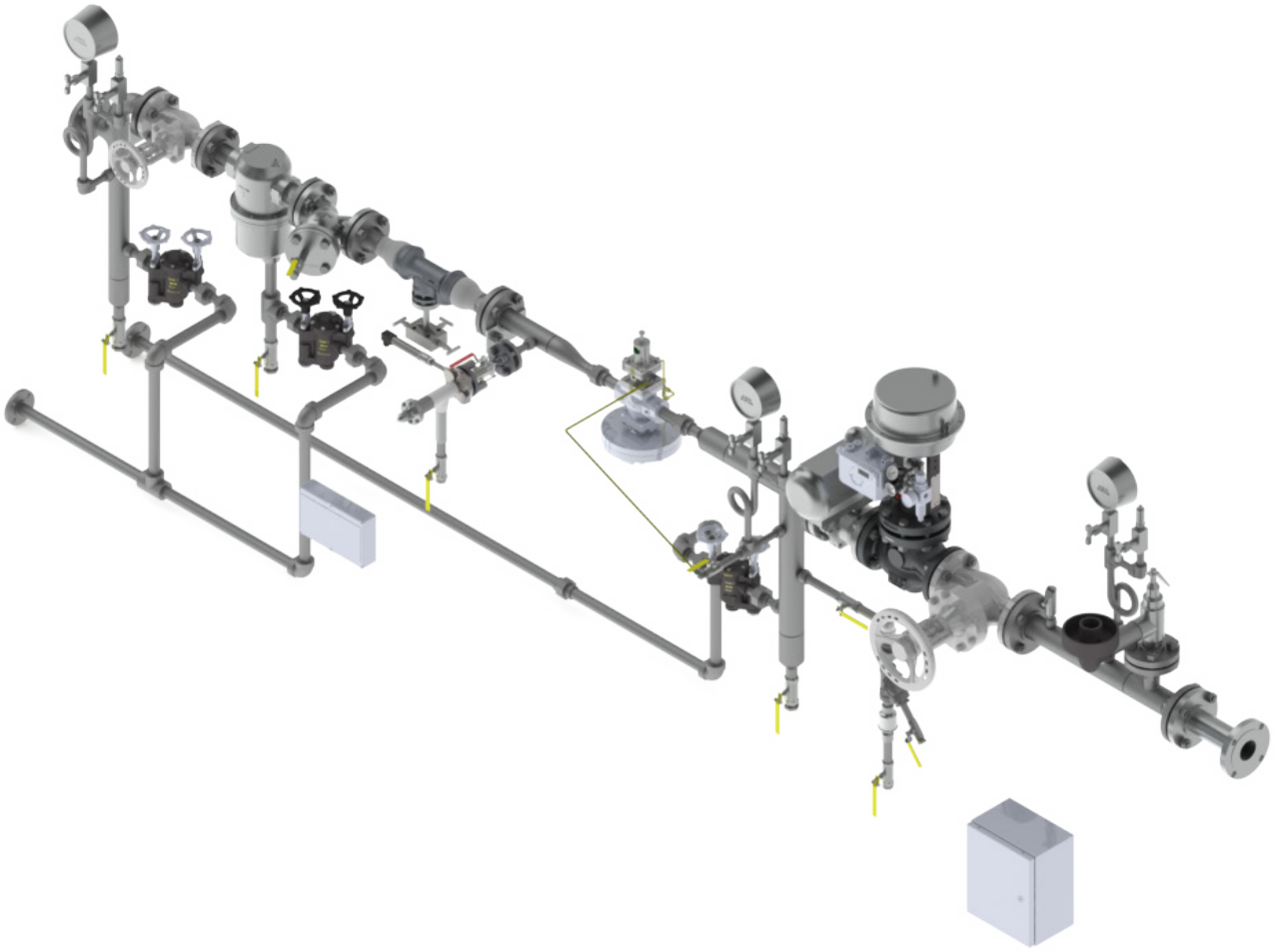
Steam Harness
Installation & Operations Manual



Please read and save these instructions

Armstrong®

1010-EN V1.8

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Safety

Icon Legend

DANGER! **Injury or death and property damage are imminent**

WARNING! **Injury or death and property damage are possible**

CAUTION! **Potential property damage, expensive repairs, and/or voiding the equipment warranty may result**

BURN HAZARD! **Contact with steam, hot water, or hot metal surfaces can cause severe skin burns. Skin exposure to 140°F (60°C) water or metal for only five (5) seconds may cause a second degree burn.**

Failure to comply with instructions following a safety icon may result in adverse consequences including, property damage, personal injury, or, in extreme cases, death

General Safety Guidelines:

1. Inappropriate use (beyond typical, intended use) could cause damage to the product and other property. It may also result in personal injury or, in extreme cases, death.

2. Only designated, qualified, and competent personnel should operate, maintain, and service this equipment in accordance with the directions in this product instruction manual.

3. Improper setup, operation, or maintenance may void the product warranty.

4. When operating and maintaining this product:

   a. ALWAYS select and wear appropriate personal protective equipment (PPE) before carrying out any physical work at the job site, per site-specific requirements. Appropriate PPE may include hard hats, safety glasses, gloves, boots or shoes w/ non-slip soles and toe guards, and protective overalls.

   b. ALWAYS scan the work area and take note of potential hazards before entering. Adjust your travel path or work position to avoid hazards and personal injury.

   c. ALWAYS observe designated safety procedures when working in hazardous locations (areas containing explosive and combustible gases, vapors, and dusts) and confined spaces (locations where the breathable air supply is limited or variable, or where entrapment could occur).

   d. ALWAYS use proper lockout-tagout procedures to disconnect power sources and de-energize machinery before conducting installation, service, and repair.

   e. ALWAYS use great care and appropriate safety gear when working above ground level, especially on ladders and platforms or in the presence of overhead, electrical power lines.

   f. ALWAYS shut off all “live” steam, water supply, and condensate return lines before breaking or loosening any plumbing joints.

   g. ALWAYS carefully relieve any residual internal pressure in the system or connecting pipe work before breaking or loosening any plumbing joints.

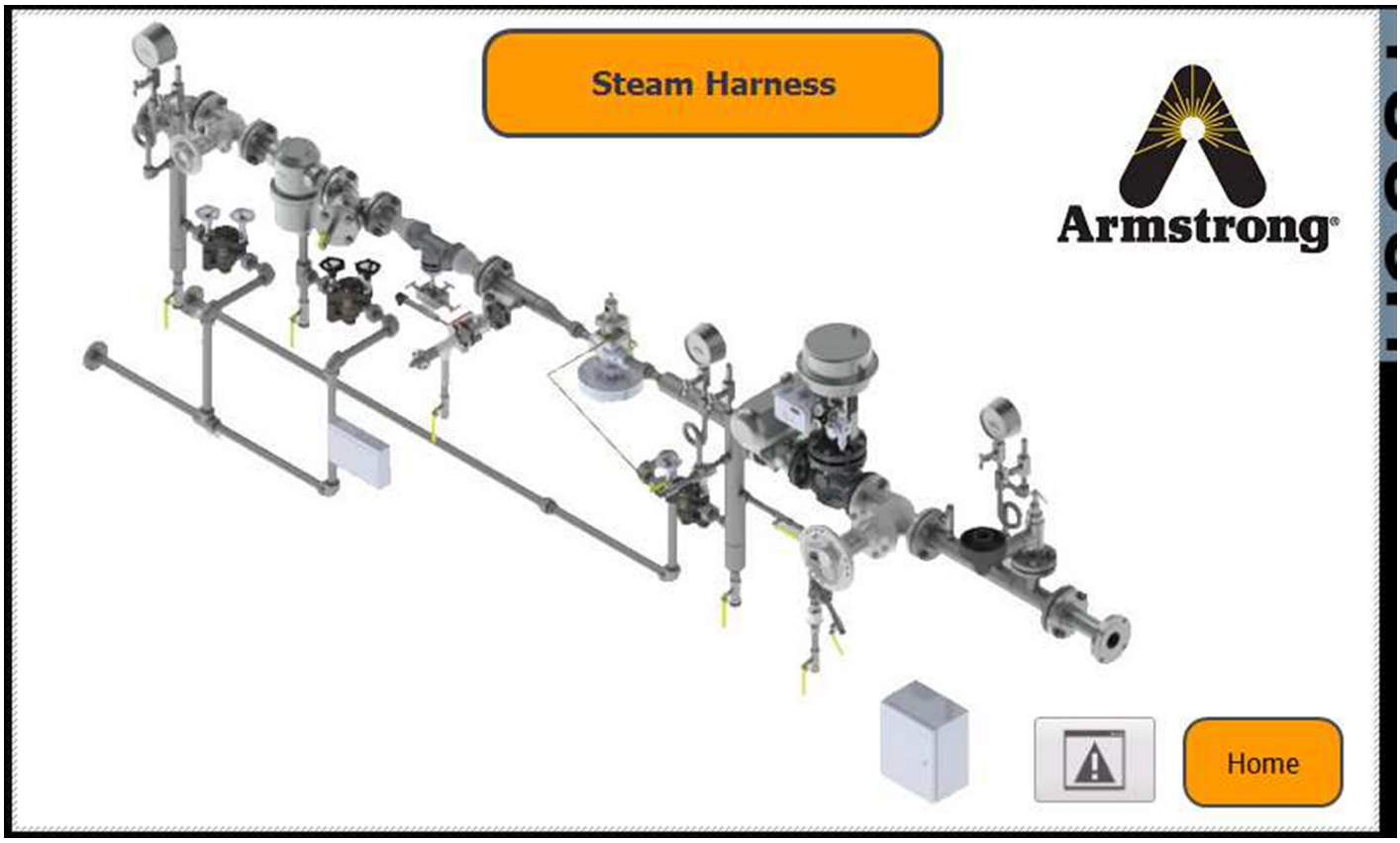
   h. ALWAYS allow hot parts to cool before servicing to avoid the risk of skin burns.

PLC Installation & Operations Manual

Please read and save these instructions

PLC Table of Contents

Starting Page:



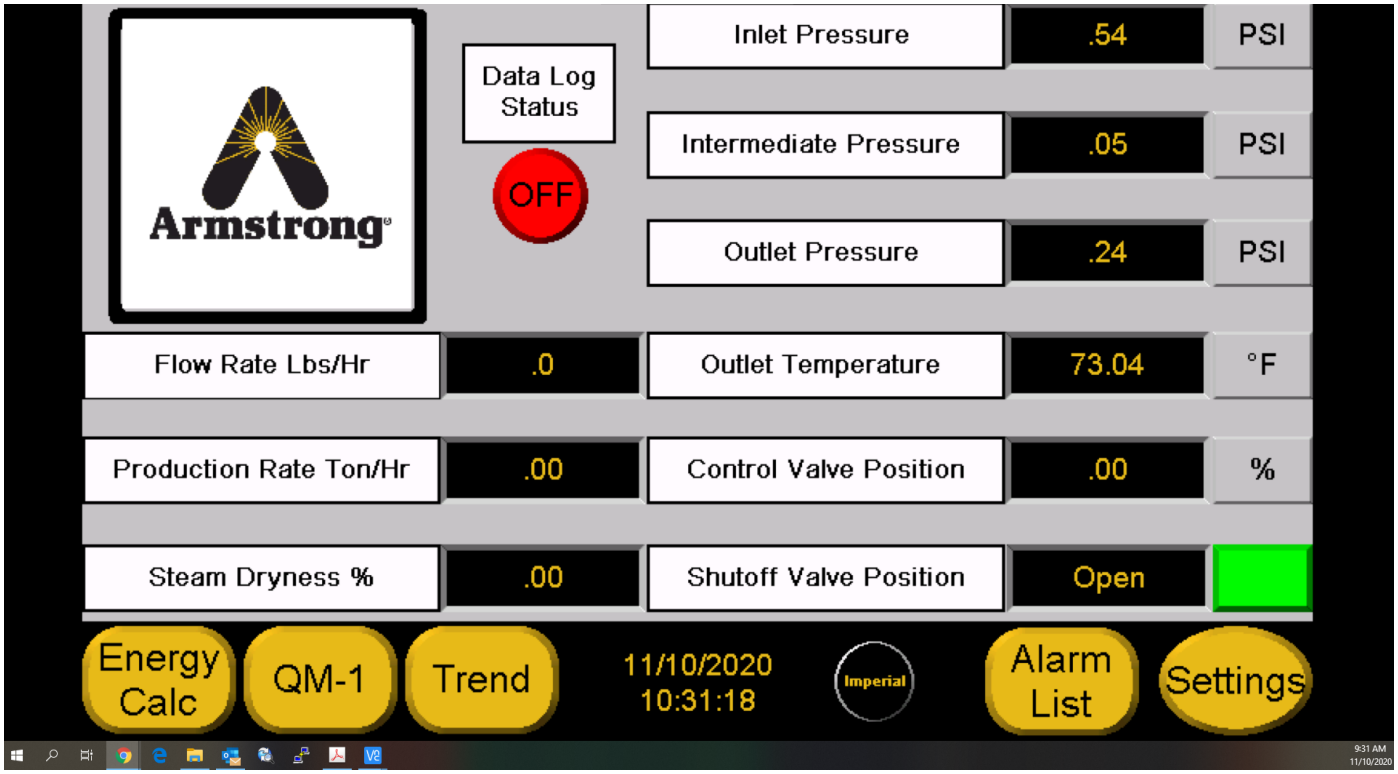
Home:

Default Login Credentials:

Username = Armstrong

Password = ASH2020

Home View:



Flow Rate kg/h(metric) or lb/hr(imperial): Scaled value from analog input "Steam Flow"

Production Rate Ton/h: Mill output value

Mill Output Value = Analog inlet pressure scaled (Mill capacity Min/Max)

Steam Dryness %: Steam QM®-1 – Dryness fraction

Inlet Pressure: Scaled Analog in value Inlet pressure in bar or PSI

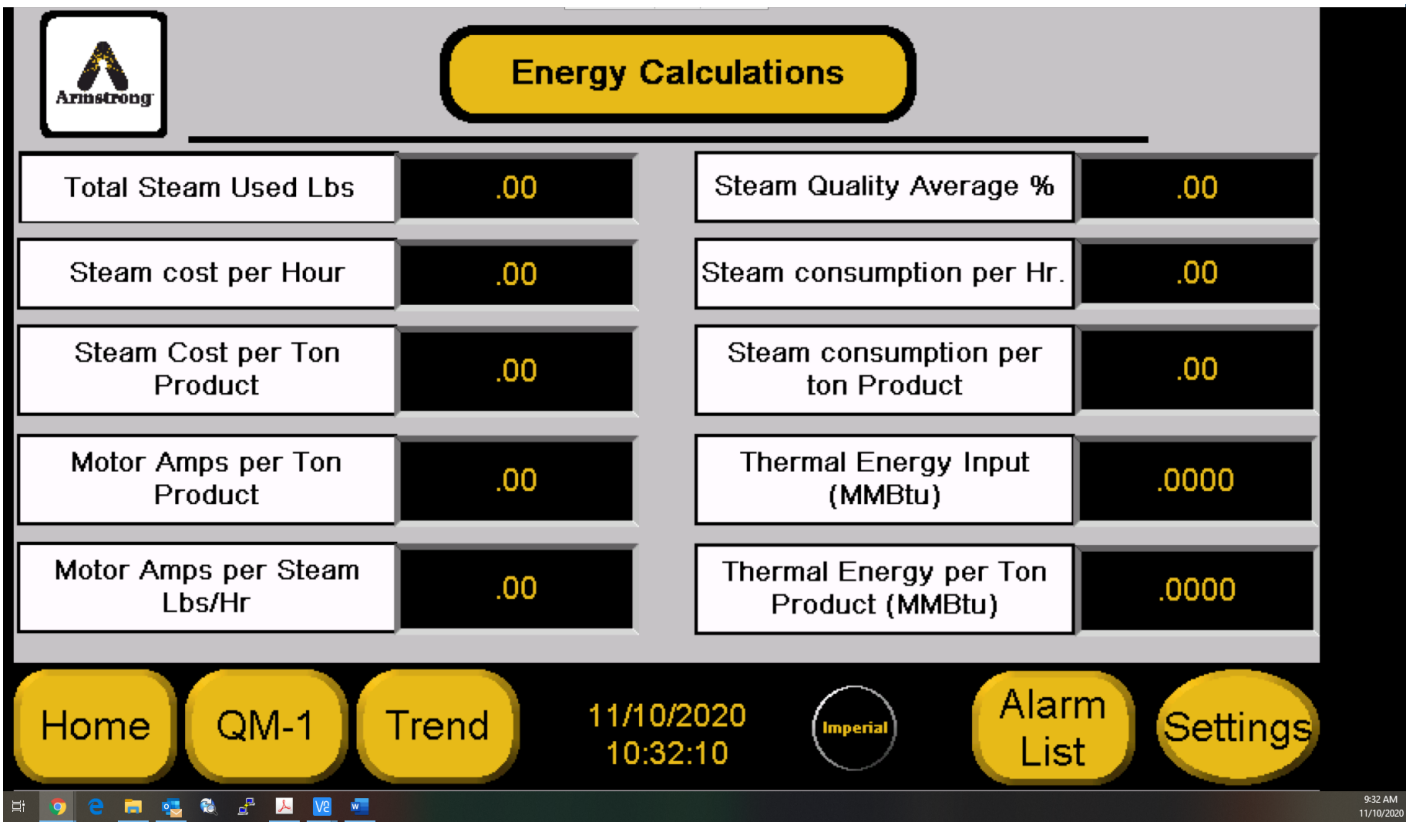
Outlet Pressure: Scaled Analog in value Outlet pressure in bar or PSI

Temperature: Temperature from analog in (in °C or F)

Control Valve Position: 4-20mA = 0 to 100% applied on valve

Control Valve Feedback must be wired in for panel functionality

Energy Calculations:



Data collected & saved is per batch/run of each formula entered by user

Total Steam Used: Totalization of Pulse * (value by pulse) on count digital input

This value can't not be set

Steam Cost Per Hour:

Steam Cost Unit = Steam per 1 K [parameter]/1000.0

Steam Cost Per Hour = Accelabar value * Steam cost unit

Steam Cost Per Ton Product:

Steam Cost Per Ton Product = Steam cost per Hour * Mill output value

Scaled value from analog input "Steam Flow"

Steam Quality Average:

Occurrence: 1 pulse each 5'

- Current_Count +1
- QM_Dryness_Average [totalized] = Dry_Out

Steam_Q_AVG = Dry_Out/Current_Count

All values set to Zero if Max_Count reached

Steam Consumption per Hr.

Accelabar® value

Steam Consumption per Ton Product

Steam Consumption per Ton Product = Accelabar value/ Mill output value

Thermal Energy Input - Thermal Energy per Ton

Metric: KWh

Imperial: MBTU

Inlet_Press_Scaled [calculation] => Entalpy Sat Steam

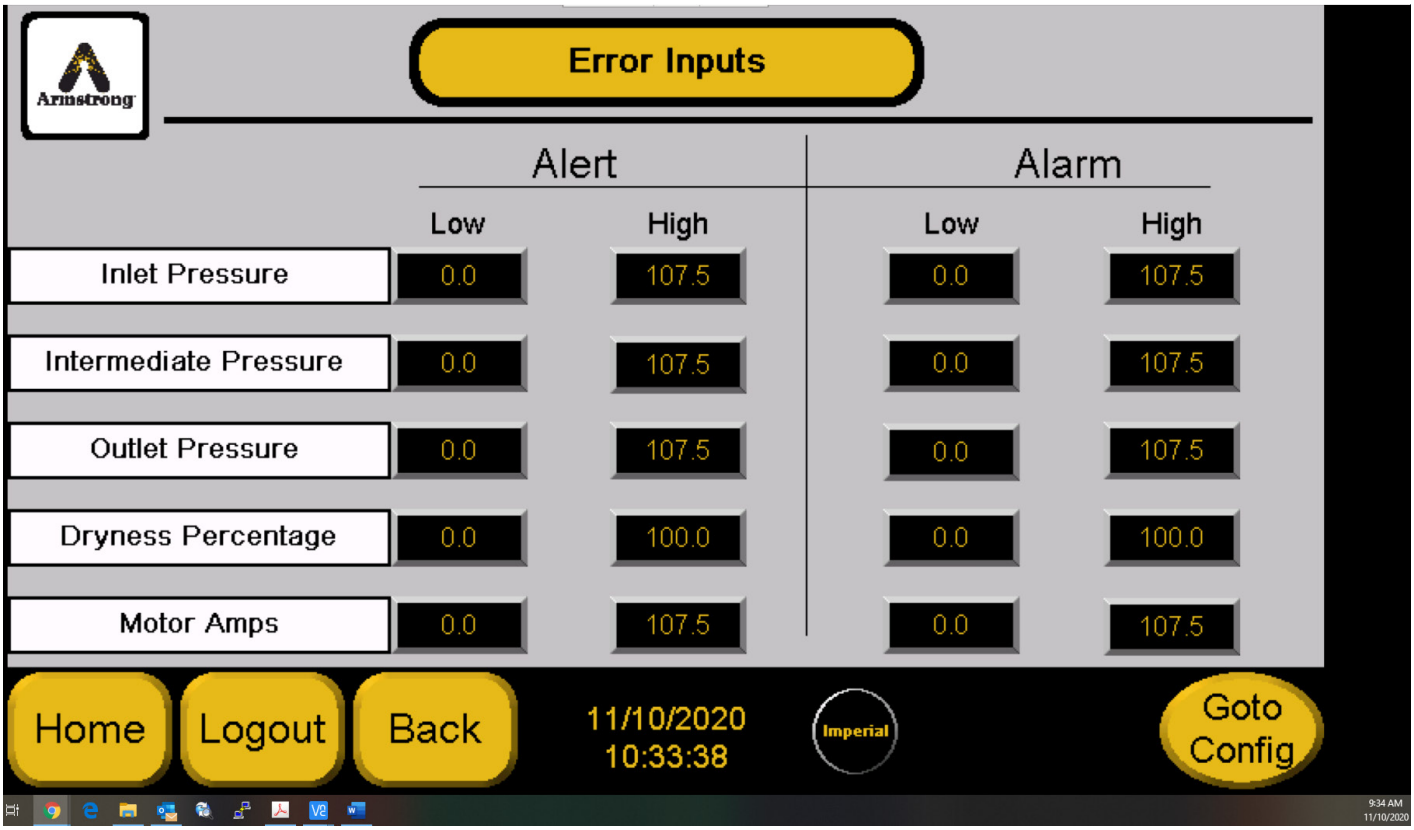
BTU_Hr = Entalpy_Sat_Steam x Accelabar® value

MBTU_Hr = BTU_Lbs_Hr / 1000000.0

.BTU_Ton_Feed = Entalpy_Sat_Steam x Steam_per_Ton_feed

MBTU_Ton_Feed = .BTU_Ton_Feed / 1000000.0

Error Inputs:



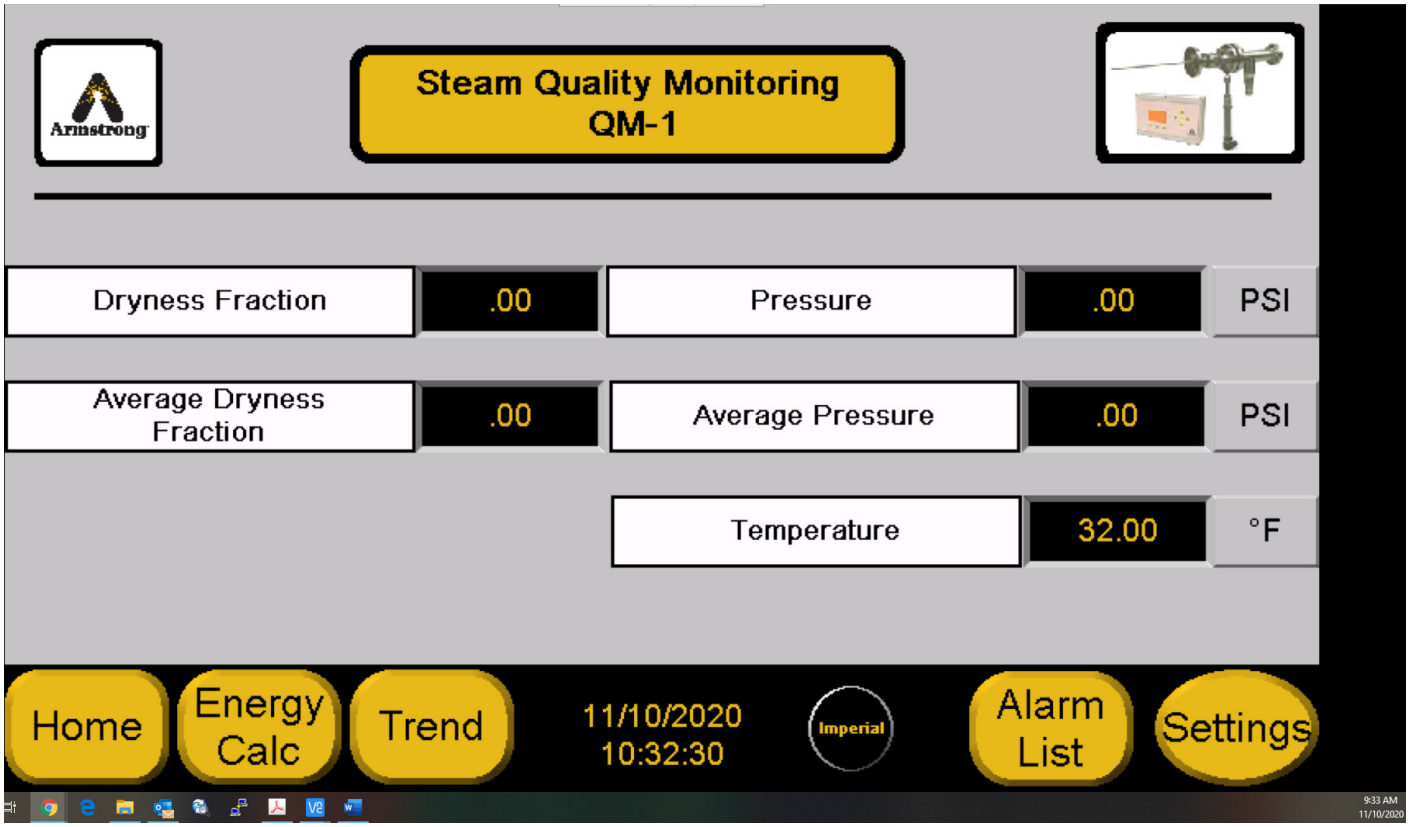
Alert = Flashing Red Light on top of Panel

Alarm = Solid Red Light on top of Panel

No Alert/Alarm = Solid Green Light on top of Panel

Alerts will self clear once data comes back to within acceptable range

Steam Quality Monitoring - Steam QM®-1:

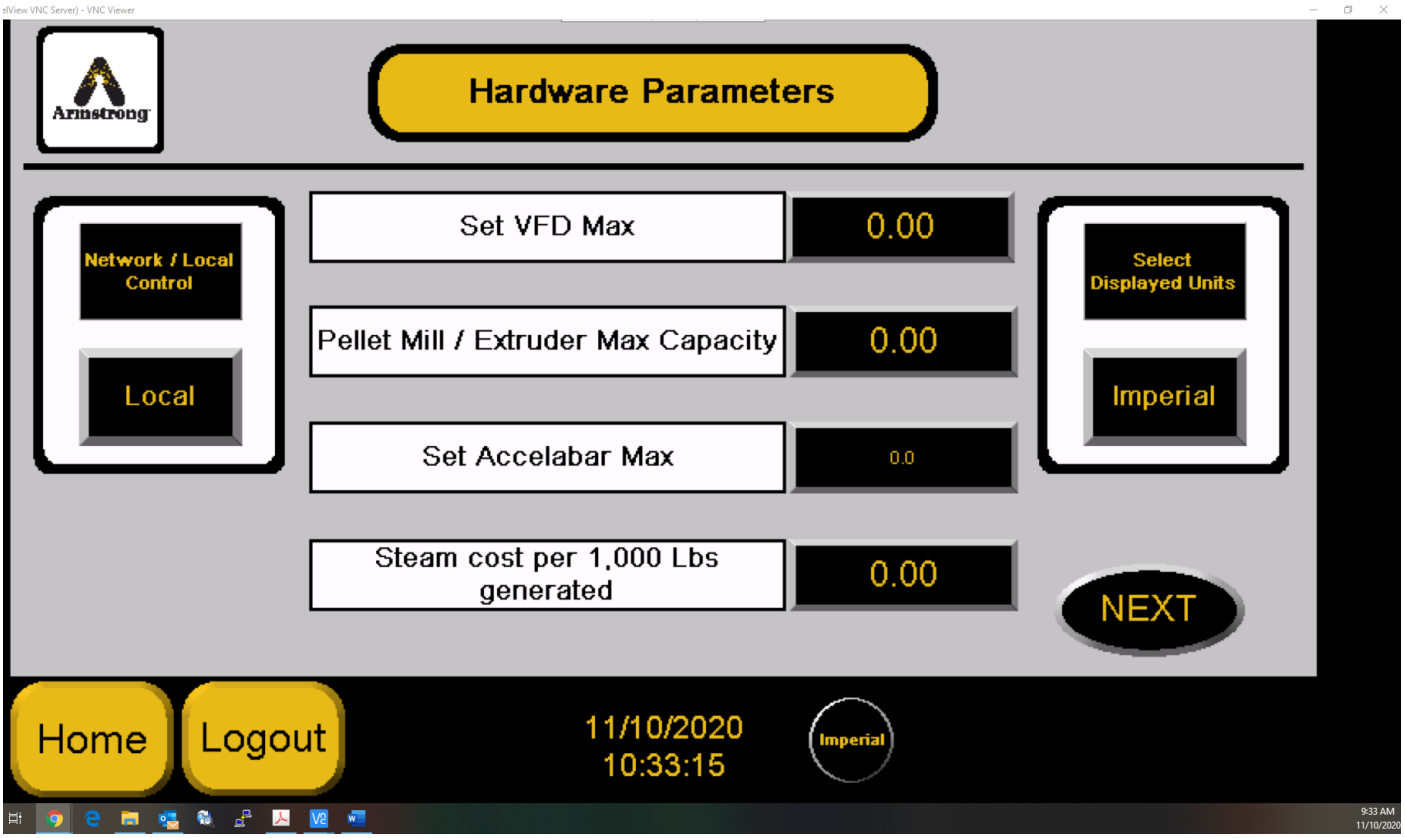


Steam QM®-1 Reading

Unit °C change to °F if imperial selected

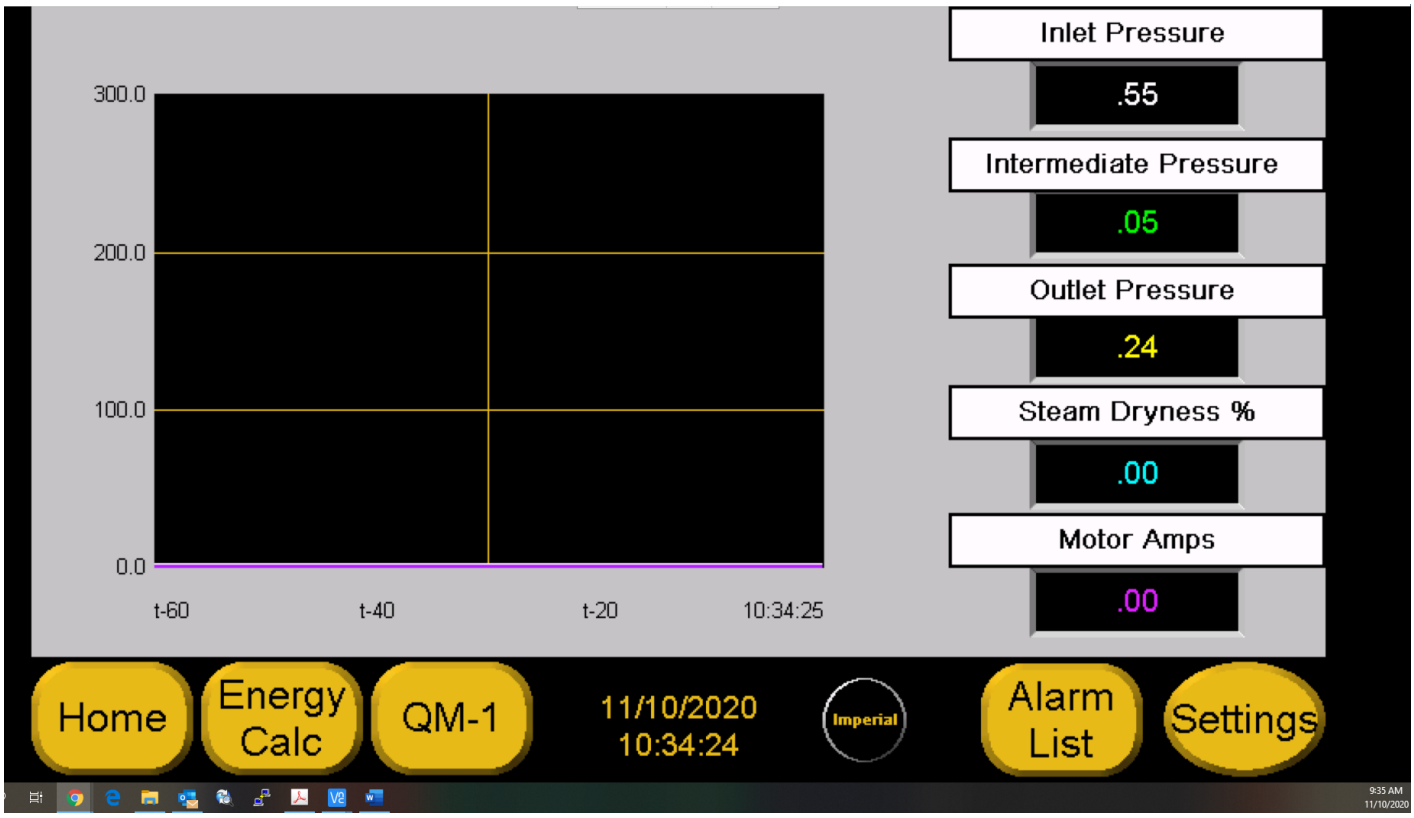
Note: BAR change to PSI if imperial unit

Hardware Parameters:



Press & toggle the 'Network/Local Control' button to switch between Network (i.e. BAS-Modbus TCP) or Local communications.

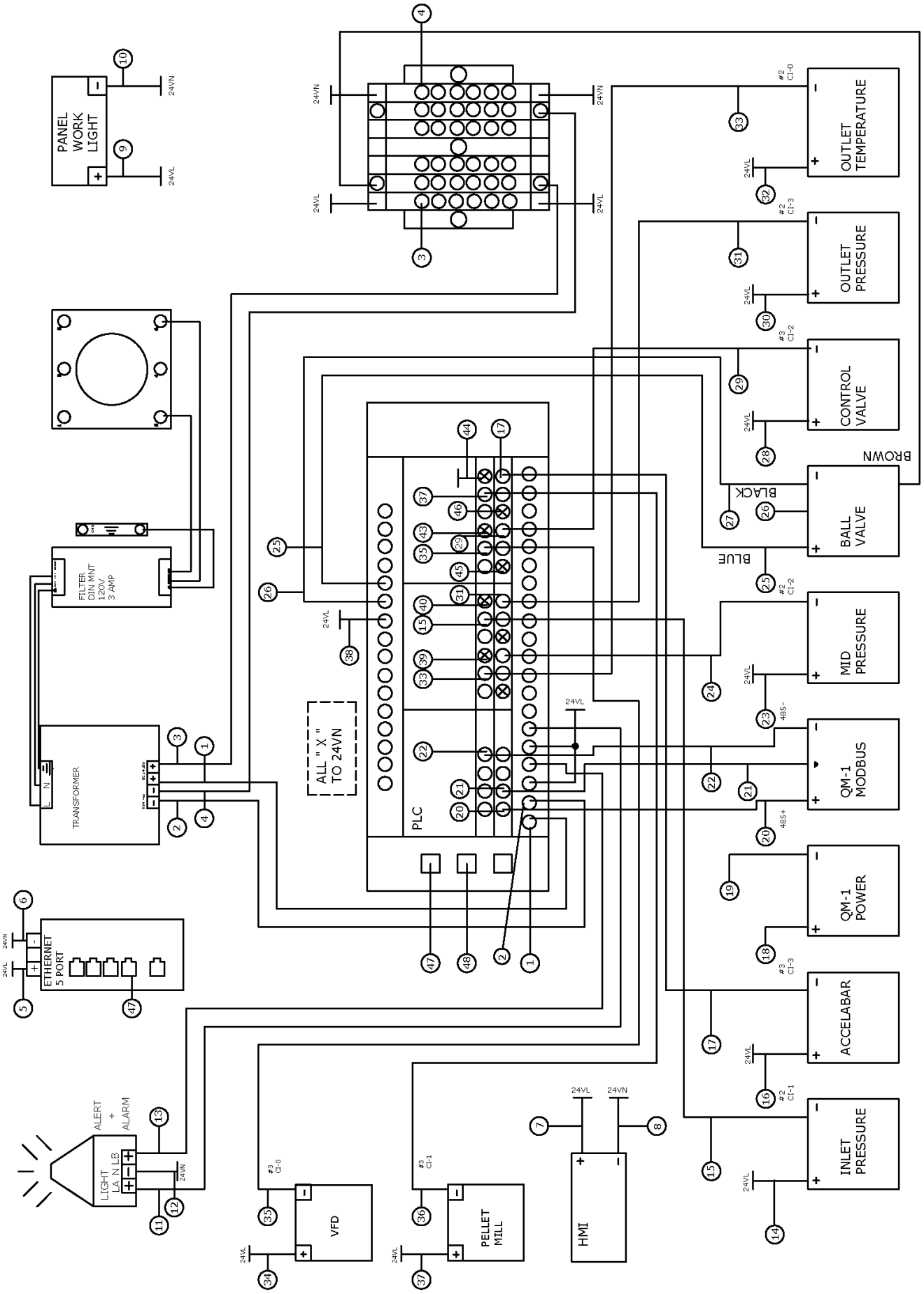
Trend View:



Data collected & saved is per batch/run of each formula entered by user

Data is saved to internal memory on the HMI that can be extracted using a USB memory drive (open panel door for USB insertion into HMI)

PLC/HMI Cabinet Wiring Details



PLC/HMI Cabinet Wiring Details

Bubble	Color	From	To	Signal
1	Purple	1606 - XLP P.S.	PLC - 24V(+)	24 VDC (+)
2	Black	1606 - XLP P.S.	PLC - 24V (-)	24 VDC (-)
3	Purple	1606 - XLP P.S.	TB 24VL	24 VDC (+)
4	Black	1606 - XLP P.S.	TB 24VN	24 VDC (-)
5	Purple	Ethernet Switch 24V(+)	TB 24VL	24 VDC (+)
6	Black	Ethernet Switch 24V(-)	TB 24VN	24 VDC (-)
7	Purple	HMI 24V(+)	TB 24VL	24 VDC (+)
8	Black	HMI 24V(-)	TB 24VN	24 VDC (-)
9	Purple	Cabinet Light 24V(+)	TB 24VL	24 VDC (+)
10	Black	Cabinet Light 24V(-)	TB 24VN	24 VDC (-)
11	Purple	Alarm Light LA	PLC 0-01	24 VDC (+)
12	Black	Alarm Light N	TB 24VN	24 VDC (-)
13	Purple	Alarm Light LB	PLC 0-00	24 VDC (+)
14	Brown	Inlet Pressure Trans. (+)	TB24VL	24 VDC (+)
15	Blue	Inlet Pressure Trans. (-)	PLC - Slot #2 - CI -1	4 - 20mA
16	Brown	VERIS Accelabar® (+)	TB24VL	24 VDC (+)
17	Blue	VERIS Accelabar® (-)	PLC - Slot #3 - CI -3	4 - 20mA
18	Brown	QM®-1 Power (+)	TB24VL	24 VDC (+)
19	Blue	QM®-1 Power (-)	TB24VN	24 VDC (-)
20	Brown	QM®-1 RS485 (+)	PLC -Slot #1 - 485 (+)	485 (+) Modbus RTU
21	White	QM®-1 Ground	PLC -Slot #1 - GND	Ground
22	Blue	QM®-1 RS485 (-)	PLC -Slot #1 - 485 (-)	485 (-) Modbus RTU
23	Brown	Mid Pressure (+)	TB24VL	24 VDC (+)
24	Blue	Mid Pressure (-)	Slot #2 - CI -2	4 - 20mA
25	Blue	Ball Valve Open Switch	PLC - I-09	24 VDC (+)
26	Black	Ball Valve Closed Switch	PLC - I-08	24 VDC (+)
27	Brown	Ball Valve	TB24VL	24 VDC (+)
28	Brown	Control Valve (+)	TB24VL	24 VDC (+)
29	Blue	Control Valve (-)	PLC -Slot #3 CI -2	4 - 20mA
30	Brown	Outlet Pressure Trans. (+)	TB24VL	24 VDC (+)
31	Blue	Outlet Pressure Trrans. (-)	PLC -Slot #2 CI -3	4 - 20mA
32	Brown	Outlet Temperature (+)	TB24VL	24 VDC (+)
33	Blue	Outlet Temperature (-)	PLC -Slot #2 CI -0	4 - 20mA
34	Brown	VFD Current Transformer (+)	TB24VL	24 VDC (+)
35	Blue	VFD Current Transformer (-)	PLC -Slot #3 CI -0	4 - 20mA
36	Brown	Pellet Mill / Extruder (+)	TB24VL	24 VDC (+)
37	Blue	Pellet Mill / Extruder (-)	PLC Slot #3 CI -1	4 - 20mA
38	Gray	PLC -Output COM1	TB24VN	24 VDC (-)
39	Gray	PLC -Slot #2 CI -0 COM	TB24VN	24 VDC (-)
40	Gray	PLC -Slot #2 CI -1 COM	TB24VN	24 VDC (-)
41	Gray	PLC -Slot #2 CI -2 COM	TB24VN	24 VDC (-)
42	Gray	PLC -Slot #2 CI -3 COM	TB24VN	24 VDC (-)
43	Gray	PLC -Slot #3 CI -0 COM	TB24VN	24 VDC (-)
44	Gray	PLC -Slot #3 CI -1 COM	TB24VN	24 VDC (-)
45	Gray	PLC -Slot #3 CI -2 COM	TB24VN	24 VDC (-)
46	Gray	LC -Slot #3 CI -3 COM	TB24VN	24 VDC (-)
47	Aqua	PLC -Slot #3 CI -3 COM	PLC - Ethernet	Ethernet/ Modbus TCP
48	Gray	PLC -Serial Port	HMI - Serial Port	CIP Serial

PLC/HMI I/O Details

Inputs to PLC from Equipment				
Item	**Value**	**Signal**	**Note (Software)**	**Note (Hardware)**
AB 836P Inlet Pressure Transducer	Pressure (psig)	4-20 mA	_IO_P2_AI_01	Slot #2 - CI-1 & COM
AB 836P Intermediate Pressure Transducer	Pressure (psig)	4-20 mA	_IO_P2_AI_02	Slot #2 - CI-2 & COM
AB 836P Outlet Pressure Transducer	Pressure (psig)	4-20 mA	_IO_P2_AI_03	Slot #2 - CI-3 & COM
AB 837T Outlet Temperature Transducer	Temperature (˚F)	4-20 mA	_IO_P2_AI_00	Slot #2 - CI-0 &COM
VERIS Accelabar®	Steam Flow (lb/hr)	4-20 mA	_IO_P3_AI_03	Slot #3 - CI-3 & COM
QM®-1 Modbus	Dryness Fraction	Modbus RS-485		
	Pressure			
	Temperature			
	Alarm			
	Avg Dryness Fraction			
	Average Pressure			
	Time Used to Calc. Avg.			
Automatic Ball Valve	ON/OFF Control	24VDC Discrete I/O Feedback	_IO_EM_DI_08 & _IO_ EM_DI_09 & COM	Top of PLC COM, I-08 & I-09
CV-1500 Control Valve	Position Feedback	4-20 mA	_IO_P3_AI_02	Slot #3 - CI-2 & COM
VFD Amperage (from customer)	Motor Amperage	4-20 mA	_IO_P3_AI_00	Slot #3 - CI-0 & COM
Pellet Mill Production (from customer)	TPH (Tons per Hour)	4-20 mA	_IO_P3_AI_01	Slot #3 - CI-01 & COM

Outputs to PLC from Equipment			
Item	**Value**	**Signal**	**Note**
Automatic Ball Valve	ON/OFF Control	24VDC Discrete I/O	
CV-1500 Control Valve	Position Control	4-20 mA	

Modbus TCP Register Map Information

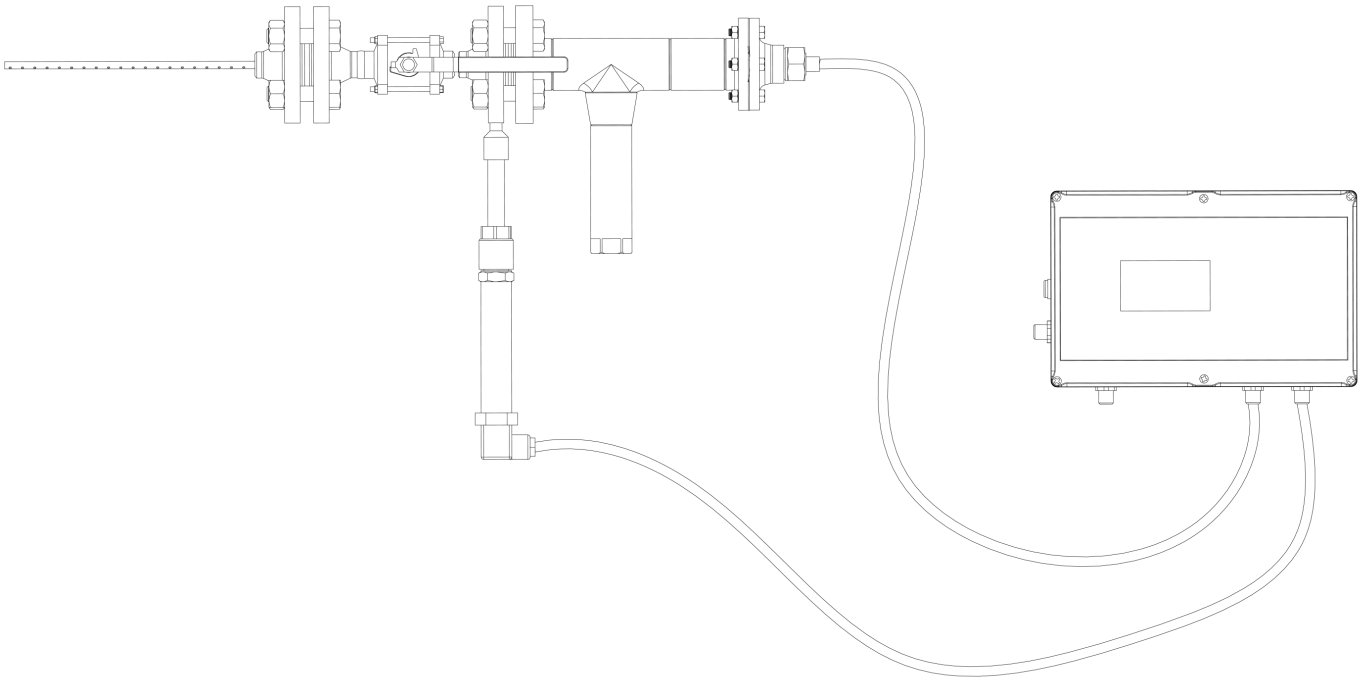
Steam Harnesss Modbus TCP			
Address	**Name**	**Description**	**Function**
1	Unit Control	True (1) = Imperial ; False (0) = Metric	Read/Write
2	Network Control	True (1) = Parameters and settings through Modbus TCP Only ; False (0) = Parameters and settings through HMI only	
10001	Inlet Alert Low	True (1) = Alarm/Alert False (0) = No Alarm/Alert	Read Only
10002	Inlet Alert High		
10003	Inlet Alarm Low		
10004	Inlet Alarm High		
10005	Mid Alert Low		
10006	Mid Alert High		
10007	Mid Alarm Low		
10008	Mid Alarm High		
10009	Out Alert Low		
10010	Out Alert High		
10011	Out Alarm Low		
10012	Out Alarm High		
10013	Dry Alert Low		
10014	Dry Alert High		
10015	Dry Alarm Low		
10016	Dry Alarm High		
10017	Motor Alert Low		
10018	Motor Alert High		
10019	Motor Alarm Low		
10020	Motor Alarm High		
10021	Data Log Status		
30001	Inlet Pressure	Inlet Pressure Display (of selected "Unit Control")	Read Only
30002	VERIS Accelabar® Display	VERIS Accelabar® Display (of selected "Unit Control")	
30003	QM®-1 Dryness Fraction	QM®-1 Dryness Fraction (%)	
30004	QM®-1 Pressure Display	QM®-1 Pressure (of selected "Unit Control")	
30005	QM®-1 Temperature Display	QM®-1 Temperature (of selected "Unit Control")	
30006	QM®-1 Dryness Average	QM®-1 Dryness Average (%)	
30007	QM®-1 Pressure Average	QM®-1 Pressure Average (of selected "Unit Control")	
30008	Mid Pressure Display	Mid Pressure Display (of selected "Unit Control")	
30009	Shutoff Valve Position	(0) = Open ; (1) = Closed ; (2) = Transition	
30010	Control Valve Position	Feedback of Control Valve (%)	
30011	Temperature Display	Outlet Temperature (of selected "Unit Control")	
30012	Motor Amps	Motor Amps Display	
30013	Mill/Extruder Output	Tons per Hour	
30014	Total Steam Used	Totalizer of Steam used per Run (of selected "Unit Control")	
30015	Steam Cost per Hour	$	
30016	Steam Cost per Ton Product	$	
30017	Motor Amps per Ton Product	Amps	
30018	Motor Amps per Steam an Hour	Amps	
30019	Steam Quality Average	Dry Average over an hour or when control valve closes (%)	
30020	Steam Consumption per Ton Product	(of selected "Unit Control")	

Modbus TCP Register Map Information

Steam Harnesss Modbus TCP - Continued			
Address	**Name**	**Description**	**Function**
40001	Motor Amp Max	Set Max Amperage x10	Read/Write
40002	Mill / Extruder Max	Set Mill/Extruder Capacity x10	
40003	VERIS Accelabar® Max	Set VERIS Accelabar® x10	
40004	Inlet Alert Low	Set Inlet Alert Low x10	
40005	Inlet Alert High	Set Inlet Alert High x10	
40006	Inlet Alarm Low	Set Inlet Alarm Low x10	
40007	Inlet Alarm High	Set Inlet Alarm High x10	
40008	Mid Alert Low	Set Mid Alert Low x10	
40009	Mid Alert High	Set Mid Alert High x10	
40010	Mid Alarm Low	Set Mid Alarm Low x10	
40011	Mid Alarm High	Set Mid Alarm High x10	
40012	Out Alert Low	Set Out Alert Low x10	
40013	Out Alert High	Set Out Alert High x10	
40014	Out Alarm Low	Set Out Alarm Low x10	
40015	Out Alarm High	Set Out Alarm High x10	
40016	Dry Alert Low	Set Dry Alert Low x10	
40017	Dry Alert High	Set Dry Alert High x10	
40018	Dry Alarm Low	Set Dry Alarm Low x10	
40019	Dry Alarm High	Set Dry Alarm High x10	
40020	Motor Alert Low	Set Motor Alert Low x10	
40021	Motor Alert High	Set Motor Alert High x10	
40022	Motor Alarm Low	Set Motor Alarm Low x10	
40023	Motor Alarm High	Set Motor Alarm High x10	

Notes

Steam QM®-1 Steam Quality Monitor Installation & Operations Manual



CE Certified

Intertek

247-EN V1.17

Keep this manual with equipment for future reference.

Armstrong®

Steam QM®-1 Table of Contents

Safety

Icon Legend

Indicates Power On

Indicates Power Off

Indicates important information concerning potential for personal injury or damage to equipment

Indicates electrical hazard

Indicates hot surface

Burn hazard! Uninsulated components upstream of cabinet may be hot.
- Do not touch when unit is working.
- Allow to cool before moving or servicing unit.

Live steam will cause burns; condensate water may cause them. Skin exposure to 140 °F (60 °C) water for only five seconds may cause a second degree burn.

Keep unit away from heat-sensitive equipment and installations.

Shock hazard!
- Electrical installation must be performed by qualified personnel.
- Disconnect power before performing any electrical service.

Read this manual. It contains important information.

This device must be installed in accordance with appropriate local, national, and international standards, codes, and practices.

Installation should always be accompanied by competent technical assistance. Improper installation, start-up, operation, maintenance, or service may void warranty. You are encouraged to contact Armstrong International or its local sales representative for additional information.

Service must be performed by a qualified person.

Equipment must be disposed of according to applicable environmental requirements.

Abbreviations and Acronyms

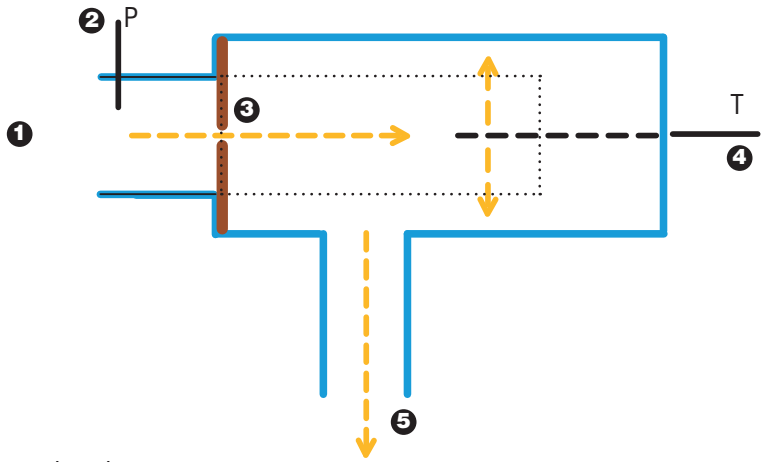
Term	Meaning	Explanation
AI	Alarm	Indicates an out-of-limit situation, but has no impact on operation. AI: Dryness below user-defined set point longer than two minutes.
C	Celsius	
cm	Centimeter	
DIN	Deutsches Institut für Normung eV	
EC	European Community	
EEC	European Electrotechnical Commission	
EN	European Norm	
F	Fahrenheit	
gal	Gallon	
h	Hour	
imp	Imperial [measure]	
in.	Inch	
kg	Kilogram	
L	Liter	
lb(s)	Pound(s)	
max	Maximum	
min	Minimum	
mm	Millimeter	
P	Pressure	P is steam pressure upstream of calibrated orifice.
psig	Pounds per Square Inch (gauge)	
QM	Quality Monitoring	
sec(s)	Second(s)	
SI	International System of Units	
T	Temperature	T: Temperature after the calibrated orifice.
X	Dryness Fraction (sometimes called steam quality or moisture content)	Xmin is the lower dryness limit. Alarm indicates the limit has been exceeded.

General Description

Steam QM®-1 is intended to replace manual testing of steam dryness and provide real-time data proving that steam quality meets applicable requirements.

Principle of operation:

1. A sample of steam is taken continuously.
2. Steam pressure is measured.
3. Steam passes through a calibrated orifice and expanded to atmospheric pressure.
4. Steam temperature is measured.
5. Sample of steam is discharge to drain (atmospheric pressure).
6. Dryness fraction is determined according to the Mollier Diagram.



Advantages over manual testing are:

- Improved safety
- Ease of use
- Real time results
- More accurate and objective results
- Ability to trend data over time

Armstrong recommends that the Steam QM®-1 unit be installed in one location and not used as a portable unit.

Data from Steam QM®-1 can be integrated in a control system using a data historian with Modbus output (see Appendix two for connection information.)

Materials of construction comply with all standards known at the time of manufacture.

Specifications

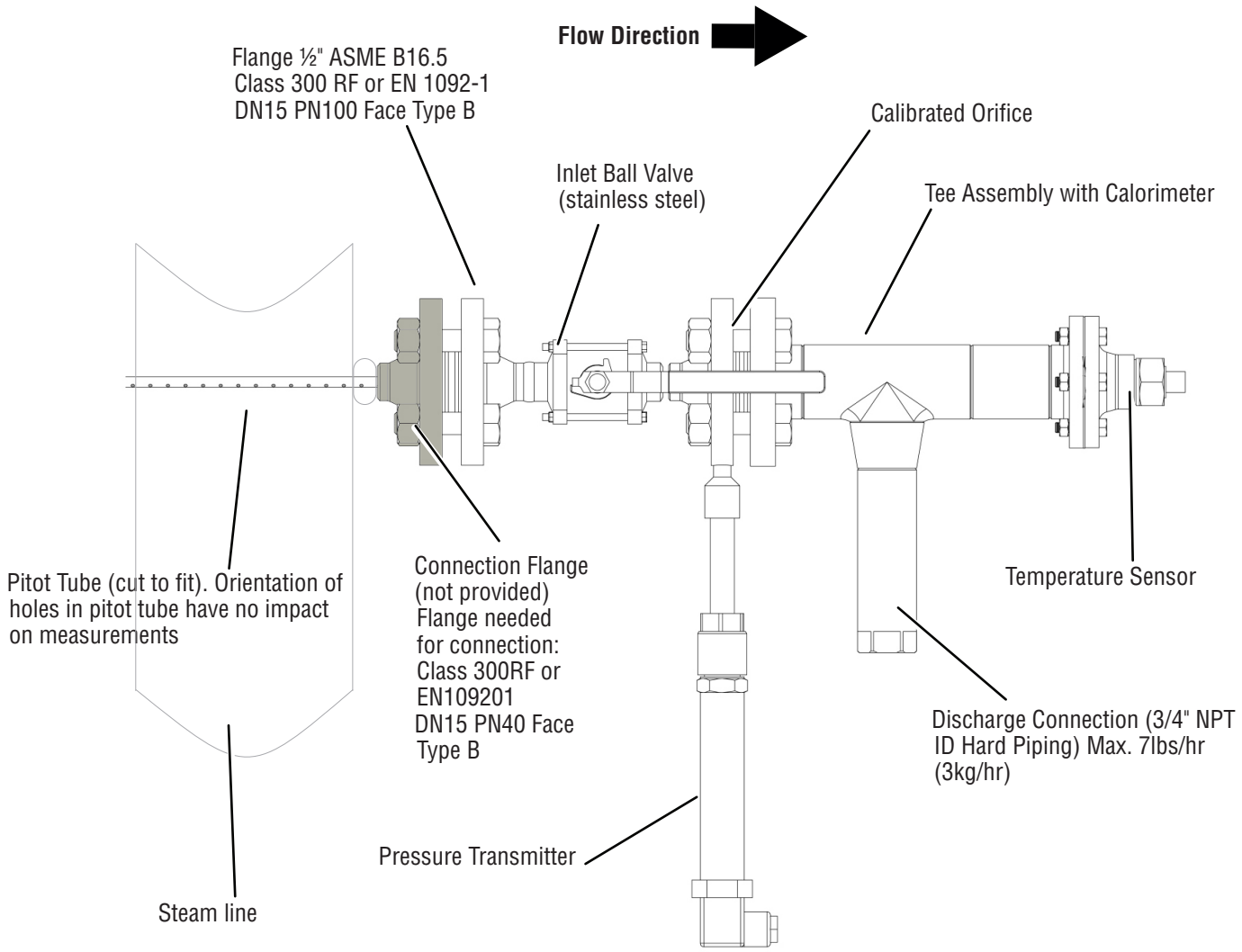
Parameter	Specification
Maximum Operating Pressure	465psig @ 500°F (32.1barg @ 260°C)
Maximum Allowable Pressure	465psig (32.1barg)
Maximum Allowable Temperature	500°F (260°C)
Dryness fraction	See Appendix 3
Electrical	15VAC* 50/60Hz or 15-24 VDC/30W

The product must be powered by an isolated external power supply in low voltage.
*If supplied with less than 15VAC, unit will still operate, however all measurements/readings will be incorrect!

Armstrong reserves the right to make design or specification changes without notification.

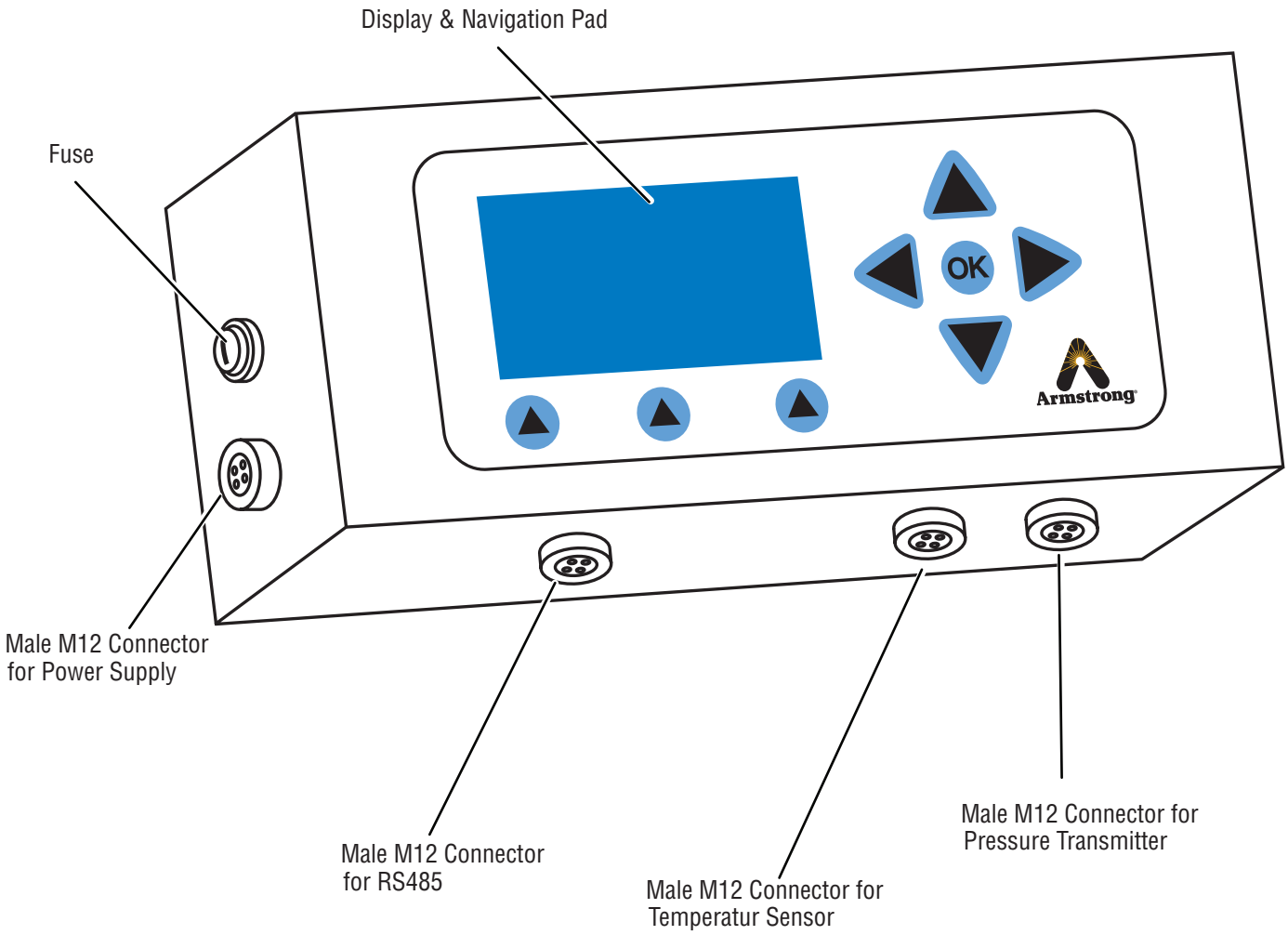
Assembly

Note: The assembly shown below is configured to be mounted horizontally.
Assembly (without flange) weighs approximately 20 lbs (9 kg).



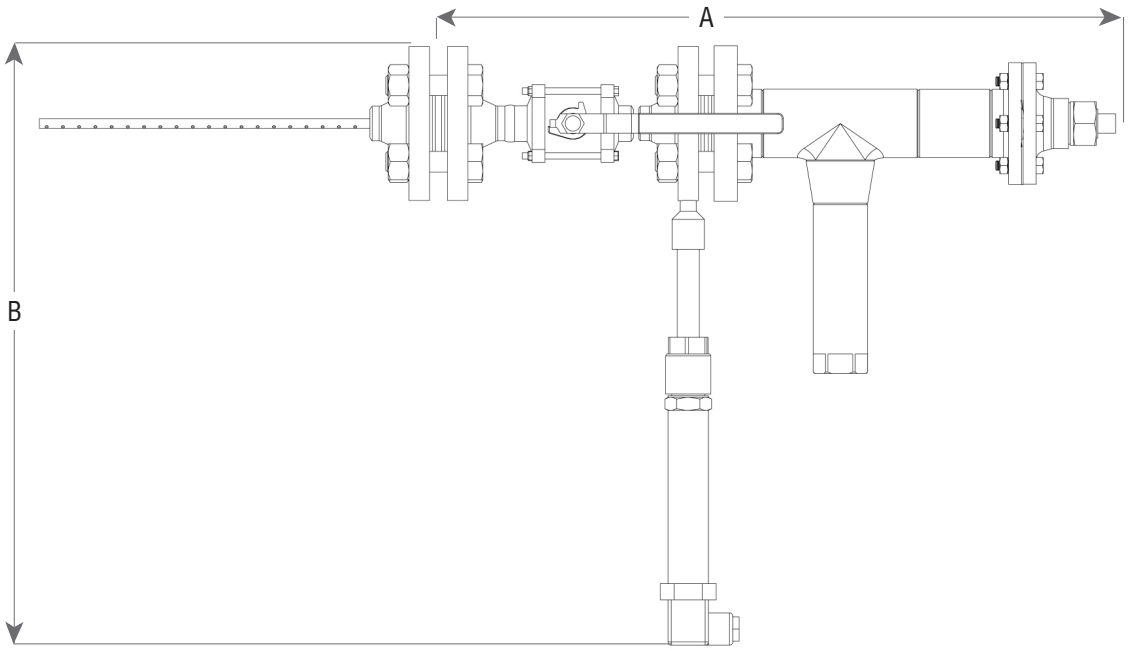
Cabinet

Cabinet weighs approximately 2 lbs (0,9 kg)

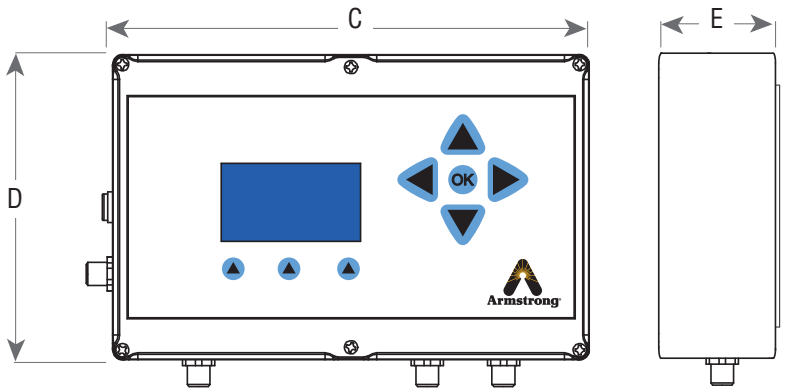


Dimensions (approx.)

Assembly



Cabinet



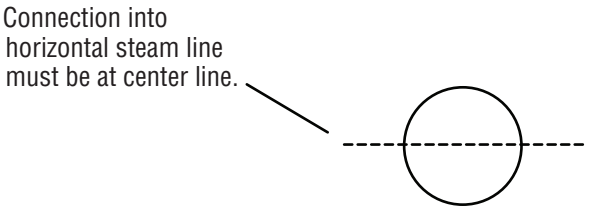
Dimensions & Weight		
	in	mm
A – Assembly Width	20	500
B – Assembly Height	15	375
C – Cabinet Width	10	250
D – Cabinet Height	6.5	160
E – Cabinet Depth	2.5	60
Assembly Weight	20 lb	9 kg
Cabinet Weight	2 lb	0.9 kg

Installation

General Considerations (Site Selection)

Ambient temperature must be 5–40 °C (41–104 °F)
Relative humidity must be 30–80%
Altitude must not exceed 2000 m (6562 ft)
Indoor Use
Pollution Degree 2

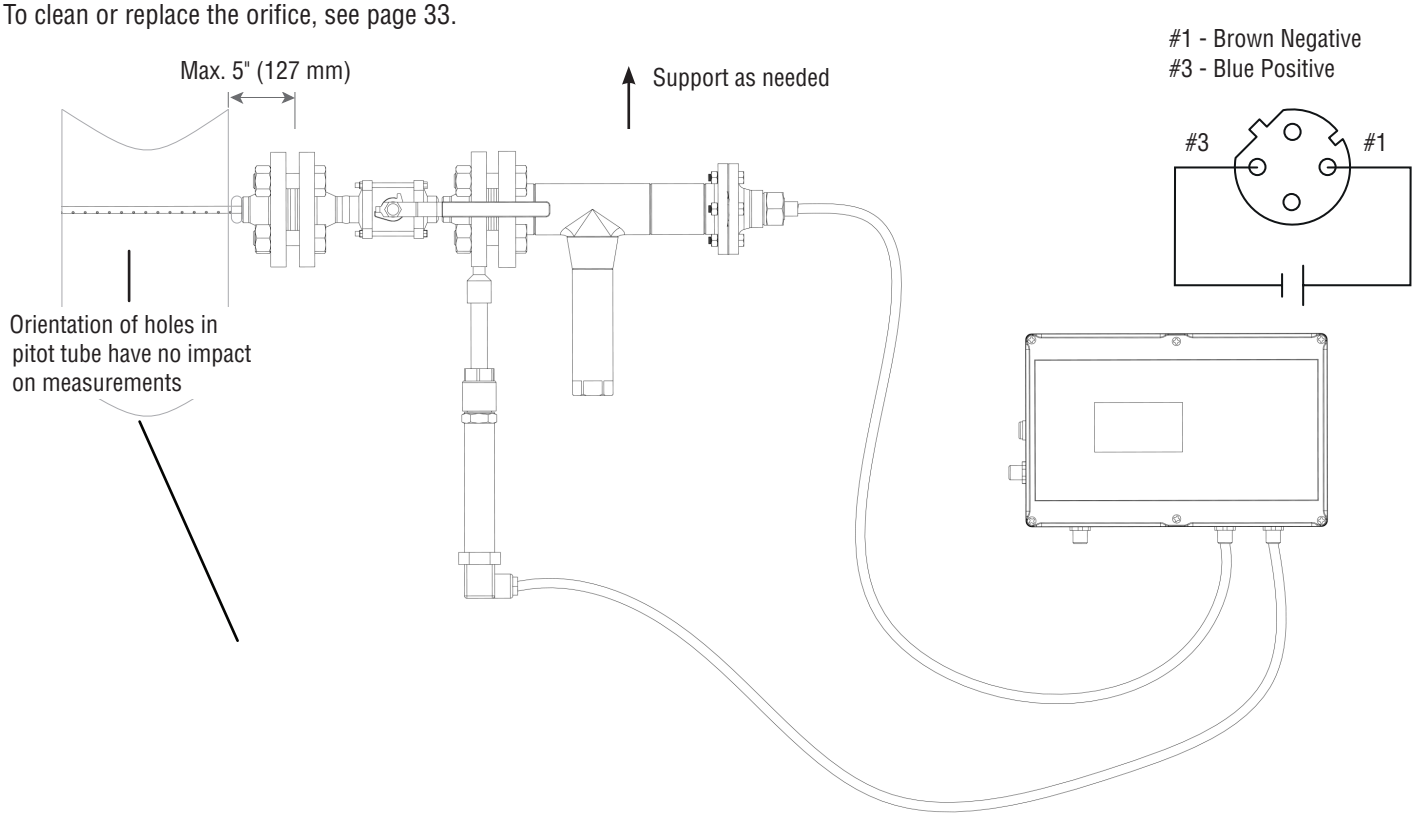
Connection to vertical steam line is optimal.
The steam sample can be taken from horizontal and vertical steam lines, as long as the steam sampling tube is in a horizontal plane.



Typical Installation

At first use, fill pressure transmitter tube with water.

By default, orifice 0.5mm is installed. For pressure below 10 barg (150 psig), use the 0.8mm orifice provided.
To clean or replace the orifice, see page 33.



To insure accuracy the discharge tubing must discharge to atmospheric pressure.
Warning: Steam and condensate up to 320 °F (160 °C) will flow from the discharge. Precautions to safely discharge the steam and condensate must be taken.
Note: Orientation of the holes in the pitot tube have no impact on the measurement
Note: Shortening or replacing a cable will require recalibration.
Note: See page 23 for details to cut pitot tube if necessary.

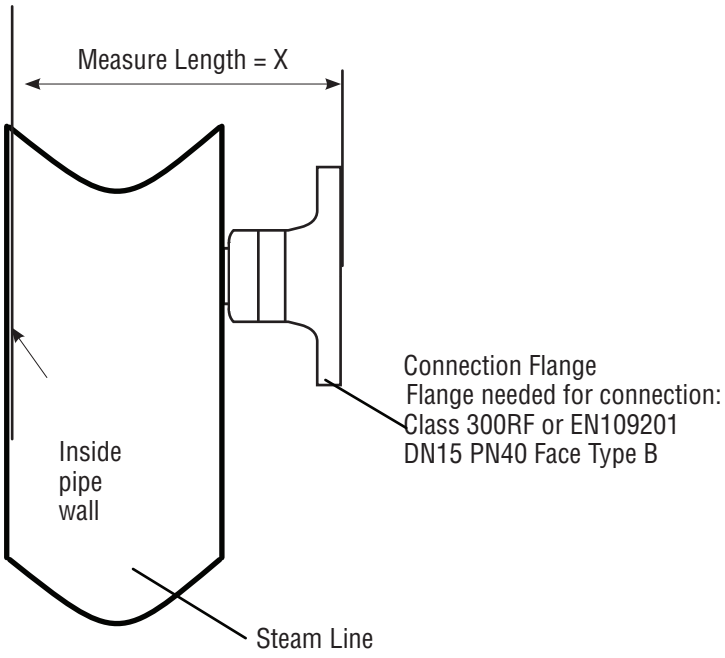
WARNING: A blocked steam discharge pipe is a safety hazard as the parts after the orifice are not designed for pressure.

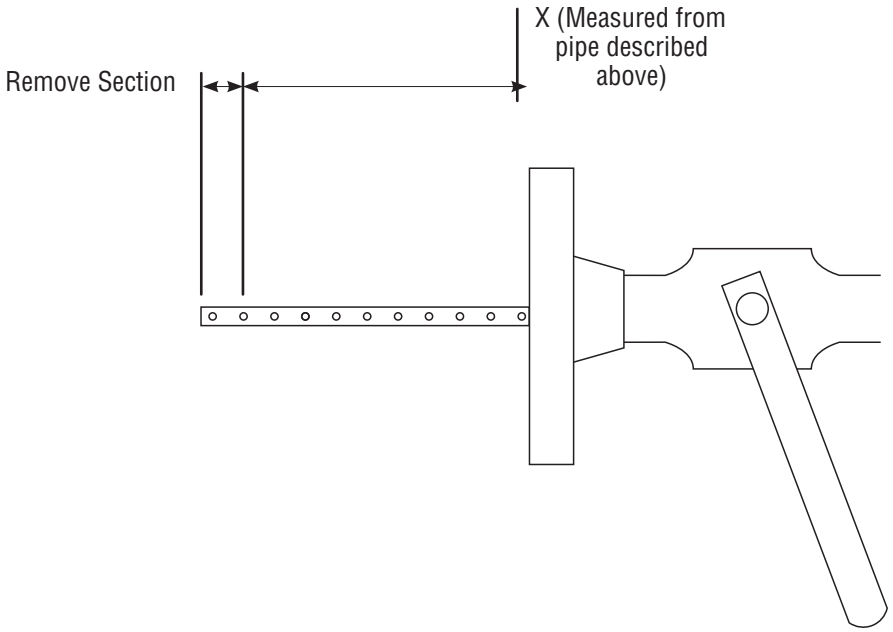
WARNING: The inlet ball valve is not designed to carry the weight of the assembly especially if a heavy steam discharge hose is connected. It is recommended to support the end of manifold.

Installation

Pitot tube must be cut accordingly if the diameter of the line is less than 6".

Measuring the length of the pitot tube.

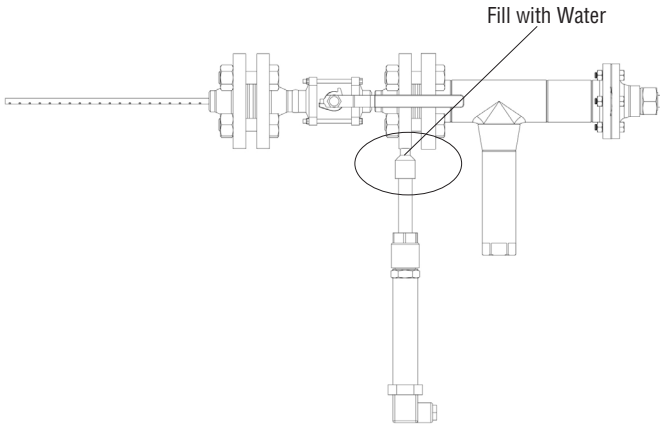




Note: If pilot tube is shorter than the measured length, then it is not necessary to cut the tube. It can be installed without any modifications. Orientation of holes in pitot tube have no impact on measurements.

Start-Up Procedure

1. To prevent damage to the pressure sensor, be sure to fill the tube before it with water before start-up



2. Confirm all connections:
   - Power
   - Drainage
   - Sensor connections

3. Turn power onto the Steam QM®-1. The main screen will display

4. Slowly open the inlet ball valve, to allow steam to flow into the assembly.

CAUTION: Uninsulated components will become hot once steam is applied.

Note: Parameters will display in about 10 minutes.

5. Check for leaks and tighten connections as necessary

6. Check that steam or water flows through the discharge pipe (up to 7 lbs/hr (3 kg/h) depending on the steam pressure)

7. In the settings menu, set the Xmin, the unit, the time and altitude (see pages 25 and 26)

8. If you are using the ModBus Connections, follow instruction in Appendix Two

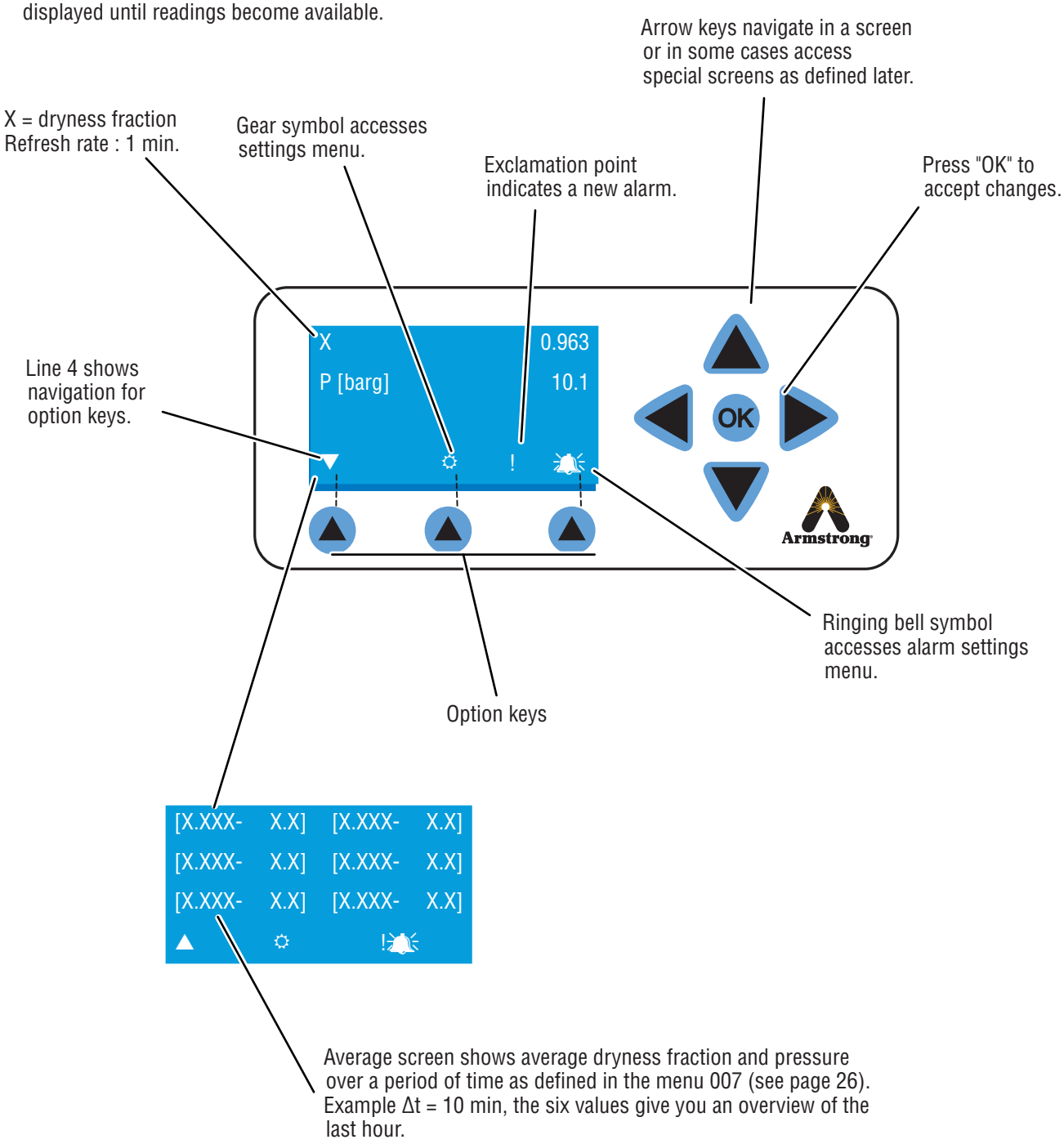
WARNING: A blocked steam discharge pipe is a safety hazard as the parts after the orifice are not designed for pressure. Do not cover ball valve handle in insulation due to inherent safety risk.

Software Navigation

Standard Screens

Main Screen

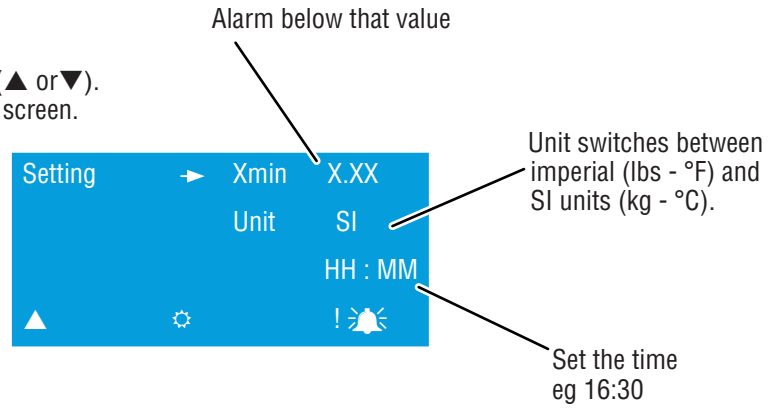
Note: During initialization, a progress bar is displayed until readings become available.



Settings Menu

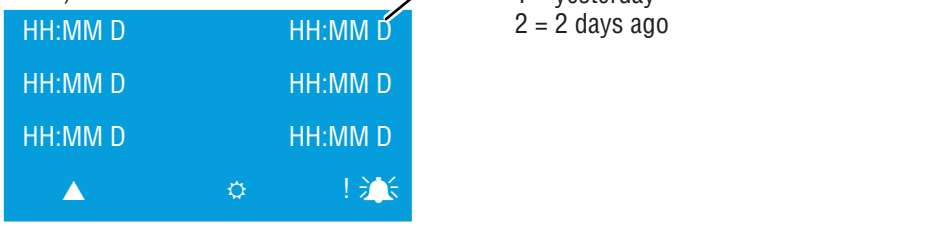
To get to the settings menu press the option key with the ☼ symbol. Scroll through the settings using up/down arrows (▲ or▼). Move arrow to value (activate selection) by pressing right arrow (▶).

Change value by pressing up/down arrows (▲ or▼). To save change press left arrow (◀) or exit screen.



Alarm Menu

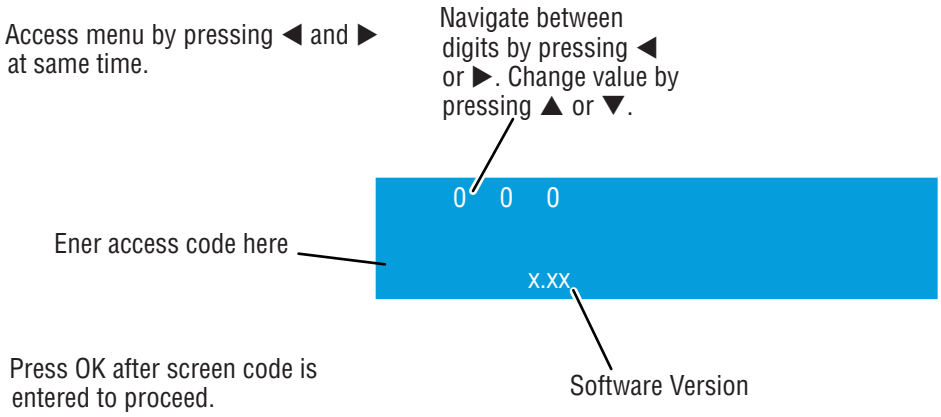
To get to the alarm menu, press the option key with the symbol. The alarm menu lists the last 6 instances the measured dryness fraction was less than the Xmin value (from the settings menu).



Alarm indicated on main screen (exclamation point) will reset automatically when consulting this screen.

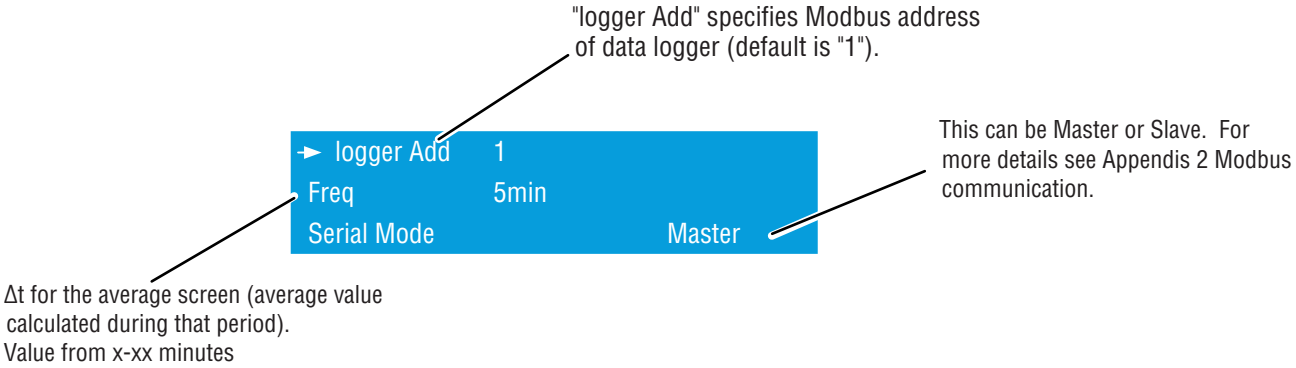
Special Screens

Code Menu



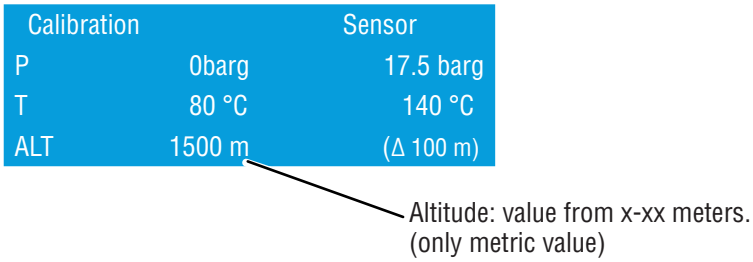
Advanced Setting Menu

Access code is 007.



Calibration Menu Screen

Access code is 152.

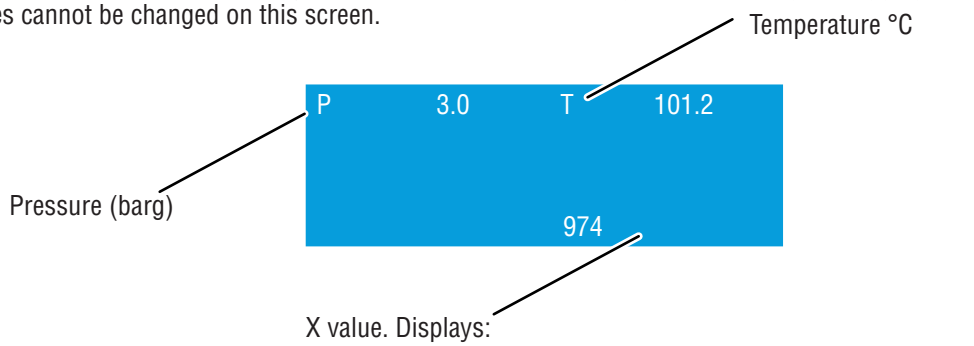


Select only ALT on this screen. If P or T are selected, calibration will be lost and the Steam QM®-1 will have to be recalibrated before returning to service.

Sensor Information Screen

Access screen by pressing ▲ and ▼ at same time.

Note:
- Information displayed are real time values, which may be irrelevant if unit is not connected to steam.
- This screen is for information only, and is intended for use during commissioning, debugging, etc. Values cannot be changed on this screen.



X value. Displays:
- 1000 during initialization
- 10 if T1 < 212 °F (100 °C) (no steam)
- > 1000 if superheated steam
- 920–1000 (dryness fraction x 1000) during normal operation

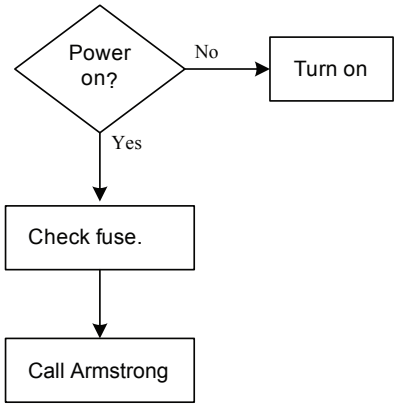
Troubleshooting

Components and water may be hot.

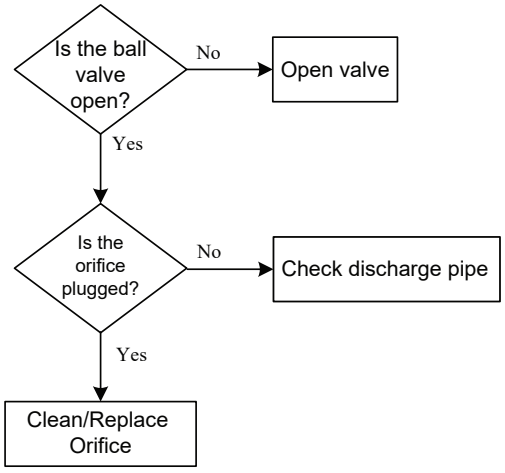
Disconnect power before performing electrical work.

If problem cannot be resolved, contact Armstrong.

Display Off



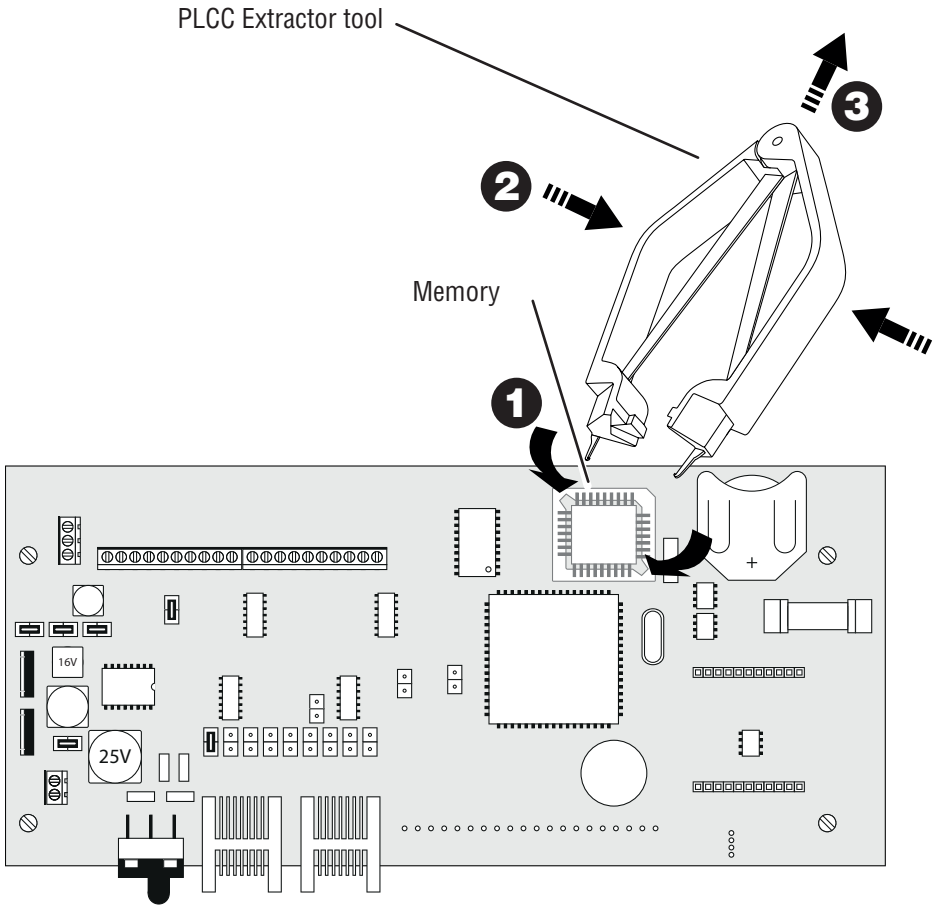
No steam or water through discharge pipe



Maintenance

Software Update

1. Unplug all M12 connector starting with unplugging the power supply.
2. Open cabinet.
3. Find the electronic board.
4. Remove cautiously the memory with the adapted tool (like a PLCC extractor).



5. Replace the memory (with your thumb, push cautiously respecting the coded pin).
6. Plug and turn on the Steam QM®-1, light is ON and screen is activated.
7. Check the version software in the code menu (press simultaneously on ◀ and ▶).

Note: Recalibration is not required with code updates.

Calibration

This chapter will walk a technician through the steps necessary to calibrate/recalibrate the Steam QM®-1. It is estimated this process will take one hour. Once recalibration has begun, all components must be recalibrated before returning the unit to service.

Recalibration is required annually or whenever any component is changed.

What To Expect:

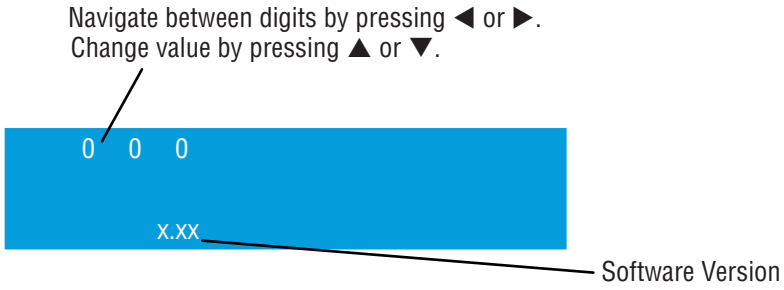
Temperature Sensors:
The temperature sensor is calibrated by true measurement method.

Pressure Transmitter:
The pressure sensor is calibrated by using a calibrated reference gauge.

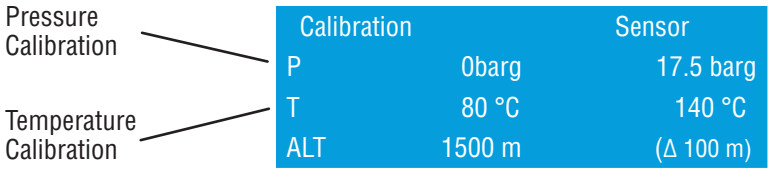
Materials Needed:
- Calibrated oil bath or dry well
- Calibrated reference pressure and temperature gauge

Calibration Procedure

Code Menu
Access the code menu by pressing < and > at the same time.

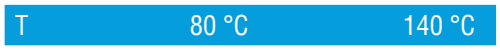


In the code menu, enter code 152 and press OK.



Calibrating The Temperature Sensor:
1. Remove the temperature sensor from Steam QM®-1 with a 27 mm wrench.
2. Place the tip of the temperature sensor in the calibrated oil bath or dry well.
3. Set the oil bath or dry well on 80°C
4. When the oil bath or dry well temperature has stabilized, move the arrow to the left of 80°C and press OK.

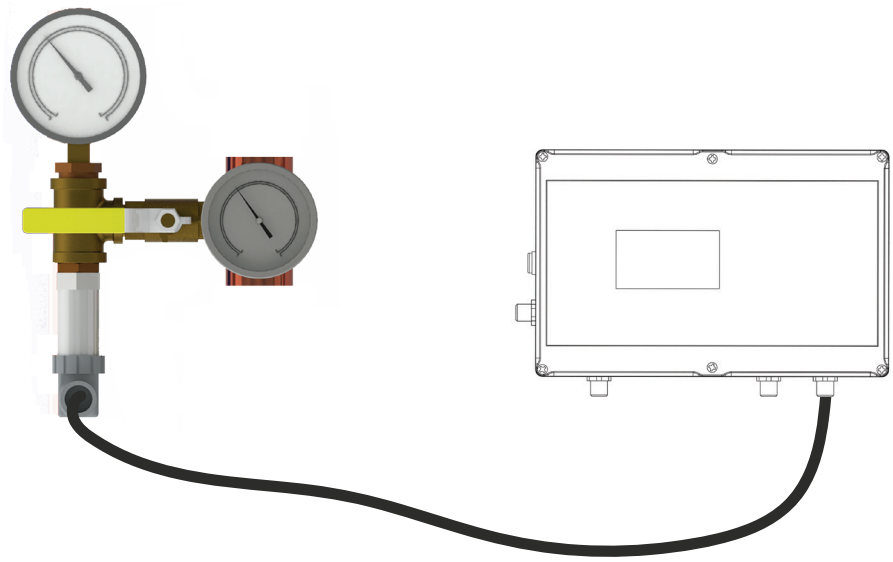
5. Set the oil bath or dry well on 140°C.
6. When the oil bath or dry well termperature has stabilized, move the arrow to left on 140°c and press OK.



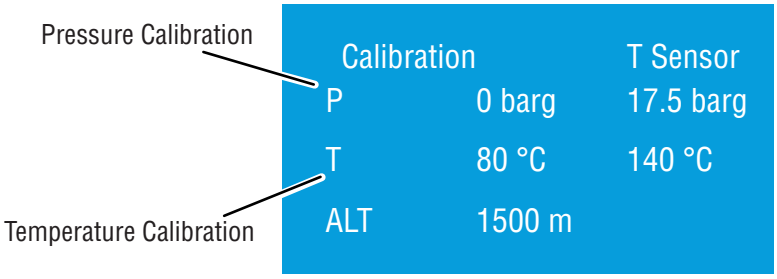
7. Reconnect the temperature sensor on the Steam QM®-1.

Calibrating the Pressure Transmitter

1. Remove the screw on top of DIN connector and unplug the DIN connector from the pressure transmitter.
2. Attach the pressure transmitter to the calibrated reference gauge.

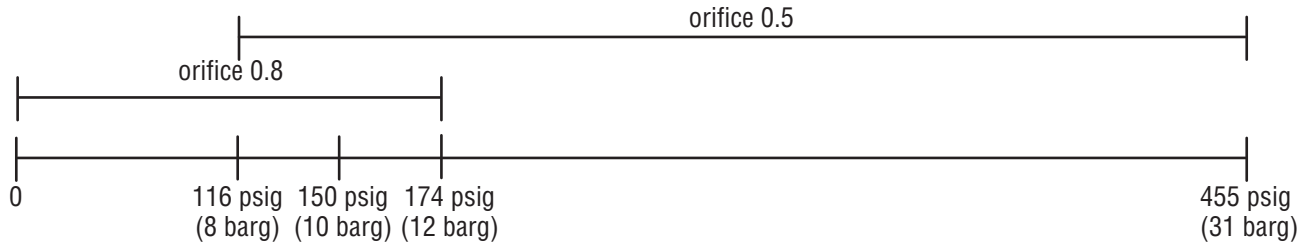


3. In the code menu, enter code 152 and press OK. (If already in the calibration menu, skip this step.)
4. Select 17.5 barg.
5. Press OK, wait for the check mark.



Code Menu 152

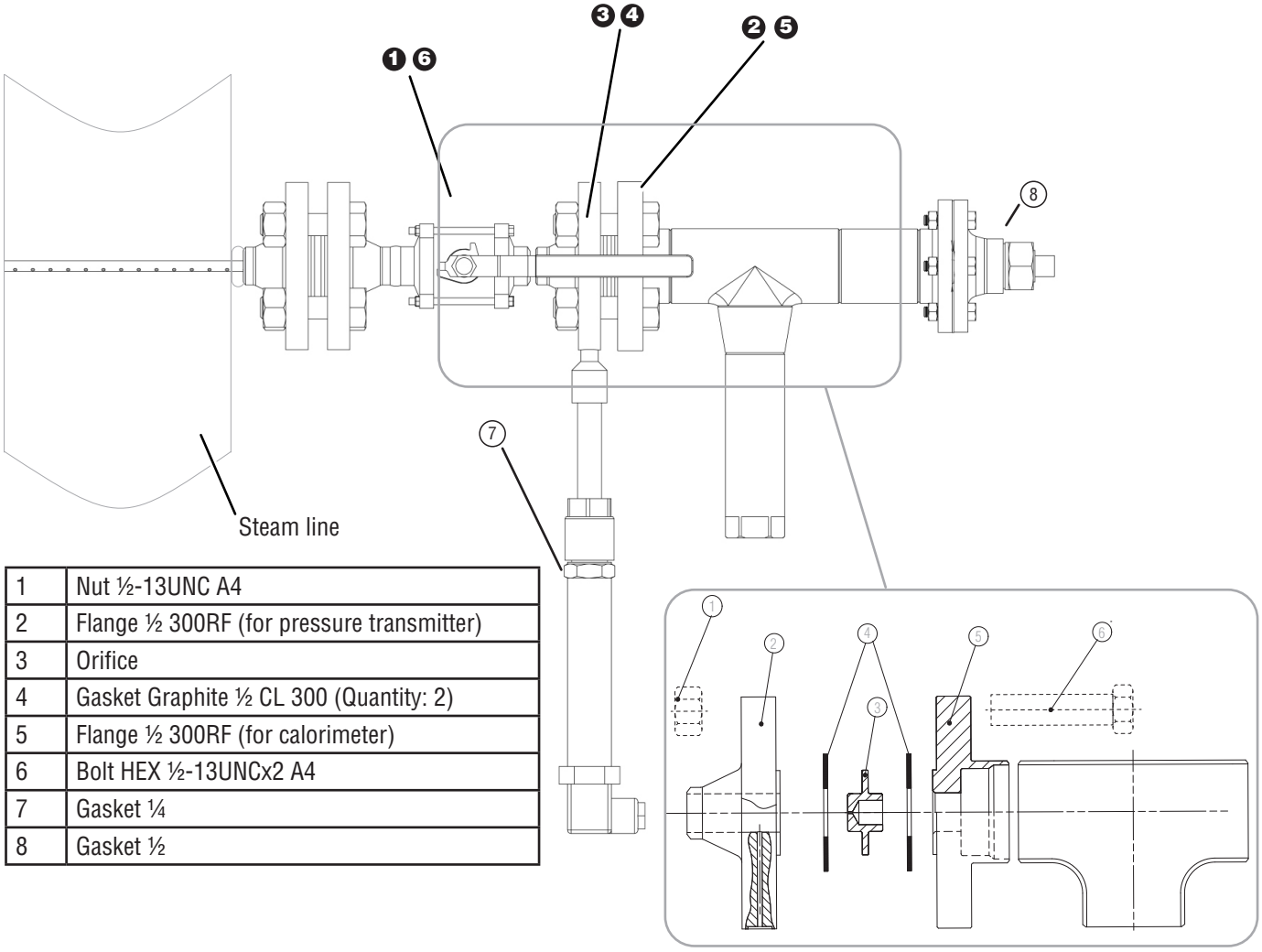
Orifice Pressure Range



Clean / Replace Orifice

Components and water may be hot.
Disconnect power before performing electrical work.
Failure to isolate the system from the steam supply can expose the technician to line pressure steam. Take all necessary precautions to insure system is isolated.
If problem cannot be resolved, contact Armstrong.

1. Close inlet ball valve and wait for the QM-1 to cool down.
2. Disassemble the flange on the outlet of the ball valve (shown below).
3. Remove the orifice located between the flanges.
4. Clean/Replace the orifice (take care not to damage or lose the gaskets).
5. Reassemble the four (4) bolts following bolting best practices and tight them.
6. Open the ball valve slowly and check for leaks.



1	Nut ½-13UNC A4
2	Flange ½ 300RF (for pressure transmitter)
3	Orifice
4	Gasket Graphite ½ CL 300 (Quantity: 2)
5	Flange ½ 300RF (for calorimeter)
6	Bolt HEX ½-13UNCx2 A4
7	Gasket ¼
8	Gasket ½

Component and Parts List

Components

Number	Description
D60739	Steam Quality Monitor Steam QM®-1 ½ 300RF Package
D94998	Steam Quality Monitor Steam QM®-1 DN15 PN40RF Package

Spare Parts

Number	Description
D59649	Steam QM®-1 ½ 300RF Assembly
D60474	Steam QM®-1 DN15 PN100RF
D60738	Steam QM®-1 Cabinet
D59910	Insulation Jacket
D62786	Pitot Tube Assembly
D64302	Tube Assembly for Pressure transmitter
D14109	Gasket 1/2 300RF
D14087	Gasket DN15 PN40
D59625	Orifice 0.5mm
D60473	Orifice 0.8mm
D44124	Main Board with Display
D44110	Temperature Sensor (T)
D59029	Pressure Transmitter (P)
D60723	Glass Fuse 1A
D60719	3m shielded cable with 1 x M12/1 x DIN connector for Pressure transmitter
D60720	3m shielded cable with 2 x M12 connector for Temperature Sensor
D60721	5m cable with 1 x M12 connector for Power Supply or RS485

Product Certifications

CE Directives

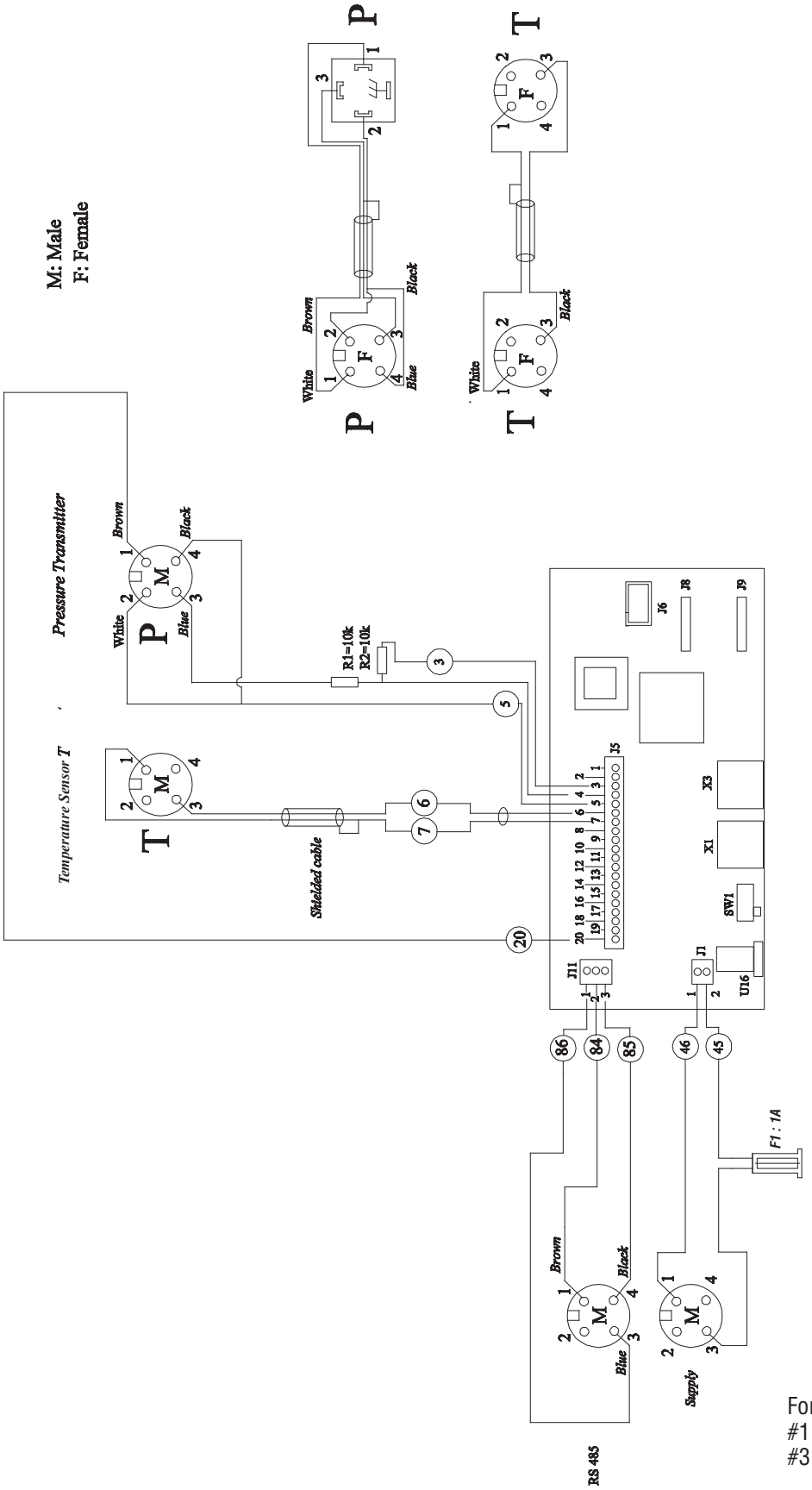
Intertek

Electromagnetic Compatibility Directive: 89/336/EEC, 2004/108/EC
Low Voltage Directive: 73/23/EEC, 2006/95/EC
Machinery Directive: 98/37/EC Amending Directive 89/392/EEC

Conforms to the following standards:

- EN 61000-6-3: Electromagnetic compatibility generic requirements (residential, commercial and light industries)
- EN 55022: class B (conducted and radiated emission limits)
- EN 61000-6-2: Electromagnetic compatibility (EMC) – Generic standards – Immunity for industrial environments
- EN 61000-4-3: Radiated, radio frequency, electromagnetic field immunity test
- EN 61000-4-6: Immunity to conducted disturbances induced by radio frequency fields
- EN 61000-4-4: Electrical fast transient/burst immunity test
- EN 61000-4-5: Surge immunity test
- EN 61000-4-2: Electrostatic discharge immunity test
- EN 60204-1: Safety of machinery – Electrical Equipment of machines – Part 1: General requirements
- EN 292 Parts 1 & 2: Safety of machinery basic principle mechanical design
- UL 61010-1: Electrical Equipment for Measurement, control and laboratory use

Appendix One: Wiring Diagram



Appendix Two

Modbus RTU Connection

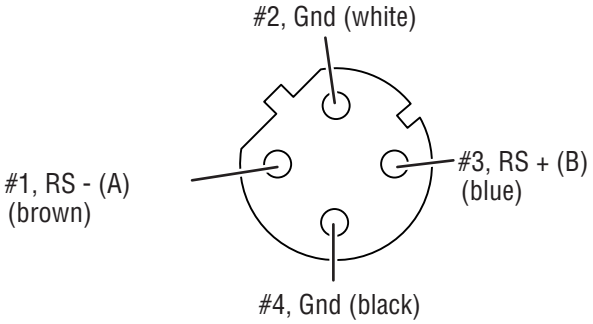
Note: The information on this page applies to any control system or data logger.

A 9 ft (3 m) cord is provided with an M12 connector for Steam QM®-1 cabinet connection.

Modbus Settings

Note: : The slave address is defined in the Steam QM®-1's Advanced Setting Menu see p. 13.
The Modbus type (slave or master) is defined in the Steam QM®-1's Advanced Setting Menu, see p. 30.

Parameter	Value
Baud Rate	9600 bauds/sec
Data Length	8 bits
Parity	None
Handshaking	N/A
Timeout	2.5 sec
Time between request (polls)	150ms
Address	From 1 to 80
Mode	Master or Slave



SQM Set In Master Mode In The Setting Menu:

The data is sent by the SQM in different registers as shown in the table below using Modbus function 16 (0x10: write multiple holding registers). All values are SI units (kg - °C). If conversion is required, it must be done manually. Decimal values are not used. Readings are shown as whole numbers, e.g., 19.2 will show as 192.

SQM Set In Slave Mode In The Setting Menu:

In slave mode you can send query's with function 0x02 (read discrete input) and 0x04 (read input register). According those register maps. **Note:** The length of the query and response must remain less than 23 bytes.

Master Mode	Slave Mode			Factor	Unit	Description
Registers	Registers	Function	Address			
40 001	30 001	0x04	0	x 1000	N/A	last minute average dryness fraction
40 002	30 002	0x04	1	x 10	barg (a)	last minute average pressure
40 003	30 003	0x04	2	x 10	°C	last minute average temperature
40 004	30 004	0x04	3	x 1000	N/A	last average cycle dryness fraction
40 005	30 005	0x04	4	x 10	barg (a)	last average cycle pressure
40 006	30 006	0x04	5	-	min	time period for the average calculation. Possible value 5 - 120 min
40 007	10 001	0x02	0	0: disable 1: enable		toggle to 1 when the unit is measuring a dryness fraction below the minimum calculable or below the minimum set in setup menu.

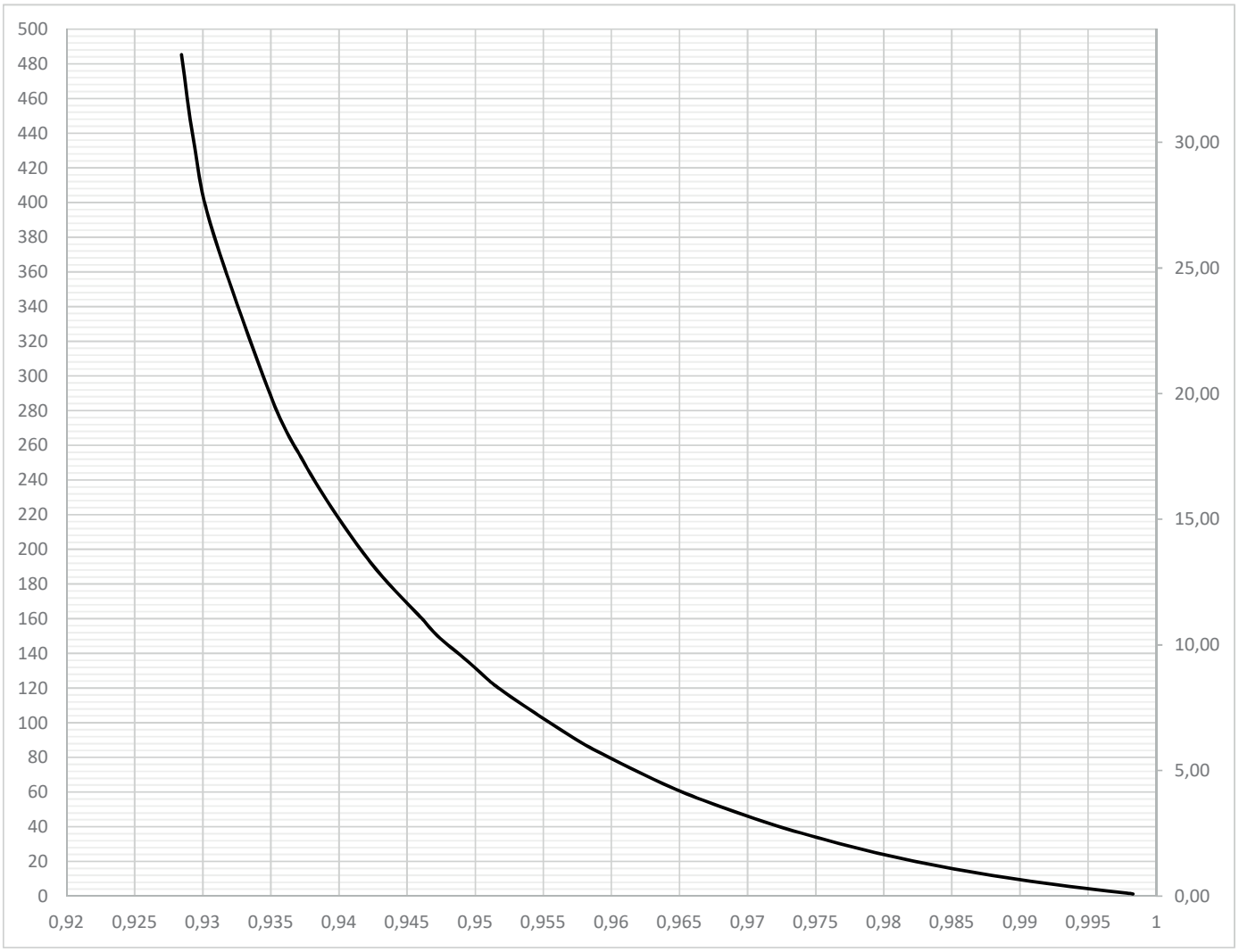
Modbus Tip: In case of frame error, reverse RS+ and RS- could fix the error.

Appendix Three

Dryness Fraction

Depending on the operating pressure, the min value of the dryness fraction that can be calculated by the Steam QM®-1 is approximate in the graphic below.

Actual values may differ slightly from those shown on graph based on actual operating conditions.



Steam Pressure	Xmin
43 psig (3 barg)	0.97
145 psig (10 barg)	0.95
460 psig (32 barg)	0.9275

Notes

2-12 inch VERIS Accelabar®
Installation & Maintenance Manual

Please read and save these instructions

Armstrong®

2-12 inch VERIS Accelabar® Table of Contents

General Safety Information

Instructions and procedures listed in this manual may require special precautions to ensure the safety of the individuals performing the operations. **Review the entire manual, taking note of safety messages prior to performing any operations listed in the manual.**

Product Information

The VERIS Accelabar® is a unique flow meter that combines two differential pressure technologies to produce performance never before attainable in a single flow meter. The VERIS Accelabar® is capable of measuring gases, liquids, and steam at previously unattainable flow rate turndowns—**with no straight run requirements**.

Section 1 Scope

These instructions provide a description of procedures for installing the 2”-12” VERIS Accelabar® model flow sensor and meter body. Procedures are given for all flow measurement applications including liquid, steam and gas in both horizontal and vertical piping orientations.

Section 2 Receiving Inspection

The following tasks should be performed as part of the receiving inspection procedure:

- When removing the Accelabar® from the crate, DO NOT lift the unit from the head of the sensor.
- Check items received against the packing list.
- Check sensor nameplate for proper model number, serial number and tag number.
- Verify the serial number on the sensor nameplate attached to the sensor and body matches that of the serial number on the packing list.
- Check assembly for signs of damage such as a bent flow sensor, or a scratched sealing surface in the flange deeper than allowed by ASME B16.5 (consult VERIS for ASME B16.5 guidelines if needed)

Section 3 Safety Precautions

The following process should be conducted prior to installing the Accelabar®:

- Check the maximum operating conditions on the flow sensor nameplate. Verify that the maximum operating conditions of the application do not exceed the parameters stated on the sensor nameplate. If any pressure, temperature, or flow limits will be exceeded, contact the factory before proceeding.
- Verify enough room available to install the meter (face-to-face and clearance).
- Check to ensure the pipe is depressurized and drained prior to installation.
- The Accelabar® is available in ASME B16.5 Class 150, 300 and 600 and DIN PN 40 and PN 100 configurations; verify the Accelabar® flanges match the required application rating.
- Verify all pressure containing components are properly installed and tightened prior to pressurizing the system.

Section 4 Installation Preparations

4.1 Location

There are no straight run requirements. Allow adequate clearance for manifold, transmitter and sensor removal.

4.2 Orientation

Verify the proper sensor orientation by checking for an "-H" (horizontal piping) or a "-V" (vertical piping) in the model number on the Accelabar® sensor nameplate. Deviation from the following mounting location instructions may cause inaccuracy in the flow measurement.

4.2.1 Horizontal Piping

For air or gas applications, the Accelabar® must be mounted with the instrument head positioned in the upper 160° position. For liquid and steam applications, the Accelabar® must be mounted with the instrument head positioned in the lower 160° position (See Figure 1).

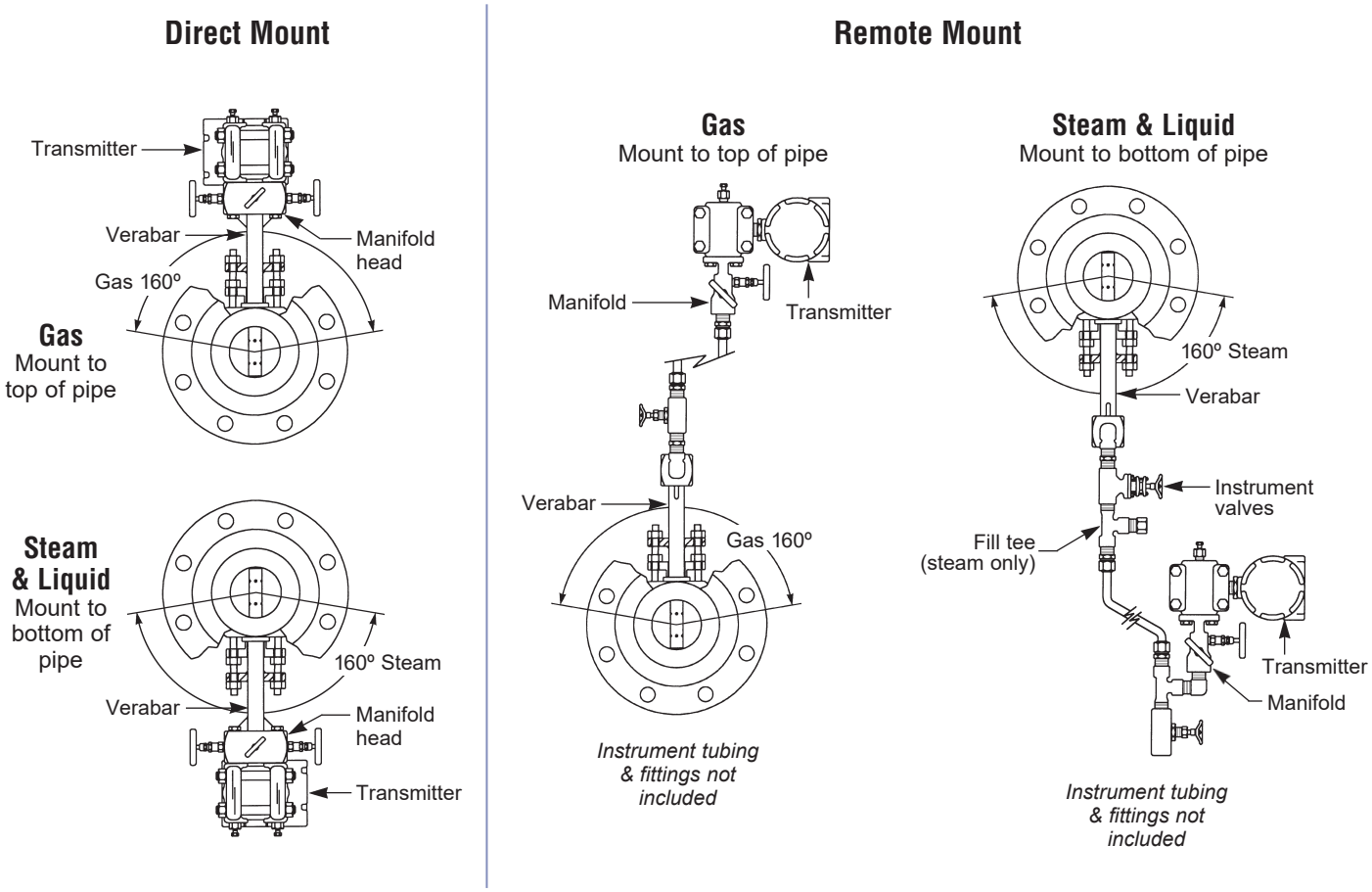


Figure 1. Accelabar® Installation Orientation

4.2.2 Vertical Piping

For vertical applications, the Accelabar® may be mounted in any location around the circumference of the pipe.

Section 5 Installation Procedure

WARNING: Large and heavy Accelabars require support at the unit and piping. Lifting by the instrument head or RTD can cause severe damage to the instrumentation and is NOT recommended.

5.1 Preparing the Pipe

- Completely depressurize and drain the pipe prior to Accelabar® installation.
- Remove a section of the pipe large enough to accommodate the face-to-face flange dimension of the corresponding sized Accelabar® shown in Table 1.

  NOTE: The face-to-face dimensions do not include gaskets (see Table 1). VERIS recommends adding 0.375" (9.5mm) to the face-to-face dimension to obtain the required distance between piping flanges.

- **IMPORTANT FOR DIRECT MOUNT TRANSMITTER APPLICATIONS:**
  Locate the Accelabar® to allow adequate clearance for a manifold and transmitter, a minimum of 24" from the centerline of the pipe. Bolt the manifold and transmitter to the Accelabar® to obtain the exact clearance requirements for the given application.
- Weld flanges to existing pipe. Make certain the pipe flanges and Accelabar® flanges are the same Nominal Pipe Size (NPS) and pressure rating. Bolt hole location typically mimics the diagram shown in Figure 2, where bolt holes straddle the centerline of the pipe (Figure 2 does not show 12 and 20 bolt patterns; orientation is typical). However, take into consideration mounting as required in Section 4.0.
- **IMPORTANT:**
  Piping must yield slightly to allow the gaskets to crush and seal completely.

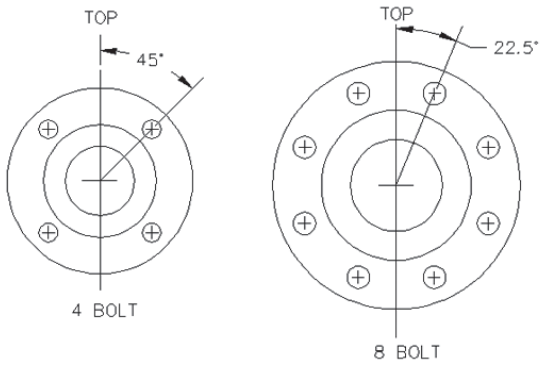


Figure 2. Bolt Hole Orientation

Meter Size	ANSI Rating	Face to Face Dim	Weight
2 inch	150	8.75” (222.25mm)	34lbs (15.42kg)
	300	9.38” (238.13mm)	37lbs (16.78kg)
	600	10.13” (257.18mm)	41lbs (18.60kg)
3 inch	150	13.78” (350.01mm)	40lbs (18.14kg)
	300	14.53” (369.06mm)	53lbs (24.04kg)
	600	15.28” (388.11mm)	53lbs (24.04kg)
4 inch	150	15.15” (384.81mm)	59lbs (26.76kg)
	300	15.90” (403.86mm)	79lbs (35.83kg)
	600	17.65” (448.31mm)	100lbs (45.36kg)
6 inch	150	19.15” (486.41mm)	115lbs (52.16kg)
	300	19.90” (505.46mm)	153lbs (69.40kg)
	600	21.90” (556.26mm)	209lbs (94.80kg)
8 inch	150	21.40” (543.56mm)	193lbs (87.54kg)
	300	22.15” (562.61mm)	247lbs (112.04kg)
	600	24.40” (619.76mm)	333lbs (151.05kg)
10 inch	150	23.15” (588.01mm)	325lbs (147.42kg)
	300	24.40” (619.76mm)	417lbs (189.15kg)
	600	27.65” (702.31mm)	595lbs (269.89kg)
12 inch	150	26.22” (665.99mm)	430lbs (195.05kg)
	300	27.47” (697.74mm)	538lbs (244.03kg)
	600	29.97” (761.24mm)	706lbs (320.24kg)

Table 1. Dimensions

5.2 Accelabar® Installation

- Refer to Figure 1 for proper Accelabar® orientation for horizontal applications (orientation is not critical for vertical applications).
- Position Accelabar® in piping void that has been prepared per dimension in Table 1. Be certain the flow arrow on the Accelabar® is oriented in the same direction as the flow in the pipe. Failure to orient the Accelabar® correctly may result in poor and inaccurate flow measurement.
- Place the appropriate gasket between the pipe flanges and the Accelabar® flanges.
- Insert the flange bolts through the flanges and tighten the nuts, hand-tight, on each end of the bolts. Once all the bolts are hand-tight, tighten opposing sets of bolts until the gasket is crushed. The complete crushed gasket height should be approximately 1/8” (0.125”) (3.175mm).

Section 6 Sensor And Component Installation

The Accelabar® sensor assembly is factory installed in the meter body with the packing rings in place. The following instructions are intended for replacement sensors, replacement packing rings, or Accelabars with special handling instructions (i.e. O2 service) that require field installation of sensor and packing.

The following instructions describe complete assembly of the Accelabar® sensor in the Accelabar® meter body.

- **IMPORTANT:** Depressurize and drain the pipe if the Accelabar® is installed in the line. 
- Parts necessary for Accelabar® are itemized in Table 2. Consult factory for specifications if these items are not factory supplied.

Reference	Part Number	Quantity	Item
1	01139-001	3	SCREW,CAP,SOCKET HEAD,3/8-16UNC x 2.50
2	00120-007	3	BOLT,HEX HEAD,3/8 - 16UNC x 1.50,CLASS 2,316
3	01227-001 (-05)	1	FOLLOWER,05,CASTING,ACCELABAR,CF8M
4	00163-007 (-05)	4	PACKING,05,GRAPH-LOCK,3/4
3	01228-001 (-10)	1	FOLLOWER,10,CASTING,ACCELABAR,CF8M
4	00163-004 (-10)	4	PACKING,10,GRAPH-LOCK
5	00225-002	6	WASHER,LOCK,SPLIT,3/8,316
6	00230-002	2	GASKET,O-RING,MANIFOLD,TEFLON (Direct Mount Only)
7	00430-002	4	BOLT,HEX HEAD,7/16 - 20UNF x 2.00,Gr. 8 (Direct Mount Only)
8	Varies	1	Accelabar® Sensor
9	Varies	1	Accelabar® Body

Table 2. Accelabar® Parts List

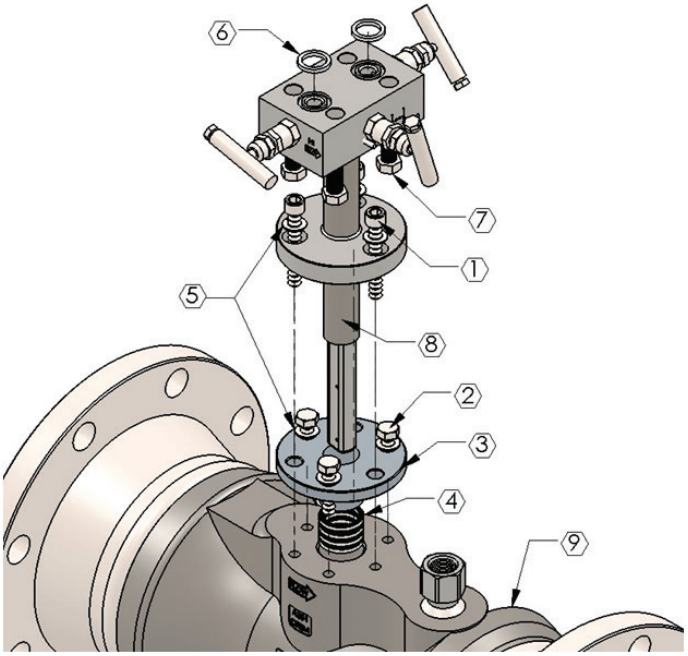


Figure 3. Accelabar® Sensor Assembly

6.1 Packing Installation

Insert a tube fixture (not supplied) or insert the Accelabar® sensor into the bottom bore of the Accelabar® body. Use a 0.75" O.D tube for -05 sensors and a 1.00" O.D tube for -10 sensors. (See Figure 3)

- Using a blunt screwdriver, swage the packing material between the wall of the packing box and the outside diameter of the tube. Care must be taken not to twist the packing material or damage the packing box surface during installation.
- After each individual packing ring is swaged around the tube, the follower should be pushed down firmly on the packing ring to seat the ring in the packing box.
- Repeat steps for the other three packing rings, being sure that the splits in the packing rings are 90° apart as shown in Figure 4.

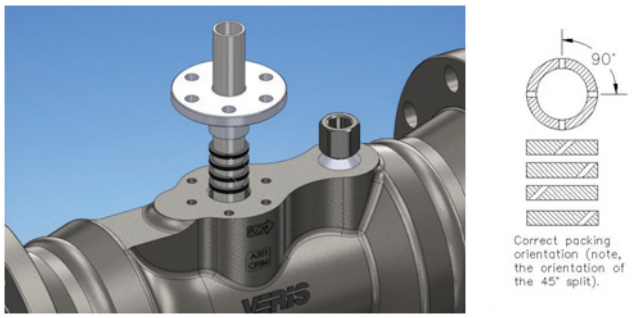


Figure 4. Packing Ring Installation

6.2 Packing Bolt Installation

- Put one split washer on each packing bolt and apply a small amount of anti-seize paste onto the first three to five threads of the packing bolts.
- Install packing bolts per orientation shown in Figure 5, hand tighten.
- Remove tube fixture, if used.

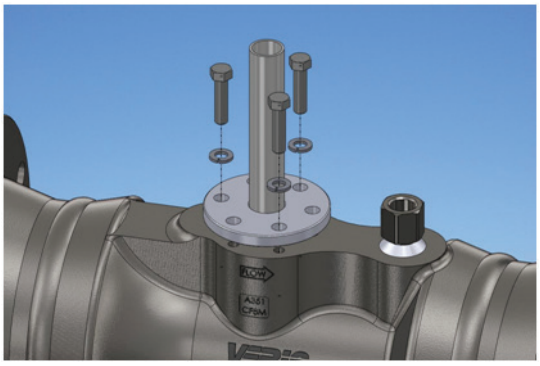


Figure 5. Packing Bolts Installation

6.3 Accelabar® Sensor Installation

- Carefully insert the Accelabar® sensor into the Accelabar® meter body. The sensor can only be inserted in one direction due to the orientation of the mount disk and the packing bolts. Verify direction of the flow arrow on body and sensor match. (See Figure 6)
- Bottom the sensor firmly in the meter body.
- Place one split locking washer onto socket head cap screw and apply Loctite® 262, high strength thread-locking compound. Thread until screw is hand tight, tighten ½ turn beyond hand tight.
- Tighten the socket head cap screws to a torque of 135 inch-pounds (15.25 Nm) on (–05) models and 205 inch-pounds (23.16 Nm) on (–10) models.
- Tighten the packing bolts to a torque of 70 inch-pounds (7.9 Nm) on (-05) models and 100 inch-pounds (11.30 Nm) on (–10) models.

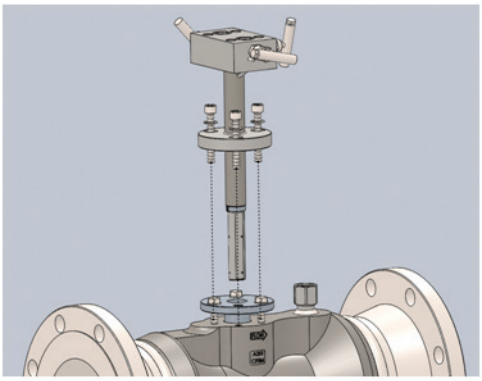


Figure 6. Sensor installation
(Vertical Orientation shown. Orientation Varies)

6.4 Help

Contact the factory for installation assistance.

Section 7 RTD Assembly Installation (If Supplied)

NOTE: The 2" RTD is located on the side of the body and the elbow and union are not required.

- Apply thread sealant or tape to the bottom RTD threads and thread into the thermowell. Assure that the RTD is bottomed.
- Apply the same thread sealant to the top RTD threads and thread the union onto the RTD, rotating side up. Tighten the union so that the top does not spin.
- Gently thread the RTD wires through the elbow. Apply the same thread sealant to the elbow threads and thread into union. If necessary, loosen the union and position the elbow so that it points to the side of the body as shown in Figure 7, re-tighten the union.
- Push the RTD wires into the junction box and thread the box onto the elbow in the orientation shown in Figure 7.
- If a cable is supplied, thread it into the junction box and hook up the wires, red-to-red, red-to-red, and white-to-white, refer to Figures 8, 9, or 10. Clip the drain wire (un-insulated) off at the base. R, P, and T heads are typically not supplied with a cable.

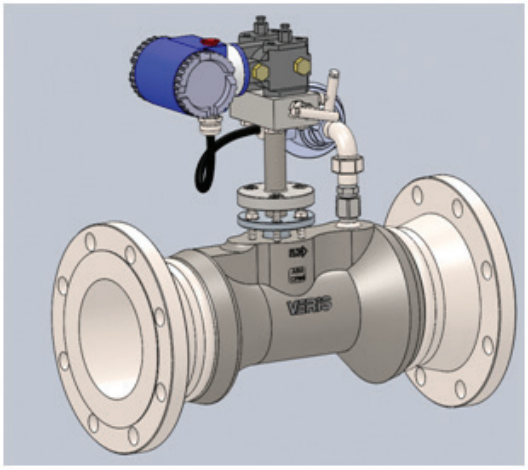


Figure 7. RTD Assembly Orientation

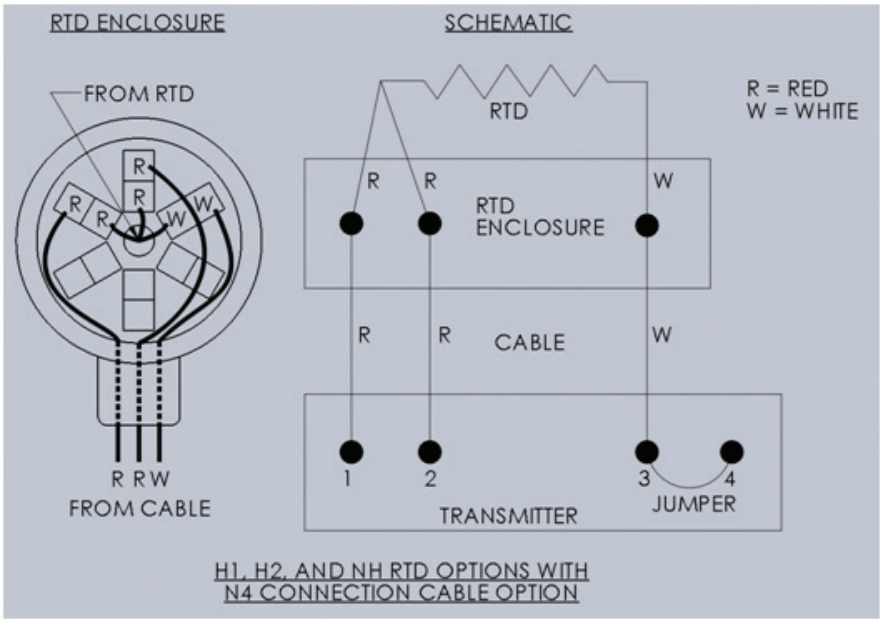


Figure 8. H1, H2, AND NH RTD WITH N4 CABLE

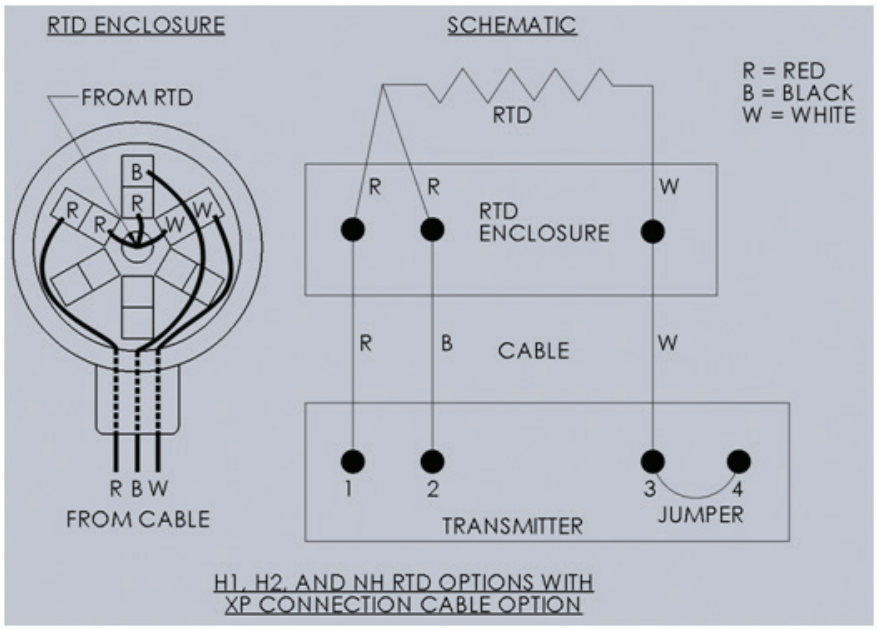


Figure 9. H1, H2, AND NH RTD WITH XP CABLE

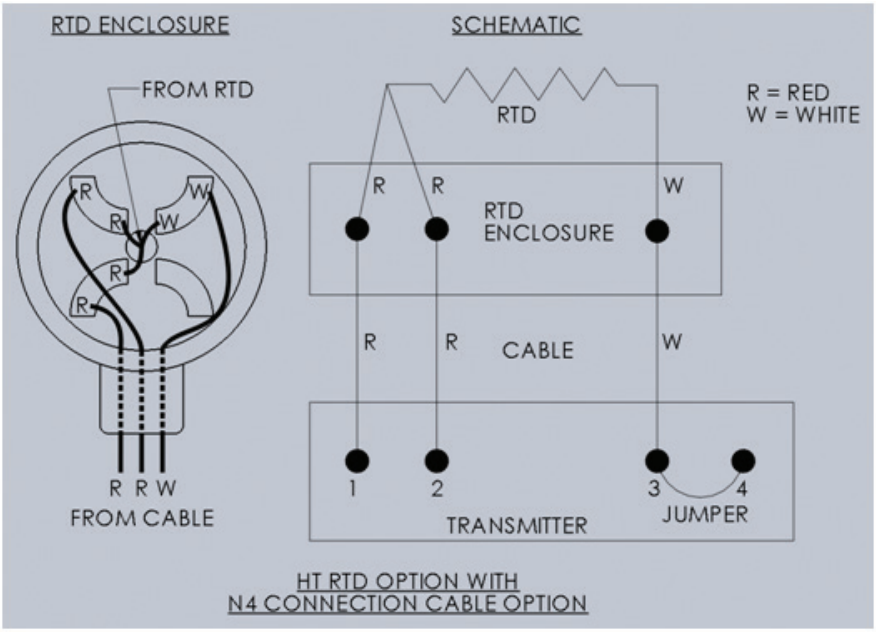


Figure 10. HT RTD WITH N4 CABLE

Section 8 Periodic Maintenance

The assembly should be periodically checked. Verify that no leaks are present. Retaining nuts and packing bolts should be tight.

8.1 Replacing Packing

The following instructions describe removing the Accelabar® sensor from the meter body and replacing the packing rings:

IMPORTANT: Depressurize and drain the pipe.

- Unbolt and remove transmitter from the Accelabar®, or remove the instrumentation tubing from head.
- Loosen and remove socket head cap screws. (See Figure 6)
- Loosen the follower bolts and gently remove the sensor from the meter body.
- Remove follower bolts and follower from the meter body.
- Carefully remove old packing, taking care in not damaging the surface of the packing box.
- Install new packing and reinstall sensor per procedures described in Section 6.
- Reassemble the transmitter or instrumentation tubing to the sensor head.

Notes

Models DS-1 and DS-2
Installation & Operations Manual

Cyclone Separators
Zyklonabscheider
Séparateurs à cyclone
Separadores ciclónicos
Cycloonafscheiders
Separatori a ciclone

These instructions should be used by experienced personnel !
Diese Gebrauchsanweisung ist von Fachpersonal zu benutzen !
Ces instructions devraient être utilisées par du personnel expérimenté !
¡Estas instrucciones deben ser utilizadas por personal experimentado !
Onderhoud uitsluitend uit te voeren door ervaren personeel !
Queste istruzioni devono essere utilizzate da personale esperto !

Please read and save these instructions

Armstrong®

Models DS-1 and DS-2 Table of Contents

PRODUCT DESCRIPTION - PRODUKTBESCHREIBUNG - DESCRIPTION DU PRODUIT - DESCRIPCION DEL PRODUCTO - PRODUKT OMSCHRIJVING - DESCRIZIONE DEL PRODOTTO

Model shown on the picture: DS-2 – Die Abbildung zeigt das Modell DS-2 – Photo : DS-2

Modelo de la foto: DS-2 – Model op foto: DS-2 – Modello in figura: DS-2

GB Armstrong Nodular Iron Cyclone Separator.
For Steam or Compressed Air.

D Armstrong Zyklonabscheider aus Sphäroguss.
Für Dampf oder Druckluft.

F Séparateur à cyclone Armstrong en fonte nodulaire.
Pour la vapeur ou l'air comprimé.

E Separador ciclónico de fundición dúctil de Armstrong.
Para vapor o aire comprimido.

NL Armstrong nodulair gietijzeren cycloonafscheider.
Voor stoom of perslucht.

I Separatore a ciclone in ferro nodulare Armstrong.
Per vapore e aria compressa.

For detailed material specifications, options, approximate dimensions and weights, see Armstrong literature or consult your local Representative.

Für detaillierte Werkstoffangaben, Zubehör, Abmessungen und Gewichte, sehen Sie die Armstrong Datenblätter oder fragen Sie Ihre Armstrong-Vertretung.

Pour toute spécification détaillée des matières, options, dimensions et poids, veuillez vous référer à la littérature Armstrong ou prendre contact avec votre Représentant local.

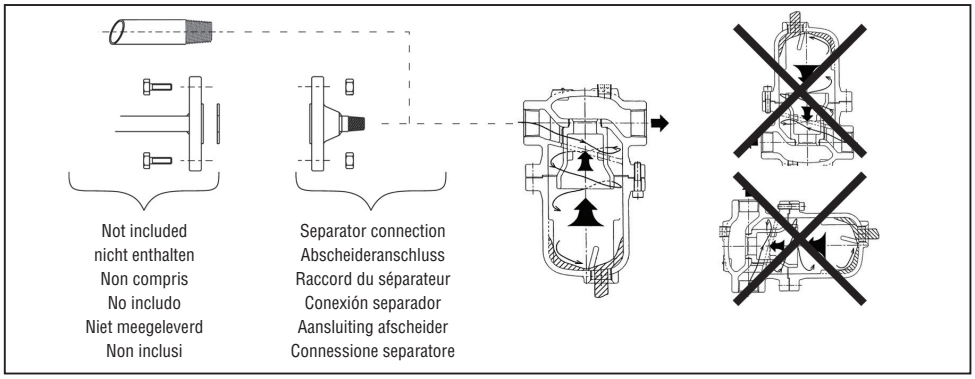
Para especificaciones de materiales detalladas, opciones, dimensiones aproximadas y pesos, ver catálogos Armstrong o consultar con su Representante local.

Voor gedetailleerde materiaal specificaties, afmetingen en gewichten, zie de Armstrong documentatie of neem contact op met uw plaatselijke Vertegenwoordiger.

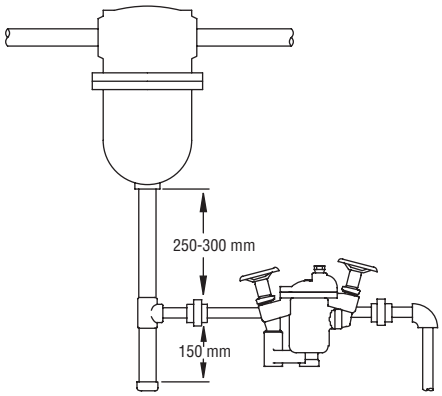
Per la specifica dettagliata dei materiali, accessori opzionali, dimensioni e pesi approssimativi, vedere la documentazione appropriata o contattare il Distributore locale.

INSTALLATION - INSTALLATIONSANWEISUNG - INSTALLATION
INSTALACION - INSTALLATIE - INSTALLAZIONE

Model shown on the drawing: DS-1 – Die Zeichnung zeigt das Modell DS-1 – Schéma : DS-1
Modelo del dibujo: DS-1 – Getoond model op tekening: DS-1 – Modello in figura: DS-1



START-UP AND SHUT-DOWN PROCEDURE –
Inbetriebnahme und Außerbetriebnahme
MISE EN SERVICE ET ARRÊT – PUESTA EN MARCHA Y PARADA
PROCEDURE VOOR HET OPSTARTEN EN UITSCHAKELEN –
PROCEDURE DI AVVIO E FERMATA



For detailed hookups and adapted start-up and shut-down procedures, see Armstrong literature or consult your local Representative.

The installation shown below is for steam applications. For air, the steam trap draining the separator should be replaced by a liquid drainer.

- No special start-up or shut-down procedure is needed. Make sure that the separator is drained by a steam trap or a liquid drainer as shown above.

GB

Detaillierte Informationen über Einbau, Inbetriebnahme und Außerbetriebnahme finden Sie in den Datenblättern, oder Sie fragen Ihre Vertretung.

Die unten abgebildete Installation bezieht sich auf Dampfanwendungen. Für Luft sollte der Kondensatableiter gegen einen Entwässerer ausgetauscht werden.

- Zur Inbetriebnahme und Außerbetriebnahme sind keine besonderen Maßnahmen erforderlich. Sicherstellen, dass der Abscheider durch einen Kondensatableiter oder Entwässer entleert wird (siehe oben).

D

Pour plus d'informations sur les procédures de démarrage et d'arrêt, ainsi que sur l'installation, veuillez consulter la documentation Armstrong ou contacter votre Représentant local.

L'installation illustrée ci-dessous concerne les applications à la vapeur. Pour l'air, le purgeur de vapeur du séparateur doit être remplacé par un purgeur de liquide.

- Aucune procédure spéciale de mise en service ou d'arrêt n'est nécessaire. Vérifier que le séparateur est purgé par un purgeur de vapeur ou de liquide (voir ci-dessus).

F

Para conocer las posibilidades de conexión y procedimientos de parada y puesta en marcha, consulte los catálogos Armstrong o hable con su Representante local.

La instalación que se muestra a continuación es para aplicaciones de vapor. Para el uso con aire, el purgador de vapor que drena el separador se debe reemplazar por un drenador de líquido.

- No se requiere ningún procedimiento especial de puesta en marcha o apagado. Asegúrese de que el separador está drenado por un purgador de vapor o un drenador de líquido tal como se indica arriba.

E

Voor gedetailleerde montage en installatie instructies zie het betreffende Armstrong documentatieblad of neem contact op met uw plaatselijke Vertegenwoordiger.

Onderstaande installatie is bedoeld voor stoomtoepassingen. Voor lucht dient de condenspot van de afscheider te worden vervangen door een vloeistoflozer.

- Er is geen specifieke opstart- of uitschakelprocedure nodig. Controleer of de afscheider wordt ontwaterd door een condenspot of een vloeistoflozer - zie bovenstaande illustratie.

NL

Per procedure dettagliate di collegamento, d'avviamento e di fermata, vedere la documentazione Armstrong o consultare il Distributore locale.

L'installazione mostrata sotto è per applicazioni a vapore. Per l'aria lo scaricatore di condensa per il drenaggio del separatore deve essere sostituito da uno scaricatore di liquidi.

- Non è richiesta alcuna particolare procedura di avvio e fermata. Assicurarsi che il separatore sia drenato da uno scaricatore di condensa o di liquidi come mostrato sopra.

I

MODELS WITH CE MARKING - MODELLE MIT CE KENNZEICHNUNG - MODELES MARQUES CE - MODELOS CON LA MARCA CE - MODELLEN MET CE KEUR - MODELLI CON MARCATURA CE

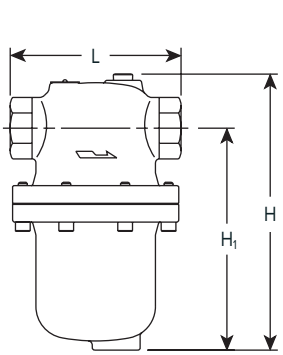
Separator Model	PMA	TMA	DN	PMO
Abscheidermodell	PMA	TMA	DN	PMO
Séparateur	PMA	TMA	DN	PMO
Modelo de separador	PMA	TMA	DN	PMO
Afscheider model	PMA	TMA	DN	PMO
Modello separatore	PMA	TMA	DN	PMO
DS-2	20 bar	232°C	65	20 bar
			80	
			100	

DS Series Drain Separators

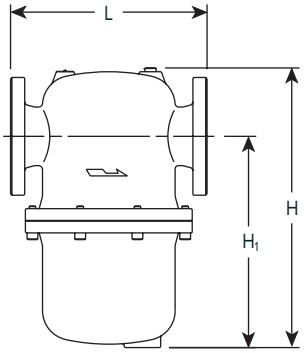
Condensate in steam and air piping reduce thermal efficiency, cause water hammer, corrode equipment such as valves and pipes, and cause other problems.

Armstrong drain separators separate condensate efficiently by using the centrifugal force of steam or air created by introducing it into a specifically shaped path. Because of the simple structure of the drain separators, pressure loss is minimized, enabling clean, dry steam or air to be fed to equipment.

With correct sizing and proper drainage, the separators are designed to eliminate 98% of all entrained liquids and particles that are 10 microns and larger in size.



DS-1 / DS-3 / DS-4



DS-2 / DS-3 / DS-4

Features

- A cyclone structure maximizes liquid separation efficiency
- Pressure loss is extremely low
- No moving parts means no breakdowns

Operating Principle

When steam or air flow enters the drain separator, centrifugal force is generated in the fluid because of the device's internal structural design. The fluid drains along the wall because of the difference in specific gravity with steam or air, eventually striking the baffle. The baffle guides the fluid to the drain outlet and to the trap, which drains it. As a result, both small dirt particles and condensate are separated and removed from the system through the bottom drain.

For fully certified drawings refer to:

DS-1 / DS-2	**CDY1102**
DS-3	**CD2126**
DS-4	**CD2127**

DS Series Specifications

Model	Application	Maximum Pressure psig (barg)	Maximum Temp. °F (°C)	Materials	
				Body	Nozzle
DS-1	Steam Air	NPT 300 (20)	430 (221)	Ductile Iron ASTM A536	Cast Iron ASTM A48
DS-2		150 lb. Flanged 185 (13)			
		300 lb. Flanged 300 (20)			
DS-3 DS-4		NPT 300 (20)	650 (343)	SS304 (DS-3) Carbon Steel (DS-4)	
		150 lb. Flanged 150 (10)	450 (232)		
		300 lb. Flanged 500 (34)	650 (343)		

DS Series Dimension and Weights

Model	Size		Face-to-Face "L"						H		H1		Drain		Weight					
			NPT		150#		300#								NPT		150#		300#	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	lb	kg	lb	kg	lb	kg
DS-1	1/2	15	5-15/16	150	—	—	—	—	9-9/16	243	7-5/8	193	3/4	20	16	7.3	—	—	—	—
	3/4	20	5-15/16	150	—	—	—	—	9-9/16	243	7-5/8	193	3/4	20	16	7.3	—	—	—	—
	1	25	5-15/16	150	—	—	—	—	9-9/16	243	7-5/8	193	3/4	20	16	7.3	—	—	—	—
	1-1/4	32	7-1/2	190	—	—	—	—	11-1/8	243	8-3/8	213	1	25	28	12.7	—	—	—	—
	1-1/2	40	7-1/2	190	—	—	—	—	11-1/8	243	8-3/8	213	1	25	28	12.7	—	—	—	—
	2	50	8-5/8	219	—	—	—	—	13-15/32	243	10-1/4	260	1	25	45	20.5	—	—	—	—
DS-2	2-1/2	65	—	—	11-1/2	292	11-15/16	303	16-15/32	418	12-3/8	314	1	25	—	—	45	20.5	77	35
	3	80	—	—	13-1/2	343	14-1/64	356	19	484	14-1/2	361	1-1/4	32	—	—	77	35	99	45
	4	100	—	—	15-13/16	402	16-7/16	418	23-3/8	594	17-1/2	445	1-1/4	32	—	—	99	45	143	65
DS-3 DS-4	1/2	15	5-1/2	140	9	229	9	229	16	356	9	229	1	25	28	12.7	30	13.6	32	14.5
	3/4	20	5-1/2	140	9	229	9	229	16	356	9	229	1	25	28	12.7	30	13.6	32	14.5
	1	25	6-3/8	162	10-1/2	267	10-1/2	267	16	356	10-1/2	267	1	25	30	13.6	33	15	35	15.9
	1-1/4	32	6-3/8	162	10-1/2	267	10-1/2	267	16	356	10-1/2	267	1	25	32	14.5	35	15.9	37	16.8
	1-1/2	40	7-5/8	194	11-1/2	292	11-1/2	292	19	483	12-1/2	318	1	25	46	20.9	50	22.7	56	25.4
	2	50	7-7/8	200	11-1/2	292	11-1/2	292	19	483	12-1/2	318	1	25	51	23.1	55	24.9	59	26.8
	2-1/2	65	—	—	16	406	16	406	22	559	15	381	1	25	—	—	100	45.4	110	49.9
	3	80	—	—	18	457	18	457	26	660	18	457	1	25	—	—	140	63.5	150	68
	4	100	—	—	20	508	20	508	31	787	22	559	1-1/2	40	—	—	195	88.4	220	99.8
	6	150	—	—	24	610	24	610	41	1 041	30	762	1-1/2	40	—	—	350	159	380	172
	8	200	—	—	28	711	28	711	50	1 270	37	940	2	50	—	—	475	215	610	278
	10	250	—	—	34	864	34	864	70	1 778	55	1 397	2	50	—	—	780	354	1 180	535
	12	300	—	—	38	965	38	965	75	1 905	58	1 473	2-1/2	65	—	—	940	426	1 510	685

DS Series Drain Separators

Capacities for Steam Service

DS-1/DS-2 Series Steam Capacities (lb/hr)									
Size	**5 psig**	**10 psig**	**25 psig**	**50 psig**	**100 psig**	**150 psig**	**200 psig**	**250 psig**	**300 psig**
1/2”	34	43	69	113	200	287	374	461	548
3/4”	60	75	121	198	351	503	656	809	962
1”	98	122	197	320	568	816	1 063	1 311	1 559
1-1/4”	169	212	340	555	983	1 412	1 840	2 269	2 698
1-1/2”	230	288	463	755	1 338	1 922	2 505	3 088	3 672
2”	379	475	763	1 244	2 206	3 167	4 129	5 090	6 052
2-1/2”	541	678	1 089	1 775	3 147	4 519	5 891	7 263	8 635
3”	835	1 046	1 682	2 741	4 860	6 978	9 096	11 215	13 333
4”	1 437	1 802	2 896	4 720	8 368	12 016	15 664	19 312	22 960

DS-1/DS-2 Series Steam Capacities (kg/hr)									
Size	**0.34 barg**	**0.69 barg**	**1.7 barg**	**3.4 barg**	**6.9 barg**	**10.3 barg**	**13.8 barg**	**17.2 barg**	**20.7 barg**
1/2”	16	20	31	51	91	130	170	209	249
3/4”	27	34	55	90	159	228	298	367	436
1”	44	55	89	145	258	370	482	595	707
1-1/4”	77	96	154	252	446	640	835	1 029	1 224
1-1/2”	104	131	210	342	607	872	1 136	1 401	1 665
2”	172	215	346	564	1 001	1 437	1 873	2 309	2 745
2-1/2”	245	307	494	805	1 428	2 050	2 672	3 294	3 917
3”	379	475	763	1 243	2 204	3 165	4 126	5 087	6 048
4”	652	817	1 314	2 141	3 796	5 450	7 105	8 760	10 414

DS-3/DS-4 Series Steam Capacities (lb/hr)									
Size	**5 psig**	**10 psig**	**25 psig**	**50 psig**	**100 psig**	**150 psig**	**200 psig**	**250 psig**	**300 psig**
1"	190	225	295	390	550	675	780	860	1 000
1-1/4"	320	345	460	620	860	1 050	1 125	1 140	1 160
1-1/2"	460	500	680	880	1 225	1 550	1 800	2 000	2 250
2"	790	910	1 050	1 550	2 200	2 700	3 150	3 700	4 000
2-1/2"	1 075	1 120	1 585	2 400	3 400	4 300	5 000	5 375	6 400
3"	1 950	2 300	2 950	3 750	5 250	6 600	7 600	9 000	10 000
4"	3 250	3 800	4 975	6 100	9 000	11 100	13 000	11 500	11 650
5"	4 975	5 850	7 650	9 250	11 400	11 700	12 000	23 000	25 000
6"	7 700	8 990	10 100	10 450	21 500	26 500	31 000	36 000	39 000
8"	10 750	11 450	12 000	23 750	34 000	43 000	51 000	58 000	66 000
10"	20 000	22 500	29 500	37 000	54 500	68 000	78 000	90 000	100 000
12"	29 500	34 000	44 000	54 000	81 000	100 000	105 000	112 000	114 000

DS-3/DS-4 Series Steam Capacities (kg/hr)									
Size	**0.34 barg**	**0.69 barg**	**1.7 barg**	**3.4 barg**	**6.9 barg**	**10.3 barg**	**13.8 barg**	**17.2 barg**	**20.7 barg**
1"	86	102	134	177	249	306	354	390	454
1-1/4"	145	156	209	281	390	476	510	517	526
1-1/2"	209	227	308	399	556	703	816	907	1 021
2"	358	413	476	703	998	1 225	1 429	1 678	1 814
2-1/2"	488	508	719	1 089	1 542	1 950	2 268	2 438	2 903
3"	885	1 043	1 338	1 701	2 381	2 994	3 447	4 082	4 536
4"	1 474	1 724	2 257	2 767	4 082	5 035	5 897	5 216	5 284
5"	2 257	2 654	3 470	4 196	5 171	5 307	5 443	10 433	11 340
6"	3 943	4 078	4 581	4 740	9 752	12 020	14 061	16 329	17 690
8"	4 876	5 194	5 443	10 773	15 422	19 504	23 133	26 308	29 937
10"	9 072	10 206	13 381	16 783	24 721	30 844	35 380	40 823	45 359
12"	13 381	15 422	19 958	24 494	36 741	45 359	47 627	50 802	51 710

Notes

Model GP-2000
Setting Up 1/3-2/3 PRV Station
Installation & Operations Manual

Please read and save these instructions

714-EN

Overview

WARNING: This bulletin should be used by experienced personnel as a guide to the installation and maintenance of the Armstrong GP-2000 1/3- 2/3 PRV Station. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.

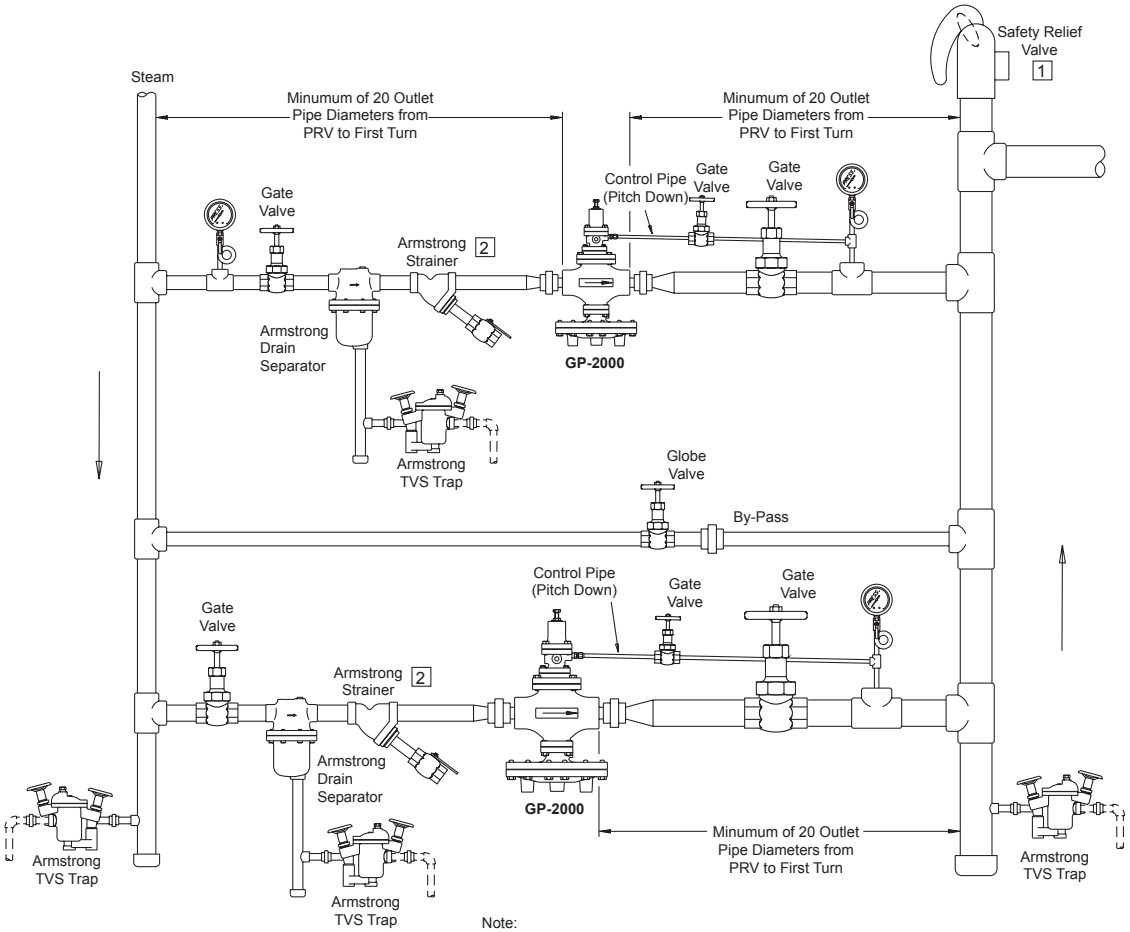
- A 1/3-2/3 station is typically utilized when there are large fluctuations in the flow rate (lb/hr or kg/hr).
- Typically, a smaller valve is installed to handle smaller steam flows and a larger valve for larger steam flows.
- The advantage to this system is that once set, it requires no manual input during seasonal or demand changes.
- Typically the two valves are set-up with a two pound differential.
  - The valve that should open first should be set to the higher output (psig/barg)
  - The valve that should open second should be set to the lower output (psig/barg)
- A typical setting for 15 psig (1 barg) outlet might be:
  - Smaller valve: 16 psig (1.1 barg)
  - Larger valve: 14 psig (0.9 barg)
- This will yield an outlet pressure very close to 15 psig (1 barg)

Before setting outlet pressure check that downstream sensing lines are properly installed sloping down and away from the pilot to guarantee proper drainage of condensate.

Installation Instructions

1. Isolate all PRVs using gate valves.
2. Open gate valve to top PRV. Set outlet pressure.
3. Re-isolate all PRVs using gate valves.
4. Open gate valve to bottom PRV. Set outlet pressure.
5. Open all gate valves: Test and adjust as necessary.

Typical plumbing diagram:



Note:

1 Safety relief valve to be set at 10 psi higher or 10% higher than the downstream pressure, whichever is greater

2 It is suggested that the inlet "Y" type strainer be installed on it's side to avoid the collection of liquid in the body that could be carried through the regulator as a damaging slug under certain conditions.

Notes

Model GP-2000 Pressure Reducing Valve Integral and Remote Pilot Installation & Operations Manual

712-D - EN

Please read and save these instructions

Armstrong®

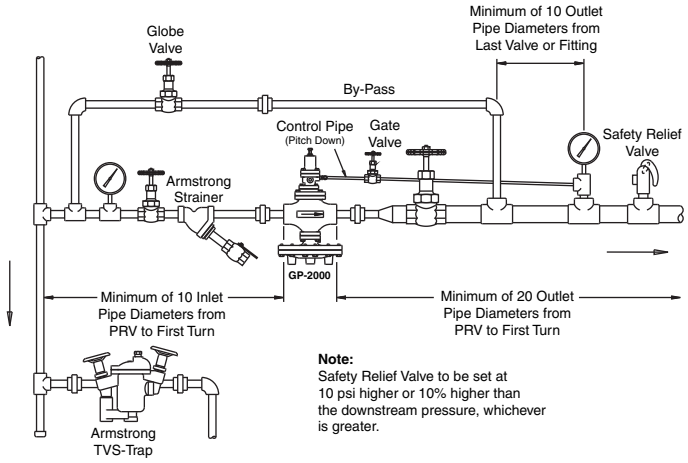
Model GP-2000 Pressure Reducing Valve Table of Contents

Overview

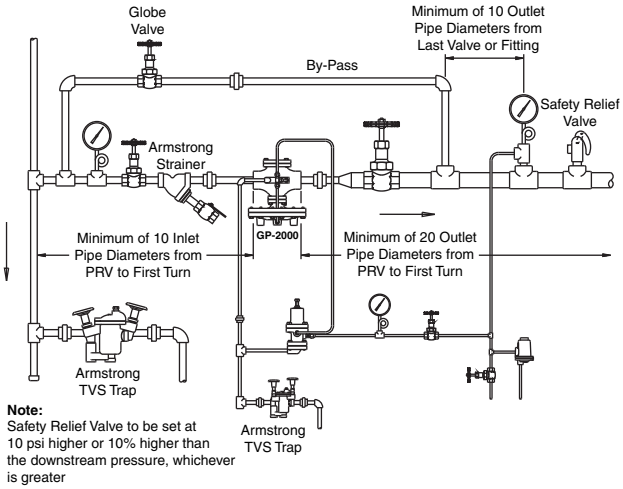
WARNING: This bulletin should be used by experienced personnel as a guide to the installation of the Model GP-2000 Pressure Reducing Valve. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.

Typical Single Stage Reduction Installation (For Steam)

Integral Mount



Remote Mount



Installation Instructions

1. An Armstrong Inverted Bucket Steam Trap is recommended to drain the condensate at the inlet of the PRV.
2. An Armstrong 100 mesh Y-Strainer should be installed before the PRV to reduce the chance of dirt fouling.Re-isolate all PRVs using gate valves.
3. Pressure gauges should be installed before and after the PRV. The downstream gauge should be installed in or near the control pipe.
4. Control pipe connections go into ¼" tapping on the side of the pilot valve. Be certain the pipe is pitched away from the PRV to drain condensate away from pilot. Erratic control could result if this is not done. Control pipe length should be a minimum of 10 outlet pipe diameters from the last tee, elbow or fitting.
5. If a bypass line is needed to allow system operation while the valve is being serviced then install a quality globe valve on the bypass line. Leaking valves will cause system problems.
6. Piping immediately downstream of PRV should be expanded to accommodate low-pressure expansion through a PRV. Approximately 6,000 – 12,000 FPM maximum velocity.
7. Install the PRV with diaphragm chamber down and with flow in the direction of the arrow on the body.
8. Do not install a quick opening or quick closing valve on the downstream side of the PRV. This can cause erratic pressure control and cause safety relief valves to discharge.

Start-Up and Adjustment Procedures

Improper sizing or adjustment of the pressure reducing valve may cause hunting, scale problems, water hammer, etc. and can heavily damage the main parts of the valve. Adjust the valve as follows:

1. Close the gate valves before and after the pressure reducing valve and blow fluid leisurely through the by-pass line. Adjusting the opening of the by-pass globe valve so as not to blow the safety relief valve. After draining, be sure to close the by-pass globe valve.An Armstrong 100 mesh Y-Strainer should be installed before the PRV to reduce the chance of dirt fouling.Re-isolate all PRVs using gate valves.
2. Loosen the lock nut and adjusting screw to relieve the pressure on the adjusting spring.
3. Slowly open the inlet side gate valve to the full open position, and open the outlet side gate valve enough so that a little fluid can flow through.
4. Slowly turn the adjusting screw clockwise until the desired pressure is obtained while watching the pressure gauge at the outlet side.
5. Slowly open the outlet side valve to the full open position.
6. After adjustment, tighten the lock nut.

Note: Downstream usage must be present in order to set any pressure-reducing valve.

Table 2-1. Spring Chart

Reduced Pressure	Color Code
*1.5 - 3 psig	Yellow
3 - 21 psig	Yellow
15 - 200 psig	Green

*When using this spring range, remove one (1) pilot diaphragm. Capacities are reduced by 1/2 when this spring is being used.

Disassembly

Note: Before disassembly, check to make sure that the valves before and after the reducing valve are closed, including the valve in the control pipe. Also, make sure that the pressure has been relieved and that the valves are holding.

A. Disassembly of the Pilot Valve Ref: (Fig. 3-1)

1. Loosen the (28) lock nut, turn the adjusting screw (27) counterclockwise and turn until pressure is relieved from spring
2. Remove the hex head bolts (37) and take out the top spring plate (25), adjusting spring (24), bottom plate (26) and two (2) pilot diaphragms (23). (1 diaphragm if 1.5-3 spring)
3. Remove the (18) pilot valve capsule [hexagonal part at the center of the (2) pilot body. Disassemble pilot valve capsule – place a 7/32" socket over small hexagonal screw in middle of capsule (21) and hold opposite end with a flat head screwdriver. Turn counterclockwise to unscrew and expose valve stem and seat.

B. Disassembly of the Main Valve

1. Disconnect the copper tubing on the side of the valve (30A), (30B), and (30C).
2. Remove the four hex head bolts (38) from the pilot body (2) to remove the pilot from the main body (1). If the pilot is mounted remotely, remove the bolts to the main valve top cover. Care should be taken when doing this – the main valve is held by a spring, which is compressed. Once bodies are apart, remove spring plate retainer (14), screen (15), main valve spring (13) and main valve (6).
3. If the seat must be replaced, remove the four nuts (40) that attach the main body (1) to the top diaphragm case. The main valve seat is tightened from the bottom side of the body using a "T" bar. Loosen with "T" bar and unscrew main valve seat from the top.– place a 7/32" socket over small hexagonal screw in middle of capsule (21) and hold opposite end with a flat head screwdriver. Turn counterclockwise to unscrew and expose valve stem and seat.

C. Disassembly of the Main Diaphragm

1. Remove all bolts (41) holding the top and bottom diaphragm cases (4 & 5) together.
2. Separate both halves. Remove both main diaphragms (12), retainer (11) and main spindle (9).

Assembly

1. Check to make sure there are no scratches on the main valve, valve seat or pilot valve. If there are no scratches apply lapping compound and re-lap the valve and seat. (See Bulletin AY-768).
2. Make sure the sliding parts (Pilot valve stem and main valve stem) move freely.
3. Never-Seeze® gasket compound should be used on both main diaphragms and on bottom of pilot diaphragms.
4. Assemble valve in reverse order from disassembly.
5. Tighten bolts uniformly (criss-cross pattern).
6. Verify if your valve has old or new type tubing to assure proper placement of orifices.
7. Be sure fitting 30A, 30B, 30C and tee fitting (33) are in the correct position and not over tightened. Ref. Figure 6-1.
8. Make sure copper pilot valve gasket (22) and main valve seat gasket (8) are in place before tightening pilot valve capsule and main valve seat.

Main Valve Kits
K-2100 thru K-2108

1 Main Valve
1 Main Body Top Gasket
1 Body Spacer Gasket

Main Diaphragm Kits
K-2130 thru K-2136

2 Main Diaphragms
Never-Seeze® compound

Gasket Sets
K-2380 thru K-2386

1 Screen
1 Main Body Top Gasket
1 Main Body Bottom Gasket
1 Body Spacer Gasket

Adapter Kits
OB-2000 and OB-2000PT
K-2020 thru K-2036

All external tubing and fittings needed to remote mount pilot valves to main valves

Pilot Kit
K-2PDK

2 Pilot Diaphrams
Never-Seeze® compound

Pilot Kit
K-2110

1 Pilot Valve Capsule
2 Pilot Diaphragms
1 Pilot Capsule Gasket

Tube Kits
K-2120

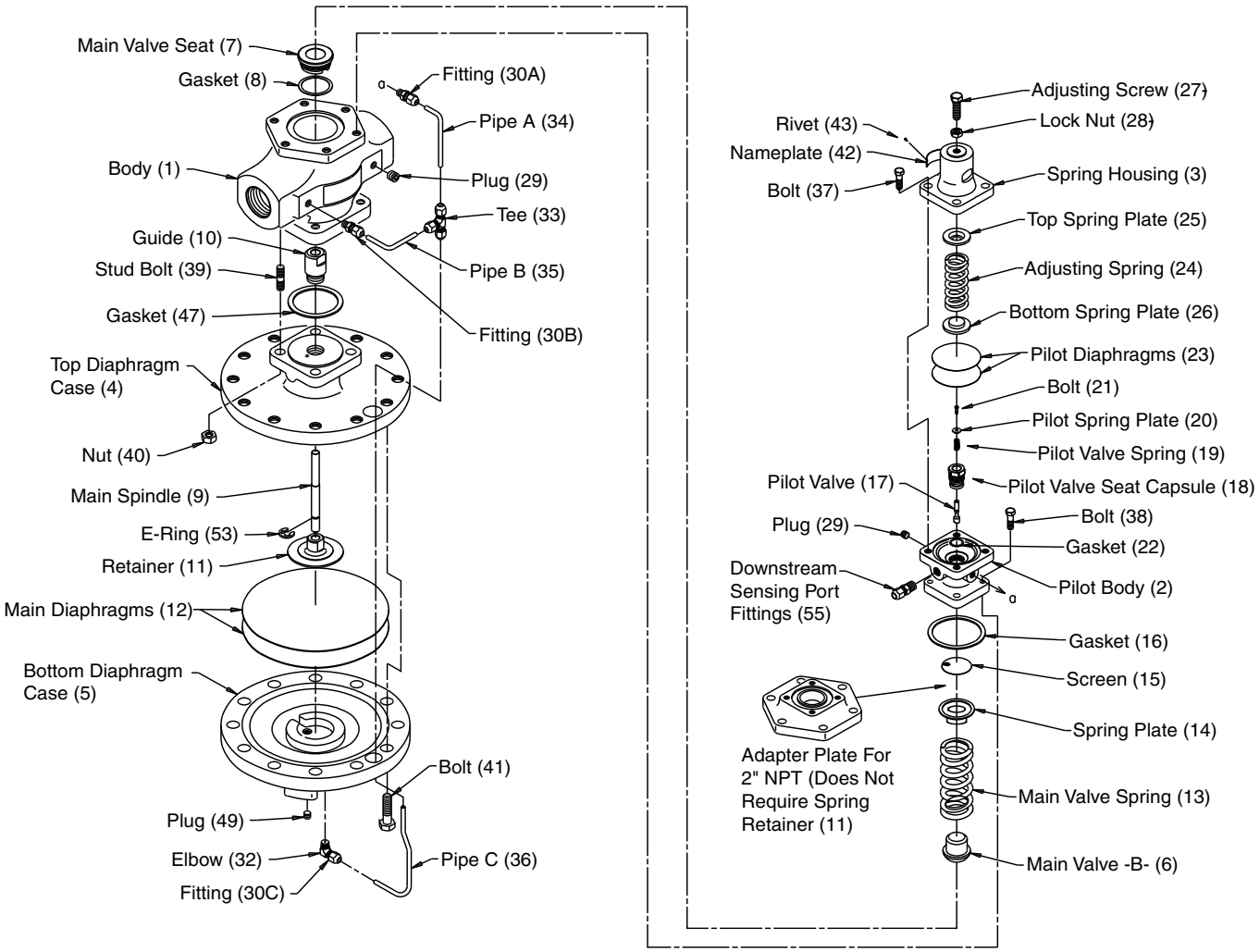
For all external tubing and fittings.

Adjusting Springs

Yellow	*1.5 - 3
Yellow	3 - 21
Green	15 - 200

*Must remove one pilot diaphragm.
(Also reduces capacity to half.)

Figure 3-1



Troubleshooting Guide

Before working on the valve, make sure that the inlet strainer is clean, bypass valve is closed and upstream and downstream pressure gauges are working properly. Refer to Figure 3-1.

Problem	Cause	Test	Solution
Outlet Pressure does not reach desired value.	Inlet pressure is not adequate for desired results.	Maximum outlet pressure is 85% of the inlet with a minimum DP = 7 psi.	Raise inlet pressure if possible.
	Adjustment is not proper.	Turn adjusting screw (27) clockwise.	Dismantle and clean.
	Orifice is too large in fitting (30B).	Remove and check.	Install proper fitting.
	Orifice of fitting (30C) is plugged.		Clean or replace fitting.
	Pilot valve is clogged.	Close inlet valve. Remove fittings (30A) and (30B). Turn (27) adjusting screw counterclockwise until it is loose. Open inlet steam valve and turn (27) adjusting screw clockwise. If fluid does not appear at (30A), pilot valve is clogged.	Disassemble and clean (18) pilot valve seat. Also, check (15) screen.
	Main diaphragms are damaged.	Close all valves and remove fitting (30C). Open bypass valve around PRV. If fluid appears out of diaphragm casing at (30C), diaphragm has failed.	Disassemble and replace (12) main diaphragms.
	Valve size is too small and cannot supply enough capacity.	Throttle downstream valve located downstream of sensing line. If desired pressure can be reached after throttling valve PRV is too small.	Resize and install larger valve.
Secondary pressure exceeds the pressure setting.	A) Adjustment is not proper.	Turn (27) adjusting screw counterclockwise.	Readjust.
	B) Orifice of fitting (30B or C) is plugged.	Remove and check.	Clean or replace fitting.
	C) Dirt is either caught between the main valve and seat or pilot main valve and seat.	1) Close inlet and outlet steam valves. 2) Turn (27) adjusting screw counterclockwise until loose. 3) Remove all copper tubing from the side of the valve. 4) Open inlet steam valve. 5) If fluid appears at (30A), proceed to solution #1. 6) If fluid appears at (30B), proceed to solution #2 and also see 'D' below. 7) Fluid does not appear at either part, proceed to 'E' below.	1) Tighten or loosen adjusting screw to flush out dirt. If pilot valve still leaks, clean or replace it. 2) Disassemble and remove main valve (it will lift out easily). If it appears shiny at one point, apply lapping compound and lap the valve and seat (see bulletin AY-768 for lapping instructions).
	D) Dirt is between main spindle (9) and guide (10).	If valve fails test at (30B) (as described above in item 6) check while assembled.	Clean.
	E) By-pass valve is not shut or is leaking.	Close and listen with stethoscope.	Repair or replace.
	F) Sensing line is plugged.	Break union and open valve.	Clean and replace.
	G) Sensing line is not connected.	Refer to Drawings on Page 1.	Install sensing line as shown on installation drawing on Page 1.
Operation is unstable.	Orifice fitting is partially plugged.	Check (30B) and (30C).	Remove and clean or replace.
	Sensing pipe is installed at a point where there is too much turbulence.	Refer to Drawings on Page 1.	Install sensing pipe at another location.
	Liquid is collecting in sensing line.		Slant pipe away from PRV.
	Quick opening/closing valve located too close to the outlet or inlet PRV.		Relocate PRV.
Excessive noise is present.	Valve size is larger than what was required causing valve chatter.	Recalculate load. Check for valve chatter.	Change valve or add orifice plate to outlet of PRV.
	Pressure reduction ratio exceeds 20:1.	Verify inlet and outlet pressure.	Use two stage reduction.
	Fluid velocity is too high.	Verify with PRV software (consult factory).	Resize station using two stage reduction or use sound silencer down from PRV.
	Automatic valve (i.e., solenoid) is too close to PRV.	Visual.	Relocate.

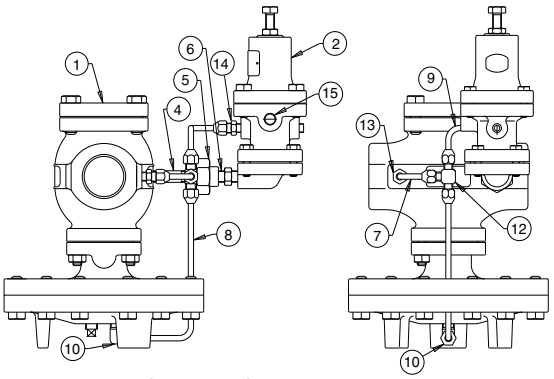
OB-2000 & GP-2000, K1, K3, K6 Remote Mount Pilot Tubing - Assembly Instructions

(See drawings for proper piping of remote pilots)

1. The valves have the following “similar” parts. ¼” long nipple (4), ¼”x ¼” short nipple (6), fitting B (13) and union set (5). Use thread tape on the threads of both nipples.
2. Remove the ¼” plug on the inlet side of the main valve body (1) (for GP-2000 remote mount pilot and OB-2000 temperature pilot) with an allen wrench.
3. Thread the ¼” long nipple (4) into the main valve body (1) (in place of the ¼” plug).
4. Thread one-half of the union set (5) onto the long nipple (4). Thread the other half onto the short nipple (6).
5. Thread the short nipple (6) into the pilot (2) or (3). **Note: The arrow on the side on the temperature pilot (3) must point away from the main valve. The short nipple (6) will thread into the bottom cap of the pressure pilot (2) (remote mount).**
6. Assemble the C-tube (8), B-tube (7) and tee (12) as shown in the diagrams on Page 6. Connect the union set (5) and tighten. **Very Important: Be sure that the groove on the Tee is on the top (Old GP-11 series does not have groove and can be used either way.**

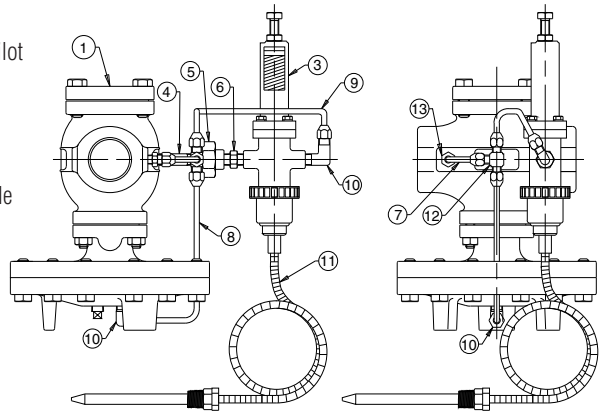
For GP-2000 Remote Mounted Pilot

7. Place fitting A (14) into the pilot and thread into place. **Note: This fitting is open with no restricted opening. Use thread tape on threads.**
8. Once the union set (5) has been tightened to fitting A (14) of the pressure pilot (2) it should be facing the main valve (1). (See remote mount drawing)
9. Connect the S shaped D-tube (9) to the outlet of the pressure pilot at fitting A (14) and to top of the tee (12) and tighten. **Note: Make sure the downstream sensing port (15) on the pilot faces downstream.**
10. Thread the elbow (10) into the outlet of the temperature pilot (3) and into the bottom of the main valve as shown in drawings.
11. Place the D-tube (9) into the elbow (10) and the tee (12) and tighten.



GP-2000, GP-2000K-1, GP-2000K-3, GP-2000K-6 Remote Mount

1	Main Valve Body
2	Pressure Pilot or Air Pilot (not shown)
3	Temperature Pilot
4	1/4” Long Nipple
5	Union Set
6	1/4” x 1/4” Short Nipple
7	B-Tube
8	C-Tube
9	D-Tube
10	Elbow
11	Capillary
12	Tee
13	Fitting B
14	Fitting A
15	Downstream Sensing Port



OB-2000

GP-2000 Main and Pilot Valve Lapping Procedure

Please read and save these instructions

Overview

WARNING! This bulletin should be used by experienced personnel as a guide to the installation and maintenance of the Armstrong GP-2000 Pressure Reducing Valve. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.

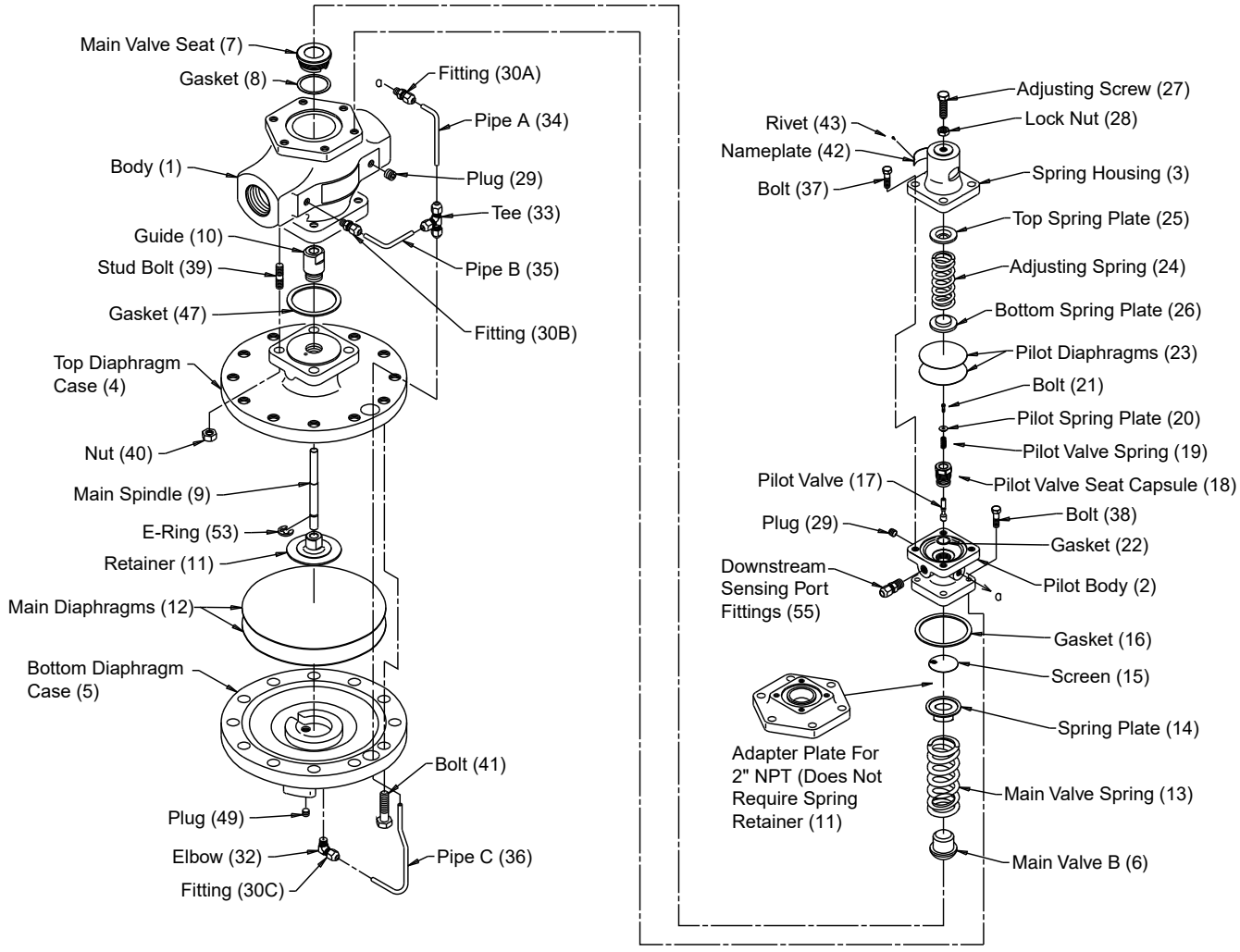
Lapping Procedure for GP-2000 Pilot Valve

1. Remove the GP-2000 pilot spring housing (3), adjusting spring (24), and pilot diaphragms (23).
2. Remove the pilot valve seat capsule (18), which includes the pilot spring plate (20), pilot valve spring (19) and pilot valve (17). Leave the capsule assembled.
3. Now you are ready to lap the pilot valve. Push out the pilot stem and valve, which is one piece, by compressing the pilot spring plate (20) inward or down. Apply a thin layer of lapping compound on the area of the valve where the pilot valve (17) meets the seat. (Use 1000 grit lapping compound). Place the pilot valve against the seat and by hand, rotate the valve back and forth against the seat, using a flat head screwdriver. Be sure to push the valve down firmly against the seat while rotating the valve back and forth. After approximately five minutes of rotating the valve back and forth a new clean surface will be created.
4. Reassemble the pilot valve seat capsule (18) and install back into the pilot body (2). Finish the re-assembly with the items mentioned in Step 1 in reverse order. Test the valve to make sure there are no leaks. (Refer to the troubleshooting section from the I.O.M. Bulletin No. AY-712-B for the GP-2000).

Lapping Procedure for GP-2000 Main Valve

1. Remove the complete pilot valve from the main valve (if an integral mount pilot). For 2 inch valves and up, also remove the adapter plate. Otherwise, for a valve with a remote mount pilot you only need to remove the main valve cover.
2. Remove the main valve spring (13), retainer (11), and screen (15). **Note:** There is not a screen on valves with remote mount pilots.
3. Now you are ready to lap the main valve. Remove the main valve (6) off from the main spindle (9). On larger valves 2-1/2 - 4 inch the stem is attached to the valve and will come out as one piece. Apply a thin layer of lapping compound around the radius edge of the main valve (6) where the valve and valve seat (7) meet. Place the main valve (6) onto the main valve seat (7) and by hand rotate the valve back and forth against the seat. Be sure to push the main valve firmly against the seat while rotating back and forth. For a new valve and seat it will take approximately 40 minutes to create a new clean surface. (This is due to the hardness of the stellite trim used. A diamond based 1000 grit lapping compound is recommended).
4. Reassemble and test the valve for leaks. (Refer to the troubleshooting section from the I.O.M. Bulletin No. AY-712 for the GP-2000).

Lapping Procedure for GP-2000 Main Valve - contintued



On/Off Model 2000 Serice Valve

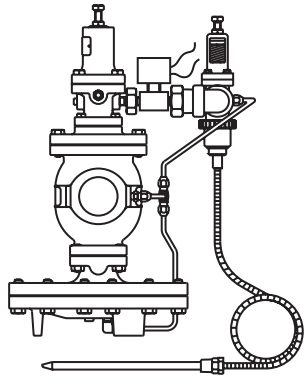
Assembly Instructions

Bulletin No. AY-709-A

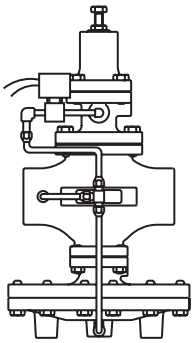
This instruction sheet should be used in addition to the appropriate Instruction and Operating Manual for your specific model. There are five ON/OFF Model combinations shown. Please consult factory if your specific model is not shown in the drawings.

Assembly Instructions

1. Assembly of the 2000 Series On/Off will consist of the following main parts. The pressure reducing valve (1), the solenoid valve (2), the tube and adapter kit (all the connecting tubing *some parts may be extra depending on your particular model) (3), and the pilot (4).
2. Use the drawing on the next page as a reference for your particular On/Off model.



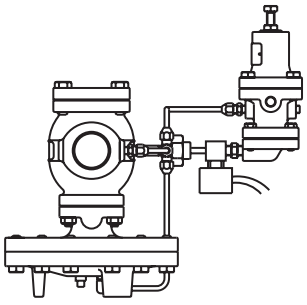
OB-2000PT Integral



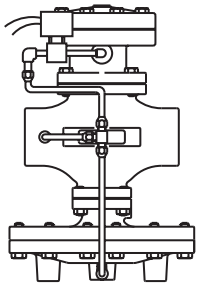
GP-2000 Integral

Solenoid Pilot Tubing Assembly

3. Start by using the parts from your tube and adapter kit. **Note: Use teflon tape or pipe dope on all joints.**
4. Thread the appropriate adapter(s) into the pilot or main valve inlet body side as shown.
5. Next thread the other end of that appropriate adapter into the solenoid valve inlet. **Note: Be sure that you assemble the solenoid correctly. The solenoid is marked with an "IN" to verify flow direction.**



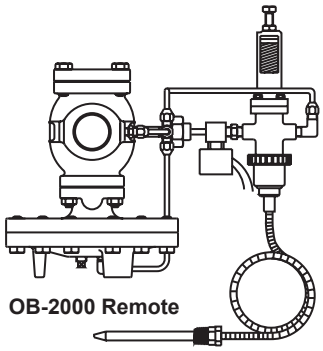
GP-2000 Remote



GP-2000K-1, K-3, K-6 Integral

For GP-2000 Integral Models Skip To Step Number 7

6. Thread the appropriate adapter to the outlet side of the solenoid and the other side into the inlet of the OB-2000 pilot or GP-2000 remote pilot. Note: The OB-2000 Pilot Valve will have an arrow showing the direction of flow.
7. Thread the 1/4" brass elbow into the outlet of the solenoid valve or OB-2000 pilot valve. Attach the brass elbow outlet with the extra tubing supplied to the top of the tee which is part of your existing valve.Use the brass ferrules and compression fittings to assure proper seal. Note: Be sure the groove on the tee is on the top in the upward position.



OB-2000 Remote

GP-2000W1P

Non Electric Self-Controlled Shut Down Device for Water Pressure Loss to Fixed Steam Pressure Heat Exchangers

Overview

WARNING! This bulletin should be used by experienced personnel as a guide to the installation of the Model GP-2000W1P Pressure Reducing Valve. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.

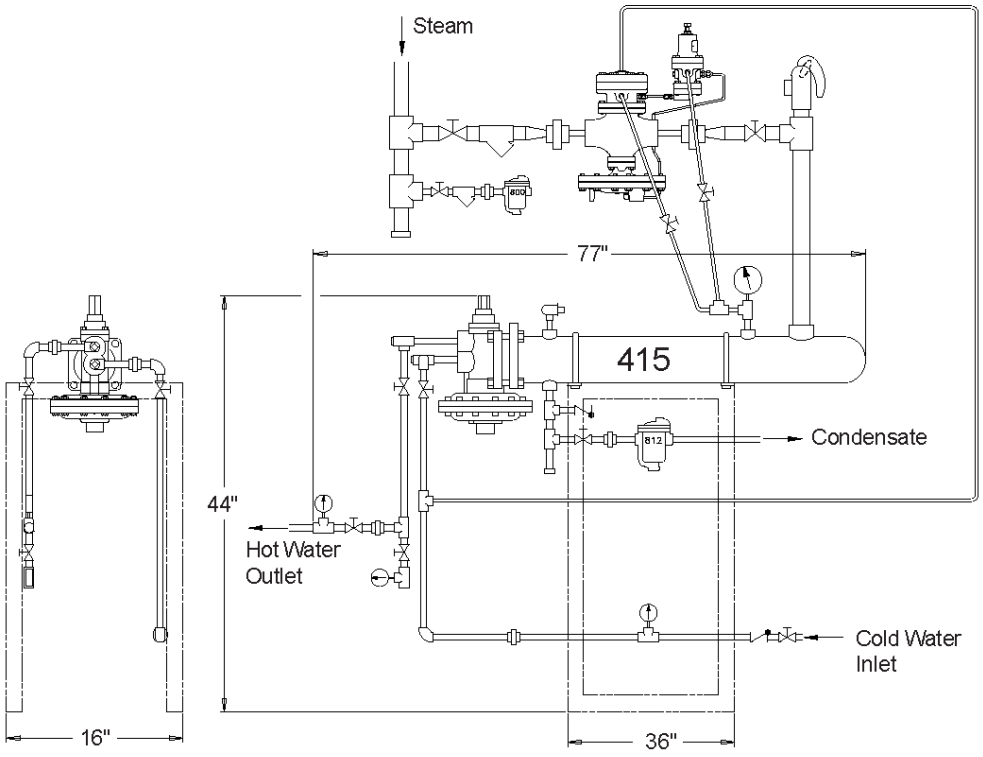
The problem that many facilities experience today with their hot water supply is keeping their water supply at the correct temperature for their needs. This problem can be caused by many variables. One in particular is the water pressure that is used for fixed steam pressure and feedforward instantaneous water heaters.

All feedforward instantaneous steam water heaters on the market today operate with the water pressure higher than the steam pressure. The common recommendation is to have the water pressure at least 10-20 PSI greater than the steam pressure to prevent the water in the tubes of the water heater from boiling. With control of the water pressure, you can prevent damage to the unit, as well as boiling of the water, leading to personal injury. In the past, many applications that needed to control the water pressure and steam pressure relationship used a pressure switch in the supply water to activate a solenoid valve or electric actuated valve to shut off the steam supply. The Armstrong GP-2000W1P is a self-controlled shut down device avoiding the need for electricity to control any of these systems, making it an even more economical solution.

How the System Works

The system, when piped as shown in the drawing, will provide a safe dependable shut down of the main steam valve when the water pressure fails or drops rapidly on a fixed pressure steam water heater. Unlike a solenoid application, which shuts the steam down when the water pressure drops below a pre-set point, the GP-2000W1P offers another benefit in that it allows the system to keep producing hot water even when the water pressure is below the set pressure. The GP-2000W1P Combination valve essentially lets the steam pressure modulate below the water pressure by 2 or 3 pounds, allowing a water heater to supply hot water even when water pressure is low.

The GP-2000W1P combination valve is piped together with a Feedforward type instantaneous hot water heater. Incoming cold water is piped into the hot water heater with a sample line piped to the K-1 Pilot of GP-2000W1P. At the same time the cold water is supplying the water heater its pressure, it is also supplying the K-1 Pilot. When the pressure of the incoming cold water decreases, the K-1 Pilot modulates down the supply of steam to the pressure pilot controlling the main steam valve, acting as a non-electric self-controlled shutdown device. Ultimately, this valve eliminates the use of any electricity and gives the customer safe control of their hot water supply when water pressure loss or fluctuating water pressure conditions exist.



Model OB-2000 & GP-2000, K1, K3, K6 Remote Mount Pilot Installation & Operations Manual

Please read and save these instructions

Armstrong®

Overview

WARNING! This bulletin should be used by experienced personnel as a guide to the installation the installation of the Model OB-2000 & GP-2000, K1, K3, K6 Remote Mount Pilot. Selection or installation of equipment should always be accompanied by competent technical assistance. We encourage you to contact Armstrong or your local representative if further information is required.

Installation Procedures

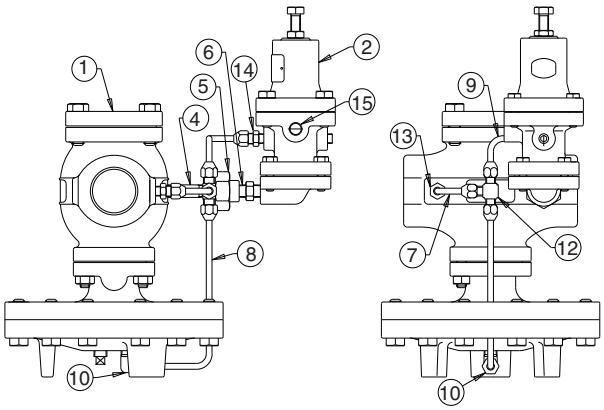
1. The valves have the following “similar” parts: 1/4” long nipple (4), 1/4” x 1/4” short nipple (6), fitting B (13) and union set (5). Use Teflon® tape on the threads of both nipples.
2. Remove the 1/4” plug on the inlet side of the main valve (1) (for the GP-2000 remote mount pilot and OB-2000 temperature pilot) with an allen wrench.
3. Thread the 1/4” long nipple (4) into the main valve (1) in place of the 1/4” plug.
4. Thread one-half of the union set (5) onto the long nipple (4). Thread the other half onto the short nipple (6).
5. Thread the short nipple (6) into the pilot (2) or (3). Note: The arrow on the side of the temperature pilot (3) must point away from the main valve. The short nipple (6) will thread into the bottom cap of the pressure pilot (2) (remote mount).
6. Assemble the C-tube (8), B-tube (7) and tee (12) as shown in the diagrams on the bottom of this page. Connect the union set (5) and tighten. Very important: Be sure that the groove on the Tee (12) is on the top.

Model OB-2000

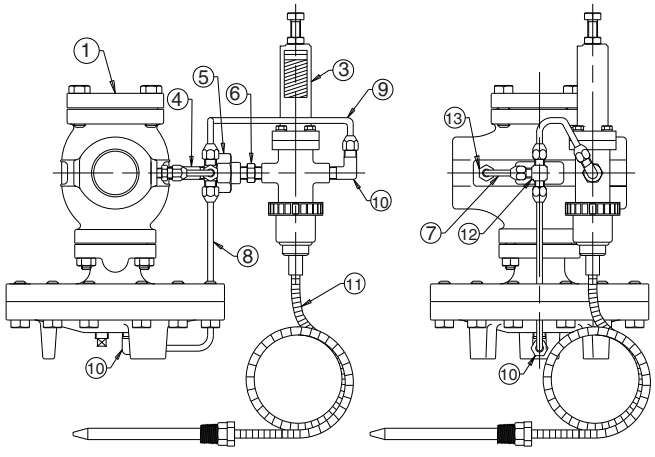
7. Thread the elbow (10) into the outlet of the temperature pilot (3) and into the bottom of the main valve as shown in drawings.
8. Place the D-tube (9) into the elbow (10) and the Tee (12) and tighten.

Model GP-2000 Remote Mounted Pilot

9. Place fitting A (14) into the pilot and thread into place. Note: This fitting is open (5 mm) with no restricted opening. Use thread tape on threads.
10. Once the union set (5) has been tightened, fitting A (14) of the pressure pilot (2) should be facing the main valve (1). See remote mount drawing.
11. Connect the D-tube (9) to the outlet of the pressure pilot at fitting A (14) and to the top of the Tee (12) and tighten. **Note: Make sure the downstream sensing port (15) on the pilot faces downstream.**



GP-2000, GP-2000K-1,
GP-2000K-3, GP-2000K-6
Remote Mount



OB-2000

1. Main Valve Body
2. Pressure Pilot
3. Temperature Pilot
4. 1/4” Long Nipple
5. Union Seat
6. 1/4” x 1/4” Short Nipple
7. B-Tube
8. C-Tube
9. D-Tube
10. Elbow
11. Capillary
12. Tee
13. Fitting B
14. Fitting A
15. Downstream Sensing Port

Notes

Notes

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Electromagnetic Flow and BTU Meters, Ultrasonic Flow and BTU Meters: 21 months from the date of installation, but not longer than 24 months from the date of shipment from the Veris Factory.

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