts to send.

Parameter	Meaning
Send-attempt duration	Use this setting to specify how long the system is to attempt to e-mail a message. In most cases (but not always), it is advisable to no longer send an old message when its cause has been probably remedied in the interim.

Tab. 34 E-Mail Send options

2. Enter the required data into the *Sender's name* and *Contact's phone number* fields.
3. The factory-set default values of the remaining data must be adjusted only if needed.
4. Select the *Basic settings* sub-menu. Use this menu to set the e-mail communication parameters required for sending messages via e-mail. Request the required information from your IT department.

The *Basic settings* sub-menu displays the following e-mail parameters:

Parameter	Meaning
Sender's e-mail address	The e-mail address used by the sender.
Receiver's e-mail address	The e-mail address of the recipient. You can only enter one e-mail address.
SMTP Host	The IP address of the SMTP mail server receiving and forwarding the message.
SMTP Port	The port address of the SMTP mail server receiving and forwarding the message.
SMTP user name	The log-in user name for logging on to the SMTP mail server.
SMTP Password	The log-in password for logging on to the SMTP mail server.
SMTP Timeout	In this field, enter the seconds for SAM 2 to wait for a reply by the SMTP server before cancelling sending.

Tab. 35 E-Mail Basic settings

5. Enter the required communication parameters into the data fields.
All data fields are completed.
6. You can now send a test message to verify the settings. Press **Send test E-mail**.
You have completed the settings upon verification of the successful reception of the test mail.
7. Select the *Send options* sub-menu.
8. In the *Send message* field, touch the **Active** option box. A check mark appears in the option box and e-mail sending is activated.

7.8 Setting up the display

You can adjust the display brightness and the time behaviour of the screen saver.

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").

1. Press **Configuration** → **Display**.
2. Set brightness and time behaviour.

7.9 Setting the Data recording

Use the *Data recording* menu to set automatic data recording for the SAM 2 .


Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").

1. Press Configuration → Data recording .

The *Data recording* menu displays the currently set parameters.

Parameter	Meaning
Data recorder active	Touch the Active option box to set a check mark and activate internal data recording.
Data to be recorded	Touch the Station map to activate data recording for the compressed air station. Touch the System information option box to activate the recording of the SAM 2 system data. These data can be useful when determining the cause of a fault.
Resolution	This setting specifies the time between the individual measuring points.
Every nth station map	Use this setting to specify whether every station map is recorded or only every second, fourth or eighth station map.
Current allocation	The system displays here information about the current memory allocation in MB and as a percentage value of the data volume internally recorded by SAM 2 .
Buffer emptied on	This variable displays the time of the last data recording reset for information purposes.
Buffer full on	This variable displays the time at which the internal data memory was full. The system no longer records data after this time.

Tab. 36 Data recording

2. If required, change the setting by touching the option box or the  symbol and selecting the available setting values.
3. In the *Data recorder active* field, touch the Active option box. A check mark appears in the option box and data recording is activated.

7.10 Periphery

The communication between SAM 2 and the connected machines and devices must be configured to ensure proper functioning.

➤ Enter the settings in the sequence described below:

7.10.1 Starting the SBU



During the registration process, you can only register one SBU at SAM 2 at any time. If you want to register multiple SBU , you have to do this in sequence. Any SBU not yet registered must remain deactivated.

Follow the following sequence to ensure the proper commissioning of the SBU .

Precondition All installation tasks and wiring as described in chapter 6 "Installation" are properly completed.
The SAM 2 is switched on.
SBU is switched off at the supply disconnect device

1. Switch on the supply disconnect device for the SBU .
The L/A IF1 LED at the Bus controller of the SBU illuminates green.
At the SAM 2 , a pop-up window displays *New Bus controller detected*.
2. Press the Create new block (4) key.
A pop-up window displays *New I/O block added*

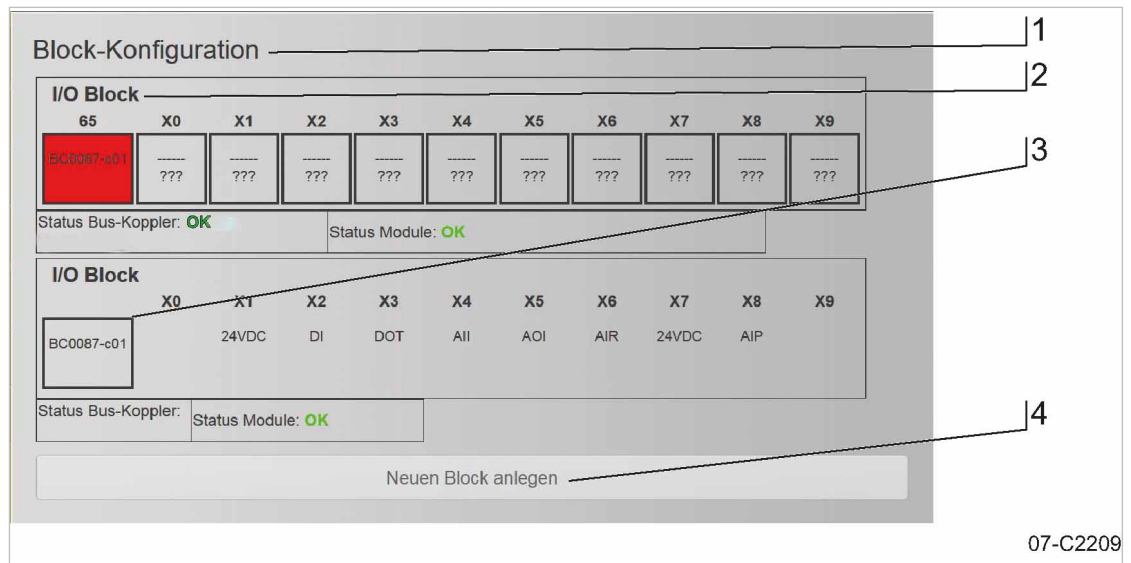


Fig. 32 Block configuration menu

3. Press **Configure new I/O block**.
The *Block configuration* menu opens.
Alternatively, you can manually access this menu: Press **Start-up** → **SIGMA NETWORK**.

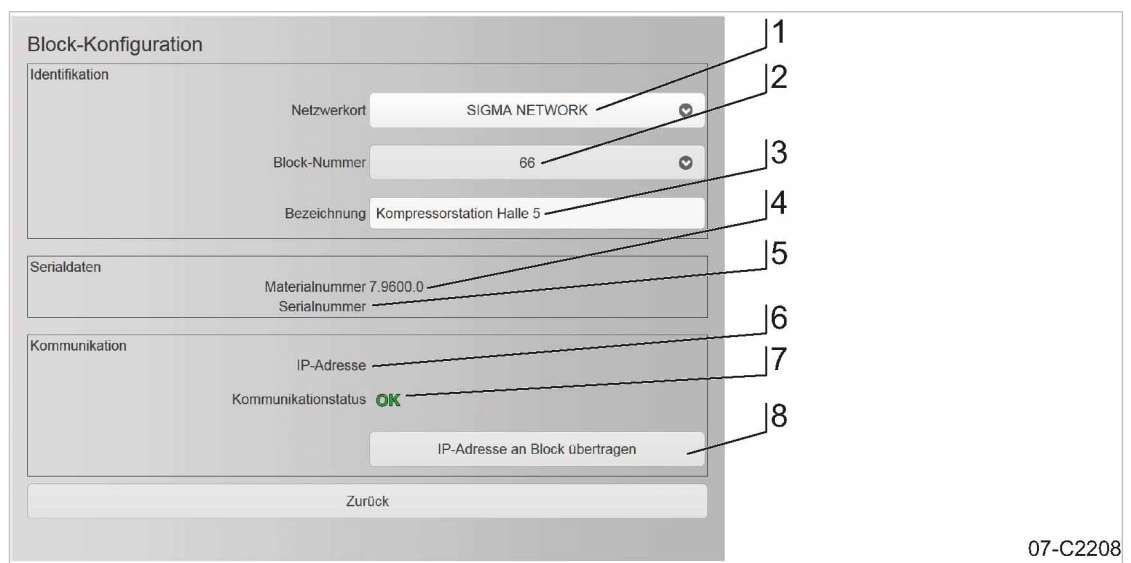


Fig. 33 I/O block menu

4. Select I/O block 66 [2].

The *Block configuration* sub-menu displays these parameters:

Item No.	Parameter	Meaning
Identification		
[1]	Network location	Select the name of the network from the list.
[2]	Block number	Select a SIGMA NETWORK address of the SBU from the list.
[3]	Description	In this field, enter an explanatory name (Compressor station Hall 5, for example) for the SBU .
Serial data		
[4]	Material number	If possible, the Material number from the SBU is retrieved and displayed here. Alternatively, you can manually enter the Material number .
[5]	Serial number	If possible, the Serial number from the SBU is retrieved and displayed here. Alternatively, you can manually enter the Serial number .
Communication		
[6]	IP address	This field displays the IP address currently assigned to SBU .
[7]	Communication status	This field displays the current communication status: <ul style="list-style-type: none"> ■ Not connected ■ OK
[8]	Send IP address to block	Use this key to transfer changed settings to the Bus controller .

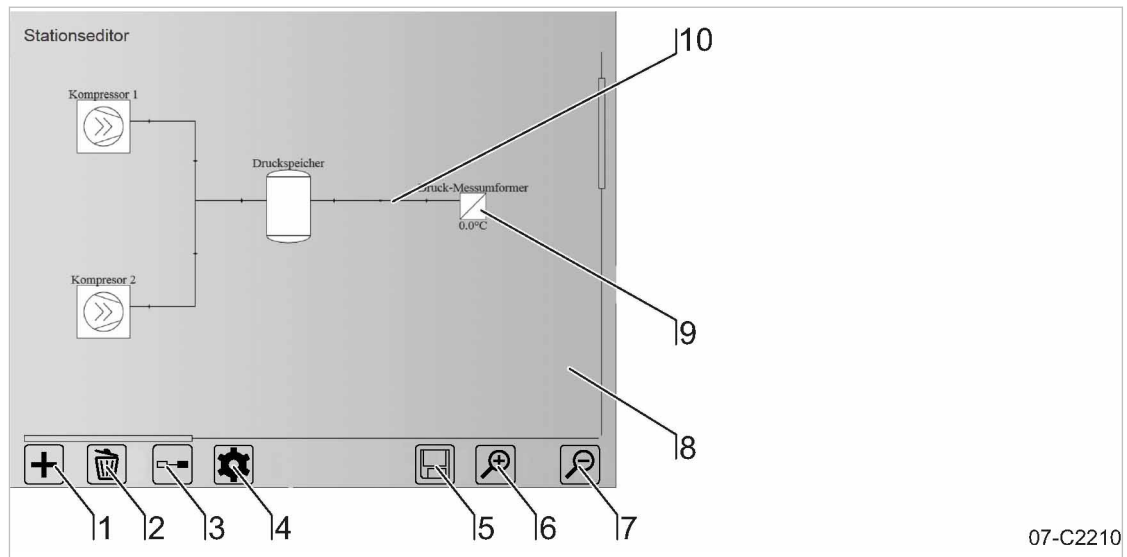
Tab. 37 Block configuration menu

5. If necessary, add or adjust the settings in the *< Block configuration >* menu.
6. Press the Send IP address to block key.
A message is displayed.
7. Confirm the message.
The network configuration for SBU is completed.
For the configuration of the I/O block see chapter "I/O block configuration".
8. If you want to register other SBU at the SAM 2 , you must follow the procedure described above from item 1. for every SBU .

7.11 P+I diagram

The fundamental configuration of the compressed air station is realised with a visual P&I diagram in SAM 2 . Using a graphical editor, you place, configure and connect the components retrieved from a library in the drawing area.

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").










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Fig. 34 Station editor menu

1. Press Start-up → P+I diagram .

The *Station editor* menu is displayed.







Item No.	Sign	Meaning
①		Add component
②		Remove component
③		Connect components
④		Component details
⑤		Save
⑥		Enlarge view
⑦		Reduce view
⑧	-	Drawing area
⑨	-	Component
⑩	-	Connection

Tab. 38 Station editor

2. Press .

The *Add component* menu is displayed.






The *Component* menu is active.

3. Touch the  symbol.
The available component types are displayed in a list (see chapter 7.11.1 "Component types").
4. Add component: Select the required component by touching it.
The selected component is copied to the clipboard and the drawing area  of the Station Editor opens.
5. Touch the drawing area  at the desired location.
The previously selected component is pasted on the touched position on the drawing area.
The placed component is framed by dashed line. This identifies the component as currently **inactive**.
6. Touch the placed component.
The selected component is framed in grey.
7. Touch the  symbol.
The *Details* menu opens. Configure the details for the selected component (see chapter 7.11.2 "Configuring the components").
8. Moving a component: Touch and drag the component (without releasing it) to another position on the drawing area .
9. Delete component: Touch to mark the component to be deleted (the selected component will be framed) and press .
- The marked component is removed.
10. Add any other components as described above, until all components required for the P&I diagram are placed on the drawing area and arranged as required.



The number of possible compressors is limited by the SAM 2 type available (see chapter 2.3 "Technical Specification"). However, for the SAM 2-4 and SAM 2-8 types, it can be expanded by Upgrade (see chapter "Upgrade").

The P&I diagram flows from left to right.

11. Use the  and  symbols to enlarge or reduce the view of the drawing area.
Touch and drag the drag arrows to move the view into the desire direction.
12. Touch the  symbol.
The connecting mode is active.
The  symbol is displayed with a green background.
13. Add connection: Touch the first component to be connected.
The selected component is framed in grey.
14. Touch the second component to be connected.
A connecting line is drawn between both components.
The dashed frame of the first component disappears. This marks this component to be **active**.
15. Delete connection: Execute the same procedure as described in "Add connection".
16. Add all other connections as described above, until all components of the P&I diagram are connected.
17. Touch  to save the completed P&I diagram.



The above created P&I diagram of the compressed air station will be used as the valid configuration of SAM 2 for machine control, calculations and display purposes only **after it has been saved**.

7.11.1 Component types

Component type	Symbol (example)
Compressor	
Dryer	
Filter	
Receiver	
Valve	
Sensor	

Tab. 39 Component types

7.11.2 Configuring the components


You must properly configure the components shown in the P&I diagram in order for SAM 2 to receive the correct parameters for output calculations, network communication and maintenance, for example.

Precondition Log on with access level 2: Operating (see chapter 7.4 "User log-on").

The Component mode is active (see chapter 7.11 "P+I diagram").

At least one component is positioned on the drawing area  (see chapter 7.11 "P+I diagram").

1. Configuring the component: select the required component by touching it.
The selected component is framed in grey.

2. Touch the  symbol.
The configuration menu for the selected component is displayed.



The items available in the configurations depend on the selected component type.

The configuration menu has maximally the following sub-menus:

- Connection
- Identification
- Performance data
- Maintenance management

3. Select a sub-menu.

Parameter	Meaning
Connection	Use this menu to set the fundamental communication options for connecting the selected component with SAM 2 . Some options are available only for certain components.
Number	The system automatically assign a unique ID to every component. This enables the activation of the component via "SAM 2.Logic" for example.
Active	Touch the option box <i>Active</i> to set a check mark which ensures that the signals of the corresponding component will be evaluated by SAM 2 .
Connection type	Set here the connection type: <ul style="list-style-type: none"> ■ Controlled: The component is automatically controlled. ■ Monitored+: The component is not automatically controlled and operates independently. ■ Monitored: The component is not automatically controlled and operates independently. The component is not taken into account when the compressed air station is energetically evaluated. ■ Not connected: The component is only displayed in the P&I diagram. <p>Only machines are controlled.</p>
Communication medium	Set here the communication medium: <ul style="list-style-type: none"> ■ SIGMA NETWORK ■ PROFIBUS ■ conventional <p>Only machines are controlled via SIGMA NETWORK or PROFIBUS.</p>
Controller type	The type of KAESER controller is displayed here: <ul style="list-style-type: none"> ■ SIGMA CONTROL ■ SIGMA CONTROL 2
IP address	The IP address of the component is displayed.
PROFIBUS slave address	Enter here the PROFIBUS slave address.
Definition of conventional signals	Use this key to open the <i><Conventional signals></i> menu.
Identification	In this menu, enter general information about the component to be registered.

Parameter	Meaning
Description	The name of the component within the compressed air station, for example "Compressor 1".
Material number	The manufacturer's article number for the component.
Serial number	The manufacturer's serial number for the component.
Equipment number	The KAESER-specific number.
Device type	The manufacturer's type designation for the component.
Manufacturer	The name of the component manufacturer.
Performance data	Use this menu to enter the basic technical data for the component previously registered in the <i>Identification</i> menu. Obtain this information from the nameplate and/or the operating manual.
Rated pressure	Enter the component's rated pressure in the set unit of pressure.
Rated power	Enter the component's rated power in the set unit of power.
Rated air delivery	Enter the component's rated air delivery in the set unit of delivery volume.
Idle power	Enter the power consumption in IDLE in the set unit of power.
Variable speed	Touch the option box <i>Active</i> to set a check mark and activate the "Variable speed" option.
Add-on dryer	Touch the option box <i>Active</i> to set a check mark and activate the "Add-on dryer" option.
Speed parameter field	Use this key to open the <i>Speed parameter field</i> menu.
Add-on dryer technical data	Use this key to open the <i>Add-on dryer</i> menu.
Copying technical data from the SD card	Use this key to open the <i>SC card</i> menu.
Maintenance management	Set the maintenance options in this menu.
Maintenance management via SAM 2	Touch the option box <i>Active</i> to set a check mark and activate the Maintenance management option. SAM 2 now manages the component's maintenance signals in the <i>< Messages ></i> menu.

Tab. 40 Parameters in the configuration menu

4. Set all required parameters for the selected component in the provided sub-menus as described above.

7.12 Control

The Control parameter menu has the following sub-menus:

- "Parameter"
- Priority
- Dynamic Control
- "Required pressure"

1. Press Control → Settings or Control → Pressure parameters .

2. If the menu page displayed has several sub-menus, touch one of the tabs to open the corresponding sub-menu.
3. Enter the required parameters in the corresponding fields.
4. If necessary, activate the desired functions by touching the selection box.

7.12.1 Setting the Parameter

The fundamental pressure values of the station must be set in the Parameter menu.

7.12.1.1 Pressure range upper limit [pR]

You define the pressure margin by setting a pressure value above the required pressure.

For example, if you want a required pressure of 7.0 bar and a pressure margin of 0.5 bar, you must specify 7.5 bar as value for the upper pressure margin.

7.12.1.2 Pressure range

The pressure margin is the difference resulting from the upper margin limit and the required pressure.

For energetic reasons, select the largest possible pressure margin. Practical values are 0.8–1.2 bar, for example. Lower values for the pressure margin result in more frequent machine motor starts.

7.12.1.3 Required pressure [pREQ]

The required pressure is the pressure required by the consumers in the compressed air network (measured with the "pressure transducer").

SAM 2 usually maintains the required pressure with a maximum deviation of 0.1 bar. For energetic reasons, the operating pressure is to be set as low as possible, i.e., not higher as required for the consumers within the compressed air network. A pressure of 1 bar higher than required causes approximately 6 % more energy consumption.

7.12.1.4 Maximum pressure

Pressure high [ph] is a monitoring function. If the monitoring function is activated, the system issues a warning message as soon as the mains pressure exceeds the set threshold value for the set time.

7.12.1.5 Minimum pressure

Pressure low [pt] is a monitoring function. If the monitoring function is activated, the system issues a warning message as soon as the mains pressure falls below the set threshold value for the set time.

The monitoring function is provided in two variants:

- Δpt: This monitoring function uses a pressure limit relative to the set required pressure.
- pt: This monitoring function uses a pressure limit which is independent of the required pressure.



You cannot use both variants at the same time.

7.12.2 Setting the Pressure parameters

Use this menu to specify the limits within the working pressure may be set (SAM 2) or specified (Process control).

7.12.2.1 Maximum required pressure

The maximum working pressure represents the upper pressure limit which still ensures safe operation for the consumers within the air network.

7.12.2.2 Required pressure minimum

The minimum working pressure represents the lower pressure limit which still ensures safe operation for the consumers within the air network.

7.12.2.3 Decrease of required pressure

You can lower the required pressure by an adjustable amount either manually or by an external signal.

7.13 Activating SAM 2

- Precondition Nobody is working on the machine.
 All access doors on the machines are closed.
 The ambient conditions for SAM 2 are met as described in chapter 5. "Installation and Operating Conditions"
 The temperature of the machines is not below +3 °C.
 All installation tasks and wiring as described in chapter 6 "Installation" are properly completed.
 There is no bus error.



WARNING

Risk of injury during an automatic machine start.


- Before switching on, make sure that all conditions are met.
- Compare the settings for initial start-up of SAM 2 with those listed in the operating manual.

- Use the "Commissioning" check list.

To be checked	Description	Confirmed?
date and time is set	Chapter 7.5 "Date and time"	
machines are set up	Chapter 6.12 "Setting up the machines"	
Machines are connected	Chapter 7.10 "Periphery"	
Required pressure is set	Chapter 7.12 "Control"	

Tab. 41 "Commissioning" check list

Precondition All points in the "Commissioning" check list are complied with,.

- Key "Automatic" Press .

Result Key "Automatic"  illuminates **green**.


SAM 2 assumes control of the compressed air station.


8 Operation

8.1 Switching on and off

Precondition The ambient conditions are met as described in chapter 5. "Installation and Operating Conditions" All installation tasks and wiring as described in chapter 6 "Installation" are properly completed. Commissioning in accordance with chapter 7 "Initial Start-up" is completed.


8.1.1 Switching the compressed air station on


➤ Press the  key.

Result The compressed air station switches on.
The  key illuminates **green**.

8.1.2 Switching the compressed air station off








You can switch off the compressed air delivery **for the entire station** at SAM 2 .

➤ Press the  key.

Result The compressed air station shuts down and **compressed air is no longer delivered**.
The  key illuminates **red**.

8.2 Help function

SAM 2 features an integrated Help function. A matching description can be displayed for the currently displayed menu.

1. Press the  key.
The matching Help page is displayed.
2. If the Help page is more than one screen page, swipe with your finger up or down.
3. Touching underlined terms opens further Help pages with corresponding descriptions.
4. Use the  and  keys to browse back and forward in the Help file.
5. Press  to open the table of contents.
6. Press  to open the glossary.
7. Press  to return to the Help page of the current SAM 2 menu.
8. Press  again.

The Help page is closed and the current SAM 2 menu is again displayed.



When you close the currently displayed Help page and again call up the Help function, the page displayed is the same page which you saw before closing the function.

If you close the currently displayed Help page 10 minutes after the initial call up, the system displays the initially description matching the menu when you re-call the Help function.

8.3 Main menu

The menu has the following sub-menus:

- Net pressure station
- Net pressure

- Current values
- Total values
- Drag Indicator
- View station

1. Press **Status** → **Overview** or **Status** → **View station**.
2. If the menu page displayed has several sub-menus, touch one of the tabs to open the corresponding sub-menu.

8.3.1 Net pressure station

The pressure curve is the visual display of the network pressure progression and set limit values for the entire station or the selected machines.

One or more pressure transducers in the network provide the measured values. " " If multiple pressure transducers are used, the software calculates a weighted mean value.

The values are displayed in the previously set units for the set time axis.

8.3.1.1 Net pressure [pN]

The system displays the progression curve of the network pressure over the time axis.

The values are displayed in the set unit.

8.3.1.2 Required pressure [pREQ]

The required pressure is the pressure required by the consumers in the compressed air network (measured with the "pressure transducer").

SAM 2 usually maintains the required pressure with a maximum deviation of 0.1 bar. For energetic reasons, the operating pressure is to be set as low as possible, i.e., not higher as required for the consumers within the compressed air network. A pressure of 1 bar higher than required causes approximately 6 % more energy consumption.

8.3.1.3 Pressure range

The pressure margin is the difference resulting from the upper margin limit and the required pressure.

For energetic reasons, select the largest possible pressure margin. Practical values are 0.8–1.2 bar, for example. Lower values for the pressure margin result in more frequent machine motor starts.

8.3.1.4 Compressor

The machine's name within the station. This name can be set in the P&I diagram menu.

8.3.1.5 Free air delivery

Current compressed air volume delivered by the machine.

The values are displayed in the set unit.

8.3.1.6 Pi

Current compressed air volume generated by the machine.

The values are displayed in the set unit.

8.3.1.7 ADT

"Airend discharge temperature" of the machine.

The values are displayed in the set unit.

8.3.1.8 Operating state

Current operating state of machine, for example:

- READY
- IDLE
- LOAD

8.3.1.9 Error state

Current fault state of machine, for example:

- Fault
- Warning
- Communication alarm
- Local mode

8.3.2 Pressure chart

This sub-menu page displays the current network pressure as numerical value in large font.

This display type enables good legibility from a larger distance.

The values are displayed in the set unit.

8.3.3 Current values

The display of current measuring values of the entire station or selected machine(s).

8.3.3.1 Power

The display of the currently measured power consumption of the entire station or selected machine(s).

The values are displayed in the set unit.

8.3.3.2 Free air delivery

The compressed air volume currently delivered by the entire station or selected machine(s).

The values are displayed in the set unit.

8.3.3.3 Specific power

This standard value is used as reference value in the assessment of the station's efficiency, The value is calculated from the power consumption per delivery volume. Lower values indicate a high degree of efficiency.

8.3.3.4 Switch events

The number of motor starts of the selected machine within the last 60 minutes.

8.3.3.5 Consumption

Calculated current compressed air usage in the air network.

The values are displayed in the set unit.

8.3.4 Drag Indicator

This sub-menu page records the maximum, mean or minimum pressure values.

8.3.4.1 Maximum pressure

The maximum pressure in the network, measured from the reference time set. This value corresponds to the highest measured pressure in the network and can be used to evaluate the compressed air quality.

The values are displayed in the set unit.

8.3.4.2 Average pressure

The mean pressure in the network, calculated since the reference time set.

The values are displayed in the set unit.

8.3.4.3 Minimum pressure



The minimum pressure in the network, measured from the reference time set. This value corresponds to the lowest measured pressure in the network and can be used to evaluate the compressed air quality.

The values are displayed in the set unit.


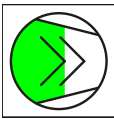
8.3.4.4 RESET

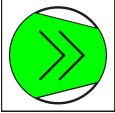


The set reference time is reset to the current date and the current time.

8.3.5 Station view

Display of the P&I diagram of the compressed air station. The P&I diagram illustrates the structure, operating modes and important data of the station and is updated continuously. Use the  and  symbols to scale the view and move it by touching and dragging with your finger.

The display of the symbols changes with the operating state of the corresponding machine.

Sign	Meaning
	Machine in operating mode READY
	Machine in operating mode IDLE

Sign	Meaning
	Machine in operating mode LOAD
	Machine has warning messages or service messages
	Machine has fault messages

Tab. 42 Symbols in View station

9 Fault Recognition and Rectification

9.1 KAESER SERVICE



The messages valid for SAM 2 are dependent on how the compressor station is equipped.

1. Do not attempt fault rectification measures other than those given in this manual!
2. If the fault cannot be removed by the action suggested: Contact KAESER SERVICE.

9.2 Messages

Alarm, service and warning messages are displayed at SAM 2 and stored in the event memory. A pop-up window appearing on top of the current display notifies the user of new messages.

New messages are displayed together with the following data:

- Event :
 - Number of messages: Error
 - Number of messages: Warning
 - Number of messages: Maintenance



You must acknowledge the messages.

- Press **Active reports** to open the *< Unacknowledged messages >* menu.

The event memory differentiates between:

- Unacknowledged messages
- Current reports
- Message history storing the last 1000 messages.

1. Press **Message**.

2. Select a menu option:

- **Unacknowledged messages**
- **Current reports**
- **Message history**

The system displays three different event times for individual messages:

- Event “k”: Message coming
- Event “q”: Message acknowledged
- Event “g”: Message gone

- The following data are shown in addition:

- Time : Date and time
- Number : Message number
- component
- Message : Message text

3. If the message list is longer than one screen page, swipe with your finger up or down.

4. In the Unacknowledged messages message page, touch an individual message for selection. Press **Acknowledge message** to acknowledge the message.

9.3 Other faults

Fault	Possible cause	Remedy
Operation of the touch screen is difficult and/or returns errors.	The touch screen is dirty.	Wipe the touch screen surfaces with a soft cloth (micro-fibre, for example) without any harsh cleaning agent.
	SAM 2 is incorrectly connected to the equipotential bonding. The capacitive touch screen must be earthed to work reliably.	Connect SAM 2 to the equipotential bonding (see chapter 6.11.2).

Tab. 43 Other faults

10 Maintenance

10.1 Maintenance tasks on electrical equipment



Maintenance tasks on electrical equipment may only be carried out by the following persons:

- Specialist personnel, see chapter 3 “Assigning personnel”.
- Technicians qualified to maintain SAM 2 and service personnel instructed by and under the supervision of such a qualified technician
- Authorised KAESER service personnel.

1. Check personnel for specialised qualifications.
2. Assign suitable personnel to maintenance tasks.
3. Instruct on correct maintenance procedures in accordance with the operating manual.
4. Document maintenance tasks carried out.



Enter completed maintenance tasks in the corresponding lists in the operating manual.

10.2 Additional buffer battery

SAM 2 features a permanently installed buffer battery. In the event of a failure, you can install a second buffer battery. This additional buffer battery is switched in parallel to the factory-installed battery and assumes its function. The functionality of this second battery is not impaired by the discharged factory-installed battery.

- Comply with the following instructions.

10.2.1 Danger from batteries



WARNING

There is danger of acid burns if batteries are overheated or damaged.

- Store the battery in a cool and dry place.
- Properly dispose of discharged buffer batteries.

10.2.2 Buffer battery life

Under normal operating conditions, the buffer battery in SAM 2 has a life of at least 10 years.



NOTICE

Data loss from discharged buffer battery

- Heed warning messages from SAM 2 concerning the buffer battery charge level.
- Install the additional buffer battery only when SAM 2 is switched on.



In the event of a voltage loss and discharged buffer battery, the internal clock is reset to the date 01.01.1970 after power has returned.

- Notice the maximum storage times for unused buffer batteries.

10.2.3 Installing the additional buffer battery

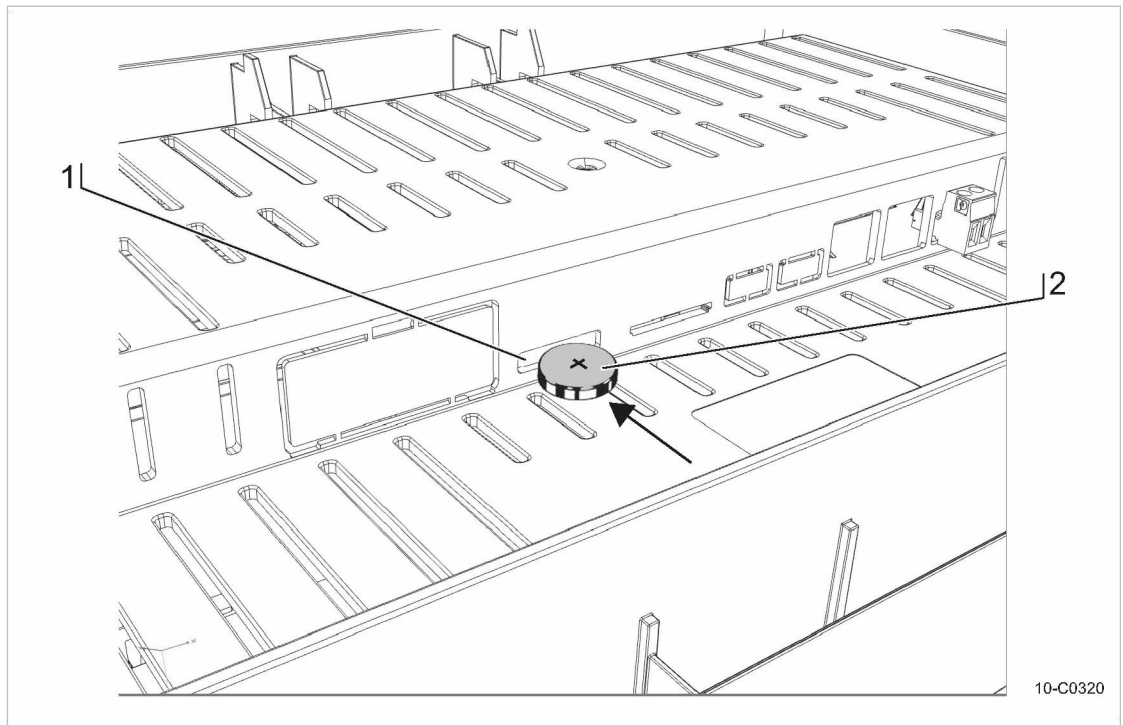


Fig. 35 Buffer battery location

- ① Slot for additional buffer battery
- ② Buffer battery

Precondition You have a new buffer battery at hand (for article number and type, please see chapter 11).
The SAM 2 is switched on.

1. Use a slot-head screwdriver to break off the plastic cover ("Battery X2") at the rear of SAM 2 .
2. Insert the buffer battery ② into the slot ①. The positive pole of the buffer battery points to the terminal rear.
3. Insert the buffer battery until you feel resistance.
4. Check and correct, if required, the time zone, date and time (see chapter 7.5).
5. Record the installation date of the buffer battery in the maintenance table in the annex of this operating manual (chapter 13.7).



Discharged batteries are hazardous waste.

- Dispose of discharged batteries according to national regulations and directives.

11 Spares, Operating Materials, Service

11.1 Note the nameplate

The nameplate contains all information to identify your machine. This information is essential to us in order to provide you with optimal service.

- Please give the information from the nameplate with every enquiry and order for spares.

11.2 Spare parts

Name	Voltage [V]	Capacity [Ah]	Model
Lithium buffer battery	3.0	0.19	CR2032/BR2032

Tab. 44 Spare buffer battery

11.3 KAESER AIR SERVICE

KAESER AIR SERVICE offers:

- Authorised service technicians with KAESER factory training
 - Increased operational reliability ensured by preventive maintenance
 - Energy savings achieved by avoidance of pressure losses
 - optimum conditions for operation of the compressed air system,
 - The security of genuine KAESER spares.
 - Increased legal certainty as all regulations are kept to.
- It make sense to sign a KAESER AIR SERVICE maintenance agreement.
 Your advantage:
 lower costs and higher compressed air availability.

11.4 Displaying the software version

You can display the versions of the various software modules in SAM 2 .

- Press **Configuration** → **Software versions** .
 The *Software versions* menu is displayed.

Parameter	Meaning
Software	Software name SAM 2

Tab. 45 Software versions menu

12 Decommissioning, Storage and Transport

12.1 De-commissioning

De-commissioning is necessary, for example, under the following circumstances:

- SAM 2 is (temporarily) not needed.
 - SAM 2 is to be moved to another location.
1. Isolate SAM 2 from all power phases (power supply isolating device).
 2. Switch off external power sources.
 3. Disconnect SAM 2 from all connections when the device is to be moved to another location.

12.2 Disposal

Precondition SAM 2 is de-commissioned.

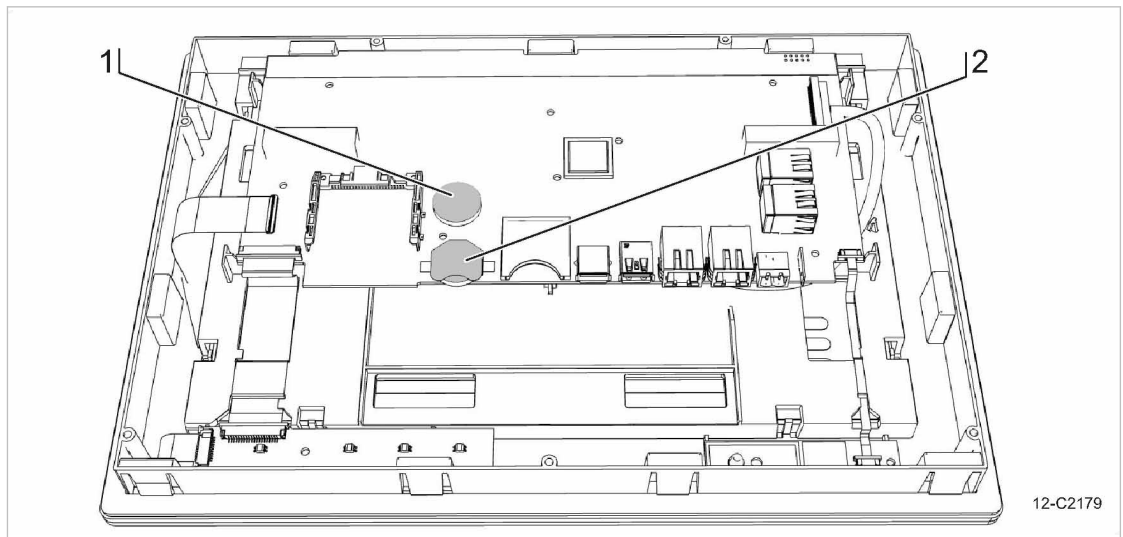


Fig. 36 Buffer battery positions

- ① Permanently installed buffer battery
- ② Additional buffer battery

1. Disconnect SAM 2 from all connections.
2. Open the control cabinet of the SAM 2 cover (see chapter 6.6).
3. Detach all connections from the SAM 2 terminal.
4. If necessary, use a suitable tool to force the removal of incommoding cover parts.
5. Use a Torx screwdriver to remove the T9 screws at the rear housing panel of the SAM 2 terminal.
6. Remove the housing panel.
7. Use a suitable tool to remove the permanently installed and any additional buffer battery.
8. Properly dispose of the buffer batteries.
9. Hand the SAM 2 over to an authorised disposal expert.



Discharged batteries are hazardous waste.

- Dispose of discharged batteries according to national regulations and directives.

13 Annex

13.1 Anchor holes for the control cabinet

See instructions in chapter 6.6

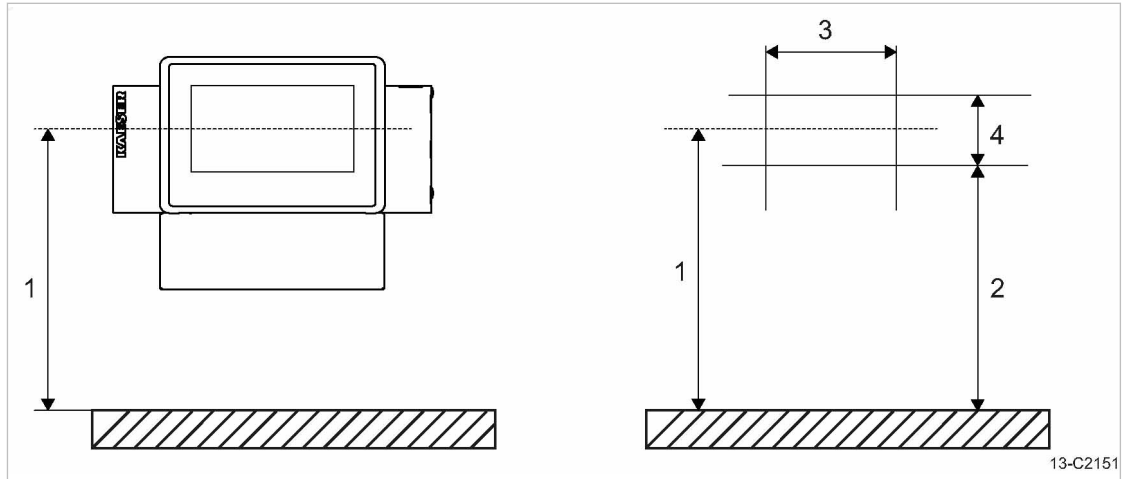


Fig. 37 Anchor holes for the SAM 2 control cabinet

- ① 1300 mm
- ② 1084 mm

- ③ 507 mm
- ④ 180 mm

13.2 Machine assignment

No.	Model	Machine number	Year of manufacture	No. in wiring diagram	Bus address or number Slave
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

No.	Model	Machine number	Year of manufacture	No. in wiring diagram	Bus address or number Slave
16					

Tab. 46 Machine assignment

13.3 SBU (SIGMA NETWORK BUS CONVERTER)

No.	Model	Material number	SIGMA NETWORK address
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Tab. 47 SBU

13.4 SAM 2 setting values

Save your settings on an SD card after commissioning and any modifications of the default values. Use the following list "Technician settings" to document major modifications.

- Save the setting data to the SD card and enter major modifications in the "Technician settings" list.

Result Data backup and the documentation of major modifications simplify the task of external Service Technicians in particular, in determining the cause of problems arising.

13.4.1 Technician's settings

Technician's settings			

Technician's settings			

Technician's settings			

Tab. 48 Technician's settings

13.5 Machine settings

13.5.1 Setting the pressure regulation (pressure controller in series with the SAM 2 load output)

See instructions in chapter 6.12.3

Setting suggestion for machines with an "external load control" actuating input [bar]



- The reference point is the maximum working pressure
- Adjust the setting values for the pressure regulation (pressure switch (-B1) or system pressure) as follows:

Machine number	Cut-in pressure	Cut-out pressure
Maximum working pressure 1 bar to 2.5 bar:		
Machine 1/5	ON – 0.10	OFF + 0.05
Machine 2/6	ON – 0.15	OFF + 0.05
Machine 3/7	ON – 0.20	OFF + 0.05
Machine 4/8	ON – 0.25	OFF + 0.05

Machine number	Cut-in pressure		Cut-out pressure	
Maximum working pressure 2.5 bar to 6 bar:				
Machine 1/5	ON	- 0.2	OFF	+ 0.2
Machine 2/6	ON	- 0.4	OFF	+ 0.2
Machine 3/7	ON	- 0.6	OFF	+ 0.2
Machine 4/8	ON	- 0.8	OFF	+ 0.2
Maximum working pressure 6 bar to 16 bar:				
Machine 1/5	ON	- 0.4	OFF	+ 0.3
Machine 2/6	ON	- 0.7	OFF	+ 0.3
Machine 3/7	ON	- 1.0	OFF	+ 0.3
Machine 4/8	ON	- 1.3	OFF	+ 0.3
Maximum working pressure 16 bar to 32 bar:				
Machine 1/5	ON	- 4.0	OFF	+ 1.0
Machine 2/6	ON	- 5.0	OFF	+ 1.0
Machine 3/7	ON	- 6.0	OFF	+ 1.0
Machine 4/8	ON	- 7.0	OFF	+ 1.0

Tab. 49 Recommended settings: Pressure controller in series with SAM 2 "external load control" load output

Setting suggestion for machines with the "Man/Auto"/ "Load/Idle" operating mode" control input [bar]



The reference point is the maximum working pressure

- Adjust the setting values for the pressure regulation (pressure switch (-B1) or system pressure) as follows:

Machine number	Cut-in pressure		Cut-out pressure	
Maximum working pressure 1 bar to 2.5 bar:				
all	ON	- 0.10	OFF	+ 0.05
Maximum working pressure 2.5 bar to 6 bar:				
all	ON	- 0.2	OFF	+ 0.2
Maximum working pressure 6 bar to 16 bar:				
all	ON	- 0.4	OFF	+ 0.3
Maximum working pressure 16 bar to 32 bar:				
all	ON	- 4.0	OFF	+ 1.0

Tab. 50 Recommended settings: Pressure controller in series with the SAM 2 "Man/Auto and Load/Idle" load output

Personal settings

Date/time							
Switching point		ON	OFF	ON	OFF	ON	OFF
	Unit						
Machine 1	[bar]						
Machine 2	[bar]						
Machine 3	[bar]						
Machine 4	[bar]						
Machine 5	[bar]						
Machine 6	[bar]						
Machine 7	[bar]						
Machine 8	[bar]						
Machine 9	[bar]						
Machine 10	[bar]						
Machine 11	[bar]						
Machine 12	[bar]						
Machine 13	[bar]						
Machine 14	[bar]						
Machine 15	[bar]						
Machine 16	[bar]						

Tab. 51 Personal settings: Pressure controller in series with SAM 2 load output

13.5.2 Pressure range for manual operation

To avoid simultaneous cut-in of machines in manual mode, you must set the system pressure p2 and/or system pressure switch –B1.1.

Suggested setting [bar]:

Machine number	Cut-in pressure		Cut-out pressure	
Maximum working pressure 1 bar:				
Machine 1/5/9/13	ON	0.93	OFF	1.00
Machine 2/6/10/14	ON	0.91	OFF	0.98
Machine 3/7/11/15	ON	0.89	OFF	0.96
Machine 4/8/12/16	ON	0.87	OFF	0.94
Maximum working pressure 7.5 bar:				
Machine 1/5/9/13	ON	7.0	OFF	7.5
Machine 2/6/10/14	ON	6.7	OFF	7.2
Machine 3/7/11/15	ON	6.4	OFF	6.9
Machine 4/8/12/16	ON	6.1	OFF	6.6
Maximum working pressure 10 bar:				

Machine number	Cut-in pressure		Cut-out pressure	
	ON	OFF	ON	OFF
Machine 1/5/9/13	ON	9.3	OFF	10.0
Machine 2/6/10/14	ON	9.0	OFF	9.7
Machine 3/7/11/15	ON	8.7	OFF	9.4
Machine 4/8/12/16	ON	8.4	OFF	9.1
Maximum working pressure 13 bar:				
Machine 1/5/9/13	ON	12.3	OFF	13.0
Machine 2/6/10/14	ON	12.0	OFF	12.7
Machine 3/7/11/15	ON	11.7	OFF	12.4
Machine 4/8/12/16	ON	11.4	OFF	12.1
Maximum working pressure 25 bar:				
Machine 1/5/9/13	ON	22	OFF	25
Machine 2/6/10/14	ON	21	OFF	24
Machine 3/7/11/15	ON	20	OFF	23
Machine 4/8/12/16	ON	19	OFF	22
Maximum working pressure 32 bar:				
Machine 1/5/9/13	ON	27	OFF	32
Machine 2/6/10/14	ON	26	OFF	31
Machine 3/7/11/15	ON	25	OFF	30
Machine 4/8/12/16	ON	24	OFF	29

Tab. 52 Recommended settings: Pressure range for manual operation

Personal settings

Date/time							
Switching point		ON	OFF	ON	OFF	ON	OFF
	Unit						
Machine 1	[bar]						
Machine 2	[bar]						
Machine 3	[bar]						
Machine 4	[bar]						
Machine 5	[bar]						
Machine 6	[bar]						
Machine 7	[bar]						
Machine 8	[bar]						
Machine 9	[bar]						
Machine 10	[bar]						
Machine 11	[bar]						
Machine 12	[bar]						
Machine 13	[bar]						

Date/time							
Switching point		ON	OFF	ON	OFF	ON	OFF
	Unit						
Machine 14	[bar]						
Machine 15	[bar]						
Machine 16	[bar]						

Tab. 53 Personal settings: Pressure range for manual operation

13.5.3 System offset for manual mode

tv = time delay for switching machines on after a power failure

Date/time						
Name						
Time delay	tv [s]	tv [s]	tv [s]	tv [s]	tv [s]	tv [s]
Machine 1						
Machine 2						
Machine 3						
Machine 4						
Machine 5						
Machine 6						
Machine 7						
Machine 8						
Machine 9						
Machine 10						
Machine 11						
Machine 12						
Machine 13						
Machine 14						
Machine 15						
Machine 16						

Tab. 54 Personal settings: System offset (manual operation)

13.6 Installation accessories

Communication modules

Name	Material number	Remarks
PROFINET IO retrofit kit	7.5250.01920	Communication module with accessories, to be installed by the user, can be retrofitted.
PROFIBUS DP-V0 Retrofit Kit	7.5250.01880	
Modbus TCP retrofit kit	7.5250.01950	

Tab. 55 Communication modules

SIGMA NETWORK

Name	Material number	Remarks
SIGMA NETWORK cable	7.9679.0	CAT5 2x2x0.64 gr, for indoor installation, PVC coating, grey, Ø 6.5 mm, by the metre
RJ45 bus connector	7.7628.1	RJ45 plug, 4 insulation displacement/clamping contacts, tool-free installation (fast connect)
LAN RJ45 retrofit kit	7.5250.01870	RJ45 bus connector, screw fittings, accessories

Tab. 56 SIGMA NETWORK installation accessories

Pressure transducer

Name	Material number	Pressure range
For model I	7.4599.0	0-1 bar
For model II	7.3397.1	0-6 bar
	7.2816.3	0-10 bar
	7.2817.3	0-16 bar
	7.4762.0	0-20 bar
	7.6689.0	0-32 bar
	7.4773.0	0-45 bar
For model III	7.7040E3	0-16 bar
For vacuum	7.7046.0	0-1 bar (absolute)

Tab. 57 Pressure transducer

Pressure transducer connection parts and line

Name	Material number	Remarks
Fitting set straight, elbow G 1/4, G1/2 with shut-off valve and accessories up to 16 bar up to 45 bar	8.0484.10050 8.0484.00090	for air receiver connection
Fitting set G 1/4, G1/2 with shut-off valve and accessories up to 15 bar	204465.0	1-litre air receiver for connection to pipework

Name	Material number	Remarks
Connecting cable for pressure transducer	7.2679.0	Screened, 2x0.75 mm ² , for indoor installation, PVC sheath, grey, 6 mm diameter

Tab. 58 Pressure transducer accessories

SBU for wall mounting

Scope of supply: Sheet steel control cabinet, 100-240 V mains voltage, single phase, 50-60 Hz

Name	Material number	DI (24 VDC)	DO (24 VDC 0.5A)	Relay at DO	AI (0-20mA, p/a)	AO (0-20 mA)	AIR (PT100)	SNW free ports Cu RJ45 / LWL	DP master	Isolating amplifiers	Relay signal duplication
Converter SBU400-1	7.9681.0	6	6	6	4	0	0	1/0	0	0	0
Converter SBU400-1_PT	7.9681.00010	6	6	6	4	0	4	1/0	0	0	0
Converter SBU400-1_FC	7.9681.00020	6	6	6	4	2	0	1/0	0	1	0
Converter SBU400-1_DHS	7.9681.00030	6	6	0	4	0	0	1/0	0	0	6x2
Converter SBU400-1_SW	7.9681.02000	6	6	6	4	0	0	7/0	0	0	0
Converter SBU400-1_OLM	7.9681.00040	6	6	6	4	0	0	3/1	0	0	0
Converter SBU400-1_DP	7.9681.01000	6	6	6	4	0	0	1/0	1	0	0
Converter SBU400-1_SWDP	7.9681.03000	6	6	6	4	0	0	7/0	1	0	0
Converter SBU400-2	7.9682.0	6	6	0	8	4	1	1/0	0	0	0
Converter SBU400-3_X	7.9683.0	12	12	12	4	2	0	1/0	0	0	0
Converter SBU400-3_XDP	7.9683.01000	12	12	12	4	2	0	1/0	1	0	0
Converter SBU400-3_XLFC	7.9683.02010	12	12	12	4	2	0	7/0	0	2	0
Converter SBU400-4	7.9684.0	36	6	6	4	2	0	1/0	0	0	0
Converter SBU400-4_SW	7.9684.02000	36	6	6	4	2	0	7/0	0	0	0

Tab. 59 SBU types for wall mounting

SBU for installation in machines without SIGMA CONTROL

Scope of supply: Retrofit kit, components including installation description

Name	Material number	DI (24 VDC)	DO (24 VDC 0.5A)	Relay at DO	AI (0-20mA, p/a)	AO (0-20 mA)	AIR (PT100)	SNW free ports Cu RJ45 / LWL	DP master	Isolating amplifiers	Relay signal duplication
Converter SBU-1 ¹⁾	On request	6	6	6	4	0	0	1/0	0	0	0
Converter SBU-1_FC ²⁾	On request	6	6	6	4	2	0	1/0	0	1	0

¹⁾ For star-delta machines

²⁾ For machines with frequency converter

Tab. 60 SBU types for installation in machines without SIGMA CONTROL

Profibus installation parts and line

Name	Material number	Remarks
Connecting cable for PROFIBUS	7.4666.0	Screened, 1x2x0.64/2.55, for indoor installation, PVC sheath. violet, 8mm diameter.
PROFIBUS connector plug for SIGMA AIR MANAGER	7.4664.20010	35° cable exit (not required for model 16/8)
PROFIBUS plug set for SIGMA CONTROL	7.5250.00300	For PG and M fittings including EMC fittings.
PROFIBUS DP communication module set for SIGMA CONTROL 2	7.5250.01880	Module, bus connector, fittings

Tab. 61 PROFIBUS installation accessories

Load/idle control module

Name	Pressure	Material number	Remarks
Module for external load/idle control (7.7005.1 or 7.7005.2)	8 bar	7.7006.00003	Digital input for load control via SIGMA AIR MANAGER. For machines with SIGMA CONTROL BASIC (7.7005.1 or 7.7005.2) without frequency converter.
	11 bar	7.7006.00013	
	15 bar	7.7006.00023	
SFC module with external load/idle control	8 bar	7.7706.00033	as 7.7006.00003 but for machines with variable frequency drive (SFC)
Module for external load/idle control (7.7005.3).	8 bar	7.7056.00002	Digital input for load control via SIGMA AIR MANAGER. For machines with SIGMA CONTROL BASIC (7.7005.3) without frequency converter.
	11 bar	7.7056.00012	
	15 bar	7.7056.00022	

Name	Pressure	Material number	Remarks
SFC module with external load/idle control	8 bar	7.7056.00035	as 7.7056.00002 but for machines with frequency converter (SFC)

Tab. 62 Load/idle module

RC interference suppressor

Name	Material number	Remarks
RC interference suppressor	7.2812.1	For suppression of inductive loads connected to the relay outputs of the master controller. Coil voltage: 110–230 V AC/DC Coil retention capacity: 15 VA

Tab. 63 RC interference suppressor

13.7 Installing the buffer battery

Installing the buffer battery				
Date/time				
Name				

Tab. 64 Installing the buffer battery

13.8 Electrical Diagram

1	2	3	4	5	6	7	8	
<p>Electrical diagrams</p> <p>Sequencer</p> <p>SIGMA AIR MANAGER 2</p>								
<p>Manufacturer: KAESER KOMPRESSOREN SE 96450 Coburg GERMANY</p>								
<p>The drawings remain our exclusive property. They are entrusted only for the agreed purpose. Copies or any other reproductions, including storage, treatment and dissemination by use of electronic systems must not be made for any other than the agreed purpose. Neither originals nor reproductions must be forwarded or otherwise made accessible to third parties.</p>								
c		Datum	18.06.2014	E				=
b		Bearbeiter	Silber					+
a		Geprüft	Büchner					DWASAM2-03000.00
A) Änderung	Datum	Name	Ersatz durch:					1
								1 Bl.
					<p>KAESER KOMPRESSOREN</p> <p>Cover page Sequencer SAM 2</p>			
								Ursprung:

Lfd. Nr. No.	Benennung Name	Zeichnungsnummer (Kunde) Drawing No. (customer)	Zeichnungsnummer (Hersteller) Drawing No. (manufacturer)	Blatt Page	Anlagenkennzeichen Unit designation
1	Cover page		DWASAM2-03000.00	1	
2	List of contents		ZWASAM2-03000.00	1	
3	general instructions / electrical equipment identification		UWASAM2-03000.00	1	
4	Equipment parts list		UWASAM2-03000.00	2	
5	Block diagram		UWASAM2-03000.00	3	
6	Block diagram		UWASAM2-03000.00	4	
7	Block diagram		UWASAM2-03000.00	5	
8	Block diagram		UWASAM2-03000.00	6	
9	Circuit diagram		SWASAM2-03000.00	1	
10	Circuit diagram		SWASAM2-03000.00	2	
11	Circuit diagram		SWASAM2-03000.00	3	
12	Circuit diagram		SWASAM2-03000.00	4	
13	Circuit diagram		SWASAM2-03000.00	5	
14	Circuit diagram		SWASAM2-03000.00	6	
15	Circuit diagram		SWASAM2-03000.00	7	
16	Circuit diagram		SWASAM2-03000.00	8	
17	Circuit diagram		SWASAM2-03000.00	9	
18	Circuit diagram		SWASAM2-03000.00	10	
19	Circuit diagram		SWASAM2-03000.00	11	
20	Circuit diagram		SWASAM2-03000.00	12	
21	Circuit diagram		SWASAM2-03000.00	13	
22	Component layout		AWASAM2-03000.00	1	

List of contents		=	
Sequencer SAM 2		+	
		ZWASAM2-03000.00	
		page 1	
		Bl. 1	

c	Datum	18.06.2014
	Bearbeiter	Silber
b	Geprüft	Büchner
	Num	
a	Ersatz durch:	
	Ersatz für:	
B	List of contents	
Sequencer SAM 2		
KOMPRESSOREN		
Usprung:		

1	2	3	4	5	6	7	8	
<p>general instructions</p> <p>ATTENTION !!!</p> <p>Install supplies, grounding and shock protection to local safety regulations.</p> <p>Control circuits are single-end-earthed, if they are floating they may only be used together with insulation monitoring.</p> <p>Do not make or break live plug-in connectors.</p>								
<p>control cabinet wiring for non-designated conductors with multi-standard stranded conductors</p> <p>primary circuits ungrounded: black</p> <p>Control voltage AC ungrounded: red 1mm² H05V-K, 18AWG UL-Style 1015, CSA-TEW</p> <p>Control voltage DC ungrounded: blue 1mm² H05V-K, 18AWG UL-Style 1015, CSA-TEW</p> <p>primary circuits grounded: grey</p> <p>Control voltage AC grounded: white 1mm² H05V-K, 18AWG UL-Style 1015, CSA-TEW</p> <p>Control voltage DC grounded: white/blue 1mm² H05V-K, 18AWG UL-Style 1015, CSA-TEW</p> <p>earth conductor: green/yellow H07V-K, UL-Style 1015, CSA-TEW</p>								
<p>option E1 = PROFIBUS-Master</p> <p>option E2 = 2. SIGMA NETWORK switch</p> <p>option E10 = Communication module PROFINET IO</p> <p>option E11 = Communication module Modbus TCP</p> <p>option E12 = Communication module PROFIBUS</p>								
<p>SIGMA AIR MANAGER 2</p> <p>-A1 Communication module</p> <p>-A1-X1</p> <p>-F1 Overload protection switch Power supply</p> <p>-K1 I/O-Module Bus Controller</p> <p>-K1-X0 I/O-Module Power supply</p> <p>-K1-X1 I/O-Module digital inputs</p> <p>-K1-X2 I/O-Module digital outputs</p> <p>-K1-X3 I/O-Module analog inputs 20mA</p> <p>-K1-X4 I/O-Module Potential distributor</p> <p>-K10-K11 Ethernet Switch</p> <p>-K21...-K25 Coupling relay</p> <p>-M1 Control cabinet ventilator</p> <p>-T1 Power unit</p> <p>-T10 protocol converter SIGMA NETWORK - PROFIBUS DP</p> <p>-W80...-W82 cables SIGMA NETWORK</p> <p>-X1 Terminal strip Power supply</p>								
c	Datum	18.06.2014	general instructions / electrical equipment identifier					=
b	Bearbeiter	Siller	Sequencer SAM 2					+
a	Geprüft	Buchner	Ursprung:					
c	Änderung	Datum	Name	Ersatz durch:	Ersatz für:	UWASAM2-03000.00		
							1	
							6 Bl.	

model		Equipment parts list		SAM 2		Equipment parts list		Sequencer SAM2		UWASAM2-03000.00		page 2		6 Bl.	
machine power supply		100-240 V ±10 %, 50/60 Hz		24 V ±10 %, DC											
Sequencer	-A1 Prodrive	7.9696P0 SIGMA AIR MANAGER 2		7.9696P0 SIGMA AIR MANAGER 2											
Communication module PROFINET IO option E10	-A1-X1 HMS	7.7606.00030 AB6434-B		7.7606.00030 AB6434-B											
Communication module Modbus TCP option E11	-A1-X1 HMS	7.7606.00050 AB6455-B		7.7606.00050 AB6455-B											
Communication module PROFIBUS DP option E12	-A1-X1 HMS	7.7606.00040 AB6426-B		7.7606.00040 AB6426-B											
I/O-Module Bus Controller	-K1 B&R	7.9631.0 X20BC0087-C01		7.9631.0 X20BC0087-C01											
I/O-Module Power supply	-K1-X0 B&R	7.9631.00010 X20PS9400		7.9631.00010 X20PS9400											
I/O-Module 6DI	-K1-X1 B&R	7.9631.00020 X20DI6371		7.9631.00020 X20DI6371											
I/O-Module 6DOT	-K1-X2 B&R	7.9631.00030 X20DO6322		7.9631.00030 X20DO6322											
I/O-Module 4 All	-K1-X3 B&R	7.9631.00040 X20DO6322		7.9631.00040 X20DO6322											
I/O-Module Potential distributor	-K1-X4 B&R	7.9631.00090 X20PD2113		7.9631.00090 X20PD2113											
I/O-Module Lower part	-K1 B&R	7.9630.0 X20BB80		7.9630.0 X20BB80											
I/O-Module Lower part	-K1-X1...-X4 B&R	7.9630.00010 X20BM11		7.9630.00010 X20BM11											
I/O-Module terminal block	-K1-X0...-X4 B&R	7.9632.0 X20BM11		7.9632.0 X20BM11											
Switch	-K10 Wieland	7.9662.0 WIENET UMS 8		7.9662.0 WIENET UMS 8											
Switch option E2	-K11 Wieland	7.9662.0 WIENET UMS 8		7.9662.0 WIENET UMS 8											
protocol converter option E1	-T10 Hilscher	7.9661.0 NT100-RE-DP/KAES		7.9661.0 NT100-RE-DP/KAES											
Cable	-W80,-W81 Weidmüller	7.7818.1 LSZH grey 0,5m		7.7818.1 LSZH grey 0,5m											
Cable option E1/E2	-W82 Weidmüller	7.7818.1 LSZH grey 0,5m		7.7818.1 LSZH grey 0,5m											
Terminals	-X1 Wieland	2x 7.3149.02230 WKFN4 E/VB/35 7.3149.02210 WKFN4 E/SL/35		4x 7.3149.02230 WKFN4 E/VB/35 7.3149.02210 WKFN4 E/SL/35											
Cut-out	-F1 Siemens	7.6298.0 5SY4106-6		7.6298.0 5SY4106-6											
Power supply	-T1 Prodrive	7.7605P0 PSDC24/2.5		---											
Coupling relay	-K21,-K25 Phoenix	7.3172.00310 RIF-0-RPT-24DC/21		7.3172.00310 RIF-0-RPT-24DC/21											
Control cabinet ventilator	-M1 Rübsamen&Herr	7.9660.0 614NGML-283		7.9660.0 614NGML-283											
Fan safety grille	-M1 Rübsamen&Herr	7.9660.00010 BG80		7.9660.00010 BG80											
Ferrit bead hinged	Würth	7.4890.00070 74271112		7.4890.00070 74271112											
Ferrit bead closed	Würth	7.4890.00020 74270081		7.4890.00020 74270081											
Screwed cable gland M 16 x 1,5 EMV	Lapp	7.5781.00780 SKINTOP MS-SC-M16x 1,5		7.5781.00780 Skintop MS-SC-M16x 1,5											
Screwed cable gland M 20 x 1,5	Jacob	7.5289.00010 50.620PA/R7035		7.5289.00010 50.620PA/R7035											
Screwed cable gland M 25 x 1,5	Jacob	7.5290.00010 50.625PA/R7035		7.5290.00010 50.625PA/R7035											
Counter-nut M 25 x 1,5 EMV	Lapp	895291.00030 SKINTOP BRUSH M 25 x 1,5		895291.00030 SKINTOP BRUSH M 25 x 1,5											

Equipment parts list

KAESER
KOMPRESSOREN

Ursprung:

Ersatz für:

Ersatz durch:

18.06.2014

Silber

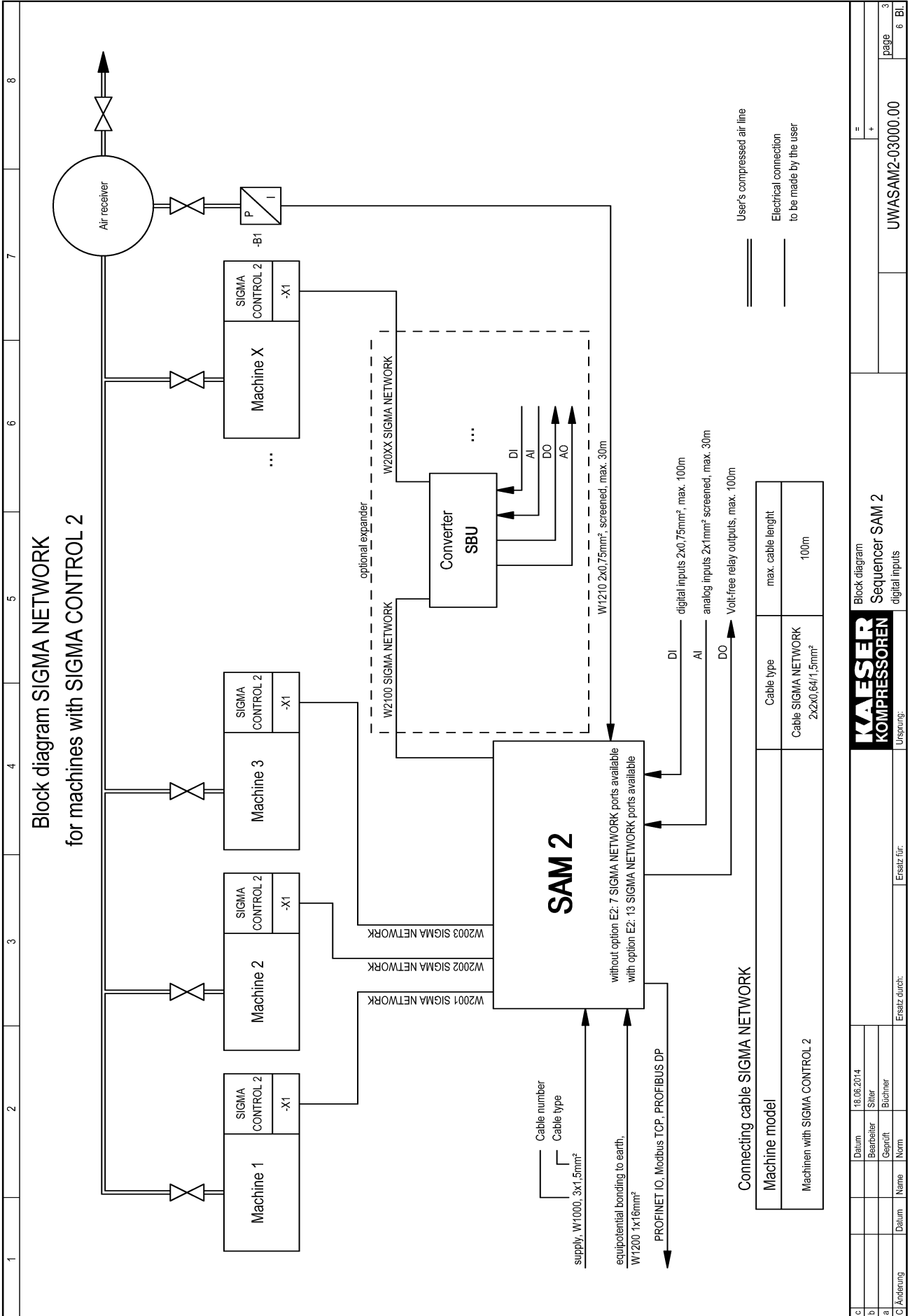
Buchner

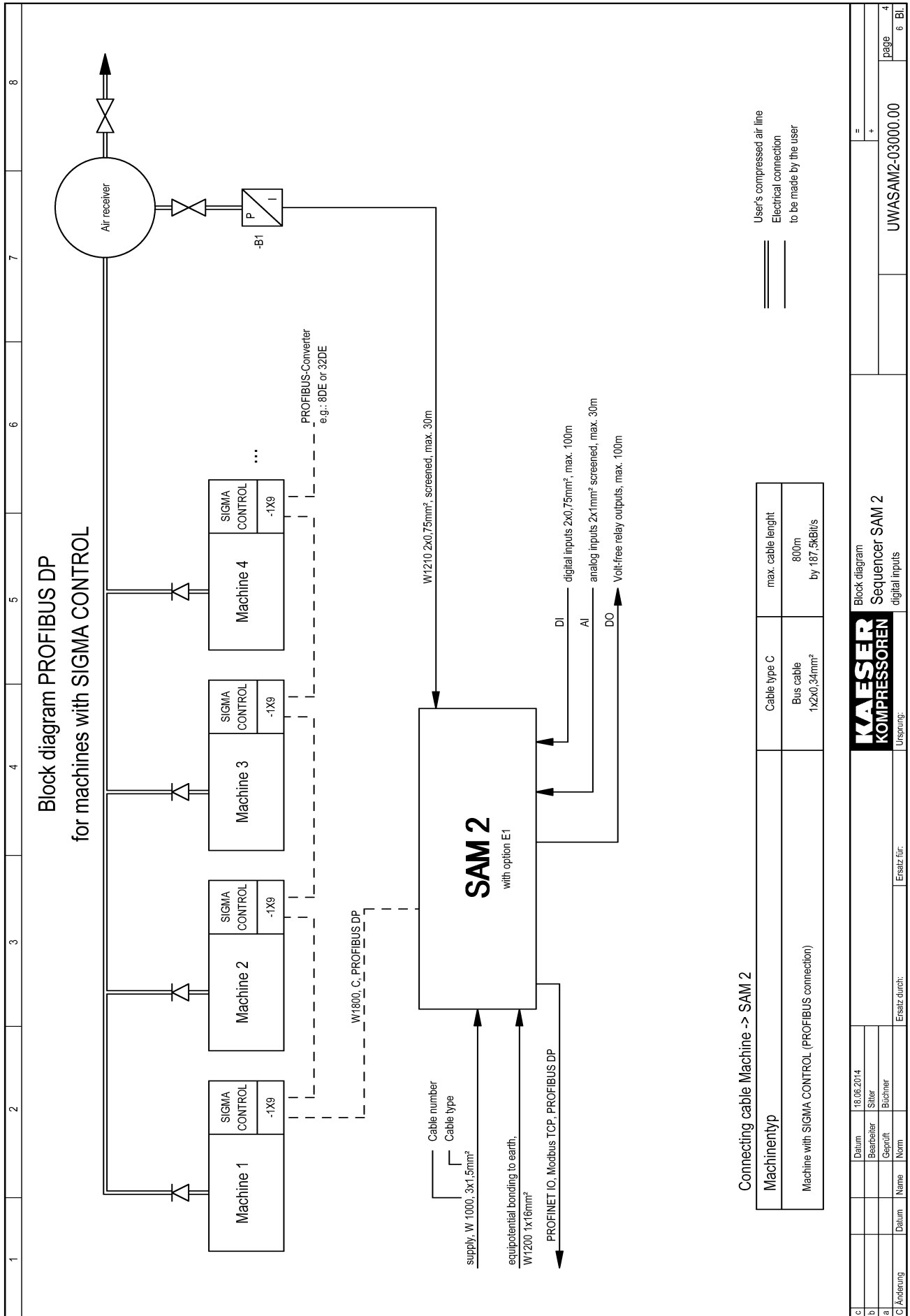
Datum

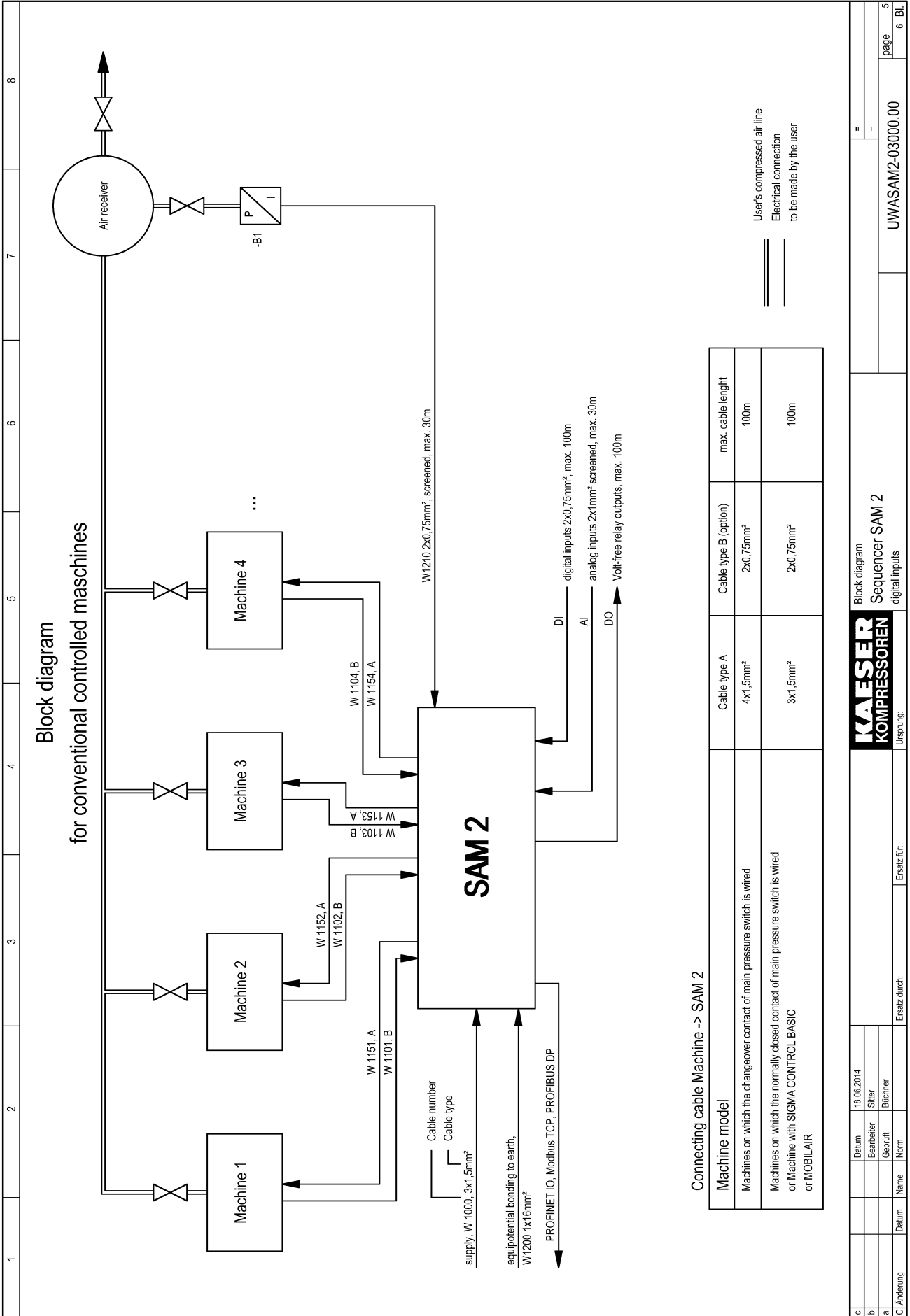
Bearbeiter

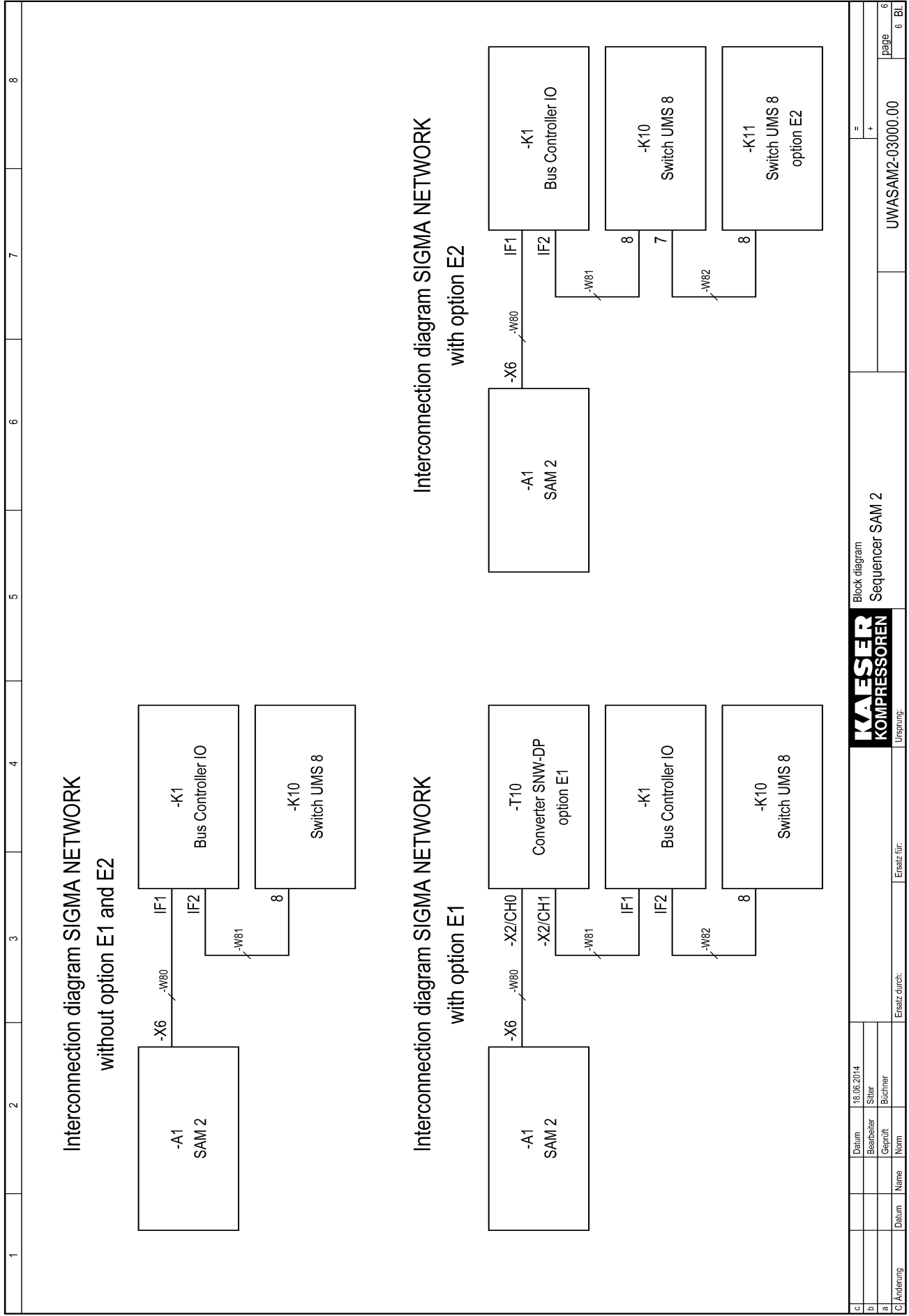
Genrifi

Name

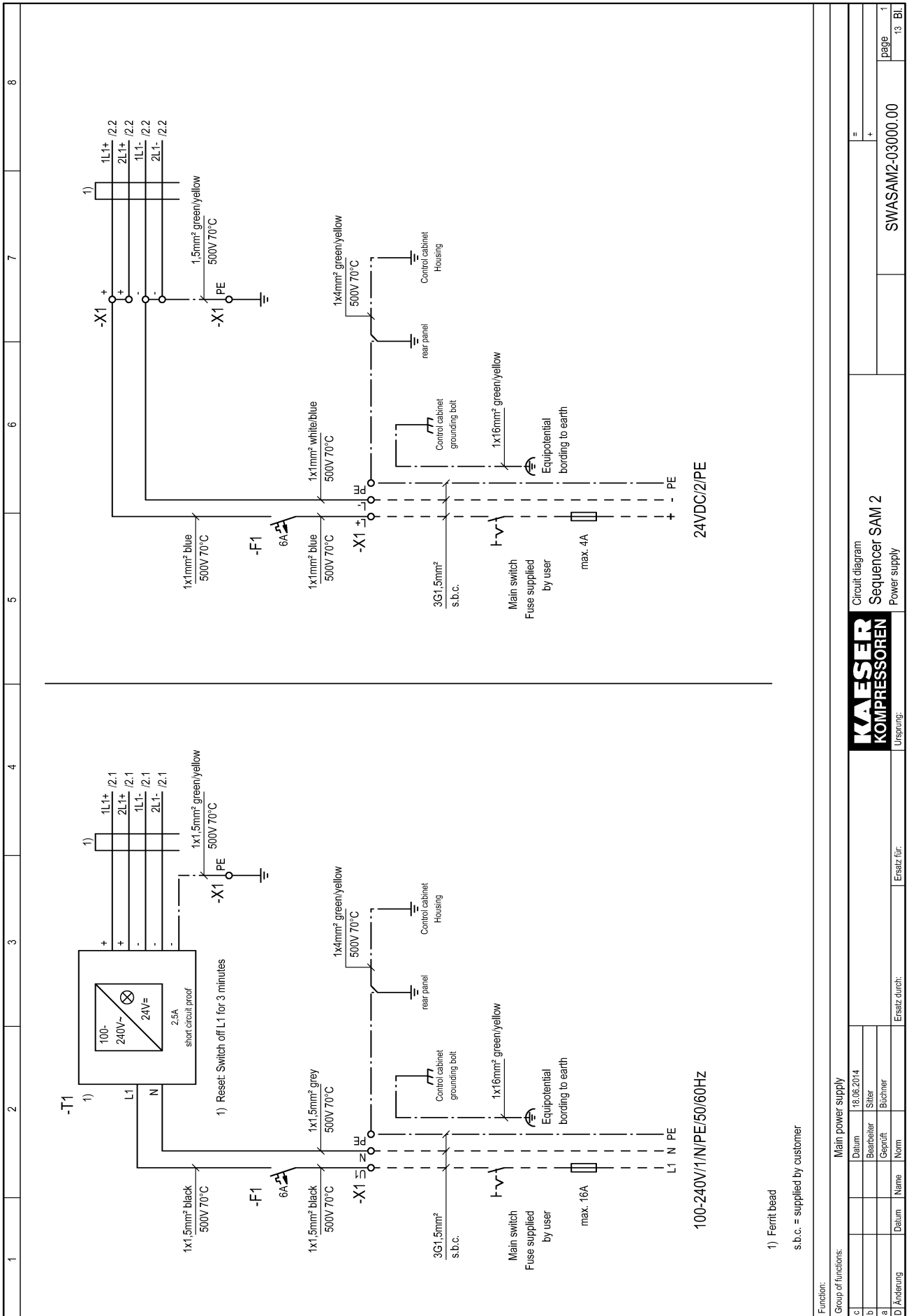








c	Datum	18.06.2014	Ersatz durch:		Ersatz für:		Ursprung:	
b	Bearbeiter	Siller					Block diagram	
a	Geprüft	Büchner					Sequencer SAM 2	
c/	Änderung	Datum	Name	Norm			UWASAM2-03000.00	
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							+	6 Bl.



Function:

Group of functions:

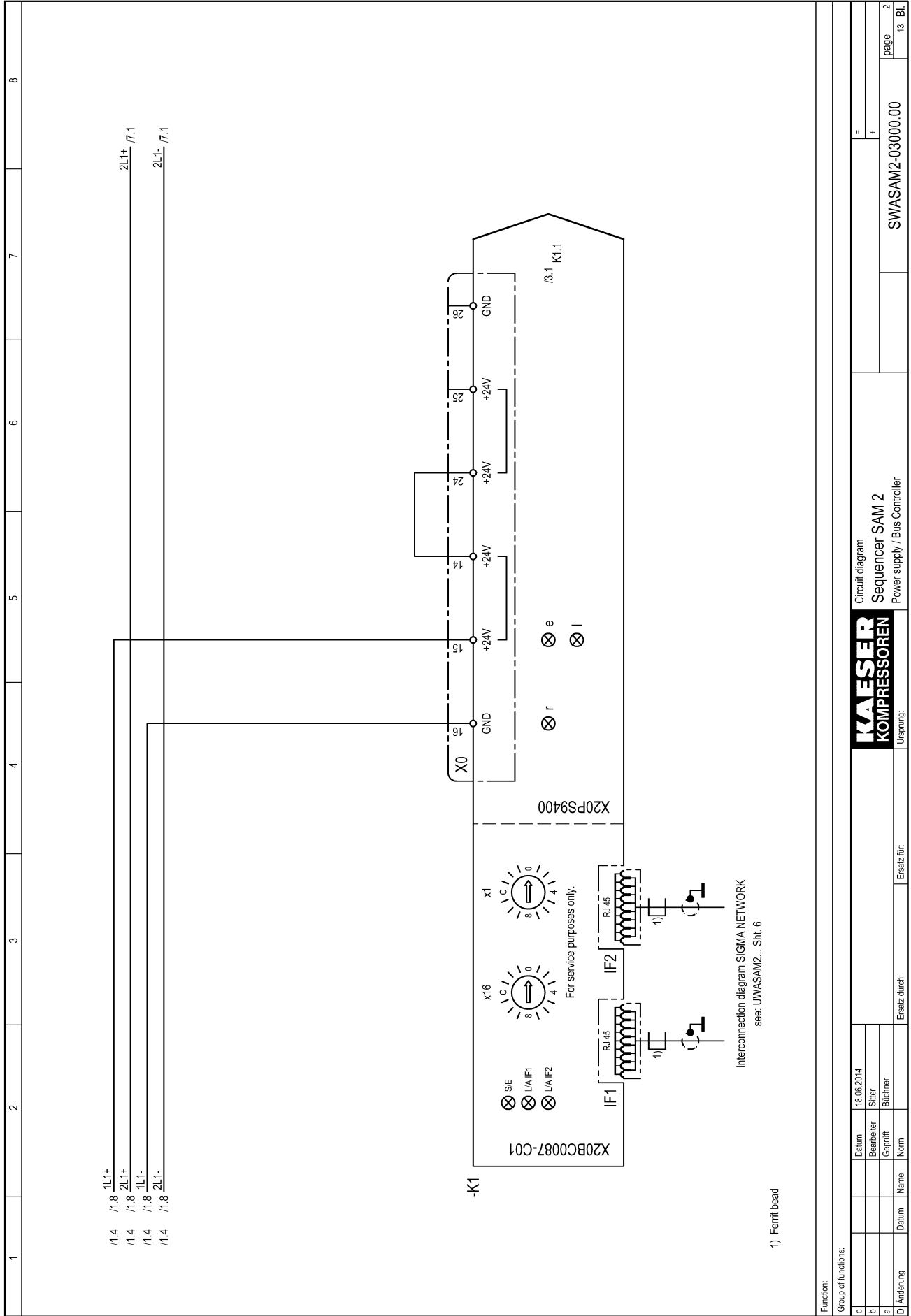
Main power supply	
c	Datum 18.06.2014
b	Bearbeiter Siller
a	Geprüft Buchner
D	Änderung Datum Name Norm Ersatz durch: Ersatz für:



Circuit diagram
Sequencer SAM 2
Power supply

SWASAM2-03000.00

page 1
13 Bl.

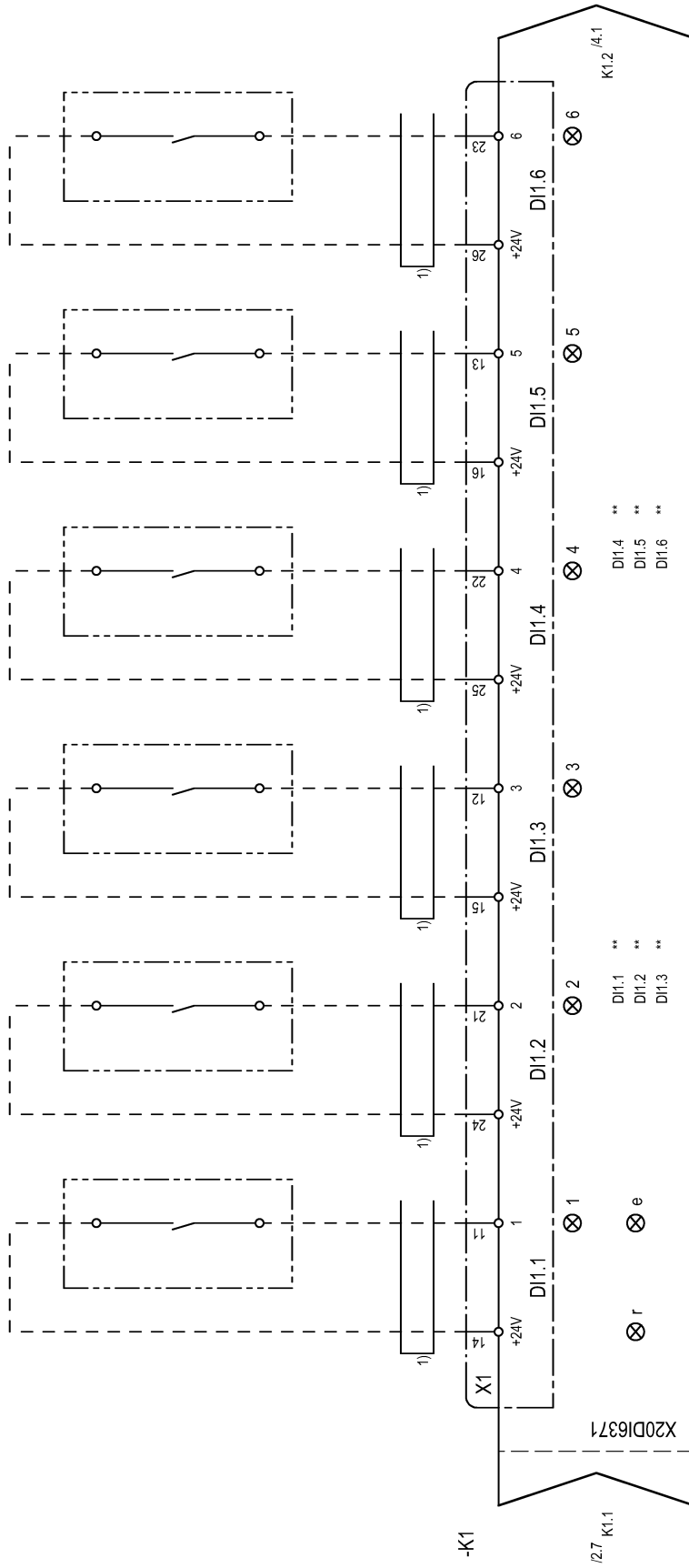


1 2 3 4 5 6 7 8

/1.4 /1.8 1L1+ 2L1+ /7.1
 /1.4 /1.8 2L1+ 2L1- /7.1
 /1.4 /1.8 1L1-
 /1.4 /1.8 2L1-

Function:		Circuit diagram	
Group of functions:		Sequencer SAM 2	
c	Datum	18.06.2014	=
b	Bearbeiter	Silber	+
a	Geprüft	Büchner	
D	Änderung	Datum	Name
			Ersatz durch:
			Ersatz für:
			Ursprung:
			SWASAM2-03000.00
			page 2
			13 Bl.

1 2 3 4 5 6 7 8



** Configuration See service manual

1) Ferrite bead

Function:
Group of functions:

c	Datum	18.06.2014
b	Bearbeiter	Silber
a	Geprüft	Büchner
D	Änderung	Datum Name Norm

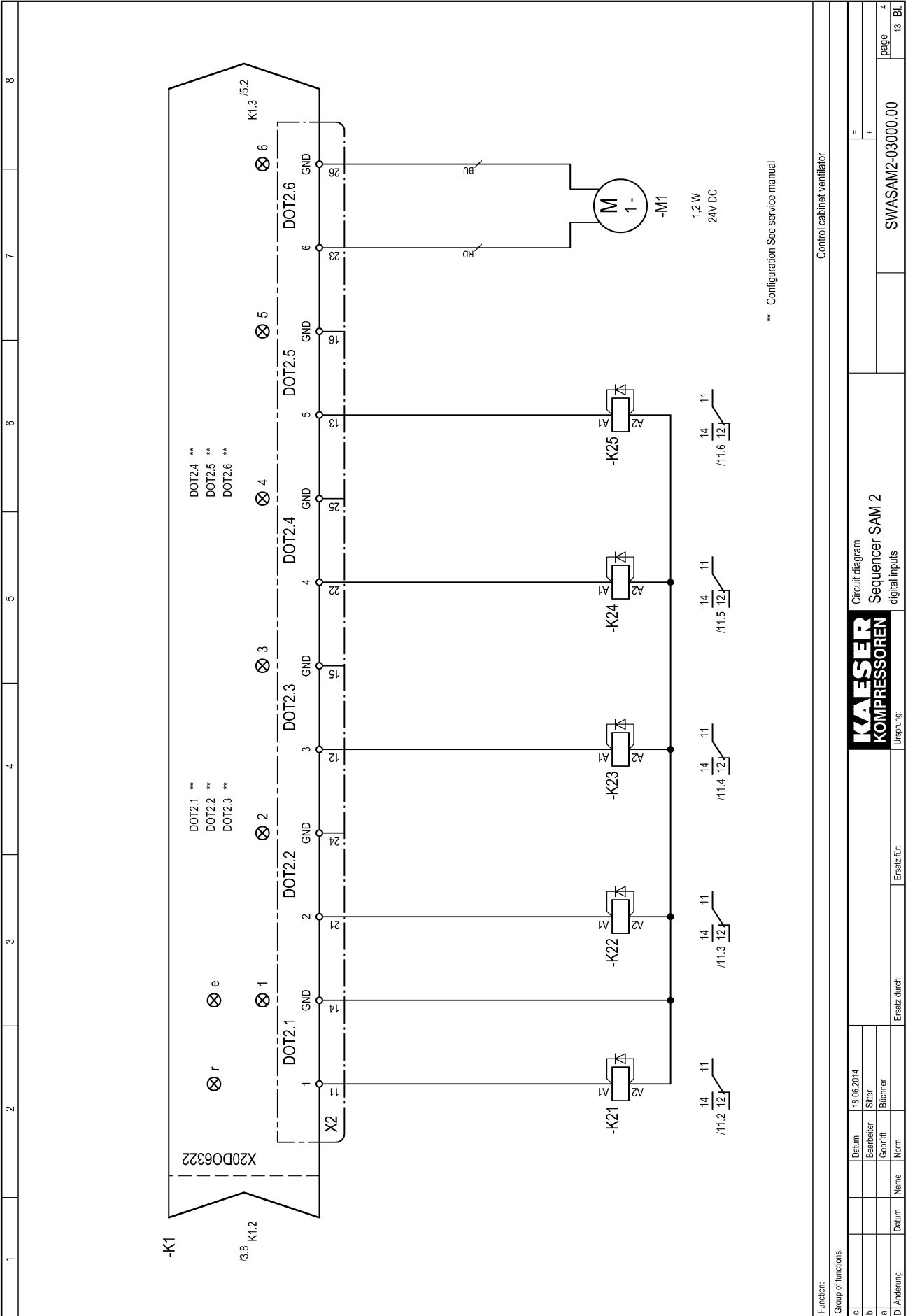
Circuit diagram
Sequencer SAM 2
digital inputs

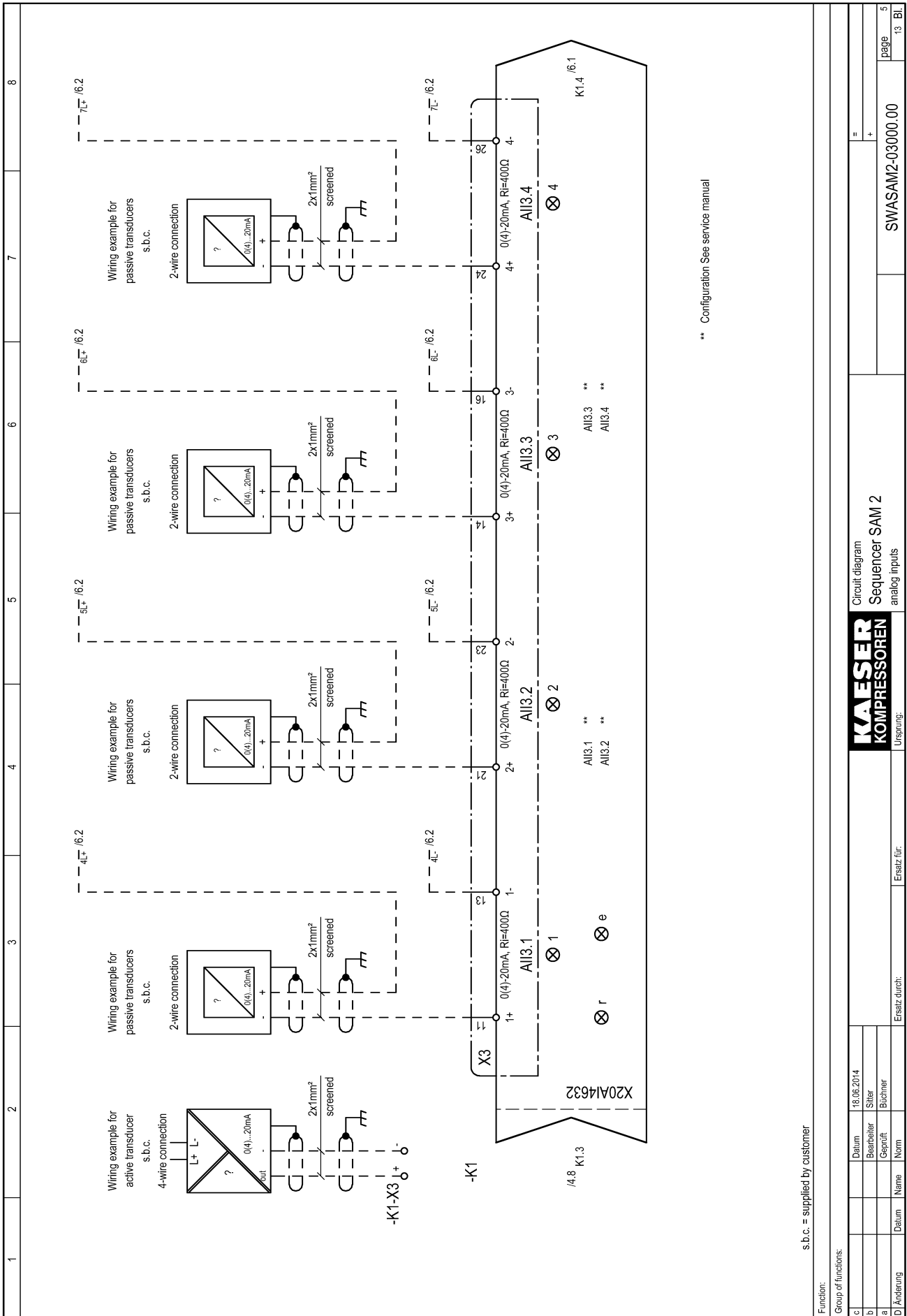
KAESER
KOMPRESSOREN
Ursprung:

Ersatz durch: Ersatz für:

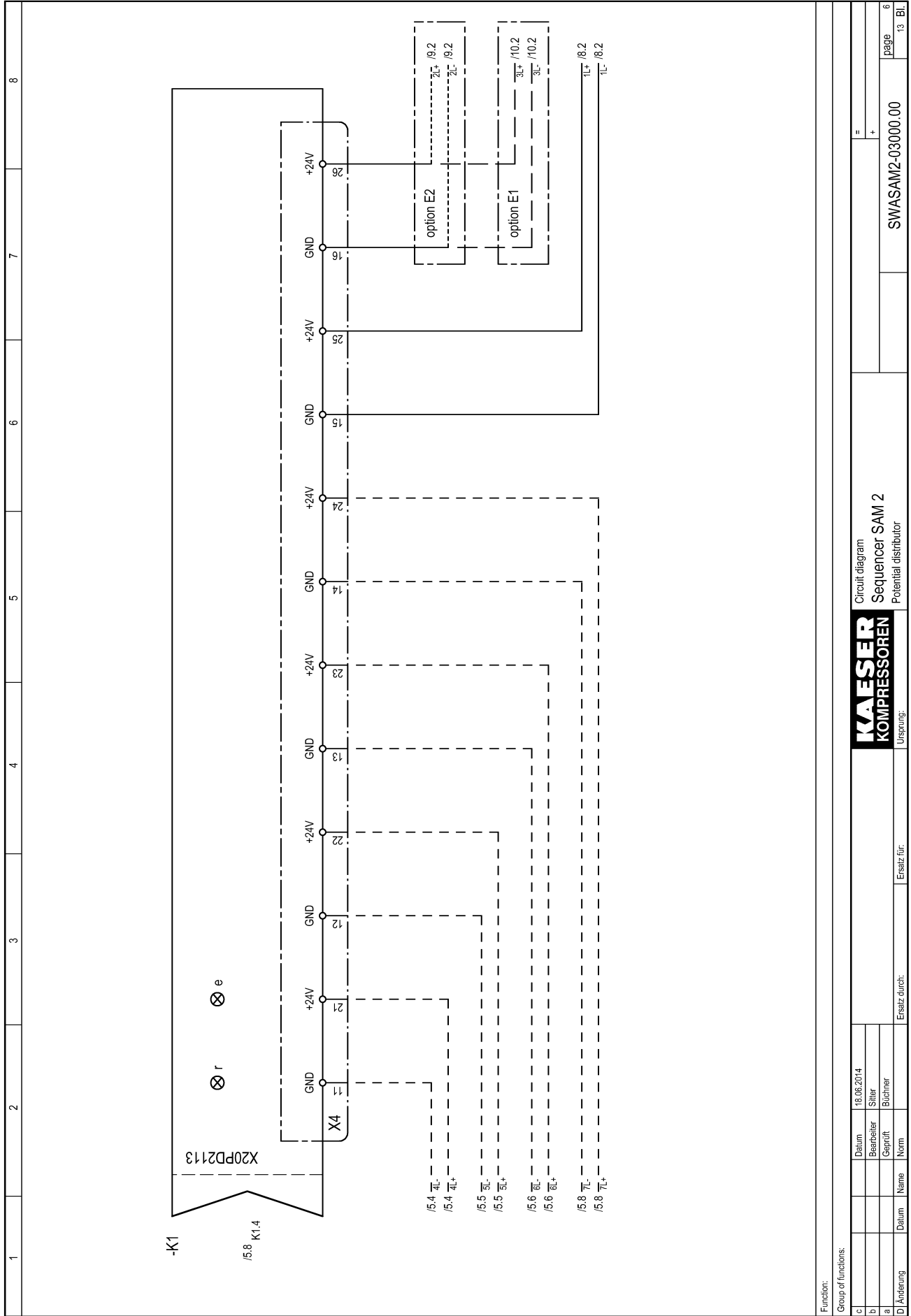
SWASAM2-03000.00

page 3
13 Bl.



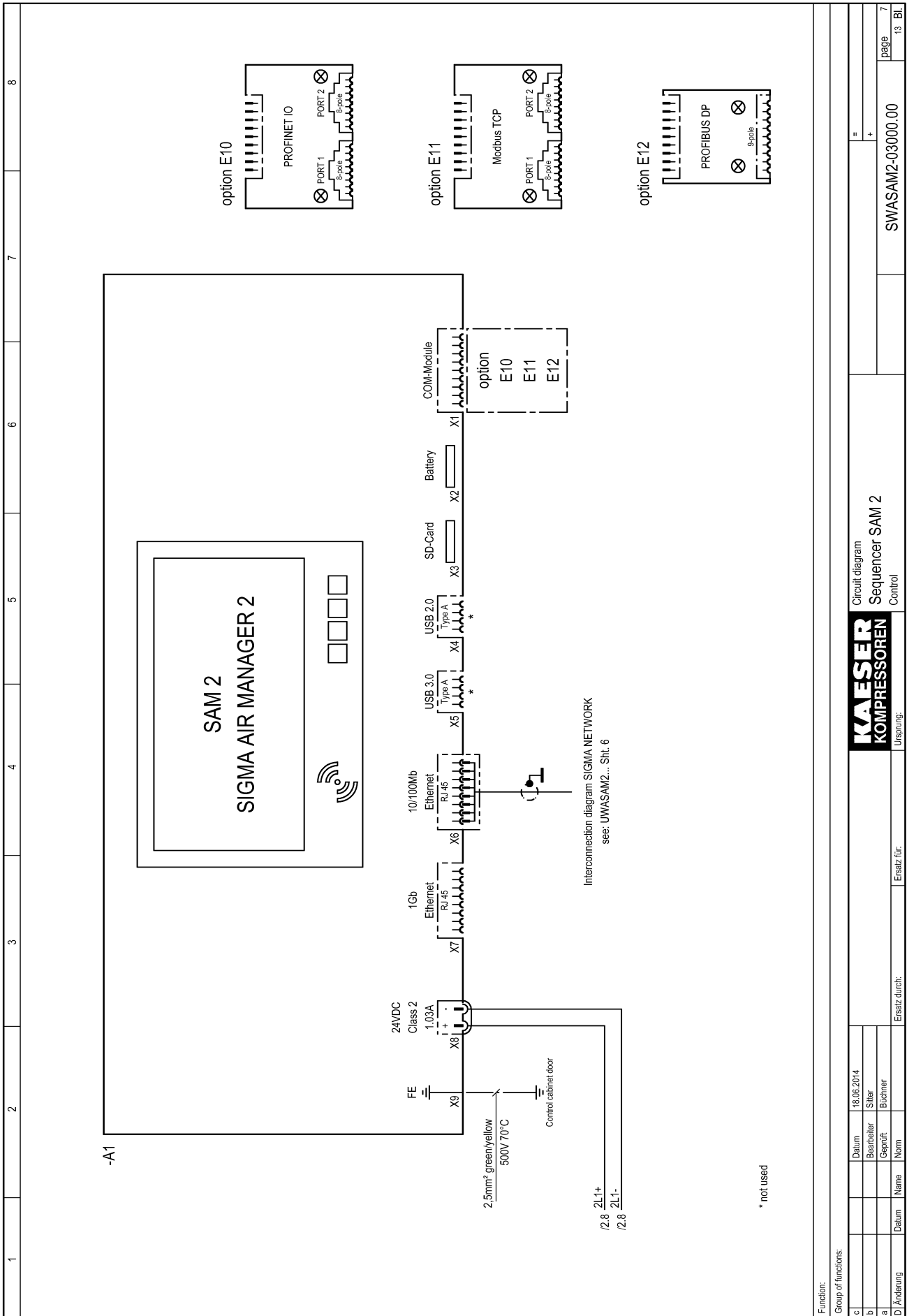


Function:		s.b.c. = supplied by customer	
Group of functions:			
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b	Bearbeiter	Siller	+
a	Geprüft	Büchner	
D/Änderung	Datum	Name	Ersatz durch:
			Ersatz für:
Circuit diagram		Sequencer SAM 2	
analog inputs		SWASAM2-03000.00	
page	5	13 Bl.	



Function:		Circuit diagram	
Group of functions:		Sequencer SAM 2	
		Potential distributor	
		SWASAM2-03000.00	
		=	
		+	
		Page 6	
		13 Bl.	

Date: 18.06.2014		Ersatz durch:	
Bezeichnet:	Silber		
Geprüft:	Büchner		
Norm:			
Ursprung:			



Function:

Group of functions:

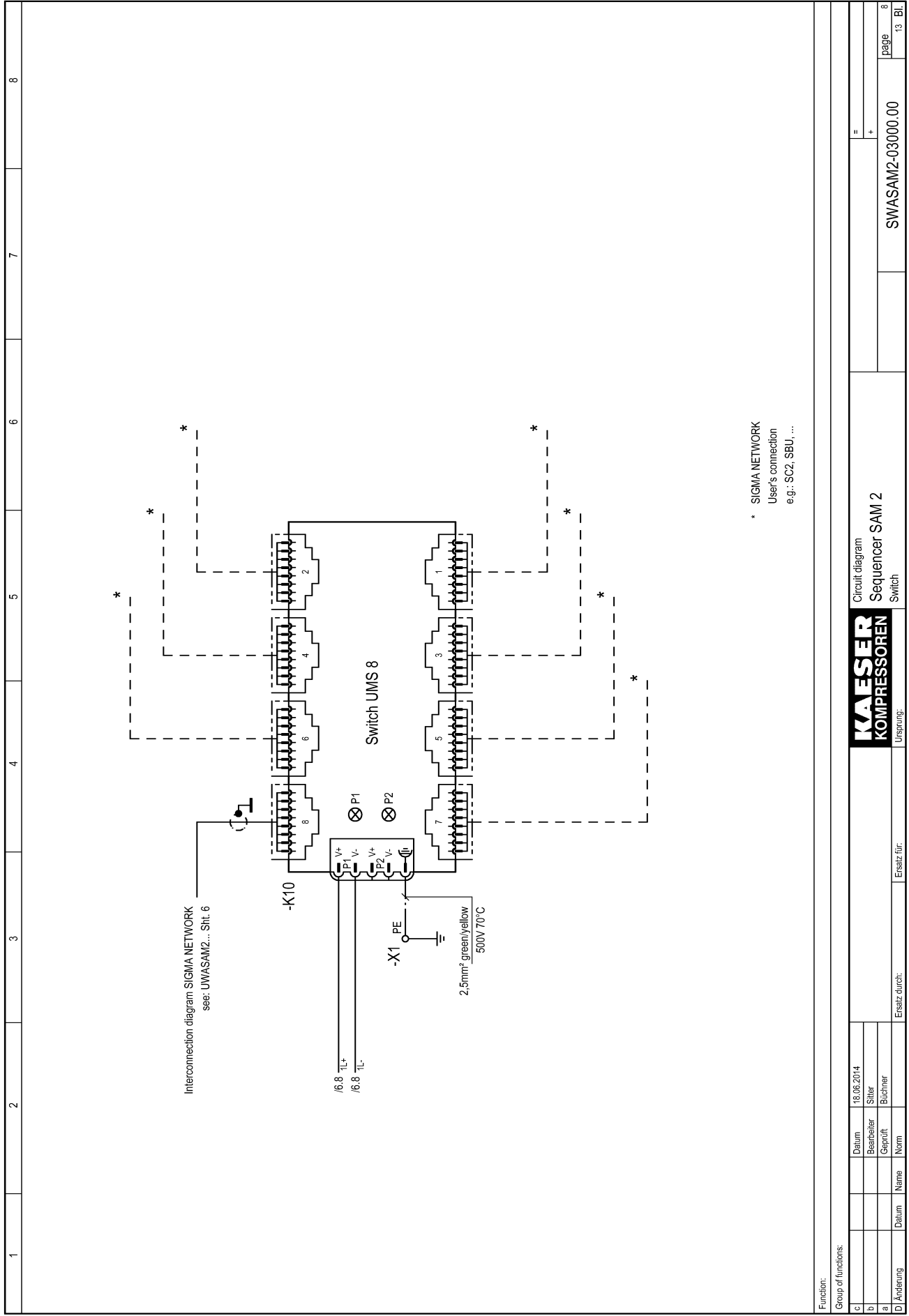
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b	Bearbeiter	Siller
a	Geprüft	Büchner
D	Änderung	Datum Name Norm

Ersatz durch:	Ersatz für:	Ursprung:
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Circuit diagram
Sequencer SAM 2
Control

SWASAM2-03000.00

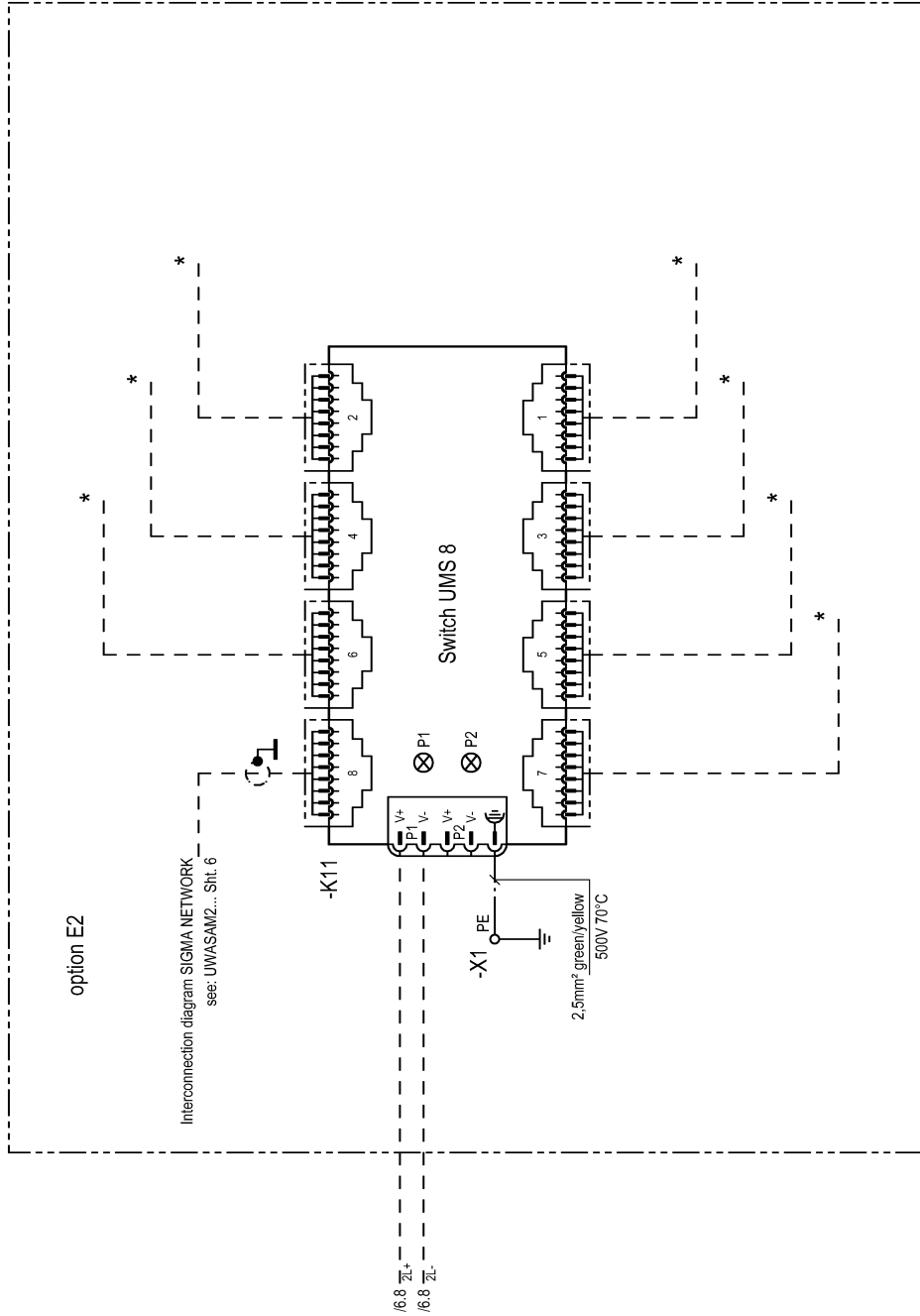
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13 Bl.



1 2 3 4 5 6 7 8

Function:		Circuit diagram	
Group of functions:		Sequencer SAM 2	
c	Datum	18.06.2014	=
b	Bearbeiter	Siller	+
a	Geprüft	Büchner	
D/Änderung	Datum	Name	Ersatz durch:
			Ursprüngl.
			SWASAM2-03000.00
			page 8
			13 Bl.

1 2 3 4 5 6 7 8



* SIGMA NETWORK
User's connection
e.g.: SC2, SBU, ...

Function:

Group of functions:

c	Datum	18.06.2014
b	Bearbeiter	Silber
a	Geprüft	Büchner
D/Änderung	Name	Norm

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Circuit diagram
Sequencer SAM 2
Switch / option E2

Ursprung:

Ersatz durch:

SWASAM2-03000.00

page 9
13 Bl.

8

7

6

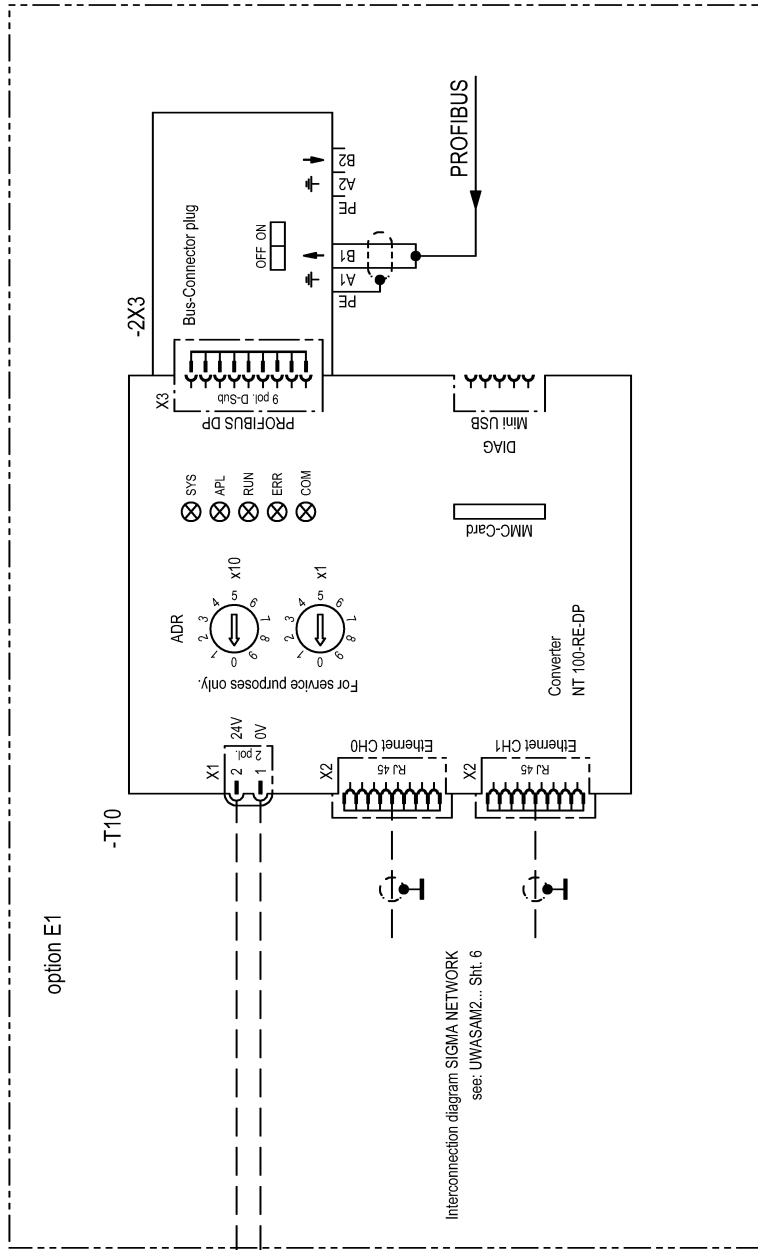
5

4

3

2

1

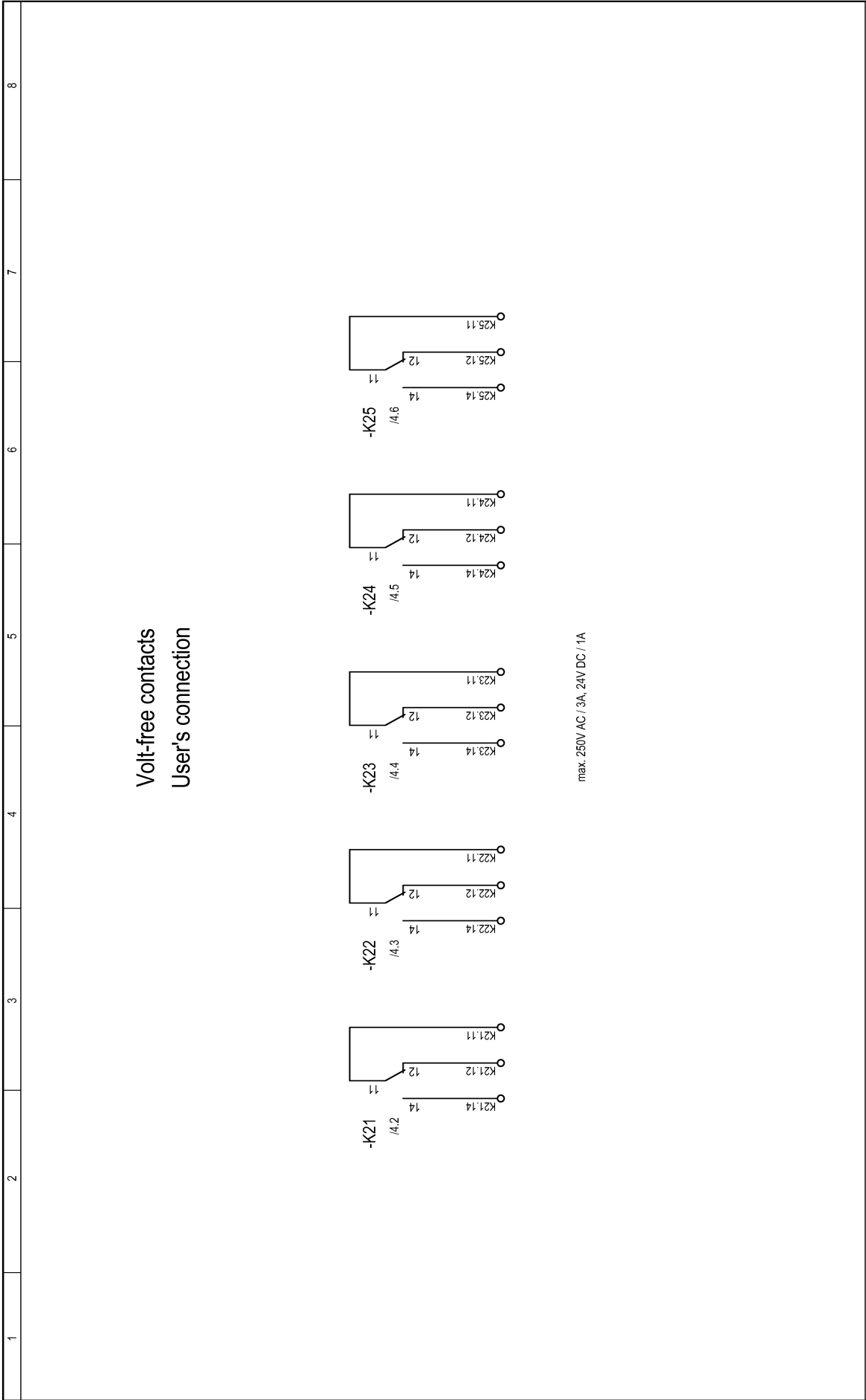


Function:
Group of functions:

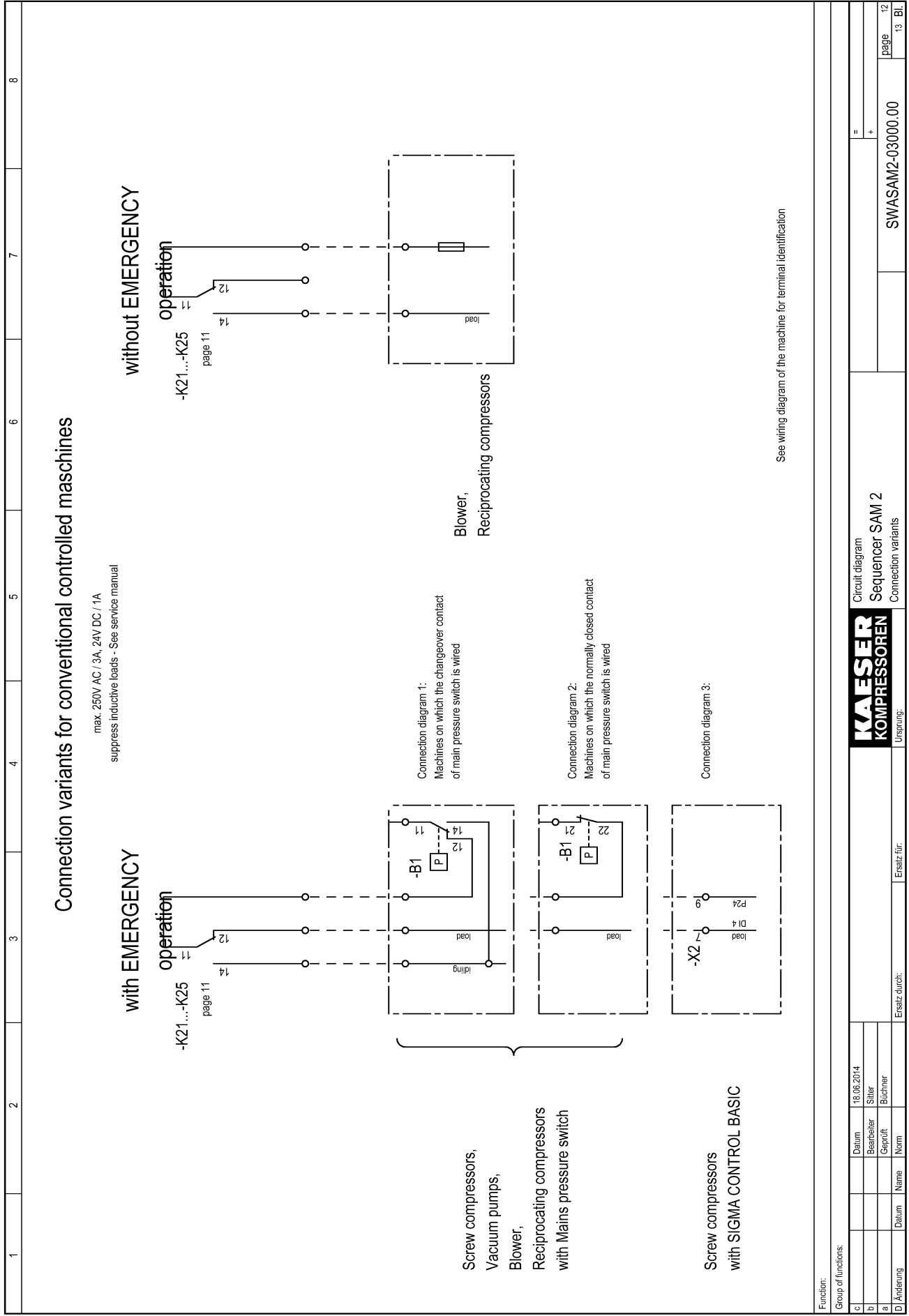
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	18.06.2014			SWASAM2-03000.00	
a	b	Geprüft	Büchner		
D	Anderung	Name	Norm	page	10
				13	Bl.

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Circuit diagram
Sequencer SAM 2
Converter / option E1



Funktion:		Group of functions:		Circuit diagram		=	
c		Datum	18.06.2014	Bearbeiter	Siller	+	
b		Gepüft		Büchmer			
a		Name		Ersatz durch:			
d	Änderung	Datum		Ersatz durch:			
KAESER KOMPRESSOREN						Sequencer SAM 2 Volt-free contacts	
Usprung:						SWASAM2-03000.00	
						page	11
						13	Bl.

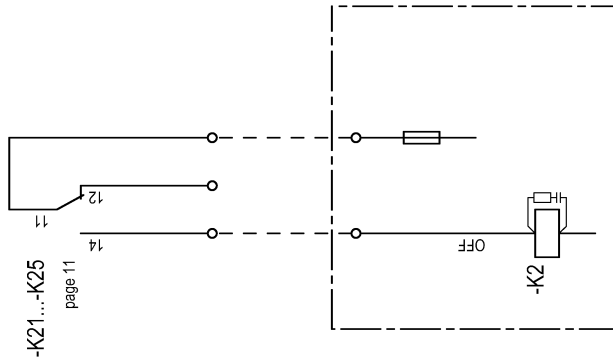


Function:			
Group of functions:			
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b	Bearbeiter	Siller	+
a	Geprüft	Büchner	
D/Änderung	Datum	Name	
		Ersatz durch:	
		Ursprung:	
		KAESER KOMPRESSOREN	
		Circuit diagram Sequencer SAM 2 Connection variants	
			SWASAM2-03000.00
		page	12
			13 Bl.

1 2 3 4 5 6 7 8

Connection variants for MOBILAIR

max. 250V AC / 3A, 24V DC / 1A
suppress inductive loads - See service manual



MOBILAIR

See wiring diagram of the machine for terminal identification

Function:

Group of functions:

c	Datum	18.06.2014
b	Bearbeiter	Siller
a	Geprüft	Büchner
D	Änderung	Datum Name

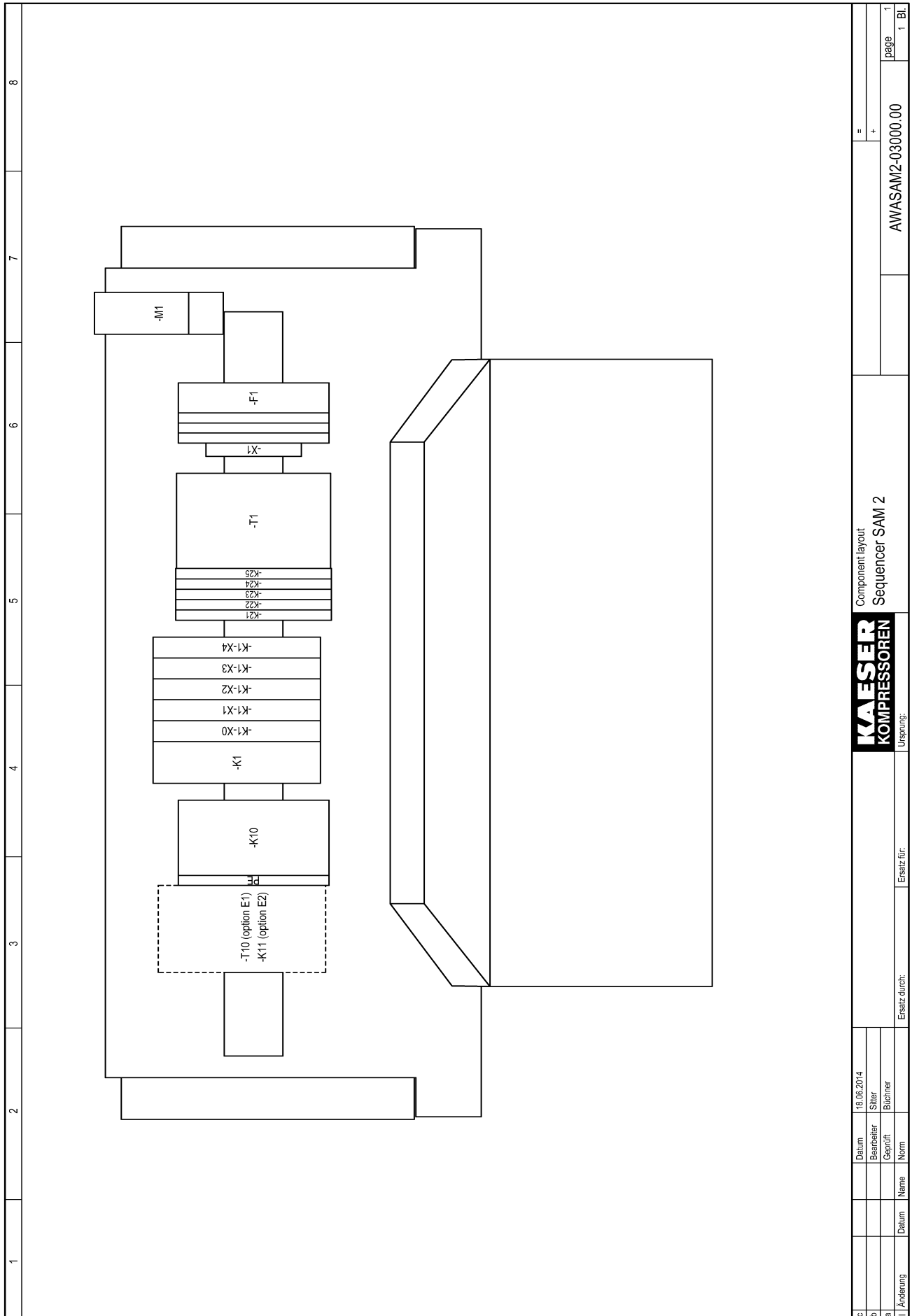
Ersatz durch:	Ersatz für:

KAESER
KOMPRESSOREN
Ursprung:

Circuit diagram
Sequencer SAM 2
Connection variants

=	
+	SWASAM2-03000.00

page 13
13 Bl.



c	Datum	18.06.2014	Ersatz durch:		Ersatz für:		AWASAM2-03000.00		=	1
b	Bearbeiter	Siller	Ersatz durch:		Ersatz für:		AWASAM2-03000.00		+	1
a	Geprüft	Büchner	Ersatz durch:		Ersatz für:		AWASAM2-03000.00			1
U	Änderung	Datum	Name	Name	Name	Name	AWASAM2-03000.00			1 Bl.

13.9 I/O block 6DI&6DOT&4AI with relays

Enter the wiring information of the actual application into the following tables.

Sample entry in assignment table

Input	Terminal	Line	Destination	Application
DI 1.1	1 X1	W7625 2x0.75 mm ² : 1	Compressor 3 -X1:25	Motor running K3
	+24V X1	W7625 2x0.75 mm ² : 2	Compressor 3 -X1:26	Motor running K3
DOT 2.1	1 X2	1x1 mm ² : SM	-K21: A1	Internal wiring
	GND X2	1x1 mm ² : SM	-K21: A2	Internal wiring
All 3.1	1+ X3	W4713 2x1.5 mm ² : BN	DHS -X1:19	Pressure from air main charging system
	1- X3	W4713 2x1.5 mm ² : SW	DHS -X1:20	
	+24V X4			
	GND X4			
Relay -K21		A1 1x1 mm ² : SM	-K1-X2: 11	Internal wiring
		A2 1x1 mm ² : SM	-K1-X2: 14	Internal wiring
	CC	W4633 3G 1.5 mm ² : BN	Compressor 3 -X3: 18	C3 load
	NC	12		
	NO	W4633 3G 1.5 mm ² : SM	Compressor 3 -X3: 19	C3 load

Tab. 65 Sample entry in assignment table I/O block with relays

Module 1: X1 DI1.x

Input	Terminal	Line	Objective	Application
DI 1.1	1 X1	11		
	+24V X1	14		
DI 1.2	2 X1	21		
	+24V X1	24		
DI 1.3	3 X1	12		
	+24V X1	15		
DI 1.4	4 X1	22		
	+24V X1	25		
DI 1.5	5 X1	13		
	+24V X1	16		
DI 1.6	6 X1	23		
	+24V X1	26		

Tab. 66 Assignment I/O block – Module 1: X1 DI1.x – 20DI6371 – 6x DI 24VDC

Module 2: X2 DOT2.x (wiring when shipped)

Input	Terminal	Line	Objective	Application
DOT 2.1	1 X2	11 1x1 mm ² : SM	-K21: A1	Internal wiring
	GND X2	14 1x1 mm ² : SM	-K21: A2	Internal wiring
Relay -K21		A1 1x1 mm ² : SM	-K1-X2: 11	Internal wiring
		A2 1x1 mm ² : SM	-K1-X2: 14	Internal wiring
	CC	11		
	NC	12		
DOT 2.2		14		
	2 X2	21 1x1 mm ² : SM	-K22: A1	Internal wiring
	GND X2	24		
Relay -K22		A1 1x1 mm ² : SM	-K1-X2: 21	Internal wiring
		A2 Wire jumper	-K21: A2	Internal wiring
	CC	11		
	NC	12		
DOT 2.3		14		
	3 X2	12 1x1 mm ² : SM	-K23: A1	Internal wiring
	GND X2	15		
Relay -K23		A1 1x1 mm ² : SM	-K1-X2: 12	Internal wiring
		A2 Wire jumper	-K21: A2	Internal wiring
	CC	11		
	NC	12		

Input	Terminal		Line	Objective	Application
DOT 2.4	NO	14			
	4	X4	22 1x1 mm ² : SM	-K24: A1	Internal wiring
	GND	X4	25		
Relay -K24			A1 1x1 mm ² : SM	-K1-X2: 22	Internal wiring
			A2 Wire jumper	-K21: A2	Internal wiring
	CC	11			
	NC	12			
DOT 2.5	NO	14			
	5	X5	13 1x1 mm ² : SM	-K25: A1	Internal wiring
	GND	X5	16		
			A1 1x1 mm ² : SM	-K1-X2: 13	Internal wiring
Relay -K25			A2 Wire jumper	-K21: A2	Internal wiring
	CC	11			
	NC	12			
	NO	14			
DOT 2.6	6	X6	23 1x1 mm ² : SM	SBU : -K26: A1 SAM 2 : Control cabinet fan	Internal wiring
	GND	X6	26 SAM 2 : 1x1 mm ² : SM	SAM 2 : Control cabinet fan	
			A1 1x1 mm ² : SM	-K1-X2: 23	Internal wiring
SBU : Relay -K26			A2 Wire jumper	-K21: A2	Internal wiring

Input	Terminal	Line	Objective	Application
	CC	11		
	NC	12		
	NO	14		

Tab. 67 Assignment I/O block – Module 2: X2 DOT2.x – X20DO6322 – 6x relays

Modules 3 & 4: X3 & X4 AI3.x

Input	Terminal	Line	Objective	Application
AI1 3.1	1+ X3	11		
	1- X3	13		
	+24V X4	21		
	GND X4	11		
AI1 3.2	2+ X3	21		
	2- X3	23		
	+24V X4	22		
	GND X4	12		
AI1 3.3	3+ X3	14		
	3- X3	16		
	+24V X4	23		
	GND X4	13		
AI1 3.4	4+ X3	24		
	4- X3	26		
	+24V X4	24		
	GND X4	14		

Tab. 68 Assignment I/O block Modules 3 & 4 – X3 & X4 AI3.x – X20AI4632 – 4x AI1 0-20mA 16Bit & X20PD2113

13.10 Module 6DI – Digital inputs

Enter the wiring information of the actual application into the following table. If you require more than table, please use this table to create photocopies.

Module __: X__ DI__x

Input	Terminal	Line	Objective	Application
DI __.1	1 X__	11		
	+24V X__	14		
DI __.2	2 X__	21		
	+24V X__	24		
DI __.3	3 X__	12		
	+24V X__	15		
DI __.4	4 X__	22		
	+24V X__	25		
DI __.5	5 X__	13		
	+24V X__	16		
DI __.6	6 X__	23		
	+24V X__	26		

Tab. 69 Assignment Module 6DI – X20DI63716x – DI 24VDC

13.11 Module 6DOT – Digital outputs 24VDC 0.5A

Enter the wiring information of the actual application into the following table. If you require more than table, please use this table to create photocopies.

Module __: X__ DOT __.x

Input	Terminal	Line	Objective	Application
DOT __.1	1 X__	11		
	GND X__	14		
DOT __.2	2 X__	21		
	GND X__	24		
DOT __.3	3 X__	12		
	GND X__	15		
DOT __.4	4 X__	22		
	GND X__	25		
DOT __.5	5 X__	13		
	GND X__	16		
DOT __.6	6 X__	23		
	GND X__	26		

Tab. 70 Assignment Module 6DOT – X20DO6322 – 6x DOT 24VDC 0,5A

13.12 Module 4All – Analogue inputs 0-20mA




Enter the wiring information of the actual application into the following table. If you require more than table, please use this table to create photocopies.



Module __ & __: X__ & X__ All __.x

Input	Terminal	Line	Objective	Application
All __.1	1+ X__	11		
	1- X__	13		
	+24V X__	21		
	GND X__	11		
All __.2	2+ X__	21		
	2- X__	23		
	+24V X__	22		
	GND X__	12		
All __.3	3+ X__	14		
	3- X__	16		
	+24V X__	23		
	GND X__	13		
All __.4	4+ X__	24		
	4- X__	26		
	+24V X__	24		
	GND X__	14		

Tab. 71 Assignment 4All – X20AI4632 – 4x All 0-20mA 16Bit & X20PD2113

13.13 Glossary

Term	Meaning
"Current reports"	Displays a chronologically sorted list of the last messages returned by the system. The newest messages are shown at the top.
"Required pressure"	The required pressure is the pressure required by the consumers in the compressed air network (measured with the "pressure transducer").
"Operating state"	The operating states of compressors are: <ul style="list-style-type: none"> ■ READY  ■ IDLE  ■ LOAD 
"Maximum pressure"	Pressure high is a monitoring function. If the monitoring function is activated, the system issues a warning message as soon as the mains pressure exceeds the set threshold value.
"Minimum pressure"	Pressure low is a monitoring function. If the monitoring function is activated, the system issues a warning message as soon as the mains pressure falls below the set threshold value.
"Air Main Charging Valve"	The air main charging system is a component designed for the relief of the compressed air treatment facility when an empty air network is filled. It prevents problems in the components of the compressed air treatment facility when compressed air flows at high speed through the components.
"Net pressure station"	The pressure curve is the visual display of the network pressure progression and set limit values for the entire station or the selected machines.
"Pressure range"	The pressure margin is the difference resulting from the upper margin limit and the required pressure.
"Pressure range upper limit"	You define the pressure margin by setting a pressure value above the required pressure. For example, if you want a required pressure of 7.0 bar and a pressure margin of 0.5 bar, you must specify 7.5 bar as value for the upper pressure margin.
"Pressure transducer"	Sensor for measuring the pressure (relative, absolute or differential pressure). The sensor is available for different pressure measuring ranges and converts pressure into an electric signal.
"Frequency converter"	Device converting fixed mains AC voltage to an AC voltage with changeable frequency for the speed regulation of three-phase motors.
"Total values"	Calculated sum of important measuring data.
"Process control"	Central control and monitoring station. SAM 2 can be remote controlled via an Ethernet interface.
"Free air delivery"	The compressed air volume currently delivered by the entire station or selected machine.
"Message history"	Chronologically sorted list of the last 1000 messages.
"Current values"	The display of current measuring values of the entire station or selected machine(s).
"Pressure chart"	"Mains pressure" as numeric value in large display. This display type enables good legibility from a larger distance.

Term	Meaning
PROFIBUS	The Process Field Bus is a standard for fieldbus communication in plant engineering. The PROFIBUS subscribers are connected in series, that is, one after another. A terminating resistor is required at both ends of the wiring.
Pt100	Platinum sensor for temperature measuring. A change in temperature causes a change in the platinum sensor's resistance which can be reliably evaluated. A Pt100 sensor has a 100 Ohm resistance at 0 °C.
"Buffer volume"	Volume of the air receiver storing the compressed air. A larger buffer volume ensures a lower switching frequency of the compressor at equal compressed air consumption.
"P&I diagram station"	<p>Piping and instrument flow chart in plant and process engineering. The P&I diagram symbolically displays all components required for the station operation, such as:</p> <ul style="list-style-type: none"> ■ Compressors  ■ Blowers ■ Receivers  ■ Separators ■ Filters ■ Valves ■ Fan ■ Cooler ■ Pipes ■ Instruments ■ Actuators ■ Sensors ■ Measuring devices
"RFID"	Radio Frequency IDentification. Touch-less and reliable identification technology. Consists of a reader and a chip card or chip.
SAM	SIGMA AIR MANAGER. KAESER first generation master controller for the energy-efficient control of compressed air stations with up to 16 compressors.
"SAM 2"	SIGMA AIR MANAGER 2. KAESER second generation master controller for the energy-efficient control of compressed air stations with up to 16 compressors.
"SAM 2.Logic"	Using SAM 2.Logic, you can create programs for the control of machines or devices, similar to a PLC (programmable logic controller).
"SBU"	The SIGMA NETWORK BUS CONVERTER is an interface expansion for SAM 2. A SBU is connected via a SIGMA NETWORK conductor with SAM 2.
"Switch events"	The number of motor starts of the selected machine within the last 60 minutes.
"Drag Indicator"	Display of maximum, average and minimum pressure values.
"SIGMA NETWORK"	KAESER-specific network for the machine control. The SIGMA NETWORK subscribers are linked in a star pattern.

Term	Meaning
"Specific power"	The power in kW required to compress 1 m ³ air per minute. This standard value is used as reference value in the assessment of the station's efficiency,
"Station editor"	The fundamental configuration of the compressed air station is realised with a visual P&I diagram in SAM 2 . Using a graphical editor, you place, configure and connect the components retrieved from a library in the drawing area.
"Unacknowledged messages"	New messages not yet acknowledged by the operator. You can highlight individual messages and acknowledge them with Acknowledge message. This action removes the message from the list of unacknowledged messages.
"Upgrade"	Use the Upgrade function to upgrade SAM 2-4 or SAM 2-8 to the next larger type SAM 2-8 or SAM 2-16 when the station is expanded with additional compressors. To do so, you require an activation code.
"Consumption"	Calculated current compressed air usage in the air network.
"ADT"	Compressed air is heated during the compression process. The airtend discharge temperature is the compression temperature at the compressed air outlet, measured directly at the airtend.

Tab. 72 Glossary

