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Description

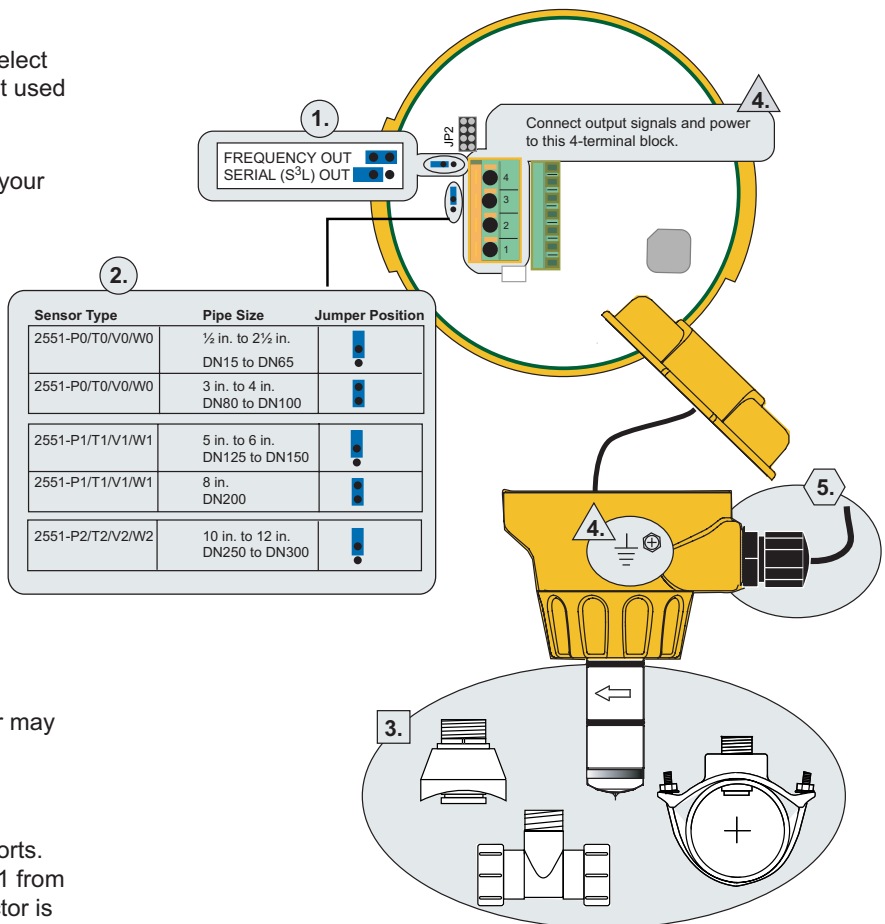
The Signet 2551 Magmeter is an insertion style magnetic flow sensor that features no moving parts. The patented sensor design is available in corrosion-resistant materials to provide long-term reliability with minimal maintenance costs. Material options include PP with stainless steel, PVDF with stainless steel, PVDF with Hastelloy-C, or PVDF with Titanium. Utilizing the comprehensive line of Signet installation fittings, sensor alignment and insertion depth is automatic, delivering accurate flow measurement in pipe sizes ranging from DN15 to DN300 (½ to 12 inches).

Signet 2551 Magmeters offer many output options of frequency/digital (S³L) or 4 to 20 mA. The frequency or digital (S³L) sensor output can be used with Signet’s extensive line of flow instruments while the 4 to 20mA output can be used for a direct input to PLCs, chart recorders, etc. Both the 4 to 20 mA output and digital (S³L) sensor interface is available for long distance signal transmission of up to 1,000 ft. An additional benefit is the empty pipe detection which features a zero flow output when the sensors are not completely wetted. Also, the frequency output is bi-directional while the 4 to 20mA output can be set for uni- or bi-directional flow using the RS232 set-up tool which connects to PCs for programming capabilities.

1. Quick Start Guide

This manual contains the general installation, wiring and calibration data for the Signet 2551-XX-11 Magmeter with Frequency or Serial data output, and for the Signet 2551-XX-12 Magmeter with Current output. The basic steps are outlined on this page. See each referenced section for detailed information.

1. Configure the Hardware
2551-XX-11 ONLY: Position this Jumper to select digital (S³L) output or Frequency output. (Not used for Current output version) Sec. 8 Pg. 6
2. Position the PIPE SIZE Jumper according to your pipe size. Sec. 5 Pg. 4
3. Install the Magmeter into the pipe.
Use Signet installation fittings ONLY.
The installation fitting is critical to Magmeter performance. Sec. 3-4, Pg. 3
4. Connect POWER and OUTPUT wiring.
2551-XX-11 Frequency out: Sec. 8.1 Pg. 6
2551-XX-11 Serial data out: Sec. 8.2 Pg. 9
2551-XX-12 Current out wiring: Sec. 7 Pg. 5



GROUNDING

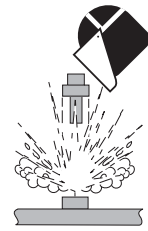
Without a good Earth Ground, the Magmeter may not operate efficiently. Sec. 6 Pg. 5

5. Route the wiring out through the two cable ports.
Use appropriate hardware to secure the 2551 from moisture intrusion. One Liquid Tight Connector is included. Sec. 5-6 Pg 4-5



SAFETY INSTRUCTIONS

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. Do not exceed maximum temperature/pressure specifications.
4. Wear safety goggles or face shield during installation/service.
5. Do not alter product construction.
6. Disconnect power before attempting any service or wiring.



2. Specifications

General

Pipe size range: DN15 to DN 300 (0.5 in. to 12 in.)

Flow Range

- Minimum: 0.05 m/s (0.15 ft/s)
 - Maximum: 10 m/s (33 ft/s)
- Linearity: ±1% reading plus 0.01m/s (0.033 ft/s)
 Repeatability: ±0.5% of reading @ 25°C (77°F)
 Minimum Conductivity: 20 µS/cm

Wetted Materials:

- Sensor body and Electrodes and Grounding ring:
 - -P0, -P1, -P2: Polypropylene and 316L SS
 - -T0, -T1, -T2: PVDF and Titanium
 - -V0, -V1, -V2: PVDF and Hastelloy-C
 - -W0, -W1, -W2: PVDF and 316L SS
- O-rings: FPM (standard)
EPDM, Kalrez® (optional)

The user is responsible for determining the chemical suitability of these materials for a specific application.

- Case: PBT
- Display window: Polyamide

Electrical

Power Requirements

- 4 to 20 mA: 21.6 to 26.4 VDC, 22.1 mA max.
- Frequency: 5 to 26.4 VDC, 15 mA max.
- Digital (S³L): 5 to 6.5 VDC, 15 mA max.

Reverse polarity and short circuit protected

Current output (4 to 20 mA):

- Loop Accuracy: 32 µA max. error (25°C @ 24 VDC)
- Isolation: Low voltage < 48 VAC/DC from electrodes and auxiliary power
- Maximum cable: 300 m (1000 ft.)
- Error condition: 22.1 mA
- Max. Loop Resistance: 300 Ω
- Compatible with PLC, PC or similar equipment

Frequency output:

- Max. Pull-up Voltage: 30 VDC
- Compatible with Signet 5075, 5500, 5600, 8550, 8900

Digital (S³L) Output:

- Serial ASCII, TTL level 9600 bps
- Compatible with Signet 8900

Environmental Requirements

Storage Temperature: -20° to 70°C (-4° to 158°F)

Relative Humidity: 0 to 95% (non-condensing)

Operating Temperature:

- Ambient: -10° to 70°C (14° to 158°F)
- Media: 0° to 85°C (32° to 185°F)

Max. operating pressure:

- 10.3 bar @ 25°C (150 psi @ 77°F)
- 1.4 bar @ 85°C (20 psi @ 185°F)

Standards and Approvals

CE

NEMA 4X / IP65 Enclosure (with cap installed)

EMC: EN55011: 1998 +A1:99+A2:02

Class B Emissions

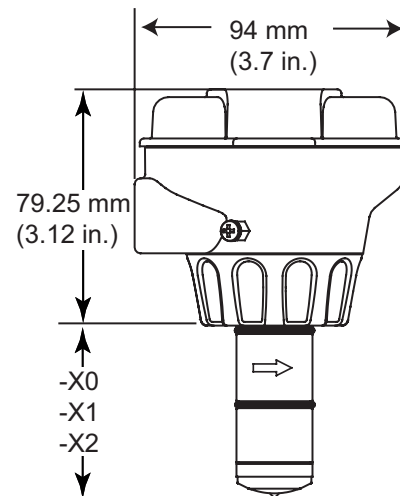
EN61326: 1997 +A1:98+A2:01

EN61000-6-2:2001

Safety: EN61010-1:2001

U.S. Patent No. 7,055,396 B1

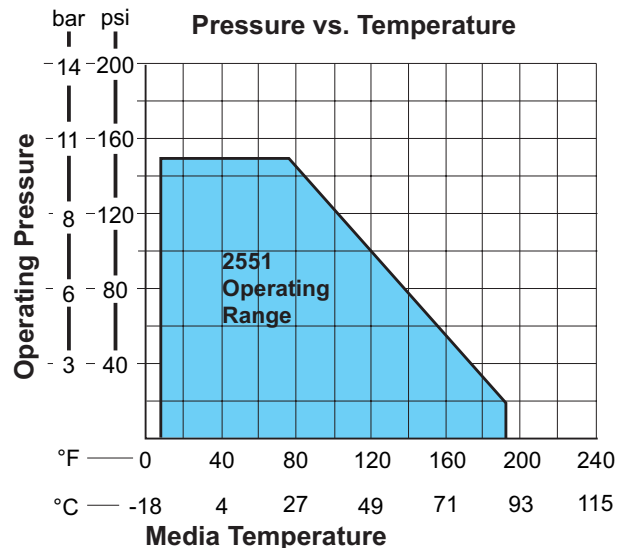
Dimensions



Pipe Range











- 1/2 to 4 in. -X0 = 58 mm (2.3 in.)
- 5 to 8 in. -X1 = 91 mm (3.6 in.)
- 10 to 12 in. -X2 = 167 mm (6.6 in.)

X = Sensor Body P, T, V, or W



3. Installation: Pipe fittings

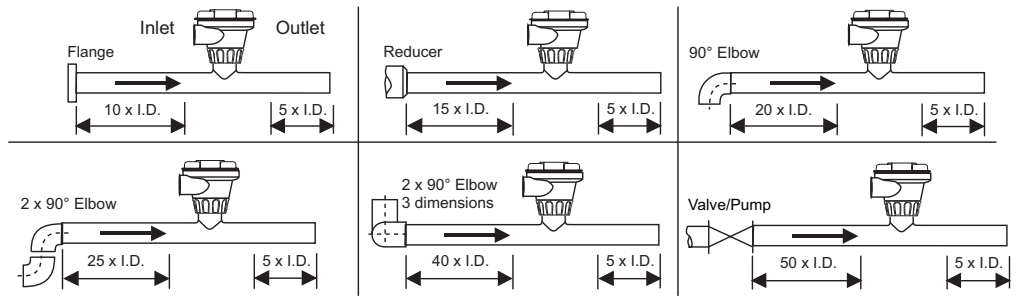
George Fischer Signet offers a wide selection of installation fittings that control the position of the Magmeter electrodes in relation to the dimensions of the pipe. You will find a complete list of order numbers for installation fittings in the Calibration tables on pages 10-13.

Type	Description	Type	Description
Plastic tees 	<ul style="list-style-type: none"> 0.5 to 4 inch versions PVC or CPVC 	Iron, Carbon Steel, 316 SS Threaded tees 	<ul style="list-style-type: none"> 0.5 to 2 in. versions Mounts on threaded pipe ends
PVC Glue-on Saddles 	<ul style="list-style-type: none"> Available in 10 and 12 inch sizes only Cut 2-1/2 inch hole in pipe Weld in place using solvent cement 	Carbon steel & stainless steel Weld-on Weldolets 	<ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe Over 4 inch, cut 2-1/8 inch hole in pipe
PVC Saddles 	<ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe 6 to 8 inch, cut 2-1/8 inch hole in pipe 	Fiberglass tees & saddles: FPT  FPS 	<ul style="list-style-type: none"> 1.5 in. to 8 in. PVDF insert > 8 in. PVC insert
PP Clamp-on Saddles 	<ul style="list-style-type: none"> Available in 10 and 12 inch sizes only Cut 2-1/8 inch hole in pipe 	Metric Union tees 	<ul style="list-style-type: none"> For pipes from DN 15 to 50 mm PP or PVDF
Iron Strap-on saddles 	<ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe Over 4 inch, cut 2-1/8 inch hole in pipe 		

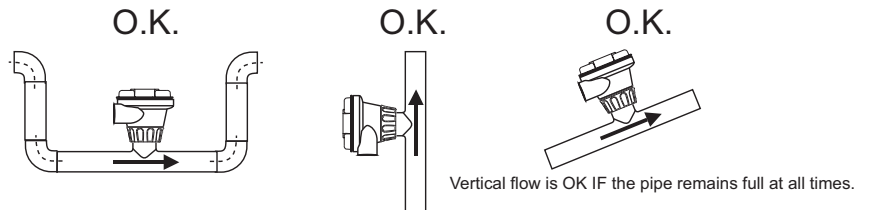
4. Selecting a Location

- The 2551 requires a full pipe and a fully developed turbulent flow profile for accurate measurement.
- If the piping system harbors air pockets or bubbles, take steps to locate the sensor so the air pockets will not contact the electrodes.
- In vertical installations, assemble the 2551 so the conduit ports are facing downward. This prevents condensation inside the conduit from being directed into the 2551 electronics housing.

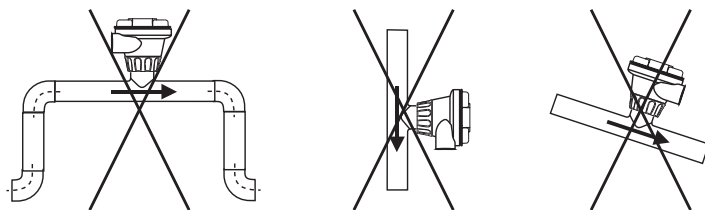
Select a location with sufficient distance of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.

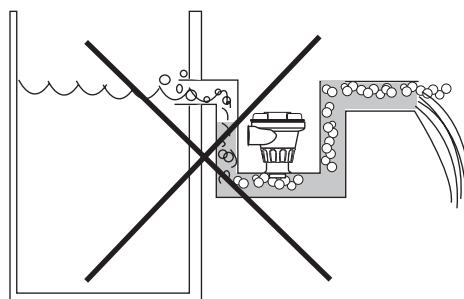


These configurations are not recommended because it is difficult to keep the pipe full.



In a gravity-flow system, the tank must be designed so the level does not drop below the outlet.

This causes the pipe to draw air in from the tank. If air bubbles pass across the Magmeter electrodes, the output will become erratic.

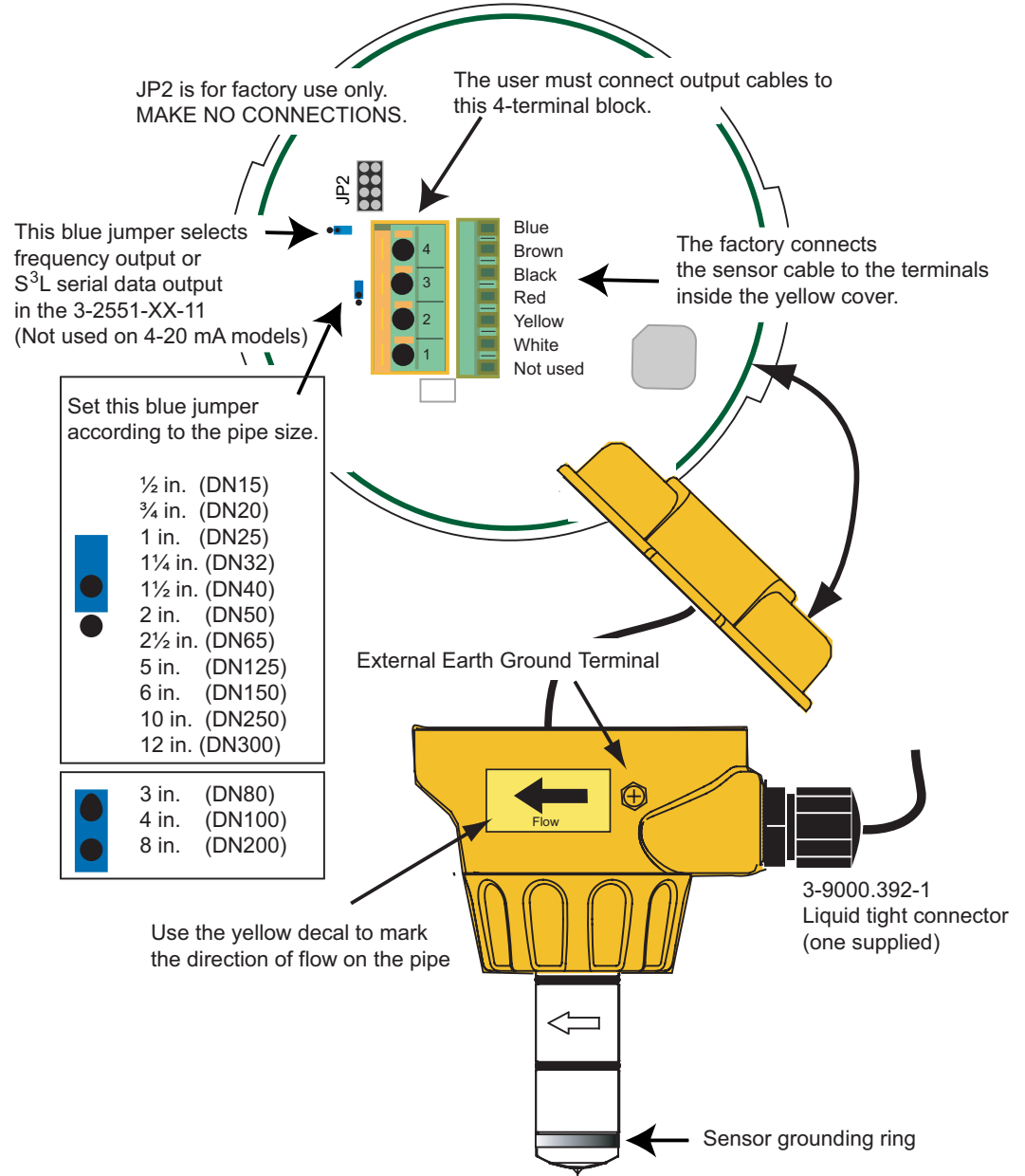


5. 2551 Magmeter Configuration

Whether using the 2551-XX-11 (frequency or digital S³L output) or the 2551-XX-12 (with 4-20 mA output), the wiring terminals located on the inside of the yellow cover are identical. All of the connections from the Magmeter to external equipment (PLC, Datalogger, Chart Recorder, Flow meter, etc.) are made at the large 4-position terminal connector.

When the cover is removed the wiring from the sensor can be seen connected to the smaller terminal block. These connections should always remain connected to prevent inadvertent damage or miswiring.

The terminals on the 2551 Magmeter are designed for conductors from 16 AWG to 22 AWG.



WARNING!

If the second conduit port is used, carefully drill the opening. (The plastic is too strong to be punched out.)

- Secure the Magmeter in a vise to prevent damage or injury.
- The plastic inside the port is very thin. Do not allow the drill to penetrate too deeply and damage the Magmeter wiring.



Important:

- The directional arrow on the body of the sensor must be pointed DOWNSTREAM.
- The FLOW arrow decal can be placed directly on the pipe to identify the direction of flow.
- Use a cable gland or a liquid tight connector to seal the cable ports from water intrusion.
- The yellow housing may be reversed to align the conduit ports as required.
- If the Magmeter is installed on a vertical pipe, the conduit ports should be turned to point downward. This will prevent condensation from being channeled into the enclosure.
- Use plumber's tape or a suitable sealant on cable ports.

6. General Installation and Grounding Tips

Sensor conditioning

The Magmeter output signal may be unstable immediately after installation. Allowing the sensor to soak in a full pipe (or in any container of water) for 24 hours will stabilize the performance.

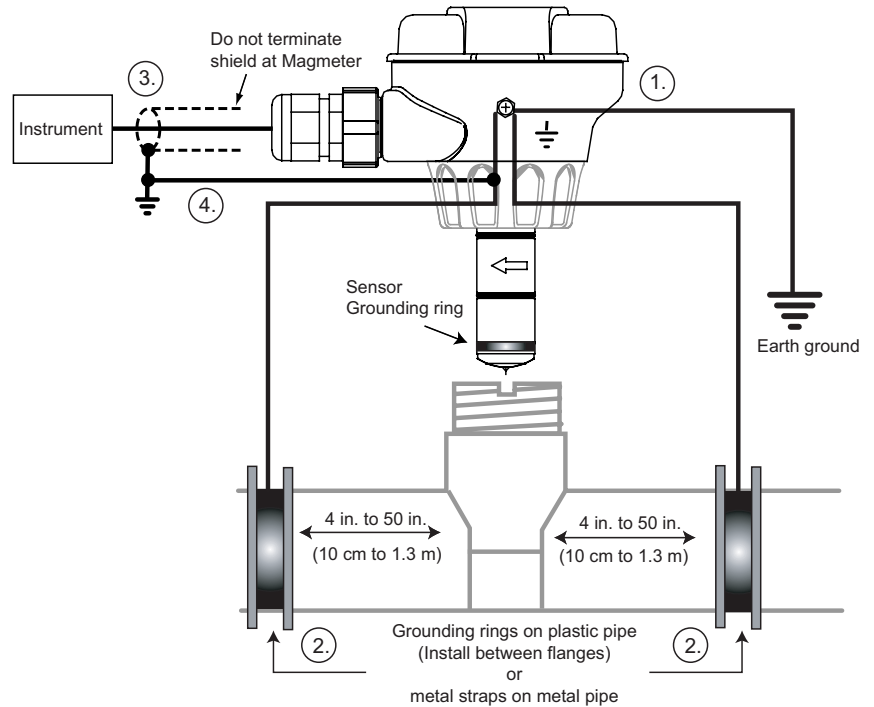
- Very low conductivity fluids may require a longer conditioning period. (The Magmeter may not operate properly in fluids where the conductivity is less than 20 $\mu\text{S}/\text{cm}$.)

Grounding

The 2551 Magmeter is unaffected by moderate levels of electrical noise. However, in some applications it may be necessary to ground portions of the system to eliminate electrical interference. The grounding requirements will vary with each installation.

One or more of the following steps may be applied if the 2551 Magmeter is affected by electrical noise:

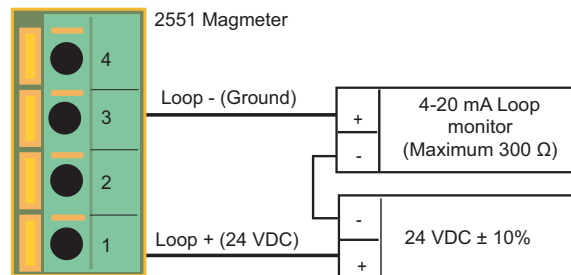
- ① The ground terminal on the outside of the yellow housing is connected internally to the grounding ring at the tip of the sensor. Connect a wire (14 AWG/2.08 mm^2 recommended) from this terminal directly to a local Earth ground.
- ② Install fluid grounding devices immediately upstream and downstream of the Magmeter. Connect the fluid grounds to the Earth ground terminal on the 2551. Use flanged grounding rings or metal electrodes on plastic pipes, or metal clamps on metal pipes. Fluid grounds must be in direct contact with the fluid, and as near to the Magmeter as possible.
- ③ The shield from the output cable must be terminated at the remote instrument ONLY. This shield must not be connected at both ends!
- ④ Connect an additional wire (minimum AWG 14/2.08 mm^2) from the remote instrument ground to the Magmeter ground terminal.



7. Wiring the 2551-XX-12 Magmeter with 4-20 mA Loop Output

The 2551-XX-12 Magmeter is a traditional 2-wire passive 4-20 mA loop transmitter.

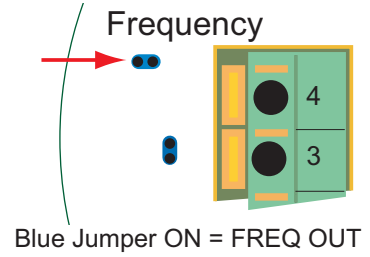
- External loop power (24 VDC $\pm 10\%$) is required. See Ordering Information for power supplies.
- **The maximum loop resistance the Magmeter can accommodate is 300 Ω .**
- All 2551-XX-12 Magmeters are shipped from the factory with the 4-20 mA output scaled for 0 to 5 m/s (0 to 16.4 ft/s). If this operating range is suitable, no adjustments are necessary. The Calibration charts on pages 10-14 list the 20 mA setpoint for each installation fitting. Use this information to program the 4-20 mA range of the loop device (PLC, Datalogger, recorder, etc.)



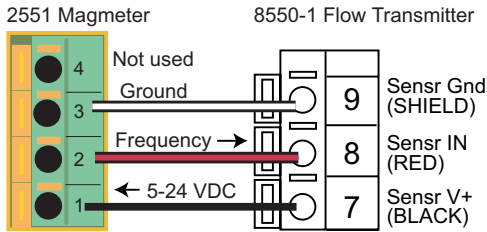
8. Wiring the 3-2551-11 with Frequency or Digital (S³L) output

8.1 Wiring: Frequency output (Compatible with all POWERED Signet Flow instruments.)

- When the blue jumper illustrated here is placed over both pins, the 2551-XX-11 outputs an open collector frequency signal that can be connected to any powered Signet flow meter. (Models 5075, 5500, 5600, 8550, 8900.)
- 5 VDC power is provided to the 2551 Magmeter by all Signet flow instruments. No additional power is required.
- If connecting the 2551 Magmeter to a flow instrument from another manufacturer, 5 to 24 VDC power must be provided to the 2551. A 10 K Ω pull up resistor must also be connected between terminals 1 and 2.
- The frequency output will be displayed as positive flow regardless of the flow direction.

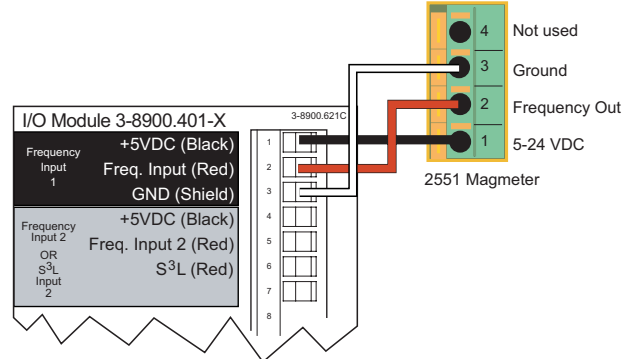


2551 Frequency Out to Signet 8550-1

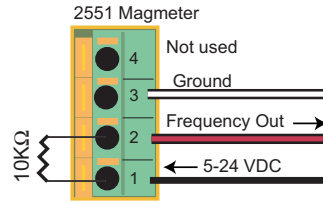


AUX power MUST be connected on the 8550 to provide power to the 2551.

2551 Frequency Out to Signet 8900



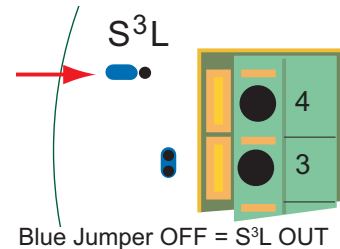
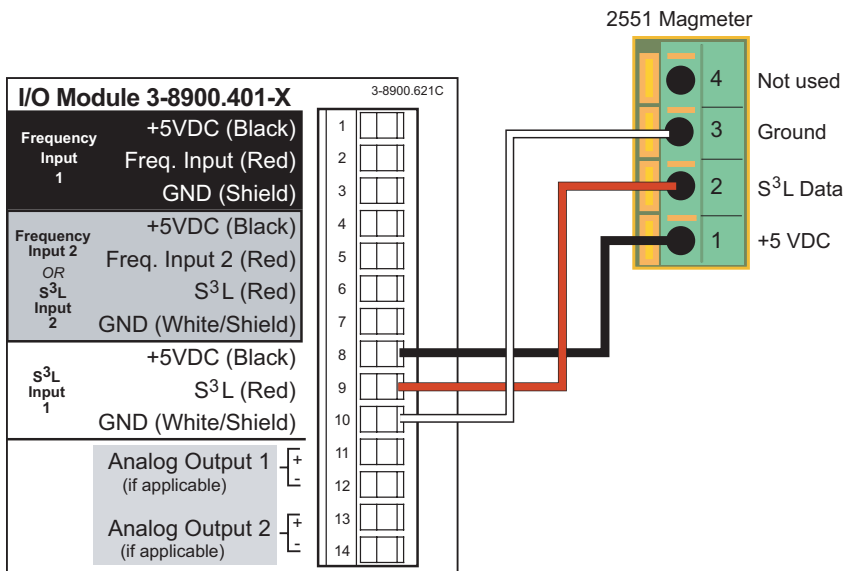
2551 Frequency Out to other Manufacturer's equipment



Install a pull-up resistor when connecting the 2551 Magmeter to other manufacturer's flowmeters.

8.2 Wiring: S³L output (Compatible with 8900 Multi-Parameter Controller only)

- When the blue jumper illustrated here is removed (or placed over one pin for storage) the 2551-XX-11 outputs a digital (S³L) signal compatible with the Signet 8900.
- The 2551 receives 5 VDC power from the 8900. No additional power is required.
- The 8900 will display 0 (Zero) flow rate during periods of reverse flow.



NOTE:

The maximum cable length from the 2551 to the 8900 depends on the 8900 configuration. Refer to the 8900 manual for complete information.

9. Custom System Span and Setup

- The 3-0232 Setup tool enables the user to configure the 2551 Magmeter to suit the application.
- The Setup tool connects the 2551 to a computer by converting the serial data output into standard RS232 format.
- The computer operating system must be Windows 98, 2000, 2000 Pro, XP, XP Pro ONLY.
- The 3-0232 Setup tool is not compatible with any other operating system.
- Managed and network systems may have security measures enabled that interfere with the installation of this program. See the network administrator or IT staff if the program cannot be installed.

9.1 Collect the Equipment and information that will be required:

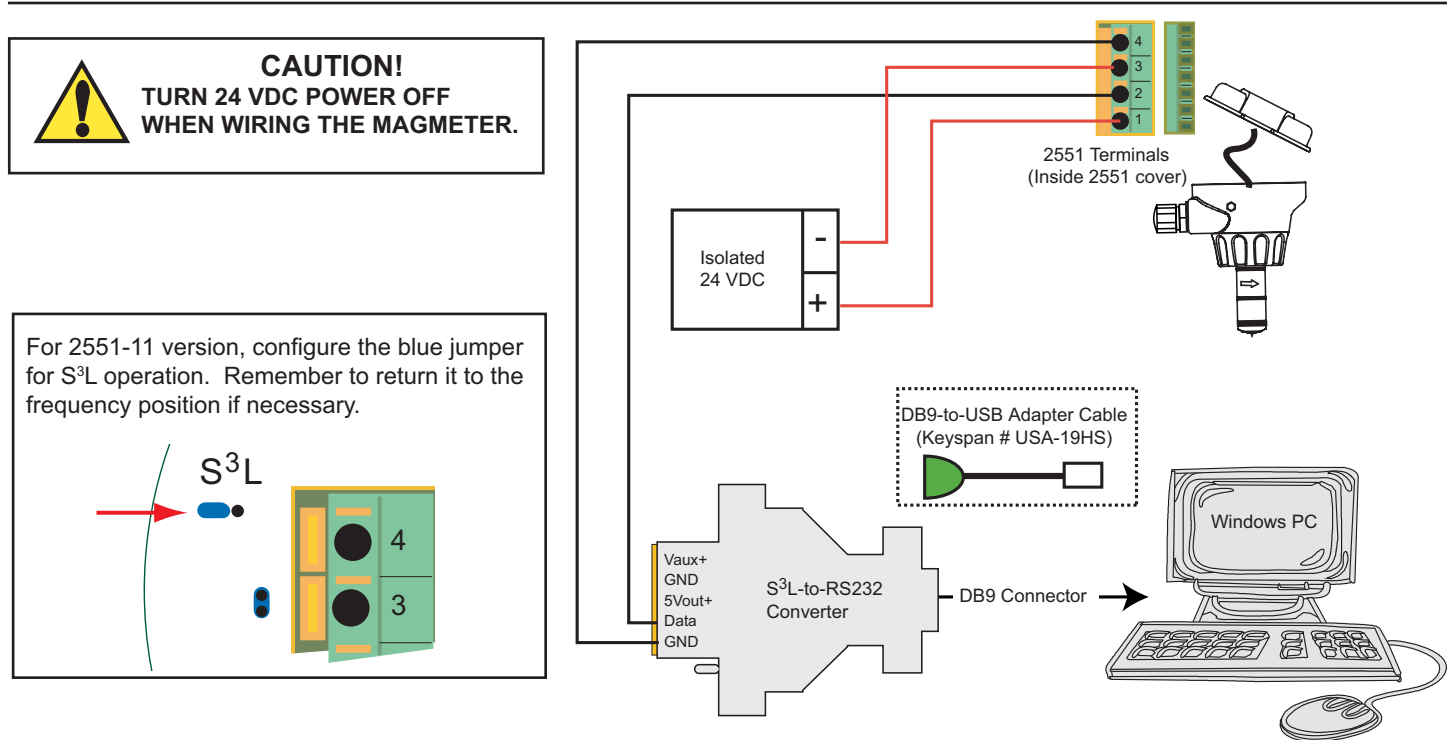
- 3-0232 Setup Tool (Includes one RS232 Converter and one CD-ROM with software)
- 24 VDC ISOLATED power source.
- Personal computer with:
 - Intel Pentium or Higher or AMD 1800 or Higher
 - Windows 98, 2000, 2000 Pro, XP, XP Pro operating system
 - CD ROM Reader capable of reading ISO 9660 Format
 - Free Disk Space Of 400 KB
- DB9 serial-to-USB converter cable (required only for computers that do not have a DB9 serial port available.)
- Pipe data (id, K-factor from Sec. 12, Pg 10-14)
- Measurement Preferences (engineering units, timebase)

9.2 Install the software onto the computer:

1. Insert the CD-ROM into a computer that is running on Win98, Win2000, or Win XP.
2. Click the START button, then Run. Click the BROWSE button and navigate to the CD drive and select the Setup.exe file. Click Open, then click OK.
3. If unable to install the program, contact the system administrator for assistance.

9.3 Connect the Magmeter to the computer:

1. Remove the cover from the Magmeter.
2. Connect the 2551 output terminals 2 and 4 to the input terminals of the RS232 Interface.
3. Connect the isolated 24 VDC power source to the 2551, terminals 1 and 3.
4. For 2551-11 version, configure the blue jumper for S³L operation. Remember to return it to the frequency position if necessary. (section 8.2, Pg 6.)
5. Connect the DB9 serial output connector from the RS232 Interface to the computer.
Note: If the computer does not have an available DB9 serial port, use a serial-to-USB converter cable. Signet recommends cable model USA-19HS by Keyspan. (www.keyspan.com)



The following page outlines each step in the 2551 Magmeter Setup Tool software.

10. Using the 3-0232 i-Go S³L to RS232 Converter and Setup Tool to customize the 3-2551 Magmeter

Procedure:

1. Set the general information about the pipe and application preferences in the Application Settings fields.

Note: Press the "Restore Factory Settings" button while all fields are blank to load the setup program with factory settings.

After a value is entered into any field, the "Restore Factory Settings" button will not change them.

Flow/Velocity Units (factory set: Meters)

- Select the engineering units from the list: meters, feet, cubic meters, liters, cu. ft., U.S. gallons, Imp. gallons.

Timebase (factory set: Seconds)

- Set the timebase preference: seconds, minutes, hours, days

Pipe ID (Inside Diameter) (factory set: 44.0)

- Enter the inside diameter of the pipe.

ID Units: (factory set: millimeters)

- Select inches or mm for the dimensions of the pipe.

NOTE: Check all associated settings after changing the units.

This program does not convert values automatically.

K-Factor (factory set: 65.7665)

- K-factors are published in the Magmeter manual as "pulses per gallon" and "pulses per liter".

The screenshot shows the 'Signet Magmeter Setup Tool' interface. It has a title bar '3_2551 MagMeter Set Up Program' and a logo '+GF+'. The main area is divided into several sections: 'Application Settings' with dropdowns for units and timebase; 'Loop Settings (4-20mA Sensors Only)' with input fields for set points; 'Performance Settings' with dropdowns for averaging time and sensitivity; 'Sensor Information' with fields for serial number and type; and 'Controls' with buttons for various actions. A red text box in the Application Settings section says 'Select Pipe Inner Diameter Units in Inches or mm'.

2. Set the 4-20 mA span (4-20 mA output models only)

- Enter the flow rate at 4 mA. (Factory set: 0 m/s)
- Enter the flow rate at 20 mA. (Factory set: 5 m/s)
- When the RESTORE FACTORY SETTINGS button is pressed, the 20 mA setpoint will be restored to the equivalent of 5 m/s, in terms of the Flow units and Timebase selected above.

3. Set the Performance Settings to best accommodate the unique conditions in the pipe.

Averaging Time in Seconds (Factory set: 14 seconds)**

- Select the time the Magmeter will use as the averaging period.

Example: With averaging at 14 seconds, each display is an average of the previous 14 seconds input.

Use higher averaging times to smooth the display and current output where the flow in the pipe is erratic.

Quick Response Sensitivity (Factory set: 25% of Max Range, or 2.5 m/s)**

- Set the percentage of change in the flow rate required to allow the Magmeter to override the AVERAGING and jump to a new flow rate immediately.

(2551 maximum range is 10 m/s)

A detailed explanation of **averaging** and **sensitivity** functions is provided on the following page.

Noise Rejection Frequency (Factory set: 60 Hz)**

- Select 50 Hz or 60 Hz according to local AC power specifications.

Low Flow Cut-off (Factory set: 0.05 m/s)

- Set the flow rate where all Magmeter outputs will be forced to zero.

(When the flow rate drops below this value, the frequency output will be 0 Hz. and the current output will be 4 mA.)

Note: If a Low flow Cutoff or a 4-20 mA field turns RED, the value entered is outside of the allowable range. The maximum allowable value will be automatically loaded.

**** SELECT FROM PULL-DOWN MENU ONLY.** Direct text input will not be accepted. Error message will appear: "Cannot write all settings to sensor."

4. Click "Write Settings to Sensor" at the bottom of the display to download the new settings to the Magmeter.

- To repeat the same settings in another Magmeter, remove 24 VDC Power to the magmeter and connect the second Magmeter.
- Click "Write Settings to Sensor" again.
- Click "Read Sensor Settings" to validate the new settings.

Note: All settings are lost when you exit the program.

Sensor Information

Serial Number, Sensor Type:

- Information for these fields is read from the Magmeter when you press the "Read Sensor Settings" button.

Messages

- Displays messages related to the current selection. Error messages and procedure instructions appear here.

Controls

- **Read sensor settings:** Read information and setup values from the Magmeter into this setup display.
- **Restore factory settings:** Restores Loop and Performance settings to original factory values. Press this button before entering any data into the program if you want to load all factory settings.
- **Write settings to sensor:** Copies all of the settings in this setup display into the Magmeter.
- **Load settings from file:** Load a saved meter setup file into the Magmeter Setup Tool.
- **Save settings to file:** Save a meter setup file on your local hard drive to be used again.

11. 2551 Magmeter Averaging and Sensitivity Settings

Because ideal flow conditions are often impossible to achieve, the flow rate is often erratic, which causes any control features (ie; relays, 4-20 mA loops, etc.) that are associated with the flow rate to also be erratic.

The best solution to these problems is to correct the piping deficiencies that cause the instability. This may involve longer straight runs upstream, reducing the pipe size to maintain a full pipe at all times, and other installation changes. But in many situations these measures are simply not possible.

The 2551 Magmeter provides several tools that are designed to "work around" these deficiencies. They are called "Performance Settings" and can be modified only through the i-Go S³L to RS232 Converter and the 2551 Magmeter Setup Tool. The noise rejection and the Low Flow Cutoff settings are self-explanatory. The Averaging and the Sensitivity features should be studied before making adjustments.

Averaging Time in Seconds (Factory set: 14 seconds)

- Set the time the Magmeter will use as the averaging period.
With averaging at 14 seconds, each display is an average of the previous 14 seconds input.
Use higher averaging times to smooth the display and current output where the flow in the pipe is erratic.

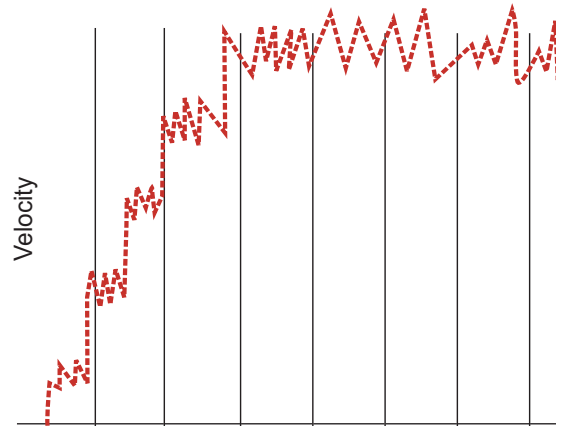
Quick Response Sensitivity (Factory set: 25% of Maximum Range, or 2.5 m/s)

- Set the percentage of change in the flow rate required to allow the Magmeter to override the AVERAGING and jump to a new flow rate immediately. (2551 maximum range is 10 m/s)

The pictures below illustrate the effect of these settings.

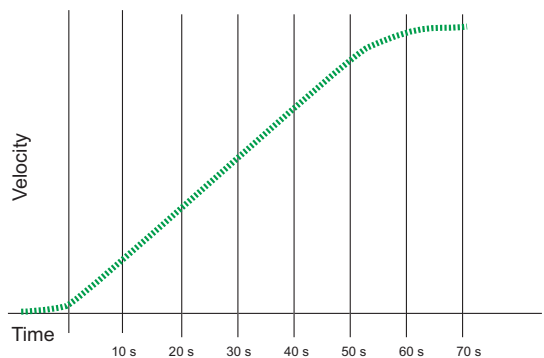
No AVERAGING, no SENSITIVITY

With AVERAGING set to 0 (zero) the SENSITIVITY is ineffective, and the flow rate may be very unstable. This will cause the output signals to respond erratically.



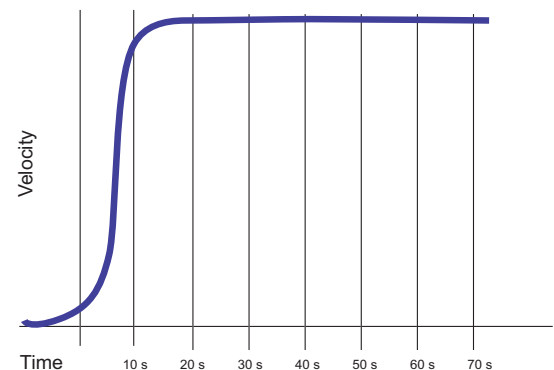
AVERAGING Only

With AVERAGING set to 60 seconds and SENSITIVITY set to 100%, the flow rate is stabilized, but a sharp change in flow rate is not represented for 60 seconds or longer. This can cause system problems if one of the operating setpoints falls within this range.



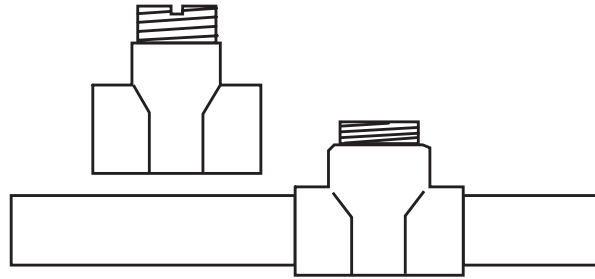
AVERAGING and SENSITIVITY

With AVERAGING at 60 seconds and SENSITIVITY set to 25%, the flow rate is stabilized, but the sudden shift in flow is reflected very quickly.



12. Calibration Data: K-factors and Full Scale Current Values

Plastic Installation Fittings: PVC Tees and Saddles



PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters*	20 mA= in GPM	20 mA= in LPM
SCH 80 PVC TEES FOR SCH 80 PVC PIPE					
½	PV8T005	2289.37	604.85	13.1	49.6
¾	PV8T007	1430.41	377.92	20.97	79.38
1	PV8T010	876.86	231.67	34.21	129.5
1¼	PV8T012	447.06	118.11	67.1	253.99
1½	PV8T015	324.19	85.65	92.54	350.25
2	PV8T020	206.69	54.61	145.15	549.38
2½	PV8T025	131.46	34.73	228.2	863.74
3	PV8T030	82.52	21.80	363.55	1376.04
4	PV8T040	44.78	11.83	669.88	2535.49
SCH 80 PVC TEES FOR SCH 80 CPVC PIPE					
½	CPV8T005	2496.03	659.45	12.02	45.49
¾	CPV8T007	1381.48	364.99	21.72	82.19
1	CPV8T010	857.98	226.68	34.97	132.34
1¼	CPV8T012	445.17	117.61	67.39	255.07
1½	CPV8T015	325.56	86.01	92.15	348.78
SCH 80 PVC SADDLES FOR SCH 80 PVC PIPE					
2	PV8S020	193.83	51.21	154.77	585.81
2½	PV8S025	138.01	36.46	217.38	822.78
3	PV8S030	83.89	22.16	357.62	1353.60
4	PV8S040	40.88	10.80	733.88	2777.74
6	PV8S060	22.53	5.95	1331.85	5041.06
8	PV8S080	12.52	3.31	2395.41	9066.64
10	PV8S100	7.94	2.10	3778.75	14302.57
12	PV8S120	5.71	1.51	5256.69	19896.57
SCH 80 PVC SADDLES FOR SCH 40 PVC PIPE					
2	PV8S020	180.01	47.56	166.66	630.81
2½	PV8S025	123.72	32.69	242.49	917.82
3	PV8S030	75.81	20.03	395.71	1497.76
4	PV8S040	41.87	11.06	716.56	2712.19
6	PV8S060	19.71	5.21	1521.92	5760.46
8	PV8S080	11.73	3.10	2558.12	9682.50
10	PV8S100	7.43	1.96	4037.60	15282.3
12	PV8S120	5.23	1.38	5734.87	21706.48
POLYPROPYLENE CLAMP-ON SADDLES ON SCH 80 PP PIPE					
10	PPS100	7.94	2.10	3778.75	14302.57
12	PPS120	5.71	1.51	5256.69	19896.57
POLYPROPYLENE CLAMP-ON SADDLES ON SCH 40 PP PIPE					
10	PPS100	7.43	1.96	4037.60	15282.3
12	PPS120	5.23	1.38	5734.87	21706.48

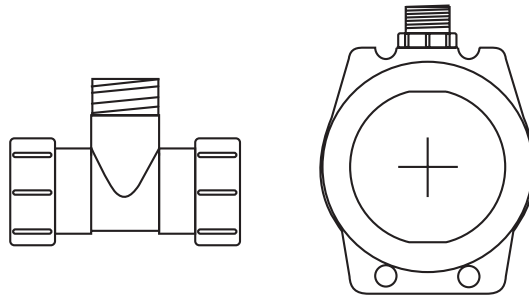
12. Calibration Data: K-factors and Full Scale Current Values

Plastic Installation Fittings for Metric Pipes:

Polypropylene True Union Tees and Wafers

PVDF True Union Tees and Wafers

PVC True Union Tees and Wafers



PIPE SIZE (Metric)	FITTING TYPE	K-Factor Gallons	K-Factor Liters*	20 mA= in GPM	20 mA= in LPM
POLYPROPYLENE FITTINGS (DIN/ISO ,BS, ANSI)					
DN15	PPMT005	2192.73	579.32	13.68	51.78
DN20	PPMT007	1327.81	350.81	22.59	85.52
DN25	PPMT010	737.16	194.76	40.70	154.04
DN32	PPMT012	453.46	119.81	66.16	250.41
DN40	PPMT015	275.03	72.66	109.08	412.86
DN50	PPMT020	164.17	43.35	182.74	691.66
DN65	PPMT025	112.02	29.59	267.82	1013.70
DN80	PPMT030	77.40	20.45	387.60	1467.06
DN100	PPMT040	51.76	13.68	579.58	2193.70
DN125	PPMT050	40.14	10.61	747.36	2828.74
DN150	PPMT060	24.51	6.47	1224.17	4633.48
DN200	PPMT080	15.66	4.14	1915.10	7248.67
PVDF FITTINGS (DIN/ISO ,BS, ANSI)					
DN15	SFMT005	1946.49	514.26	15.41	58.34
DN20	SFMT007	1158.05	305.96	25.91	98.05
DN25	SFMT010	749.09	197.91	40.05	151.58
DN32	SFMT012	439.51	116.12	68.26	258.36
DN40	SFMT015	248.93	65.77	120.52	456.16
DN50	SFMT020	146.85	38.80	204.30	773.26
DN65	SFMT025	104.84	27.70	286.16	1083.10
DN80	SFMT030	72.01	19.02	416.64	1576.97
DN100	SFMT040	46.82	12.37	640.69	2425.00
DN125	SFMT050	31.93	8.44	939.63	3556.51
DN150	SFMT060	18.78	4.96	1597.70	6047.30
DN200	SFMT080	11.86	3.13	2529.84	9575.44
PVC FITTINGS (DIN/ISO ,BS, ANSI)					
DN15	PVMT005	2067.76	546.30	14.51	54.91
DN20	PVMT007	1136.61	300.29	26.39	99.90
DN25	PVMT010	716.52	189.31	41.87	158.47
DN32	PVMT012	446.07	117.85	67.25	254.56
DN40	PVMT015	278.83	73.67	107.59	407.23
DN50	PVMT020	159.36	42.10	188.26	712.55
DN65	PVMT025	110.11	29.09	272.46	1031.26
DN80	PVMT030	73.92	19.53	405.84	1536.12
DN100	PVMT040	47.86	12.64	626.87	2372.70
DN125	PVMT050	36.18	9.56	829.10	3138.16
DN150	PVMT060	21.56	5.70	1391.30	5266.07
DN200	PVMT080	13.81	3.65	2172.63	8223.4

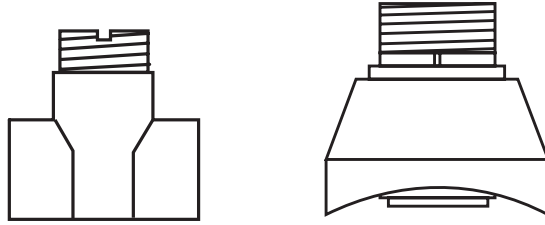
12. Calibration Data: K-factors and Full Scale Current Values

Metal Installation Fittings:

Carbon Steel Tees and Weld-o-Lets

Stainless Steel Tees and Weld-o-Lets

Galvanized Iron Tees

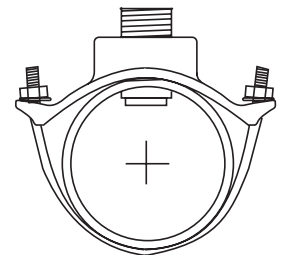


PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters*	20 mA= in GPM	20 mA= in LPM
CARBON STEEL TEES ON SCH 40 PIPE					
1/2	CS4T005	1572.66	415.50	19.08	72.20
3/4	CS4T007	1086.73	287.11	27.61	104.49
1	CS4T010	582.34	153.86	51.52	194.99
1 1/4	CS4T012	377.48	99.73	79.48	300.81
1 1/2	CS4T015	267.79	70.75	112.03	424.02
2	CS4T020	167.85	44.35	178.73	676.48
STAINLESS STEEL TEES ON SCH 40 PIPE					
1/2	CR4T005	1601.26	423.05	18.74	70.91
3/4	CR4T007	937.78	247.76	31.99	121.08
1	CR4T010	606.18	160.15	49.49	187.32
1 1/4	CR4T012	279.68	73.89	107.26	405.99
1 1/2	CR4T015	147.65	39.01	203.19	769.06
2	CR4T020	111.90	29.56	268.09	1014.73
STAINLESS STEEL WELDOLETS ON SCH 40 PIPE					
2 1/2	CR4W025	106.31	28.09	282.19	1068.10
3	CR4W030	72.27	19.09	415.12	1571.25
4	CR4W040	36.84	9.73	814.34	3082.28
5	CR4W050	29.28	7.73	1024.70	3878.50
6	CR4W060	20.29	5.36	1478.26	5595.21
8	CR4W080	11.73	3.10	2557.72	9680.96
10	CR4W100	7.45	1.97	4028.83	15249.13
12	CR4W120	5.24	1.39	5722.73	21660.53
CARBON STEEL WELDOLETS ON SCH 40 PIPE					
2 1/2	CS4W025	105.70	27.93	283.82	1074.27
3	CS4W030	70.68	18.67	424.45	1606.56
4	CS4W040	36.38	9.61	824.65	3121.30
5	CS4W050	29.28	7.73	1024.70	3878.50
6	CS4W060	20.29	5.36	1478.26	5595.21
8	CS4W080	11.73	3.10	2557.72	9680.96
10	CS4W100	7.45	1.97	4028.83	15249.13
12	CS4W120	5.24	1.39	5722.73	21660.53
GALVANIZED IRON TEES ON SCH 40 PIPE					
1	IR4T010	558.50	147.56	53.71	203.31
1 1/4	IR4T012	334.45	88.36	89.70	339.51
1 1/2	IR4T015	248.97	65.78	120.49	456.07
2	IR4T020	146.00	38.57	205.48	777.76

12. Calibration Data: K-factors and Full Scale Current Values

Metal Installation Fittings

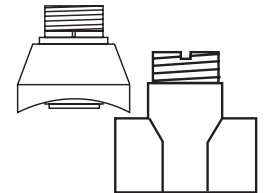
Iron Saddles



PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters	20 mA= in GPM	20 mA= in LPM
SCH 80 IRON SADDLE ON SCH 80 PIPE					
2	IR8S020	194.85	51.48	153.96	582.75
2½	IR8S025	142.28	37.59	210.86	798.10
3	IR8S030	87.53	23.13	342.72	1297.20
4	IR8S040	40.62	10.73	738.58	2795.54
5	IR8S050	29.28	7.74	1024.43	3877.48
6	IR8S060	22.30	5.89	1345.58	5093.03
8	IR8S080	12.52	3.31	2395.41	9066.64
10	IR8S100	7.94	2.10	3778.75	14302.57
12	IR8S120	5.65	1.49	5311.45	20103.83
SCH 80 IRON SADDLE ON SCH 40 PIPE					
2	IR8S020	185.35	48.97	161.85	612.61
2½	IR8S025	127.47	33.68	235.36	890.83
3	IR8S030	76.62	20.24	391.54	1481.99
4	IR8S040	40.23	10.63	745.72	2822.57
5	IR8S050	27.32	7.22	1098.24	4156.83
6	IR8S060	19.71	5.21	1521.92	5760.46
8	IR8S080	11.61	3.07	2584.23	9781.30
10	IR8S100	7.36	1.94	4078.8	15438.2
12	IR8S120	5.18	1.37	5793.39	21927.98

Metal Installation Fittings:

Bronze and Copper Tees and Brazolets



PIPE SIZE (IN.)	FITTING TYPE	K-Factor Gallons	K-Factor Liters	20 mA= in GPM	20 mA= in LPM
BRONZE TEES ON SCH 40 PIPE					
1	BR4T010	582.34	153.86	51.52	194.99
1¼	BR4T012	330.54	87.33	90.76	343.53
1½	BR4T015	254.76	67.31	117.76	445.71
2	BR4T020	157.36	41.58	190.64	721.58
COPPER TEES FITTING ON COPPER PIPE SCH K					
½	CUKT005	2459.19	649.72	12.20	46.17
¾	CUKT007	1108.02	292.74	27.08	102.48
1	CUKT010	649.87	171.70	46.16	174.73
1¼	CUKT012	422.03	111.50	71.09	269.06
1½	CUKT015	281.43	74.35	106.60	403.47
2	CUKT020	136.02	35.94	220.55	834.78
COPPER TEES FITTING ON COPPER PIPE SCH L					
½	CUKT005	2406.30	635.75	12.47	47.19
¾	CUKT007	1174.77	310.37	25.54	96.66
1	CUKT010	672.28	177.62	44.62	168.90
1¼	CUKT012	402.84	106.43	74.47	281.87
1½	CUKT015	294.99	77.94	101.70	384.92
2	CUKT020	149.63	39.53	200.50	758.89
COPPER/BRONZE BRAZOLET ON SCH 40 PIPE					
2½	BR4B025	117.31	30.99	255.74	967.96
3	BR4B030	78.62	20.77	381.58	1444.28
4	BR4B040	45.13	11.92	664.77	2516.15
5	BR4B050	32.79	8.66	914.91	3462.95
6	BR4B060	22.73	6.01	1319.87	4995.72
8	BR4B080	13.14	3.47	2283.68	8643.71
10	BR4B100	8.34	2.20	3597.17	13615.29
12	BR4B120	5.87	1.55	5109.58	19339.76

13. Maintenance

The 2551 Magmeter requires very little maintenance. There are no user-serviceable components in the Magmeter.

- If the fluid contains deposits and solids that may coat the electrodes, a regular cleaning schedule is recommended.
- Do not use abrasive materials on the metal electrodes. Clean with soft cloth and mild detergent only.
- Use a cotton swab and mild detergent to remove deposits on the metal electrodes at the tip of the sensor.

13.1. Environmental Recommendations:

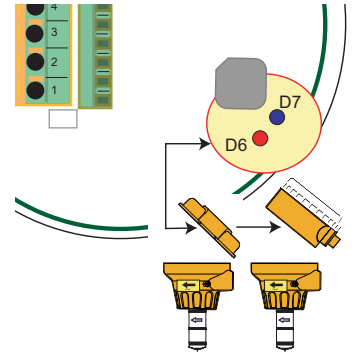
- When used properly, this product presents no inherent danger to the environment.
- Please follow local ordinance when disposing of this or any product with electronic components.

13.2 Troubleshooting

Symptom	Possible Cause	Possible Solution
<ul style="list-style-type: none"> • Frequency, Digital or Current output is erratic. 	<ul style="list-style-type: none"> • Magmeter installed too close to upstream obstruction. • Magmeter electrodes are coated with solids. • Magmeter electrodes exposed to air bubbles/pockets. • Electrical noise is interfering with the measurement. • New sensor, metal surface not properly conditioned. 	<ul style="list-style-type: none"> • Move the Magmeter upstream at least 10 pipe diameters from obstruction. • Clean the electrodes with soft cloth. Do not use abrasives. • Eliminate air bubbles in the pipe. • Remove the Magmeter and reinstall with the flow direction arrow on the sensor body pointed DOWNSTREAM. • Modify grounding as required to protect the Magmeter from interference. • Soak sensor overnight in fluid.
<ul style="list-style-type: none"> • Output is not 0 when flow is stopped. 	<ul style="list-style-type: none"> • Electrode not adequately conditioned. • Electrical noise is interfering with the measurement. • Vibration or other movement in pipe causes magmeter to detect flow. • Defective Magmeter 	<ul style="list-style-type: none"> • Soak sensor overnight in fluid. • Modify grounding as required to protect the Magmeter from interference. • Set low flow cutoff higher. • Return to factory for service.
<ul style="list-style-type: none"> • 4-20 mA output is incorrect. 	<ul style="list-style-type: none"> • 4-20 mA is not scaled same as Loop device. • Loop device is not scaled same as Magmeter. • Range Jumper not placed correctly. • Defective Magmeter 	<ul style="list-style-type: none"> • Use 3-0232 Span and Setup tool to set output range. • Respan Loop device to match Magmeter. • Set Range Jumper correctly. • Return to factory for service.
<ul style="list-style-type: none"> • Frequency output is inoperative • Digital (S³L) output is inoperative. • Loop output is inoperative. 	<ul style="list-style-type: none"> • 2551 is wrong model. • Blue jumper not in correct position. • Wiring is not correct. • Frequency input to other manufacturer's flow instrument does not have pull-up resistor. 	<ul style="list-style-type: none"> • Frequency model is 3-2551-11. • Place blue jumper correctly. (Sec. 5 pg. 9) • Check wiring, make corrections. • Install 10kΩ resistor. Sec 8.1, pg. 6)
<ul style="list-style-type: none"> • Output is 22.1 mA. 	<ul style="list-style-type: none"> • Conductivity is less than 20 μS/cm. • Electronic component failure. 	<ul style="list-style-type: none"> • Unsuitable application for Magmeter. • Return to factory for service.

Troubleshooting with the RED and BLUE lights

No Lights:	The power is off or the sensor is not connected
Solid Blue:	The power is on but there is no flow in the pipe.
Blinking Blue:	Normal operation, blink rate is proportional to the flow rate.
Alternating Red-Blue:	Empty pipe indication (electrodes are not wet.)
Blinking Red:	System errors (Electrical noise interference)
Solid Red:	Instrument error (defective electronics component)



Reverse flow:

- Frequency out cannot distinguish reverse flow from forward flow. The output will be the absolute value.
- Digital (S³L) output: Reverse flow results in 0 flow rate displayed on 8900
- 4-20 mA output can be spanned into negative flow range using the custom setup tool. (example: 4-20 mA = -100 to +100 GPM)

Empty Pipe Detection

- Frequency output will be locked to 0 Hz if electrodes are not wet.
- Digital (S³L) output will be locked to 0 if electrodes are not wet.
- 4-20 mA will be locked to 4 mA if electrodes are not wet.
- Blue and Red LED indicators on the magmeter circuit will blink alternately if the electrodes are not wet.

Accessories and Replacement Parts

O-Rings

Mfr. Part No.	Code	Description
1220-0021	198 801 186	O-ring, FPM (Viton®)
1224-0021	198 820 006	O-ring, EPDM
1228-0021	198 820 007	O-ring, FFPM (Kalrez®)

Replacement Transducers

Mfr. Part No.	Code	Description
3-2551-P0	159 001 211	PP/316L SS, DN15 to DN100 (½ to 4 in.) pipe
3-2551-P1	159 001 212	PP/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-P2	159 001 444	PP/316L SS, DN250 to DN300 (10 to 12 in.) pipe
3-2551-T0	159 001 213	PVDF/Titanium, DN15 to DN100 (½ to 4 in.) pipe
3-2551-T1	159 001 214	PVDF/Titanium, DN125 to DN200 (5 to 8 in.) pipe
3-2551-T2	159 000 445	PVDF/Titanium, DN250 to DN300 (10 to 12 in.) pipe
3-2551-V0	159 001 376	PVDF/Hastelloy-C, DN15 to DN100 (0.5 to 4 in.) pipe
3-2551-V1	159 001 377	PVDF/Hastelloy-C, DN125 to DN200 (5 to 8 in.) pipe
3-2551-V2	159 000 446	PVDF/Hastelloy-C, DN250 to DN300 (10 to 12 in.) pipe
3-2551-W0	159 001 234	PVDF/316L SS, DN15 to DN100 (0.5 to 4 in.) pipe
3-2551-W1	159 001 235	PVDF/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-W2	159 001 447	PVDF/316L SS, DN250 to DN300 (10 to 12 in.) pipe

Replacement Electronics Module

Mfr. Part No.	Code	Description
3-2551-11	159 001 215	Magmeter electronics, no display, frequency or digital (S ³ L) output
3-2551-12	159 001 216	Magmeter electronics, no display, 4 to 20 mA output

Miscellaneous

Mfr. Part No.	Code	Description
7300-7524	159 000 687	24 VDC Power supply 7.5 W, 300 mA
7300-1524	159 000 688	24 VDC Power supply 15 W, 600 mA
7300-3024	159 000 689	24 VDC Power supply 30 W, 1.3 A
7300-5024	159 000 690	24 VDC Power supply 50 W, 2.1 A
7300-1024	159 000 691	24 VDC Power supply 100 W, 4.2 A
3-8551.521	159 001 378	Clear plastic cap for display
3-0232	159 000 865	4 to 20 mA spanning CD with RS232 Converter

Ordering Information

Sensor Part No.	
3-2551	
Sensor Body (Transducer) and electrodes/grounding ring materials - Choose one	
-P	Polypropylene and 316L SS
-T	PVDF and Titanium
-V	PVDF and Hastelloy C
-W	PVDF and 316L SS
Pipe size - Choose one	
0	DN15 to DN100 (1/2 to 4 in.)
1	DN125 to DN200 (5 to 8 in.)
2	DN250 to DN300 (10 to 12 in.)
Display Options - Choose One	
-1	No Display
Output options - Choose One	
1	Frequency, Digital (S ³ L)
2	4 to 20 mA output
3-2551	-P 0 -1 2 Example Part Number

Part Number	Code	Part Number	Code
3-2551-P0-11	159 001 105	3-2551-V0-11	159 001 257
3-2551-P0-12	159 001 110	3-2551-V0-12	159 001 259
3-2551-P1-11	159 001 106	3-2551-V1-11	159 001 258
3-2551-P1-12	159 001 111	3-2551-V1-12	159 001 260
3-2551-P2-11	159 001 107	3-2551-V2-11	159 001 450
3-2551-P2-12	159 001 112	3-2551-V2-12	159 001 451
3-2551-T0-11	159 001 108	3-2551-W0-11	150 001 230
3-2551-T0-12	159 001 113	3-2551-W0-12	159 001 231
3-2551-T1-11	159 001 109	3-2551-W1-11	159 001 232
3-2551-T1-12	159 001 114	3-2551-W1-12	159 001 233
3-2551-T2-11	159 001 448	3-2551-W2-11	159 001 452
3-2551-T2-12	159 001 449	3-2551-W2-12	159 001 453



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