

UniMag Non-Full Pipe (NFP) System

Getting Started Guide



Part #69-4403-011
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Released August, 2002



FOREWORD

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Isco recommends that you read this manual completely before placing the equipment in service.

Although Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or email the Isco Customer Service Department for assistance. Contact information is provided below. Simple difficulties can often be diagnosed over the phone. If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Contact Information

Phone:	(800) 228-4373 (USA, Canada, Mexico) (402) 464-0231 (Outside North America)
Repair Service:	(800) 775-2965 (Analytical and Process Monitoring Instruments) (800) 228-4373 (Samplers and Flow Meters)
Fax:	(402) 465-3022
Email address:	Info@isco.com
Website:	www.isco.com
Return equipment to:	4700 Superior Street, Lincoln, NE 68504-1398
Other correspondence:	P.O. Box 82531, Lincoln, NE 68501-2531

UniMag NFP System

Getting Started Guide

GS-1 Overview

This guide provides basic instructions for setting up an Isco UniMag Non-Full Pipe (NFP) System. Additional information can be found in the separate user manuals for the flow tube, 4430 flow meter, and 4412 and 4411 transmitters.

The UniMag NFP System consists of a specially configured UniMag flow tube with an Isco 4430 flow meter and an Isco 4412 transmitter. (An Isco 4411 transmitter can be used for bidirectional flow.)

Non-full flow measurement is useful when monitoring flow over a wide range of flow conditions. Common applications include:

- Retrofit of full pipe flow meters that suffer from inaccuracies due to non-full conditions.
- Overflow and bypass lines
- Flow measurement in difficult conditions where open channel flow devices and full pipe flow meters are not practical, possible, or cost effective.

A typical configuration is shown in Figure GS-1. In a non-full pipe application, **the flow tube must be installed horizontally**. A UniMag sensor, mounted in a standpipe on the bottom of the flow tube, measures the average flow velocity. Two sensors are used for flow tube diameters 38 inches (950 mm) or larger.

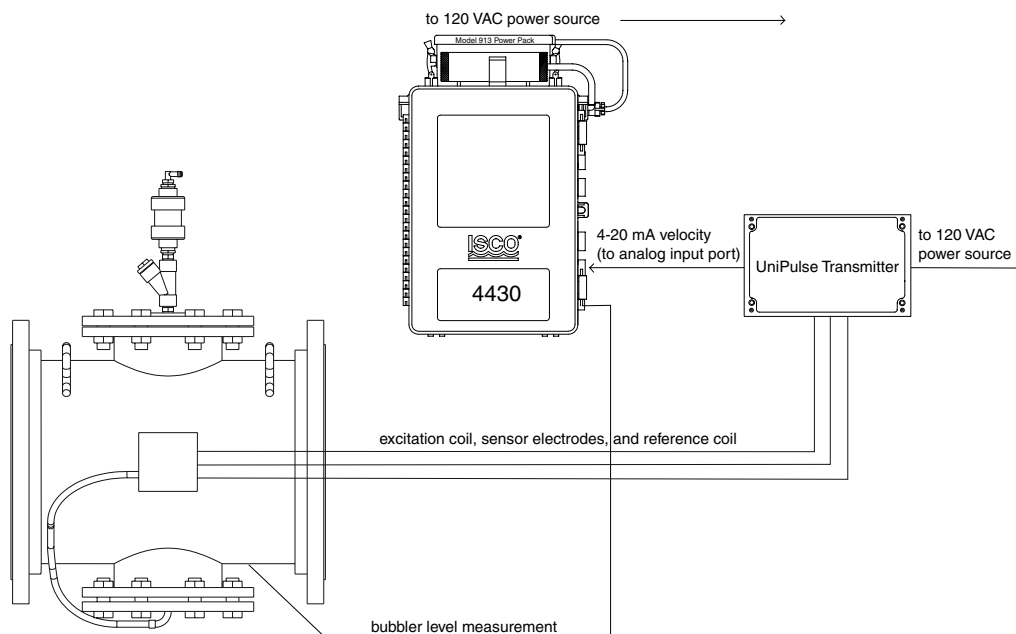


Figure GS-1 NFP System Diagram

Power to the flow tube is provided through the 4412 transmitter. Power to the 4430 flow meter is provided using an Isco 913 power pack connected to a 120 VAC power source.

The liquid level in the flow tube is measured with a self-cleaning bubbler system along with the 4430 flow meter. The velocity information is measured by the 4412. An alphanumeric display on the 4430 shows rate and total flow.

Other features include 4-20 mA and RS-232 serial outputs, internal data storage, and an internal dot matrix printer for recording. Sampling and parameter ports allow for connection to a sampler, YSI-600 sonde, rain gauge, analog output, and/or modem.

GS-2 Installation Using a 4412 Transmitter

The list below provides a summary of the flow meter and transmitter installation steps. More detailed instructions can be found in the 4430 and 4412 manuals. For steps 6-8, refer to the connection diagram in Figure GS-2. It is assumed your flow tube is already installed. Refer to your flow tube user manual for details.

1. Stop the flow of water to the flow tube. The pipe should be empty.
2. Securely mount the 4430 within 30 feet of the flow tube.
3. Install the bubble line and reference line.
4. Install the 913 power pack on the 4430.
5. Securely mount the 4412 transmitter.
6. Attach the Excitation Coil, Sensor Electrodes, and Reference Coil wires to the terminal connections on the 4412 as indicated in the table below and in Figure GS-2.

Table GS-1 Cable Connections

Excitation Coil	Sensor Electrodes	Reference Coil
Black to 4	Black to 24	Black to 31
White to 5	White to 25	White to 32
Shield to 6	Shield to 26	Shield to 19

7. Run the 4-20 mA cable from the 4412 converter terminal connections (red 27 and black 28) to the 4430 analog input amphenol.
8. Wire the AC directly to the 4412 motherboard: 1 (Hot), 2 (N), case ground.

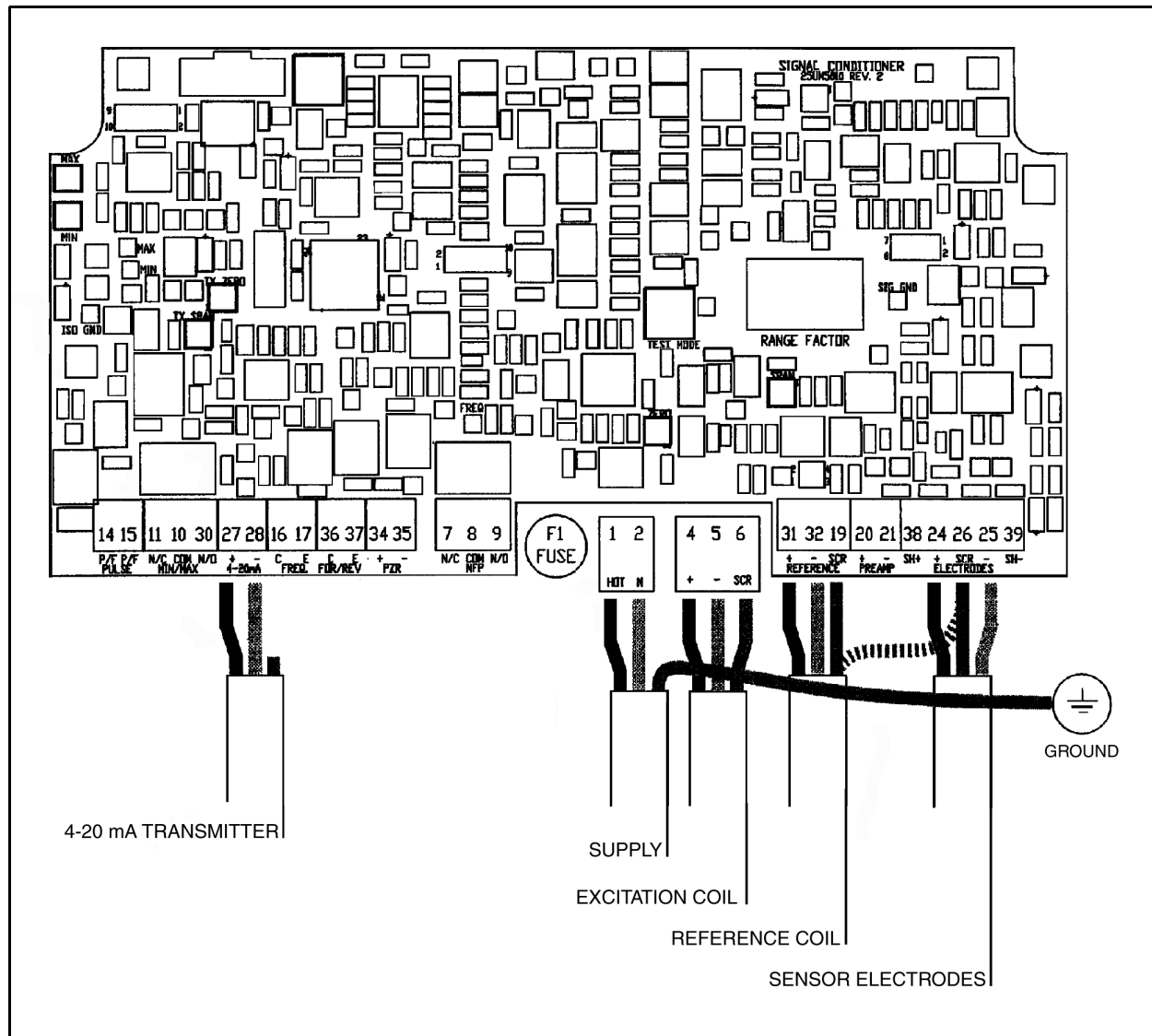


Figure GS-2 4412 Connection Diagram

9. The main power switch SW1 is located in the bottom left hand corner of the lower power board. When switched to the right, it is suitable for 120 Vac, to the left, 230 Vac. Put the switch in the appropriate position and apply power to the 4412.
10. On the 4412, place the Test Mode Switch in position "0".
11. Program the 4430 flow meter, following the steps in Section GS-2.1. Detailed instructions can be found in the 4430 Flow Meter user manual.
12. When you are done programming, your non-full pipe system is ready for use. If you have any questions, or need assistance, contact Isco's Service Department

**GS-2.1 Programming Steps
For 4430/4412**

Press the ON key on the 4430 keypad. The display below is typical of what the flow meter will display when it is in the normal operating mode and you are *not* programming it.

0000004.78 CF	1.13 FT	16-JUL-02
1.03 CFS	(X X)	8:25:37

Press the ENTER/PROGRAM STEP key to advance to the Select Option screen. The display will change to two lines of text; the first line describes the step you are programming, and the second line shows the menu choices available.

One of the choices shown will be flashing, indicating that this choice is the current one held in memory. If you are satisfied with this choice, just press ENTER and advance to the next step.

If you want a different choice from the one that is flashing, move across the display by using the LEFT and RIGHT ARROW keys. When the desired selection is flashing, press ENTER. If a step requires entry of a numeric value, use the number and decimal keys on the keypad to enter the correct value.

Follow the steps below to program the 4430 and 4412. The programming screens are organized into nine general steps, outlined on the 4430's front panel. If you make a mistake in programming and want to back up, press the EXIT PROGRAM key, then press the GO TO PROGRAM key and enter the step you want to return to. You can also use the GO TO PROGRAM key to advance to specific screens, rather than stepping through all the screens sequentially.

Step No.	Display	Procedure
1	<div style="border: 1px solid black; padding: 5px;"> SELECT OPTION • PROGRAM • • SETUP • </div>	When you press the ENTER/PROGRAM STEP key, the display shown to the left will appear. Select PROGRAM to advance to the programming screens. As you progress through the screens, be aware that if you stop programming for more than two minutes, the flow meter will leave programming mode and revert to its normal display.
2	<div style="border: 1px solid black; padding: 5px;"> LEVEL UNITS OF MEASURE • FT • • IN • • M • • MM • • NOT MEASURED • </div>	Select the unit of measure you want to use for measuring level (normally inches).
3	<div style="border: 1px solid black; padding: 5px;"> FLOW RATE UNITS OF MEASURE • GPS • • GPM • • GPH • • MGD • • CFS • • CFM • --> </div>	Indicate what unit of measure you want to use for flow. If the unit you want is not in view, use the ARROW keys to move to the right or left to view the rest of the options.
4	<div style="border: 1px solid black; padding: 5px;"> TOTALIZED VOLUME UNITS OF MEASURE • GAL • • MGAL • • CF • • L • • M3 • • AF • </div>	Select the unit of measure for totalized volume.

Step No.	Display	Procedure
5	VELOCITY UNITS OF MEASURE • FT/S •• M/S •• NOT MEASURED •	Select the unit of measure for velocity.
6	RAINFALL UNITS OF MEASURE • IN •• MM •• NOT MEASURED •	Indicate the units of measure for rainfall, if you will be using an attached rain gauge. Otherwise, select NOT MEASURED.
7	YSI 600 CONNECTED • YES •• NO •	Indicate if you have a YSI sonde connected.
8	SELECT SPOOL SIZE • 10" •• 12" •• 14" •• 16" •• 18" •• 20" •• 24" •• 28" -->	Use the ARROW keys to choose the appropriate spool size.
9	MAXIMUM FLOW RATE XX.XX (unit)	Enter what your maximum flow rate will be.
10	TRANSMITTER TYPE • 4411 •• 4412 •	Select 4412 to advance to the programming screens specific to the 4430/4412 NFP System. (If you are using a 4411, you should be reading Section GS-3 of this Getting Started Guide.)
11	ENTER C FACTOR FROM FLOW TUBE C FACTOR = X	The calibration factor C is on the name plate of your flow tube. Enter that number here.
12	R FACTOR = X MAX VEL = X.XX (unit) ENTER R FACTOR INTO UNIPULSE TRANSMITTER	<p>The range factor (R) and the maximum velocity will be automatically calculated for you and displayed on the first line of the screen display. You need to enter that R Factor into your 4412.</p> <p>Locate the thumb switch marked Range Factor on the analog board in the 4412 and set it to match the displayed R Factor on the 4430 screen.</p>
13	DATA TYPE FOR ANALOG OUTPUT 1 • OFF •• LEVEL •• VELOCITY •• FLOW RATE •	Select Level, Velocity, or Flow Rate for the data type if you are connecting 4-20mA to an external device, such as a chart recorder. (If you specifically ordered multiple channels, you will be asked to enter multiple outputs; otherwise, only one output data type will be requested.)
14	ANALOG OUTPUT 1 4 MA = XX.XX	After you have entered your data type, you will be asked to enter the analog output ranges for 4 mA (minimum) and 20 mA (maximum).

Step No.	Display	Procedure
15	PARAMETER TO ADJUST • NONE •• LEVEL •• VELOCITY •	<p>If you select Level, you will be given the option to automatically or manually adjust the level. Measure the level in your pipe, and adjust if necessary.</p> <p>If you select Velocity, the screen display will change to read SET TRANSMITTER TO MAX VELOCITY/PRESS ENTER WHEN STABLE. To set the 4412 to maximum velocity, change the Test Mode Switch position from 0 to 2. When the velocity reading is stable, press ENTER. Then change the Test Mode Switch to position one. When the velocity on the 4430 is stable, press ENTER. Set the Test Mode Switch back to 0.</p> <p>After you have adjusted level and/or velocity, or if no adjustments are needed, select NONE from the PARAMETER TO ADJUST screen.</p>
16	FLOW TOTALIZER: XX.XX (unit) PRESS 'ENTER'	<p>The flow totalizer value will be displayed. Press ENTER to proceed.</p>
17	RESET FLOW TOTALIZER? • YES •• NO	<p>Indicate if you want to reset the totalizer to zero. If an installation is permanent, you generally won't reset the flow totalizer. If the flow meter is moved to a different site, it would generally be reset at that time.</p>
18	ENABLE TOTALIZER: XX.XX (unit) PRESS 'ENTER'	<p>Enable Totalizer sends pulse signals to a sampler. Press ENTER to proceed.</p>
19	RESET SAMPLER ENABLE TOTALIZER? • YES •• NO •	<p>Indicate if you want to reset the sampler enable totalizer. (When you are first connecting a sampler, you may want to reset the sampler enable totalizer.)</p>
20	SAMPLER PACING • DISABLE •• VOLUME •• CONDITIONAL •	<p>If you have a sampler connected to the 4430, you may want to proceed with the sampler pacing screens (refer to your 4430 user manual for details). If you are not using a sampler or do not want to use Sampler Pacing, select Disable.</p>
21	SAMPLER ENABLE MODE • ENABLE •• DISABLE •• CONDITIONAL •	<p>If you are using Sampler Enable, proceed through the screens to set up enable conditions (refer to your 4430 user manual for details). If you do not have a sampler connected, select DISABLE.</p>

Step No.	Display	Procedure
22	<div style="border: 1px solid black; padding: 5px;">PLOTTER SPEED • OFF •• 1/2"/HR •• 1"/HR •• 2"/HR •• 4"/HR •</div>	The 4430 has a built-in printer. Select the desired plotter speed, from 1/2" to 4" per hour, or select OFF if you do not want any printing done.
23	<div style="border: 1px solid black; padding: 5px;">REPORT GENERATOR A (B) • ON •• OFF •</div>	These two screens let you indicate if the report generators are turned on or off. The two generators allow you specify reports at different time periods, such as weekly and monthly. If you turn a generator ON, you then select a duration (hours, days, months) and when you want the first report to be generated.
24	<div style="border: 1px solid black; padding: 5px;">PRINT FLOW METER HISTORY • YES •• NO •</div>	If you want to print the flow meter history, select YES to initiate printing. Otherwise, select NO.
25	<div style="border: 1px solid black; padding: 5px;">CLEAR HISTORY? • YES •• NO •</div>	Indicate if you want to clear the print history. If you select YES, the history will be printed before being cleared.

GS-3 Installation Using a 4411 Transmitter

The list below provides a summary of the installation steps for the flow meter and transmitter. More detailed instructions can be found in subsequent parts of this manual, or in the 4430 and 4411 manuals. For steps 6-8, refer to the connection diagram in Figure GS-3. It is assumed that the flow tube is already installed. Refer to the flow tube user manual for details.

1. Stop the flow of water to the flow tube. The pipe should be empty.
2. Securely mount the 4430 within 30 feet of the flow tube.
3. Install the bubble line and reference line.
4. Install the 913 power pack on the 4430.
5. Securely mount the 4411 transmitter.
6. Attach the Coil and Electrode wires to the terminal connections on the 4411 as indicated in Figure GS-3. Note that the Reference Coil wire is NOT used.
7. Run the 4-20 mA cable from the 4411 terminal connections 6 (-) and 7 (+) to the 4430 analog input amphenol.
8. Connect the power leads to terminal L1 (Hot) and L2/N. Connect the ground wire to the Power Ground terminal.

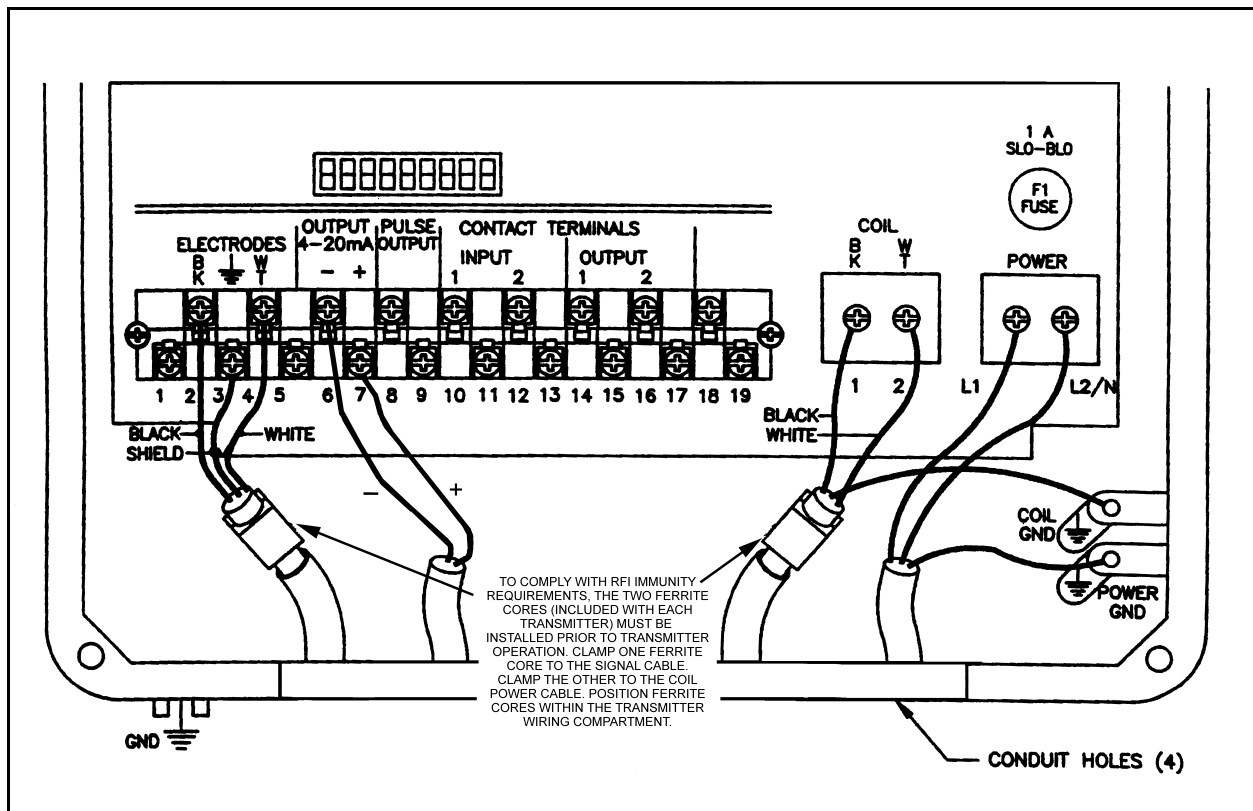
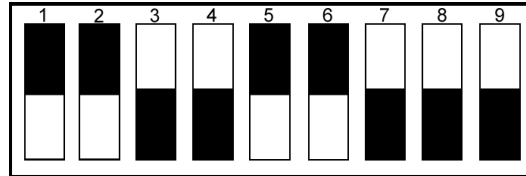


Figure GS-3 4411 Connection Diagram

9. There is a group of nine DIP switches on the 4411, above the terminal connections (Figure GS-3). The first four set the analog and digital loop power, the next four control the pulse loop output power, and the last switch controls the write protect function. Make sure the switches are set as shown in Figure GS-4.



Switches 1 and 2: Top Pushed In
Switches 3, 4 and 9: Bottom Pushed In
Switches 5-8 are for Pulse Loop Output Power

Figure GS-4 4411 DIP Switch Settings

10. Apply power to the 4411.
11. Program the 4430 flow meter, following the steps in Section GS-3.1. Detailed instructions can be found in the 4430 Flow Meter user manual.
12. When you are done programming, your non-full pipe system is ready for use. If you have any questions, or need assistance, contact Isco's Service Department.

GS-3.1 Programming Steps For 4430/4411

Press the ON key on the 4430 keypad. The display below is typical of what the flow meter will display when it is in the normal operating mode and you are *not* programming it.

0000004.78 CF	1.13 FT	16-JUL-02
1.03 CFS	(X X)	8:25:37

Press the ENTER/PROGRAM STEP key to advance to the SELECT OPTION screen. The display will change to two lines of text; the first line describes the step you are programming, and the second line shows the menu choices available.

One of the choices shown will be flashing, indicating that this choice is the current one held in memory. If you are satisfied with this choice, just press ENTER and advance to the next step.

If you want a different choice from the one that is flashing, move across the display by using the LEFT and RIGHT ARROW keys. When the desired selection is flashing, press ENTER. If a step requires entry of a numeric value, use the number and decimal keys on the keypad to enter the correct value.

Follow the steps below to program the 4430 and 4411. The programming screens are organized into nine general steps, outlined on the 4430's front panel. If you make a mistake in programming and want to back up, press the EXIT PROGRAM key, then press the

GO TO PROGRAM key and enter the step you want to return to. You can also use the GO TO PROGRAM key to advance to specific screens, rather than stepping through all the screens sequentially.

Step No.	Display	Procedure
1	SELECT OPTION • PROGRAM •• SETUP •	When you press the ENTER/PROGRAM STEP key, the display shown to the left will appear. Select PROGRAM to advance to the programming screens. As you progress through the screens, be aware that if you stop programming for more than two minutes, the flow meter will leave programming mode and revert to its normal display.
2	LEVEL UNITS OF MEASURE • FT •• IN •• M •• MM •• NOT MEASURED •	Select the unit of measure you want to use for measuring level (normally inches).
3	FLOW RATE UNITS OF MEASURE • GPS •• GPM •• GPH •• MGD •• CFS •• CFM • -->	Indicate what unit of measure you want to use for flow. If the unit you want is not in view, use the ARROW keys to move to the right or left to view the rest of the options.
4	TOTALIZED VOLUME UNITS OF MEASURE • GAL •• MGAL •• CF •• L •• M3 •• AF •	Select the unit of measure for totalized volume.
5	VELOCITY UNITS OF MEASURE • FT/S •• M/S •• NOT MEASURED •	Select the unit of measure for velocity.
6	RAINFALL UNITS OF MEASURE • IN •• MM •• NOT MEASURED •	Indicate the units of measure for rainfall, if you will be using an attached rain gauge. Otherwise, select NOT MEASURED.
7	YSI 600 CONNECTED • YES •• NO •	Indicate if you have a YSI sonde connected.
8	SELECT SPOOL SIZE • 10" •• 12" •• 14" •• 16" •• 18" •• 20" •• 24" •• 28" -->	Use the ARROW keys to choose the appropriate spool size.
9	MAXIMUM FLOW RATE XX.XX (unit)	Enter what your maximum flow rate will be.
10	TRANSMITTER TYPE • 4411 •• 4412 •	Select 4411 to advance to the programming screens specific to the 4430/4411 NFP System. (If you are using a 4412, you should be reading Section GS-2 of this Getting Started Guide.)
11	ENTER UNIPULSE METER FACTOR X.XXXX	Enter the meter factor, located on the name plate of your flow tube.

Step No.	Display	Procedure
12	MAX VEL = X.XX (unit) PRESS ENTER TO CONTINUE	The maximum velocity will be displayed. Press ENTER to continue.
13	DATA TYPE FOR ANALOG OUTPUT 1 • OFF •• LEVEL •• VELOCITY •• FLOW RATE •	Select LEVEL, VELOCITY, or FLOW RATE for the data type if you are connecting 4-20mA to an external device, such as a chart recorder. (If you specifically ordered multiple channels, you will be asked to enter multiple outputs; otherwise, only one output data type will be requested.)
14	ANALOG OUTPUT 1 4 MA = XX.XX	After you have entered your data type, you will be asked to enter the analog output ranges for 4 mA (minimum) and 20 mA (maximum).
15	PARAMETER TO ADJUST • NONE •• LEVEL •• VELOCITY •	<p>If you select Level, you will be given the option to automatically or manually adjust the level. Measure the level in your pipe, and adjust if necessary.</p> <p>If you select Velocity, the screen display will change to read SET PRESET ON THE 4411 TO 20MA/PRESS ENTER WHEN STABLE. Refer to Section GS-3.2 for instructions on how to set the Preset.</p> <p>After you have adjusted level and/or velocity, or if no adjustments are needed, select NONE from the PARAMETER TO ADJUST screen.</p>
16	FLOW TOTALIZER: XX.XX (unit) PRESS 'ENTER'	The flow totalizer value will be displayed. Press ENTER to proceed.
17	RESET FLOW TOTALIZER? • YES •• NO	Indicate if you want to reset the totalizer to zero. If an installation is permanent, you generally won't reset the flow totalizer. If the flow meter is moved to a different site, it would generally be reset at that time.
18	ENABLE TOTALIZER: XX.XX (unit) PRESS 'ENTER'	Enable Totalizer sends pulse signals to a sampler. Press ENTER to proceed.
19	RESET SAMPLER ENABLE TOTALIZER? • YES •• NO •	Indicate if you want to reset the sampler enable totalizer. (When you are first connecting a sampler, you may want to reset the sampler enable totalizer.)
20	SAMPLER PACING • DISABLE •• VOLUME •• CONDITIONAL •	If you have a sampler connected to the 4430, you may want to proceed with the sampler pacing screens (refer to your 4430 user manual for details). If you are not using a sampler or do not want to use Sampler Pacing, select Disable.

Step No.	Display	Procedure
21	SAMPLER ENABLE MODE • ENABLE • • DISABLE • • CONDITIONAL •	If you are using Sampler Enable, proceed through the screens to set up enable conditions (refer to your 4430 user manual for details). If you do not have a sampler connected, select DISABLE.
22	PLOTTER SPEED • OFF • • 1/2"/HR • • 1"/HR • • 2"/HR • • 4"/HR •	The 4430 has a built-in printer. Select the desired plotter speed, from 1/2" to 4" per hour, or select OFF if you do not want any printing done.
23	REPORT GENERATOR A (B) • ON • • OFF •	These two screens let you indicate if the report generators are turned on or off. The two generators allow you specify reports at different time periods, such as weekly and monthly. If you turn a generator ON, you then select a duration (hours, days, months) and when you want the first report to be generated.
24	PRINT FLOW METER HISTORY • YES • • NO •	If you want to print the flow meter history, select YES to initiate printing. Otherwise, select No.
25	CLEAR HISTORY? • YES • • NO •	Indicate if you want to clear the print history. If you select YES, the history will be printed before being cleared.

GS-3.2 Setting the Preset on the 4411

To set the Preset, you will be using the keypad on the 4411 transmitter (Figure GS-5). Pressing Shift plus one of the other four outer keys performs the function indicated on the key. Pressing an outer key without Shift performs an "arrow" function, moving through the program menus in the direction indicated by the arrow.

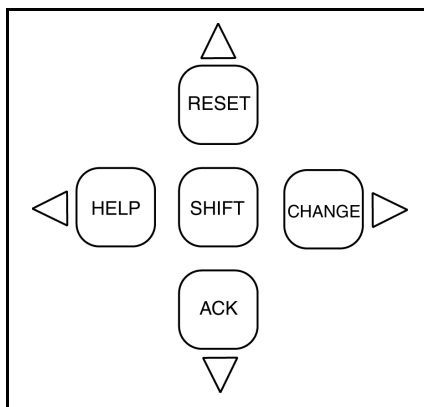


Figure GS-5 4411 Keypad

The flow rate information should be showing on the 4411 display. From this point, follow the steps below to set the Preset:

- a. Press the LEFT ARROW to move to the 1 TOP LEVEL/MEASUREMENTS screen.
- b. Press UP to reach the 1 TOP LEVEL/SETUP screen.
- c. Press the RIGHT ARROW key to display 2 SETUP/SYSTEM.
- d. Press UP to move to 2 SETUP/CALIBRATION.
- e. Press the RIGHT ARROW to go to 3 CALIBRATION/METER FACTOR.
- f. Press the DOWN ARROW three times until the display reads 3 CALIBRATION/PRESET OUTPUTS.
- g. Press the RIGHT ARROW twice. The display should read ANALOG PRESET? {20.00} mA.
If it does read 20 mA, skip to Step “i”. If it does not read 20 mA, follow Step “h” below.
- h. If the preset does not read 20 mA, hold down the SHIFT key while pressing the CHANGE key. You will be asked if you want to go offline. Press the RIGHT ARROW to select YES. Then use the arrow keys to change the number. Use the LEFT and RIGHT ARROW keys to change the cursor position, and the UP and DOWN arrows to change the number.
When you are done, press the RIGHT ARROW key until curly brackets { } are displayed around the value instead of straight brackets [].
Press the RIGHT ARROW key once more to display ANALOG PSET ON?. To turn it on, press SHIFT/CHANGE and the UP arrow key to change the display to read ON.
- i. When the Preset is at 20 mA, wait until the reading on the 4430 flow meter is stable, then press ENTER on the 4430 to proceed.
- j. You will need to repeat the above steps to set the Preset to 12 mA for zero velocity.
On the 4411, press the LEFT ARROW key until you are prompted to go online. Press the RIGHT ARROW key to select YES.
To return to the flow rate display, press the LEFT ARROW until the 1 TOP LEVEL/MEASUREMENTS screen is displayed, and then press the RIGHT ARROW key once.

GS-3.3 Other Settings to Check on the 4411

After programming the flow meter and transmitter, there are some other settings on the 4411 that you should check:

- Upper Range Value (URV) - it should match the Maximum Flow Rate in Step 9 of the programming instructions.
- Meter Factor

- Flow Direction - Should be Bidirectional Positive
- Analog Output Mode - Should be BiDirectional Split Range.

