M-Series Mag Meter	Model M3000	Installation & Operation Manual

IMPORTANT !!!! Read this manual before attempting any handling or installation of the meter.

BME-M3000-09-07

Disclaimer

The user/purchaser is expected to read and understand the information provided in this manual, follow any listed Safety Precautions and Instructions and keep this manual with the equipment for future reference.

The information in this manual has been carefully checked and is believed to be entirely reliable and consistent with the product described. However, no responsibility is assumed for inaccuracies, nor does Badger Meter Europe assume any liability arising out of the application and use of the equipment described.

Should the equipment be used in a manner not specified by Badger Meter Europe, the protection provided by the equipment may be impaired.

Questions or Service Assistance
If you have questions regarding the product or this document contact:

Badger Meter Europa GmbH
Nürtinger Str. 76
72639 Neuffen (Germany)

Telephone: +49-7025-9208-0
Fax: +49-7025-9208-15

On the Web: www.badgermeter.de
or call your local Badger Meter representative.

Product Identification Information
Record the product identification numbers from the nameplate.
Modular Mag Meter
Model Number _M3000_____
Serial Number _____
Tag Number _____(if applicable)

Basic safety advices

The electromagnetic flow meter is only suitable for the measurement of conductive fluids. The manufacturer is not liable for damages that result from improper or nor not in accordance with the requirements use.
The meters are constructed according to state-of-the-art technology and tested operationally reliable. They have left the factory in a faultless condition concerning safety regulations.
The mounting, electric installation, taking into operation and maintenance of the meter may only be carried out by suitable technicians. Furthermore the operating personnel has to be trained by the operating authority and the instructions of this manual have to be followed.
Principally the regulations for the opening and repairing of electrical equipment in your country have to be payed attention.

Repairs
Should you send back a flow meter in operation, please take notice of the following points:

- Please enclose a description of the fault as well as a precise statement of the measured medium (if necessary a safety specification sheet).
- The meter has to be in a cleaned condition (outside and inside). Especially with harmful measuring mediums you have to pay attention that there are no impurities in the pipe or at the connections.
- If it is not possible to clean the meter completely, particularly with harmful materials, do not send back the meter.

We reserve the right to repair only cleaned meters. Costs, which result from insufficient cleaning, will be charged to you.

CE mark
The electromagnetic flow meter complies with the European regulation ATEX 94/9/EC,
EMC regulation 2004/108/EC and PED regulation 97/23/EC.

The device is so designed and manufactured that it cause no danger by direct or indirect contact.

Badger Meter Europe confirm the conformity with the European regulations by printing the CE sign on the meter.

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SAFETY PRECAUTIONS and INSTRUCTIONS

Safety considerations are emphasized by the placement of safety symbol icons on the product or next to important text, pictures or drawings throughout this manual. The symbols are:

When and where this symbol is attached to the product it indicates a potential hazard. It means that documentation must be consulted to determine the nature of the potential hazard and any actions that need to be taken.

⚠WARNING

Warning indicates an action or procedure, which, if not performed correctly, can result in sever personal injury, death, or substantial property damage. Comply with the instruction and proceed with care.

⚠CAUTION

Caution indicates an action or procedure, which if not performed correctly, will or can cause minor personal injury or property damage. Comply with the instruction and proceed with care.

Equipment Unpacking, Inspection, Moving and Return Policies

1. If shipping container damage is evident at delivery, have a responsible person present when the meter is unpacked.
2. Inspect the shipping container for unpacking, lifting or moving instructions.
3. As the unit is opened and unpacked, verify the shipment packing list and your order form match the items in the shipment.
4. Open the container and remove all cushioning materials. Keep the shipping container and packing materials should the meter need to be returned or put in storage.
5. Remove the meter from the container. For meter flow tube diameters between 2” and 8” (50 and 200mm) use a crane or lifting device with soft straps placed around the detector body, at the flanges. For meter flow tube diameter sizes 10” (250mm) and larger, lift the unit via the lifting lugs with a crane, cables and hooks.
6. Inspect the meter for signs of shipping damage; scratches, loose or broken parts.

NOTE: If damage is found, a formal claim for damage in transit is the responsibility of the customer. Within 48 hours of delivery request an inspection report from the carrier. File a claim with the carrier. Contact the Badger Meter factory to facilitate repair or replacement, +49 7025 92080.

7. All detectors with PTFE liners are shipped with a liner protector to maintain proper form of the PTFE material during shipping and storage.

NOTE: Do not remove the liner protector until installation.

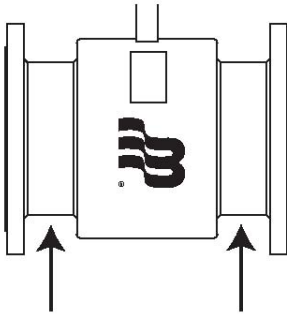
8. Storage: If the meter is to be stored, place it in its original container in a dry, sheltered location. Storage temperature ranges are: -4°F to 158°F (-20°C to 70°C).

Rigging, Lifting, Moving Large Units

DO NOT lift or move a meter via its amplifier, junction box or cables.

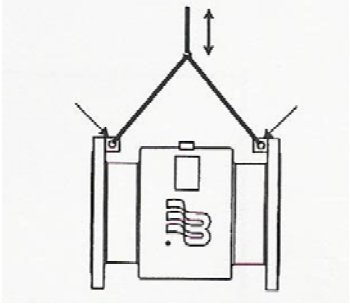
⚠CAUTION

Lift and move meters with flow tubes between 2" and 8" (50 and 200mm) with a crane rigged with soft straps. Place a strap around the detector body, between the flanges, on each side of the detector.



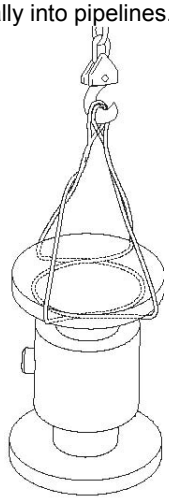
⚠CAUTION

Lift meter flow tube diameter sizes 10" (250mm) and larger via its lifting lugs. Use the proper size crane, cables and hooks. DO NOT lift the meter by the amplifier or, on remote style meter, by the junction box.



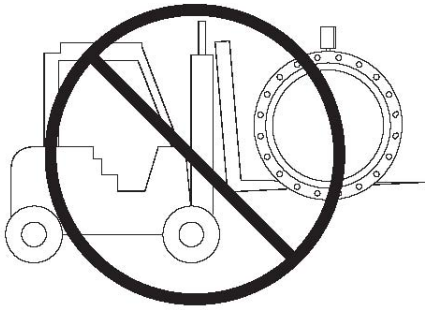
⚠CAUTION

Use the sling-rigged method to lift large detectors into a vertical position while still crated. Use this method to position large detectors vertically into pipelines.



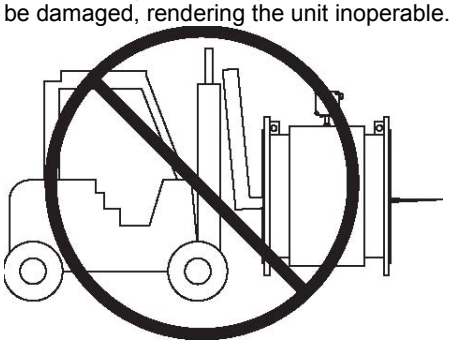
⚠CAUTION

Do not lift a detector with a forklift via the detector body between the flanges. The housing could be dented and/or damage caused to internal coil assemblies.



⚠CAUTION

NEVER place forklift forks or rigging chains, straps, slings, hooks or other objects inside or through the detector flow tube for lifting or handling purposes. The isolating liner could be damaged, rendering the unit inoperable.



Instructions Specific to Hazardous Area Installations
These instructions apply to equipment covered by ATEX Certificate Number FM08ATEX0051X issued by FM.

1. During any installation or repair, perform all procedures in accordance with the applicable code of practice.
2. Suitably trained personnel shall perform all installation or repair procedures.
3. If the equipment is likely to come into contact with aggressive substances, it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.

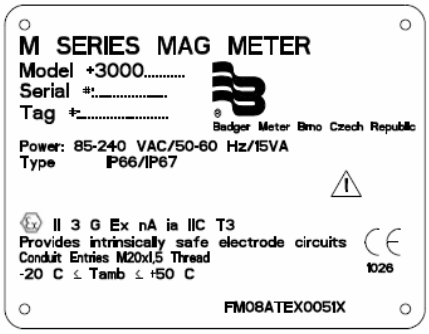
Aggressive Substances – e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.

Suitable Precautions – e.g. regular checks as part of routine inspections or establishing, from the material's data sheet, that it is resistant to specific chemicals.

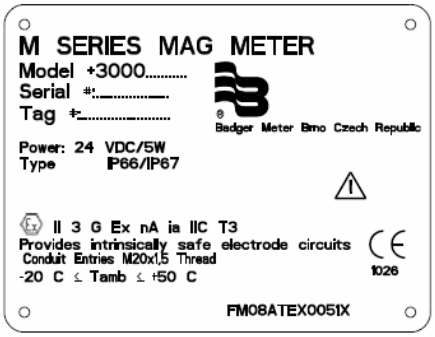
Additional Information
Certification markings are noted on the product label.

For additional information regarding importation, equipment installation, equipment repair, equipment return or renewal parts, please contact Badger Meter Europe or your local Badger Meter representative.

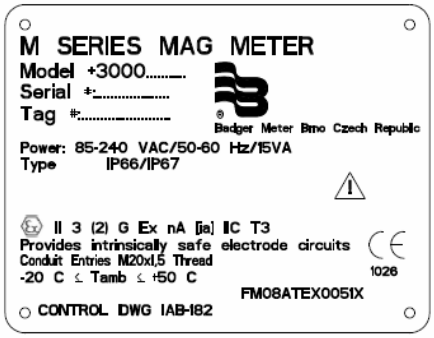
Meter mounted 85-240 VAC



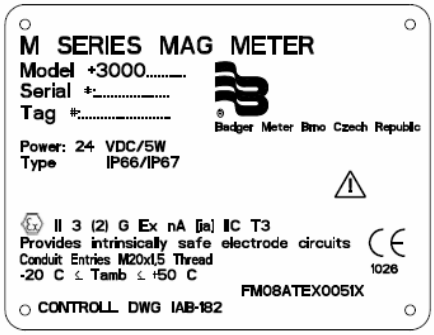
Meter mounted 24 VDC



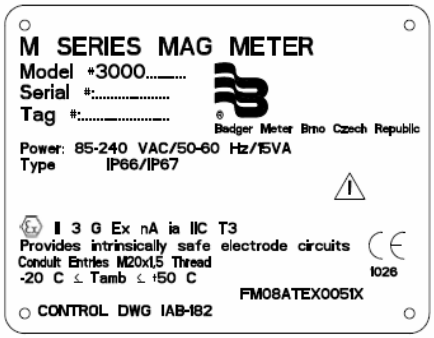
Remote mounted 85-240 VAC - Amplifier



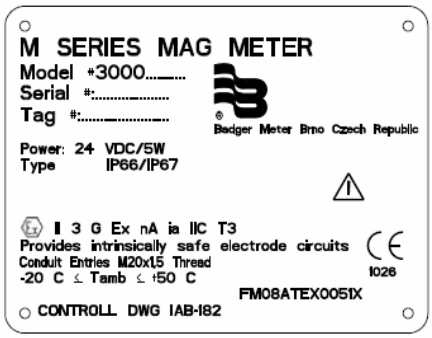
Remote mounted 24 VDC - Amplifier



Remote mounted 85-240 VAC - Detector



Remote mounted 24 VDC - Detector

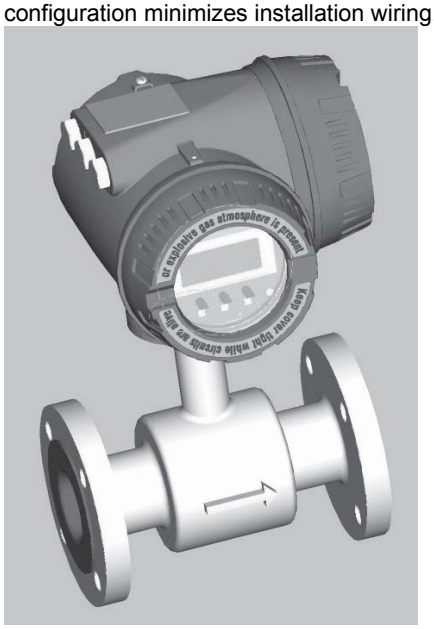


METER DESCRIPTION
Badger Model M3000 electromagnetic meters are ATEX approved for Zone 2 hazardous locations. To achieve hazardous location ratings electrodes in the flow tube are Intrinsically Safe, designed according to ATEX standards. Those standards limit the amount of energy that can be sent to electrodes to prevent a spark from occurring.

Empty Pipe Detection
Badger Magnetoflow Mag meters are equipped with an Empty Pipe Detection feature. Empty Pipe Detection is accomplished by positioning a third electrode between 12 o'clock and 1 o'clock. Any time this electrode is not covered by fluid, for a minimum of five seconds, the meter displays an Empty Pipe Detection condition, sends out an error message if desired, and stops measuring to maintain accuracy. When the electrode is again covered with fluid, the error message disappears and the meter continues measuring.

Amplifier Mounting Configuration Options
Two amplifier-mounting configuration options are available to meet a variety of meter placement and environmental conditions.

Meter Mount Configuration
The **Meter Mount** configuration has the amplifier mounted directly on the detector. This compact, self-contained configuration minimizes installation wiring.



Meter Mount

Remote Mount Configuration
Remote Mount configuration places the amplifier and its functions at a location separate from the fluid flow and detector. This configuration is necessary in situations where process fluid temperature or environment exceeds amplifier ratings. A remote mounting bracket is supplied.

Detector and amplifier are connected by wires, run through conduit, between junction boxes on the detector and remote mounted amplifier. The distance between the detector junction box and amplifier junction box can be up to 100 feet (30m).

This configuration can also provide a more convenient amplifier programming and display placement for monitoring meter readings.

METER/AMPLIFIER LOCATION, ORIENTATION and APPLICATIONS
Remote Amplifier Outdoor Location
The amplifier can be installed and operated outdoors. However, protection from the elements must be considered:
1. Be aware of the ambient environment and temperature ratings for the unit -4°F to 122°F (-20°C to 50°C).
2. If an indoor location is within 100 feet (30m) of the detector installation, consider increasing the cable length and mounting the amplifier indoors.
3. Consider mounting the amplifier in a IP 67 outdoor enclosure.
4. At a minimum, fabricate a roof or shield over and/or around the amplifier to protect the LCD display screen from sunlight and to keep the possibility of rain or moisture problems to a minimum.

Temperature
To prevent meter damage in any environment, minimum and maximum temperature ranges must be observed.

1. For remote amplifier applications, the fluid temperature range is -4°F to 221°F (-20°C to 105°C) at a maximum ambient temperature of 122°F (50°C) for the following liner materials: PTFE.

2. For remote amplifier applications, the fluid temperature range is 32°F to 178°F (0°C to 80°C) at a maximum ambient temperature of 122°F (50°C) for the following liner materials: Hard rubber.

3. For meter mounted amplifier applications, the fluid temperature range is -4°F to 212° (-20°C to 100°C) at a maximum ambient temperature of 122°F (50°C) for the following liner materials: PTFE.

4. For meter mounted amplifier applications, the fluid temperature range is 32°F to 178°F (0°C to 80°C) at a maximum ambient temperature of 122°F (50°C) for the following liner materials: Hard rubber.

5. The ambient temperature range surrounding the amplifier is -4°F to 122°F (-20°C to 50°C.)

6. The ambient temperature range surrounding a remote junction box mounted to the detector is -4°F to 122°F (-20°C to 50°C.)

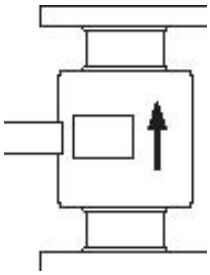
Pipelines and Fluid Flow
Although the Model M3000 is rugged, there are some pipeline and fluid flow conditions that should be avoided:

1. Do not install the meter where extreme pipe vibrations exist. If vibrations are present, secure piping before and after the meter with appropriate pipe supports. If vibrations can't be restrained, consider mounting the amplifier remotely.
2. Avoid installing the detector close to pipeline valves, fittings or impediments that can cause flow disturbances.
3. For detectors with PTFE liners, avoid installing the detector on suction sides of pumps.
4. Avoid installing the detector on outlet sides of piston or diaphragm pumps. Pulsating flow can affect meter performance.
5. Avoid locations near equipment producing electrical interference such as electric motors, transformers, variable frequency, power cables, etc.
6. Verify both ends of the signal cables are securely fastened.
7. Place power and signal cables in separate conduit.
8. Place the meter where there is enough access for installation/maintenance purposes.

Meter Orientation
Mag Meters can operate accurately in any pipeline orientation and can measure volumetric flow in forward and reverse directions.

NOTE: A Forward Flow direction arrow is printed on the detector label.

Vertical Placement
Mag meters attain optimal performance when placed vertically, with liquid flowing upward and meter electrodes in a closed, full pipe.

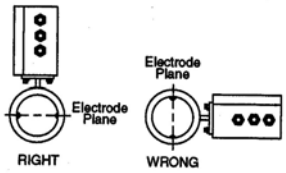


Vertical placement allows the pipe to remain completely full, even in low flow, low pressure applications and it prevents any solids build-up or sediment deposit or accumulation on the liner and/or electrodes.

NOTE: Carefully observe the "Forward Flow" label on the meter body and install the meter accordingly.

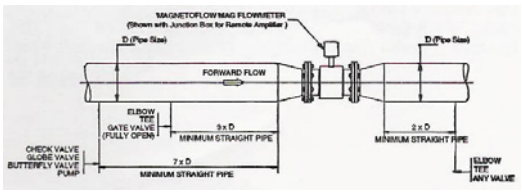
Horizontal Placement
In a horizontal piping orientation, mount the detector to piping with the flow measuring electrode axis in a horizontal plane (3 and 9 o'clock).

This arrangement prevents solids build-up or sediment deposit or accumulation on the electrodes.



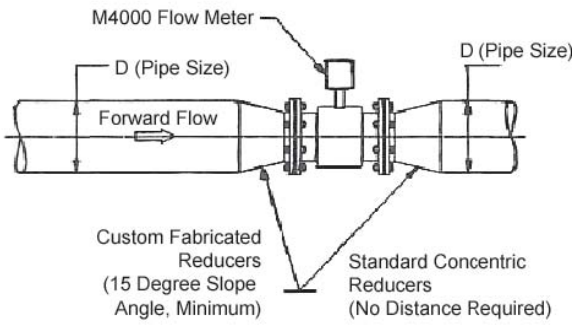
Straight Pipe Requirements
Sufficient straight pipe runs are required at the detector inlet and outlet for optimum meter accuracy and performance. An equivalent of three (3) diameters of straight pipe is required on the inlet (upstream) side. Two (2) diameters are required on the outlet (downstream) side.

Pipe Reducer Requirements
With pipe reducers a smaller size meter can be mounted in larger pipelines. This arrangement may increase low flow accuracy.

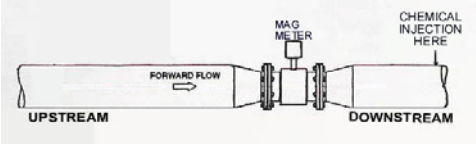


There are no special requirements for standard, concentric, pipe reducers.

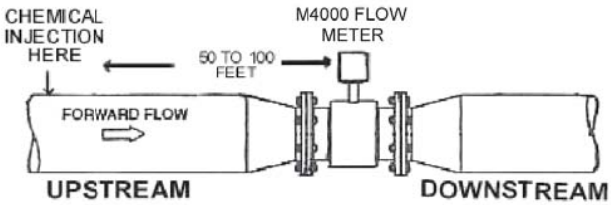
Custom fabricated pipe reducers must have a minimum slope angle of 15 degrees to minimize flow disturbances and excessive loss of head. If this is not possible, install the custom pipe reducers as if they were fittings and install the amount of straight pipe stated previously.



Chemical Injection Applications
For water line applications with a chemical injection point, install the meter upstream of the injection point. This eliminates any meter performance issues.



If a meter must be installed downstream of a chemical injection connection, the distance between the meter and the injection point must be significant; 50 to 100 feet (15 to 30 meters). When the water/chemical solution reaches the meter it must be a complete, homogeneous mixture. If the injection point is too close, the meter senses two (2) different liquids (conductivity is different for each) and correct data output cannot be assured. The injection method: spaced bursts, continuous stream of drips, a liquid or gas can also affect downstream readings by the meter.

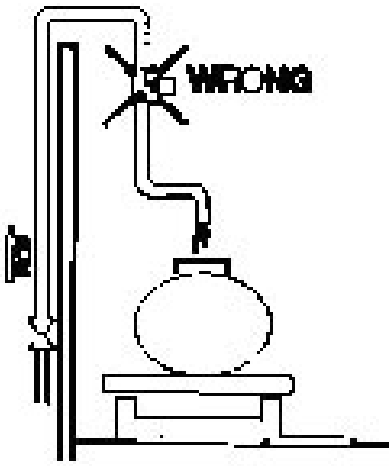


Sometimes it's difficult to specify the exact downstream placement distances because of the number of variables. Contact Badger Meter Technical Support, +49 7025 92080, to review your application if necessary.

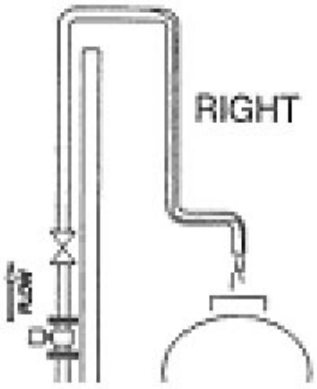
Partially Filled Pipe Situations
It is possible to encounter situations where the process pipe is momentarily only partially filled. Examples include; lack of backpressure, insufficient line pressure, gravity flow applications, etc.

To eliminate these situations:

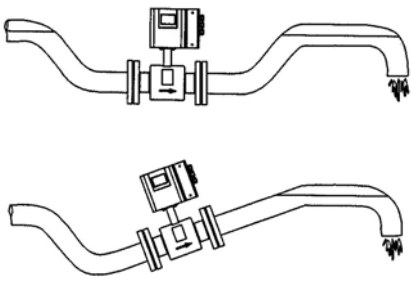
Do not install the meter in
the highest point of the pipeline



Do not install the meter in a vertical, downward flow section of pipe



ALWAYS locate ON/OFF valves on the downstream side of the meter



To minimize the possibility of partially full pipe flows in horizontal, gravity or low pressure applications, create a pipe arrangement that insures the detector remains full of liquid at all times.

Meter Gaskets and Grounding

Two other considerations to meter location, orientation and application are gasket and grounding requirements and placement.

Meter/Pipeline Connection Gaskets

Gasket(s) (not provided) must be installed between the detector isolating liner and the pipeline flange to ensure a proper and secure hydraulic seal. Use gaskets compatible with the fluid flow. Center each gasket on the flange to avoid flow restrictions or turbulence in the line.

Do not use graphite or any electrically conductive sealing compound to hold gaskets during installation. Measuring signal accuracy could be affected.

If a grounding ring is used in the detector/pipeline connection, place the ring between two gaskets. (See **Non-Conductive Pipe Grounding** section.)

Meter Grounding

Process pipeline material can be either electrically conductive (metal) or not electrically conductive (made of or lined with PVC, fiberglass or cement).

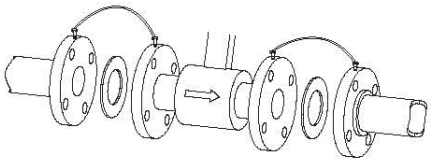
⚠CAUTION

To ensure proper unit operation, the mag meter impact ground (zero voltage reference) must be connected to the liquid media and to a good, solid earth ground. Perform grounding procedures after the meter is connected to the pipeline.

Conductive Pipe Grounding

A grounding bolt is located on each mag meter flange. Drill and tap the pipeline flanges on each side of the meter and install a grounding bolt to each.

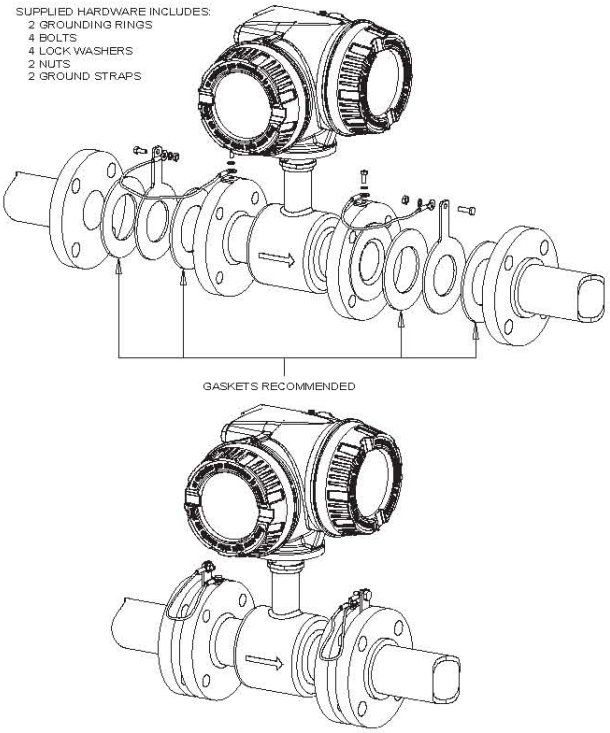
To ground the unit, attach a ground strap (provided) of copper wire, at least 12AWG size, between the grounding bolts on the meter flanges and the bolts on the pipeline flanges. Do this on the inlet and outlet sides of the meter.



Non-Conductive Pipe Grounding

If the process pipeline material is not electrically conductive and your meter was not ordered with an optional grounding electrode, place a grounding ring (available from Badger Meter) between two gaskets on both ends of the meter.

GROUNDING RING INSTALLATION KIT



After the grounding rings, gaskets and meter are attached to the pipeline, attach ground straps (provided) of copper wire, at least 12AWG size, to grounding bolts on meter flanges and to the grounding rings.

If your meter was ordered with an optional grounding electrode, the use of grounding rings is not necessary.

METER INSTALLATION PLANS and EXECUTION

Plan meter layout, location and installation. During installation, remember these important points:

1. Heed all safety notifications.
2. Select a detector location with room for installation and maintenance procedures.
3. Use proper lifting, rigging and moving procedures for large units.
4. Consider the meter environment; particularly ambient and process flow temperatures.
5. Consider the process pipeline (vibrations) and its flow characteristics (valve and pump locations).
6. Meter orientation to the pipeline (vertical or horizontal).
7. Straight pipe requirements.
8. Pipe reducer requirements.
9. Special applications and/or situations.

For Remote Mount Units consider:
1. Amplifier location.
2. Remote amplifier mounting bracket.
3. Proper conduit and conduit fittings.
4. Wiring and conduit locations.

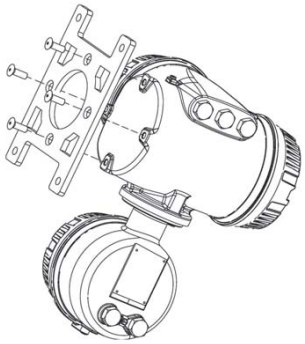
REMOTE MOUNT AMPLIFIER
NOTE: Screws are supplied to attach bracket to amplifier. Screws are not supplied to attach bracket at mounting location.

NOTE: Not relevant to meter mount units.

Remote Mount Amplifier Location Requirements:
1. A sturdy and safe mounting surface capable of holding the amplifier weight (20 pounds, 9 Kg).
2. Within the allowable temperature range: -4°F to 122°F, (-20°C to 50°C).
3. Access to amplifier covers, ports, terminals, screen and adjustments.
4. As close to the detector as possible.
5. Determine length and route of cable/conduit runs.

Use the supplied remote mount amplifier bracket to secure the remote mount amplifier at a desired location. An amplifier unit weighs approximately 20 pounds (9 Kg).

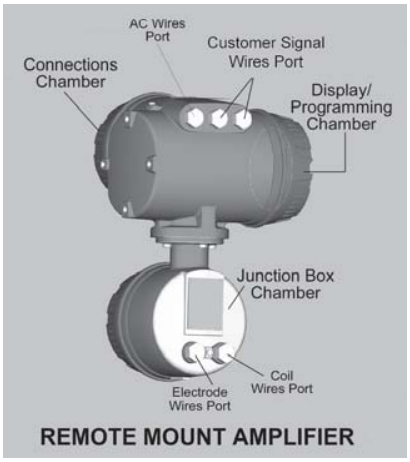
Mount Bracket to Amplifier
1. Align bracket-mounting holes with amplifier mounting holes.
2. Attach bracket to amplifier with supplied screws. Torque screws to 80 in. lb.



Mount Bracket/Amplifier to Location
1. Position the bracket/amplifier in the desired orientation.
2. Secure bracket/amplifier to location.

REMOTE MOUNT AMPLIFIER/DETECTOR WIRING
Remote Mount Amplifier
The remote mount amplifier has three chambers and five wire ports. The Junction Box and Connections Chambers and wiring ports provide amplifier openings for wire, conduit, tool and hands access to amplifier terminal blocks. Detector to amplifier wires connect in the Junction Box Chamber.

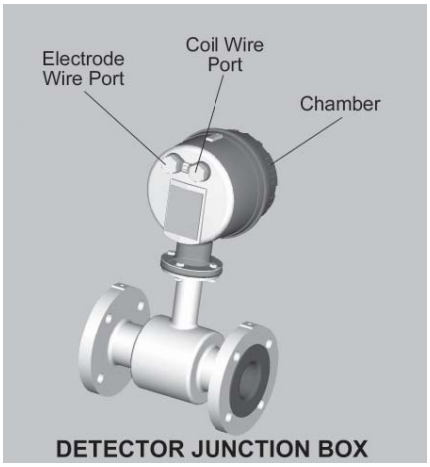
The Display/Programming Chamber provides access to fuses and circuit boards. They are discussed later.



REMOTE MOUNT AMPLIFIER

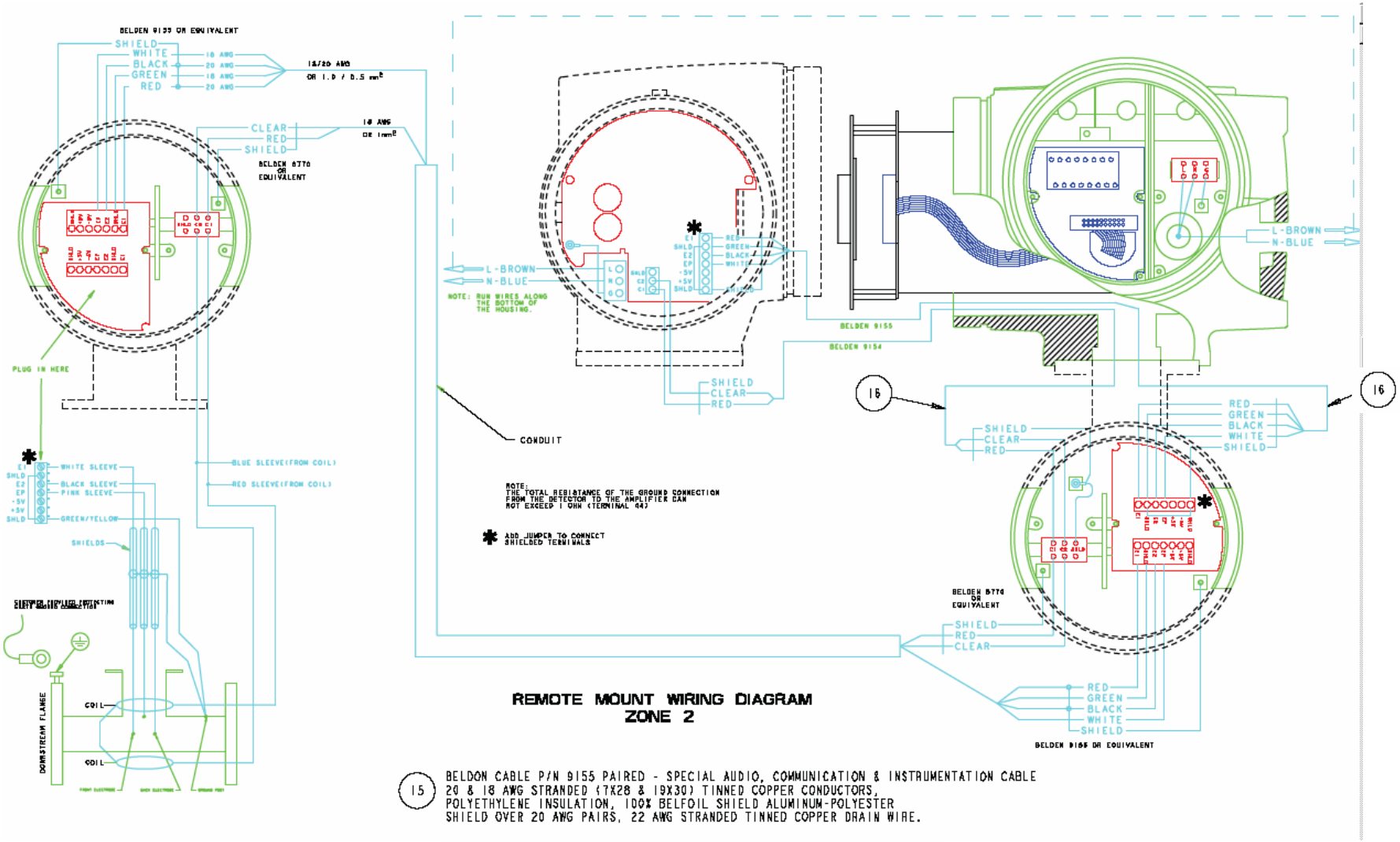
(Refer to the Remote Mount Wiring Diagram on page 15.)

Detector Junction Box
The Detector Junction Box has one chamber and two wire ports. The Junction Box, Chamber and wiring ports provide openings for wire, conduit, tool and hands access to terminal blocks. Detector to remote mount amplifier electrode and coil wires connect to the detector through the chamber wire ports.



DETECTOR JUNCTION BOX

⚠WARNING
· Suitably trained personnel shall perform all installation or repair procedures.
· Disconnect power to the unit before attempting any installation or maintenance.
· Do not bundle or route signal wires with power wires.
· Use proper conduit, connections and supplied cables in all wiring procedures.
· Observe all local applicable electrical codes when wiring any equipment.



REMOTE MOUNT WIRING DIAGRAM
ZONE 2

(15) BELDON CABLE P/N 9155 PAIRED - SPECIAL AUDIO, COMMUNICATION & INSTRUMENTATION CABLE
20 & 18 AWG STRANDED (7X28 & 19X30) TINNED COPPER CONDUCTORS,
POLYETHYLENE INSULATION, 100% BELFOIL SHIELD ALUMINUM-POLYESTER
SHIELD OVER 20 AWG PAIRS, 22 AWG STRANDED TINNED COPPER DRAIN WIRE.

(16) BELDON CABLE P/N 8770 NO-PAIRED - AUDO CONTROL & INSTRUMENTATION CABLE
18 AWG STRANDED (16X30) TINNED COPPER CONDUCTORS,
CONDUCTORS CABLED, POLYETHYLENE INSULATION,
OVERALL BELFOIL ALUMINUM-POLYESTER SHIELD,
COVERAGE 20 AWG STRANDED TINNED COPPER DRAIN
WIRE, PVC JACKET.

Electrode and Coil Wiring From Detector Junction Box to Remote Mount Amplifier Junction Box
A remote mount unit requires electrode and coil cables, from the detector junction box to the amplifier junction box, be enclosed in properly rated conduit. Use conduit fittings (not supplied) that are rated for Zone 2 hazardous locations.

⚠WARNING

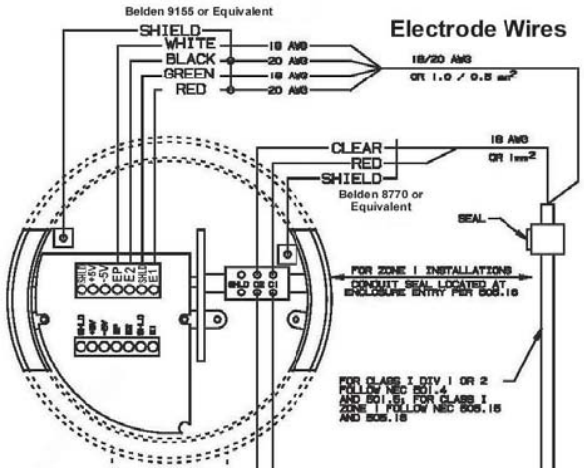
Failure to use proper conduit fittings rated for Zone 2 hazardous locations, invalidates the ATEX rating and any warranties, expressed or implied, for this equipment.

1. Lay out the cable and conduit between the Detector Junction Box and the Amplifier Junction Box.
2. Run cables through the conduit, between Detector Junction Box and Amplifier Junction Box.
3. Place four IP 67, M20 fittings on conduit.
4. Remove the four junction box wire port screws, two on each junction box.

Electrode Wiring in Detector Junction Box
To connect electrode wires in the Detector Junction Box:
1. Unscrew the Detector chamber cover. If necessary, use a strap wrench.
2. Remove the protective plastic cover to access the terminal block screws.

NOTE: Plastic cover must be reattached to maintain hazardous location rating.

3. Strip the cable jacket back 2 inches (50mm).
4. Strip the 4 wires back ¼ inch (6mm).
5. Thread wires through the proper cable access. Connect the wires to the compression style screw terminals of the Detector Junction Box.



Red to terminal labeled	E1
Green to terminal labeled	SHLD
Black to terminal labeled	E2
White to terminal labeled	EP

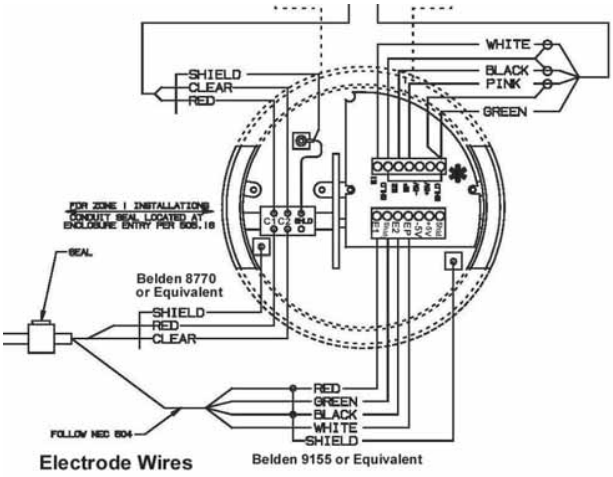
Cable length, between Junction Boxes, may be up to 100 feet (30M).

6. Run cable and conduit to Amplifier junction box.

Electrode Wiring in Amplifier Junction Box
To connect the electrode wires in the Amplifier Junction Box:
1. Unscrew the amplifier junction box chamber cover. If necessary, use a strap wrench.
2. Remove the protective plastic cover to access the terminal block screws.

NOTE: Plastic cover must be reattached when wiring is complete to maintain hazardous location rating.

3. Strip the cable jacket back 2 inches (50mm).
4. Strip the 4 wires back ¼ inch (6mm).
5. Thread wires through the proper cable access. Connect the wires to the compression style screw terminals of the Amplifier Junction Box.

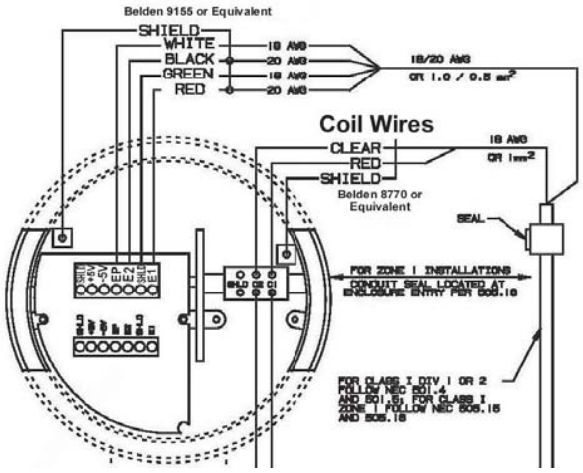


Red to terminal labeled -E1
Green to terminal labeled -SHLD
Black to terminal labeled -E2
White to terminal labeled -EP

Coil Wiring in Detector Chamber
To connect coil wires in the Detector chamber:
1. Lay out the cable and conduit between the Detector Junction Box and the Amplifier Junction Box. Use Belden #8770 cable or equivalent for coils.

NOTE: Plastic cover must be reattached to maintain hazardous location rating.

2. Strip the cable jacket back 2 inches (50mm).
3. Strip the 2 wires back ¼ inch (6mm).
4. Thread wires through the proper cable access. Connect the wires to the compression style screw terminals of the detector chamber.

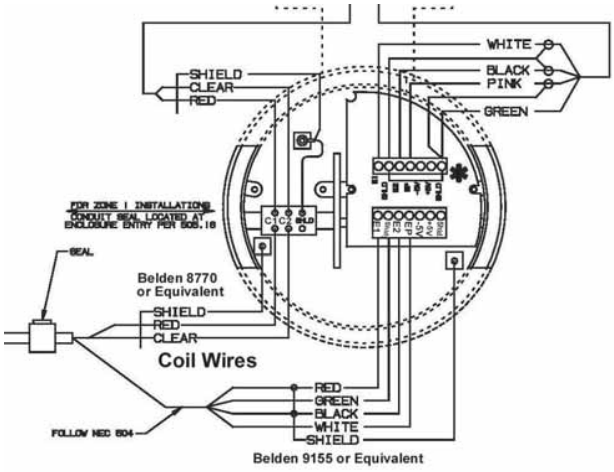


Red to terminal labeled – C1
Clear to terminal labeled – C2

5. Connect conduit to junction box. Use a IP 67, M20 fitting.
6. Install protective plastic cover over terminal blocks.
7. Attach detector chamber cover.

Cable length between Junction Boxes may be up to 100 feet (30M).

Coil Wiring in Amplifier Junction Box
To connect the coil wires in the amplifier junction box:
1. Strip the cable jacket back 2 inches (50mm).
2. Strip the 2 wires back ¼ inch (6mm).
3. Connect the wires to the compression style screw terminals of the amplifier junction box.



Red to terminal labeled – C1
Clear to terminal labeled – C2

4. Connect conduit to junction box. Use a M20 fitting.
5. Install protective plastic cover over terminal blocks.
6. Attach the amplifier junction box chamber cover.

OUTPUT WIRING
The Badger M3000 Meter converts liquid flow into electrical signal(s). With proper output wiring and amplifier programming, the signal(s) are sent to, and used by, processing equipment used in operations or other procedures.

NOTE: Output wires and terminals are the same for meter mount or remote mount meters

Output wiring requires 18 to 22 AWG maximum, shielded wire (not supplied). Signal wire insulation temperature class should exceed the maximum temperature where installed (typical, 185°F, 85°C).

Use conduit and conduit fittings (not supplied) rated for Zone 2 hazardous locations.

Output Wire Connections

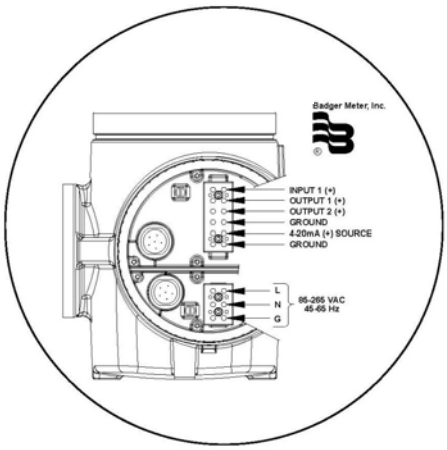
⚠WARNING

· Properly trained personnel must perform all installation and/or repair procedures.
· Disconnect power to the unit before attempting any installation or maintenance.

To connect control signal wires:
1. Remove the connections chamber cover. If necessary, use a strap wrench.
2. Remove the two terminal block wire port access screws.
3. Connect output wires to processing equipment.
4. Group and place output wires in conduit. Position conduit at amplifier terminal block wire ports.
5. Connect conduit to control output signal wires ports.
6. Run output wires through wire ports, into amplifier terminal chamber.
7. Strip output wires back ¼ inch (6mm).
8. Connect output wires to terminals (see below).

NOTE: Use twisted pair shielded wire for all output wiring. Belden #1266A or equivalent.

Amplifier Output Wire Terminal Block Connections:
Reference Control Signal Wiring Diagrams on next two pages.



Terminal 1 Input 1 (+)
Function: reset, positive zero return.

Terminal 2 Output 1 (+) Programmable Transistor Output (open collector) - Passive Output to Badger external counter.
Functions: forward pulse, AMR pulse, flow set point, error alarm, empty pipe, flow direction.
Active Output to external counter.

Terminal 3 Output 2 (+) Programmable Transistor Output (open collector) - Passive Output to Badger external counter.
Functions: reverse pulse, frequency output, preset output, flow set point, error alarm, flow direction
Active Output to external counter.

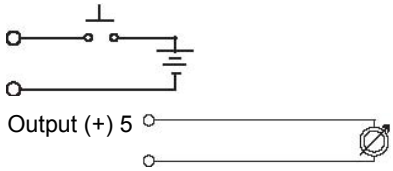
Terminal 4 Common field ground.

Terminal 5 mA Analog Output (+) Source.

Terminal 6 Common field ground.

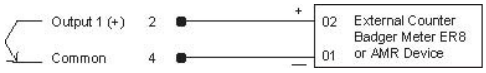
Analog Input Wiring Diagram

Function: 4-20 mA, 0-20mA, 0-10mA
Analog Output (Loop voltage = 18VDC Sourced)



Output 1 - Transistor Output (open collector)

Functions: Forward Pulse, AMR Pulse, Flow Set Point, Error Alarm, Empty Pipe, Flow Direction



Output 2 - Transistor Output (open collector)

Functions: Reverse Pulse, Frequency Output
Preset Output, Flow Set Point, Error Alarm,
Flow Direction

External Disconnect

⚠CAUTION

Position this device in an accessible location.

Position and identify the disconnect device so as to provide safe and easy operation.

Label the disconnect device as being for the Mag Meter.

Install an external disconnect switch or circuit breaker that meets local standards.

AC Power Wiring

For AC power use three wire, sheathed, cable with cable diameter of 18 AWG (not supplied).

AC wire insulation temperature class must not exceed the maximum ambient temperature of its location (typical, 185°F, 85°C).

Use conduit and conduit fittings (not supplied) that are rated for Zone 2 hazardous locations. To maintain a IP66 rating, use watertight fittings that are rated IP66 or better.

⚠CAUTION

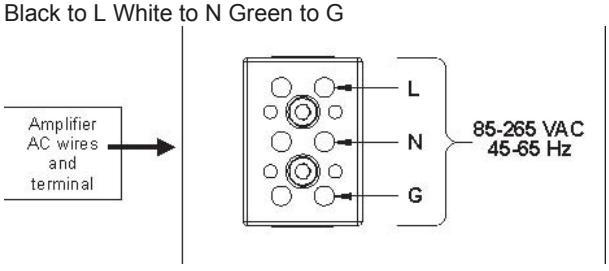
To prevent accidents connect main power only after all other wiring has been completed.

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

AC wiring is the same for meter mount and remote mount amplifiers.

1. Remove AC Wires Port screw from amplifier connections chamber.
2. Lay out AC cable and conduit to amplifier.
3. Place cable in conduit.
4. Strip AC cable back 2 inches (50mm).
5. Strip AC wires back ¼ inch (6mm).
6. Attach AC wires to amplifier terminal.

Black to L White to N Green to G



7. Connect conduit to amplifier.
8. Attach chamber cover.

Adjustable Display/Control Card

Because meter positioning sometimes places the amplifier display/programming chamber in an awkward position, the display/control card is adjustable in 90-degree increments.

⚠WARNING

Disconnect main power to the unit before attempting any device maintenance.

To re-position or rotate the display/control card in the amplifier:

1. Remove display chamber cover. Turn the cover counterclockwise to remove it from the amplifier. If necessary, use a strap wrench.

2. Remove the 2 card screws and washers. (NOTE: Use a split screwdriver to prevent dropping screw into

3. Tilt card up/out approximately 45 degrees at the holding clips.

4. Gently pull card down and out from between holding clips.

5. Rotate card to appropriate position.

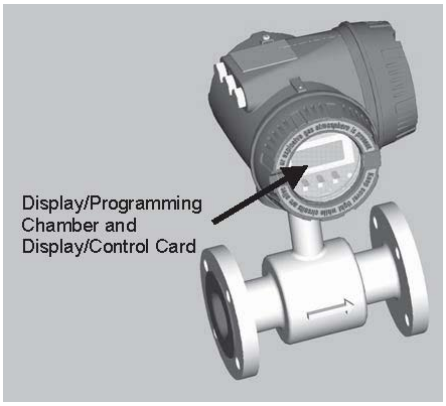
6. Angle card and position card holes between the holding clips.

7. Push card in, between holding clips. Lower card back into position and attach card with screws and washers.

8. Attach the chamber cover.

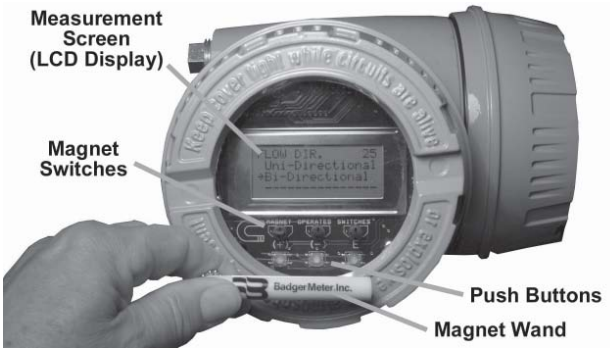
AMPLIFIER CONTROLS, CONTROL METHODS and DATA DISPLAY PROGRAMMING

The M3000 amplifier display/programming chamber contains a display/control card. This card and its display screen provide easy access to meter information and the ability to view, program and adjust meter data parameters.



Card Display and Controls

The M3000 uses a 2.5 X 1 inch (63 X 25mm) four line, 16-character, backlit, LCD display.



Display screens and screen data are manipulated with magnet switches or push buttons. By operating the switches or buttons different screens are accessed, program parameters are selected and changed and settings are reprogrammed.

If no contact is made with switches or buttons for 2 minutes, in any parameter, the display returns automatically to the Main Screen.

ACCESS to AMPIFIER SCREENS, DATA and PARAMETER PROGRAMMING

NOTE: The M3000 can be programmed to meter many flow situations and serve a variety of purposes during a production process. To meet diverse needs there are a wide variety of programming options and parameters. Your metering requirements probably do not require the use of all program screens, options and parameters.

Your M3000 amplifier is delivered preprogrammed, based on information available at the time the unit was ordered. In most instances it will not require any changes.

Use this section to program flow signal outputs or reprogram your meter to specific requirements.

Flow measurement and totalizing continues during amplifier programming.

Two Programming Methods
There are two methods for programming.

In one method a magnet wand is used to manipulate +, - and E switches to view and change screens and program functions and settings. The amplifier display chamber cover stays on.

The other method involves removing the display chamber cover and manipulating the +, -and E push buttons to view and change settings and program desired meter functions and settings.

AMPLIFIER SCREENS, MENUS and PROGRAMMING
Amplifier programming requires planning, moving and activating the **+**, **-**and **E** selections on three types of menu/ parameter screens, List screen, Input Numbers screen and select ON or Off screen.

MAIN SCREEN(S)
The first screen is the Main Screen. It is always displayed when programming functions are not occurring.

NOTE: When programming, if no contact is made with switches or buttons for 2 minutes, in any parameter, the display returns automatically to your programmed Main Screen.

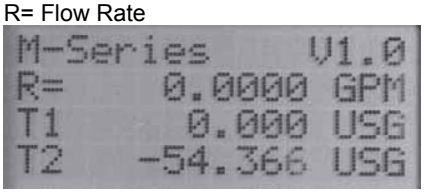
Two **Main Screen Format** settings are possible. Which setting to use is determined by the fluid Flow Direction through your meter. The settings are Uni-Directional flow or Bi-Directional flow (reference page 27/28 to set flow direction).

Both main screens display the rate of flow (R=) and flow units (reference page 26 to set flow units).

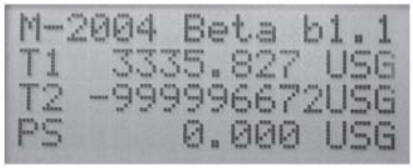
Uni-Directional Flow Main Screen
Uni-directional Flow Totalizes Pipe Flow in only one direction, the flow direction on the detector label. (reference page 27/28 to set uni-directional flow)

Uni-directional readings, on the display screen, are identified as R=, T1, T2 and PS.

R= Flow Rate



T1 registers Forward Volume
T2 registers Forward Volume and can be reset through Input 1.

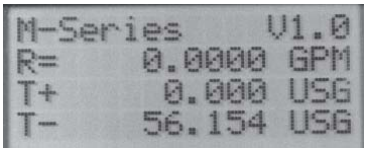


PS registers Preset Batch Amount

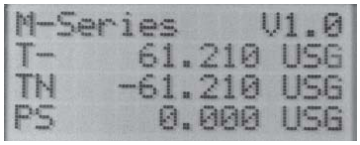
With this information an operator can tell at a glance the volume going through the meter.

Bi-Directional Flow Main Screen
Bi-Directional Flow totalizes pipe flow in both directions (reference page 27/28 to set bi-directional flow)

Bi-directional totalizers readings, on the display screen, are identified as R=, T+, T- , TN and PS.



R= Flow Rate
T+ registers Forward Volume
T- registers Reverse Volume
TN Net Total = (T+) - (T-)



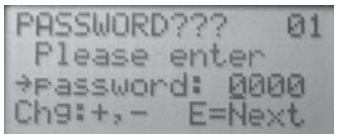
PS registers Present Batch Amount

With this information an operator can tell at a glance the volume going through the meter in both directions.

With your Main Screen showing on the display, switch or press **E**. Screen **PASSWORD??? 01** opens.

PASSWORD??? O1
PASSWORD??? 01 is a typical Input Numbers screen.

If a password had been entered into your program, this screen opens (reference page 24 to input a password)



An underscore (_) is positioned under the first 0.

1. Switch or press **+** to increase the number by one digit. Switch or press **–** to decrease the number by one digit.

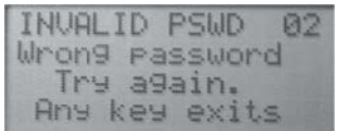
2. After the correct number is entered for that digit, press **E** to move the underscore to the next 0.

3. Repeat the number selection process for this and all the 0's.

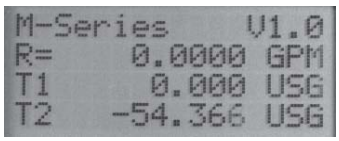
4. After the last number is entered, press **E**.

5. The MAIN MENU appears.

However, if the wrong password was entered:
Screen INVALID PSWD 02 opens.



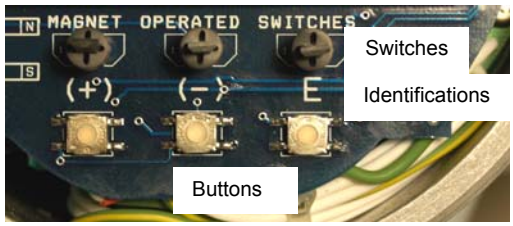
1. Select **+**, **-**or **E** to return to the Main Screen.



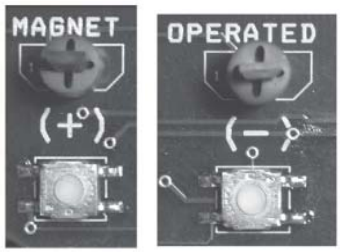
2. Press **E** again.
3. The screen returns to **PASSWORD??? 01**. Enter the correct password as described above.

All passwords are factory set to 0000 (no password is programmed or required). If 0000 is the password, pressing **E** from the Main Screen opens the **MAIN MENU** screen.

Amplifier Access Switches/Buttons
Accessing amplifier menus, movement to and between screen, parameter selections and settings are all accomplished by pressing the +, - and E magnet operated switches or push buttons in conjunction with an on-screen location arrow.



Switch/Buttons (+ and -)



Select/Press **+** to:

- move text up by one line, relative to the on screen arrow, for each select/press when choosing menu or sub-menu list names
- move text up by one line, relative to the arrow, for each select/press when selecting a parameter from a list
- increase a number by one digit for each select/press when inputting parameter numeric settings

Select/Press **–** to:

- move text down by one line, relative to the on screen arrow, for each select/press when choosing menu or sub-menu list names
- move text down by one line, relative to the arrow, for each select/press when selecting a parameter setting from a list
- decrease a number by one digit for each select/press when inputting parameter numeric settings

E Switch/Button

Select/Press **E** to:

- enter (open) a menu or sub-menu topic at which the arrow is pointing
- select between ON/OFF parameter settings for each select/press
- Move the parameter numeric setting underscore (_) one place to the right for each select/press when inputting parameter numeric settings
- SAVE a parameter numeric setting. After all numbers are input, press **E** and the setting is saved, the screen closes and the previous screen with the arrow pointing at “Exit this Menu” shows again. Select **E** again. That screen closes and the previous screen appears with the arrow pointing at its “Exit this Menu”
- Continue selecting **E** to return to the Main Screen.
- If your amplifier is not password protected, press **E** from the Main Screen to access the MAIN MENU. The MAIN MENU is a list that provides access to all amplifier menus and parameters
- If your amplifier is password protected and E is pressed from the Main Screen, the PASSWORD screen opens (reference PASSWORD??? 01, on page 26)

Amplifier Access Switches/Buttons

Accessing amplifier menus, movement to and between screens, parameter selections and settings are all available using +, - and E buttons.

- Move the parameter numeric setting underscore (_)one place to the right for each select/press when inputting parameter numeric settings.
- SAVE a parameter numeric setting. After all numbers are input, press **E** and the setting is saved, the screen closes and the previous screen with the arrow pointing at "Exit this Menu" shows again. Select **E** again. That screen closes and the previous screen appears with the arrow pointing at its “Exit this Menu”.
- Continue selecting **E** to return to the Main Screen.
- If your amplifier is not password protected, pressing **E** from the Main Screen accesses the MAIN MENU. The MAIN MENU is a list that provides access to all amplifier menus and parameters.
- If your amplifier is password protected and **E** is pressed from the Main Screen, the PASSWORD screen opens (reference PASSWORD??? 01, on page 26)

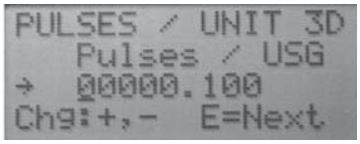
How to Program

Amplifier screens, menus and program parameters are arranged in the familiar “branching” format where the MAIN MENU screen is a list of selections. The Main Menu list provides access to other lists, selections or parameter screens which provide input for meter programming.

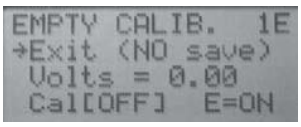
The amplifier program uses three types of screens; a List screen, an Input Numbers screen and a select ON or Off screen.

MAIN MENU 00
>Exit this Menu Meter
Setup Measurements
Inputs/Outputs
Clear Totals
Communications
Info/Help
Logout
Language Select

Sample List Screen



Sample Input Numbers Screen



Sample Select ON or OFF Screen

The following pages introduce you to the screen formats, describe how to maneuver to and through them and provide some specifics about programming terminology and parameters.

If possible, have access to your amplifier display and controls and perform these screen manipulations.

MAIN MENU
The MAIN MENU contains a list of eight selections and an "Exit this Menu" choice. All amplifier programming and parameters are accessed from this list

```
MAIN MENU        00

>Exit this Menu
 Meter Setup
 Measurements
 Inputs/Outputs
 Clear Totals
 Communications
 Info/Help
 Logout Language
 Select
```

Only four lines of text are visible on the display screen. Operating the **+** and **–** switches/buttons moves text up or down and into view.

When an item from the list on the MAIN MENU is selected, (press **E** when the item is in line with the arrow) either a screen opens that requires an action such as select a size or numeric unit for a parameter, turn a parameter on or off, etc. or a screen with another list may open requiring another selection be made to access and set a specific parameter size, numeric unit or on/off configuration.

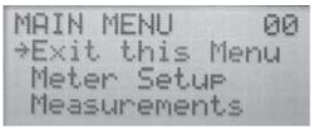
Each screen has a name and number that displays at the top of the screen. Write down screen names, numbers and parameters that you access and change should other changes be needed later.

NOTE: Your metering requirements may not require the use of all screens, options and parameters.

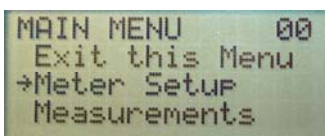
MAIN MENU 00 is a typical List screen. It provides access to parameter screens.

The MAIN MENU is a list of eight selections and an "Exit this Menu" choice. All amplifier programming and parameters are accessed from this list.

1. Press **+** or **–** to position the arrow at a selection.



2. For example, press **+** once to place the arrow at Meter Setup.

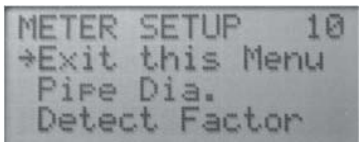


3. Next, press **E**.

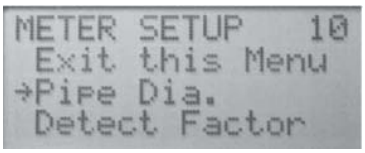
4. Screen METER SETUP 10 opens

METER SETUP 10 is another List screen. It provides access to common meter parameters.

1. Maneuver the **+** or **–** magnetic switches or push buttons to position the arrow at a selection.



2. For example, place the arrow at Pipe Dia. by pressing or activating **+** button once.

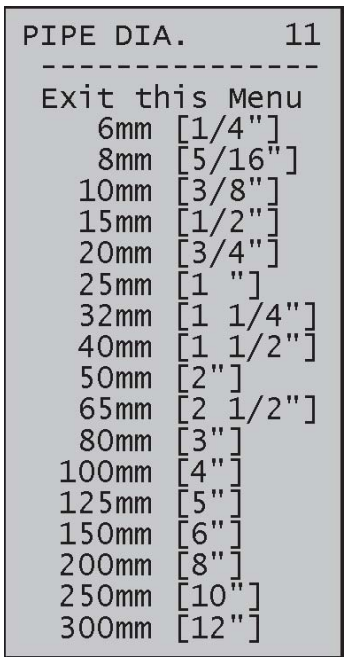


3. Press **E** to open the Pipe Dia. screen.

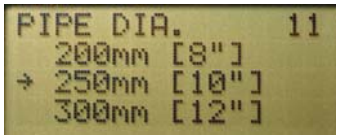
4. Screen Pipe Dia. 11 opens.

PIPE DIA. 11 is another List screen. It requires a parameter selection.

PIPE DIA. 11 is a list of pipe diameter sizes.

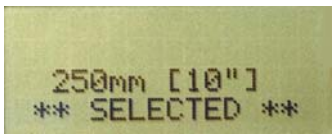


5. Press **+** or **–** to position the arrow at the appropriate pipe size.



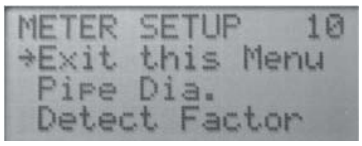
6. Press **E**.

7. A screen, with the statement [(xx mm [xx"]] **SELECTED** appears for about 2 seconds.



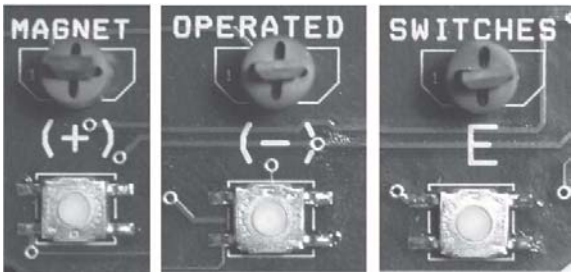
It verifies that the selected pipe diameter size parameter was entered into the amplifier settings.

8. The screen automatically returns to METER SETUP 10 with the arrow pointed at Exit this Menu.

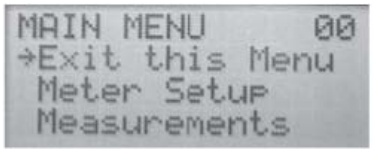


Transitions

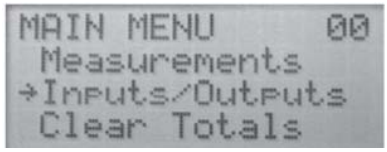
1. Press **+** or **–** to position the arrow at another selection or **E** to return to the Main Menu.



2. Use the **E** key to return to screen Main Menu 00.

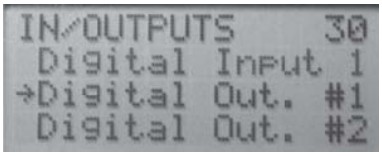


3. Next, press **+** three times to position arrow at Inputs/ Outputs.



4. Press **E**.

5. Press **+** three times to position arrow at Digital Out. #1 on screen In/Outputs 30.



6. Press **E**.

7. Press **+** once to move the arrow across from Pulses / unit.

```
DIG OUTPUT 1  33
 Exit this Menu
→Pulses / unit
 Pulse width
```

8. Press or activate **E**.

Pulses / Unit 3D is a typical Input Numbers screen.
1. When the screen opens, the arrow is pointing at a number.

```
PULSES / UNIT 3D
   Pulses / USG
→  00000.100
Chg:+,-  E=Next
```

2. Use **+** or **–** selections to increase or decrease the underscored number to the desired digit.
3. Select **E** to move the underscore to the next digit and repeat the number selection process.
4. To skip a digit press **E**. The underscore moves to the next digit.
5. When all digits are set, press **E**. Pulses / Unit 3D is programmed into the system and the screen Dig Output 1 33 returns.

Empty Pipe is a "branch" list screen from the MAIN MENU. From here calibrate ON or OFF is made.

1. Press **E** to activate the Main Menu 00 screen.

```
MAIN MENU     00
→Exit this Menu
 Meter Setup
 Measurements
```

2. Press the **+** once to place the cursor at Meter Setup.

```
MAIN MENU     00
 Exit this Menu
→Meter Setup
 Measurements
```

3. Press **E** to bring up Meter Setup 10 screen.

4. Press **+** five times to position the cursor at Empty Pipe.

```
METER SETUP   10
 Calibration
→Empty Pipe
 Chg. Password
```

5. Select or Press **E**.

6. Screen Empty Pipe 15 opens.

```
EMPTY PIPE    15
→Exit this Menu
 Cal. empty pipe
 Cal. full pipe
```

Empty Pipe 15 is a typical select ON/OFF screen.

Empty Pipe is usually **OFF**. To turn **Empty Pipe, On:**
1. Press **+** once to move the cursor down one place, to **Cal. empty pipe**.
Press **E**.

```
EMPTY PIPE    15
 Exit this Menu
→Cal. empty pipe
 Cal. full pipe
```

2. In screen **EMPTY CALIB. 1E,** press **+** twice.
3. Press **E** to turn **Cal=[ON]**.

```
EMPTY CALIB.  1E
 Volts = 1.66
→Cal[ON ]  E=OFF
 Exit WITH save
```

4. Press **+** to move cursor to **Exit WITH save**.

5. Press **E** to lock the selection into the program.

Continue pressing **E** to reverse through the screens to your **next programming selection** or to return to the **Main Screen**.

You have now used the **+**, **-**and **E** selections to access the three types programming screens, **List**, **Input Numbers** and **Select ON** or **Off** and maneuver through some meter programming.

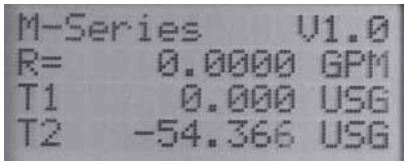
What to Program
There are a variety of screens available. Go to 'Addendum C' for flow chart reference. That section describes how to determine and record what parameters need to be programmed.

PROGRAMMING REQUIRED PARAMETERS
All meters have required parameters that must be programmed. They include a **Password**, the **Main Screen** for **Uni-or Bi-Directional Flow**, **Empty Pipe**, **Pulse Output** and **Analog Output,** among others.

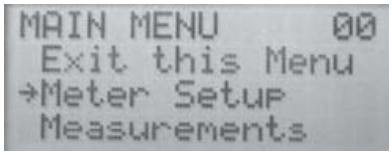
This section presents keystroke details describing how to program required parameters.

Input a Password

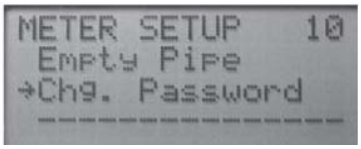
1. With Main Screen up, press **E,** to open MAIN MENU 00.



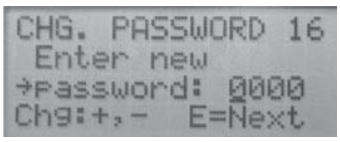
2. With MAIN MENU 00 up, press **+** once to move cursor to Meter Setup. Press **E**.



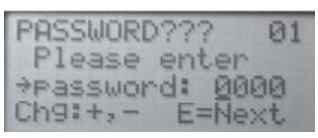
3. On METER SETUP 10 screen, press **+** six times or once to go to Chg. Password.



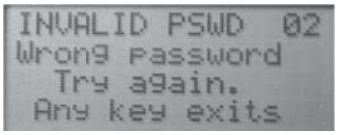
4. At CHG. PASSWORD 16 screen, input a password number.



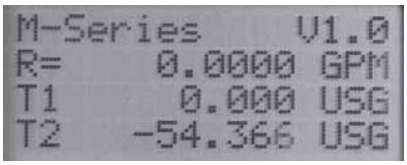
5. Or this screen comes up. Input the correct password.



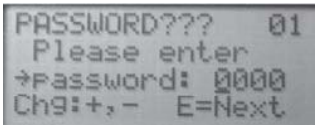
6. If the wrong number is input, INVALID PSWD comes up. Press **+**, **-**or **E** once.



7. Main Screen appears. Press **E** again.

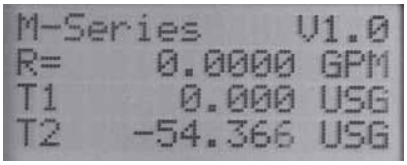


8. PASSWORD??? 01 screen reactivates. Input the 7. From TotalizerUnit 22 press **+** or **-**to select a totalizer correct password. unit. Press **E**.

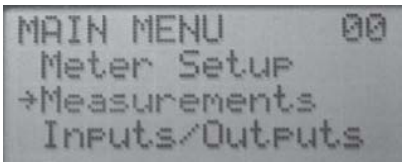


Set Flow Units

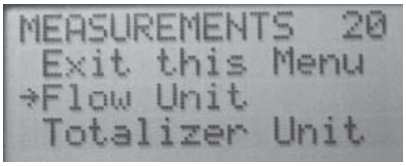
1. With Main Screen up, press **E**.



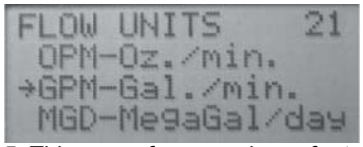
2. With MAIN MENU 00 active, press **+** twice (Measurements) and then **E**.



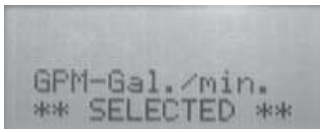
3. On the MEASUREMENTS 20 screen press **+** once to place cursor at Flow Unit. Press **E**.



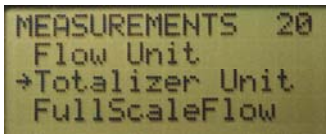
4. From FLOW UNITS 21 press **+** or **-**to select a flow unit.
Press **E**.



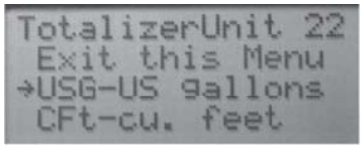
5. This **type** of screen shows for two seconds.



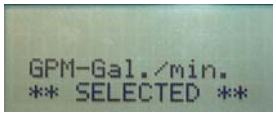
6. The screen returns to MEASUREMENTS 20. With the cursor at Exit this Menu, press **+** twice to move the cursor to Totalizer Unit.
Press **E**.



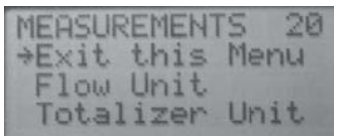
7. From TotalizerUnit 22 press **+** or **–** to select a totalizer unit.
Press **E**.



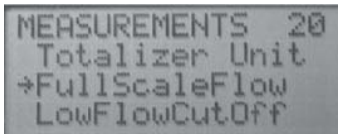
8. This type of screen shows for two seconds.



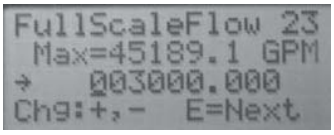
8. Screen goes back to MEASUREMENTS 20.



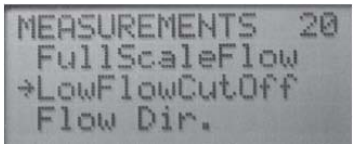
Set Full Scale Flow
1. Press **+** three times to move the cursor to FullScaleFlow.
Press **E**.



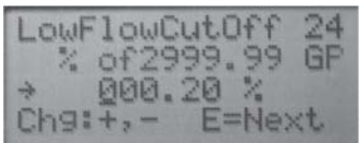
2. At FullScaleFlow 23 input the proper flow. Select **E** to move cursor as described earlier.



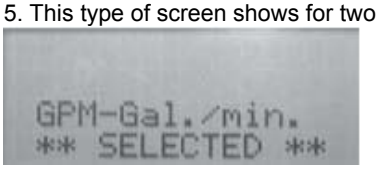
3. Screen returns to MEASUREMENTS 20. Press **+** four times, to place cursor at LowFlowCutOff.
Press **E**.



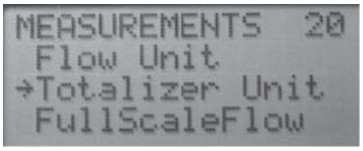
4. At LowFlowCutOff 24 screen input a percentage at the arrow.
Press **E**.



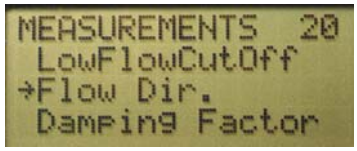
5. This type of screen shows for two seconds.



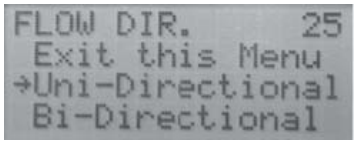
6. The screen returns to MEASUREMENTS 20. With the cursor at Exit this Menu, press **+** twice to move cursor to Totalizer Unit.
Press E.



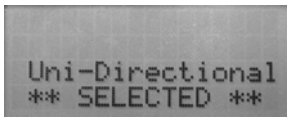
Set Flow Direction
1. At MEASUREMENTS 20 press **+** five times to set the arrow Flow Dir.
Press **E**.



2. At FLOW DIR 25 press **+** or - to select Uni-Directional or Bi-Directional.



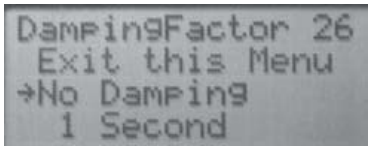
3. This type of screen shows for 2 seconds.



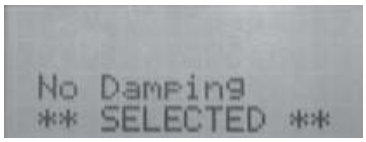
Set Damping Factor

1. At MEASUREMENTS 20 press **+** six times to move the arrow to Damping Factor.
Press **E**.

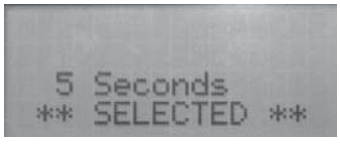
2. At DampingFactor 26 press Exit this Menu, No Damping or press a Time Frame.



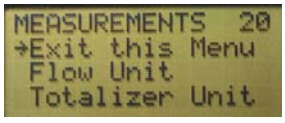
3. If No Damping is selected, this **type** of screen shows for 2 seconds.



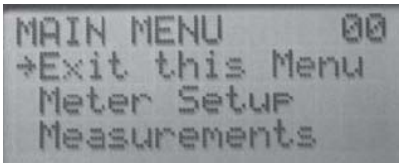
4. And this **type** of screen shows for 2 seconds when Damping Factor time is selected.



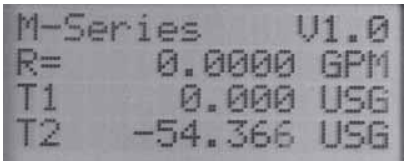
5. MEASUREMENT 20 screen returns with the arrow pointing at Exit this Menu.



6. Press **E** once to place cursor at Main Menu 00.

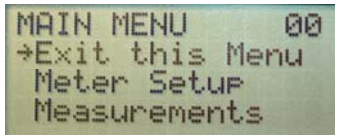


7. Press **E** once to move cursor back to the Main Screen.

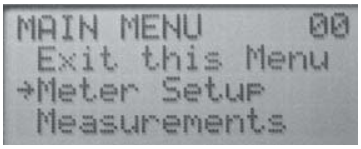


Empty Pipe Calibration

1. Press **E** once to move cursor to Main Menu.

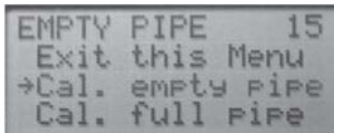


2. In the MAIN MENU 00, press **+** once to move the cursor to Meter Setup.
Next, press **E**.

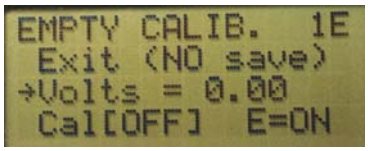


3. In METER SETUP 10, press **+** five times to display Empty Pipe.
Next, press **E**.

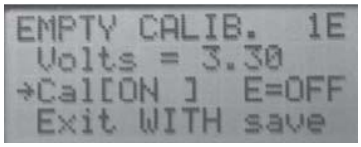
4. In EMPTY PIPE 15, press **+** once to place cursor at Cal. empty pipe.
Next, press **E**.



5. In EMPTY CALIB. 1E, press **+** once to place cursor at Volts = 0.000. Change the number as described earlier.
Press **E** to move cursor to Cal[OFF] E=ON.



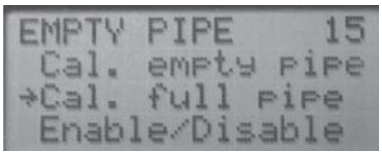
6. At Cal[OFF] E=ON, press or select E once to change OFF to ON.
NOTE: Make sure the Flow Detector Pipe is Empty.



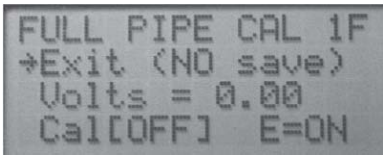
NOTE: With the pipe empty the usage reading should be between 3.00 and 3.30 Volts.

7. Press **+** once to move cursor to Exit WITH save. Press **E** once to save the setting and return to EMPTY PIPE 15.

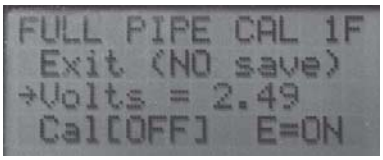
8. In EMPTY PIPE 15, press **+** twice to place cursor at Cal. full pipe.
Then, press **E**.



9. In FULL PIPE CAL 1F, press **+** once to move cursor to Volts = 0.00. Change the number as described earlier.
Press **E** to move the cursor to Cal[OFF] E=ON.

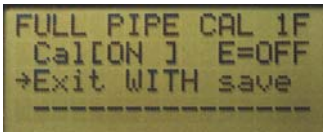


10.At Cal[OFF] E=ON, press or select **E** once to change to OFF to ON.
(**NOTE:** Make sure the Flow Detector pipe is full of fluid.)

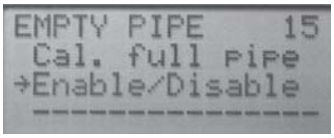


NOTE: The full pipe voltage reading should be below 3.00 Volts.

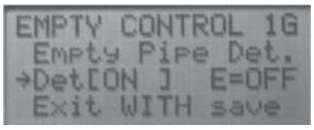
11.Press **+** once to move cursor to Exit WITH save. Press **E** once to save the setting and return to EMPTY PIPE 15.



12. In EMPTY PIPE 15, press **+** three times to place cursor at Enable/Disable.
Next, press **E**.



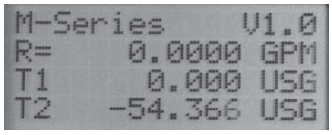
13.In EMPTY CONTROL 1G, press **+** twice to move cursor to Det[OFF] E=ON.
Press **E** once to switch OFF to ON.



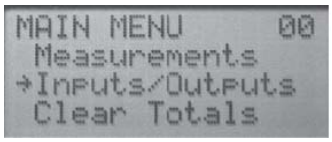
14. Press **+** once to move cursor to Exit WITH save.
Press **E** once to save the setting and return to EMPTY PIPE 15.

Pulse Output

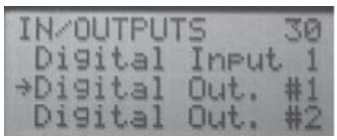
1. Press **E** once to move cursor to Main Menu.



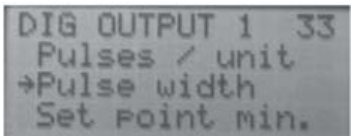
2. In the MAIN MENU 00, press **+** three times to move the crusor to Inputs/Outputs.
Next, press **E**.



3. At IN/OUTPUTS 30 press **+** three times to place the cursor at Digital Out. #1.
Press **E**.

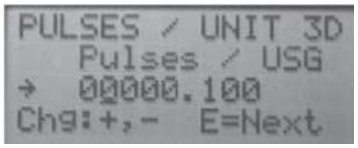


4. In DIG OUTPUT 1 33, press **+** once to move the cursor to Pulses / unit.
Press **E**.

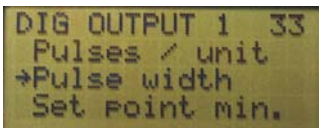


You only need to do this if the function of output one (1) is to be Fwd Pulse or AMR (50ms pulse). Reference Addendum C, Digital Output #1.

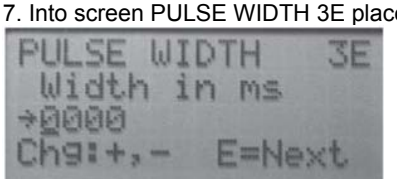
5. In PULSES/UNIT 3D input a proper number as described earlier.
Press **E**.



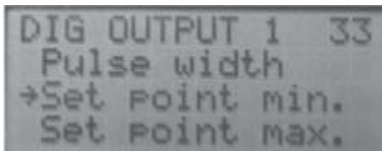
6. The screen returns to DIG OUTPUT 1 33.
Press or activate **+** twice, then press **E**.



7. Into screen PULSE WIDTH 3E place a number. Press **E**.

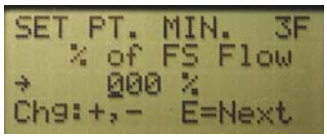


8. The screen returns to DIG OUTPUT 1 33. Press **+** three times, then press **E to see this screen**.

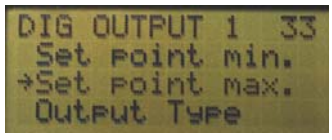


This is only for Flow Set Point. (Reference Addendum C, Digital Output #1.)

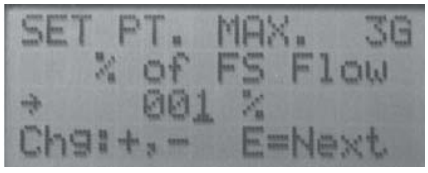
9. Into screen SET PT. MIN 3F place a number as described earlier.
Press **E**.



10. The Screen returns to DIG OUTPUT 1 33.
Press **+** four times, then press **E**.



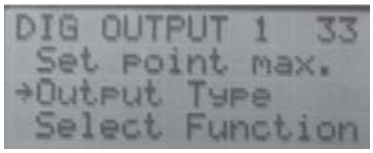
11. In SET PT. MAX 3G input a number as described earlier.



This is only for Flow Set Point. (Reference Addendum C, Digital Output #1.)

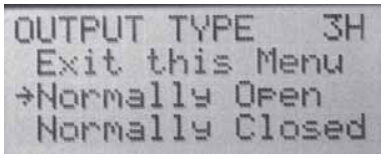
12. Press or activate the letter **E** to return to screen DIG OUTPUT 1 33.

13. n DIG OUTPUT 1 33 press **+** five times, to Output Type.



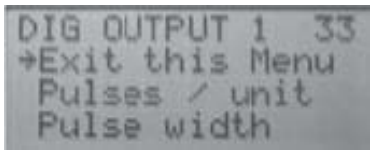
14. In OUTPUT TYPE 3H press Normally Open or Normally Closed.

- Select N.O. or N.C. for any output. (Reference Addendum C, Digital Out. #1.)



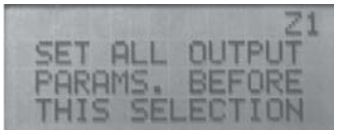
- Normally Opened or Closed **Selected** shows for two (2) seconds.

- The screen goes back to DIG OUTPUT 1 33.

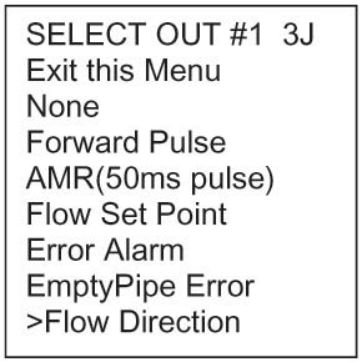


15. Pres **+** six times, or **-**once to Select Function.

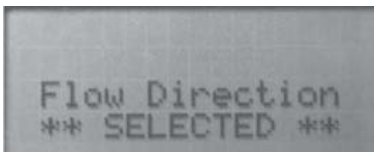
16. When Select Function is selected, screen Z1 appears for two (2) seconds.



17. It then switches to SELECT OUT #1 3J. Make a selection.
Press **E**.



18. This **type** of screen shows for two (2) seconds and then returns to DIG OUTPUT 1 33.



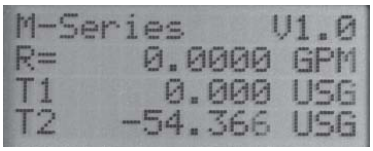
Whichever selection is made from screen SELECT OUT #1 3J, the next screen always shows ** SELECTED**.

The screen then returns to DIG OUTPUT 1 33 where you will have to:
1. Select Functions screen
2. Screen Z1 appears
3. Select another screen.
Do this until all required selections are programmed.

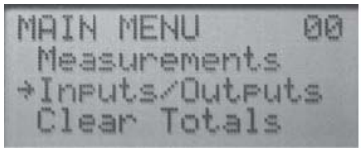
There are four Digital Outputs in this program. Perform the same for all of them, if applicable.

Analog Output

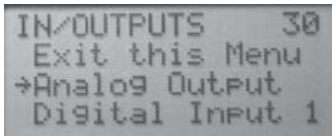
1. Press **E** once to move cursor to Main Menu.



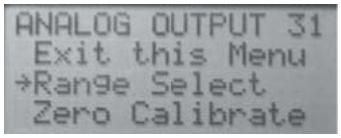
2. In the MAIN MENU 00, press **+** three times to move the cursor to Inputs/Outputs.
Next, press **E**.



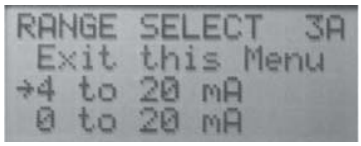
3. At IN/OUTPUTS 30 press **+** once to place the cursor at Analog Output.
Press **E**.



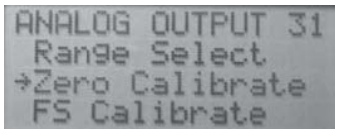
4. In ANALOG OUTPUT 31 press **+** once to move the cursor to Range Select.
Press **E**.



5. In RANGE SELECT 3A select a range with the **+** button and then press **E**.

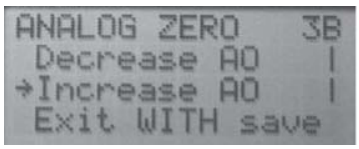


6. The screen returns to ANALOG OUTPUT 31. Press **+** twice to move the cursor to Zero Calibrate and then press **E**.

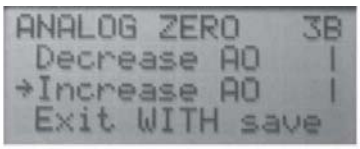


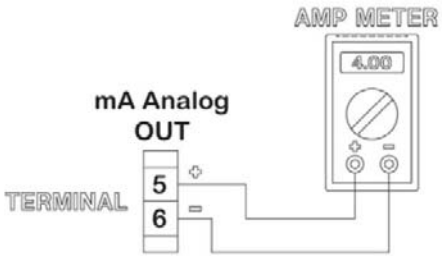
Connect amp meter to mA analog output pins 5 and 6.

7. In ANALOG ZERO 3B make a selection of Decrease or Increase based on what the amp meter is reading.



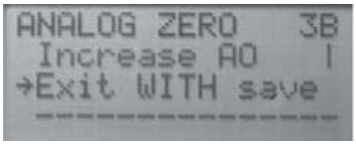
8. Press the **E** button until the amp meter reads the desired No Flow set point. (The line to the left of the selection rotates as the **E** button is pressed, to show that there is activity.)





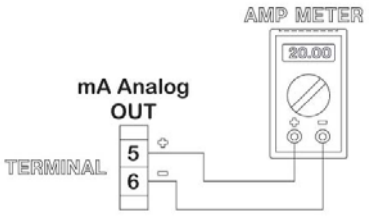
9. Press **+** to set the cursor at Exit With save.

10. Press **E** to Save.



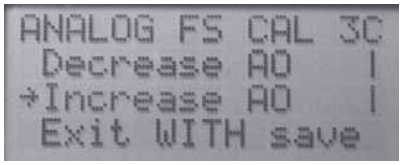
11. After pressing **E**, the menu goes back to ANALOG OUTPUT 31. Press **+** three times to place arrow at FS Calibrate.
Press **E** once.

12. Screen ANALOG FS CAL 3C comes up. Press **+** to set the arrow across from Decrease AO or Increase AO. Press **E** button until amp meter reads the desired Full Scale set-point.

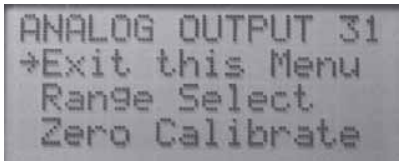


13. Press **+** to set screen at Exit WITH save.

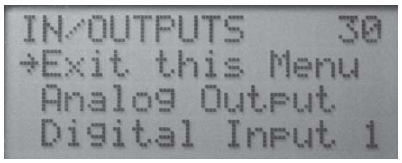
14. Press **E** to Save.



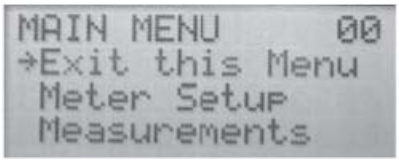
15. ANALOG OUTPUT 31 returns with the arrow pointing at Exit this Menu.
Press **E**.



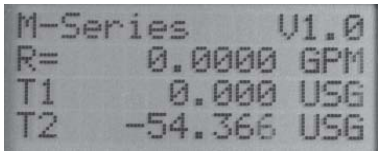
16. IN/OUTPUTS 30 returns with the arrow pointing at Exit this Menu.
Press **E**.



17. MAIN MENU 00 returns with the arrow pointing at Exit this Menu.
Press **E**.

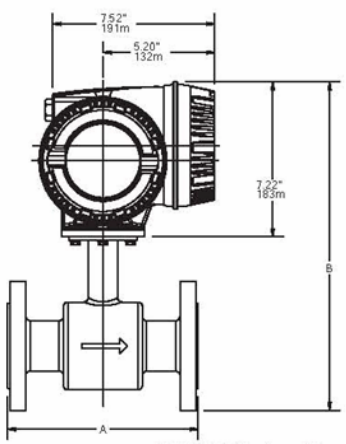


18. The screen returns to the Main Screen.

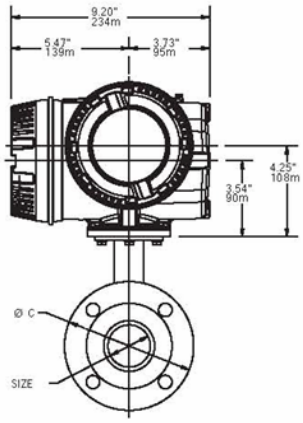


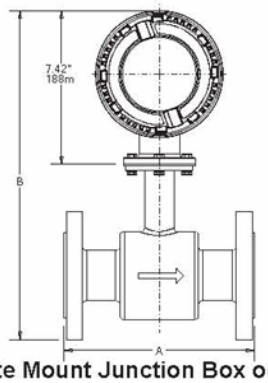
The above sections guided you through various screens and programming. These are just a few of the screen and screen settings.

If you need help programming, call +49 7025 92080, to discuss screens and screen settings with a Technical Support Specialist.



M3000 Meter Mount Amplifier on Detector





M3000 Remote Mount Junction Box on Detector

Size		A		B		C		D		Est.Weight with Amplifier		Flow Range GPM		Flow Range LPM	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	Lbs	Kg	Min	Max	Min	Max
¼	6	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.02	5	0.063	20
5/16	8	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.03	9	0.114	34
3/8	10	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.05	14	0.177	53
½	15	6.7	170	13.4	342	3.5	89	13.9	351	17	7.7	0.11	33	0.416	125
¾	20	6.7	170	13.6	347	3.9	99	14	356	17	7.7	0.2	59	0.75	225
1	25	8.9	225	13.8	352	4.3	108	14.2	361	18	8.8	0.3	93	1.20	350
1 ¼	32	8.9	225	14.6	372	4.6	117	15	381	20.3	9.2	0.5	152	2.00	575
1 ½	40	8.9	225	14.8	376	5.0	127	15.2	386	22	10	0.8	239	3.00	900
2	50	8.9	225	15.3	389	6.0	152	15.7	398	26	11.7	1	373	4.70	1400
2 ½	65	11.0	280	16.5	420	7.0	178	16.9	429	35	15.7	2	631	8	2400
3	80	11.0	280	16.7	426	7.5	191	17.2	435	38	17.1	3	956	12	3600
4	100	11.0	280	17.8	452	9.0	229	18.2	461	49	22.1	5	1493	19	5600
5	125	15.8	400	19	484	10.0	254	19.4	493	60	27.1	8	2334	30	8800
6	150	15.6	400	20	510	11.0	279	20.4	519	71	32.1	11	3361	40	12700
8	200	15.8	400	21.9	558	13.5	343	22.9	583	95	43.1	20	5975	75	22600
10	250	19.7	500	26.2	677	16.0	406	26.6	676	130	59.1	30	9336	120	35300
12	300	19.7	500	28.3	720	19.0	483	28.7	729	219	99.3	45	13444	170	50800
14	350	23.6	590	30.2	768	21.0	533	30.7	779	287	130.2	60	18299	230	69200
16	400	23.6	590	33.1	842	23.5	597	33.5	851	354	160.9	80	23901	300	90400
18	450	23.6	590	34.4	876	25.0	635	34.9	885	409	185.3	100	30250	380	114000
20	500	23.6	590	337.6	955	27.5	699	38	964	502	228.3	125	37346	470	140000
22	550	23.6	590	39	991	29.5	749	39.4	1000	532	241.3	150	45188	570	170000
24	600	23.6	590	41.6	1057	32.0	813	42	1066	561	255.3	180	53778	680	200000

Flow range: 0.1 to 39.4 ft/s (0.03 – 12 m/s)

Flow direction: Uni- or Bi- directional

Sizes : 1/4" to 12" (15 to 600 mm)

Conductivity: min. 5 µS/cm

Accuracy: ±0,25% o.r. for velocites ≥ 1.64 ft/s (0.5 m/s)
±0.004 ft/s o.r. for velocities < 1.64 ft/s (0.5 m/s)

Electrode material: Alloy C, gold/platinum, tantalum, platinum/rhodium

Liner material: PTFE from ½" to 12" (15 to 600 mm)
hard rubber from 1" to 12" (25 to 600 mm)

Fluid temperature
max ambient temp. 122°F (50°C)

remote mounted amplifier
PTFE –4°F to 248°F (-20°C to 105°C)
Hard rubber 32°F to 178°F (0°C to 80°C)

mounted amplifier
PTFE –4°F to 212°F (-20°C to 100°C)
Hard rubber 32°F to 178°F (0°C to 80°C)

Pressure Limits: max. 16 bar

Ambient Temperature : -4°F to 122°F (-20°C to 50°C)

Coil Power: Pulsed DC

Pipe Spool Material: 316 stainless steel

Spool housing Material: Carbon Steel, welded

Junction Enclosure Material Cast aluminium (powder coated paint)

Flanges: Carbon Steel or 316 stainless steel

Grounding Rings: 316 stainless steel or Alloy C

Grounding Electrode: Alloy C, gold/platinum, tantalum or platinum/rhodium

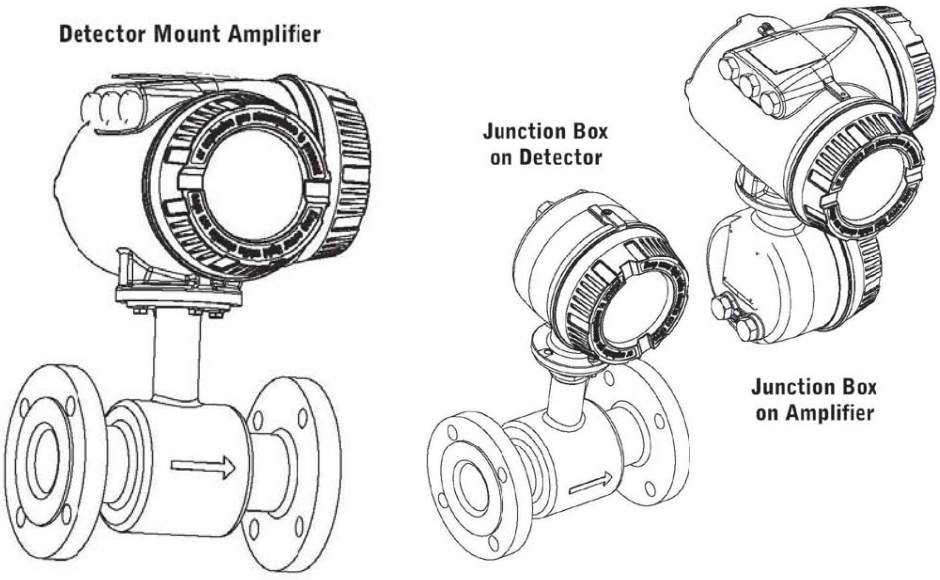
Amplifier Enclosure: AlSi12 acc. ISO3522 (CSN 424330)
IP 67, 3 x M 20, painted

Electrical Classification:

Mounted Version
Ex II 3/1G EEx nA ia IIC T3

Remote Version Amplifier
Ex II 3/1G EEx nA [ia] IIC T3

Remote Version Detector
Ex II 3/1G EEx nA ia IIC T3



SPECIFICATIONS

Power Supply: 85-265VAC, 45-65Hz or 24 VDC
Power Consumption: 20W
Accuracy: ± 0.25% of rate for velocities greater than 1.64 ft/s (0.50 m/s)
± 0.004 ft/s (± 0.001 m/s) for velocities less than 1.64 ft/s (0.50 m/s)
Repeatability: <0.1% of full scale
Flow Range: 0.10 to 39.4 ft/s (0.03 to 12 m/s)
Fluid Conductivity: Min. 5.0 microSiemens/cm
Flow Direction: Unidirectional or bidirectional (programmable)
Totalization: 3 separate displayable totalizers – 10 digits (programmable - forward, reverse and net)
Analog Outputs: 0-10mA, 0-20mA, 4-20mA (programmable and scalable)
Voltage sourced (18VDC) – isolated.
Max. loop resistance = 750 Ω
Frequency Output: Open Collector – Max. full scale flow = 10Khz.
Digital Outputs:
(2) Open Collector, (programmable – scaled pulse, flow alarm, status, or frequency output)
Max. 24VDC, 0.5W
(2) AC solid state relay (programmable – flow alarm or status). Max. 24VDC@0.5A
Pulse Width: Open Collector, 5ms to 1 second (programmable) or automatic 50% duty cycle
Min-Max Flow Alarm: Open collector or solid state relay (programmable – 0 to 100% of flow)
Empty Pipe Detection: Field tunable for optimum performance based on specific application
Excitation Frequency: Programmable - 3.75Hz, 7.5Hz or 15Hz
Auxiliary Input: Max. 24VDC (programmable – positive zero return, external totalizer reset or preset batch start)
Noise Dampening: 1 to 30 seconds (programmable)
Units of Measure: U.S. gallons, Imperial gallons, MGD, cubic feet, cubic meters, liters, oil barrels, pounds, ounces, acre feet
Low Flow Cut-Off: 0 to 100% of full scale (programmable)
Zero-Point Stability: Automatic correction
LC Display: 4 lines X 16 character alphanumeric – back light
Displays: 3 totalizer values, flow rate, alarm status, output status, error / diagnostic messages
Programming: Internal 3 button or external magnetic wand
Galvanic Separation: £ 500 volts
Electrical Classification:
see namplate information page 8
Housing: Amplifier enclosure and remote junction enclosure: cast aluminum (powder coated paint)
Material AlSi12Mn (ISO 3522)
Housing Rating: Amplifier enclosure and remote junction enclosure – IP67
Mounting: Direct detector mount or remote wall mount – bracket included. (for remote mount, max. cable distance = 100 ft (30M)
Field Wiring Entry Ports: (3) M20, internal thread
Ambient Temperature: -40°F to 122°F (-40°C to 50°C)
Communication: RS232C serial, standard ANSI terminal compatible data stream

ADDENDUM B

MAINTENANCE
Mandatory, routine or scheduled maintenance should not be required for the Badger M3000 Mag Meter electronics or flow tube after proper installation.

However, some occurrences may require personnel to perform the following:
- Flow Tube and Electrode Cleaning
- Fuse Replacement
- Amplifier I&C Card Stack Replacement

These maintenance procedures are discussed in this section.

⚠WARNING
Disconnect main power to the unit before attempting any device maintenance or cleaning. Do not clean components inside the amplifier or junction box.

Flow Tube and Electrode Cleaning
At times flow tube, electrodes, amplifier/junction box housings and the amplifier window may need periodic cleaning, depending on process fluid properties, fluid flow rate and surrounding environment.

Clean the flow tube and electrodes by following the material handling and cleaning procedures documented in MSD Sheets for the products(s) that were in contact with the flow tube and electrodes.

Should flow tube and/or electrode cleaning become necessary:

1. Disconnect detector from pipeline.

2. Clean electrodes with isopropyl alcohol or fresh, clean water depending on the chemical compatibility of the measured fluid.

3. Reconnect detector to pipeline

Fuse Replacement

⚠WARNING
Disconnect main power to the unit before attempting any device maintenance.

⚠CAUTION
Risk of electrical shock. Replace fuse ONLY with the same type and rating.

Authorized personnel must perform fuse replacements.

Replace fuses with fuses of the same ampere rating and type. Refer to wiring diagrams when ampere ratings are unknown or questionable.

Detector coil and incoming amplifier power supplies are each protected by a fuse in the amplifier.

Detector coils are protected by a 630mA, 250VAC, slow blow fuse

Incoming amplifier power is protected by a 500mA, 250VAC, slow blow fuse

Fuse ratings are listed on the circuit board, next to the fuse holders. Refer to the M-Series, Model 4000

To access and replace fuses:

1. Remove display chamber cover. Turn the cover counterclockwise to remove it from the amplifier. If necessary, use a strap wrench.

2. Remove the 2 display card screws and washers.

3. Tilt card up/out approximately 45 degrees at the holding clips.

4. Fuses are in the round/black fuse holders. Use a flat screwdriver to turn the holder cap counterclockwise until the lock tab reaches the opening and the holder and fuse disengage.

5. Replace the fuse.

6. Reverse steps 1 to 3 to assemble the unit.

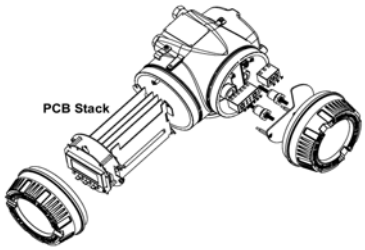
Amplifier Printed Circuit Board (PCB) Stack Replacement

All M3000 mag meters operate through printed circuit boards (PCBs) housed in the amplifier. The PCBs are grouped in a stack located behind the display/control card in the display/programming chamber.

Because PCBs are complex circuits, with all meter functions enabled through multiple links and layers, determining the exact board and circuit that is causing a system problem is difficult and usually requires test equipment.

Should a meter problem occur:
1. Call Badger Meter at +49 7025 92080, and discuss the problem with a Technical Support Specialist.

2. If the problem appears to originate in a PCB, it will be recommended that the entire PCB stack be removed and returned to Badger Meter.



PCB Stack in Amplifier

REMOVE PCB STACK

⚠WARNING

Disconnect main power to the unit before attempting any device maintenance.

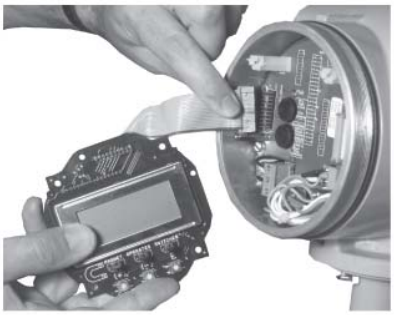
1. Remove display/programming chamber cover. Turn the cover counterclockwise to remove it from the amplifier. If necessary, use a strap wrench.

2. Remove 2 display card screws and washers. Place in storage for reuse.

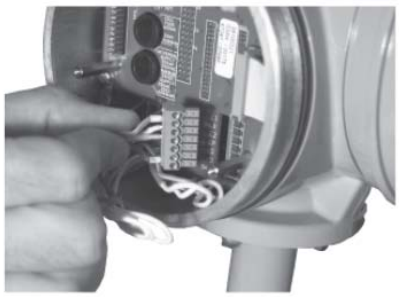
3. Tilt display card up/out approximately 45 degrees at the holding clips.

4. Gently pull card down and out from between holding clips.

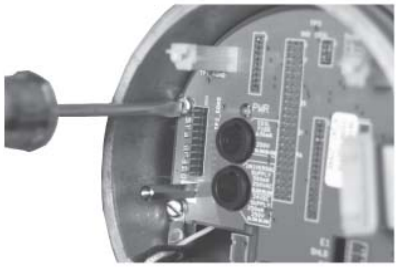
5. Disconnect display card plug from left side of PCB display.



6. Disconnect the Power, Coil, Electrode and I-O plugs and harnesses from the PCB interconnect card.



7. Remove the 4 screws holding the PCB stack in the amplifier housing. Place in storage for reuse.

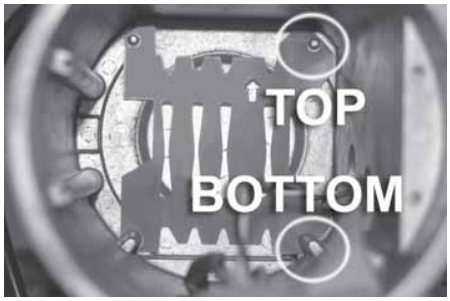


8. Gently remove the card stack from the amplifier housing. Do not tug or pull to remove the stack. Ease it out carefully.

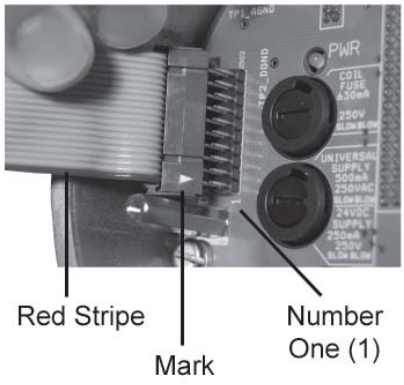
9. Carefully wrap and package the PCB stack and display card. Send back to Badger Meter.

10. Reverse these steps to install a PCB stack.

When replacing the PCB stack, be sure to place the two lower feet of the circuit board support along the edges of the amplifier housing. Gently move the stack back into the housing until the to holes at the top mate with the housing. (The stack is not connected to the circuit board in this picture.)



When placing display card back into PCB Display, verify mark and red stripe are aligned with Number 1.



For safety reason, all replaced parts should be provided by Badger Meter Europe.
Use only Equipment as designed and specified as in the manual.

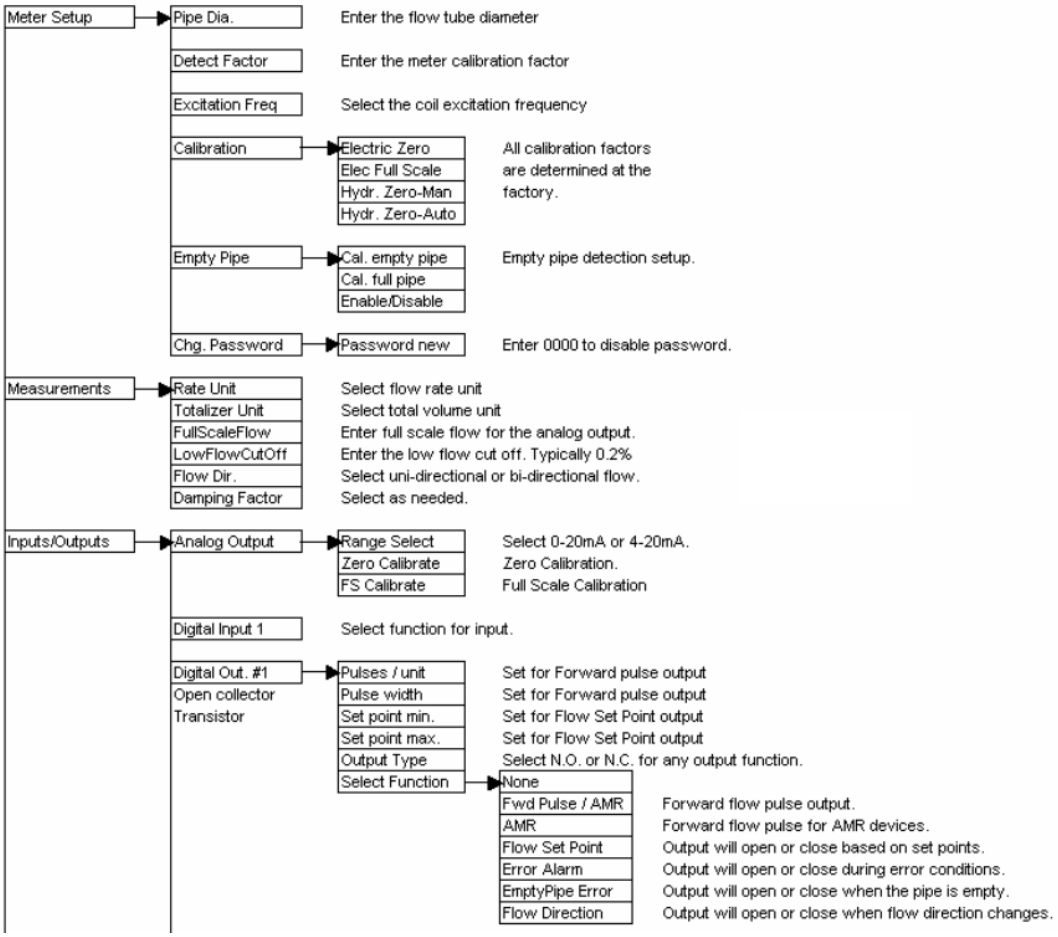
ADDENDUM C

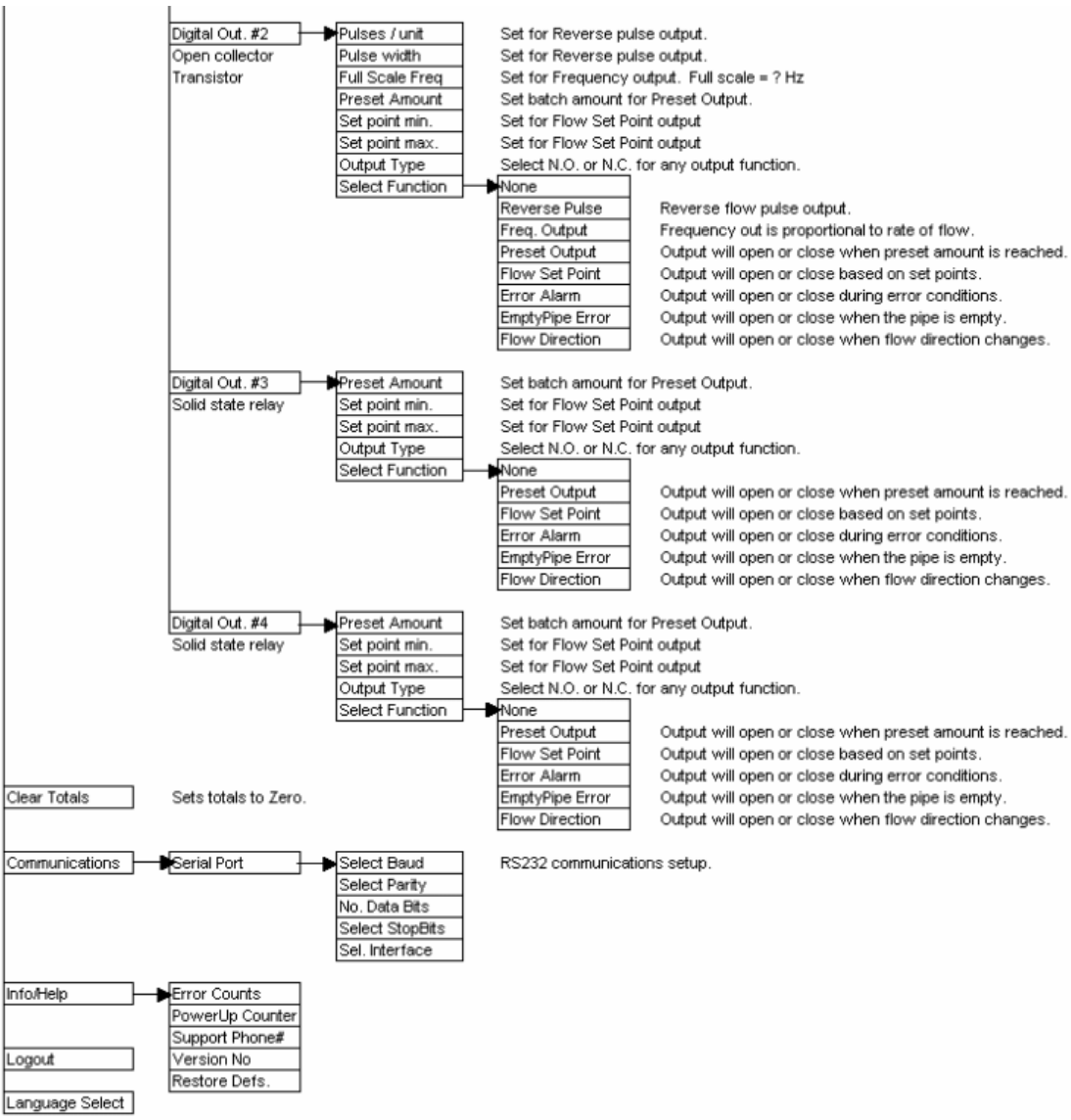
In the Flow Chart:
1. Each separate screen is inside a box.
2. If a screen “branches”, an arrow points right and each screen of the branch is in a box.
3. When there is text, but it’s not in a box, that signifies a parameter setting and a short explanation is given of the parameter.

Mark on the chart what parameters need to be set. Note parameter settings on the chart. Program your amplifier accordingly.

Keep the chart as a reference for other shifts and personnel and to monitor meter performance.

Menu Structure




Digital Out. #2
Open collector
Transistor
Pulses / unit
Pulse width
Full Scale Freq
Preset Amount
Set point min.
Set point max.
Output Type
Select Function
Set for Reverse pulse output.
Set for Reverse pulse output.
Set for Frequency output. Full scale = ? Hz
Set batch amount for Preset Output.
Set for Flow Set Point output
Set for Flow Set Point output
Select N.O. or N.C. for any output function.
None
Reverse Pulse
Freq. Output
Preset Output
Flow Set Point
Error Alarm
EmptyPipe Error
Flow Direction
Reverse flow pulse output.
Frequency out is proportional to rate of flow.
Output will open or close when preset amount is reached.
Output will open or close based on set points.
Output will open or close during error conditions.
Output will open or close when the pipe is empty.
Output will open or close when flow direction changes.
Digital Out. #3
Solid state relay
Preset Amount
Set point min.
Set point max.
Output Type
Select Function
Set batch amount for Preset Output.
Set for Flow Set Point output
Set for Flow Set Point output
Select N.O. or N.C. for any output function.
None
Preset Output
Flow Set Point
Error Alarm
EmptyPipe Error
Flow Direction
Output will open or close when preset amount is reached.
Output will open or close based on set points.
Output will open or close during error conditions.
Output will open or close when the pipe is empty.
Output will open or close when flow direction changes.
Digital Out. #4
Solid state relay
Preset Amount
Set point min.
Set point max.
Output Type
Select Function
Set batch amount for Preset Output.
Set for Flow Set Point output
Set for Flow Set Point output
Select N.O. or N.C. for any output function.
None
Preset Output
Flow Set Point
Error Alarm
EmptyPipe Error
Flow Direction
Output will open or close when preset amount is reached.
Output will open or close based on set points.
Output will open or close during error conditions.
Output will open or close when the pipe is empty.
Output will open or close when flow direction changes.
Clear Totals
Sets totals to Zero.
Communications
Serial Port
Select Baud
Select Parity
No. Data Bits
Select StopBits
Sel. Interface
RS232 communications setup.
Info/Help
Logout
Language Select
Error Counts
PowerUp Counter
Support Phone#
Version No
Restore Defs.

ADDENDUM D

Atex Certificate

Please see our website at

www.badgermeter.de
for specific contacts.

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent

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