

Magnetoflow®
Electromagnetic Flow meters
Sizes 1/4" through 54"

Installation & Operation Manual



***IMPORTANT !!!! Read this manual before
attempting any installation, wiring or operation.***



BadgerMeter, Inc.

Bulletin No. IOM-074-02

Part No. 53400-074

May 2000



BadgerMeter, Inc.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

1. SCOPE OF THIS MANUAL

This manual contains information concerning the installation, operation and maintenance of Badger's Magnetoflow Electromagnetic flow meters. To ensure proper performance of the meters covered, the instructions given in this manual should be thoroughly understood. Retain the manual in a readily accessible location for future reference.

DESCRIPTION

Badger's electromagnetic meters are intended for use in fluid metering applications involving water, chemical solutions and food ingredients. The meters are available in a variety of sizes and configurations that cover a wide range of flow rates and special applications.

The basic components of an electromagnetic flow meter (see Figure 1-1) consists of a stainless steel tube internally lined with an isolating material. Two (2) electrodes are mounted flush with the liner walls. The entire meter is sealed and therefore cannot be serviced other than the occasional cleaning of the electrodes. This manual focuses on the installation of the meter, the wiring, and programming procedures.

OPERATION

The operation of the magmeter is fairly simple. As fluid flows through the meter, the electrodes pick up a voltage directly proportional to the velocity of the fluid. This is made possible by creating a magnetic field inside of the tube with two electromagnets that are placed on the outside of the tube. This voltage is then amplified, filtered from other internal and external electrical noise and converted into an analog and a digital signal that can be translated into engineering units of measure such as gallons, liters etc.

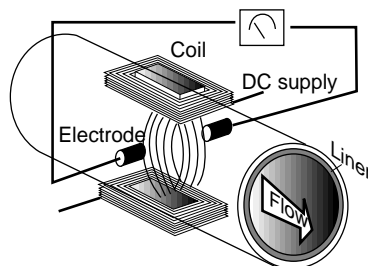


Figure 1-1.

UNPACKING AND INSPECTION

To avoid damage in transit, Badger meters are shipped to the customer in a special shipping container. Upon receipt

of the meter, perform the following unpacking and inspection procedures. If damage to the shipping container is evident, be present when the meter is unpacked.

A. Carefully open the shipping container following any instructions that may be marked on the container. Remove all cushioning material surrounding the meter and carefully lift meter from container. Retain the container and all packing material for possible use in reshipment or storage.

B. Visually inspect the meter for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery. Then file a claim with the carrier. A claim for equipment damaged in transit is the responsibility of the customer.

STORAGE

If the meter is not to be installed right away, store it in it's original container in a dry, sheltered location. Storage temperature: -4 to 158°F (-20 to +70°C)

2. INSTALLATION

INSTALLATION

The procedures covering the installation of a standard electromagnetic meter are essentially the same regardless of the meter model being installed or the configuration involved. Before attempting the installation, read the instructions given in the following paragraphs to become familiar with the requirements and procedures involved. Any special instructions required for the installation and/or electrical connection of accessory equipment such as indicators, pulse transmitters, remote batch controllers, etc., will be provided as a supplement to the manual.

A. PRELIMINARY CONSIDERATIONS. Factors to consider before proceeding with installation:

1. Avoid locating the meter in close quarters. The area in which the meter is to be installed should provide adequate space to permit cleaning and maintenance.

2. Verify that the operating temperature range of the meter is compatible with the temperature range of the fluid or fluids to be metered.

CAUTION: The meter must be operated within its rated temperature range (see technical brief) to obtain optimum accuracy and prevent damage to the meter.

3. Ensure that the flow range of the meter agrees with the flow rate or rates to be used in metering the fluid. Refer to the appropriate Technical Brief for the applicable meter flow range specification.

4. In metering applications involving abrasive materials, slurries, or liquids that may leave a residue or buildup of deposits on the electrodes, provisions should be made to inspect and clean the liner and electrodes periodically.

INSTALLING THE METER

Location:

The following guidelines should be observed when selecting a mounting location for the meter:

- Avoid locations where the fluid is pulsating.
- Avoid locations near equipment producing electrical interference such as motors, transformers, radio transmitters or other equipment that causes electromagnetic or electrostatic interference.
- Avoid locations where there is extreme vibration in the pipe.
- Avoid places where there is direct sunlight, use a sun shade otherwise.
- Avoid places where there is not enough room or access to provide maintenance or comfortably observe the LCD display.
- Install the meter so that the detector is always filled with fluid. This may require special piping arrangements.
- Avoid places where the meter will be exposed to extreme humidity or corrosive environments.
- For corrosion safety, install any chemical injection downstream from the meter.

The three styles of electromagnetic meters: flanged, wafer and sanitary, are designed for in-line installation. However each style and size will require a different set of dimensions and clearances. After unpacking the meter, carefully measure all the dimensions to make sure to select an appropriate installation site. The most important dimension is the lay length of the meter.

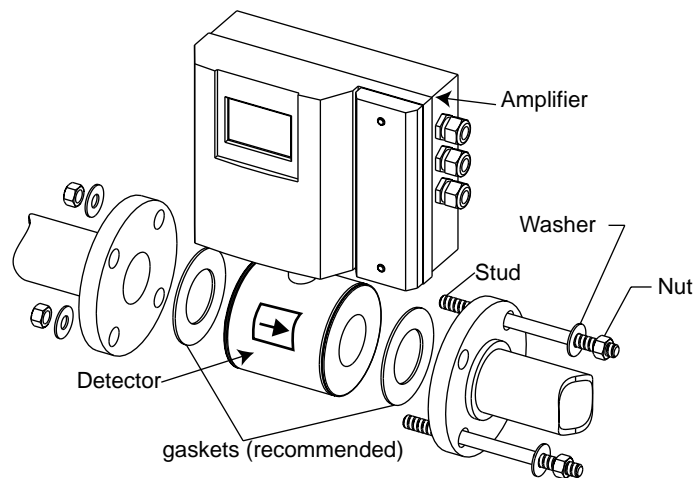


Figure 2-1.

NOTE: Even though the meter can be installed in any orientation, if the fluid contains solids that can deposit at the bottom or on the electrodes, it is strongly recommended to install the meter in a vertical position with the fluid moving upwards. When installing the meter horizontally make sure that the electrodes are oriented level horizontally.

After reviewing the applicable dimension requirements, perform the following procedures:

1. Install appropriate mating connectors in pipeline. Provide proper gap length for meter. On meters with flanged ends, allow for gaskets at both inlet and outlet of meter. The wafer style meter does not require gaskets between flanges since the liner will provide, in most cases, enough of a seal for proper operation. If however, this is not the case, install gaskets that are chemically compatible with the fluid to be measured. On wafer style meters, the detector is "sandwiched" between two flanges. Special flange through studs are provided for the installation. (See figure 2.1)

Note: For best operation and accuracy make sure to supply at least (3) diameters of straight pipe ahead of the meter and (2) diameters after, measured from the middle of the meter body.

Note: Both the flanged and the wafer meter when lined with PTFE, are shipped from the factory with wooden ends in order to prevent the liner from losing its shape. Do not remove these ends until you are ready to position the meter between the mating flanges.

2. For larger meter and line sizes, consideration may be given to placing a support under the meter to relieve any strain on the facility piping caused by meter weight.

3. For flanged or sanitary style meters follow the standard mounting procedures of each type of meter. For wafer style meters, first insert the two lower mounting bolts through the holes in one of the end flanges. If necessary, install the flange gaskets and guide the lower bolts through the holes. Install the meter in between the flanges making sure that the flow arrow on the meter tag is in proper relation to the direction of flow of the liquid. Finish installing the rest of the bolts.

4. Thread nuts on both ends of the 4 or more mounting studs but only finger-tight, making sure that the meter is centered with the longitudinal axis of the pipe. Tighten the nuts with a wrench diagonally across in even increments. Do not overtighten or the meter liner could be damaged.

Very important !!!

5. Once the meter is securely installed make the grounding connections using the two 1/4" Faston terminals from the Primo housing or junction box (in remote Primo mounting) to one stud of each end flange. Use at least a 12 gauge (4mm² cross section) copper wire to ground the meter. **Failure to properly ground the detector will result in erratic readings and inaccurate measurements.**

Note: If your piping is non-metallic, the meter must have a grounding electrode or grounding ring. To confirm this, observe the inside of the meter to see if there is a third electrode installed or if grounding rings are present. If not, contact the factory. Do not install the meter without the grounding electrode or grounding rings.

Check the following to ensure the meter is properly installed and operational.

A. Check all piping connections to the meter for proper mating and firm connection.

B. Apply fluid pressure to the meter and check connections for possible leaks. Retighten connections as required.

3. Wiring

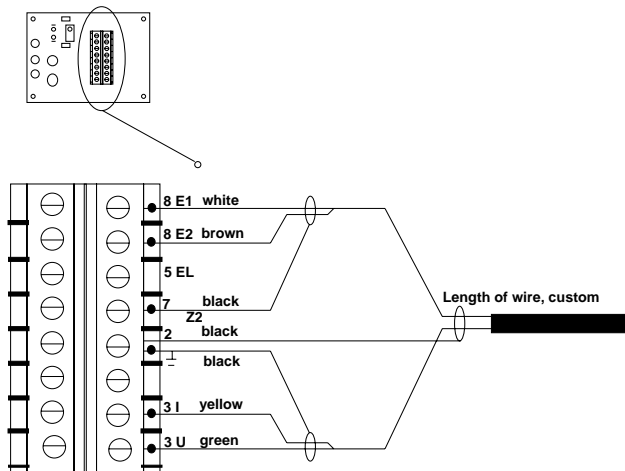
Wiring between the sensor and the Primo amplifier comes completed from the factory. However, if because of temperature or location constraints, the unit you have received has a remote configuration, that is, the Primo unit is not meter mounted, but is connected via a cable to a junction box atop the meter, and you must use conduit in your installation, then observe the following procedure.

WIRING TO A REMOTE PRIMO AMPLIFIER

1. Using a flat screwdriver, remove the four screws on the junction box lid. Carefully remove the wires that lead to the Primo amplifier from the terminal strip, making sure to remember or make note of each wire terminal.

2. Remove the wire nut at the bottom of the Primo housing and replace it with the appropriate conduit connector.

3. Install the wire through the conduit, and the new conduit connector at the junction box. Complete the conduit assembly and then rewire the cable into the terminal strip exactly as it was before step one.

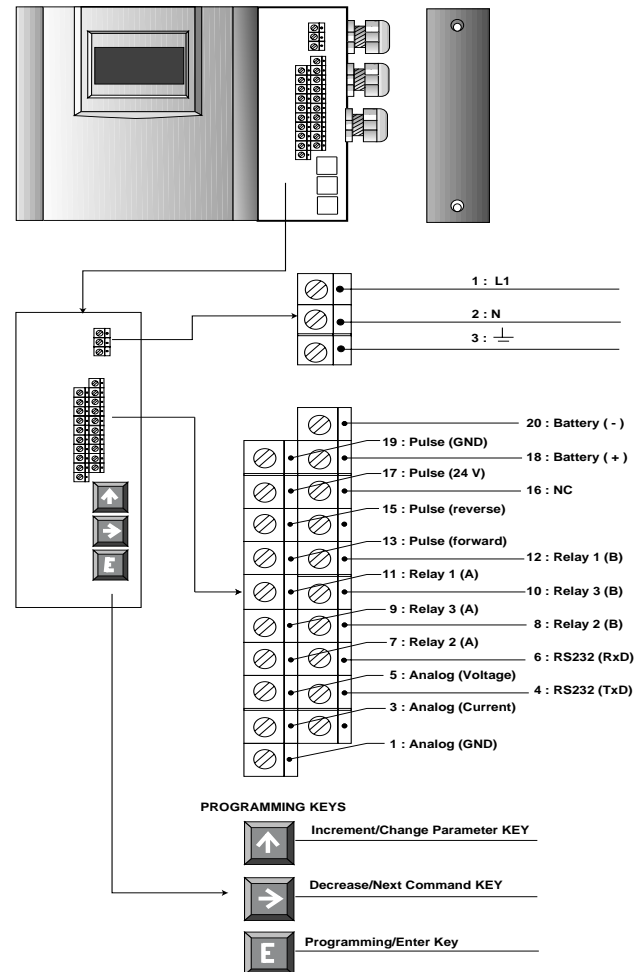


WIRING INPUTS AND OUTPUTS TO THE PRIMO AMPLIFIER

Once the wiring between the sensor and the amplifier is done proceed to wire the inputs and outputs to the Primo amplifier.

Note: For safety reasons leave AC power connections to the unit as the last step. Follow all the safety precautions and local code to prevent electrical shock and/or damaging of the electronic components.

1. Using a small flat screwdriver or a suitable 3 mm Allen wrench remove the two bolts off the red amplifier cover. Remove the cover and place it on a flat surface. Inside the amplifier you will see a terminal strip similar to the one depicted in the picture below.



At installation, be sure to comply with the following requirements:

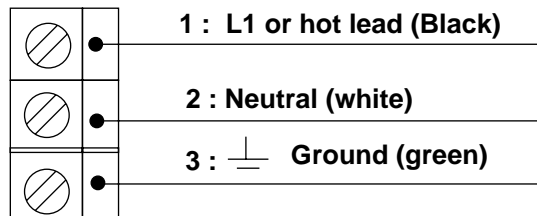
- **Disconnect power to the unit before attempting any connection or service to the unit.**
- Do not bundle or route signal lines with power lines.
- Keep all lines as short as possible.
- Use twisted pair shielded wire for all output wiring.
- Observe all applicable local electrical codes.

If you are going to use cable conduit, replace the cable-only port connectors with the appropriate conduit connectors. For the AC power connections use three wire sheathed cable. For signal output use 16 gauge shielded cable (cross-sectional area of 1.25mm² and overall diameter of 11 to

13mm).

How to connect the amplifier to the main AC power supply (Refer to label at the connection terminals)

120 or 240 AC volts connection



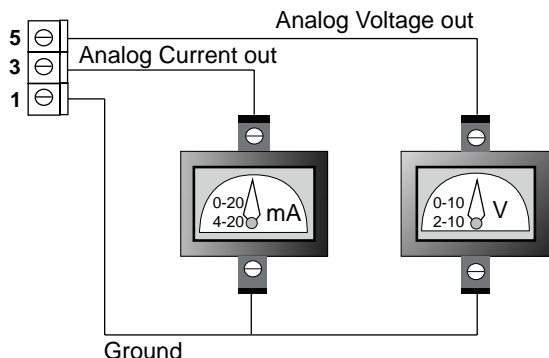
CAUTION: To prevent accidents, power connection should be made only after all other connections have been completed.

The PRIMO amplifier is a microprocessor based device. It is important that the power supply be as "clean" as possible. Avoid using power lines that feed heavy loads such as pumps, motors, etc. If dedicated lines are not available, a filtering or isolation system might be required.

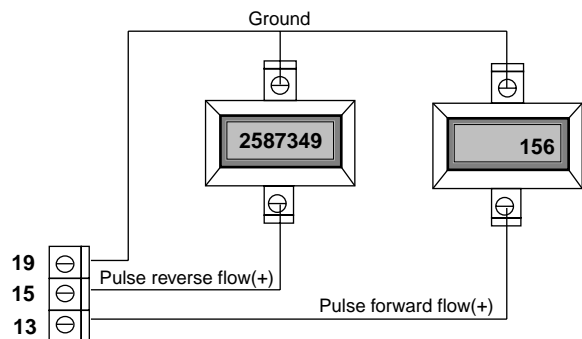
It is recommended that the internal fuse protection be maintained. Use a 2/10th amp slow blow fuse on 120 VAC and a 1/10th amp slow blow fuse on 240 VAC supply.

Typical US electrical code identifies the black wire as the hot or high lead, the white wire as the low or neutral lead, and the green wire as the chassis or ground lead.

How to connect the amplifier to remote analog indicators



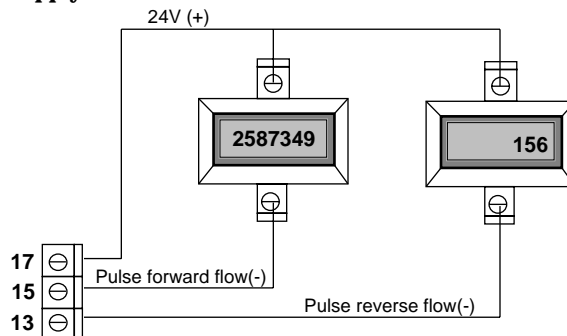
How to connect the amplifier to remote digital indicators/totalizers that do not require external power supply



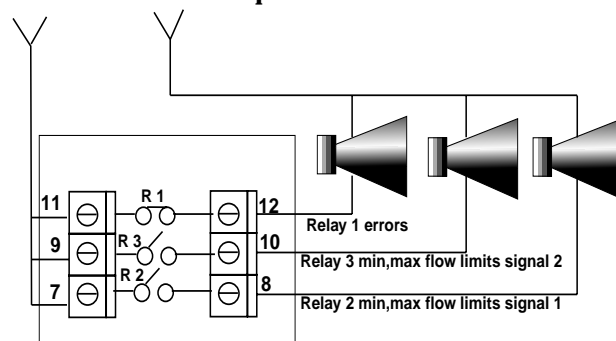
This connection is intended for use with indicators that do not require an external power supply such as the ER series indicators from Badger Meter. For the ER-6, ER-8 or ER-9, connect terminal 13 of the Amplifier to terminal 2 of the ER series for forward totalization, terminal 15 to terminal 2 for reverse totalization and terminal 19 to ground or terminal 1 of the ER indicator.

For connection to the PC 100 Controller, connect terminal 13 of the amplifier to terminal 14 of the PC 100 and terminal 19 of the amplifier to terminal 12 of the PC 100.

How to connect the amplifier to remote digital indicators/totalizers that require external power supply



How to connect the amplifier to remote flow alarms



Relay 1 is used to signal any error conditions in the amplifier. Connect this output to an alarm to alert the operator of any malfunctioning of the meter. Note that for safety reasons this relay is normally closed and it will open on signal. You will need to adjust your alarm wiring accordingly.

Relay 2 can be used to turn on and audio/visual alarm when the flow rate exceeds or falls under a programmed percent of flow (refer to flow signal 1 in the programming procedures). This is a normally open relay.

Relay 3 can be used to turn on and audio/visual alarm when the flow rate exceeds or falls under a programmed percent of flow (refer to flow signal 2 in the programming procedures). This is a normally open relay.

Carefully consider all the connections to be made leaving the power supply connection for last. After all the connections are done, apply power to the amplifier and test operation in a manner that is suitable for each particular application. Please exercise extreme caution !! Please contact our technical support department or your local Badger Representative should you need additional

support.

Programming

The Primo amplifier comes preprogrammed from the factory and in most instances will not require any additional manipulation. However, if you will be using the flow signal outputs or need to recalibrate the meter to suit your particular needs, it will be necessary to familiarize yourself with the programming procedures.

Programming of the Primo amplifier is very simple.

This section gives step by step instruction on how to program each of the functions of the amplifier and an explanation of the choices that are available for each one.

First, using a small flat screwdriver or Allen wrench remove the red cover from the main amplifier housing. At the lower right corner of the unit you will see three square buttons. These buttons are used to perform all programming procedures.

Note:

The programming buttons have been placed inside the amplifier housing to prevent tampering or accidental reprogramming of the unit. After programming, be sure to replace the red cover on the amplifier housing.

The four line 16 digit LCD display of the Primo amplifier is used to guide you through each of the programming steps. The main screen of the unit, when in operation, will display the flow rate, the forward and reverse flow totalizers and the software date and issue number or one of several error messages:

```
rate> 350.00GPM
tot1 234567.73 G
tot2- 1234.00 G
v2.23us 28.04.98
```

To enter the programming mode press the Enter or E key (bottom key) and you will see the main SUBMENU screen:

```
>factors/totals
outputs
measurement
back E=End
```

As you will see, there are three main submenus: Factors/totals, outputs and measurement. Each submenu gives access to the following appropriate functions:

Factors/totals:

- 1) Amplifier factor
- 2) Detector factor (Scale or calibration factor)
- 3) Reset of both totalizers to zero

Outputs:

- 1) Analog outputs (voltage or current)

- 2) Scaled pulse output
- 3) Pulse width
- 4) High-low flow relay signal 1 output
- 5) High-low flow relay signal 2 output

Measurement:

- 1) Unit of measure
- 2) Maximum Flow rate
- 3) Low Flow Cutoff
- 4) Empty pipe detection
- 5) Flow direction (Forward or reverse)
- 6) Pipe diameter
- 7) Dampening filter

PROGRAMMING OF MEASUREMENT PARAMETERS

Once the programming screen has appeared, notice the right arrow on the far left side. In the previous screen the arrow is pointing to the Factors/totals submenu. Using the up ^ arrow key you can position the arrow in front of the submenu or command that you wish to interrogate. We recommend that you start with the measurement submenu followed by the outputs submenu and finally the factors/totals submenu.

```
factors/totals
outputs
>measurement
back E=End
```

Use the ^ key to position the > arrow next to "measurement" and press the > key. The following screen will appear:

```
unit
> change
next parameter
back E=End
```

This is where you will select the unit of measurement for the flow rate indication and the totalizers. Use the ^ key to place the > arrow next to "change" and press >. The first unit of measurement screen will appear:

```
unit
Gallon/min
> next
E Enter
```

With the arrow> on the "next" line keep pressing the > key until you reach the screen with the appropriate unit of measure, then press ENTER.

On US measure Primo units, the choices are:

Gallons/min, Ounces/min, Lbs/min and Millgallon/day.

On the metric version, Primo units of measure are:

Liters/minute, m3/hour, Liters/second Liters/hour

Once you have selected the correct unit of measure and press the E key the following screen will appear:

```
max. flowrate
    75 GPM
^ up  > down
E Enter
```

If you changed the unit of measure the Maximum flow must also be changed to reflect the maximum flow rate with the new unit of measure. This is a very important parameter if you are using the flow limit signals 1 and 2. Input the new maximum flow based on your meter size and your applications requirements, making sure that it falls within the suggested flow range of the meter.

Once this is done, press E and the following screen will appear:

```
pulse output
    100 Pulse/G
^ up  > down
E Enter
```

This is the pulse output parameter that is set in the outputs menu. This parameter must be programmed only if you are going to use the pulse output to drive a remote counter or controller. If that is the case and since you could have changed the maximum flow rate, this may cause the pulse output to go over 10Khz (the limit of the Primo unit) and needs to be reprogrammed. Refer to the section on OUTPUTS (page 9) to program the pulse output function.

Once you have programmed the pulse output and press the E key you will go back to the main parameter menu screen.

STEP A Press Enter until you reach the main parameter menu. Place the arrow next to the line "measurement" and press the > key. The following screen will appear:

```
unit
Gallon/min
>      next
E Enter
```

Place the arrow text to the line "next " and press the > key until the next desired parameter is shown. (End of step A)

Press the > key until the following screen shows:

```
low flow cutoff
>  change
next parameter
back      E=End
```

This is the low flow cutoff function. It is used to assign a low flow rate at which measurement will stop, preventing measurement and thus totalization errors. This parameter can be programmed from 0 % up to 10% of maximum flow rate. Place the > arrow next to change and press >. The following screen will appear:

```
low flow cutoff
    0.0 %
^ up  > down
E Enter
```

In general, programming this value at 0.2% or higher will prevent false readings during stop conditions due to fluid movement in the pipe caused by vibrations or piping arrangements.

Using the ^ and > keys select a value and then press ENTER.

Repeat step A until you see the following screen:

```
empty pipe det.
>  change
next parameter
back      E=End
```

The empty pipe parameter when programmed to be ON will deactivate Relay 1 and also show an empty pipe error message on the display. Position the arrow next to "change" and press the > key. The following screen will appear:

```
empty pipe det.
    on
^ on  > off
E Enter
```

Use the ^ and > keys to turn the feature ON or OFF and press ENTER. Repeat step A until you see the following screen:

```
flow direction
>  change
next parameter
back      E=End
```

Place the arrow next to "change" and press the > key. The following screen will show:

```
flow direction
both directions
^ one  > both
E Enter
```

The flow direction feature allows you to select if you are going to monitor and totalize in forward only or in forward and reverse direction. If you select "one" the meter will monitor and show both totalizers in the forward flow only. If you choose "both" one totalizer will show forward flow and the other will show reverse flow using a minus sign (-).

Your selection will also have an effect on the analog and pulse outputs. That is, you will be able to wire your outputs to indicators that will show both forward and reverse flow or only forward flow.

Using the ^ and > key select which flow direction you want and press ENTER.

Repeat step A until you see the following screen:

```

pipe diameter
>  change
next parameter
back      E=End
  
```

Place the arrow next to "change" and press the > key. The following screen will show:

```

pipe diameter
      25 mm
^ up < down
E Enter
  
```

On this screen you can select the pipe diameter of your flow meter. By using the ^ and > keys you can change the number to match your meter size.

The selection is made in millimeters. Enter the equivalent size of your meter in millimeters (1 inch is 25mm, 2 inches is 50mm and so on). Please refer to the technical brief table for exact size specifications

Most of the time this parameter will come preprogrammed from the factory, but on occasion if you replace the software chip or the entire amplifier in the field you may need to re-program this parameter.

Once you have selected the meter or pipe size, press E and follow step A until you see the following screen:

```

filter
>  change
next parameter
back      E=End
  
```

This is the last parameter of the measurement submenu. This feature is used to increase the signal to noise ratio and

stabilize the flow rate indication by increasing measurement integration time.

In general, the meter is programmed at 1 but if you notice too much back and forth oscillation of the flow rate indication, increase this value incrementally until the display is more stable. Your choices are 1,2,4,8,16,32,64,128 and 256. Only under extreme conditions will you need to use this feature. To change the filter value, place the arrow next to "change" and press the > key. The following screen will show:

```

filter
      2
^ up < down
E Enter
  
```

Using the ^ and > keys select the desired filter value and then press ENTER to return to the main submenu screen.

PROGRAMMING OF OUTPUTS

The next submenu deals with the amplifier's analog digital and signal outputs.

STEP B From the main submenu screen, position the arrow next to the "outputs" submenu and press the right arrow key.

```

factors/totals
>outputs
measurement
back      E=End
  
```

The following screen will appear:

```

analog outputs
change
>next parameter
back      E=End
  
```

This is the first of several output screens but they all have the same elements in them. If you want to change the specific output, position the arrow next to the "change" line and press the right arrow key. If you want to bypass the parameter, position the arrow in the "next parameter" line and press the right arrow until you see the desired parameter.
End of STEP B.

ANALOG OUTPUTS

Press the > key at the "change" line the following screen will appear:

```

analog outputs
+/-4...+/-20 mA
  
```


> next
 E Enter
 Press ">" until you find the type of analog output that you desire among the following screens:

```

  analog outputs
  0...+/-10 mA
  > next
  E Enter

  analog outputs
  +/-2...+/-10 mA
  > next
  E Enter

  analog outputs
  0...+/-20 mA
  > next
  E Enter
  
```

Once you have found the right output, press the ENTER key to select that particular output. (See Primo Technical brief for voltage equivalent to mA outputs).

The next parameter to be selected is Pulse Output. Repeat Step B until the following screen appears:

```

  pulse output
  > change
  next parameter
  back      E=End
  
```

The pulse output will determine how many pulses per gallon, litre, etc. will be sent out to remote counters and controllers and also how many decimal digits will be displayed on the totalizers. If, for example, you choose 100 pulses per gallon, then the display totalizers will have two digits after the decimal point. Move the > arrow next to "change", then press the > key and the following screen will appear:

```

  pulse output
  100 Pulse/G
  ^ up > down
  E Enter
  
```

Use the ^ and > buttons to change the number to the desired pulse rate. The maximum pulse output for this unit is 10,000 pulses per second, thus, depending on the maximum flow selected you may be limited to a certain number of pulses per unit.

Press ENTER when you have programmed the right number.

The next parameter is pulse width, or the time duration that each pulse will be "ON". This can be programmed from zero, which means 50% on 50% off, to 1000 milliseconds in increments of one millisecond. Program this parameter to match the required pulse width of the remote accessory that will use the pulse output. Repeat step B until you see this screen:

```

  pulse width
  > change
  next parameter
  back      E=End
  
```

Position the > arrow next to "change" and press the > key. The following screen will appear:

```

  pulse width
  0 ms
  ^ up > down
  E Enter
  
```

Use the ^ and > buttons to set the right number. Once the correct number is selected press ENTER.

The next parameters to be programmed are the high and low flow signals. The amplifier has three relays. Relays two and three are used to signal an audio or visual alarm or other devices, when the flow rate is below a minimum flow or above a maximum flow. You can program one or both relays with similar or different values. The values are based on a percentage of the maximum flow programmed under the "measurement" submenu.

Repeat Step B until you can see the Flow signal 1 screen:

```

  Flow signal 1
  > change
  next parameter
  back      E=End
  
```

Move the > arrow next to "change" and press the > key. The following screen will appear:

```

  Min Flowsig 1
  10 %
  ^ up > down
  E Enter
  
```

Once you use the ^ and > keys to select the minimum flow percentage and press ENTER the following screen will appear:

```

  Max Flowsig 1
  90 %
  
```

```

^ up   >down
E Enter

```

Again use the ^ and > arrows to change the maximum flow percentage and press ENTER to program the values. Repeat step B until you find the Signal 2 screen and use the same procedure as used with Signal 1 programming.

Note: On the signal output, the relays will remain energized until the flow rate returns to within the flow limits.

CALIBRATION & TOTALIZERS RESET

The third and last submenu "Factors/Totals" is used to calibrate the meter and to reset the totalizers back to zero.

STEP C: Press ENTER until you reach the main submenu screen. Position the arrow next to the "factors/totalizers" submenu and press the > key. The following menu will appear:

```

>amplifier fact.
  detector factor
Reset Totals
back      E=End

```

Press the ^ key to position the arrow > next to the parameter you need to view or change, then press the > key to enter that particular menu.

END OF STEP C

The first choice is the amplifier factor. This is a factor preprogrammed into the amplifier at the time the meter is calibrated in the factory and **should not be changed**. Using the ^ button move the arrow to the "detector factor" line and press the right > button. The following screen will appear:

```

  detector factor
      286.30
>change
back      E=End

```

The detector factor in this example is set at 286.3. It is with this factor that you can fine tune your calibration to meet your applications needs. For example, if you find that the meter is off by a certain percentage you can modify the detector factor to achieve the desired accuracy.

CALIBRATION CHECK AND ADJUSTMENTS

All meters are accuracy tested with water at the factory using calibrated test equipment. However, because of your specific installation and fluid parameters, it is sometimes necessary to recalibrate a meter under actual operating conditions with the liquid being metered.

The following instructions are provided to assist in performing an on-site calibration check and adjustment. This procedure may require either a test tank or vessel of known capacity or a second flow meter installed in the same line.

ACCURACY TEST

1. Place a test tank of calibrated volume at the output of the meter.
2. Operate meter until test tank is filled to the appropriate calibrated level. Since meter accuracy varies somewhat with flow rate, make test run at the same flow rate used in actual operation.
3. Record quantity indicated on amplifier display totalizer.
4. Repeat run three times and average recorded indications.
5. Perform the following calculation to determine the percent of accuracy of the meter.

$$\frac{\text{Qty. Delivered in vessel}}{\text{Qty. Indicated on Primo}} \times \frac{\text{Old Detector Factor}}{\text{New Detector Factor}}$$

Example 1.

$$\frac{100 \text{ Gallons}}{95 \text{ Gallons}} \times 286.3 = 301.3$$

In this example, the meter accuracy is low and must be increased by a calibration correction.

Example 2.

$$\frac{100 \text{ Gallons}}{104 \text{ Gallons}} \times 286.3 = 275.2$$

In this example, the meter accuracy is high by 4% and must be reduced by a calibration correction. To do this, multiply the detector factor programmed in the unit by 0.96 and enter the new number, 275.2, as follows:

With the arrow pointing to the word "change" press the right arrow key and the following screen will appear:

```

  detector factor
      275.2
^ up   > down
E Enter

```

Using the ^ and > buttons change the detector factor to the new number and then press ENTER.

The third and last parameter in this submenu is the Reset Totals. Press ENTER to see the following screen:

```

  amplifier fact.
  detector factor
>Reset Totals
back      E=End

```

Move the arrow to the "reset totals" line and press the right arrow key >. The following screen will appear:

```

Reset forward
and reverse
> totalizers
back      E=End

```

By pressing the right arrow key you will reset both, forward and reverse totalizers back to zero. Finally press ENTER twice to return to the main display screen.

5. TROUBLESHOOTING

The Magnetoflow mag meter should give you many years of maintenance free operation. However, should it malfunction, there are certain things that we recommend you check before contacting our technical support department or your local Badger Representative.

On the detector side, there are no moving components, thus the only problems that can be encountered are with the liner or with the electrodes.

Note: If the fluid measured has a high concentration of conductive solids, they may accumulate as deposits on the internal liner walls and electrodes. These deposits will cause a reduction of the measuring output. Thus, it may be necessary to periodically take the meter off-line and inspect the liner and electrodes. If deposits are found, remove them with a soft brush. Do this periodically to insure the best accuracy possible.

If the flow rate or totalizers are not displayed, check for the following:

- a) Make sure the right power supply is being used and the wiring of power and Input/Output connections are correct.
- b) Is the recommended fuse protection active? If not, replace the fuse.
- c) Make sure that the maximum flow rate is set correctly.
- d) Make sure that the flow direction coincides with the arrow on the flow tag of the detector.

If the flow rate is shown but you know it is wrong, check for the following:

- a) Re-select the maximum flow rate.
- b) Make sure the electrodes and liner are free of deposits.
- c) Make sure the right pipe size was selected.

If the flow rate indication is not stable, check for the following:

- a) Make sure that power supply is clean.
- b) Make sure that cables between detector and amplifier are securely connected.
- c) Make sure that the flow meter is properly grounded to a good earth ground (100 ohms or less ground resistance).
- d) Make sure that the pipe is always full of fluid.
- e) Make sure that the fluid does not have air bubbles coming from a leaking connection in your piping.
- f) Make sure that the amplifier is not too close to sources of electrical interference.

Problems with accuracy can also be traced to faulty pumps, valves and other piping components. Make sure all your mechanical and electronic components are in proper working order.

Primo amplifier problems.

The amplifier is a processor based unit and it runs self diagnostics routines on a periodical basis. When it finds a component problem, it alerts you with the error messages described below. However, if the processor is damaged, diagnostics will not be possible and the unit will have to be sent back to the factory for inspection and repair if necessary.

If after checking all of the above recommendations, the meter still malfunctions, please contact our **technical support department at 1-800-456-5023**. Or contact your local Badger Representative.

1 Primo Amplifier Error - messages

Explanation of the error messages

Error message	Cause	Remedy
Detector error	- Detector is not connected or broken. - Detector resistor is too high. - Supply voltage is too low.	- Contact the Factory.
Detector-off err.	- A fixed gain is setting but the offset voltage is too high.	- Contact the Factory.
Slave-ack err.	- Connection error between master and slave processor	- Check the connection between the processor and the E-PROM.
Unknown error	- Error in the master processor.	- Check all programmed parameters.
error 1	- Error in the slave processor	- Contact the Factory.
error 2	- Pulse overflow - There are lost pulses at the output.	- Lower the pulse width or set the pulse width to zero.
error 4	- Transmit to slave error.	- Contact the Factory.
error 8	- Temperature over-ranges.	- Contact the Factory.



BadgerMeter, Inc.

P.O. Box 245036 Milwaukee, WI 53224-9536
Telephone: (414) 355-0400
Fax: (414) 355-7499

Due to continuous research, product improvements
and enhancements, Badger Meter reserves the right to
change product or system specifications without notice.
Copyright© Badger Meter, Inc. 2000
All rights reserved.