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DOCUMENT COVER SHEET

Document Number: UM 78-1 ExS Rev. No.: 1 _____
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Document Title: **ValveWatch II Hardware Installation and Setup Manual**

DESCRIPTION OF CHANGES:

If this is a new document, steps 1 through 6 need not be completed.

1) This Revision/Addenda Supersedes Revision No. ___, Addendum No. _.

2) List the Section Changed: _____

_____

3) List the Reasons for the Changes: _____

_____

4) Does this Change Affect Other Documents: [ ] Yes [ ] No

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6) Did this change involve conversion to a different word processing platform?_____. If Yes, Perform a detailed review of entire document.

REVIEW AND APPROVALS: [X] Standard [ ] Emergency

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CRANE VALVE SERVICES

A CRANE Co. Company

ValveWatch II Hardware Installation and Setup Manual

Scheduled Document
No Modifications Permitted
Without Reference to the
Notified Body

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THIS IS THE USER CAUTION SYMBOL. IT INDICATES A CONDITION WHERE DAMAGE TO THE EQUIPMENT OR INJURY TO THE OPERATOR COULD OCCUR IF OPERATIONAL PROCEDURES ARE NOT FOLLOWED. TO REDUCE THE RISK OF DAMAGE OR INJURY, FOLLOW ALL STEPS OR PROCEDURES AS INSTRUCTED.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC. rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause If the road and over the and harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case, the user will be required to correct the interference at his own expense.

Caution: FCC approved RF operation of this equipment is permitted only with the approved antennas, cable and connectors provided with this product.

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EC DECLARATION OF CONFORMITY

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(Manager, Product Development)	(Manager, Quality Assurance)	Kennesaw (Location)	(Date)

1 Intended Use of the Equipment

The ValveWatch II system is intended for permanent installation and long term monitoring, trending and analysis of critical parameters for industrial equipment. Although ValveWatch was primarily developed for monitoring Emergency Shutdown Valves (ESD) for the petroleum industry, the design also allows other general purpose equipment parameter monitoring. The parameters measured are useful for determining equipment operation and integrity. Early awareness of degradations in parameters can lead to advanced scheduling of maintenance tasks before serious equipment damage or safety hazards occur.

2 Product Specifications

2.1 Certifications

2.1.1 Certifications Required

CSA (US and Canada) Intrinsically Safe
ATEX Intrinsically Safe
CENELEC Standards per directive 94/9/C Intrinsic Safety
CE Markings – See EC Declaration of Conformity

2.2 Hub Assembly (3-51006EX) Specifications

FCC Notice: Changes or modifications to this device not expressly approved by the manufacturer could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the antenna and all persons.

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2.2.1 Physical Size ~ 19.0in(49cm) x 12in(31cm) x 12in(31cm)
2.2.2 Weight ~ 20 lbs (9 Kg)
2.2.3 Temperature -40 to +158° F (-20°C to 60°C)
2.2.4 Humidity 95% non-condensing
2.2.5 Power Requirements
Voltage 85 - 264 VAC
Frequency 45 - 65 Hz
Current 1.9 – 0.80 Amps.
2.2.6 Inputs/Outputs
Field connections: screw terminals for easy field installation for power and data to valves.
Data Over Power: per IEC61058-2 physical layer interface at 31.5 kbps nominal data rate
RF: SMA-RP connection, 2.4 GHz < 200 milliwatts max power at 40K kbps nominal data rate
Ethernet: RJ45 10BaseT
2.2.7 Installation Drawing – J-51009ExS

2.3 LDAU Assembly (3-51004EX and 3-51005EX) Specifications

FCC Notice: Changes or modifications to this device not expressly approved by the manufacturer could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
This equipment complies with FCC radiation exposure limits for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the antenna and all persons.

2.3.1 Physical Size ~ 17in(43cm) x 11(28cm) 7in(18cm)
2.3.2 Weight ~ 15 lbs (7 Kg)
2.3.3 Temperature -40 to +158°F (-40°C to 70°C)
2.3.4 Humidity 95% non-condensing
2.3.5 Enclosure IP66
2.3.6 Power Requirements
Voltage 9-23.3 VDC
Current < 250 milliamps
2.3.7 Inputs/Outputs
Field connections: plug-in screw terminals for easy field installation and service
Data Over Power: IEC61058-2 physical layer interface at 31.5 kbps nominal data rate
RF: 2.4 GHz < 200 milliwatts max power at 40K kbps nominal data rates
Memory: 16 Megabytes data storage storing from 1 to 16 individual tests.
2.3.8 Installation Drawing – J-51008ExS

2.4 Dynamic Pressure Kit (2-53306EX and 2-53005EX) Specifications

2.4.1 Physical

Sensor: 3.0in(76 mm) high, 0.82in(22.5 mm) dia, 0.25 lbs(114 g) ¼ 18 NPT thread, 316 SS

Base Mount: 1.8in(185mm) high, 1.5in(38mm) dia, 1.0 lbs(450 g) 1/2 14 NPT thread, 316 SS

Protective Tube: 4.25in(115mm) high, 1.5in(38mm) dia, 0.5 lbs(230g) 3/8 20 UN-2B, 316 SS

Cable Assembly: 50 ft (18 m) long, 22 gauge twisted pair, shielded, royal blue, halogen free, connector is hermetically sealed, stainless steel one end is open lead for wiring into field apparatus.

2.4.2 Temperature -40 to +176°F (-40°C to 80°C)

2.4.3 Humidity 95% non-condensing

2.4.4 Electrical Specifications

Sensitivity	50 millivolt/PSI
Measurement Range	+/-20 PSI
Max Static Pressure	8000 PSI
Frequency Response	5 to 10 KHz
Excitation Voltage	6 to 30 volts
Excitation Current	0.5 to 20 milliamps
Isolation	>500 volts

2.5 Strain Sensor Kit (3-53100EX) Specifications

2.5.1 Physical

Sensor: 0.75in(18 mm) high, 1.0in(25 mm) dia, 0.25 lbs (114 g), hermetically sealed, SS housing

Cable: integral to sensor, 50ft (18m) long, 22 gauge twisted pair, shielded, royal blue, halogen free, open lead end for wiring into field apparatus

2.5.2 Temperature -40 to +176°F (-40°C to 80°C)

2.5.3 Humidity 95% non-condensing

2.5.4 Electrical Specifications

Type	Full Bridge Single Coupon
Resistance	5000 ohm
Full scale load	500 microstrain
Full scale output	1mv/V nominal
Excitation Voltage	1 to 10 volts
Excitation Type	DC or AC
Isolation	>500 volts

2.5.5 Installation Drawing J-53101ExS

2.6 Static Pressure Kit (2-53300Ex-xxxxx) Specifications

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2.6.1 Physical

Sensor; 3.0in(76 mm) high, 1.0in(25 mm) dia, 0.25 lbs (114 g), hermetically sealed, SS housing

Cable: 50 ft (18 m) long, 22 gauge twisted pair, shielded, royal blue, halogen free, Connector is hermetically sealed, stainless steel one end is open lead for wiring into field apparatus.

Standard connection: ¼ in female NPT

2.6.2 Temperature -40 to +176°F (-40°C to 80°C)

2.6.3 Humidity 95% non-condensing

2.6.4 Electrical Specifications

Type	Full Bridge
Resistance	2000 ohm
Range	10 to 10,000 PSI
Full scale overload	100%
Full scale output	10mv/v
Excitation Voltage	1 to 10 volts
Excitation Type	DC or AC
Accuracy	0.08% FS
Isolation	>500 volts rms ac

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3 Installing the System

Caution:
This document is considered a “Scheduled Drawing” document. No modifications are permitted without reference to the Notified Body.

Caution:
If the system is used in a manner not specified by the manufacturer, any protection provided by the manufacturer may be impaired.

Installing the ValveWatch II System involves multiple steps. Perform the following installation tasks in their entirety, in the order that is appropriate for your installation.

3.1 General Intrinsic Safety Requirements

The following list is based on general guidelines followed for installation in an explosive area. This is only a guideline and all site specific installation requirements shall be followed.

A. Installations should provide ease of access for inspection and maintenance.
B. Locate equipment in the least hazardous area practicable.
C. Review all system documentation prior to installation.
D. Verify use of certified equipment for hazardous area conditions.
E. Route cables to minimize risk of mechanical damage.
F. Seal unused cable entry holes with qualified blanking plugs.
G. Wall openings for cable routing between hazardous and non-hazardous areas shall be properly sealed.
H. Conductor splicing should be avoided but, if required, shall be accomplished in approved enclosures.
I. Stranded conductors shall be protected against separation by appropriate lugs.
J. Unused conductors shall be insulated from earth and other conductors by approved insulators on both ends.
K. Sensors, components or cables shall not be installed or routed where ambient temperatures will exceed rated values.
L. Cables and conduits shall meet national requirements.
M. Intrinsically safe circuits shall remain separated from non-intrinsically safe circuits.
N. Individual conductors (including individual strands of multi-stranded conductors) shall be greater than 0.1 mm diameter.
O. Cable test voltages shall be greater than 500 VAC.
P. Cable screens shall be connected to earth on only one end.
Q. Cables containing intrinsically safe circuits shall be light blue in color.
R. Cabinet wiring for intrinsically safe circuits shall maintain a 2 in separation between intrinsically safe and non-intrinsically conductors unless other appropriate separation is provided.
S. Intrinsically safe circuits shall be blue color or adequately marked.
T. Exposed bare conductors of intrinsically safe circuits shall maintain 3 mm spacing from any metal (earthed) parts.

3.2 Site Survey

Before a system is installed, an engineering survey is required. This survey should be accomplished by an authorized Crane Valve Services Field Engineer. A summarization of the questions answered during a site survey, or walk down are as follows:

1) Does the customer desire wireless communication or data over power?
2) How many valves is the customer interested in monitoring?
3) Does each valve have a cavity?
4) Is the cavity and other pressure ports isolated from the flow area with a double block and bleed valve?
5) Is it a one, two or three pressure sensor application for each valve?
6) Is there access to the fluid media thru a tap with block and bleed valves?
7) Where can the strain sensor be mounted on the yoke for torque or thrust measurement?
8) Is static pressure going to be monitored?
9) Is there a tap and block for the actuator inlet pressure?
10) Are there special requirements for a unique sensor?
    Examples are: Differential Pressure, Accelerometer, Position, Switch, Temperature
11) Where can a local data acquisition unit enclosure be mounted for each valve?
12) What is the distance from each valve to the local data acquisition enclosure?
13) What is the distance from the local data acquisition unit enclosure to the control room?
14) How many Hub systems are required?
15) What configuration of the Hub is required?
16) Creation of plant drawings will be required
17) Creation of equipment and material lists will be required.
18) Schedule of sensor installation will be required.
19) Schedule of cable installation will be required.
20) Schedule of control room equipment installation will be required.
21) System checkout procedure will be required.
22) ValveWatch II software and MIS checklist requirements will have to be met.

4 Entity Parameters for ValveWatch II System

4.1 Entity Parameters for Dynamic Pressure Sensor

Crane Valve Services Part Number 1-53201EX (see CS-1-53210Ex for PCB certificates)

Vi - 30 Volts
Ii - 200 milliamps
Pi - 1.0 Watts
Ci - 5.0 nF
Ii - 0.0 mH

4.2 Entity Parameters for Strain Sensor Kit

Crane Valve Services Part Number 3-53100EX

The strain sensor used for monitoring valve related forces transferring from the actuator to the valve is a simple device. It cannot product energy and has no stored energy components. The key parameter for safety is the 500 volt isolation.

4.3 Entity Parameters for Static Pressure Sensor

Crane Valve Services Part Number 2-53300Ex-xxxxx (see CS-1-53301Ex for Druck certificates)

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The static pressure sensor used for monitoring various valve pressure points is a simple device. It cannot product energy and has no stored energy components. Its key parameter for safety is the 500 volt isolation design. xxxx denotes the pressure range selected for the application.

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4.4 Entity Parameters for Hub Antenna Assembly

Crane Valve Services Part Number 3-51007Ex

The HUB Antenna Assembly used for RF communications is a simple device. It cannot product energy and has no stored energy components. The power transmitted to the antenna is <200mw.

4.5 Entity Parameters for HUB Communications Module

Crane Valve Services Part Number 1-51002Ex

4.5.1 Power connection J2 Terminals 13, 14, 15 and 16

Vi - 23.3 Volts
Ii - 225 milliamps
Pi - 2 Watts
Ci - 0.0 uF
Ii - 0.0 mH

4.6 Entity Parameters for LDAU Communications Module

Crane Valve Services Part Number 1-51001Ex

4.6.1 Power connection J2 Terminals 13, 14, 15 and 16

Vi - 23.3 Volts
Ii - 225 milliamps
Pi - 2 Watts
Ci - 0.0 uF
Ii - 0.0 mH

4.7 Entity Parameters for Strain/AC Module

Crane Valve Services Part Number 1-52001Ex

4.7.1 Power connection J2 Terminals 13, 14, 15 and 16

Vi - 30 Volts
Ii - 200 milliamps
Pi - 1.2 Watts
Ci - 0.0 uF
Ii - 0.0 mH

4.7.2 Sensor connection J1 and J3

Strain Inputs Sig/Exc/Sense **Terminals 1, 2, 3,4,7 and 8**			AC Input **Terminals 5 and 6**		
Voc,	Uo	- 4.935 volts	Voc,	Uo	- 9.555 volts
Isc,	Io	- 249.25 milliamps	Isc,	Io	- 48.30 milliamps
Po		- 0.3075 Watts	Po		- 0.115 Watts
Ca,	Co	- 34.00 uF	Ca,	Co	- 3.600 uF
Ia,	Io	- 0.570 mH	Ia,	Io	- 15.00 mH

4.8 Entity Parameters for Dual AC Module

Crane Valve Services Part Number 1-52002Ex

4.8.1 Power connection J2 Terminals 13, 14, 15 and 16

Vi - 30 Volts
Ii - 200 milliamps
Pi - 1.2 Watts
Ci - 0.0 uF
Ii - 0.0 mH

4.8.2 Sensor connection J1 Terminals 1, 2, 3 and 4

AC Input

Voc,	Uo	- 9.555 volts
Isc,	Io	- 48.30 milliamps
Po		- 0.115 Watts
Ca,	Co	- 3.60 uF
Ia,	Io	- 15.00 mH

5 Local Data Acquisition Unit Installation

The Local Data Acquisition Unit (LDAU) consists of DIN rail mounted electronics modules enclosed in a stainless steel IP66 enclosure. The number of modules and configurations may vary with customer options. There is one LDAU for each valve being monitored.

Caution:
The LDAU must be installed per Installation Drawing J-51008ExS.

Mount the electrical enclosure according to specific site mounting specifications or codes. Use caution not to damage the radio frequency antenna if pre installed on the electrical enclosure. The antenna is electrically isolated from earth ground and should not touch adjacent metal structures. If the RF communications model is being installed, the unit should be mounted to prevent personnel from having normal access within a 20 cm distance from the antenna.

Low voltage DC power supply cables must be rated for temperatures from -40 to 70 degrees C and have a 300 volt working operating voltage.

Route the low voltage DC power supply cable(s) from the ValveWatch HUB Assembly location in the non-hazardous area to the ValveWatch Local data Acquisition Unit in the hazardous area according to specific site cable routing specifications or codes. Connect power supply conductors to the LDAU according to J-51008ExS. Assure that the proper sealed cable entry glands are used.

It is critical that the wiring be installed correctly. There are two power lines associated with the system. One power is dedicated to the sensor modules and the second power pair is associated with the communications power. Properly label the individual wires on both LDAU and HUB side of the field cabling. Discrete color coding and proper polarization will help assure the system is wired and working correctly the first time.

The LDAU modules have reverse polarization protection. Connecting the wires incorrectly will cause no power to flow into the system.

5.1 Example Cable Length Calculations for Power Connection

Cable lengths are critical for intrinsic safety. Before any installation is complete, an analysis of the cable length for verification of intrinsic safety is required.

The Tables below are an **example** for verifying specific cable length requirements

Assumptions for the Example Cable Length Calculation Tables 3, 4 and 5
For our example, use Ex ia IIC

Table 1. Example entity parameters for the ValveWatch Sensor Modules

Apparatus Classification	Uo (V)	Co (uF)	Lo (mH)
Ex ia IIC Class I Group A,B	**28**	**0.083**	**2.510**
Ex ia IIB Class I Group C Class II Group E	28	0.650	7.350
Ex ia IIA Class I Group D Class II Group F,G	28	2.150	20.00

Table 2. Example entity parameters for the ValveWatch Communications Module

Apparatus Classification	Uo (V)	Co (uF)	Lo (mH)
Ex ia IIC Class I Group A,B	**23**	**0.200**	**1.000**
Ex ia IIB Class I Group C Class II Group E	23	1.000	5.000
Ex ia IIA Class I Group D Class II Group F,G	23	Not specified	Not specified

- Operation modes DOP or RF are indicated
- Communications module has a minimum operating voltage of 9 volts and a peak current of 40 milliamps.
- The sensor modules have a minimum operating voltage of 9 volts and a peak current of 20 milliamps per module.
- Cable parameters used for 0.75mm^2 conductors are:
  C_{cable} = 90 nF/km or 90 pF/m
  L_{cable} = 0.75 mH/km or 0.75 uH/m
  R_{cable} = 24.8 Ω/km or 0.0248 Ω/m
- The input entity parameters of the module power terminals 13, 14,15 and 16 is zero (0) for inductance and capacitance.
- The minimum supply voltage for sensor modules is 24 vdc.
- The minimum supply voltage for the communications module is 13.8 vdc.
- The resistance for the MTL 7728P+ barrier is 252 ohms.

Table 3. For the Example provided above, the Maximum Cable Length for two Sensor Modules connected to MTL 7728P+

Calculation Type	Capacitive Litmus Calculation		Inductive Litmus Calculation		Resistive Litmus Calculation		Maximum Length Allowed
Apparatus Classification	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (m)**
Ex ia IIC Class I Group A,B	2766	922	10038	3346	7560	2520	**922**
Ex ia IIB Class I Group C Class II Group E	29400	7222	29400	9800	92458.0	2520	**2520**
Ex ia IIA Class I Group D Class II Group F,G	80000	23888	80000	26666	92458.0	2520	**2520**

Table 4. For the Example provided above, the Maximum Cable Length for a Communications Module in DOP mode connected to a SMAR SB-312

Calculation Type	Capacitive Litmus Calculation		Inductive Litmus Calculation		Resistive Litmus Calculation		Maximum Length Allowed
Apparatus Classification	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (m)**
Ex ia IIC Class I Group A,B	3000	1000	3000	1000	7560	2419	**1000**
Ex ia IIB Class I Group C Class II Group E	15000	5000	15000	5000	92458.0	2419	**2419**
Ex ia IIA Class I Group D Class II Group F,G	15000	5000	15000	5000	92458.0	2419	**2419**

Table 5. For the Example provided above, the Maximum Cable Length for both a Communications Module in RF Mode or DOP Mode and two Sensor Modules attached to the same cable connected to a SMAR SB-312

Calculation Type	Capacitive Litmus Calculation		Inductive Litmus Calculation		Resistive Litmus Calculation		Maximum Length Allowed
Apparatus Classification	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (ft)**	**Length (m)**	**Length (m)**
EEx ia IIC Class I Group A,B	3000	1000	3000	1000	450	150	**150**
EEx ia IIB Class I Group C Class II Group E	15000	5000	15000	5000	450	150	**150**
EEx ia IIA Class I Group D Class II Group F,G	15000	5000	15000	5000	450	150	**150**

5.2 Cable Length Calculations for Sensor Connection

The system is designed for the LDAU and the Sensors to be located in close proximity to one another. The system is provided with sensor cable predefined at 50 ft. For most applications, the LDAU will be installed within 15 ft of the Unit Under Test (UUT). If cable lengths longer than 50 ft are expected, the installation will require a cable length calculation for the sensor cables.

6 HUB Assembly Installation

The HUB assembly consists of a 19in rack-mountable DIN rail assembly containing all necessary power and communications capabilities to monitor and acquire test data for up to eight LDAUs connected to eight valves.

Caution:
The HUB assembly is an associated apparatus. Follow both installation requirements and wiring diagram J-51008ExS to assure safe system operation.

6.1 Initial Equipment Check List

Before going out to install any sensor, an inventory of the items needed to perform the job is always a good way to start. Below is a list of the minimum items needed to perform the task of sensor installation.

HUB Assembly Kit
HUB IEC Power cable for customer specific requirements
CAT 5 Ethernet cable for customer specific length
Screwdriver and Wrench set
Calibrated torque screwdriver for 0.6 NM torque values with 3.5mm flat tip
Eye protection
Gloves
Cable labels

6.2 Pre Installation for HUB Assembly

Caution:
All plant procedures and documents shall be followed to ensure that the installation does not impact the functionality of the unit under test.

- Perform a visual inspection of the assembly. Make sure that it does not have any physical damage to the cabinet or connections.

6.3 HUB Assembly Mounting

- Locate existing 19 in cabinet space to accommodate the HUB assembly or install a dedicated 19 in cabinet according to specific site mounting specifications or codes. Cabinet should be an IP20 or higher rated enclosure.
- The cabinet shall have an AC power (100~220 vac) plug.
- The cabinet shall have an Ethernet connection allowing communication to the Grunt Software computer.
- If RF communications will be used, the cabinet shall have a cable pathway exiting the cabinet and the equipment room to an outside antenna mounting location.

- The HUB assembly can be mounted in any vertical position in the 19 in cabinet. The assembly should be mounted so that the cables from the hazardous area enter the assembly on the hazardous entry side and are at least 2 inches from non-hazardous cables in the same cabinet. The HUB Assembly may be installed upside down to orient the hazardous cable entry openings with the hazardous cable location.
- Mount the HUB assembly in the 19 inch cabinet with at least 4 mounting screws (not provided in the kit).
- If RF communications will be used for the installation, install the HUB assembly antenna according to the next procedure section now and return to this step afterwards.
- Attach the RJ45 Ethernet connector from the ValveWatch Ethernet module to the associated system network. The network can be a plant/platform network or a dedicated router/satellite link for remote monitoring.
- Connector the power cord to the IEC connector on the HUB Assembly but do not plug into the power plug at this time.
- AC input is protected with a replaceable fuse. The fuse is located under the IEC60320 C14 inlet connector. Recommended fuse for product is a LittleFuse, 216 Series, 5x20mm, 250VAC, from 5 to 10 Amps Rating (10 amp supplied).
- The DC power supply output is protected by an 6.3 amp fuse located on the DIN rail. Recommended fuse is a LittleFuse, 216 Series, 5x20mm, 250VAC, 6.3 Amp Rating.
- TB3-Ex is designated as the hazardous area field termination connections. From 1 to 8 valves may be connected to the HUB assembly provided that safety barriers are provided.
- The DC voltage shall not exceed 28 Volts DC
- The DC current shall not exceed 250 milliamps AC
- All field wiring and equipment shall have at least 500 Volt isolation to ground except earth ground terminals.
- Route the low voltage DC power supply cable(s) from the hazardous area located ValveWatch LDAU assemblies to the ValveWatch HUB assembly in the safe area according to local cable routing specifications or codes. Connect power supply conductors to the TB3-Ex terminals according to J-51009ExS and local field drawings. Secure the cable with cable ties.
- It is critical that the wiring be installed correctly. There are two power supply barriers associated with the ValveWatch system. One barrier is connected to the ValveWatch sensor modules and the second barrier is connected to the ValveWatch communications module. Properly label the individual wires on both LDAU and HUB side of the field cable(s).
- Plug the power cord into a local AC power outlet.
- With the power cord connected to the unit and the unit connected to the valve LDAU(s), plug the AC power cord into the customer power plug.

6.4 HUB Antenna Assembly Installation

This section is required only if the system is being configured in RF mode

- The antenna location for the Hub Assembly will be selected a safe area or Zone 2.
- Selection will require that the antenna be strategically located for receiving RF communications from ValveWatch LDAU assemblies. The Antenna Assembly needs to be mounted in an area equivalent to the environment of the Hub Assembly certification. The LDAU's communicating with the HUB Assembly need to be in the same general area as the HUB Antenna. The antenna should be mounted to prevent personnel from having normal access within a 20 cm distance from the antenna.
- The maximum distance from a HUB Assembly antenna to a LDAU antenna should not exceed 1000 ft.
- The HUB Assembly Antenna cable should not exceed 100 ft. The antenna will need to be placed in close proximity to the final location of the Hub Assembly.
- Before mounting any RF equipment, a trained RF surveillance engineer should verify all LDAU and HUB Antenna Assembly mounting locations for RF propagation properties. An

RF survey may be required to ensure correct RF operation in a heavily populated industrial application.

NOTE: The ValveWatch II system is a 2.4GHz radio. It overlaps the frequency range used for WIFI networks and microwave ovens. Any additional 2.4 GHZ networks in the general vicinity of an RF configured ValveWatch system could cause performance reduction.

7 Dynamic Pressure Transducer Installation

Caution:
The pressure sensors shall be installed per this installation manual and wiring diagram J-51008ExS.

7.1 Initial Equipment Check List

Before going out to install any sensor, an inventory of the items needed to perform the job is always a good way to start. Below is a list of the minimum items needed to perform the task of sensor installation.

Dynamic pressure sensor kit with NPT adapter, protective tube and of 50 foot cable.
Thread sealant
Wrench set
Eye protection
Gloves
Cable labels

7.2 Pre Installation for Dynamic Pressure Sensor

Caution:
All plant procedures and documents shall be followed to ensure that the installation does not impact the functionality of the unit under test.

- Perform a visual inspection of the sensor. Make sure that it does not have any physical damage to the sensor mounting face or cable.

7.3 Dynamic Pressure Mounting Locations

- The desired location of the sensor in the valve cavity depends on the fluid flowing through the valve. If the fluid is a gas, the sensor should be mounted in the upper portion of the valve. If the fluid is a liquid, the preferred location would be the bottom of the valve. It should be noted that this is only a preferred location, as the system will work with the sensor mounted in either location.
- The dynamic pressure transducers are installed in three potential locations: the cavity of the ESD valve, in the pipe upstream of the ESD valve, and in the pipe downstream of the ESD valve. The system requires one cavity pressure sensor for closed valve seal leak detection and at least two sensors (cavity and either upstream or downstream) for open seal leak detection.

The use of a second sensor in the upstream or downstream position will provide optimum leak detection when the valve is in the open position.

- Review the orientation of the tap and verify that there are no obstacles preventing the sensor from being installed into the location.
- Review the Unit Under Test and determine an appropriate sensor cable routing path to the LDAU enclosure.

7.4 Mounting the Dynamic Pressure Sensor

Caution:
It is strongly recommended that safety glasses and gloves be worn during this procedure.

- A ¼ in to ½ in NPT adapter and protective cover tube are provided to protect the sensors from damage. This housing should be used in any location where there is a possibility that the sensor may be damaged by inadvertent contact. To use this protective housing, thread the ½ in adapter into the desired location (pipe or valve body). Next, thread the pressure sensor into the housing. Fit the protective tube over the sensor cable and then plug the sensor cable into the sensor connector. Upon securing the cable to the sensor, install the protective tube onto the adapter by sliding it over the sensor and thread it into the housing. The protective tubing can then be treaded into place.
- The pressure sensors are manufactured with a ¼in NPT threaded connection. They should be mounted on the ESD valve or pipe with block and bleed valves for isolation. (The block and bleed valves will allow the sensors to be safely removed without affecting the platform operation.)
- Apply thread sealant to the pressure sensor threads for preparation into the auxiliary tap.
- Screw the Dynamic Pressure sensor into the block valve housing.
- Using site specific procedures open the block valve and ensure there are no fluid leaks around the installation.

7.5 Dynamic Pressure Sensor Wiring

- The dynamic pressure sensor kit is provided with a cable for connecting the pressure sensor to the LDAU enclosure.
- Route the sensor cable(s) in site approved cable tray or tubing to the LDAU enclosure. Route the cable through an appropriate cable gland and secure. Connect the two sensor conductors and cable shield conductor as required on J-51008ExS. Connect the cable connector into the sensor connector.

Yellow - No connection
Green - No connection
Brown - SIG +
White - SIG –
Shield - Ground terminal

8 Strain Sensor Installation

Caution:
Follow all installation procedure steps and wiring diagram J-51008ExS when connecting the strain gage to its associated apparatus.

One of the key parameters of ValveWatch is to monitor the actuator to valve forces. This parameter can serve as a trigger for the data acquisition circuits and more importantly to trend relative torque or thrust values during valve strokes. The sensor is designed to measure either thrust or torque depending on the orientation during installation. The strain sensor is typically installed on a load carrying, non-moving portion of the valve such as the actuator mounting yoke. It is attached using a high performance epoxy adhesive provided in the kit. The steps below outline the sensor installation.

8.1 Initial Equipment Check List

Before going out to install the sensor, an inventory of the items needed to perform the job is always a good way to start. Below is a list of the minimum items needed to perform the task of sensor installation.

Strain Sensor with integral wiring of 50 feet
Two part epoxy pack
Epoxy applicator
File (rough)
Sand paper (rough)
Vibrating Etching tool (optional)
Variable Speed Grinder (60-80 grit silicon carbide or aluminum oxide wheel) (optional)
Eye protection
Gloves
Cable Ties (Tie Wrap)
Field cable label tags

8.2 Pre Installation Strain Sensor Test

Caution:

The strain sensor's Kapton mounting face is very sensitive to strain and exceptionally durable when installed but can be damaged if handled roughly prior to installation. The Kapton face mounting material also provides electrical insulation from earth ground. Do not remove the protective cap except for inspection or in preparation for installation. Do not apply unnecessary pressure or press on the sensor face during inspection or installation.

- Perform a visual inspection of the sensor. Make sure that it does not have any physical damage to the sensor mounting face or cable.
- Verify that the cable has not been damaged; there should be 50 feet of cable integral to the sensor.
- The sensor may be checked for electrical continuity with an ohmmeter by measuring 5000 ohms between the yellow and green wire pair as well as the brown and white wire pair. All resistances should read infinity between any insulated conductor and both the sensor metal housing or the cable shield. The cable shield and sensor housing are not electrically connected and should also read infinity.
- The strain sensor assembly is factory tested to assure 500 volt isolation from ground. No special installation process is required to assure ground isolation.

8.3 Strain Sensor Mounting Locations

- Mount the strain sensor when the valve yoke is at or above 70°F (25°C). If the valve yoke temperature is lower than this, an external heating supply such as a heat gun or heat trace must be used.
- For high temperature applications and non-symmetric yoke designs, the preferred mounting location is typically closer to the actuator than the valve body. This can be important for long yokes where oscillations and/or bending may occur. The sensor may sense yoke bending measurements as the actuator weight shifts at lower loads.
- The sensor was designed to be used for either torque or thrust. There are four mounting orientations defined for torque and four mounting orientations defined for thrust. The main reason for the four mounting locations of each is to identify the easiest sensor cable run to the LDAU enclosure box. A simple rule of thumb is to use the cable angle of the sensor to determine whether you are measuring torque or thrust. To measure torque, the cable exiting the sensor will be at a 45 degree angle with the valve stem. To measure thrust, the cable angle will be parallel or perpendicular with the valve stem. For a more detailed view of the mounting positions for the sensor, refer to J-53115ExR for Strain Sensor Field Installation.
- Verify that the cable tie length is sufficient for supporting the sensor during epoxy cure time. If there is not enough cable tie length, multiple cable ties may be connected together.

8.4 Preparing the Valve Yoke Surface

Caution:
It is strongly recommended that safety glasses and gloves be worn during this procedure.

Caution:
Follow site specific work permit requirements for work in an explosive environment.

- There are three things to remember for successfully mounting a strain sensor every time. CLEAN, CLEAN, CLEAN. A CLEAN yoke surface, a CLEAN sensor face and repeating the cleaning process until the Lent free wipes are as clean after the process as they were when you started the cleaning process.
- The prepared yoke surface area should be slightly larger than the strain sensor body diameter.
- The area should be filed, sanded, or ground to achieve a flat (to within 1/16in), bright, bare-metal, crosshatched surface finish. We recommend using a small, variable speed hand grinder at low speed (500 to 1000 rpm) with a 60 to 80 grit silicon carbide or aluminum oxide wheel. The area should be free of all paint, primer, or surface coating. Experience has shown that a vibrating etch tool works well for cleaning paint from the surface.

Caution:
The sensor must be installed within 15 minutes of sanding and cleaning. Passivation of stainless steel surface accelerates after 15 minutes.

Always read and understand safety data sheets prior to using cleaning solvents.

- The area should contain no significant casting lines or other such indications that have not been blended into the flat surface.
- The area should be essentially in the same plane over the length of the strain sensor housing.
- The area may be curved over the width of the strain sensor assembly.
- The yoke mounting area and sensor mounting face must be cleaned to be free of all grease and oily residues prior to bonding.
- Suggested degreasing agents are:
  - Denatured Alcohol
  - Ethyl Alcohol
  - Methyl Alcohol (Technical Grade)
  - Naphtha (Technical Grade)
  - Acetone

- Use these or other degreasers specifically approved by your company. A stronger degreaser/solvent than those listed above may be needed to remove grease and oily residue.
- Remove the sensor cap and use the degreaser agent to assure no oil or dirt buildup on the sensor has occurred during handling or inspection
- All surfaces must be dried with a lint free cloth prior to solvent evaporation.
- Repeat the degrease process on both surfaces just to be sure everything is clean.

8.5 Mounting the Strain Sensor

Caution:
It is strongly recommended that safety glasses and gloves be worn during this procedure.

Within 15 minutes after the mounting location has been fully prepared, sensor installation can proceed.

- The Epoxy comes in a two part packet for easy mixture. Remove the separating clip and mix the epoxy achieving a paste of uniform color and consistency. There is a 90 minute pot life for the epoxy.
- Apply an even layer of epoxy approximately 1/16in thick to the sensor mounting location on the yoke.
- Remove the protective cap. Inspect for cleanliness and damage. Light cleaning of the mounting surface area with one of the cleaning agents listed above is required if the Kapton mounting surface is contaminated with dist or grease.
- Apply an even layer of epoxy approximately 1/16in thick to the bottom of the strain sensor and body contact area. Cover the entire sensor face and metal lip to assure sensor bonding and long term stability.
- Align the sensor to one of the four available mounting positions for the type strain to be measured as shown on J-53115ExR.
- Firmly press the sensor into place on the yoke. Secure with the provided wire tie(s) wrapped around the yoke and over the sensor. Tighten to apply a light pressure.
- Verify the sensor is mounted for the desired measurement for the valve type.
- Adjust the angle of the sensor slowly just to tweak in the accuracy of the measurement. The more ideal the sensor is to the valve stem angle, the more accurate the readings from the sensor will be.
- When the sensor is positioned correctly, tighten up the tie wrap securely. A wire tie installation tool can be used for this operation to firmly compress the soft sensor mounting surface.
- The sensor should again be checked to ensure it was not damaged during installation. Test for electrical continuity with an ohmmeter by measuring 5000 ohms between the yellow and green wire pair and 5000 ohms between the brown and white wire pair. All resistances should read infinity between any insulated conductor and both the sensor metal housing or the cable shield. The cable shield and sensor housing are not electrically connected and should also read infinity.
- Allow epoxy to cure before stroking valve. The cure time is temperature dependent. The lower the temperature, the longer the cure time.

Epoxy Cure Time Chart

Temp.	Pot Life	Min Curing Time Before Use	Curing Time For Max Strength
25°C (77°F)	70 min.	24 hrs.	48 hrs.
65°C (150°F)	Not recommended	2 hrs.	4 hrs.
80°C (176°F)	Not recommended	1 hr	2 hrs

8.6 Strain Sensor Wiring

Route the sensor cable in site approved cable tray or tubing to the ValveWatch Local Data Acquisition Unit enclosure. Route the cable through an appropriate cable gland and secure. Connect the four strain sensor conductors and cable shield conductor as required on J-51008ExS.

Yellow - SIG +
Green - SIG –
Brown - EXC +
White - EXC -
Shield - Ground terminal

8.7 Strain Sensor Labeling

Once the strain sensor and cabling are installed and secured, add labeling per plant documentation for interconnection and maintenance.

9 Static Pressure Sensor Installation

Another key parameter of ValveWatch is to monitor the actuator hydraulic/air supply driving the valve actuator. This parameter can serve as a trigger for the data acquisition circuits and more importantly, to trend input pressures driving the actuator. The sensor is selected as a simple device and gives a millivolt/volt output relative to the pressures applied to the sensor. This sensor connects directly into the Strain/AC Module.

Caution:
Please follow all installation procedures and J-51008ExS when connecting the static pressure sensor to its associated apparatus.

The static pressure sensor is typically installed on the inlet of the actuator. It is installed thru a Tee connector. The steps below outline the sensor installation.

9.1 Initial Equipment Check List

Before going out to install any sensor, an inventory of the items needed to perform the job is always a good way to start. Below is a list of the minimum items needed to perform the task of sensor installation.

Static Pressure Sensor with cable assembly of 50 feet.
Thread sealant
Wrench set
Eye protection
Gloves
Cable labels

9.2 Pre Installation for Static Pressure Sensor

Caution:
All plant procedures and documents shall be followed to ensure that the installation does not impact the functionality of the unit under test.

- Perform a visual inspection of the sensor. Make sure that it does not have any physical damage to the sensor mounting face or cable.

9.3 Static Pressure Mounting Locations

- Review the Unit Under Test and determine correct location for the pressure sensor. This may require a tee adapter and block valve in the inlet pressure line.
- Review the orientation of the tap and verify that there are no obstacles preventing the sensor from being installed into the location.
- Review the Unit Under Test and determine an appropriate sensor cable routing path to the LDAU enclosure.

9.4 Mounting the Static Pressure Sensor

Caution:
It is strongly recommended that safety glasses and gloves be worn during this procedure.

- Apply thread sealant to the pressure sensor threads for preparation into the auxiliary tap.
- Screw the Static Pressure sensor into the block valve housing.
- Open the block valve and ensure there are no fluid leaks around the installation.

9.5 Static Pressure Sensor Wiring

The static pressure sensor kit is provided with a cable for connecting the pressure sensor to the LDAU enclosure. Route the sensor cable in site approved cable tray or tubing to the enclosure. Route the cable through an appropriate cable gland and secure. Connect the four strain sensor conductors and cable shield conductor as required on J-51008ExS. Connect the cable connector into the sensor connector.

Yellow - SIG +
Green - SIG –
Brown - EXC +
White - EXC -
Shield - Ground terminal

10 Installation Inspection

Perform inspection and/or testing of the system installation in accordance with local requirements.

11 Equipment Cleaning Instructions

Caution:
Follow applicable site procedures to access and ensure that the cleaning process does not impact the plant safety or operation requirements.

11.1 LDAU Assembly Cleaning Instructions

The LDAU assembly is installed in a NEMA 4 enclosure in the plant environment. Before starting any cleaning process, the DC power to the unit must be disconnected. For lose particles, vacuum and or air pressure can be used effectively to remove most typical plant type dirt. In the event that a substance adheres to the unit and/or internal components and the best approach to take is to use an isopropyl alcohol solvent on a soft clean cloth or towel to remove excess dirt on labels and exposed surfaces. It may be beneficial to attempt multiple passes and discard dirty cloths as the process advances. Once the LDAU components and area are cleaned, dry air should be blown across all components to ensure the unit is dry. A visual inspection of all interconnects should be made to ensure no disconnections have occurred during the cleaning process. Apply power to the system and perform a basic operational verification test.

Comment [t1]: Section required for 61010.

11.2 HUB Assembly Cleaning Instructions

The HUB Assembly is installed in rack mount cabinet space. Before starting any cleaning process, the AC power to the Unit must be disconnected.

NOTE: Disconnecting AC power will disable all valves being monitored by the HUB Assembly.

For lose particles, vacuum and or low air pressure can be used effectively to remove most typical plant type dirt. In the event that a substance adheres to the unit and/or internal components and the best approach to take is to use an isopropyl alcohol solvent on a soft clean cloth or towel to remove excess dirt on labels and exposed surfaces. It may be beneficial to attempt multiple passes and discard dirty cloths as the process advances. Once the Hub Assembly is cleaned, dry air should be blown across all components to ensure the unit is dry. A visual inspection of all interconnects should be made to ensure no disconnections have occurred during the cleaning process. Apply power to the system and perform a basic operational verification test once the unit is powered up.

11.3 Dynamic Pressure Sensor Cleaning Instructions

The dynamic pressure sensors are attached to a block and bleed type valve that interfaces it with the main process flow. A protective housing is recommended with every sensor installation. Cleaning may be required for purposes of identification or part of a standard plant cleaning process. Do not use High Pressure or high temperature liquids as part of the cleaning process. Such use could inadvertently damage the wire and/or connections to the sensor and the LDAU. Use of water soluble detergents should be used with a cloth or sponge and rubbing effort.

11.4 Strain Sensor Cleaning Instructions

The strain sensor is an encapsulated module permanently attached to the valve assembly. Cleaning may be required for purposes of component identification or part of a routine plant cleaning process. Do not use high pressure or high temperature liquids as part of the cleaning process. Such use could inadvertently damage the wire connecting the sensor to the LDAU. Use of water soluble detergents should be used with a cloth or sponge and rubbing effort.

11.5 Static Pressure Sensor Cleaning Instructions

The static pressure sensor is an encapsulated sensor attached to the pressure tap. Cleaning may be required for purposes of component identification or part of a standard plant cleaning process. Do not use high pressure or high temperature liquids as part of the cleaning process. Such use could inadvertently damage the wires connecting the sensor to the LDAU. Use of water soluble detergents should be used with a cloth or sponge and rubbing effort.

12 Technical Assistance

ValveWatch II is developed and supported by Crane Valve Services a CRANE Co. Company.

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