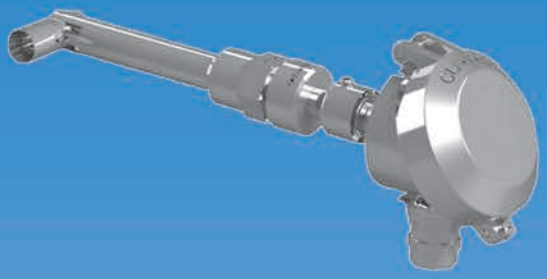
X144D e-FlowMeter

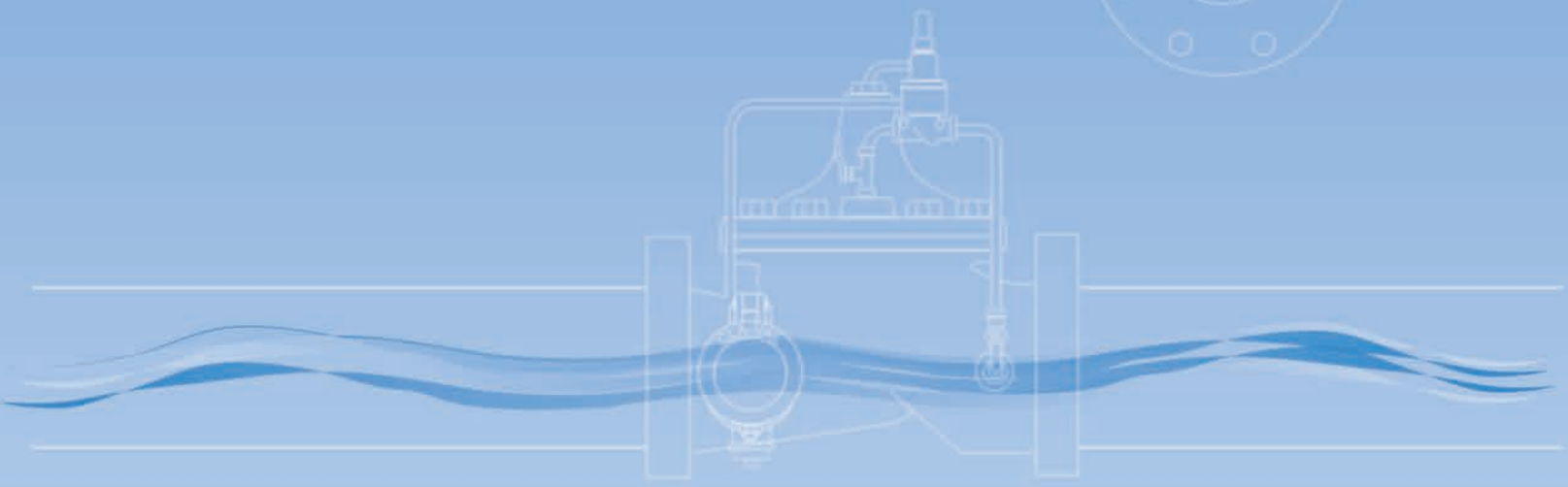
with Integral Display

Installation

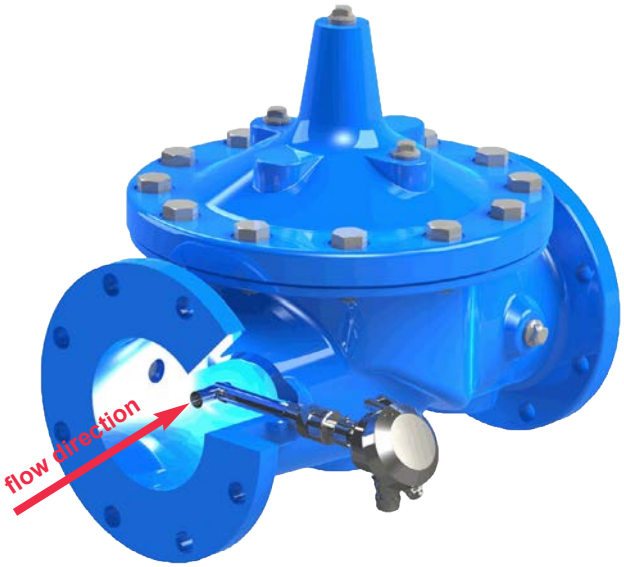


Operation

Maintenance



Plug-and-Play Metering: Cla-Val X144D e-FlowMeter



A view inside the X144D e-FlowMeter

Log-on to www.cla-val.com and click Electronic Products to learn more about our complete line of e-products.

Proven Technology from the Industry Leader

Utah State University

Imperial College London

Laboratory Tested • Field Proven • Performance Assured

X144D e-FlowMeter Installation, Operation and Maintenance

Table of Contents

INTRODUCTION:

X144D e-FlowMeter Installation, Maintenance and Operation

The X144D is an insertion flow meter designed to provide flow information from inside a Cla-Val Control valve.This innovative device measures flow information using standard Cla-Val control valve bodies at locations where typical flow meters cannot provide accurate measurements. As opposed to industry standard insertion flow meters, the X144D e-FlowMeter can be installed directly into the inlet side of a Cla-Val Control Valve, eliminating the need for costly downtime and pipe work. The X144D can also be inserted in valves at piping locations not usually permitted for flow measurement, such as directly downstream of a flow disturbance such as elbows, valves or reducer within just a few pipe diameters (see installation recommendations for conditions.)

This manual will help you install, operate, and maintain the X144D e-FlowMeter.

Important Safety Information

The following safety notices are used in this manual:

- **CAUTION:** indicates that minor personal injury, product or property damage may occur if the notice is ignored.
- **NOTE:** indicates special instructions that are important but are not related to hazards.

Please see examples shown below:

NOTE: The X144D e-FlowMeter may be installed in inlet tap of either side of the Cla-Val Automatic Control Valve.

CAUTION: Failure to install the unit correctly could result in faulty operation and/or damage to the unit.

CAUTION:
In all cases, installation should be done by qualified mechanical or electrical personnel.

CAUTION: BEFORE removing pipe plug, make sure that the pressure in the valve has been bled off to prevent injury to personnel or damage to non-waterproof equipment.

CAUTION:
Valve in which X144D e-FlowMeters are installed **MUST** have upstream and downstream Isolation Valves to ensure that the line is locked out and not under pressure during installation, maintenance or removal of the X144D e-FlowMeter.

CAUTION 1: Failure to use the provided Insertion Tool **WILL** result in damage to the e-FlowMeter

CAUTION 2: To avoid injury, isolate the valve and bleed pressure prior to removing the e-FlowMeter

for assistance, call
800.942.6326

SECTION 1: System Components and How They Work

1.1 - Theory of Operation

The X144D e-FlowMeter is an insertion vortex flowmeter based on a phenomenon which generates of a succession of alternating swirls called Karman vortex street (Figure 1-1).

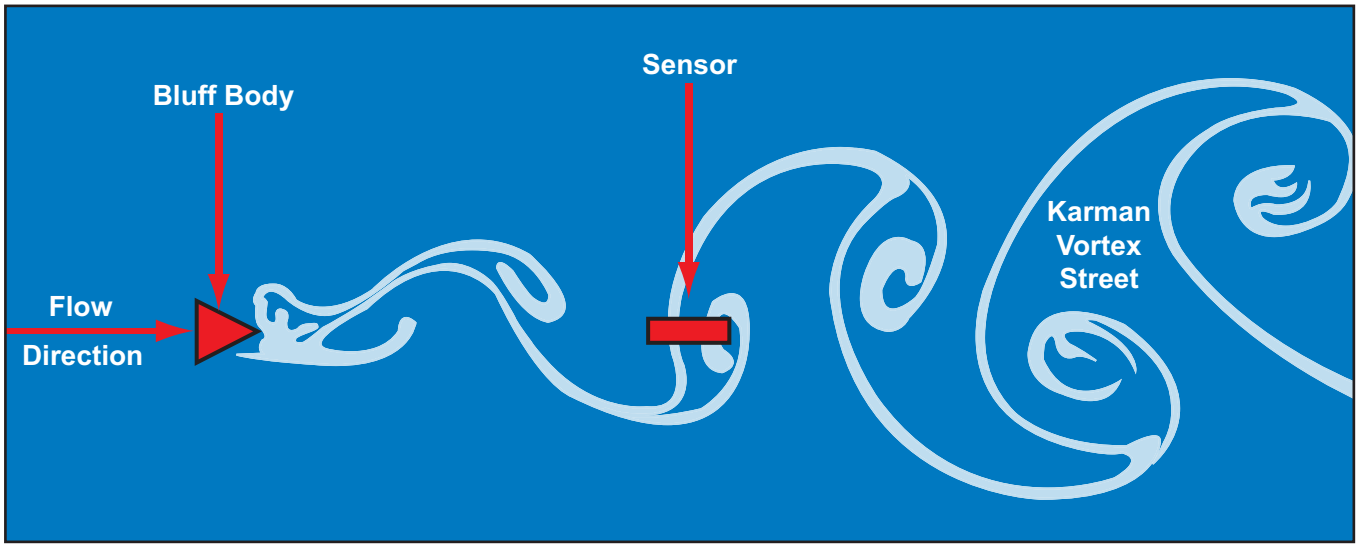


Figure 1-1: Karman Vortex Street

When the fluid meets an obstacle (called a bluff body) which is placed in parallel with the flow of the fluid it divides the flow and generates small swirls or vortices alternately on both sides downstream of the obstacle. The generation of the swirls is directly proportional to the speed of the fluid. The detached swirls generate zones of variable pressure that are detected by the forces acting on a small piezoelectric crystal encapsulated in the transmitter (Figures 1-2 and 1-3).

The X144D e-FlowMeter employs an innovative feature called the Swivel Measurement Cylinder which allows for the proper distance between the bluff body and the sensor, while still retaining the capability of being inserted into a tapping as small as 1/2-inch NPT.

Figure 1-2

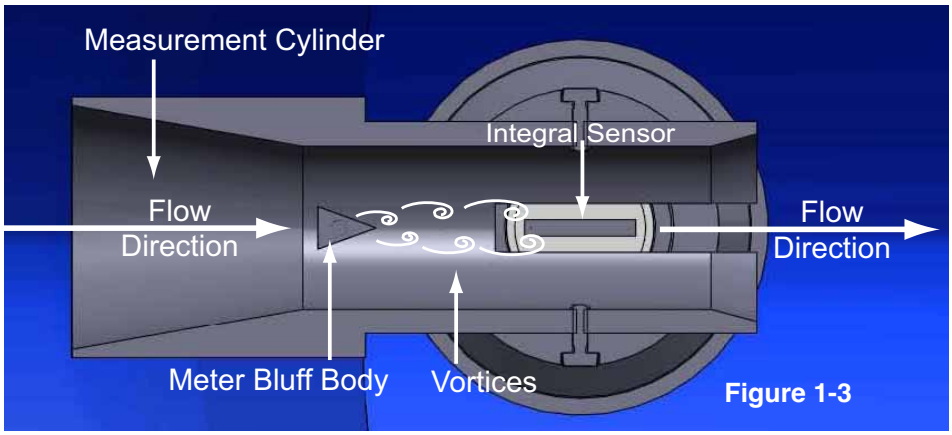


Figure 1-3

SECTION 1: System Components and How They Work (continued)

1.2 – Supplied Parts List

X144D Equipment - Supplied by Cla-Val

1) e-FlowMeter with Swivel Threaded Insert (Figures 1-4 and 1-5)
2) Insertion Tool (Figure 1-6)
3) 20 feet of Electrical Cable (See Section 2.5)

X144D e-FlowMeter Parts

1) IP68 Submersible Electronics Housing
2) Knurled Lock
3) Centering Pin
4) O-Ring
5) Shaft
6) Sensor

Figure 1-4: e-FlowMeter

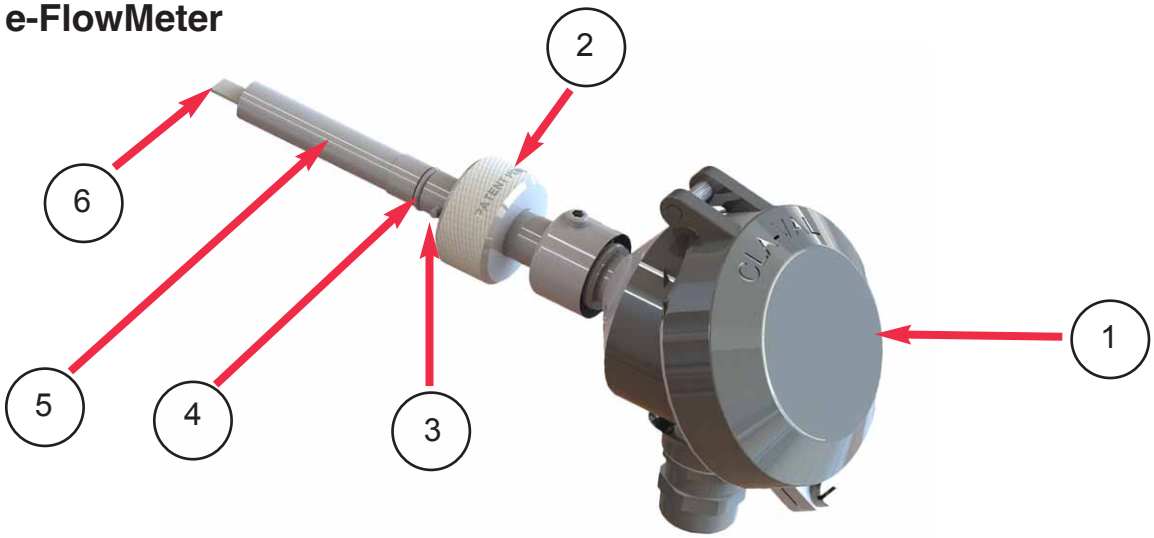
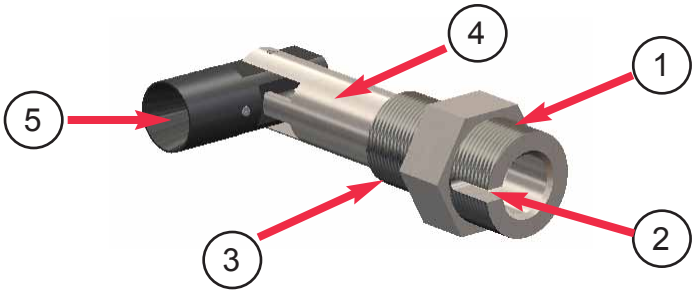


Figure 1-5: e-FlowMeter Swivel Threaded Insert Detail



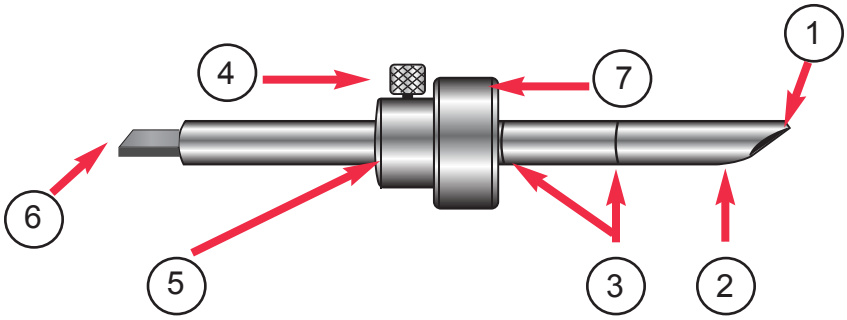
Swivel Threaded Insert Parts

1) Straight Threads
2) Centering Groove
3) Tapered Threads
4) Sleeve
5) Swivel Measurement Cylinder

Figure 1-6: Insertion Tool Kit

Insertion Tool Kit Parts

1) Bevel
2) Tool
3) Score Marks
4) Thumb Set Screw
5) Tool Lock
6) Flat Tipped End
7) Locking Collar

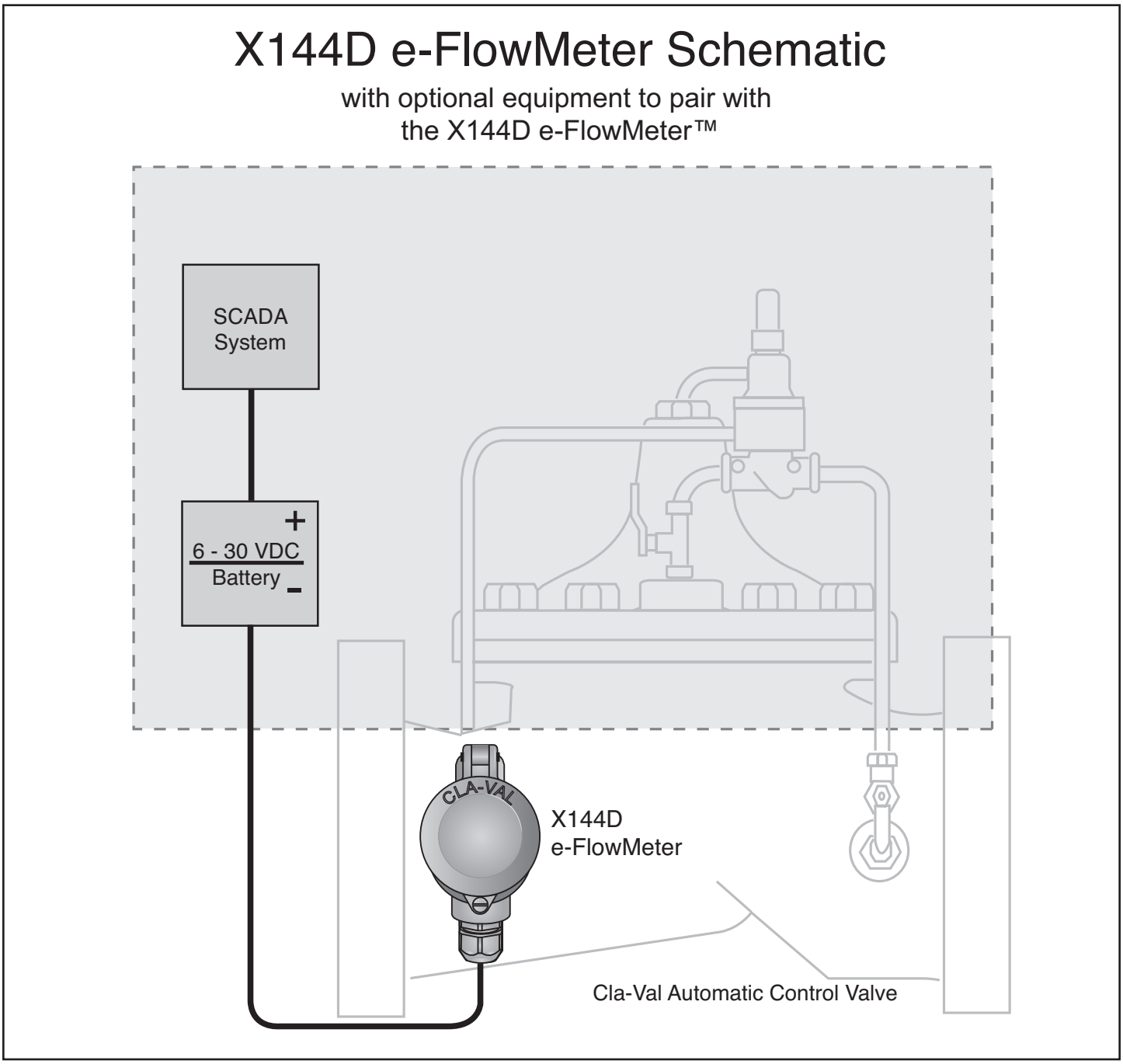


SECTION 1: System Components and How They Work (continued)

1.3 – Non-Supplied Parts List

The following parts are necessary for installation and operation but not included with the e-FlowMeter:

- Cla-Val Automatic Control valve in which to insert the e-FlowMeter - Globe or Angle Pattern, 2" - 36".
- Power supply
  - 6-30 VDC, 0.7 Watts minimum
  - Can be powered with batteries or AC/DC Converter
- Power supply/battery housing

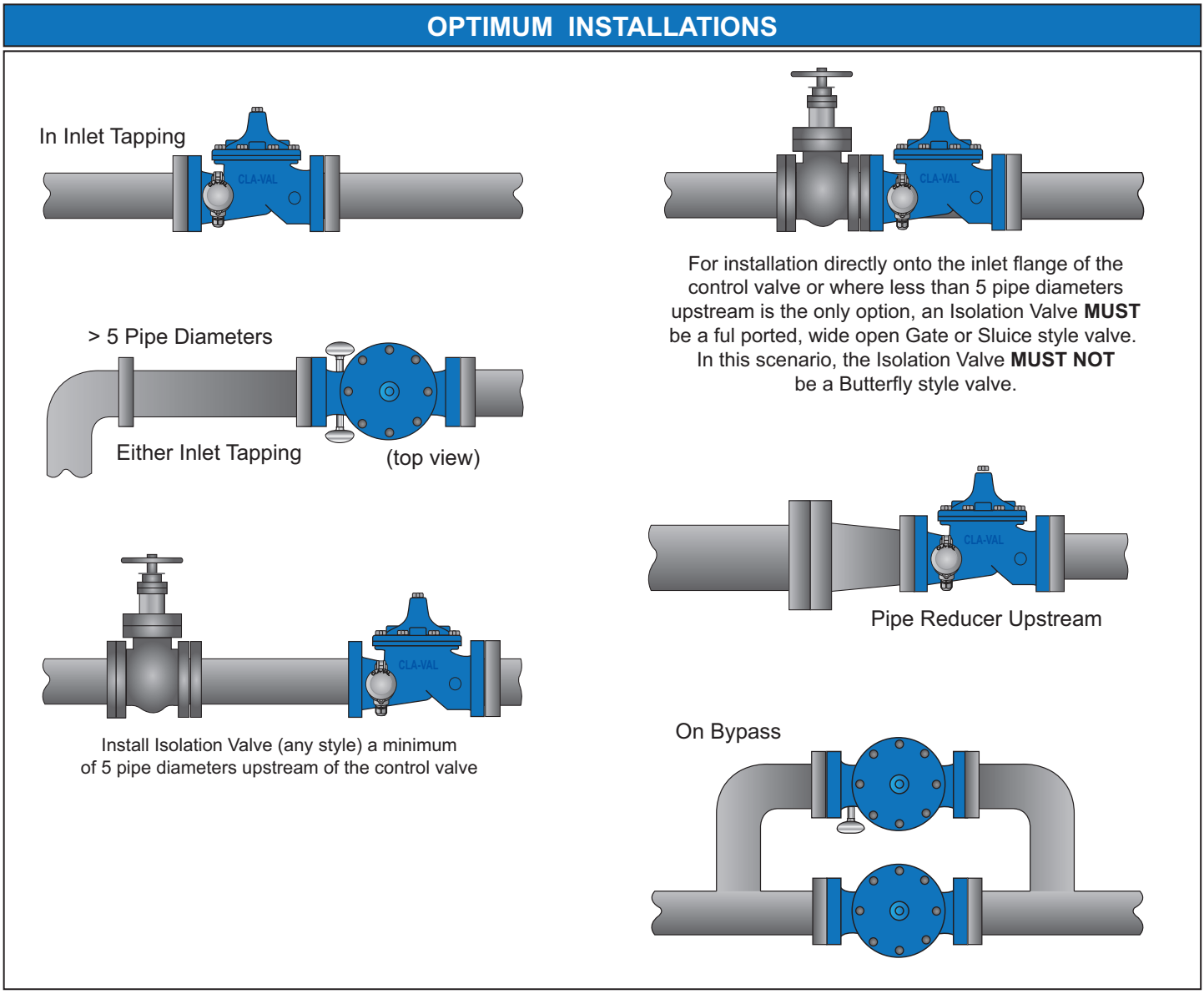


Section 2: Installation of the X144D e-FlowMeter

2.1 - Installation Locations:

For optimum performance, it is recommended that the valve in which the X144D e-FlowMeter is installed be located as shown in the “Optimum Installations” illustration below, Figure 2-1.

CAUTION: Valves in which X144D e-FlowMeters are installed **MUST** have upstream and downstream Isolation Valves to ensure that the line is locked out and **NOT** under pressure during installation, maintenance or removal of the X144D e-FlowMeter.



Note: Do not use with 40 Series Rate-of-Flow Controllers with orifice on inlet
Do not use butterfly valves adjacent to X144D installations

Figure 2-1: Installation Guidelines

Section 2: Installation of the X144D e-FlowMeter (continued)

2.2 - Materials Required for Installation

Insertion tool

- Tool allows the proper installation and alignment of the bluff body to be parallel to upstream flow, (Figure 1-5).

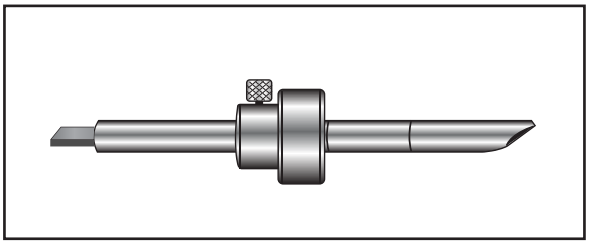


Figure 1-5: Insertion Tool

Power Supply

- 6-30 VDC, 0.7 Watts minimum. If more than one piece of equipment will be connected to this power supply, you must verify that the power supply is large enough to handle all the power needs of the entire system, not just the X144D e-FlowMeter.
- You will also need the appropriate equipment to connect the X144D to each the power supply. See your local electrical specifications to determine the appropriate wire and connection hardware.

Pipe and Fittings Mounting Hardware

- The X144D connects directly into the control valve on an inlet port and the size of the thread is dependent on the specific valve size for which it it has been calibrated - no additional fittings are required.

Cabling

- The X144D has 30 feet cable supplied and attached as a factory standard. If additional lengths of cable are needed, the connections should be made with #22 AWG or larger cable and may need to be shielded in some environments where high electrical noise may exist. If using shielded cable, one end of the shielding should be connected to an earth ground, such as a piping system fitting, etc.

CAUTION:

- In all cases, installation should be done by qualified mechanical or electrical personnel.

Log-on to www.cla-val.com
and to learn more about Cla-Val's
complete line of automatic control valves

Section 2: Installation of the X144D e-FlowMeter (continued)

2.3 - Mounting the X144D e-FlowMeter

Mount the X144D e-FlowMeter in a proper orientation as shown in Figure 2-2.

NOTE: The X144D e-FlowMeter may be installed in inlet tap of either side of the Cla-Val Automatic Control Valve.

CAUTION: Failure to install the unit correctly could result in faulty operation and/or damage to the unit.

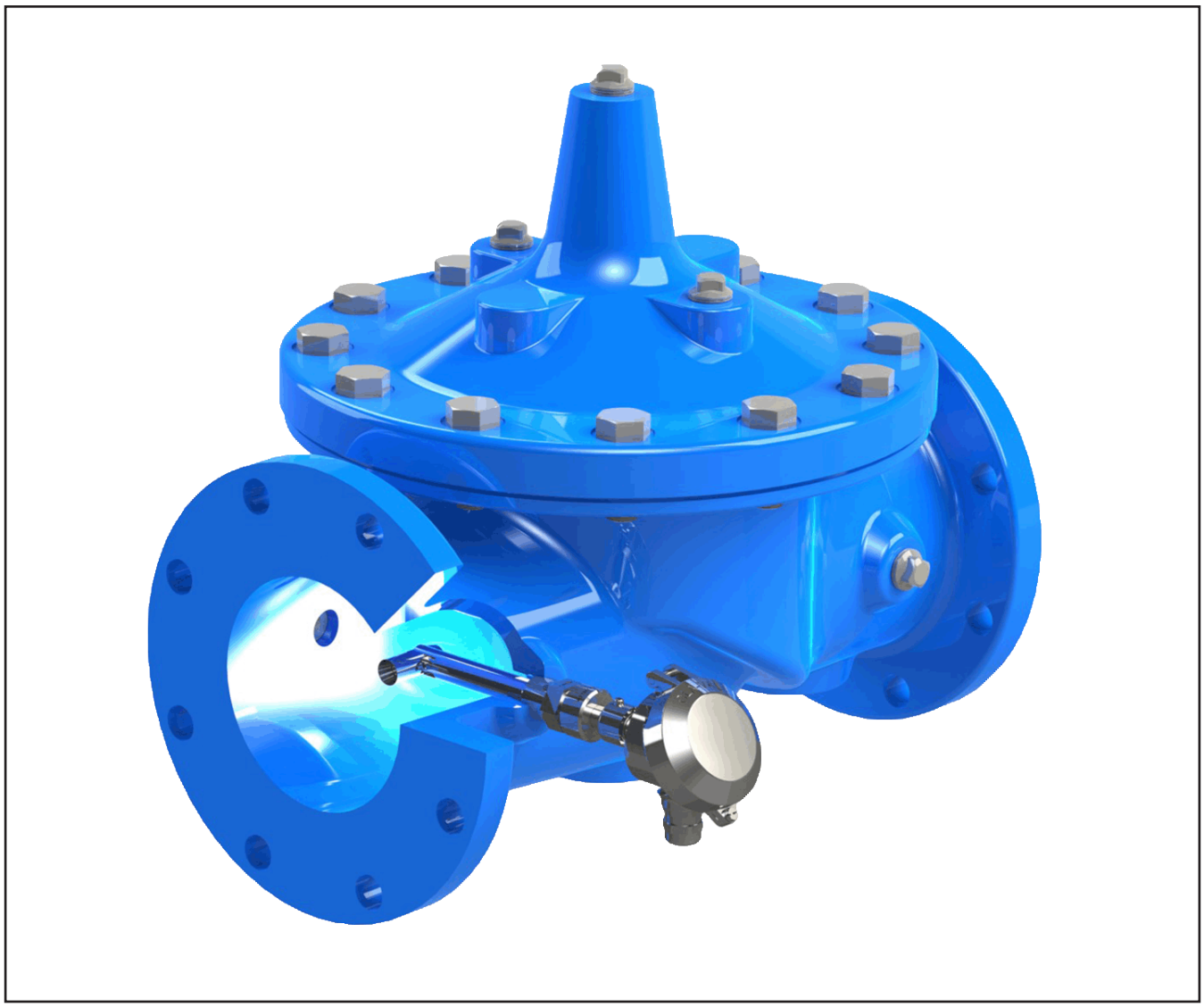


Figure 2-2: X144D e-FlowMeter correctly installed in a Cla-Val Control Valve

Section 2: Installation of the X144D e-FlowMeter (continued)

2.4 - Step-by-Step Instructions: Mechanical Installation

CAUTION: BEFORE removing pipe plug, make sure that the pressure in the valve has been bled off to prevent injury to personnel or damage to non-waterproof equipment

1) Isolate valve/pipe from pressure and flow.
2) Remove pipe plug on INLET boss of valve.

3) Remove sensor/head unit from threaded pipe insert by unscrewing the knurled lock and sliding the sensor out of the threaded insert (Figure 2-3).

   Set aside sensor head, making sure to protect the sensor tip

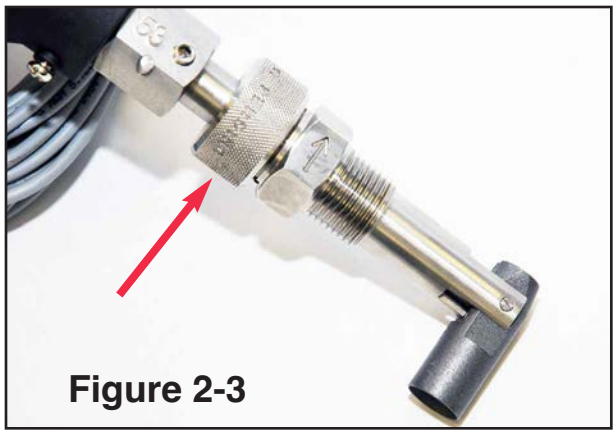


Figure 2-3

4) Apply Teflon® thread tape and/or pipe thread compound to tapered threads on pipe insert, shown below (Figure 2-4):

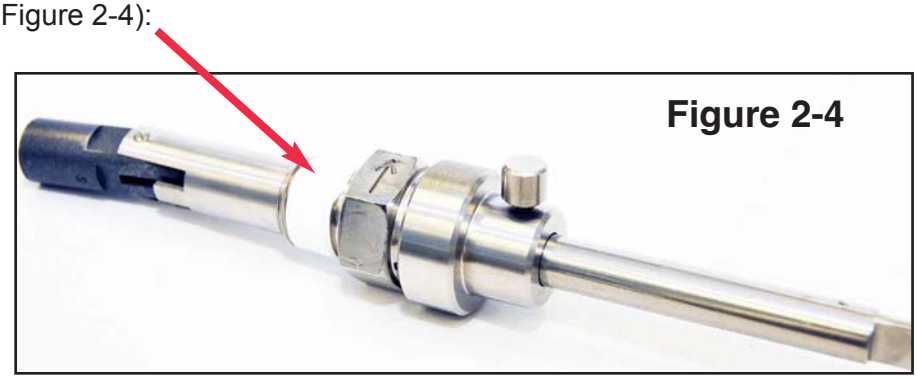


Figure 2-4

5) Straighten the Measurement Cylinder by hand to create a slight angle (Figure 2-5); Tighten the locking collar on the straight threads of the insert (2); and tighten the thumb set screw (3); to maintain the slight angle of the Measurement Cylinder.

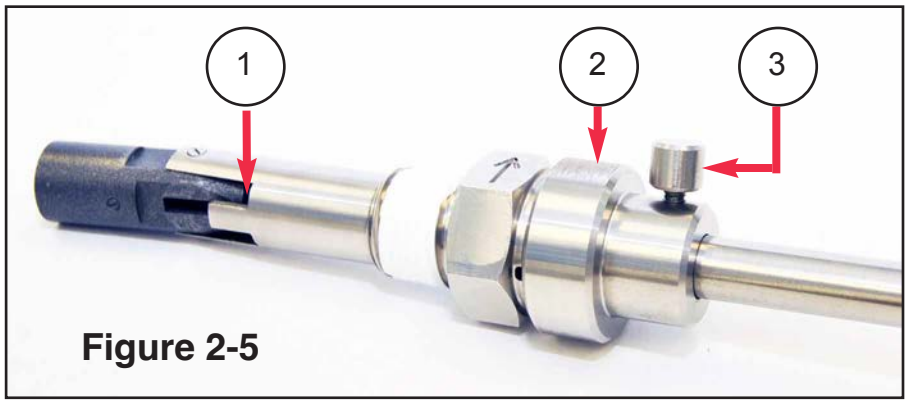


Figure 2-5

Section 2: Installation of the X144D e-FlowMeter (continued)

2.4 - Step-by-Step Instructions Mechanical Installation

6) Screw threaded insert into the inlet tap of the control valve, tighten properly and align so that the arrow points to downstream flow making sure that the wrench flat with arrow is level with the valve cover,and the measurement cylinder is facing (parallel to) upstream flow. (Figure 2-6).

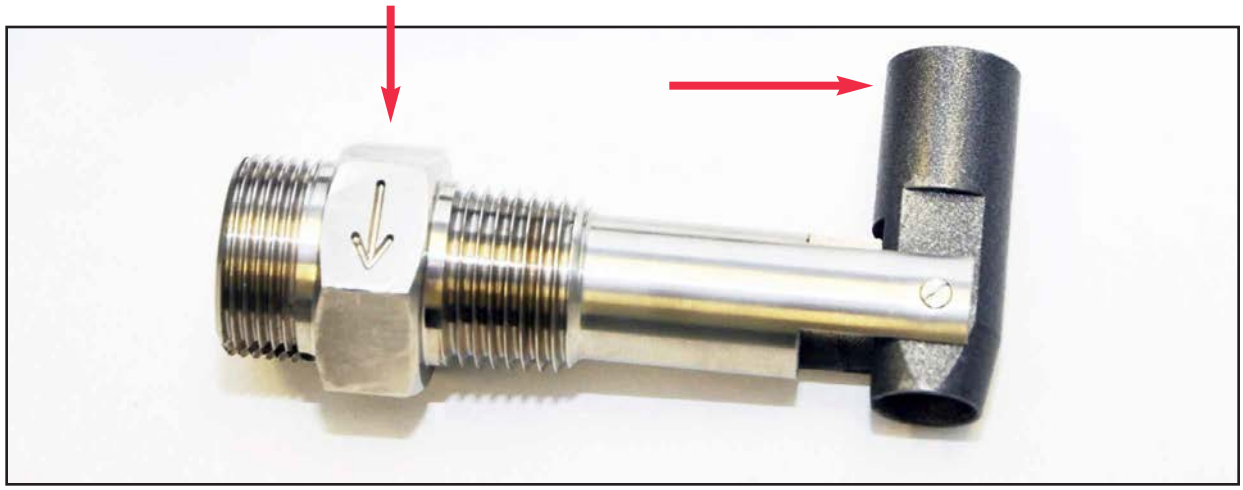


Figure 2-6

Please note that the flat with the engraved arrow must be positioned so that arrow is in line with the flow direction. Failure to do so will result in inaccurate readings.

7) **Measurement Cylinder Swivel Procedure**

a) Position of Threaded Insert + Insertion Tool, just prior to installation into valve, (Figure 2-7).

b) Slide Insertion Tool straight out, then insert the opposite side flat tipped end into the threaded insert.

c) Insert tool, flat tipped end first, making sure to feel for the Insertion Tool to engage the measurement cylinder, then push straight into the insert until the tool seats, which puts the measurement cylinder to roughly 90° to the sleeve of the threaded insert (see Figure 2-8).

d) It may help to wiggle the tool slightly while pushing firmly.

Figure 2-7

Section 2: Installation of the X144D e-FlowMeter (continued)

2.4 - Step-by-Step Instructions Mechanical Installation

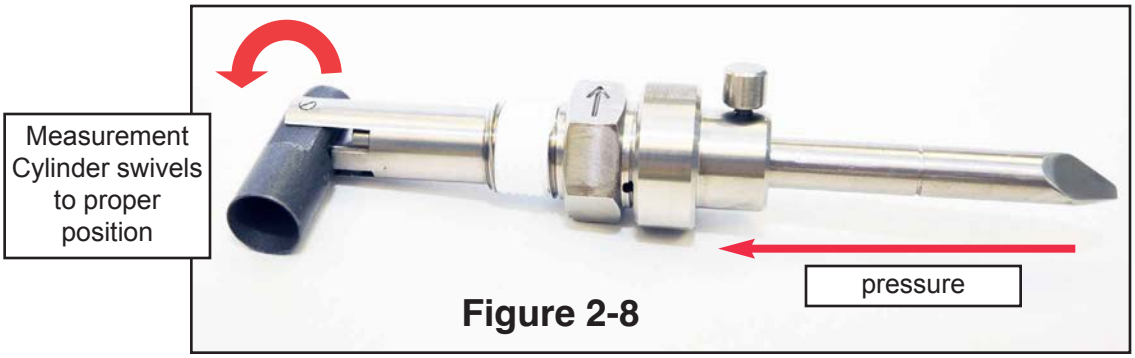


Figure 2-8

8) Once the measurement cylinder rotates, remove the tool lock then use the score marks on the Insertion Tool to verify measurement cylinder is locked in 90° orientation, ensure that the tool seated to appropriate ½" or ¾" score marks, (Figure 2-9).

9) Insert sensor into threaded pipe insert. Ensure that the centering pin is aligned with the centering groove on the threaded insert, (Figure 2-10). Push firmly to seat the o-ring.

Figure 2-9

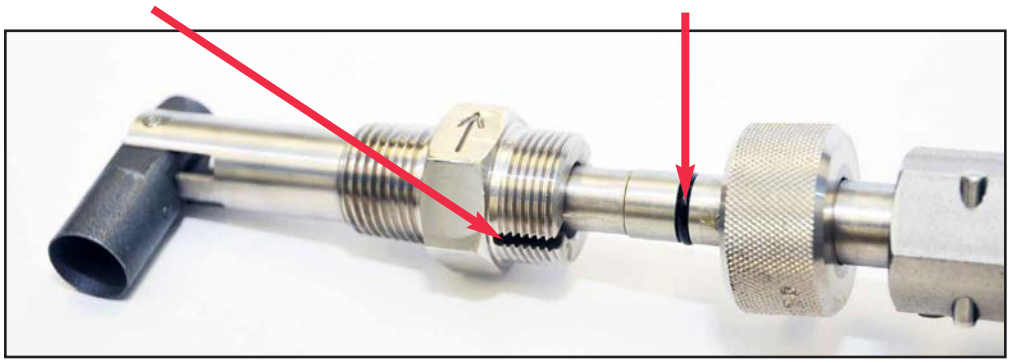


Figure 2-10

Section 2: Installation of the X144D e-FlowMeter (continued)

2.4 - Step-by-Step Instructions Mechanical Installation

10) Ensure that the e-FlowMeter is properly seated and tight using the knurled lock, hand tight only, (Figure 2-11). Tighten M3 Allen set screw to lock orientation of head.

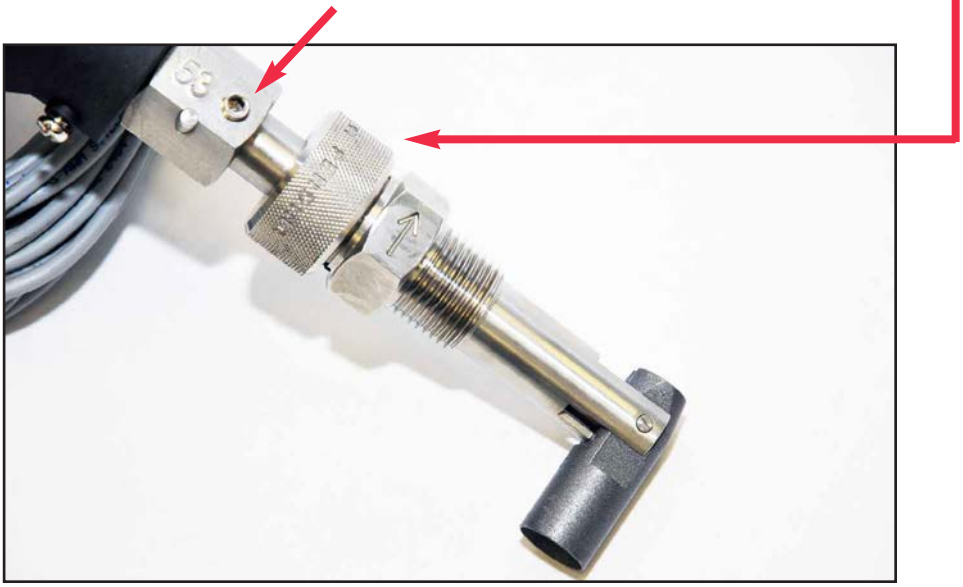


Figure 2-11

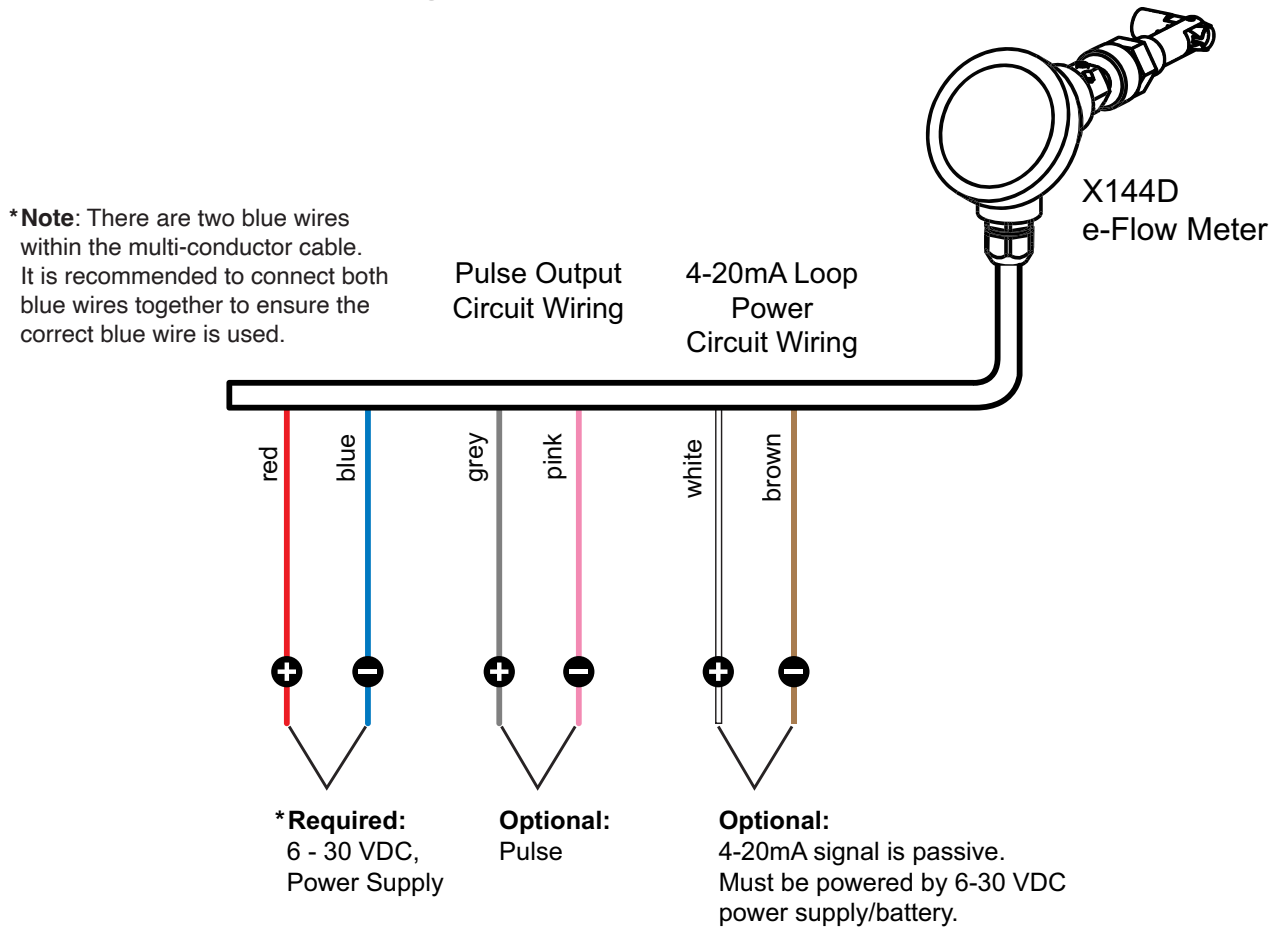
CAUTION: If the e-FlowMeter is not properly seated, it will not hold pressure and will leak. To avoid potential damage from water leaking at the tap, be sure that the e-FlowMeter is tight and seated.

Log onto www.cla-val.com and click on the X144D e-FlowMeter icon to learn more

Section 2: Installation of the X144D e-FlowMeter (continued)

2.5 - Step-By-Step Instructions: Wiring Diagrams

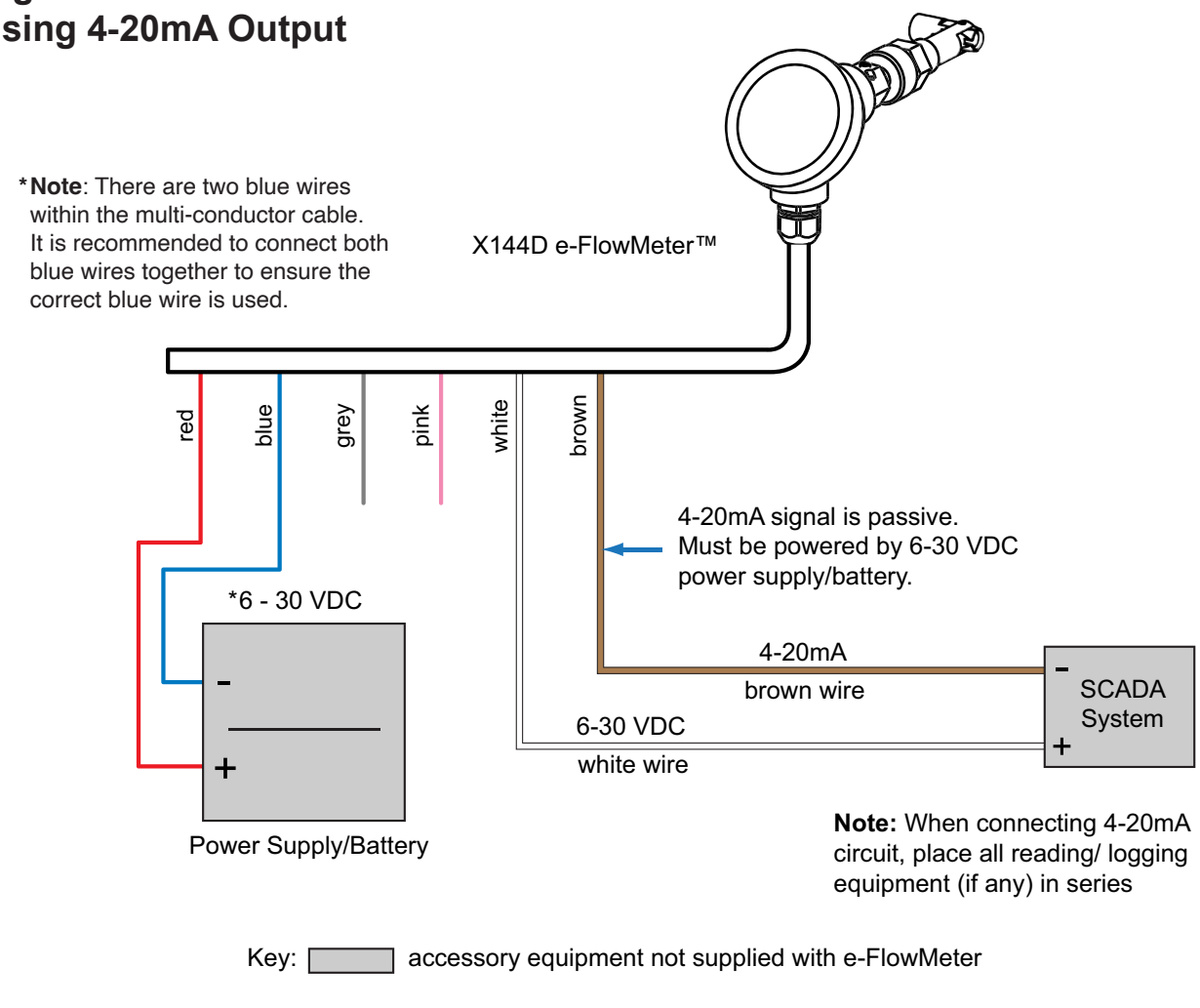
Figure 2-12:
X144D e-FlowMeter Wiring Overview



Section 2: Installation of the X144D e-FlowMeter (continued)

2.5 - Step-by-Step Instructions: Wiring Diagrams

Figure 2-13: X144D e-FlowMeter using 4-20mA Output



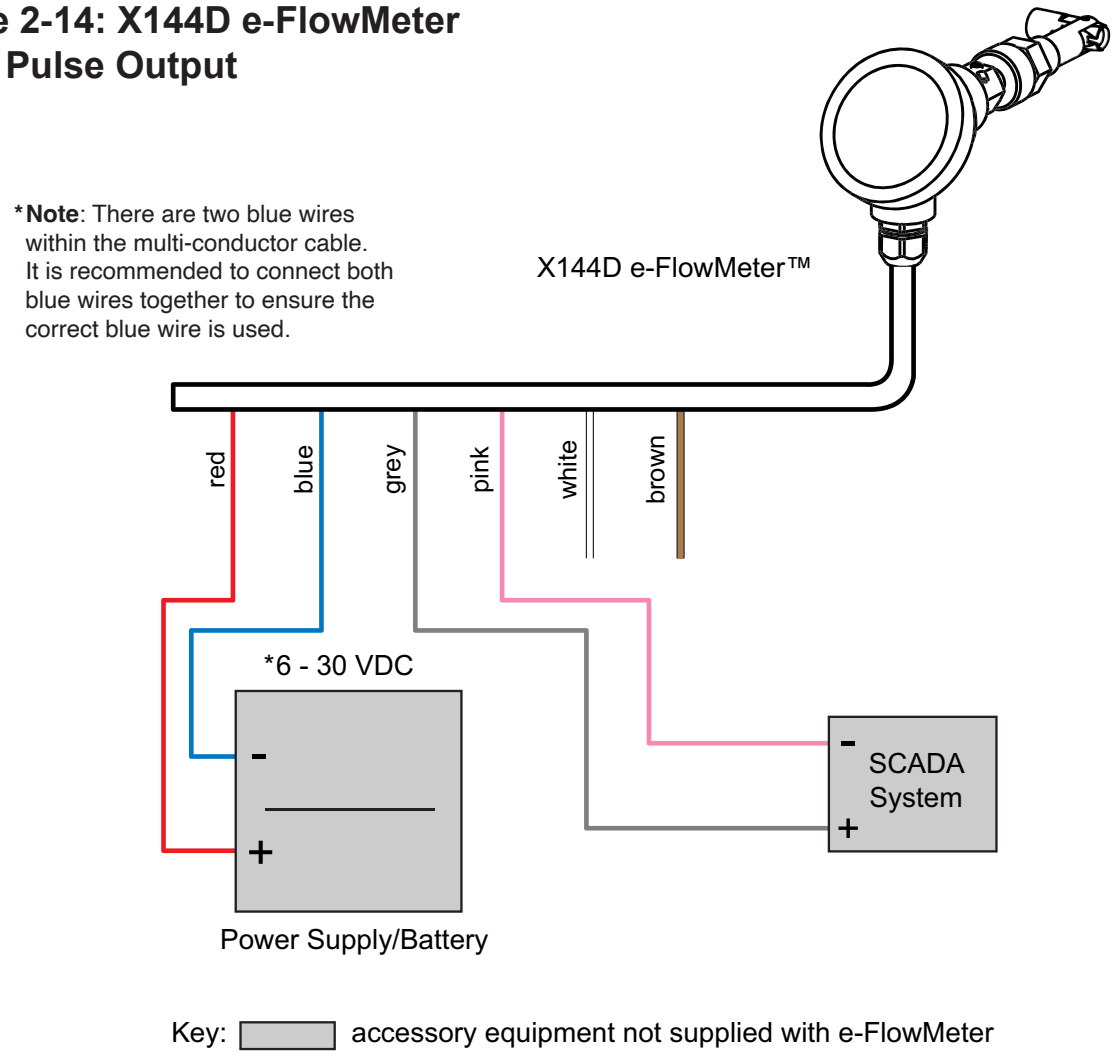
1) Connect V+ and V- wires to 6-30 VDC power source
2) Connect the wires marked 4-20mA (+/-) to the proper recording/measurement device. Connect device per manufacturer's recommendations.
3) If possible, use handheld multi-meter to verify mA readings prior to leaving installation.
   a) When there is no flow present, the X144D e-FlowMeter should read very close to 4.0 mA.

Note: AC/DC converters must be properly grounded in order to prevent electronic noise.

Section 2: Installation of the X144D e-FlowMeter (continued)

2.5 - Step-by-Step Instructions: Wiring Diagrams

Figure 2-14: X144D e-FlowMeter using Pulse Output



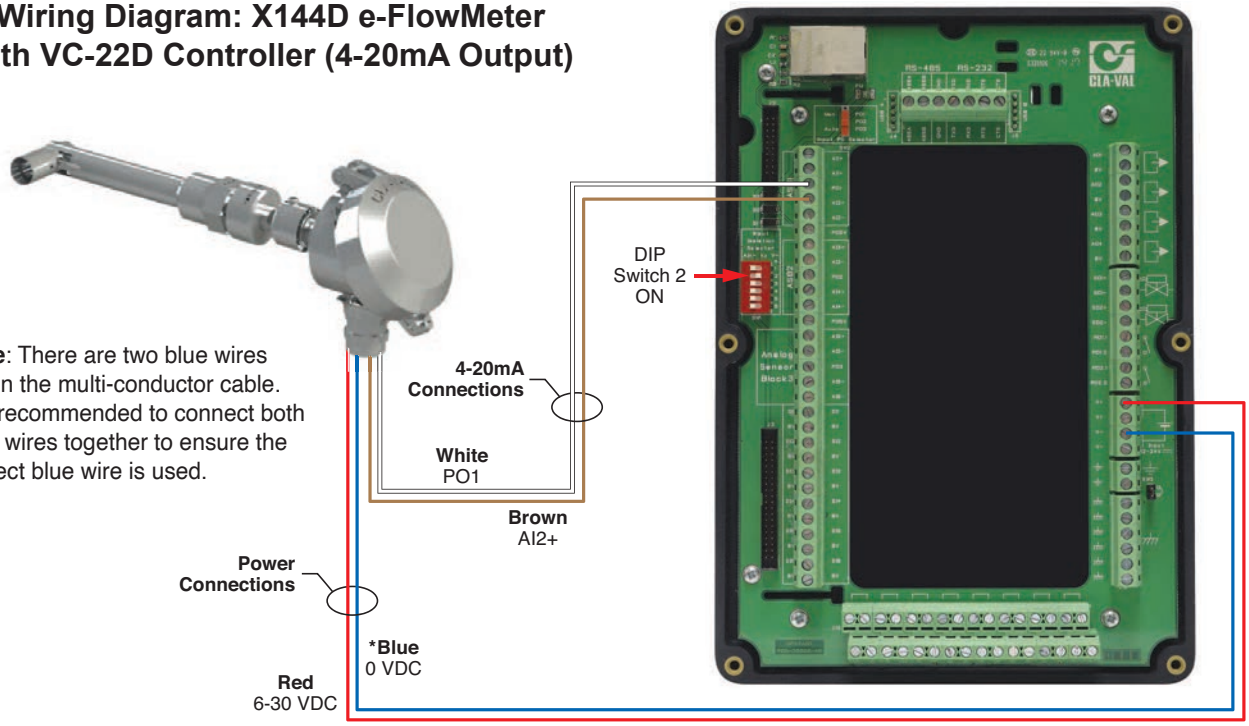
1) Connect V+ and V- wires to 6-30 VDC power source
2) Connect the wires marked pulse (+/-) to the proper recording/measurement device. Connect device per manufacturer's recommendations.

Note: AC/DC converters must be properly grounded in order to prevent electronic noise.

Section 2: Installation of the X144D e-FlowMeter (continued)

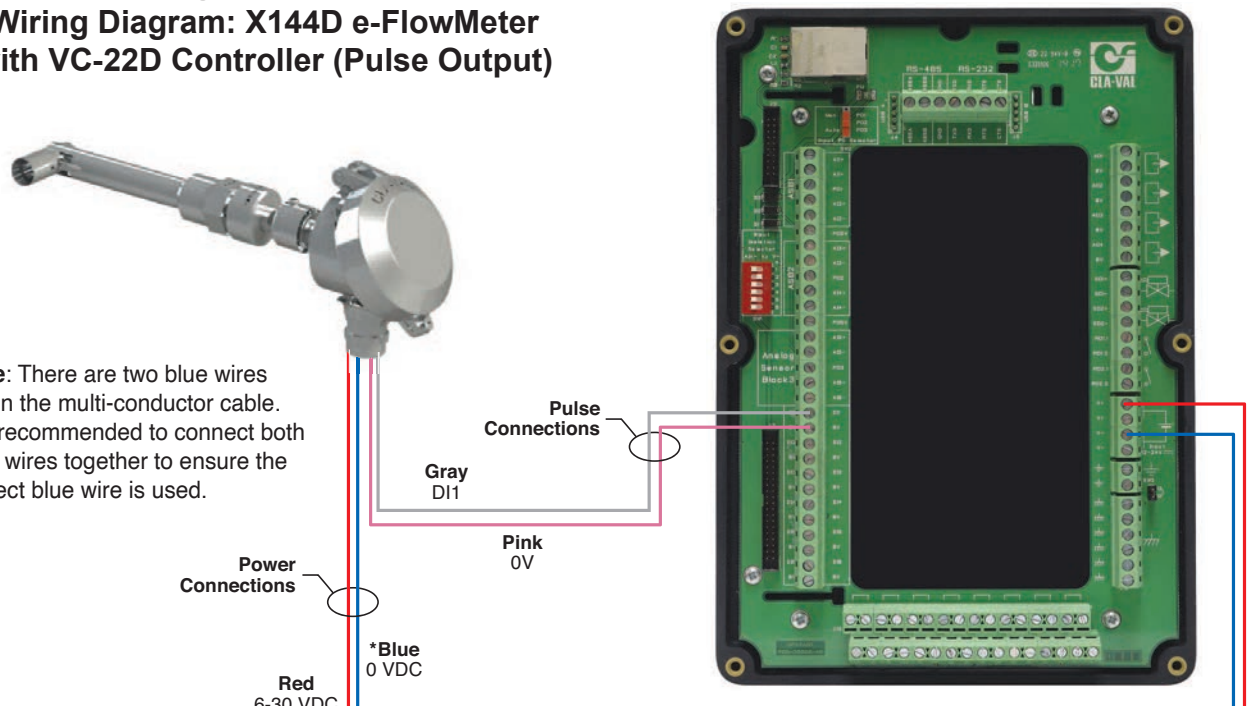
2.6 - Wiring Installation

Figure 2-15:
Wiring Diagram: X144D e-FlowMeter with VC-22D Controller (4-20mA Output)



*Note: There are two blue wires within the multi-conductor cable. It is recommended to connect both blue wires together to ensure the correct blue wire is used.

Figure 2-16:
Wiring Diagram: X144D e-FlowMeter with VC-22D Controller (Pulse Output)



*Note: There are two blue wires within the multi-conductor cable. It is recommended to connect both blue wires together to ensure the correct blue wire is used.

SECTION 3: X144D e-FlowMeter Operation

3.1 – Startup Checklist

Follow this procedure when starting the installation for the first time or after shutting the system down for maintenance of the Control Valve.

1) Check all connections to power supply and other User Devices (data loggers, telemetry, etc.)
2) Ensure all wiring is properly connected per wiring diagrams.
3) Open shut-off valves and allow water into the system.
4) Check the system for water leaks, at both the tapered threads, as well as the straight threads with knurled lock.
5) Check surrounding piping and auxiliary equipment for leaks.
6) Verify X144D is configured to correct valve size.
7) Verify mA scaling between X144D and PLC/display match. (per table 1):

Table1: X144D e-FlowMeter Analog Range (4-20mA Scaling)

Port Style	Line Size inches (mm)	**2" (50) (100-49 Body)	2-1/2" (65)	3" (80)	4" (100)	6" (150)	8" (200)	10" (250)	12" (300)	14" (350)	16" (400)	18" (450)	20" (500)	24" (600)	30" (750)
Full Port Valves 4mA = 0 (GPM - l/s)	20mA Range (GPM)	260	375	575	1000	2250	3900	6000	8750	10500	14000	17500	22000	31000	52000
	20mA Range (l/s)	16.4	23.7	36.3	63.1	142	246	379	552	663	883	1104	1388	1956	3281
Full Port Pulse Weight*	Gal/Pulse	1	1	1	1	1	1	1	2	2	3	3	4	6	9
	l/Pulse	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.13	0.13	0.19	0.19	0.25	0.38	0.57
Reduced Port Valves 4mA = 0 (GPM- l/s)	20mA Range (GPM)	not available			675	1600	2900	4500	5650	7750	9350	Consult Factory			
	20mA Range (l/s)				42.5	101	183	284	356	489	590				
Reduced Port Valves Pulse Weight*	Gal/Pulse				1	1	1	1	1	2	2				
	l/Pulse				0.63	0.63	0.63	0.63	0.63	0.13	0.13				

*2" X144D e-FlowMeter may be installed on new valves only

Note: Consult Factory for Angle Pattern Applications

Log onto www.cla-val.com and click on the X144D e-FlowMeter icon to learn more

SECTION 3: X144D e-FlowMeter Operation

CAUTION 1: Failure to use the provided Insertion Tool **WILL** result in damage to the e-FlowMeter

CAUTION 2: To avoid injury, isolate the valve and bleed pressure prior to removing the e-FlowMeter

3.2 – Shutdown/Removal of X144D e-FlowMeter

1) Close the shut-off valves to stop the flow of water, bleed pressure.
2) Disconnect all wiring.
3) Follow the steps below to remove the X144D e-FlowMeter from the Control Valve.
   a) Unscrew knurled lock and remove the sensor from the threaded insert and set aside, making sure to protect the sensor tip.

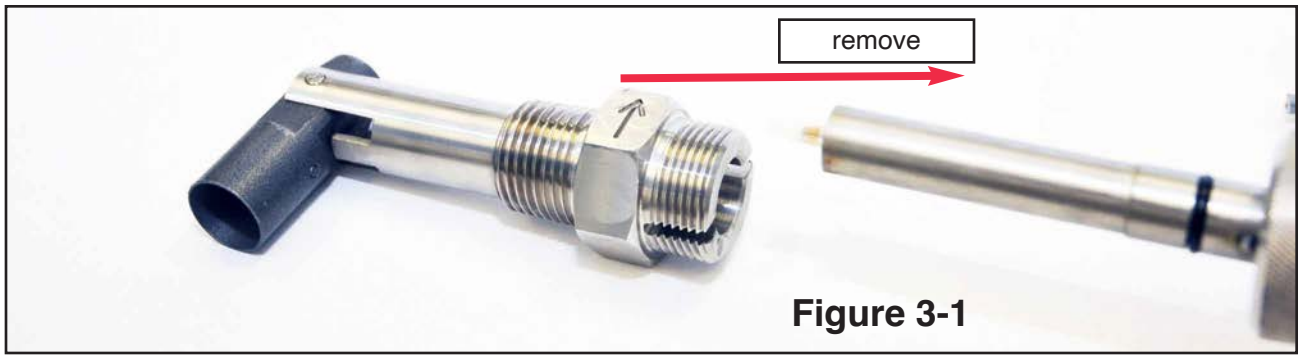


Figure 3-1

b) Orient the Insertion Tool so that the bevel is facing downstream, away from the centering groove, and insert into the threaded insert.

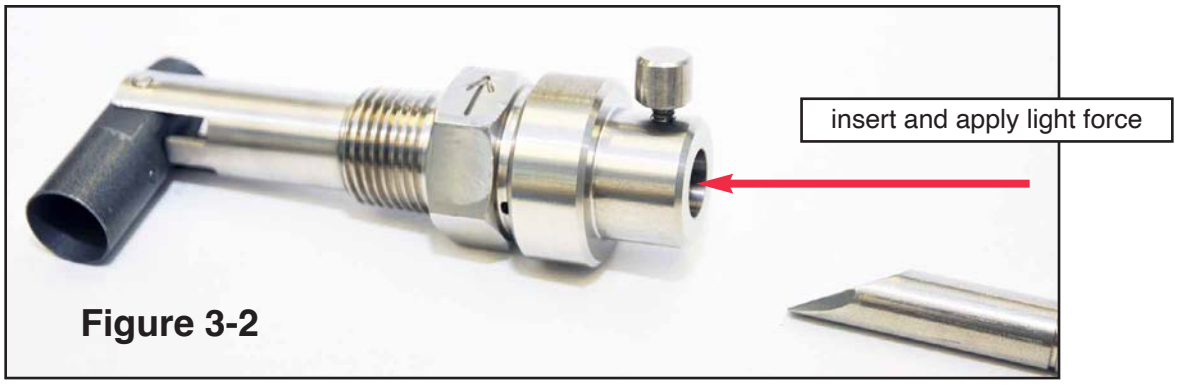


Figure 3-2

c) The tool will engage the top face of the measurement cylinder and force it to the 45° position, as shown below.

Figure 3-3

SECTION 3: X144D e-FlowMeter Operation

3.2 – Stopping Operation / Removal of X144D e-FlowMeter

d) Slide Insertion Tool straight out, then rotate 180 degrees so that the bevel is facing upstream of the valve, which is now facing the same direction of the centering groove, as shown below.

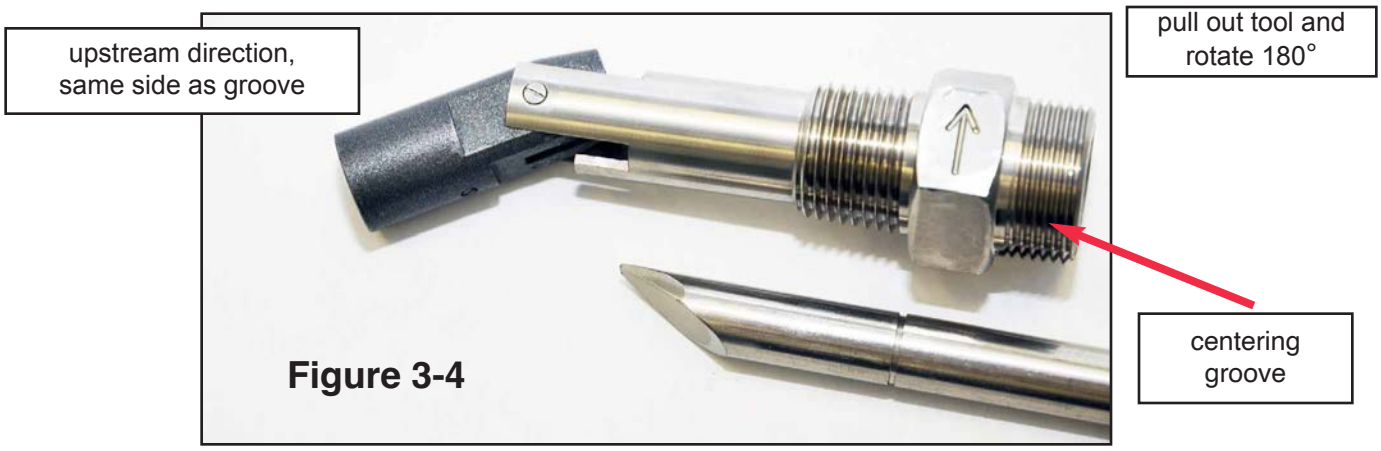


Figure 3-4

e) The lip of the Insertion Tool will engage the inside of the Measurement Cylinder, as shown below.

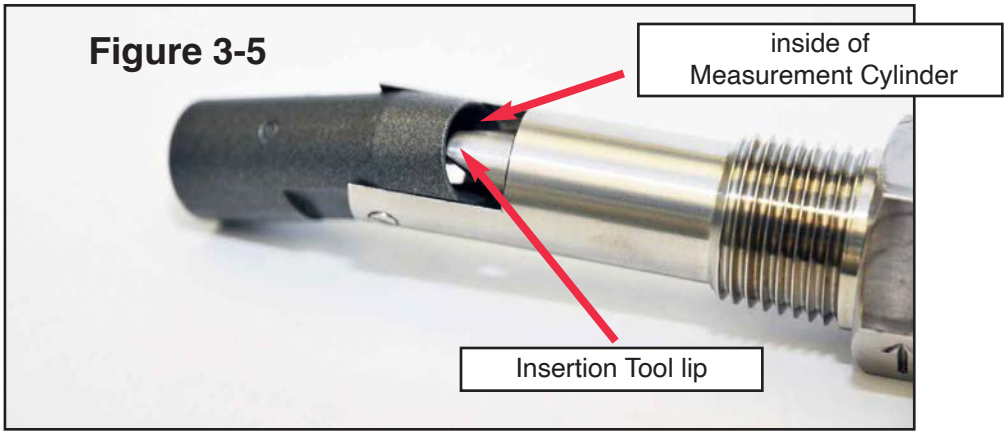


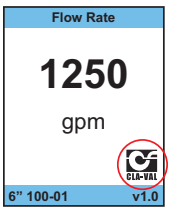
Figure 3-5

f) Once engaged, use light force to straighten the measurement cylinder, and then lock the insertion tool in place with the Insertion Tool lock, as shown below.

Figure 3-6

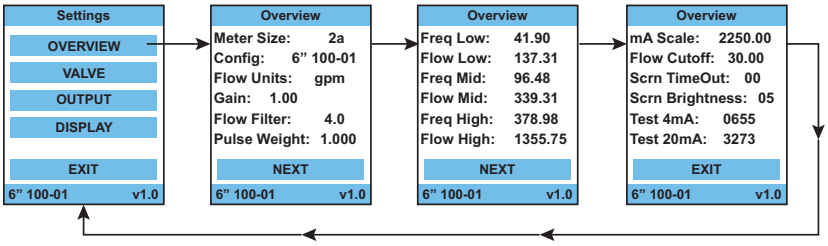
4) Re-install the pipe plug into the open boss of the valve.

SECTION 3.3: Programming



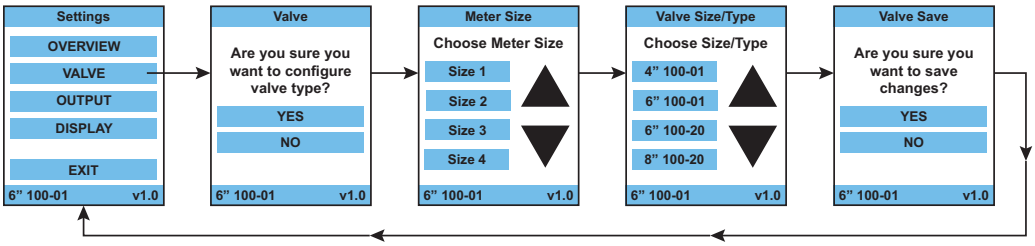
Touch Cla-Val Logo to Access Settings Menu

Overview Menus:



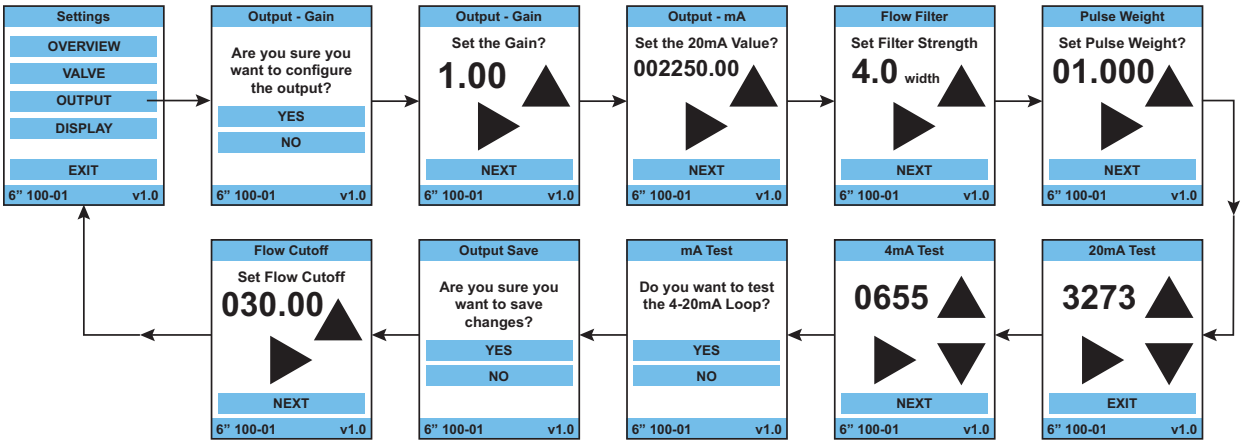
Displays all current parameters, useful when verifying parameters during commissioning. The overview menus display meter size, valve configuration, flow units, gain, flow filter, pulse weight, mA scaling, flow cutoff, screen timeout, screen brightness, and valve calibration.

Valve Selection Menu:



Follow onscreen menu instructions to configure meter size, valve size and valve type. First, select appropriate size meter; size 1, size 2a, size 3, or size 4. Based on meter size selection, a list of valve sizes and type will appear; select valve size that meter is installed in. Once selected, default parameters will populate into the fields described below.

Output Menus:



Gain:
The default setting is 1.00. Use the right and up arrows to configure the gain factor between .01 and 9.99.

20mA Valve:
The 4-20 mA output can be scaled to display flow in engineering units. See Table 1, page 19 for default values. Use the right and up arrows to configure the 20 mA scaling. The 4-20 mA output scaling must match the display/PLC scaling.

Flow Filter:
The flow filter is available for abnormally unstable flows (i.e. near elbows). The flow filter averages the flow signal over a certain period. The default value is 4.0. The level can be set from 1 to 10, low to high respectively. Use the right and up arrows to configure the valve.

Pulse Weight:
The pulse weight corresponds to the total units (e.g. gallons) to generate one pulse. For example if the pulse weight is set to 1, one pulse is generated per gallon. It is recommend the number of pulses per second never exceeds 100. Use the right and up arrows to configure the pulse weight. See table below for default values.

Flow Rate = (# pulses * Pulse Weight) / Time

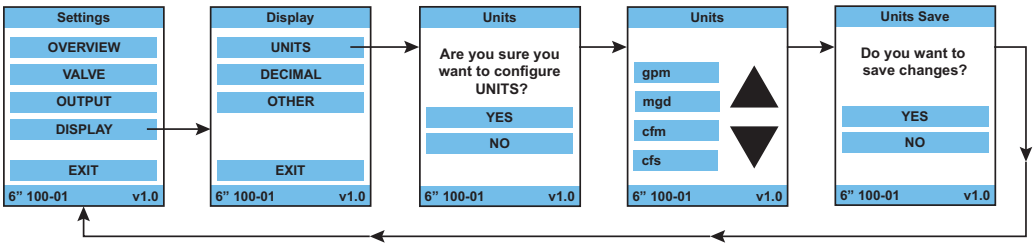
# of pulses per second = (Maximum Flow Rate in gpm / 60) / Pulse Weight

# of pulses must be < 100

Flow Cutoff:
The flow filter is a cutoff feature which allows the meter to be programmed so that any flow reading below the configured value displays zero on the meter. This feature is useful when mechanical vibrations give false flow readings when the valve is closed. Use the right and up arrows to configure value.

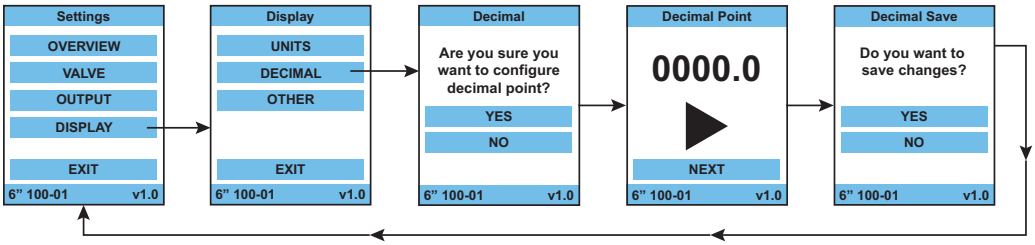
4mA & 20mA Test:
The 4 mA to 20mA test is a tool used to calibrate the 4 – 20 mA output to the display or PLC. Using the right, left and right arrows change the 4mA value unit the display or PLC input reads 4.00 mA. Next, do the same until the 20.00 mA valve is reached.
Once both 4 & 20 mA values are set the test is complete.

Units:



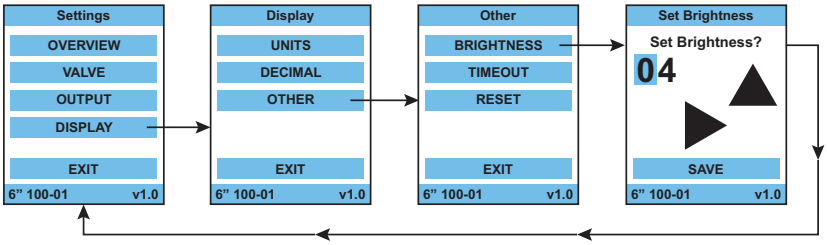
Use the up and down arrows to configure meter to appropriate units. When the correct units have been selected, 20mA scaling, pulse weight and flow cutoff values will update automatically. The following unit options are available, gpm, mgd, cfm, cfs, l/min, l/sec, m3/h, Ml/d, and UK gpm.

Flow Decimal:



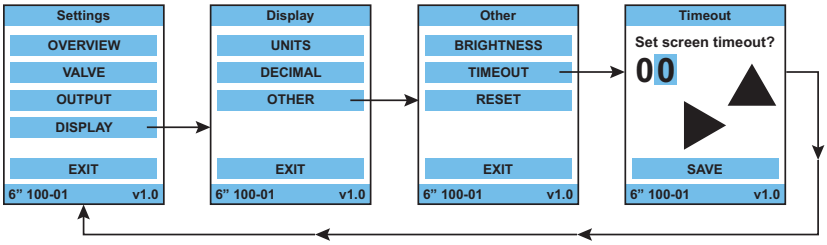
Flow decimal point may be set with up to two decimal places or no decimal point at all. Use the right arrow to configure decimal.

Screen Brightness:



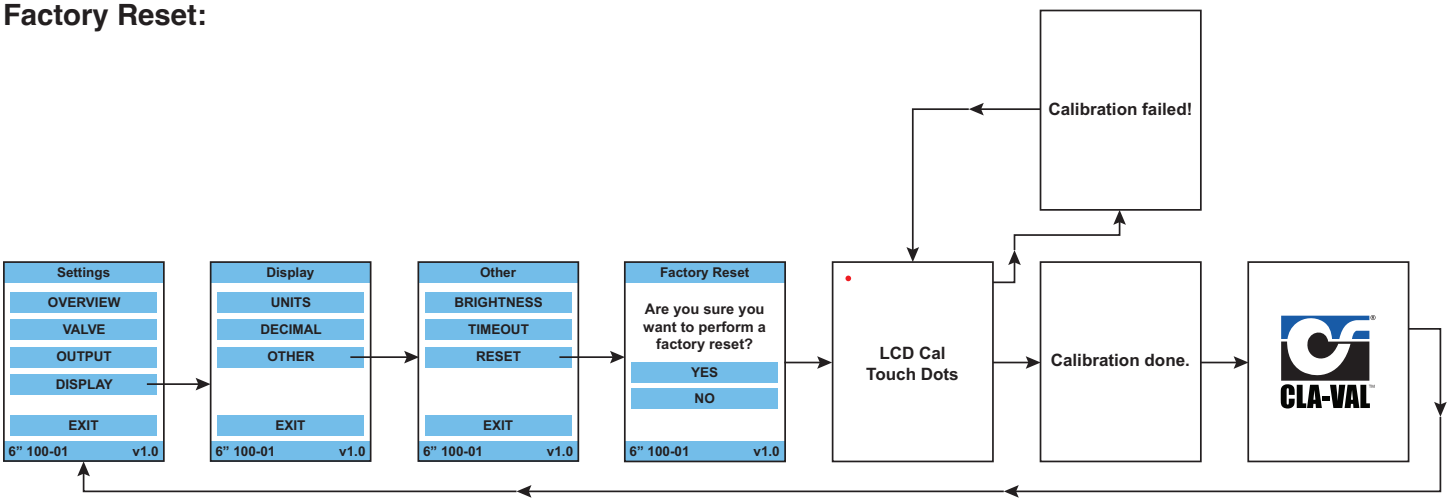
Use to increase/decrease screen brightness. Using a high setting will increase brightness, using a lower setting will reduce brightness. The default setting is 4. Use the right and up arrows to configure from 1 to 10.

Screen Timeout:



Use to configure when the LCD screen goes into sleep mode. Using a value of 00 will prompt the screen to always remain on. Use the right and up arrows to configure between 0 to 10 minutes, in one minute increments.

Factory Reset:



When a factory reset is selected, the LCD screen calibration will be reset and will prompt for recalibration. This should only be done if experiencing touch issues with the screen.

SECTION 4: Maintenance and Repair

4.1 – Routine Maintenance

CAUTION: Always disconnect the power supply, isolate and depressurize the system before performing any maintenance or repair. Failure to so may result in injury to personnel or damage to equipment.

The X144D e-FlowMeter does not have any moving mechanical parts and so is not affected by fatigue wear from mechanical stress. The system should be inspected routinely for leaks. An inspection should consist of the actions in steps 1-2 procedure outlined in section 3.1. It is recommended the equipment be turned off during inspection.

4.2 – Cleaning debris from measurement cylinder

If the readings from the X144D e-FlowMeter begin to act in an unreliable manner, then the measurement cylinder should be inspected and cleaned out to ensure proper operation.

Required Tools:

- Insertion tool
- Adjustable wrench
- Small pick or small screw driver for clearing the debris
- Tweezers or small needle-nosed pliers

CAUTION 1: Failure to use the provided Insertion Tool **WILL** result in damage to the e-FlowMeter

CAUTION 2: To avoid injury, isolate the valve and bleed pressure prior to removing the e-FlowMeter

Procedure

1) Close the shut-off valves to stop the flow of water.
2) Disconnect all wiring.
3) Go through the removal steps (section 3.2) to remove the X144D e-FlowMeter from the Control Valve,using the provided Insertion Tool
4) With the sensor still removed from the threaded insert, inspect measurement cylinder; looking specifically for debris caught on the bluff body, as shown in Figure 4-1.
5) Use pick or small screw driver and tweezers to remove all of the debris from the measurement cylinder, bluff body and anywhere else that it has accumulated.
6) Reinstall X144D according to the installation steps in section 2; verify operation per operation instructions in section 3.

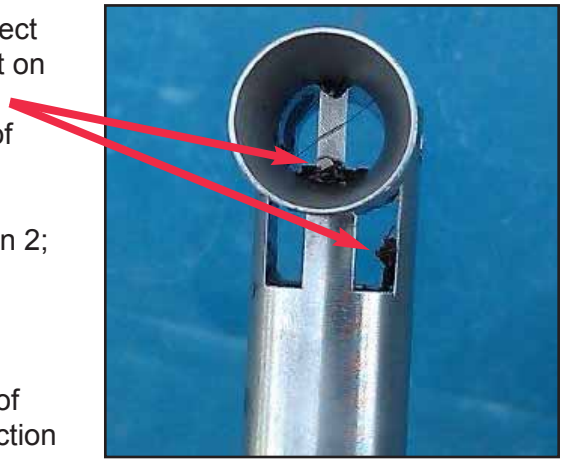


Figure 4-1

4.3 – Dealing with Sensor Tip Damage

1) If the Sensor Tip is bent, broken or damaged in the course of handling or installation, the X144D e-FlowMeter will not function properly. The sensor should be straight with respect to the sleeve. Since it is designed to sense micro-motion, if the sensor is forced to enough to detect the movement with the naked eye, it may have been damaged. In that case, contact Cla-Val Customer Service.

SECTION 5: Specifications

Table 2: Electrical Specifications

Enclosure	Stainless Steel (standard)
Output Signal Options: • Digital Pulse, proportional to flow rate • Transistor (NPN) Pulse, proportional to flow rate	• Analog output: 4 mA to 20 mA analog current loop • Current proportional to flow rate • Power supply: 6 VDC to 30 VDC compliance; 0.7 watts • 4 mA - zero flow; 20 mA maximum flow as listed in Table 6 below • Other 20 mA settings can be configured by the factory or reconfigured in the field by authorized personnel
Display Option	• LCD display alternately shows one lines of seven-digit data; i.e. flow rate + totalizer

Table 3: Mechanical Specifications

Type	Fixed Insert
Measurable Fluids	• Drinking Water • Irrigation Water • Reclaimed Water
Valve Sizes	Full Port: 2.5, 3, 4, 6, 8, 10, 12, 16-incl
Fluid Temperature	15° F - 175° F (-10° C - 80° C)
Fluid Pressure	The pressure rating for the X144D e-F is not greater than the pressure rating it is installed
Classification	IP 68 Submersible
Ambient Temperature	-20° F to 140° F (-29° C - 60° C)
Flow Range	• Minimum: 0.5 foot per second (FPS) • Maximum: 20.0 foot per second (FP
Measuring Units	• English US Gallons Per Minute (GPI • Metric: Liters per second
Accuracy (combined linearity and repeatability)	• +/-2 % of full scale
Wetted Parts	• Vortex Sensor: (plastic) • Measurement Cylinder and Bluff Bo Steel • Stem: Stainless Steel • O-Rings: BUNA N • Compression Fitting: 304 Stainless S
Straight Pipe Run	See Recommended Installation Cha

Clearance from wall or other obstruction	2”	2-1/2”	3”	4”	6”	8”	10”	12”	16”
	10.0”	10.0”	10.0”	10.5”	10.5”	14.25”	14.25”	19.0”	19.0”

SECTION 5: Specifications (continued)

Dimensional Data

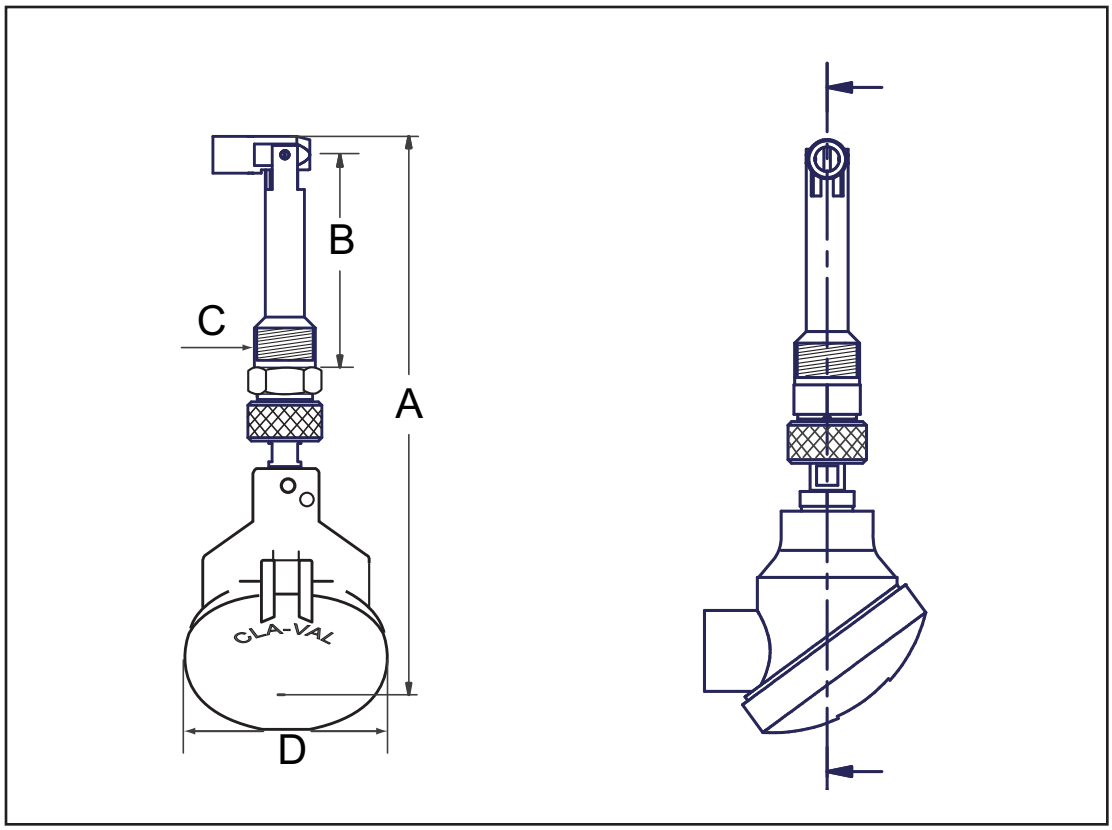


Figure 5-1: X144D e-FlowMeter

Table 4: X144D e-FlowMeter Dimensions

X144D Sizes		1			2		3		4						
Full Port Valve Sizes (inches)		2	2-1/2	3	4	6	8	10	12	14	16	18	20	24	30
Reduced Port Valve Sizes (inches)		4	4	4	6	8	10	12	14	16	18	20	24	CF	CF
Overall Length (in inches)	A	8.85	8.85	8.85	9.45	9.45	13.18	13.18	17.91	17.91	17.91	17.91	17.91	17.91	17.91
Insertion Length (in inches)	B	2.3	2.3	2.3	2.8	2.8	6.8	6.8	11.25	11.25	11.25	11.25	11.25	11.25	11.25
Pipe Thread (NPT)	C	1/2	1/2	1/2	3/4	3/4	1	1	1	1	1	1	1	1	1
Overall Width (in inches)	D	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25

*2" X144D e-FlowMeter may be installed on new valves only
Note: Consult Factory for Angle Pattern Applications

Insertion Tools: Overall Length

- T_1 = 6-1/2”
- T_2 = 14-1/2”

Figure 5-2: X144D Insertion Tool - T_1

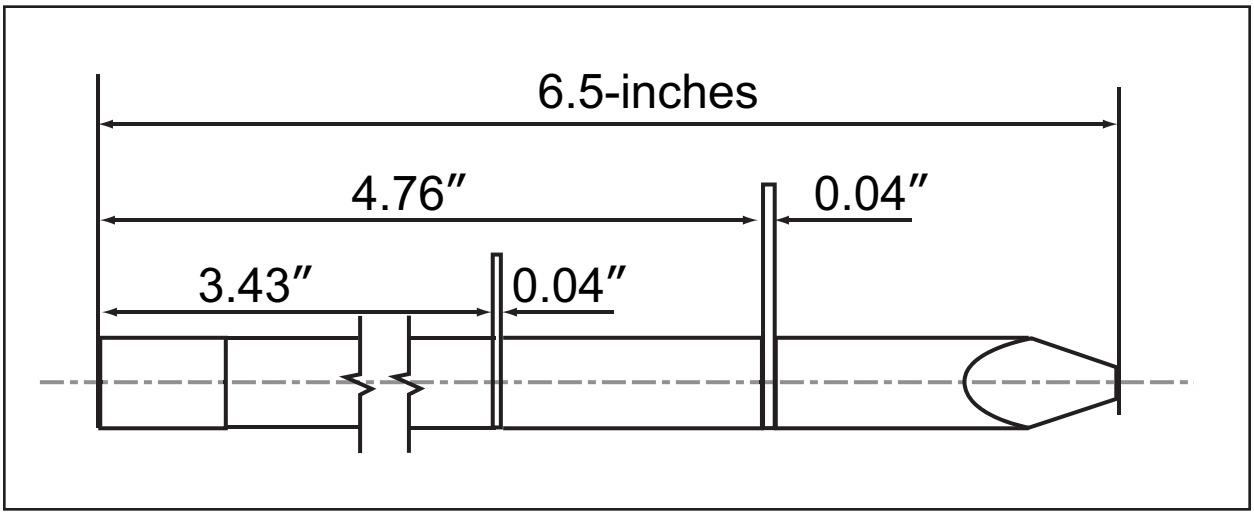


Figure 5-3: X144D Insertion Tool - T_2

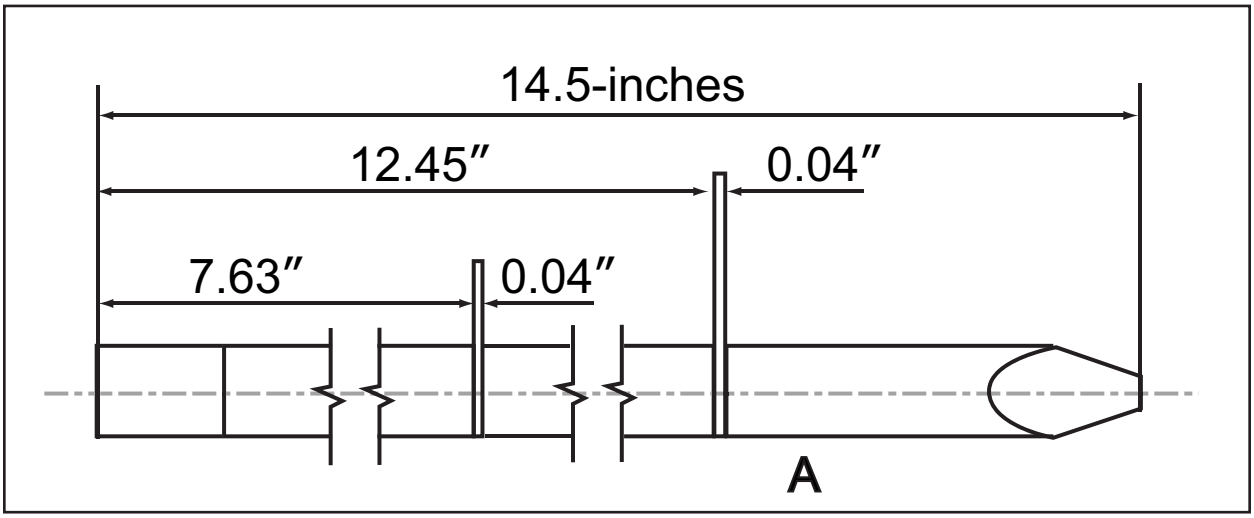


Table 5: X144D Insertion Tools

X144D Size	2"	2-1/2"	3"	4"	6"	8"	10"	12"	16"
Tool	T_1	T_1	T_1	T_1	T_1	T_2	T_2	T_2	T_2

SECTION 5: Specifications (continued)

Table 6: X144D e-FlowMeter Operational Flow Ranges

Line Size inches (mm)	*2" (50mm) (100-49 Body)	2-1/2" (65mm)	3" (80mm)	4" (100mm)	6" (150mm)	8" (200mm)	10" (250mm)	12" (300mm)	16" (400mm)
Minimum Flow (GPM)	10	10	15	20	45	80	130	180	280
Maximum Flow (GPM)	210	300	460	800	1800	3150	4950	7000	11000
Minimum Flow (l/S)	0.63	0.63	0.95	1.3	2.8	5.0	8.2	11.3	17.7
Maximum Flow (l/S)	13.3	18.9	29	50	113	200	312	442	694

If required, the factory settings of the e-FlowMeter can be adjusted. A Cla-Val USB Adapter Cable is required and can be ordered by contacting the factory at 800.942.6326.
Go to **http://www.cla-val.com/software-driver-library.php** for software/instructions.

Table 7: X144D e-FlowMeter Analog Range (4-20mA Scaling): Factory Settings

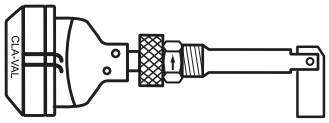
Port Style	Line Size inches (mm)	**2" (50) (100-49 Body)	2-1/2" (65)	3" (80)	4" (100)	6" (150)	8" (200)	10" (250)	12" (300)	14" (350)	16" (400)	18" (450)	20" (500)	24" (600)	30" (750)
Full Port Valves 4mA = 0 (GPM - l/s)	20mA Range (GPM)	260	375	575	1000	2250	3900	6000	8750	10500	14000	17500	22000	31000	52000
	20mA Range (l/s)	16.4	23.7	36.3	63.1	142	246	379	552	663	883	1104	1388	1956	3281
Full Port Pulse Weight*	Gal/Pulse	1	1	1	1	1	1	1	2	2	3	3	4	6	9
	l/Pulse	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.13	0.13	0.19	0.19	0.25	0.38	0.57
Reduced Port Valves 4mA = 0 (GPM-l/s)	20mA Range (GPM)	not available			675	1600	2900	4500	5650	7750	9350	**Consult Factory**			
	20mA Range (l/s)				42.5	101	183	284	356	489	590				
Reduced Port Valves Pulse Weight*	Gal/Pulse				1	1	1	1	1	2	2				
	l/Pulse				0.63	0.63	0.63	0.63	0.63	0.13	0.13				

Notes: * Ancho de Pulso = 250ms.
**2" X144D e-FlowMeter may be installed on new valves only. Consult Factory for Angle Pattern Applications

X144D e-FlowMeter
Quick Start Installation & Removal Instructions

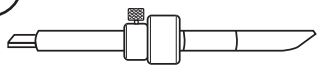
X144D e-FlowMeter Included Hardware

1 **Complete e-FlowMeter Assembly**

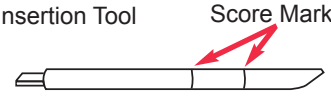


patent pending

2 **Complete Installation Kit**



a) Insertion Tool — Score Marks



b)

Thumb Set Screw — Locking Collar

Parts List

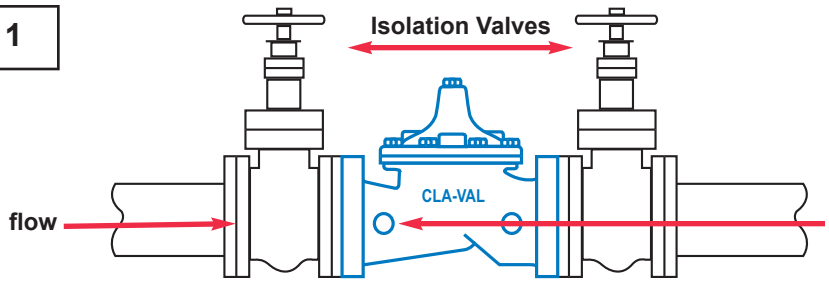
1) X144D e-FlowMeter Assembly with 30 foot cable
2) Installation Kit containing:
   a) Insertion Tool
   b) Locking Collar with Thumb Set Screw (a and b come assembled)

Installation Kit Part Numbers:

Small (2.5" - 6" + 8" reduced Port): 208450-21K
Large (8" Full Port - 16"): 208450-20A

Step-By-Step X144D e-FlowMeter Installation Instructions

1

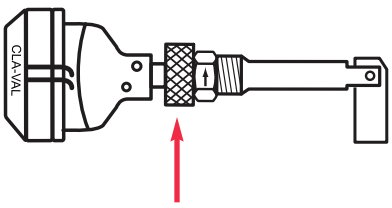


Step 1: Take necessary safety precautions

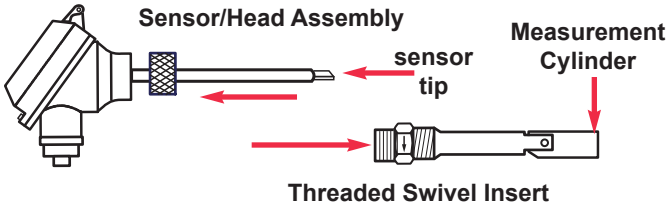
- Isolate the control valve using main line isolation valves
- Bleed pressure from valve before removing body plug
- Remove an inlet body plug

NOTE: If both inlet body tappings are used for the pilot system, consult factory for correct modification instructions.

2

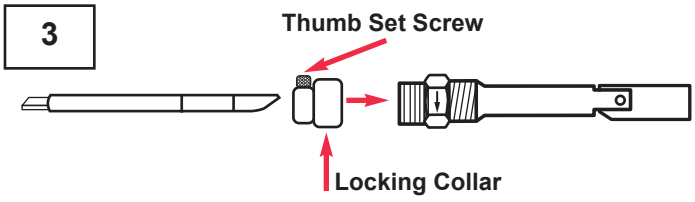


Step 2A:
Loosen Knurled Lock Nut on e-FlowMeter Assembly

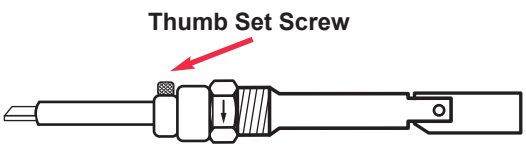


Step 2B: Pull apart. Straighten Measurement Cylinder by hand. Set aside Sensor/Head in safe location, protecting sensor tip

3

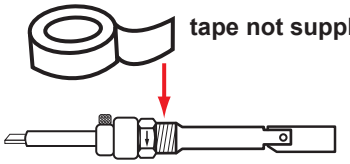


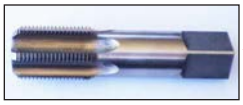
Step 3A: Screw Locking Collar on straight threads. Insert angled end of provided tool as shown, until it stops



Step 3B: Tighten Thumb Set Screw

4

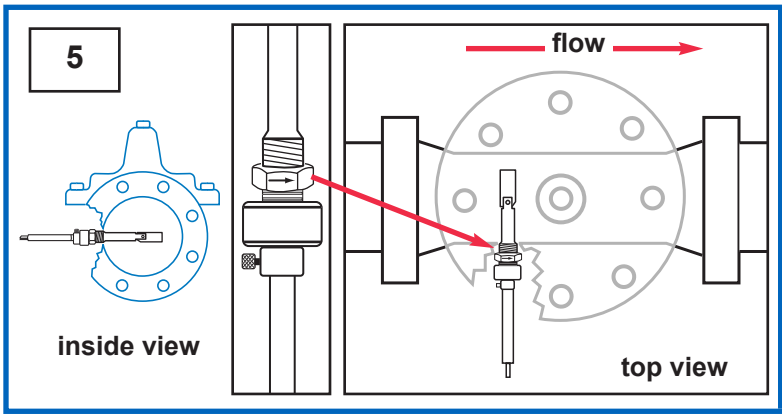




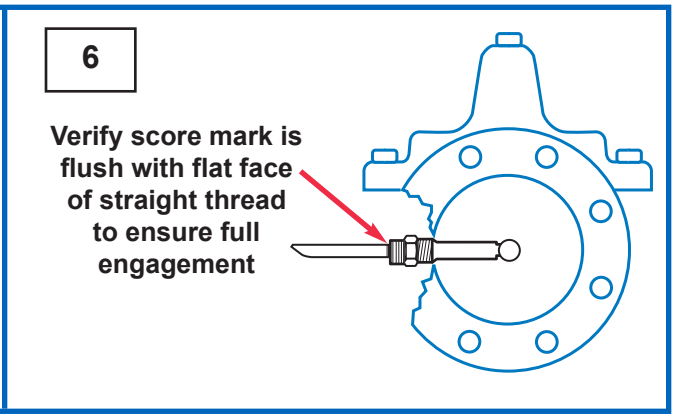
Step 4: Apply Teflon® tape to NPT Threads

- Check threads on valve
- Use thread chasing tool (not supplied), if necessary

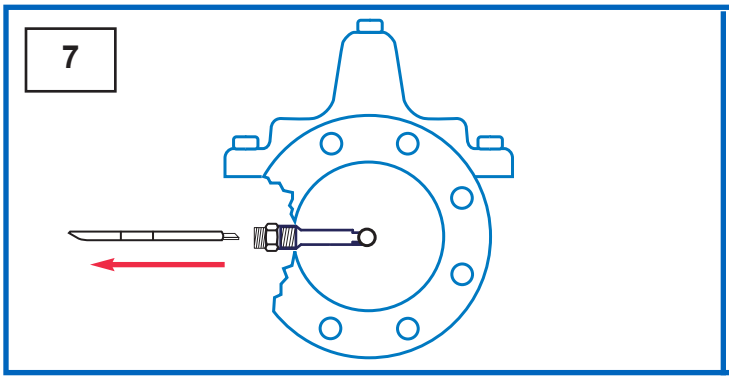
Step-By-Step X144D e-FlowMeter Installation Instructions (continued)



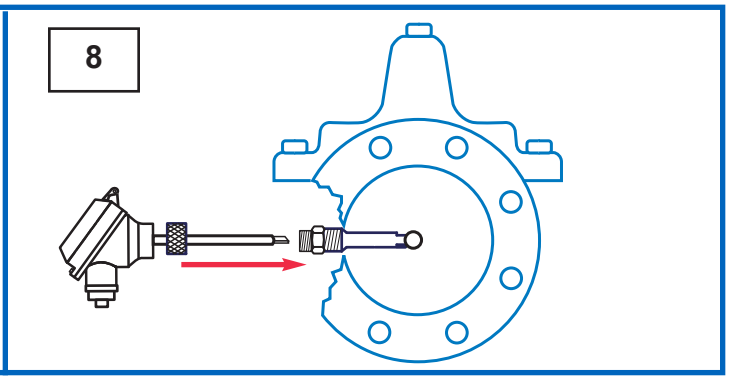
Step 5: Insert straightened Swivel Insert/Measurement Cylinder Assembly into valve, orient arrow on wrench flat to point downstream



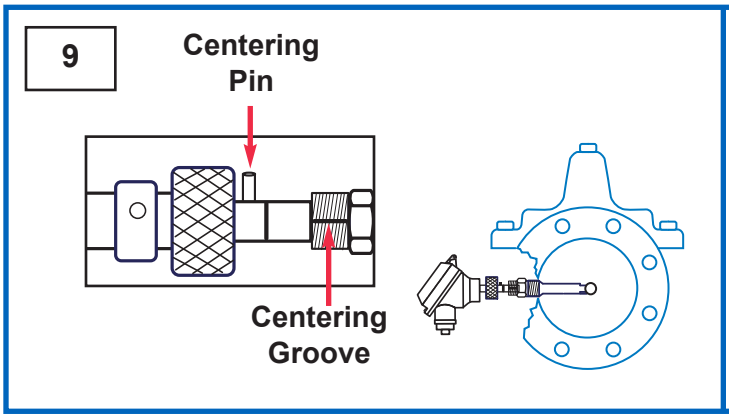
Step 6: Loosen Thumb Set Screw. Remove Locking Collar from tool. Remove tool and re-insert opposite end into Swivel Assembly. Engage the tool and push firmly to orient Measurement Cylinder 90˚ into flow path



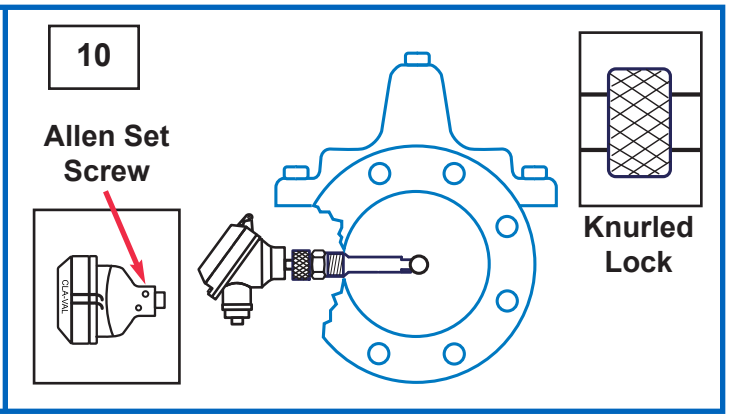
Step 7: Remove tool from Threaded Swivel Insert



Step 8: Insert tip of e-FlowMeter Sensor/Head Assembly into Threaded Swivel Insert



Step 9: Line-Up Centering Groove on straight threads with Centering Pin; push to seat o-ring



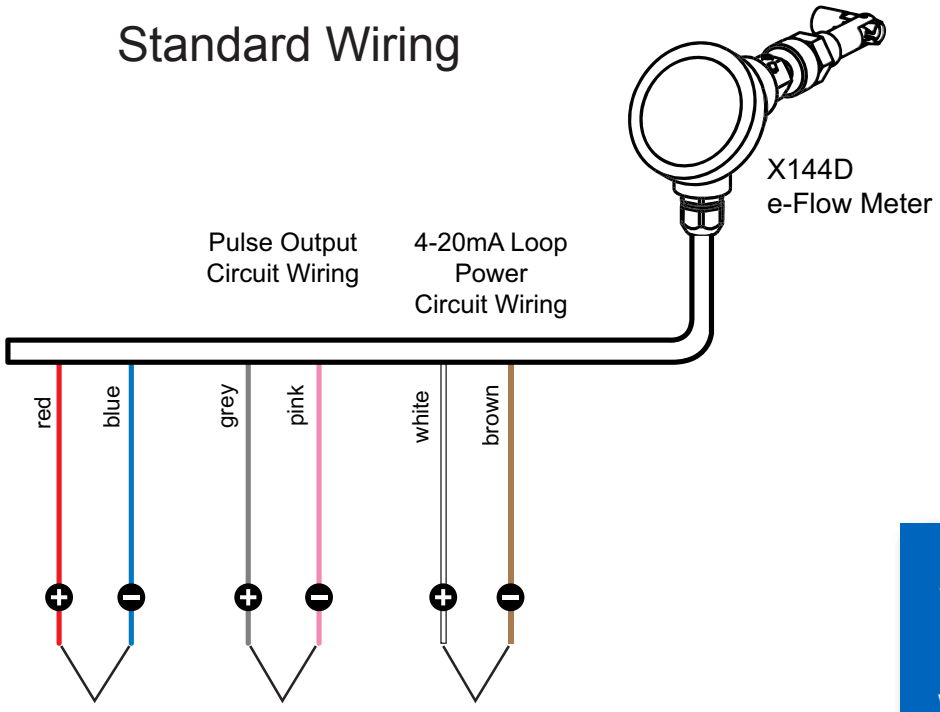
Step 10: **HAND TIGHTEN** Knurled Lock onto straight threads. Tighten Allen Set Screw with M3 Allen Wrench to lock Sensor Head Assembly.

Proceed in accordance with Wiring Diagram

X144D e-FlowMeter

Quick Start Installation & Removal Instructions

Standard Wiring



***Required:** 6 - 30 VDC, Power Supply

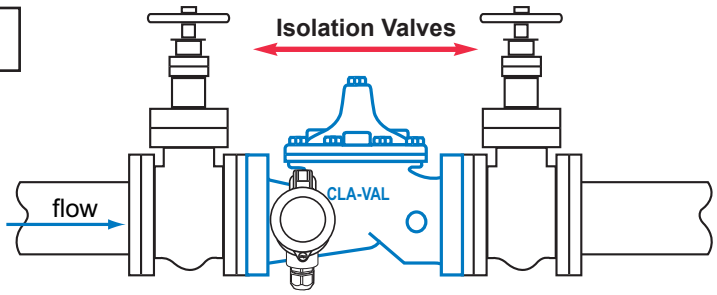
Optional: Pulse

Optional: 4-20mA signal is passive. Must be powered by 6-30 VDC power supply/battery.

for additional wiring diagrams, download N-144 IOM Manual at www.cla-val.com

Step-By-Step X144D e-FlowMeter Removal Instructions

1



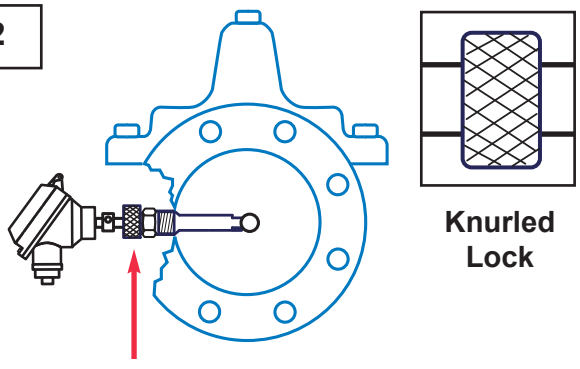
Step 1: Take necessary safety precautions

a) Isolate the control valve using main line isolation valves

b) Bleed pressure from valve before removing the e-FlowMeter

c) Disconnect power to all electronic devices on valve, including e-FlowMeter

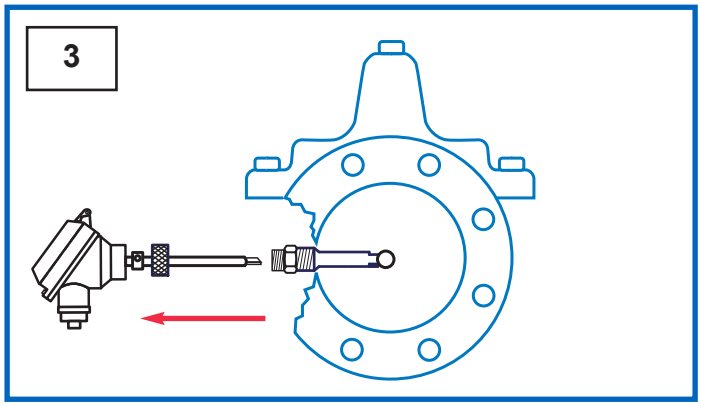
2



Step 2: After isolating the valve, bleeding pressure and disconnecting electronic devices, hand loosen the Knurled Lock from straight threads

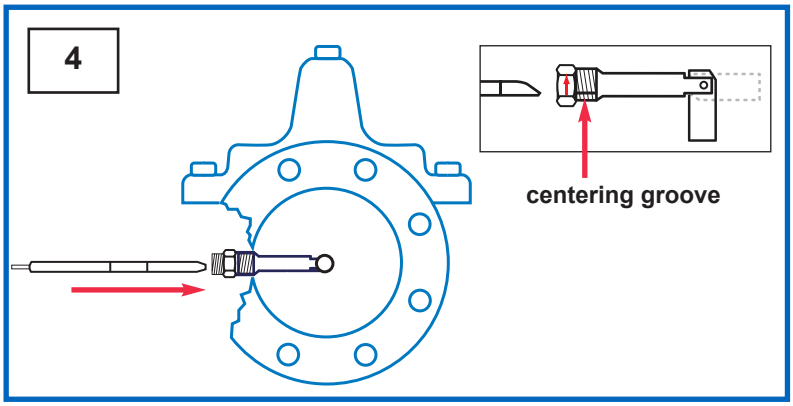
call 800.942.6326 for assistance or log-on to www.cla-val.com for more information

Step-By-Step X144D e-FlowMeter Removal Instructions (continued)



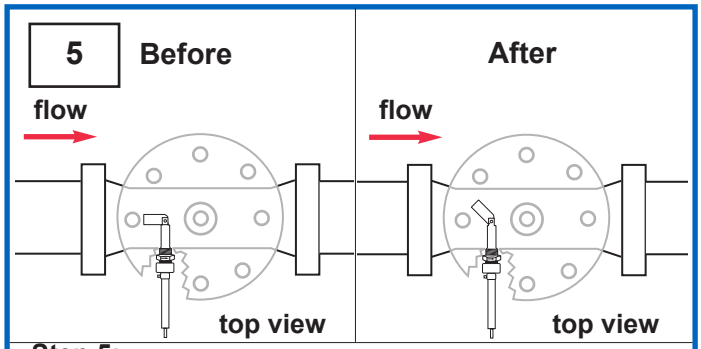
Step 3:

- Remove the e-FlowMeter Sensor/Head Assembly by pulling straight outward, being careful not to hit the sensor tip on the Threaded Swivel Insert tube
- Set Sensor/Head Assembly aside, taking care to protect the sensor tip



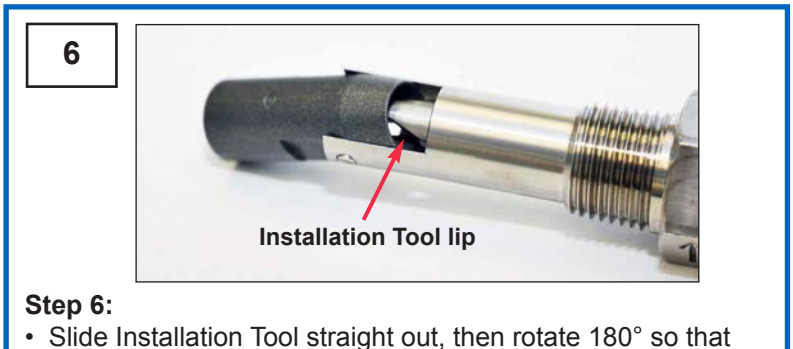
Step 4:

- Orient the Installation Tool so that the bevel is facing downstream, away from the centering groove as shown in detail drawing, and insert into the Threaded Swivel Insert



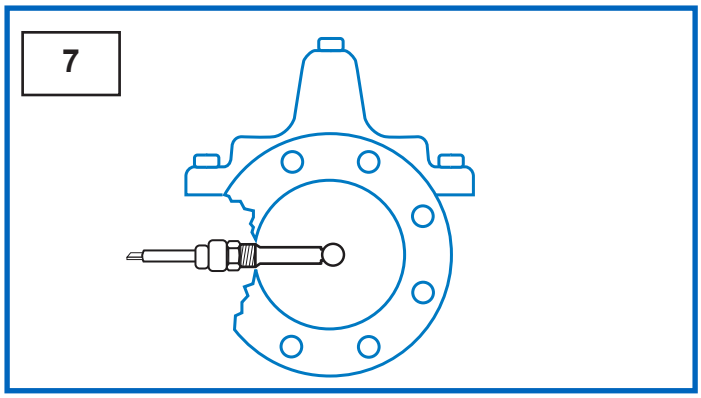
Step 5:

- Once inserted into the Threaded Swivel Insert tube, the Installation Tool will engage the top face of the Measurement Cylinder and force it to the 45° position, as shown above



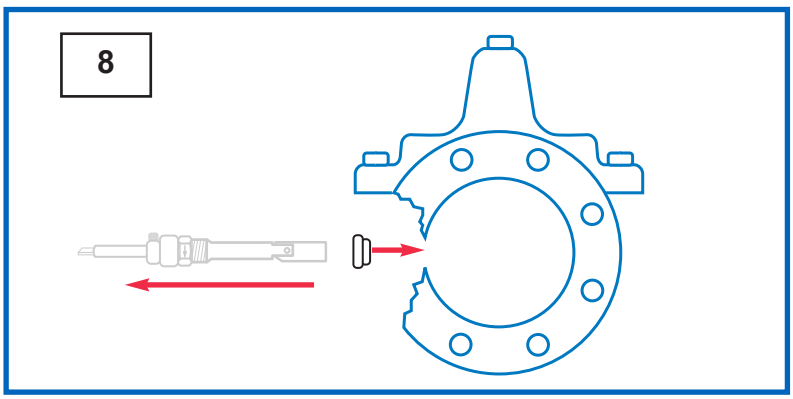
Step 6:

- Slide Installation Tool straight out, then rotate 180° so that the bevel is facing upstream of the valve, which is now facing the same direction of the centering groove, see above
- The lip of the Installation Tool will engage the inside of the Measurement Cylinder as shown in photo



Step 7:

- Once engaged, use light force to straighten the measurement cylinder, and then secure the Installation Tool in place with Locking Collar in locked position

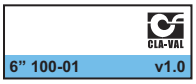


Step 8:

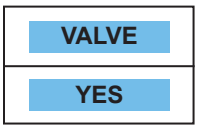
- Remove Threaded Swivel Insert from the valve tapping with the Measurement Cylinder straightened
- Insert body plug into tapping while servicing the e-FlowMeter

SETTINGS – VALVE (Adjust meter size and valve size parameters)

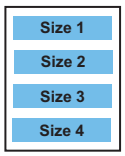
Note: Stylus Pen Recommended for Touch Screen Programming



From Flow Rate or Sensor Frequency screen, select CLA-VAL to access **Settings** menu.



Select **VALVE** then **YES** to configure meter size

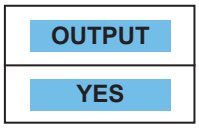


Select correct METER size from chart below

X144D Sizes	1			2		3		4						
Full Port Valve Sizes	2	2-1/2	3	4	6	8	10	12	14	16	18	20	24	30
Reduced Port Valve Sizes	4	4	4	6	8	10	12	14	16	18	20	24	CF	CF

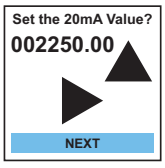
Save configuration

SETTINGS – OUTPUT (Adjust Gain, mA Scaling, mA Filtering, Pulse Weight, and 4-20mA Output Test)

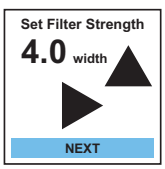


Select **OUTPUT** then **YES** to configure output.

Default Gain is 1.00. Use arrow keys to adjust gain to desired value. Increasing or decreasing value offsets factory calibration. Select **NEXT** to continue.



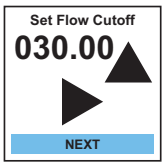
Use arrow keys to set 20mA Full Scale Output. Match 20mA value to customer display and/or SCADA. Select **NEXT** to continue.



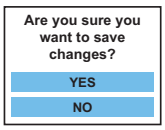
Default Filter is 4.00. Use arrow keys to increase or decrease filtering of 4-20mA signal. The higher the average filter strength, the longer the averaging time. Select **NEXT** to continue.

SETTINGS – OUTPUT (Continued)

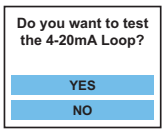
Default Pulse Weight is 1.00. Use arrow keys to increase or decrease Pulse Weight.
Flow Rate = Number of Pulses x Pulse Weight / Time. Select **NEXT** to continue.



This setting is used to set a minimum flow reading that is displayed on screen before displaying zero flow. This is used when noise or vibration is causing erratic low flow readings when there is no flow. Select **NEXT** to continue.



To save changes select **YES** .
To discard changes and advance to next menu select **NO** .

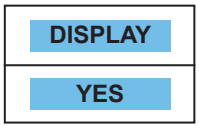


To test 4 and 20mA outputs select **YES** . To return to settings menu select **NO** .

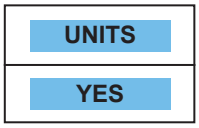
In this menu, a 4mA output signal is generated. To calibrate 4mA output to external device, use arrow keys to increase or decrease 4mA output. A Digital Multimeter to measure 4mA output.
Select **NEXT** to continue to 20mA test.

In this menu, a 20mA output signal is generated. To calibrate 20mA output to external device, use arrow keys to increase or decrease 20mA output. A Digital Multimeter to measure 20mA output Select **EXIT** to return to Settings Menu.

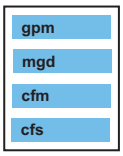
SETTINGS – DISPLAY – UNITS



Select **DISPLAY** to configure display settings.

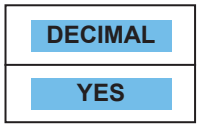


Select **UNITS** then **YES** to configure units settings.



Select desired flow units for flow rate display. Select **YES** to save changes or **NO** to discard changes and return to **DISPLAY** menu.

DISPLAY – DECIMAL



Select **DECIMAL** then **YES** to configure decimal settings.

Use arrow key to select decimal point for flow rate home screen. Select **YES** to save changes or **NO** to discard changes and return to **DISPLAY** menu.

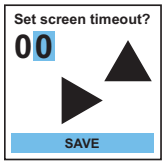
DISPLAY – OTHER – BRIGHTNESS

Select **OTHER** then **BRIGHTNESS** to configure screen brightness.

Use arrow keys to select desired brightness. Select **SAVE** to save changes and return to **OTHER** menu.

OTHER – TIMEOUT

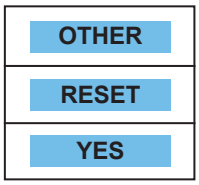
Select **TIMEOUT** to configure screen sleep.



Use arrow keys to select desired duration before screen goes into sleep mode.

Select **SAVE** to save changes and return to **OTHER** menu. Use Timeout if powering from battery source to save power consumption. If screen Timeout is set to 00 minutes, display will not go into sleep mode.

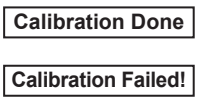
OTHER – RESET



Select **RESET** → **YES** to initiate Touch Screen Calibration.

Select **NO** to return to **OTHER** menu.

Touch RED dots as they appear on touch screen.



Successful Touch Screen Calibration will result in message **Calibration Done** .

Touch **Calibration Done** to reboot and return to home screen. If message **Calibration Failed!** is displayed, touch **Calibration Failed!** and repeat Touch Screen Calibration until successful calibration.

Menu Structure Overview

X144D e-FlowMeter Troubleshooting Guide
(Along with this document, please refer to the X144D IOM)

Notes:
- Please thoroughly review the X144D IOM for comprehensive installation instructions before using this document.

Most Common Problems:

Flow Meter - LCD Screen Blank

1. Verify display is not in sleep mode by touching screen to turn on display.

The flow meter works on a range of 6 – 30 VDC. If reading is not displayed, check to see if the flow meter is receiving power by following the procedure below:

1. Connect the multi-meter positive probe to the red positive incoming wire.
2. Connect the multi-meter negative probe to the blue negative incoming wire.
3. Verify the multi-meter is set to read voltage.
4. Confirm voltage is measured between 6-30 VDC

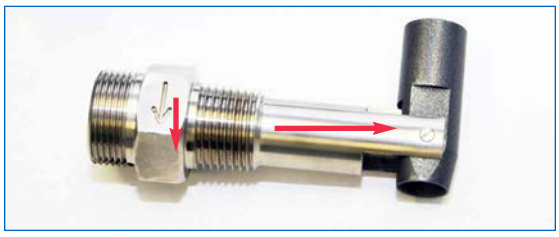
Flow Meter not communicating with SCADA

The flow meter communicates with SCADA using a 4-20mA signal. Which means when the valve is closed, the flow meter will read 4mA. To verify the flow meter is at 4mA, follow the procedure below:

1. Verify valve is in closed position.
2. Verify the multi-meter is set to mA & the probes are in the proper configuration on the multi-meter.
3. Connect the positive probe of the multi-meter to the positive 4-20mA wire of X144D e-FlowMeter.
4. Connect the negative probe to the negative wire of the X144D e-FlowMeter.
5. The multi-meter should read between 3.90mA to 4.1mA.

Flow Meter is powered, but display shows zero flow rate.

1. Check to make certain the swivel on the measurement cylinder is turned 90 degrees in direction of flow stream.
2. Verify the arrow on the measurement cylinder is pointing in the flow direction.
3. Remove measurement cylinder from valve & verify cylinder is free from debris. (Use insertion tool for removal, see IOM).
4. Verify flow path is not being blocked by gate valves, butterfly valves, etc.



Miscellaneous Symptoms

Symptom	Possible Causes	Possible Solution
Signal fluctuations	Flow meter installed too close to upstream obstruction. Obstructions include: • Butterfly Valves • Gate Valves • Flow Switches • Elbows	• Move flow meter at least five pipe diameters downstream of obstruction. • Refer to the IOM manual for complete installation instructions.
Output is not 0 when flow is stopped	• Electrical Noise Interference • Vibration or other movement in pipe. • mA Offset not correct	• Ground cable shielding. • Install flow meter in different location. • Secure surrounding piping.
Output constantly reads 20mA valve	• Flow meter default parameters not correctly set.	• Consult factory for details
Flow Meter is not accurate	• Improper installation • Meter not installed in a Cla-Val • Bad Calibration	• Meter must be 5 pipe diameters downstream of any obstruction • Recalibrate using flow meter software
Display is not visible	• Check for 6-30 VDC • Display in Timeout (sleep mode)	• Verify proper DC voltage • Adjust Time Out Setting

X144D e-FlowMeter Troubleshooting Checklist

(If returning meter to factory please include this sheet!)

Flow Meter does not turn on		
☐	Verify the flowmeter is receiving between 6-30VDC	Record Voltage:
If the checks listed above have been made and flow meter is still not powering up, please return to factory.		
Flow Meter not reading flow - Installation Check		
☐	Performing a visual inspection, verify flow meter sensor tip is not bent	
☐	Verify measurement cylinder arrow is pointed in the direction of flow	
☐	Verify measurement cylinder body is turned 90 degree in direction of flow stream. (Use insertion tool	
☐	Remove measurement cylinder & verify body is not clogged with debris. (Use insertion tool for removal)	
☐	Verify flow meter is at least 5 pipe diameters downstream of any obstructions	
If the above checks have been made & flow meter is still not powering up, please return to factory.		
Flow Meter not reading accurately or signal is fluctuating		
☐	Verify the flow meter and valve size is correct.	
☐	Verify flow meter is at least 5 pipe diameters downstream of any obstructions	
☐	Verify reading is out of Cla-Val's specified tolerance. (Cla-Val states accuracy is within 2% of full scale) 4-20mA Filter may need to be increased.	
Flow Meter reads slightly less than or greater than zero when valve is closed		
☐	Perform 4mA and 20mA test (see IOM page 23)	
Flow Meter readings will not go to zero - mA reading greater than 6mA		
☐	Where the flow meter terminations are made, verify bare wire is grounded to earth	

Additional Notes:

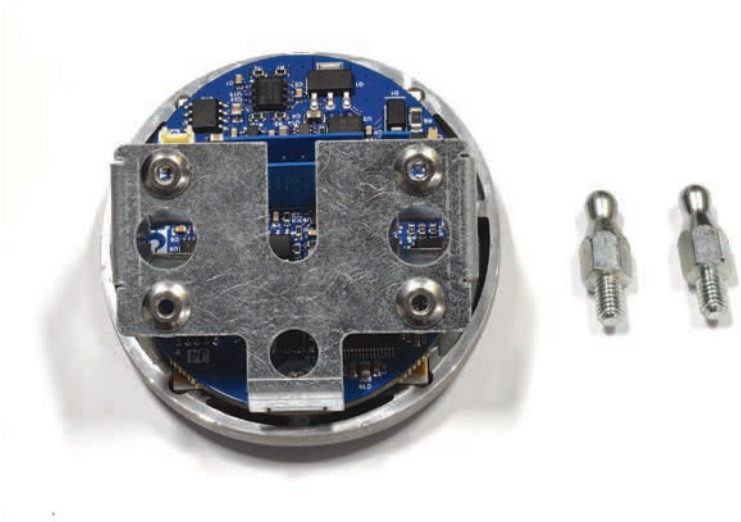
X144D e-FlowMeter

X144 to X144D Retrofit Kit Instructions

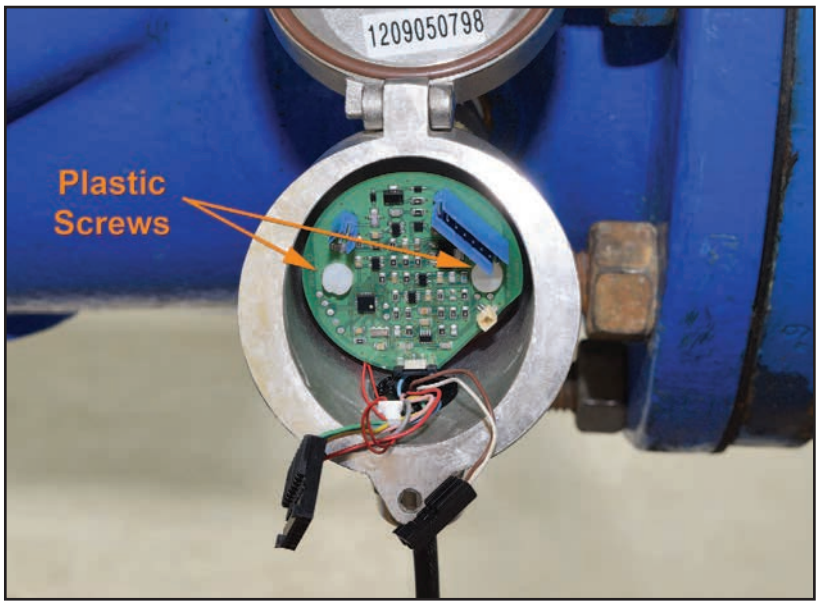
The X144D Retrofit Kit is used to convert existing X144 e-FlowMeter to X144D e-FlowMeter with integral display. The integral display utilizes a touch screen interface to configure and program parameters. With the touch screen interface, a programming cable and laptop are no longer required. NOTE: Additional power wiring is required to power the display. See X144D IOM for complete details.

SUPPLIED WITH RETROFIT KIT

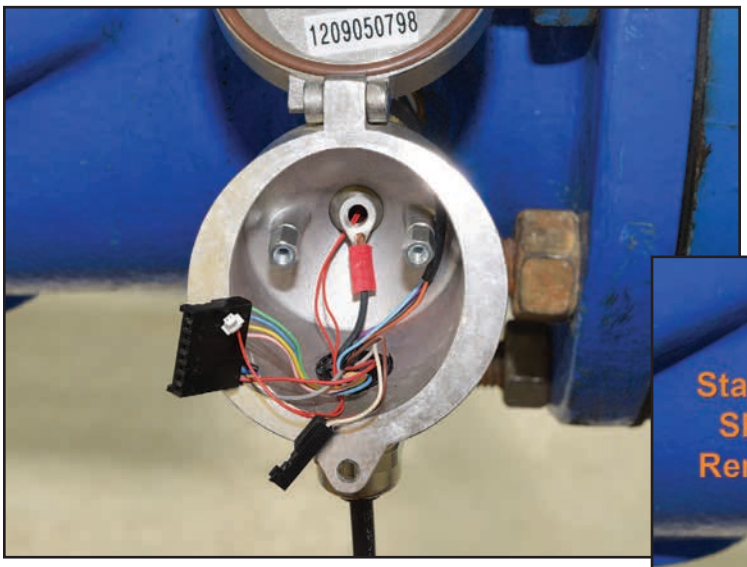
- Circuit Board with mounting bracket
- 2 ball studs

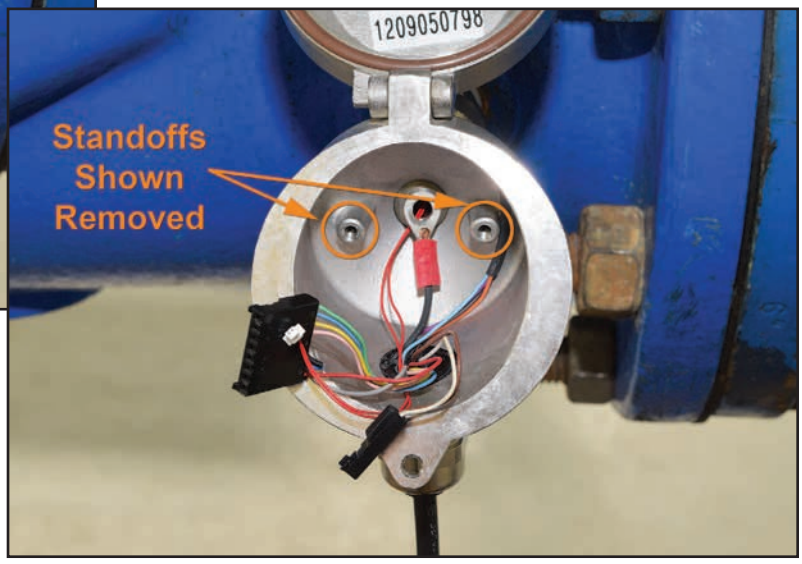


Step #1:
Turn off power and carefully disconnect 3 wires from circuit board

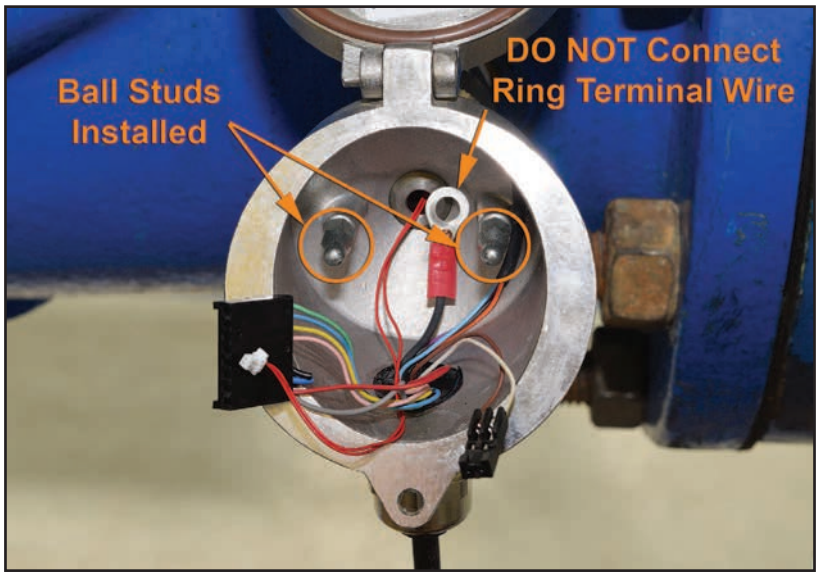


Step #2:
Remove (2) plastic screws, circuit board & (2) stainless steel standoffs.

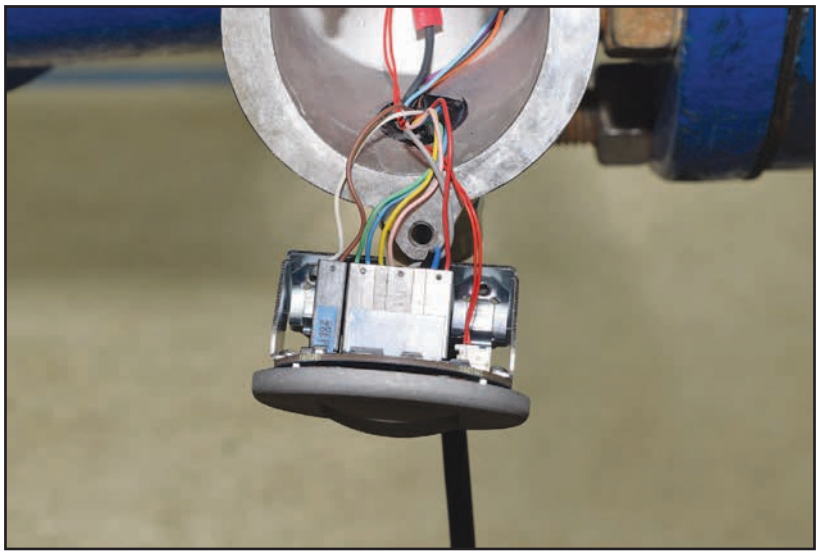




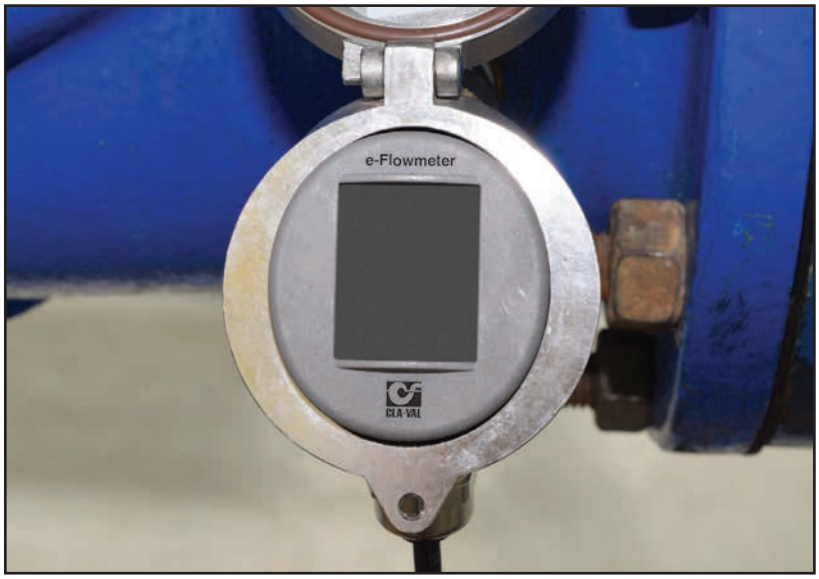
Step #3:
Install (2) stainless steel ball studs. Do not connect ring terminal wire.



Step #4:
Re-connect 2-pin, 8-pin, & sensor wires to new circuit board.



Step #5:
Insert new circuit board housing by aligning ball studs and ball stud receptacles on circuit board and gently apply pressure to outer face of display until assembly snaps in place.
CAUTION: DO NOT PUSH ON TOUCH SCREEN FOR INSTALLATION. Be sure not to pinch wires during installation.



Step #6:
Connect wires per necessary output configuration.

Figure 2-13: X144D e-FlowMeter using 4-20mA Output

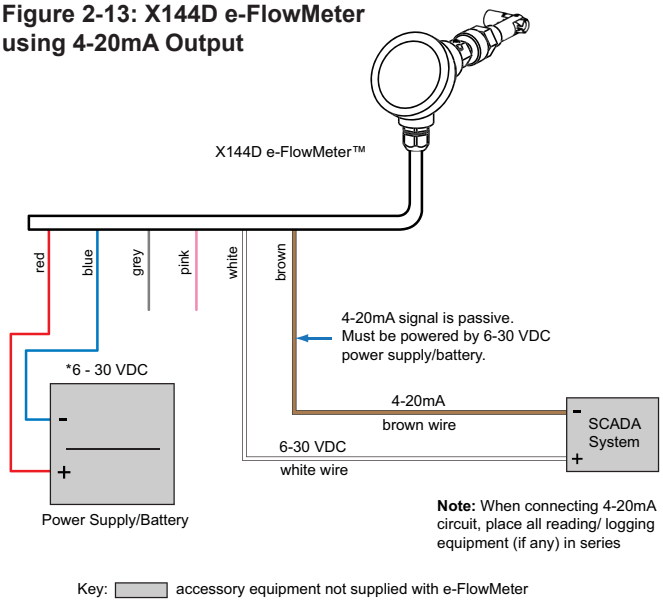
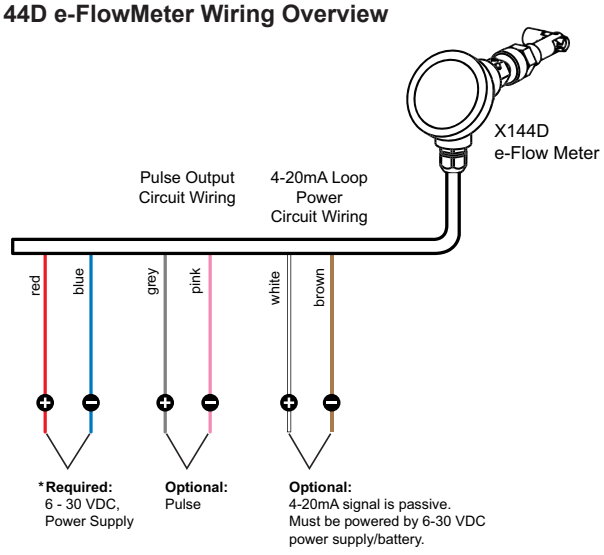


Figure 2-12:
X144D e-FlowMeter Wiring Overview



Step #7:
See X144D Programming Quick Start for programming instructions

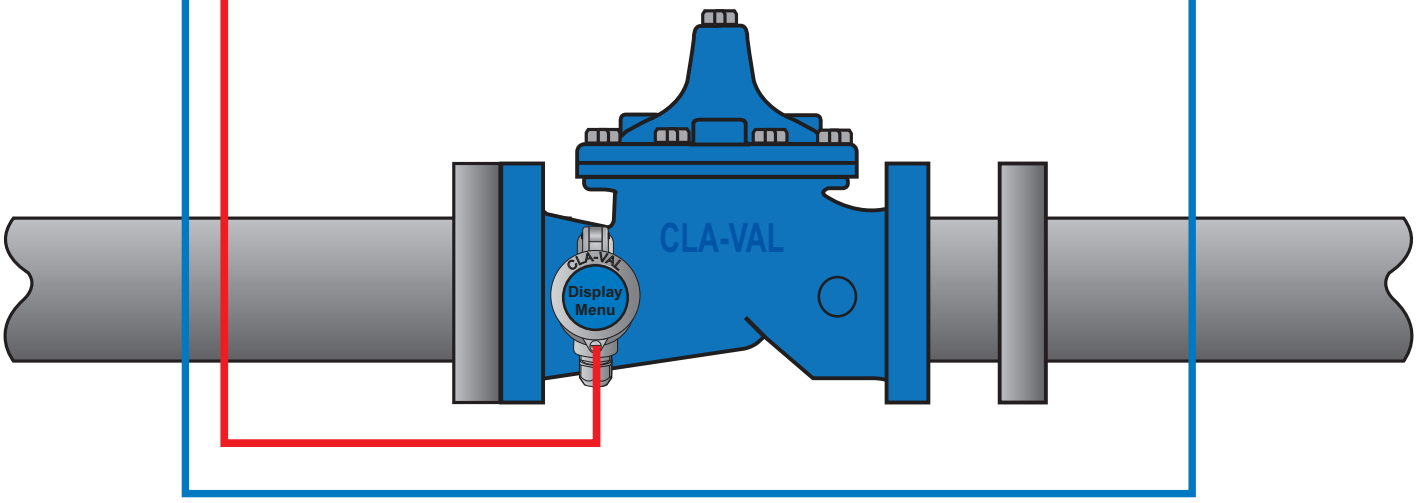
Removal:
Using a small flat head screw driver. Lift the circuit board housing out of the e-flowmeter housing.

Data Acquisition and Storage plus Power

VC-22D

Powered by an X143IP or X143MP Power Generator

Output to SCADA, PLC, data logger, etc.



Combining additonal Cla-Val electronic products with the X144D e-FlowMeter provides even more access to valve performance data installed in remote locations.

- The VC-22D Controller and X145 e-Display are ideal companions to the X144D e-flowMeter, providing access to real-time data
- The VC-22D Controller, e-Display and e-FlowMeter can be powered by the X143 Series Power Generators

GLOBAL HEADQUARTERS
1701 Placentia Avenue
Costa Mesa, CA 92627
Phone: (949) 722-4800
(800) 942-6326
Fax: (949) 548-5441
E-mail: info@cla-val.com

EASTERN REGION
6911 Richmond Highway, Suite 444
Alexandria, VA 22306
Phone: (800) 451-3030
Fax: (703) 721-1927
E-mail: bmoore@cla-val.com

NORTHERN REGION
280 Willard Avenue
Elgin, IL 60120
Phone: (800) 238-7070
Fax: (847) 697-5549
E-mail: acaselli@cla-val.com

SOUTHERN REGION
8707 Forney Road
Dallas, TX 75227
Phone: (214) 388-3493
Fax: (214) 381-9579
E-mail: tstaats@cla-val.com

WESTERN REGION
1701 Placentia Avenue
Costa Mesa, CA 92627
Phone: (949) 722-4800
(800) 942-6326
Fax: (949) 548-5441
E-mail: lvanderk@cla-val.com

CLA-VAL PACIFIC
45 Kennaway Road
Woolston, Christchurch
8023 New Zealand
Phone: 64-39644860
email:gnuthall@cla-val.com
www.cla-valpacific.com

CLA-VAL EUROPE
Chemin des Mésanges 1
CH-1032 Romanel/
Lausanne, Switzerland
Phone: 41-21-643-15-55
Fax: 41-21-643-15-50
E-mail: cla-val@cla-val.ch

CLA-VAL UK
Dainton House, Goods Station Road
Tunbridge Wells
Kent TN1 2 DH England
Phone: 44-1892-514-400
Fax: 44-1892-543-423
E-mail: info@cla-val.co.uk

CLA-VAL FRANCE
Porte du Grand Lyon 1
ZAC du Champ du Périer
France - 01700 Neyron
Phone: 33-4-72-25-92-93
Fax: 33-4-72-25-04-17
E-mail: cla-val@cla-val.fr

CLA-VAL CANADA
4687 Christie Drive
Beamsville, Ontario, Canada L0R 1B4
Phone: (905) 563-4693
Fax: (905) 563-4040
E-mail: sales@cla-val.ca

N-X144D IOM (R-03/2023)