Spire Metering Technology
www.SpireMT.com

Mission: We are Water and Energy Experts, providing innovative solutions to manage and preserve natural resources.

Vision: InSpire water and energy savings to empower a green revolution.

Values: Commitment | Quality | Innovation.

Spire Metering Technology, LLC is committed to being the partner of choice for high quality flow and energy measurement instruments and solutions. We are focused on constantly improving our quality to ensure that our customer needs are met and to satisfy all applicable requirements.

Thank you for working with us,

John Shen
President

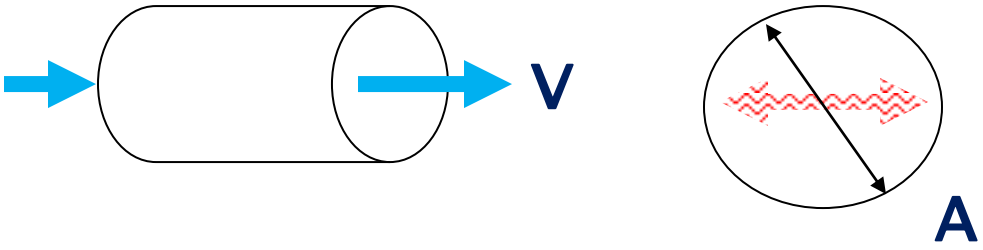
Introduction

The SpireMag Series MAG888 is designed for installation in a fixed location for long term, high accuracy flow measurement. Manufactured under strict standards, the MAG888 is intended to cover a broad range of critical applications. Constructed of high grade steel in a weatherproof design, the instrument provides robust, reliable performance. Exclusive circuitry, onboard surge protection, calibration, 110-240VAC/18-35VDC, 50/60 Hz, < 20W universal power connection and multiple output options make the MAG888 a dependable tool for compliance monitoring and process control.

Please read this entire manual prior to installation. This manual provides instructions on the orientation, wiring, programming and use of the instrument that will be critical to your associated installation preparation tasks, the instrument function, and safety.

Principles of Operation

Per Faraday's Law, a conductive fluid → moving through a magnetic field ≈≈≈ will induce a voltage proportional to the velocity (V) of that fluid. When that fluid is moving in a pipe of known dimension, the cross sectional area (A) of that pipe is multiplied by the velocity to produce a flow rate, displayed on the instrument in the units of volume and rate that you select.



V x A = flow

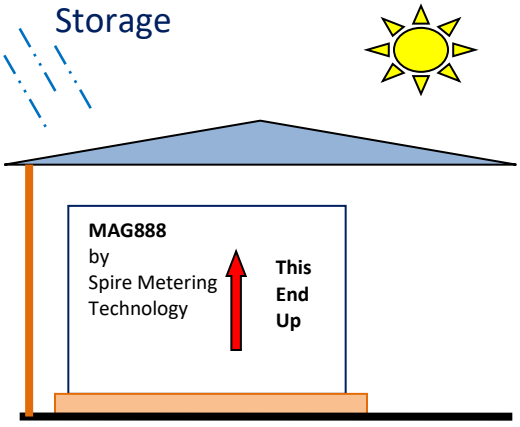
Our MAG888 will measure a variety of conductive fluids, with a minimum conductivity requirement of 5 µS/cm. **If deionized water is being measured, a minimum conductivity of 20 µS/cm is required**.

Typical fluids include water (hot, chilled, potable, sea, raw and treated sewage, stormwater) chemical feed, solvents, beverages, and ultrapure liquids. Applications include water treatment and distribution; wastewater collection, treatment and discharge; energy production; pulp and paper processing; mining; food and beverage processing. The instrument can be provided with the transmitter integrally mounted to the flow tube, or in its own remote housing. The remote configuration can be ordered with NEMA 4X or NEMA 6P flow tube, and up to 325 feet of coil and signal cable.

Receipt of Instrumentation

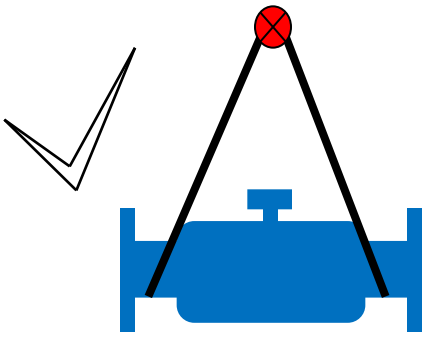
Your instrument was rigorously inspected and tested during manufacture and prior to shipment, in accordance with ISO 9001-2015 Quality Management Systems. Inspect the instrument and all ancillary components immediately upon receipt. Report any missing or damaged components immediately by emailing Support@SpireMT.com or by calling 1-888-738-0188 (Toll Free), 1-978-263-7100, option 2. Please provide your order #, located on the packing list, when contacting Spire MT. Do not proceed with installation if any components are damaged or missing.

Storage

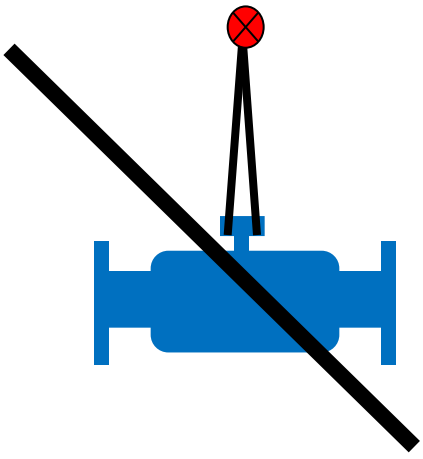


Instrument transmitters, flow tubes and ancillary components including cabling must be stored in a protected enclosure, raised off the floor, free from condensing moisture, 14°F to 120°F, away from direct sunlight and precipitation, until installation.

Transport



Correct support when moving flow tube. Support the flow tube weight at the flange necks as shown above.



Incorrect support when moving flow tube. The electronics housing is not designed to support the weight of the flow tube.

Installation Mechanical

The instrument is comprised of, at a minimum, the following components:

1) Transmitter

The transmitter incorporates the electronics for flow velocity measurement; power, input and output signal connections; communications protocol(s); display and operator interface. The transmitter is mounted directly on the flow tube, or in a separate housing suitable for wall mounting. The housing has an environmental rating of IP67/NEMA 4X. It is constructed of die cast aluminum, with powder coat finish.

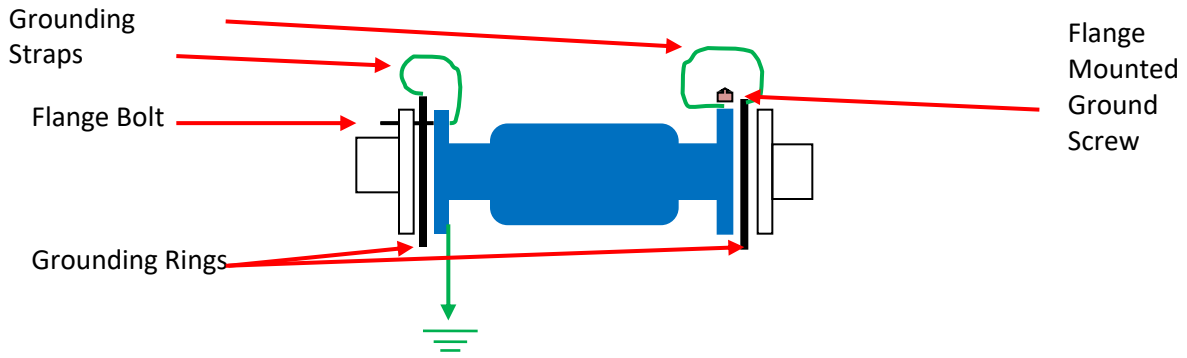
2) Flow Tube and Cables

The flow tube incorporates an electronics housing for flow sensing and connections for communication with the transmitter. The flow tube is comprised of 304 stainless sleeve in a carbon steel powder coated outer tube. The flow tube is provided with Cl 150 (or Cl 300 if ordered) ASME B16.5 flanges, for flow meters to 24"; the flanges are ASME 16.47 series A for meters 28" and above. Flanges are welded to the flow tube. The flow tube is IP67/NEMA4X unless IP68/NEMA 6P (for protection in the event of incidental submergence of the flow tube) was specifically requested at the time of order placement. The flow tube is provided with coil and signal cable, length also as specified at the time of your order placement, 325' maximum cable length available. In the event that the IP68 rating (available for the flow tube only) was specified at the time of your order, the coil and signal cable are installed on the flow tube at the factory, and the connections in the flow tube housing are potted. Coil and signal cable length cannot be extended with use of a junction box or terminal strip.

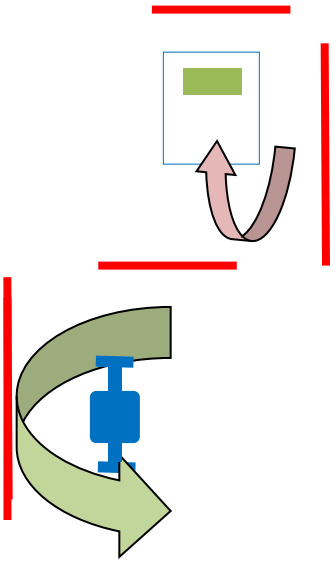
Optional Factory Components: Grounding Rings

Grounding rings are recommended for all flow tube installations, to provide adequate grounding, thereby greatly reducing or eliminating electrical interference with the instrument's proper function. In cases where the piping system is metallic, the primary electrical service to the instrument, and communications path from it are all properly grounded, grounding rings may not be necessary. In cases where the piping system is nonmetallic, grounding rings are required to ensure proper instrument function. Ground screws tapped by the factory are available on request. **Proper grounding of the installation shall be the responsibility of the customer.**

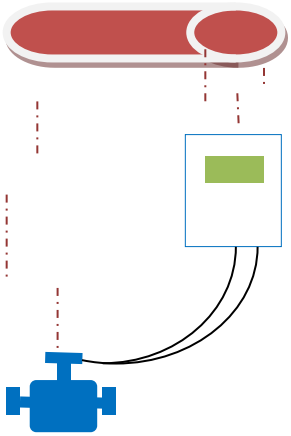
Grounding Ring Installation Example



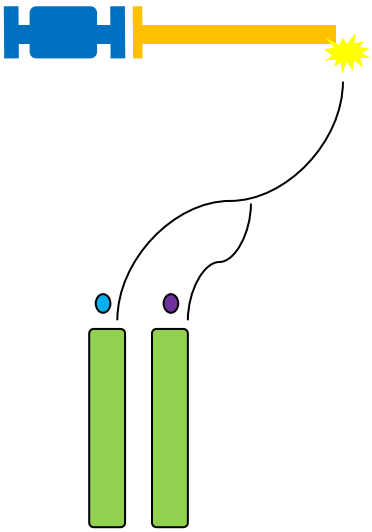
Installation Mechanical (continued)



Allow sufficient room around both flow tube and transmitter for easy access to install, program, and service.

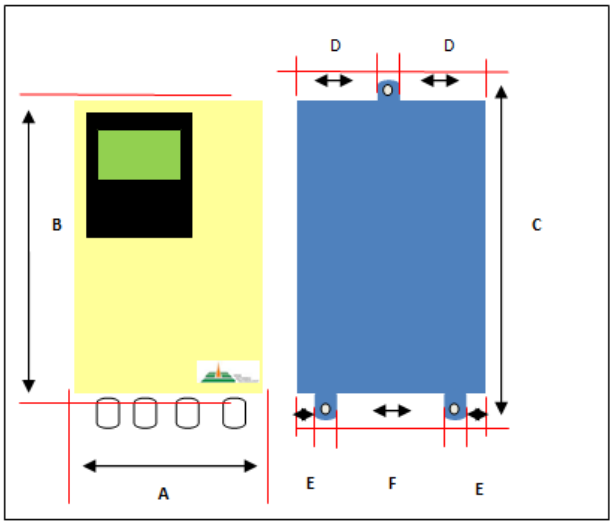


Do not expose the flow tube, cables or transmitter to potential damage from leaking fluids, falling debris or potential cable strain.



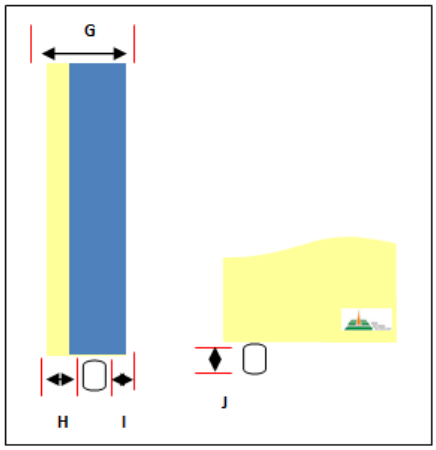
Do not expose the flow tube to extreme heat transfers from other pipe work.

Dimensions- Remote Transmitter Table 1



A = 7 7/16
B = 8 7/16
C = 9 29/32
D = 2 25/32
E = 1 13/32
F = 1 15/16

o ¼"Ø



G = 2 22/32
H = 1 1/4
I = 7/16
J = 1 1/8

J = M20 x 1.5
polyamide cable gland x 4

Installation

Hydraulic

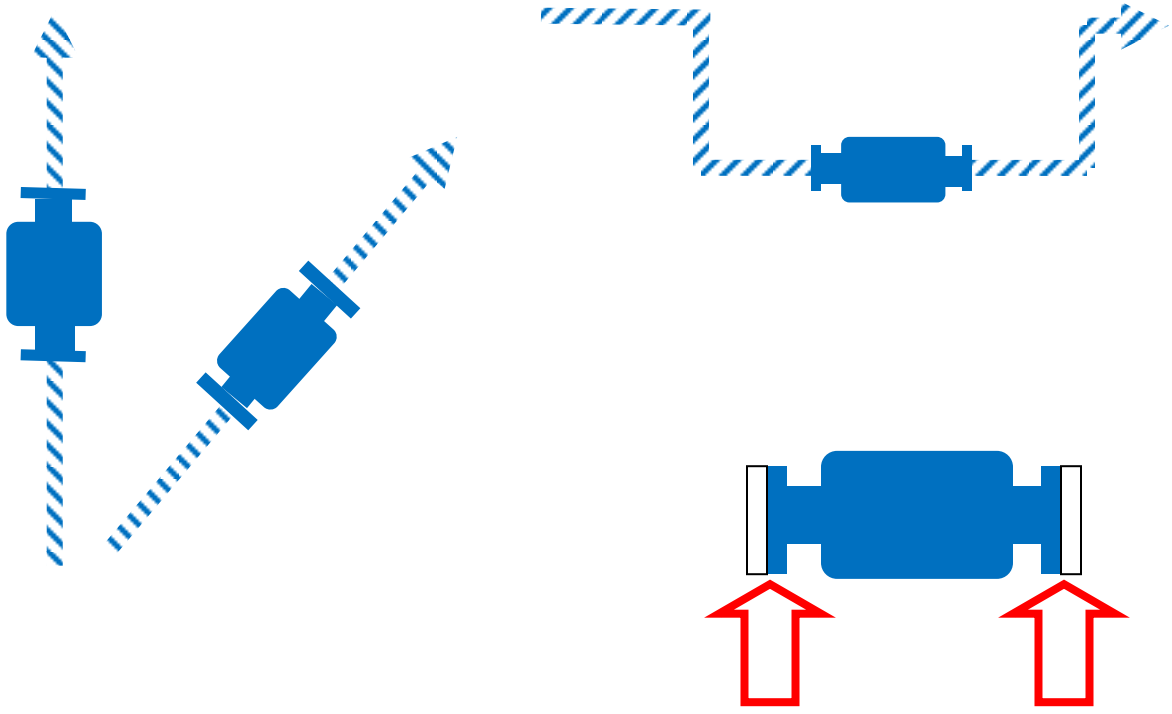
A note on Gasketing:

GASKETS ARE NOT INCLUDED WITH YOUR ORDER. Spire MT cannot stock and supply gaskets compatible with every possible process fluid or application. The flow tube has a liner, and the liner material may protrude outside the flow tube. This is a consequence of the manufacturing process, and is **NOT** intended to act as a gasket or seal. It is the responsibility of the installation contractor to acquire and install gaskets.

The instrument flow tube incorporates Cl 150 ASME (or 300 if specified) RF flanges (per page 5, 2 “flow tube and cables”), welded to the tube. The flange face to flange face length and flow tube weight are indicated in the dimensional charts beginning on page 8.

The flow tube is marked with the direction of flow as manufactured and calibrated at the factory. The sensor function is bidirectional; the corresponding calculation of flow assumes the sensor orientation in accordance with the flow direction as indicated on the side of the flow tube.

Flow tube orientation must ensure that the sensor is always completely full and free of entrained gases. Preferred orientation is vertical with the flow direction moving up through the sensor. Horizontal orientation is allowed so long as the associated piping, particularly the outlet, is higher than the sensor. Straight run requirements are five pipe diameters upstream/three pipe diameters downstream from 90° elbow or control valve; greater for compound joints. Support the weight of the flow tube at the flanges, not the flange necks or piping, when necessary to prevent pipe flex and eliminate vibration in horizontal runs.

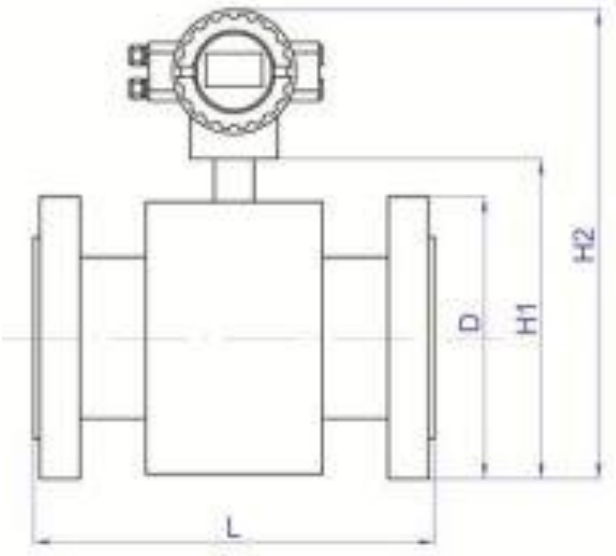


Installation Hydraulic (continued)

Flow Tube with Integral Transmitter

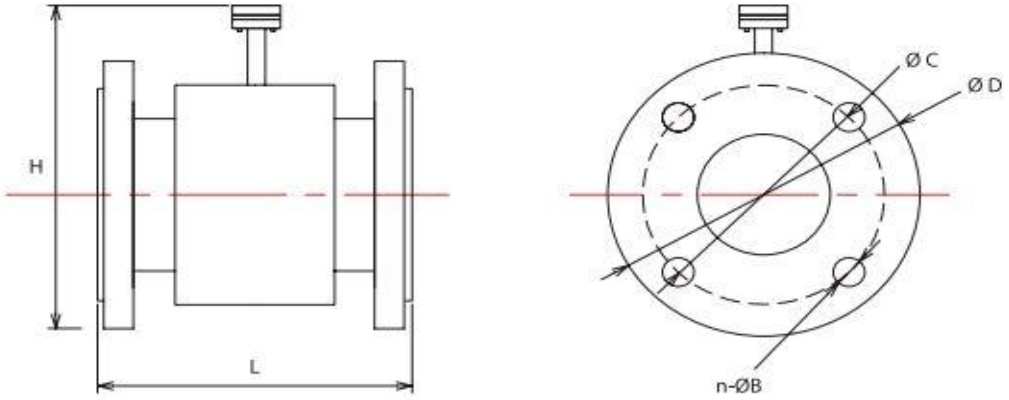
Height Dimension "H2" (Dimensions "L" and "D" are as per tables 3 and 4) **Table 2**

Nominal Size	Dimension H2		Weight		Nominal Size	Dimension H2		Weight	
	inch	mm	lbs	kg		inch	mm	lbs	kg
½"	11.22	285	16.5	7.5	16"	28.74	730	218.3	99
¾"	11.41	290	18.7	8.5	18"	30.31	770	251.4	114
1"	11.61	295	19.8	9	20"	32.67	830	295.5	134
1 ½"	12.6	320	22	11	24"	36.61	930	361.6	164
2"	12.99	330	28.6	13	28"	40.35	1025	968	439
2 ½"	1378	350	33	15	32"	45.07	1145	1210.5	549
3"	14.56	370	37.5	17	36"	49.01	1245	1453.1	659
4"	14.96	380	41.9	19	40"	53.54	1360	1794.9	814
5"	16.14	410	50.7	23	48"	62.20	1580	1938.2	879
6"	17.71	450	61.7	28	54"	69.29	1760	2738	1239
8"	20.07	510	79.4	36	64"	77.16	1960	3439.8	1560
10"	22.04	560	112.5	51	72"	82.87	2105	4608.5	2090
12"	22.41	620	156.5	71	80"	94.29	2395	5766.1	2615
14"	26.77	680	180.8	82					



Installation Hydraulic (continued)

Flow Tube with Remote Transmitter



Dimensions- Flow Tube – Cl 150 ASME B16.5 Flange (ASME B16.47 series A ≧ 28")

Table 3

Nominal Size	Dimensions						Weight (Flow Tube Only)	
	L		H		D			
	inch	mm	inch	mm	inch	mm	lbs	kg
½"	7.9	200	8.7	220	3.1	80	17.6	8
¾"	7.9	200	8.7	220	3.5	90	22	10
1"	7.9	200	8.8	223	3.9	100	26.4	12
1 ½"	7.9	200	9.8	250	5.1	130	30.9	14
2"	7.9	200	10.4	263	5.5	140	33.1	15
2 ½"	7.9	200	11.1	283	7	180	39.7	18
3"	7.9	200	11.4	290	7.5	195	44.1	20
4"	9.8	250	12.5	318	8.5	215	55	25
5"	9.8	250	13.8	350	9.6	245	61.7	28
6"	11.8	300	15.0	380	11	280	66.1	30
8"	13.8	350	16.9	430	13.2	335	110	50
10"	17.7	450	19.5	495	15.9	405	154	70
12"	19.7	500	21.5	547	17.3	440	209	95
14"	21.7	550	23.7	602	19.7	500	264	120
16"	23.6	600	26.2	665	22.2	565	308	140
18"	23.6	600	28.3	720	24.2	615	352	160
20"	23.6	600	30.8	783	26.4	670	440	200
24"	23.6	600	35.3	879	30.7	780	616	280

Installation Hydraulic (continued)

Dimensions- Flow Tube – ASME B16.47 series A Flange **Table 4**

Nominal Size	Dimensions						Weight (Flow Tube Only)	
	L		H		D			
	inch	mm	inch	mm	inch	mm	lbs	kg
28”	27.6	700	38.7	982	35.2	895	770	350
32”	31.5	800	43.0	1092	39.8	1010	880	400
36”	35.4	900	46.9	1192	43.7	1110	1056	480
40”	39.4	1000	51.1	1299	48.0	1220	1210	550
48”	47.2	1200	59.4	1510	55.3	1405	1940	880
54”	55.11	1400	66.5	1690	64.2	1630	2734	1240
64”	62.99	1600	74.4	1890	72.0	1830	3440	1560
72”	70.8	1800	82.8	2105	80.5	2045	4608	2090
78”	78.7	2000	91.5	2325	89.1	2265	4774	2615

Dimensions - Cl 150/300 ASME B16.5 Flanges **Table 5**

Nominal Size	Cl 150				Cl 300			
	ØD	ØB	n	ØC	ØD	ØB	N	ØC
½”	3 1/2	1/2	4	2 3/8	3 3/4	1/2	4	2 5/8
¾”	3 7/8	1/2	4	2 3/4	4 5/8	5/8	4	3 1/4
1”	4 1/4	5/8	4	3 1/8	4 7/8	5/8	4	3 1/2
1 ½”	5	1/2	4	3 7/8	6 1/8	5/8	4	4 1/2
2”	6	5/8	4	4 ¾	6 1/2	3/4	8	5
2 ½”	7	5/8	4	5 ½	7 1/2	3/4	8	5 7/8
3”	7 1/2	5/8	4	6	8 1/4	3/4	8	6 5/8
4”	9	3/4	8	7 3/8	10	3/4	8	7 7/8
5”	10	3/4	8	8 ½	11	3/4	8	9 1/4
6”	11	3/4	8	9 ½	12 1/2	3/4	12	10 5/8
8”	13 1/2	3/4	8	11 ¾	15	7/8	12	13
10	16	7/8	12	14 1/4	17 1/2	1	16	15 1/4
12	19	7/8	12	17	20 1/2	1 1/8	16	17 3/4
14	21	1	12	18 3/4	23	1 1/8	20	20 1/4
16	23 1/2	1	16	21 1/4	25 1/2	1 1/4	20	22 1/2
18	25	1 1/8	16	22 3/4	28	1 1/4	24	24 3/4
20	27 1/2	1 1/8	20	25	30 1/2	1 1/4	24	27
24	32	1 1/4	20	29 1/2	36	1 1/2	24	32

Installation Hydraulic (continued)

Dimensions - Flange ASME B16.47 series A **Table 6**

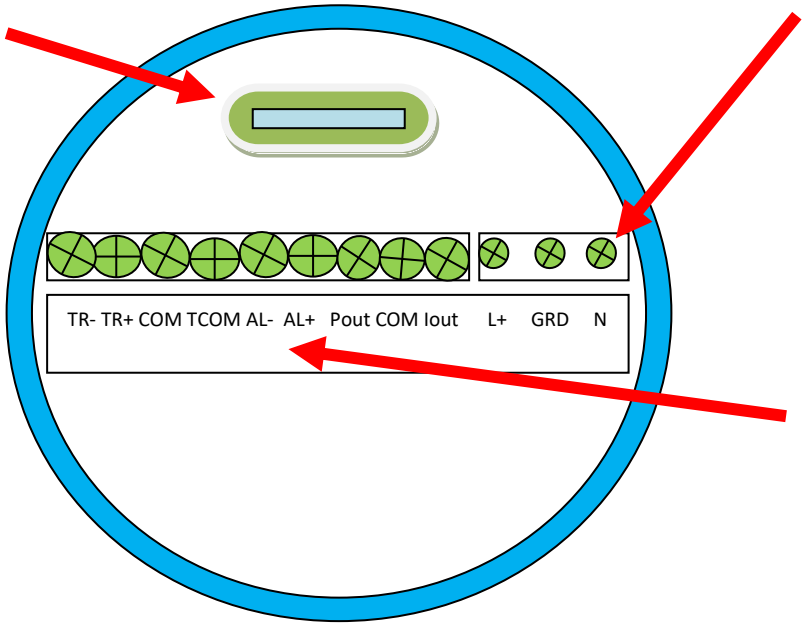
Nominal Size				
	ØD	ØB	n	ØC
28”	36 1/2	1 3/8	28	34
32”	41 3/4	1 5/8	28	38 1/2
36”	46	1 5/8	32	42 3/4
40”	50 3/4	1 5/8	36	47 1/4
48”	59 1/2	1 3/4	44	56
54”	66 1/4	1 7/8	44	62 ¾

Installation Electrical

Electrical wiring of primary power and communication circuits should only be done by properly trained and licensed personnel, in accordance with local electric code. Review all instructions before proceeding.

The terminals in the electrical compartment of the integral transmitter are arranged as follows:

Power Supply Fuse 5 x 20



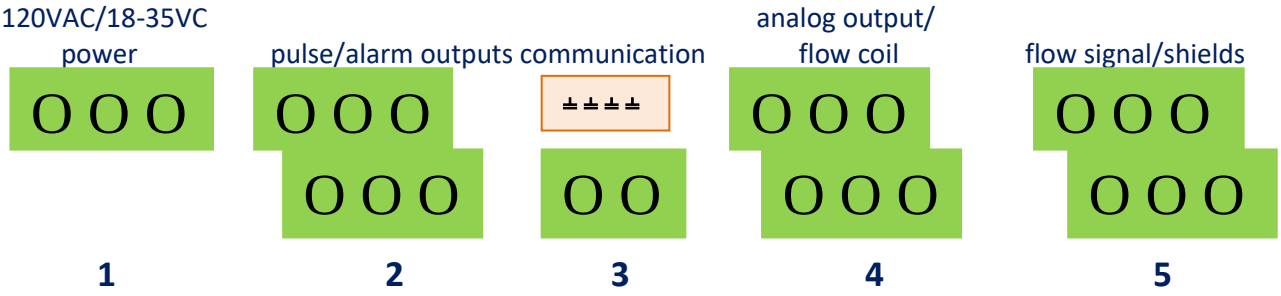
L+ = VAC/VDC +
N = VAC/VDC Neutral
GRD = ground

TR- = communications - (RS485A)
TR+ = communications + (RS485B)
COM = analog ground
TCOM = communications ground
AL- = alarm -
AL+ = alarm +
Pout = pulse/Hz +
COM = pulse/Hz ground
Iout =analog +

The analog, pulse and alarm outputs are passive outputs, requiring external voltage from your SCADA network. 5-24VDC should be sufficient to power the loop between the transmitter and your SCADA network physical connection.

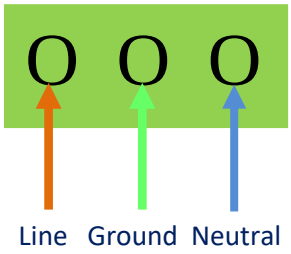
Installation Electrical (continued)

The terminals in the electrical compartment of the remote transmitter are arranged as follows:

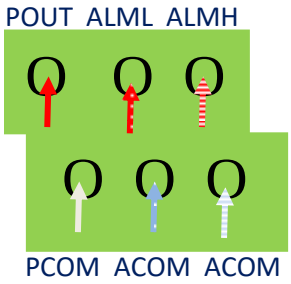


Please observe all connection instructions. DO NOT WIRE ENERGIZED EQUIPMENT. Make sure that the power to the instrument is OFF before wiring any terminal, no matter its function.

1 The instrument transmitter requires 110-240 VAC/ 1Ø / 60Hz or 18-35 VDC power. It may be provided with a three prong 120VAC US plug for installation in a standard, properly grounded receptacle. In the event you wish to hardwire the transmitter to the power supply, please observe the terminal assignments.



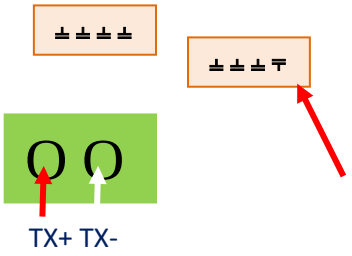
2 To the right of the power terminals are the pulse and alarm output terminals. These are the terminal assignments:



The upper terminals are the signal output (+) terminals. The lower terminals are the signal common (-) terminals
P = frequency or pulse output (Hz for rate or pulse for totalization)
ALML = alarm output low (relay)
ALMH= alarm output high (relay)
The alarm contacts are passive and require an external power of 12VDC to operate.
The pulse output is activated by placing the second dipswitch from the left in the UP position.

Installation Electrical (continued)

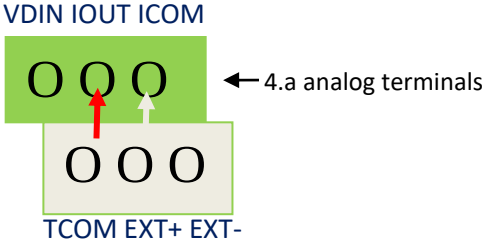
Communication/Bus and Dip Switch



Place dip switch for Modbus communications resistance to UP position

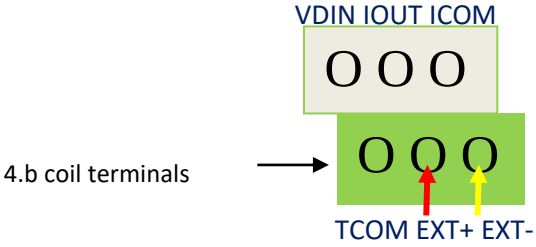
3 The far right dip switch is the communication terminal resistance switch. When using Modbus communications feature (terminals marked TRX+ and TRX- above), flip this switch UP to activate resistance on the RS485 terminals. Resistance is 139Ω and is used for communications distances greater than 150 feet. Maximum communication main cable run for Modbus RS485 is 2,100 feet (700m), with 31 devices and master connected. A resistor of same size also must be connected at the far end cable termination. Please refer to the appendix (A) on Modbus communications at the end of this manual and your own references for additional guidelines on proper wiring and programming.

4 The analog (4-20mA) output terminals are marked IOUT and ICOM



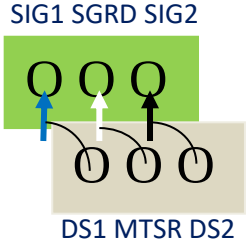
The analog output is an active output. This output does not have a dipswitch associated with it.

You will need to wire the flow tube coil and signal cables into the transmitter. The coil cable consists of two leads, red (+) and yellow (-). Wire each to its Excitation terminal, marked EXT + and EXT -.



5 The signal cable consists of three leads, blue (+), white (ground), black (-). Wire each to its signal terminal, marked SIG+, SGRD, SIG-. These terminals are arranged on the right side of the terminal strip.

Each signal lead has a corresponding shield terminal below it.

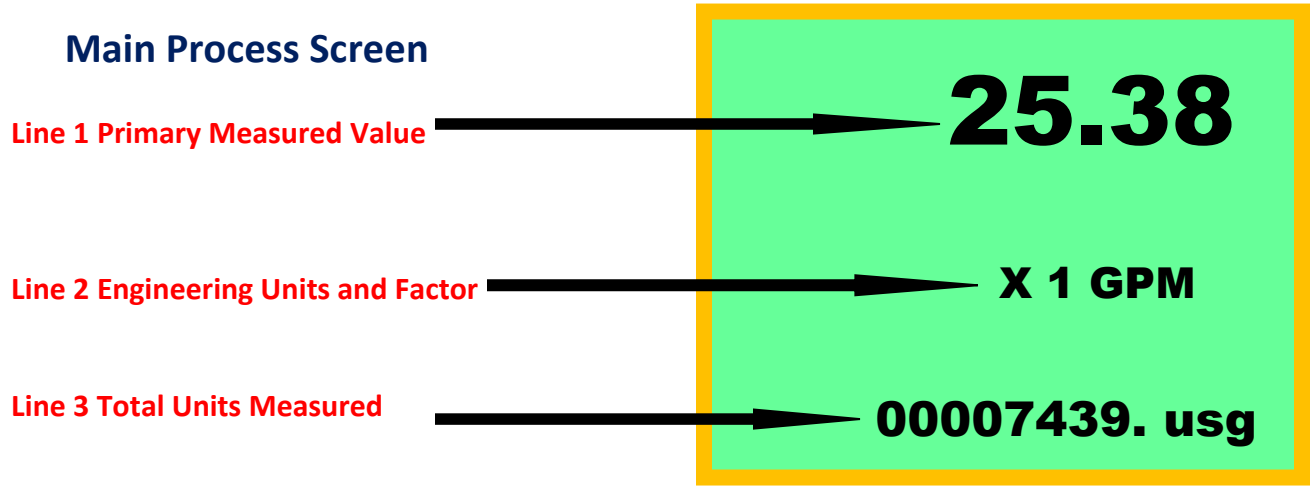


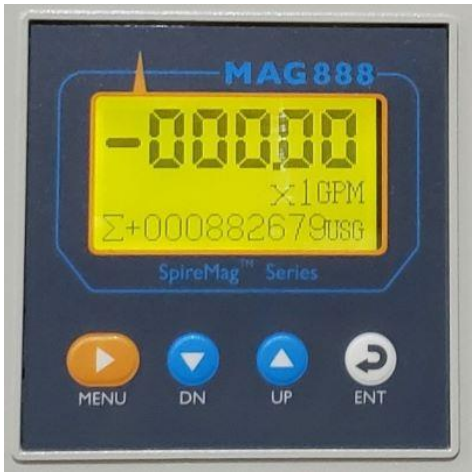
Commissioning HMI Overview

Please read this entire section before commissioning begins. The navigation soft keys have different functions depending on what level of the menu you enter. Programming is password protected, and there may be multiple passwords depending upon the instrument configuration.

Once the transmitter is powered on, the main process screen appears on the display. This screen includes the primary measured value (the volume/rate value) displayed at the top (Line 1). The engineering units for this measurement appear directly below (Line 2), and the positive totalization of this measured value (and additional information) appears at the bottom of the screen (Line 3). Please note that the values shown may not reflect actual process values or be in the engineering units required until installation and programming is complete, and the flow to be monitored is operational.

Main Process Screen





Main (process values) Screen

MENU

DN

UP

ENT

Commissioning HMI Overview (continued)

When the main process values screen is displayed, the keys have the following functions:

MENU Key: hold down, and use the UP or DN keys to change the contrast of the display; hold down and press ENT to enter the programming and informational menus.
DN Key: no function.
UP Key: scrolls through values on lower line of the main process values screen.
ENT Key: hold for eight seconds to return to the main process value screen.

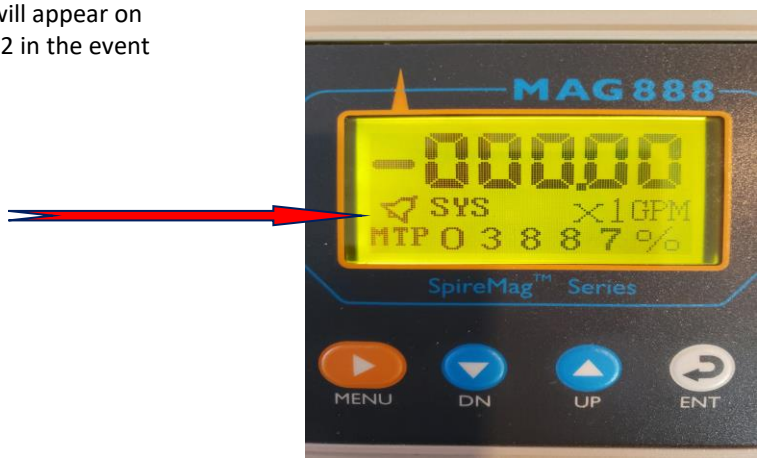
These are the operating menus:

Parameters Set†
Clr Total Record‡
Factory Modification Recordⁱ

†: programmable; password required
‡: resettable; password required
i: information only

In addition to the total flow, Line 3 can provide other information. Press the UP key to access this information. Line 3 displays nine values, and each time the UP key is pressed, this information in the line will change. The information displayed will be:
Σ+ total positive flow
Σ- total negative flow
Σᴅ net positive flow
FLS flow velocity in meters/second
FQP flow rate as a percentage of maximum flow (e.g., 18.68% = 9.34 GPM of 50 GPM maximum)
MTP empty pipe detector enabled, full pipe detected as a percentage of meter's factory lower threshold setting
LIQUID NORMAL
FLUX NORMAL
SYSTEM NORMAL

A notification will appear on the left of Line 2 in the event of an alarm.



Commissioning Menus Navigation

Once the programming menus are accessed by pressing the MENU and ENT keys together, the first menu "Parameters Set" is displayed. You will be required to enter a password to access this menu. Press the ENT key once to access the password code screen.

The password screen will appear with the cursor located to the far left. UP or DN keys will change the value of each 0; press and hold the MENU key band press the UP key to move the cursor to the right. The password is 19818. When this password has been entered, press and hold the MENU key and press the ENT key again. The first screen of the Parameters Set menu will be displayed.

The Clear Total Record password is one that you will create, prior to entering this menu. This function is also in the Parameters Set menu, and will be covered in the instructions that follow. This will allow a reset of the totalized flow (total units measured) as displayed on the main process screen Line 3.

Commissioning Menus Programming: Parameters Set

The Parameters Set Menu contains the parameter programming for all the basic functions of the instrument, both those programmed at the factory and those programmed by you to meet your process goals. There are 55 parameter screens in total. Their functions are explained below.

Once the Parameters Set menu has been accessed, the UP and DN keys will move you forward and back through the 55 screens in this menu. Press the ENT key to enter any of the parameter screens displayed, use UP and DN keys to make selections within the parameter, and use the ENT key again to return from that parameter screen.

Some of the parameters have been programmed at the factory, as part of the manufacturing process. These values should not be changed; to do so may affect the meter's performance. These parameters are identified here. When you begin commissioning, make note of the value(s) in each screen as received from the factory. This will provide a useful guide in the event a value is changed unintentionally during commissioning or thereafter.

Commissioning Menus Programming: Parameter Set (continued)

Language This is the language of the meter display. The value is English, programmed at the factory. In the event you receive a meter displaying another language, press ENT key to access this parameter, use the UP key to scroll through the possible selections until English is displayed; use ENT to return to the Parameters menu.

Comm Addres is the Modbus address you assign to this instrument in the Modbus system. The format is "000" and the options are 1 through 255. Take care not to assign the same address number to multiple instruments. Enter the address as you entered the password, with the MENU and UP keys, and use ENT to return to the Parameters menu.

Baud Rate is the speed with which the instrument transmits data out to your communication system. For example, a baud rate of 9600 means that 9600 bits of data will be transmitted per second. The baud rate of the instrument and your communication system must agree. The options are 300, 600, 900, 1200, 2400, 4800, 9600, 19200, 38400.

Snsr Size This is the nominal diameter of the electromagnetic flow tube. This value has been preselected at the factory, as part of the manufacture and testing process. DO NOT CHANGE THIS VALUE. To do so will invalidate the algorithms by which the instrument measures. You may view the value by pressing the ENT key. If this value is changed at some point, simply change it back to the factory value.

Flow Units The engineering units for flow. With the cursor in the menu text field for "flow units", use the Up Key to scroll through the options. The units may be in liquid volume in US gallons, liters, cubic meters, or UKG. The associated rates are per second (s), minute (m) or hour (h). Once the units you want are displayed, press the "ENT" key to exit this menu.

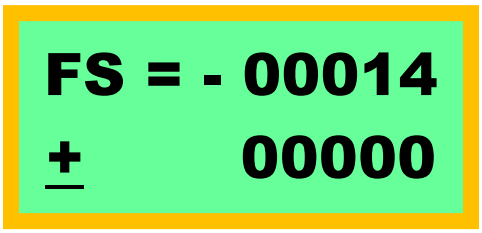
Flow Range This item allows you to set the upper range of the fluid flow you wish to measure. The format for "flow range" is 000.00, with a factor of 1. A good practice is to set this value higher than the anticipated highest flow to be measured.

Flow Response "Flow response" is the next item to be selected. The instrument senses all flow through the tube, instantaneously, displaying that value and sending the signal out to your control system, if so wired. This feature can be helpful in process control when the instantaneous value (flow rate) is highly variable due to fluid properties, pumping or other conditions, allowing you to smooth out the display and output signal. As with "flow units", it contains a list of options through which to scroll. There are ten possible settings for this, ranging from 1 second to 50 seconds. Scroll through the settings and exit once the flow response you want is displayed. This does not affect the totalization of the instrument.

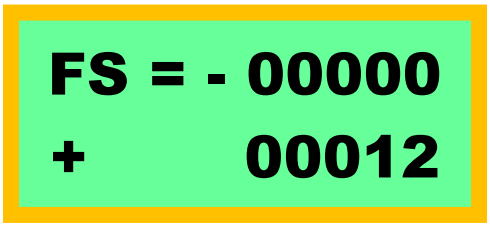
Flow Direction The instrument will measure flow both forwards and backwards through the flow tube. This item allows you to select the direction of process flow with respect to the meter orientation. The options are "**forward**" and "**reverse**".

Commissioning Menus Programming: Parameter Set (continued)

Flow Zero During installation, it is common for various instruments to be energized prior to their commissioning, and even prior to completion of the systems in which they are installed. Once the instrument sensor is energized, it will begin working, and the value(s) displayed on the main process screen are a product of raw signal and whatever settings the factory used when testing the transmitter. This feature allows a reset of the zero calibration of the meter, when the piping system is fully charged, and the flow is stopped. To reset "flow zero", first ensure that the piping system is full of fluid, without air entrainment; valve off the piping immediately upstream and downstream of the flow tube. Ensure that the downstream valve is completely closed. This is the item screen layout (values are an example only):



The "zero" velocity in millimeters/second is shown by the upper value. In the example, the value is -14 mm/s. In order to correct this, the lower value must be a corresponding offset. In the example, the "±" value should be changed to "+". Then the cursor should be moved to the "0" directly below the "1" in the upper value. Increase this value with the UP Key until the "1" in the upper value changes to "0". Move the cursor to the right, and increase that value until the "4" above becomes a "0".



Special Note: the correcting offset need not equal the original "FS" value; what is important is to return "FS" to zero velocity.

Flow Cutoff The flow tube is highly sensitive to fluid movement through it. In process control, it is often practical to set a volume of flow below which the value is not useful. This feature allows you to select a flow rate below which instrument generates a "0" output signal.

Cutoff Ena This enables the low flow cutoff function that you have programmed above.

Total Unit Many processes have very high flows. This item allows the selection of a multiplier to be applied to the displayed value. The factors available are 10, 1, .1, .01, .001. Use the UP Key to scroll to display the factor you desire.

SegmaN Ena This enables the transmitter to output pulse and analog signals. When there is no flow, the value output for each signal will be 0.

Analog Type This is the analog scale in mA. It is programmed at the factory as 4-20mA.

Commissioning Menus Programming: Parameters Set (continued)

Pulse Type This allows for the output format to be pulse or frequency.

Pulse Factor If pulse output is to be used, a pulse factor needs to be selected. The units are USG, UKG, M^3, L. The factor for each is 0.001, 0.01, 0.1 and 1.0.

Frequency Maximum This item is the upper range of the frequency output. The maximum output frequency is displayed in this item, and can be changed using ENT to access, MENU and UP to move the cursor and change individual values, and ENT to return.

Meter Sensor Enable This allows the Empty Pipe Detection Function to be Enabled or Disabled. This feature should always be enabled, as it prevents the registration of flow when the pipe is less than full. Less than full pipes contain air that interferes with the sensor performance.

Meter Sensor Trip This allows the Empty Pipe Detection Function threshold to be set.

Alarm High Enable This activates the high flow alarm function.

Alarm High Value This allows the high alarm set point value to be selected. It is expressed in percent of the flow range value you programmed (see page 18, “Flow Range”). The format is 000.00%.

Alarm Low Enable This activates the low flow alarm function.

Alarm Low Value This allows the low alarm set point value to be selected. It is expressed in percent of the flow range value you programmed (see page 18, “Flow Range”). The format is 000.00%.

System Alarm Enable A system alarm is generated when one of the system parameters (e.g. flow tube wiring not connected) occurs. This activates the system alarm function.

Clear Sum Key The totalized flow displays can be reset to zero in the “Mon Total Record” menu mentioned on page 16. This menu requires that a special password be created. To create the password, press ENT once. A series of five 0s will be displayed, with the cursor under the far left 0. Use the UP, DN keys to change the value, and press and hold MENU then press UP to move the cursor to the next 0. Repeat until you have created the password. Press and hold MENU and press ENT to save the password. The screen will then change back to all 0s. When you want to reset the totals displayed on the main screen use this password. **Write down the password and keep it in a safe location. Demonstrating that the totalizer reset function is password protected, and that access to the password is properly controlled, may be critical if you are measuring flow for the purposes of revenue metering or regulatory compliance reporting.**

Sensor Code 1 date of instrument manufacture; factory setting, do not change.

Sensor Code 2 serial number of instrument; factory setting, do not change.

Commissioning Menus Programming: Parameters Set (continued)

Field Type This allows for the selection of excitation power for the sensor coils. This value is set at the factory, based on your instrument configuration. Do not change without consulting Support@SpireMT.com or by calling 1-888-738-0188 (Toll Free), 1-978-263-7100, option 2.

Sensor Factor factory setting, do not change. This is part of your NIST traceable calibration, and must not be changed. This value also is stamped on the nameplate located on the outside of the flow tube.

Linearity CRC Enable: Factory setting, do not change.

Linearity CRC, 1 – 4 Factory settings, do not change. 00.000 m/s

Linearity Factor, 1 – 4 Factory settings, do not change. 1.0000

Forward Total Low In the event that the transmitter is replaced, you may wish to retain certain totalized process values so that the record for the application is continuous. These four "total" entries allow you to enter totals from the original transmitter record into the replacement transmitter. When the instrument is placed into service, these totals shall begin at the values you have entered. The format for this screen is 00000.

Forward Total High The format for this screen is 0000

Reverse Total Low The format for this screen is 00000

Reverse Total High The format for this screen is 0000

Plant Limit Enable As stated in the Principle of Operation, the instrument is measuring the voltage induced when fluid moves through the electromagnetic field in the flow tube. Certain applications involve fluid with heterogeneous constituents and high, varying percentages of solids, which can interfere with normal measurement. To address this, Spire MT employs advanced signal processing, variation restraint arithmetic sequencing, to separate the flow-induced signal from electrical interference. This screen allows the function to be enabled or disabled. You will need to program the next two parameters in order to customize the function to your fluid characteristics.

Plant Limit Value This allows you to select the acuity of the sequencing application, based on your fluid. It is expressed in meters/second, and the values available are 0.010, 0.020, 0.030, 0.050, 0.080, 0.100, 0.200, 0.300, 0.500 and 0.800. The smaller the value, the higher the acuity of the sequencing.

Plant Limit Delay This allows for further tuning of the Plant Limit function by applying a delay to the signal processing. This delay is selectable in milliseconds, from 0400 to 2500.

User Password 1-3 Password 1 function allows for the default password (19818) to be changed to one that the user creates. When this is done, the default password will no longer work. The default password may also be restored by entering it here. Passwords 2 and 3 allow for the creation of second and third passwords, while retaining 19818 as the default. Each will permit access to the Parameters Set menu.

Commissioning Menus Programming: Parameters Set (continued)

Analog Zero The 4 mA value of the analog signal (zero) at no flow; factory setting, do not change.

Analog Range The 20 mA value of the analog signal at maximum flow as determined by you. The factory setting for this value is arbitrary, corresponding to that value used in testing. When you programmed "**Flow Range**" (on page 18), you automatically set the 20mA value.

Meter Factor The calibration factor of the flow meter; factory setting, do not change.

Meter Code 1 factory setting, do not change.

Meter Code 2 factory setting, do not change.

Check Mode Serial communications protocols can include internal checking procedures to detect errors in the data sets transmitted. One such procedure is a parity check. If you are using a serial communications protocol, the flow transmitter serial output can be programmed here to agree with it, so that the data transmitted can be properly recognized. Confirm with your SCADA programmer whether your communication protocol includes a parity check, the type (odd, even) and select the setting accordingly.

Having completed the programming in the **Parameters Set** menu, the instrument is ready for operation.

Menus Programming: Clr Total Record

Clr Total Record is second of the three operating menus. It appears directly after **Parameters Set**. It is the other menu that is password protected. This menu is accessed in the same way as **Parameters Set** (page 17). To create a password for this function, enter **Parameters Set** and scroll to **Clear Sum Key** (page 20). Use the soft keys to create a password. Use this password when you enter **Clear Total Record** to erase totalization values collected in the instrument memory. Write down the password and keep it in a safe location.

Menus Programming: Factory Modification Record

Factory Modification Record is informational only, and cannot be edited. It contains the following information:

MF: the meter factor determined during manufacture
SF: the sensor factor, determined during manufacture
SZ: sensor zero, part of the calibration process
MR: meter measured error relative to the reading displayed
SR: sensor raw value measured error relative to the actual voltage measured

Troubleshooting

No Display

Confirm that power to transmitter is on.

Confirm proper voltage, 18-35 VDC or 110-240 VAC, < 20W.

Check fuse in the electrical housing (see page 24).

Excitation Mode Alarm

Check that the flow tube is properly grounded (see page 5).

Confirm the conductivity of the fluid is greater than 5 µS/cm (20 µS/cm for distilled water).

Remote transmitter: Turn off power to the instrument. Check wiring of the flow tube coil cable to the transmitter (see page 14). Remove the coil cable leads EX+ and EX- from the transmitter terminals. Measure the resistance between EX+ and EX-. This value should be less than 150Ω. If not, inspect the coil cable wiring in the flow tube electrical compartment to ensure those connections are secure.

Turn on power to the instrument. With water flowing through the flow tube, measure the resistance between the terminals SIG1/SGRD and SIG2/SGRD (see page 14). You should observe the resistance value increase. If the resistance value measured does not change, inspect the signal cable wiring in the flow tube electrical compartment to ensure those connections are secure. If these connections are found to be secure, and changing resistance is not observed, the signal cable or one of the flow tube electrodes may be damaged.

Reconnect the coil and signal cable wires to the transmitter terminals (see page 14). Power on the instrument.

Empty Pipe Alarm

Confirm that the pipe and flow tube are completely full.

Confirm the conductivity of the fluid is greater than 5 µS/cm (20 µS/cm for distilled water).

Check that the flow tube is properly grounded (see page 5).

Check the wiring of the flow tube signal cable to the transmitter (see page 14).

Power off the instrument. Jumper terminals SIG+, SGRD and SIG-. Power on the instrument. The Empty Pipe Alarm should no longer be displayed. If the Empty Pipe Alarm continues to be displayed, the fluid conductivity and the conductivity value programmed by the factory may not agree (see Meter Sensor Trip, page 20). Note the value as programmed and write it down. Contact Spire MT Support for assistance in selecting a new value to enter.

Troubleshooting (continued)

Flow Rate or Totalization Displayed Without Flow.

Confirm "**Meter Sensor Enable**" is set to "enable" (page 20).

The meter display, during the installation period, may display a flow rate or totals. This can occur when sensors are energized but instrument commissioning is not yet complete. See "**Flow Zero**" in the Parameters Set submenu (page 19) to adjust this value.

Electrode Cleaning

Before you begin, check the electrode and liner materials of your flow tube for chemical compatibility with your process fluid(s). Prior to accepting your order, Spire MT should have received from you a completed Flow Application Data Sheet, which we reviewed and approved. Should you suspect that your flow tube may not be compatible with your process fluids, please stop installation and contact Spire MT.

Materials required:
Rinse water to remove large debris from inside of the flow tube
180 grit sand paper
240 grit sand paper
99.7% isopropyl alcohol
Clean, grease-free cloths
Chemically resistant safety gloves
Eye protection

Power off the instrument. If your instrument has a remote transmitter, remove the coil and signal cables from the transmitter. Protect the cable leads from damage.

Drain the process piping and remove the flow tube, taking care to support the weight of the tube and the surrounding piping. Protect eyes, skin and clothing from contact with process fluid(s). Rinse the inside of the flow tube, taking care to capture the rinse water for proper disposal. Dry the inside of the flow tube with a clean, grease-free cloth. Use 180 grit sand paper to polish the electrodes to a metallic luster. Apply the alcohol to another clean, grease-free cloth and wipe down the electrodes. Use 240 grit sand paper to remove any surface irregularities remaining from the 180 grit polishing. Apply the alcohol to another clean, grease-free cloth and again wipe down the electrodes. Reinstall the flow tube (and wire transmitter if necessary) per the installation instructions (see pages 5-11, 14).

Please contact us with any questions at Support@SpireMT.com or by calling 1-888-738-0188 (Toll Free), 1-978-263-7100, option 2.

Fuse

5 x 20 Fuse Compartment.

Unplug power cord from receptacle before opening fuse compartment to remove or install fuse.

Technical Data

Nominal Sizes	1/2" to 80" (DN15 to DN2000)
Fluid Flow Accuracy	± 0.5% of reading/± 0.3% of reading (optional)
Flow Measurement Range	0.3 to 30 fps
Direction	Bidirectional with indication
Fluid Temperature	-4° F to 392° F (-20° C to 200° C) – liner dependent*
Operator Interface	Backlit LCD Instantaneous display Flow, Total Flow, status Four soft key local programming
Totalizers	Flow Totalizer
Output Signals	Analog Output (4-20mA) OCT (open collector transistor) interface Programmable as pulse, width selectable to 400.0ms Programmable as frequency (Hz) output, maximum 2000Hz
Communications Protocols	RS485 MODBUS BACnet
Housing Protection Class	IP67 Transmitter (NEMA 4X) IP67 Flow Tube (NEMA 4X) IP68(NEMA6P) optional-must be specified
Flow Tube Liner	*Polyurethane (140°F) Neoprene (140°F), PTFE (246°F) PFA (356°F) F46 (356°F) Silicon Rubber (392°F) Ceramic (to 8" diameter only)
Electrode Material	316L, Hastelloy B, Hastelloy C, Titanium, Tantalum
Flow Tube Construction	304 sensor in carbon steel powder coat sleeve, carbon steel flanges
Process Connection Rating	ASME B16.5 RF Flange, Cl 150 (Cl 300 on request)/ASME B16.47 series * above 28"
Ambient Temperature for Compact or Remote Electronics	-13° F to 122° F (-25° C to 50° C)
Ambient Humidity	5% to 95% relative humidity
Minimum Fluid Conductivity	5 µS/cm (20 µS/cm for distilled water)
Power Supply	18-35 VDC/110-240 VAC, < 20W
Configuration	Flow tube, with integral or remote transmitter

Index