User Guide OI/FET2XX–EN Rev. B

AquaMaster 3
Electromagnetic flowmeter

The smart solution for remote applications

Introduction

AquaMaster 3™ is a range of high performance electromagnetic flowmeters for the measurement of electrically-conductive fluids and is normally supplied as factory-configured, calibrated systems.

This User Guide provides end-user details for AquaMaster 3 close-coupled and remote transmitters.

When the meter is taken out of storage and installed for first use, remove the protective label (if fitted) from the front to enable light to activate the unit.

If the meter is not powered, connect any batteries or external supply as detailed in this manual.

This User Guide should be used in conjunction with the following publications:

- Programming Guide (COI/FET2XX–EN)
- MODBUS Tables Supplement (COI/FET2XX/MOD/TBL–EN)

elster

1 Safety

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

1.1 Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2010 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500 and Occupational Safety & Health Administration.

If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.2 Symbols

One or more of the following symbols may appear on the equipment labelling:

	**Warning** – Refer to the manual for instructions
	**Caution** – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

1.3 Health & Safety

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company contact details on the back cover, together with servicing and spares information.

Warning.

- Installation and maintenance must be carried out only by suitably trained personnel.
- Read all relevant sections of this manual before selecting a location.
- The safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration during installation.
- Install and use this equipment in accordance with relevant national and local standards.
- Specific safety precautions apply to the use of the GSM engine that forms part of the GSM-equipped version of this product. If the unit purchased has GSM-capability, read Appendix A on page 51 before selecting a location.

2 Mechanical Installation

2.1 Unpacking

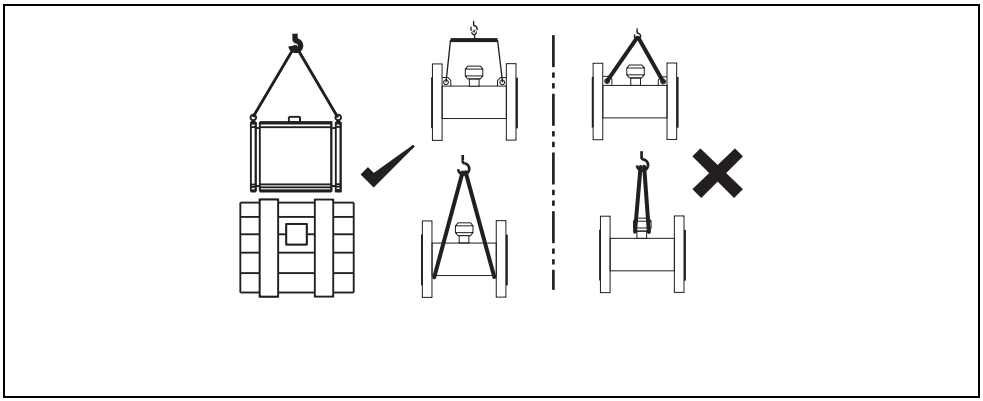


Fig. 2.1 Unpacking

2.2 Installation Conditions

Caution. Do NOT exceed the maximum working pressure marked on the equipment.

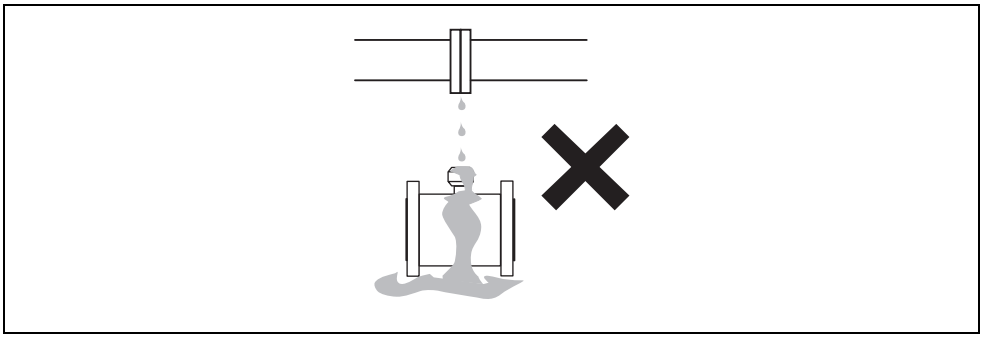


Fig. 2.2 Spillage

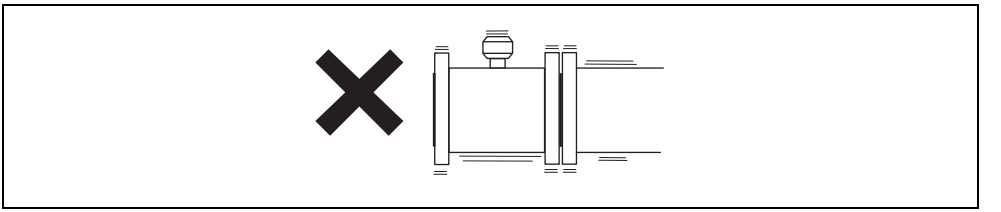


Fig. 2.3 Vibration

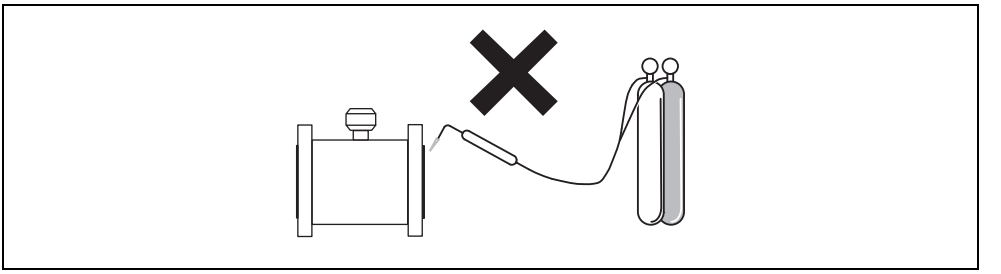


Fig. 2.4 Localized Heat

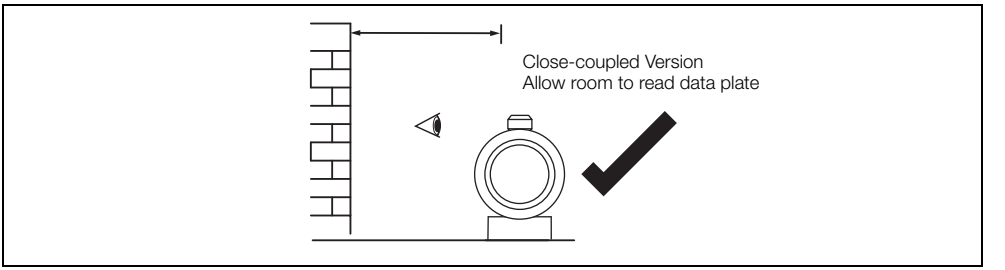


Fig. 2.5 Siting

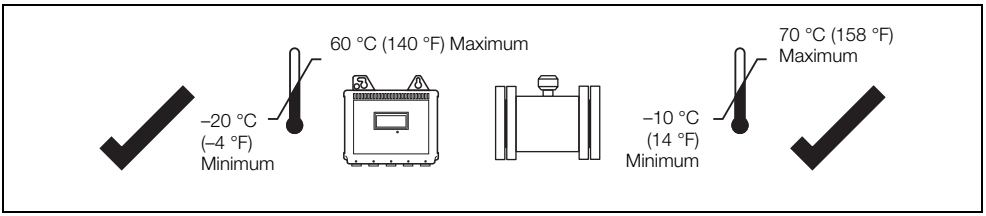


Fig. 2.6 Within Temperature Limits

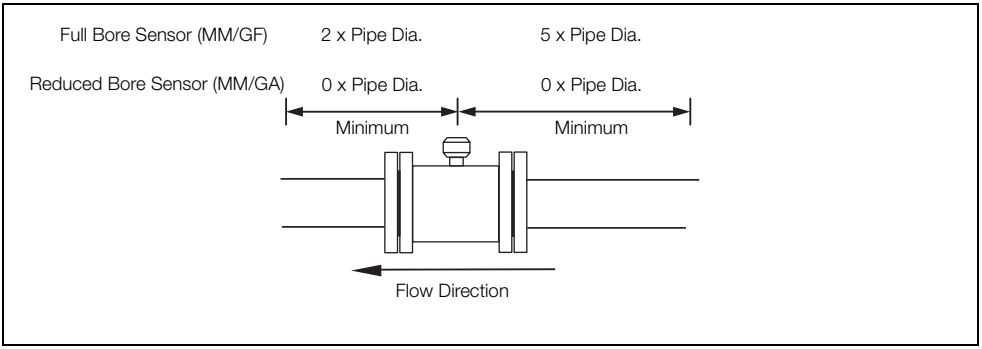


Fig. 2.7 Straight Pipe Requirements

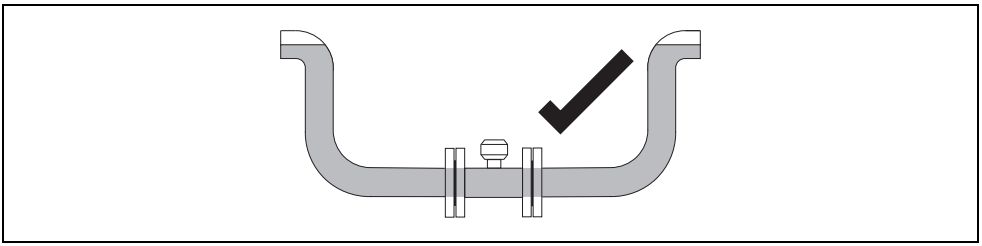


Fig. 2.8 Fluid Level

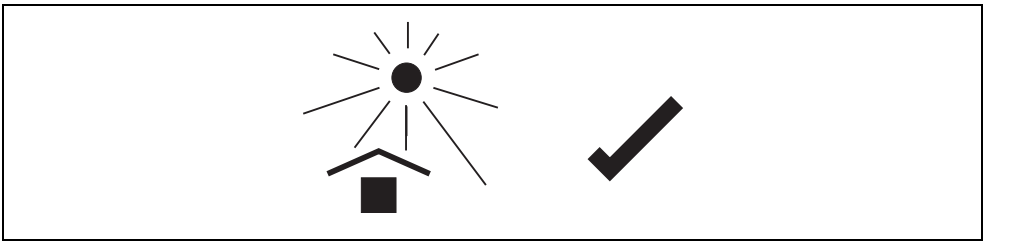


Fig. 2.9 Shade

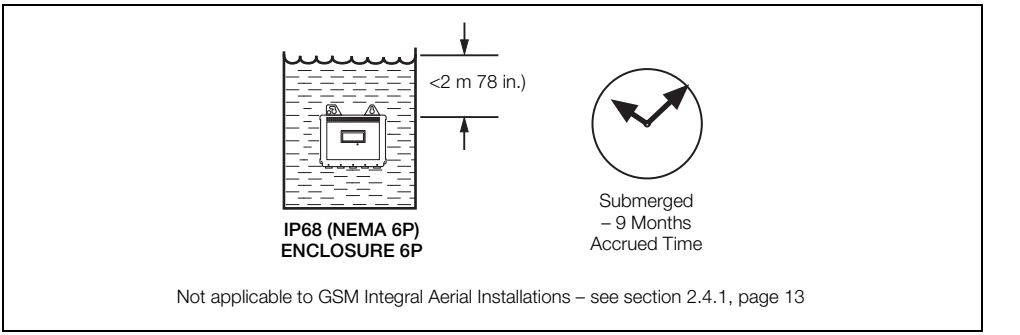


Fig. 2.10 Within Environmental Rating

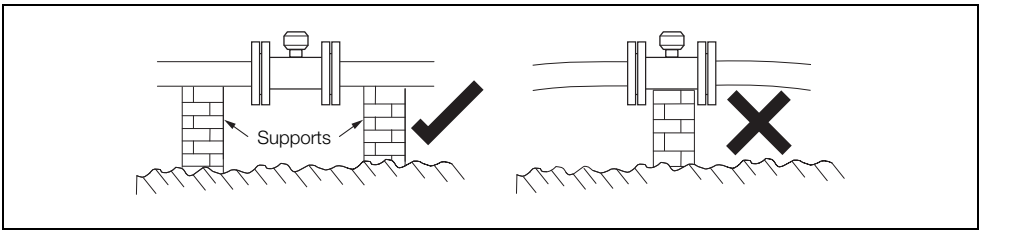


Fig. 2.11 Above Ground

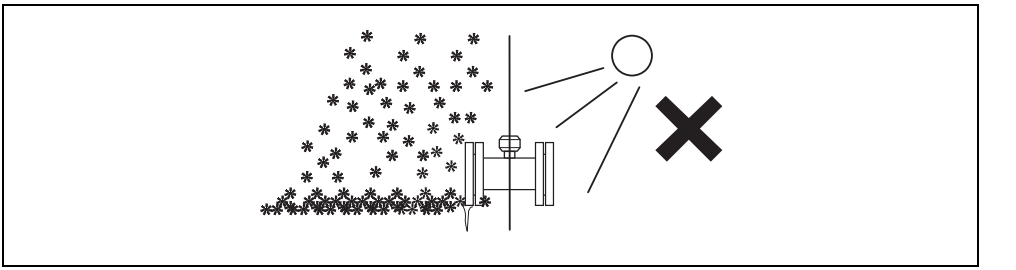


Fig. 2.12 Temperature Difference

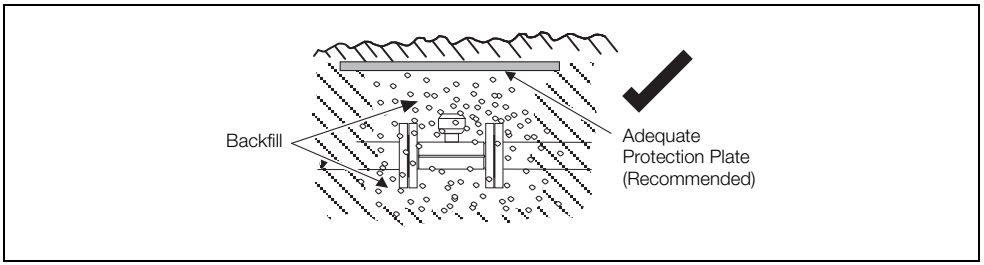


Fig. 2.13 Underground

Note. For further details when burying flow sensors contact the ABB Service Organisation.

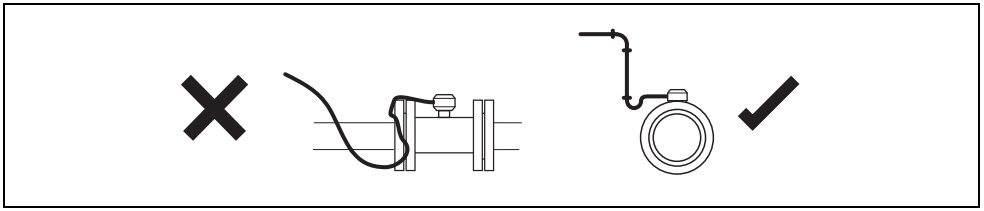


Fig. 2.14 Cable Routing

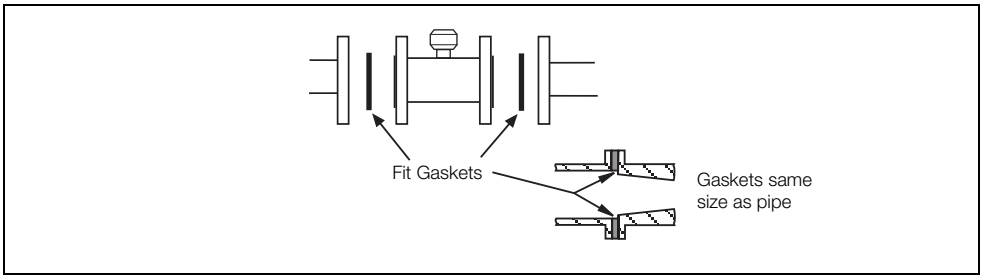


Fig. 2.15 Gasket Fitting

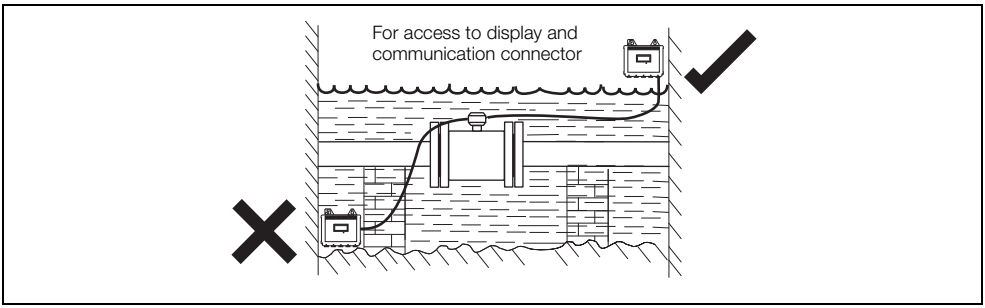


Fig. 2.16 Access to Transmitter

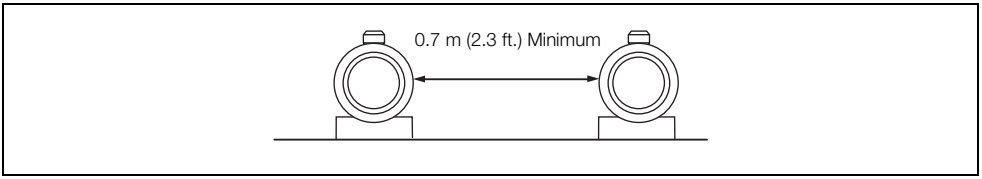


Fig. 2.17 Separation of Sensors

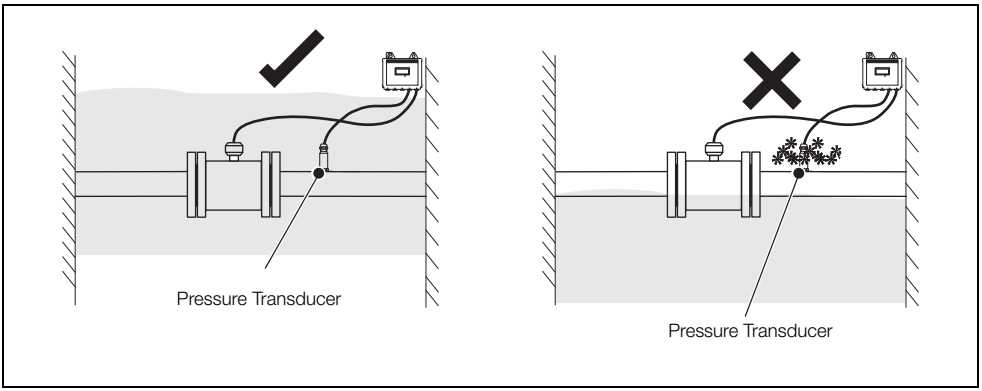


Fig. 2.18 Pressure Transducer – Protect from Frost

2.3 Dimensions

2.3.1 AquaMaster 3

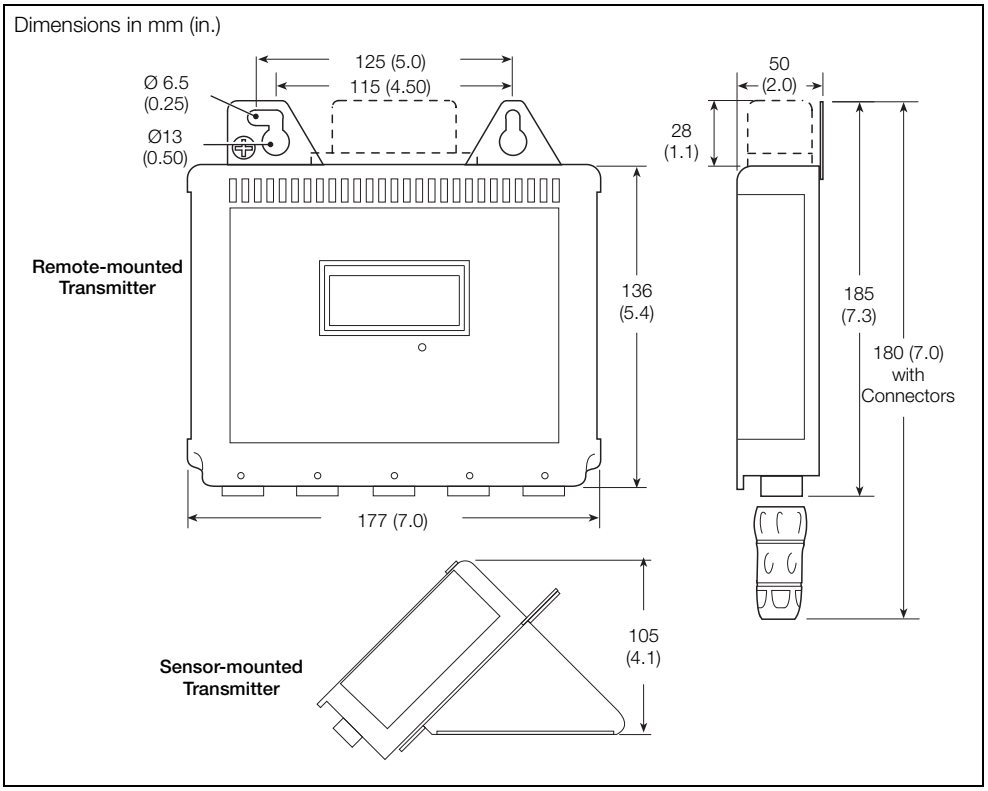


Fig. 2.19 AquaMaster 3 Dimensions

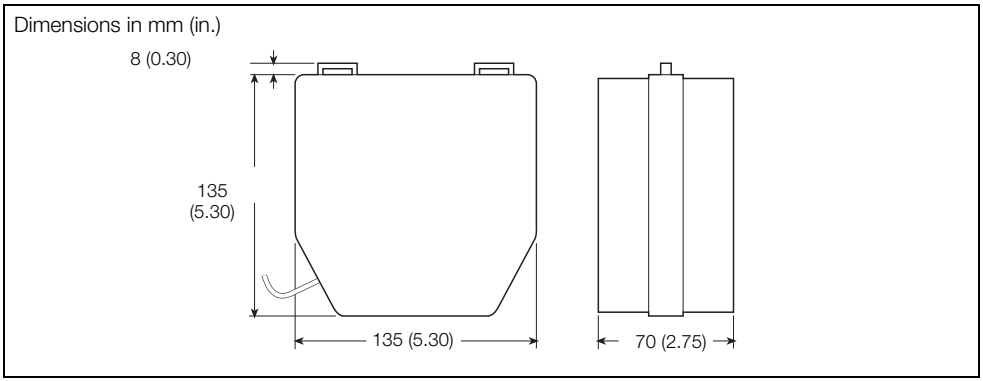


Fig. 2.20 AquaMaster 3 Battery Pack Dimensions

2.3.2 Terminal Box – Sensor-mounted

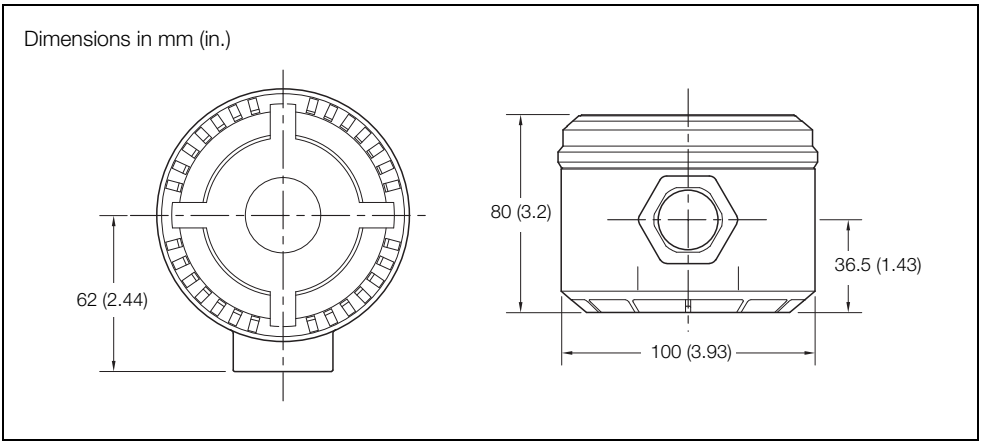


Fig. 2.21 Round Terminal Box Dimensions

2.4 GSM-equipped Transmitters

2.4.1 GSM Antenna Installation

Before deciding on an antenna mounting location, check that the local signal strength for the chosen mobile phone network is satisfactory. Use the GSM-equipped transmitter's integral signal strength test facility to establish signal strength. Refer to Programming Guide (COI/FET2XX–EN), Section 5.

If a GSM-equipped transmitter is not available, a standard mobile phone on the same network, positioned as close as possible to the intended location, gives a good indication of local signal strength. For GSM and logger download services, a minimum of 2 visible signal strength indicator 'bars' are recommended. For SMS text, a minimum of 1 visible signal strength indicator 'bar' is recommended.

The following must also be observed when deciding on the antenna mounting location:

- For best results, mount the antenna as high above local ground level as possible.
- If the antenna must be mounted below ground, achieve optimum results by ensuring:
  - there is a strong mobile phone network signal at ground level
  - the antenna, mounted 50 mm (2 in.) below the chamber cover, must be plastic – see Fig. 2.22
- Ensure the antenna does not become submerged under water – see Fig. 2.22.
- Metallic enclosures seriously degrade the signal. If an enclosure is used it must be non-metallic.
- Do not mount the antenna closer than 50 mm (2 in.) to any solid wall or surface – see Fig. 2.23.
- Do not mount the antenna beneath a solid surface (for example, metal cover, floor / ceiling).

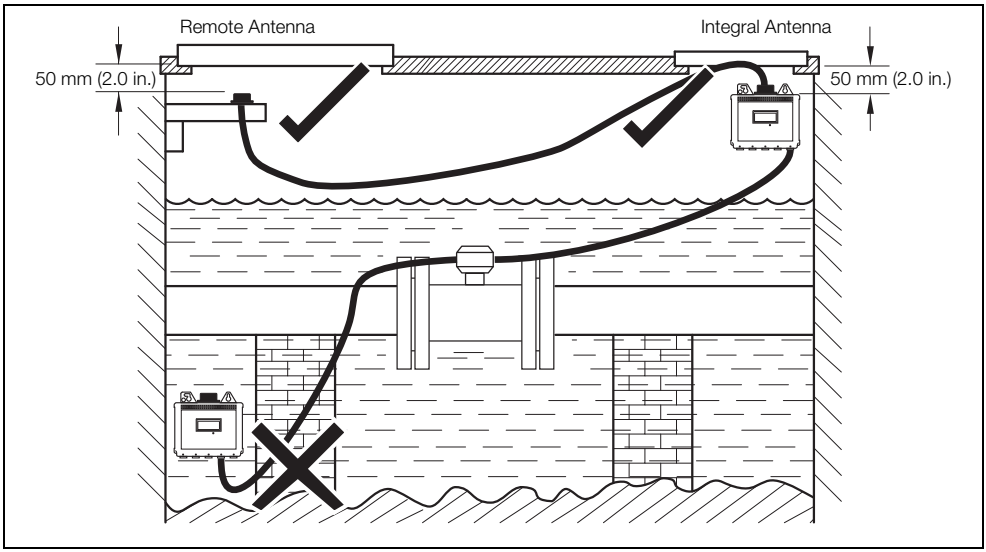


Fig. 2.22 GSM Antenna Installation

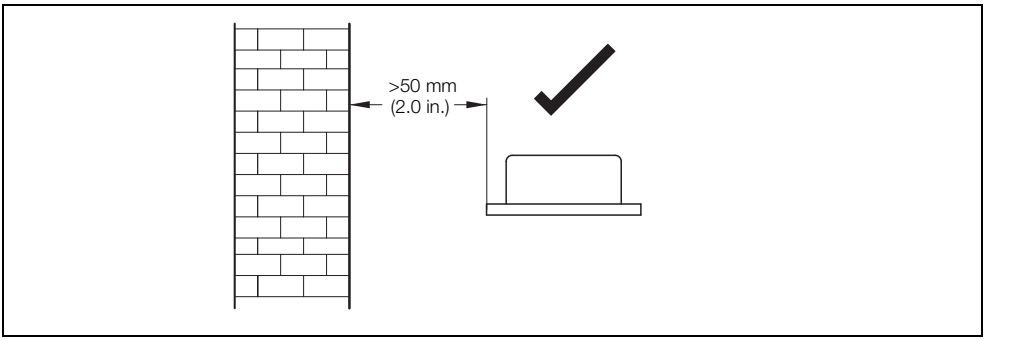


Fig. 2.23 GSM Antenna Installation

2.4.2 Connecting a Remote Antenna

Referring to Fig. 2.24:

1. Remove the cover (A) from the socket on top of the transmitter.
2. Gently push the antenna plug (B) into the socket, then twist the screw ring clockwise until locked.

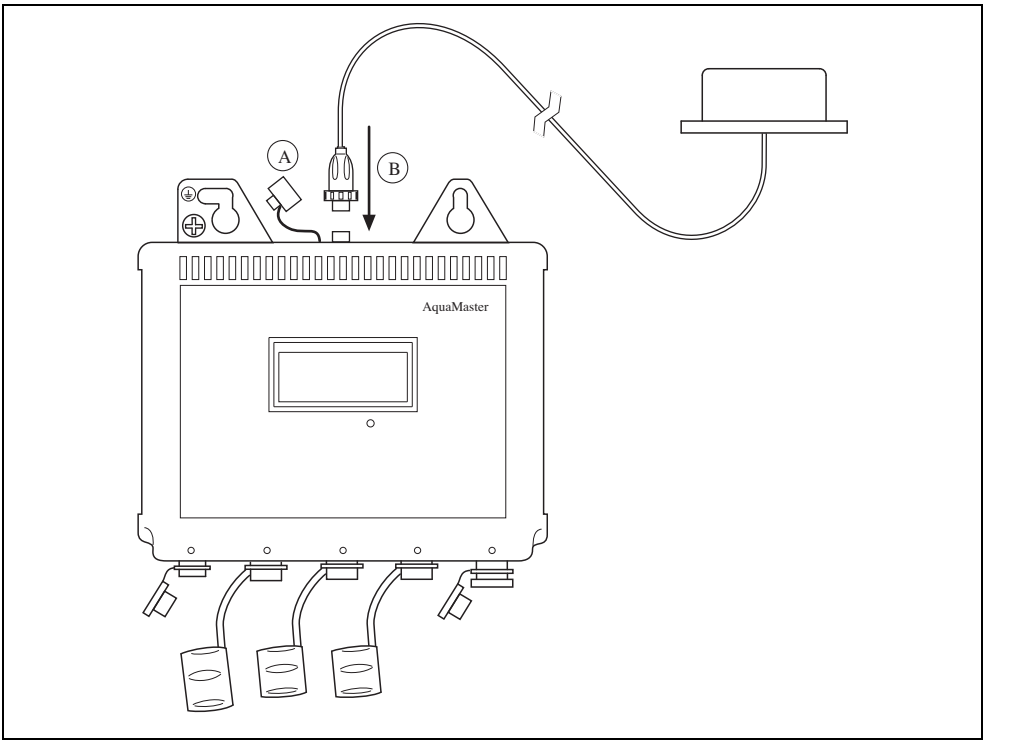


Fig. 2.24 Connecting a Remote Antenna

2.4.3 Installing a SIM Card

Referring to Fig. 2.25:

1. Remove the transmitter from its mounting point.
2. Use water to wash off any loose dirt from the case and dry the area around the SIM cover.
3. On the back of the transmitter, unscrew and remove the cover (A) protecting the SIM card holder (B).
4. If a SIM card is being changed, ensure the GSM Engine is off before removing the card by reading >368 (see COI/FET2XX–EN) and the status reported in *Off*.
5. Carefully lift the right-hand edge of the holder (B) outwards.
6. Slide the SIM card (C) into the carrier, contact side down and bevelled edge to the top-right.
7. Close the holder (B) until it clicks into place and refit the cover (A).
8. SCrew cover (A) firmly in place.

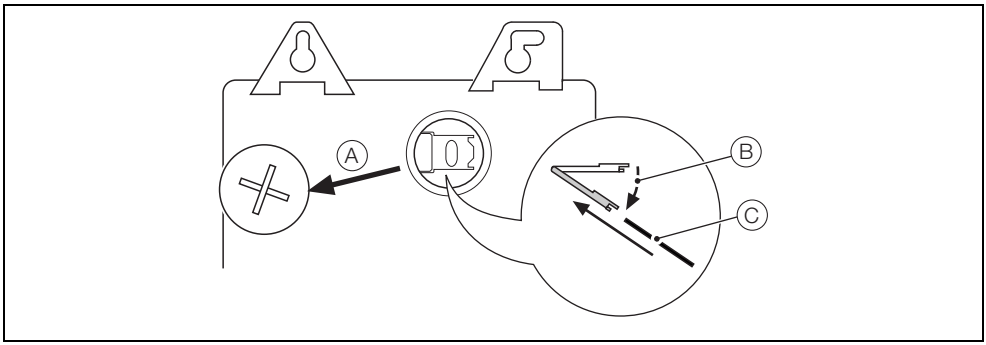


Fig. 2.25 Installing a SIM Card

3 Electrical Installation

3.1 Grounding

Caution. For safety reasons and optimum performance, the flowmeter, pipelines and medium must be bonded and grounded correctly according to regulations.

Note.

- Connect the transmitter ground connection to the flowmeter body ground – see Fig. 3.2 and Fig. 3.3.
- The flow sensor must not be connected to a ground spike.
- For bonding connections use ≥4 mm^2 (<10AWG) cable.
- Older sensors from DN40 to DN80 fitted with bare metal stainless steel flanges do not require fluid contact rings.

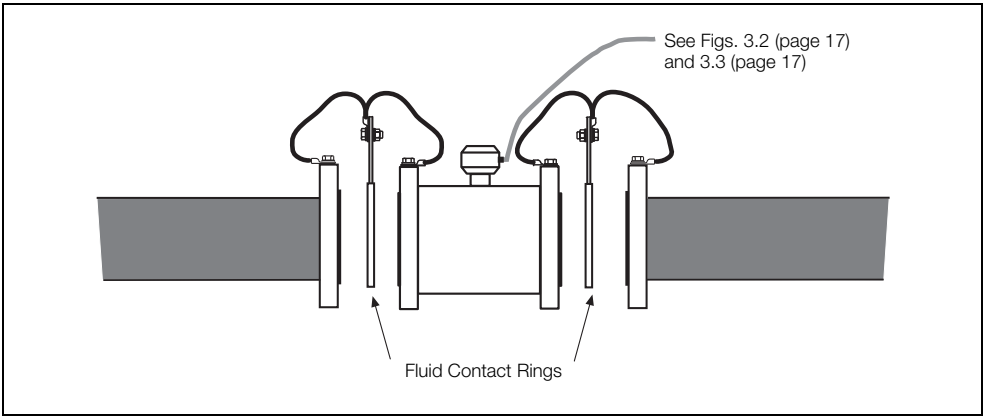


Fig. 3.1 Grounding – All Pipes

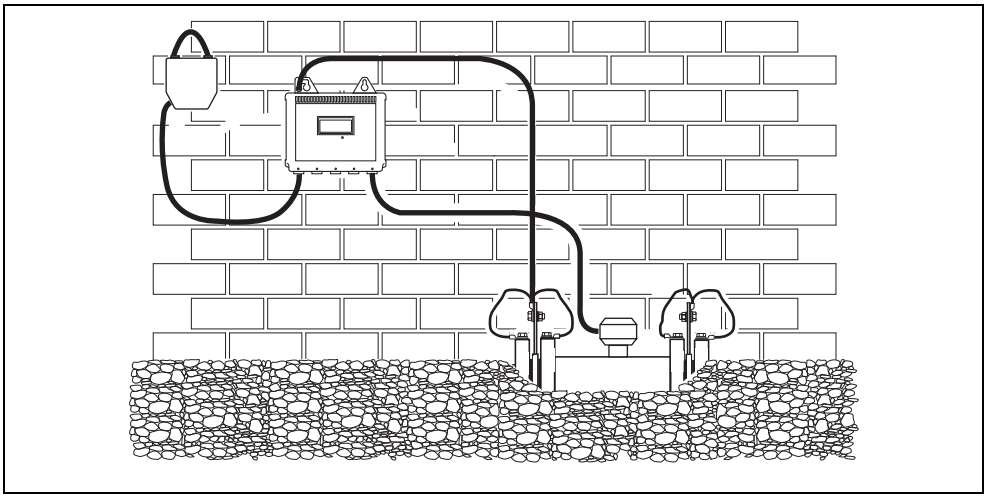


Fig. 3.2 AquaMaster 3 Transmitter Mounted in a Chamber (Battery Version Shown)

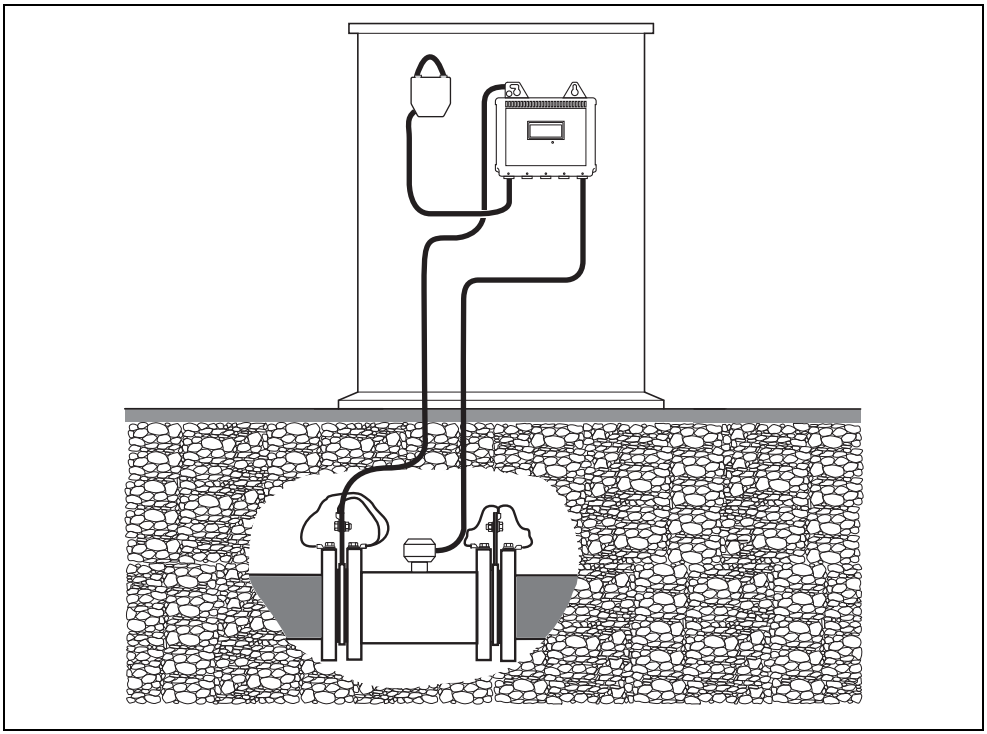


Fig. 3.3 AquaMaster 3 Transmitter Mounted in a Cabinet (Battery Version Shown)

3.2 Connections

Note. Refer to Section Fig. 3.4, page 25 for MODBUS connection.

3.2.1 AquaMaster 3 Connections

Referring to Fig. 3.4:

1. Remove the screwed cap (A) on the sensor connector.
2. Gently push the sensor plug (B) into the socket and rotate it until it engages, then tighten the locking ring.

Note. If the sensor cable is terminated with fly leads, connection is via a sensor cable adapter box (part number WABC2035, available separately).

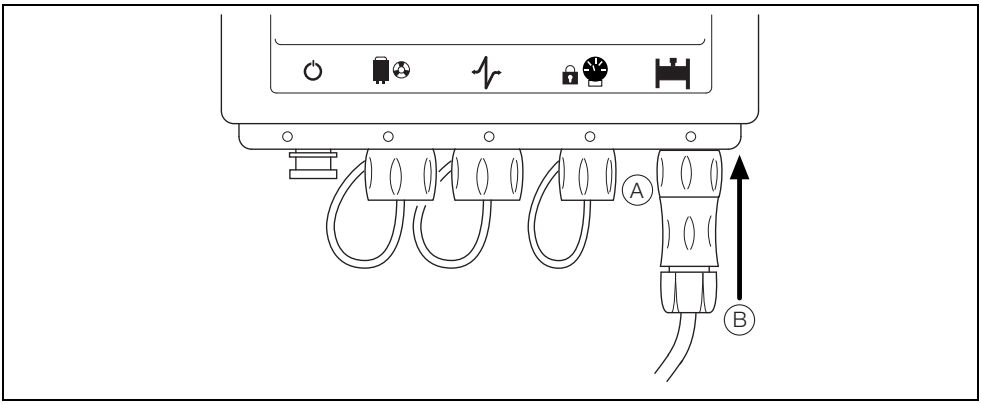


Fig. 3.4 Sensor Connections

3.2.2 Use of Tamper-detection Seals

Referring to Fig. 3.5:

1. Pass the wire of the seal through both the hole in the locking-ring and the matching hole in the front of the transmitter.
2. Close the seal.

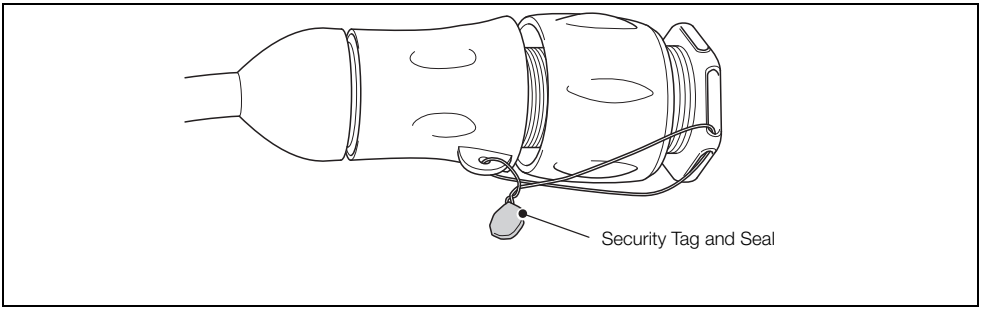


Fig. 3.5 Use of Tamper-Detection Seals

3.3 Input / Output Connections

Caution.

- Refer to the associated Data Sheets for input / output ratings.
- Inductive loads must be suppressed or clamped to limit voltage swings.
- Operation of outputs is programmable – see Programming Guide (COI/FET2XX–EN) for details.
- External isolators are not normally required as the pulse and alarm circuit is electrically-separated from all other AquaMaster 3 connections.
- Capacitive loads must be inrush current limited.
- Fully-floating pulse outputs may be subject to static damage, for example connecting to a floating datalogger, unless 'COM' is operated within its galvanic isolation range (±35 V) from earth.

3.3.1 Frequency Outputs

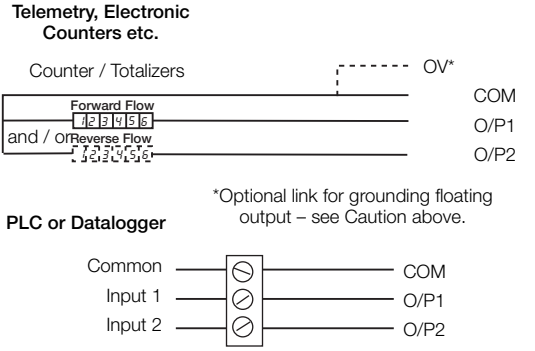


Fig. 3.6 Frequency Output Connections

Note. Outputs 1 & 2 are not polarity-sensitive. The common connection for these outputs is designated 'COM'.

3.3.2 Alarm Interface

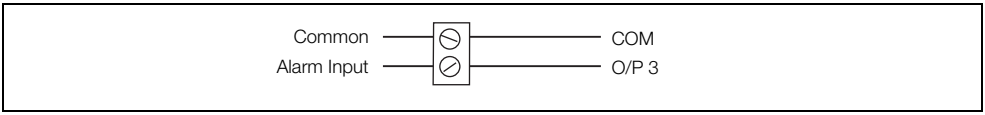


Fig. 3.7 Alarm Output Connections

Note. Output 3 is not polarity sensitive. The common connection for these outputs is designated 'COM'.

3.3.3 Input / Output Connections

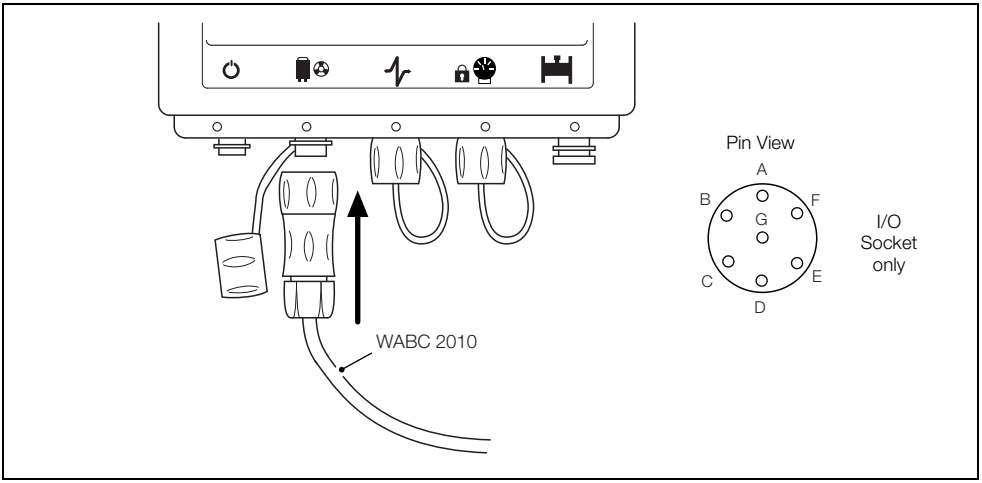


Fig. 3.8 Input / Output Connectons

Pin	Signal	Function	Color (Output Cable)
A	Not used	Not used	Violet
B	DATA	ScanReader Data	Blue
C	O/P COM	Output Common	Yellow
D	O/P2	Reverse Pulses or Direction Indicator	Red
E	O/P3	Alarm Output	Brown
F	O/P1	Forward Pulses or Forward & Reverse Pulses	Orange
G	0V	Scanreader 0V	Screen

Table 3.1 Connector Input / Output Connections

3.3.4 ScanReader Interface (Option)

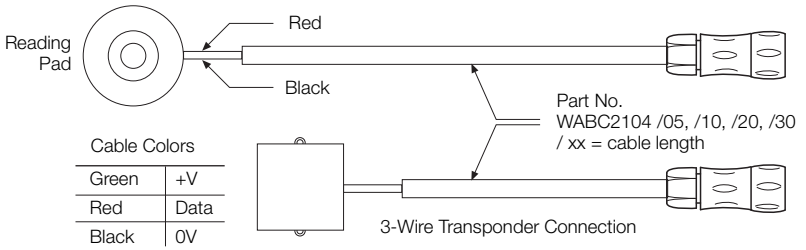
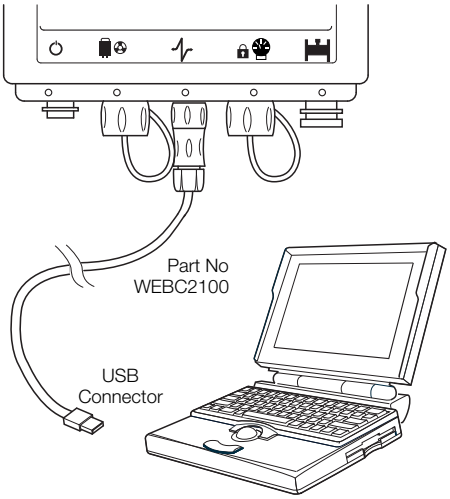
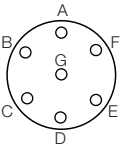


Fig. 3.9 ScanReader Connections

3.3.5 RS232 Local Computer Connection





7 Pin MIL Connector

Pin	Function
A	Not used
B	RI
C	CTS
D	RTS
E	RXS
F	TXS
G	0 V

Notes. A USB Comms lead driver is required when using WEBC2100 – download from www.ftdichip.com/FTDrivers.htm

On battery or renewable energy versions, do not leave an RS232 connection plugged in or wired with voltages applied unnecessarily. Such voltages result in far higher power consumption from the battery or backup source, limiting battery / backup life.

Fig. 3.10 RS232 Local Computer Connections

Note. The serial port connection shares the same physical port as the MODBUS connection so (depending on cable design) it may be necessary to disconnect the MODBUS connection temporarily to enable configuration of AquaMaster 3.

3.3.6 Pressure Transducer (Optional)

Optional pressure transducer cables are available for a range of pressures and cable lengths.

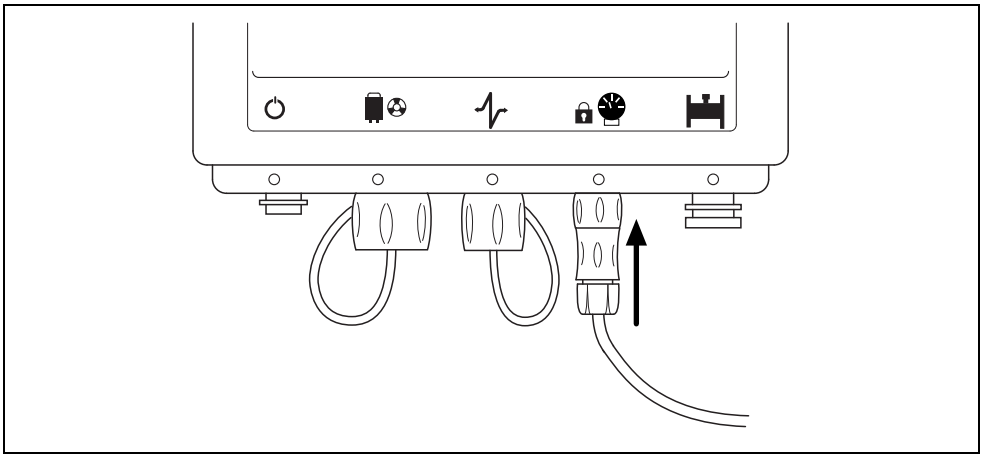
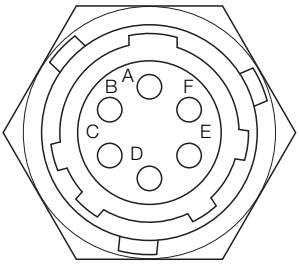


Fig. 3.11 Optional PressureTransducer Connector

Caution. Use only the pressure transducer supplied with the transmitter. Use of other pressure transducers requires alteration of the pressure span and zero factors in the transmitter.

3.3.7 Anti-tamper Protection

In some applications, such as those covered by the Measuring Instruments Directive (MID) 2004/22/EEC or OIML R49 the flowmeter can be sealed to prevent unauthorized changes to the meter settings and configuration. A read-only switch / link is used (as detailed in Fig. 3.12) to prevent login through any communication means and modification of any parameters on the AquaMaster 3.



Pressure socket

A Not used
B Not used
C Not used
D Not used
E Read-only switch link
F Read-only switch link

To force the transmitter into read-only state, link connections E & F* or fit adapters below

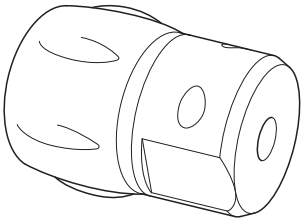
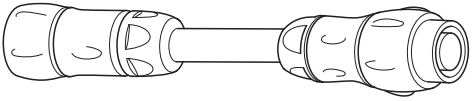


*ABB supply a plug with this link fitted – part number WEBC2054 (Pack of 5)



If a pressure transducer is required, an adapter cable (part number WEBC2025) can be used

Fig. 3.12 Read-only Switch Connections

Note. For MID installations the meter must be ordered with the MID calibration option.

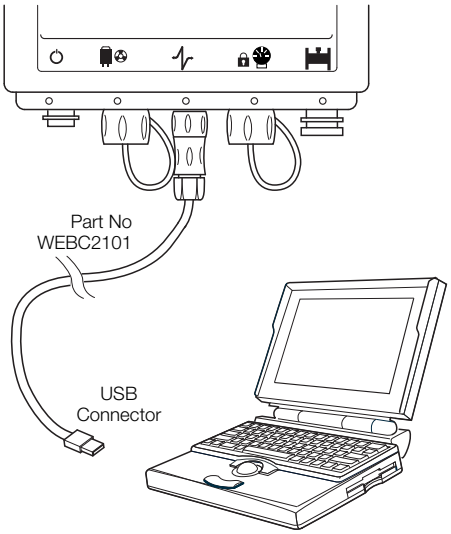
3.4 MODBUS Connection

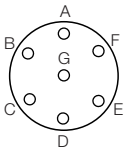
This section describes the AquaMaster 3 MODBUS serial data communications option and must be used in conjunction with:

- MODBUS Tables Supplement (COI/FET2XX/MOD/TBL–EN)
- Programming Guide (COI/FET2XX–EN)

Detailed specifications and recommendations for using and implementing MODBUS communications are contained in the following external publications:

- MODBUS over Serial Line – Specification and Implementation Guide V1.02. Dec 20, 2006. http://www.modbus.org/. Refer to this guide for hardware, cabling, grounding and shielding on MODBUS.
- MODBUS Application Protocol Specification V1.1b. Dec 28, 2006 – http://www.modbus.org/.





MODBUS Connector

Pin	MODBUS
A	D0
B	D1
C	Not used
D	Not used
E	Not used
F	Not used
G	Common

Connector B20434
available for
hard-wired installations

Note. A USB Comms lead driver is required when using WEBC2101 – download from www.ftdichip.com/FTDrivers.htm

Fig. 3.13 MODBUS Connection

3.4.1 2-wire Connection

AquaMaster 3 MODBUS RS485 uses a 2-wire serial link in accordance with EIA/TIA-485 standard – see Fig. 3.14.

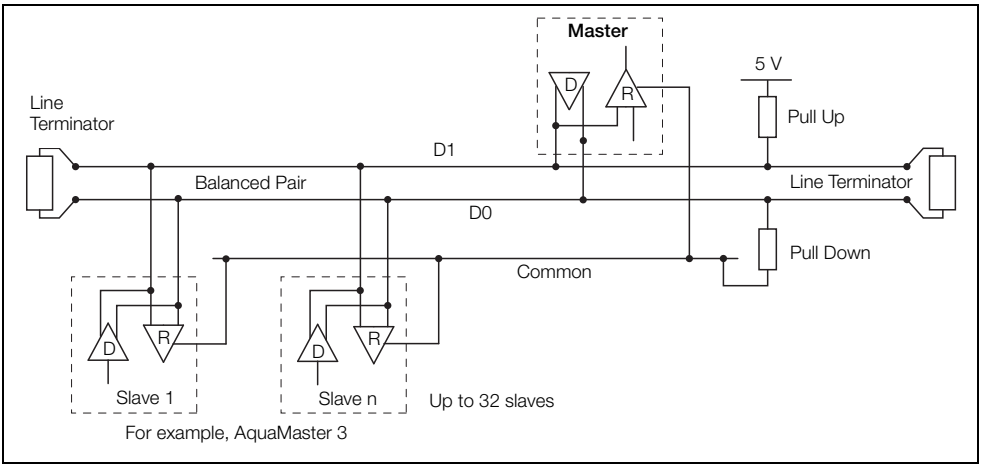


Fig. 3.14 General 2-Wire Topology

3.4.2 Host Computer Interface

An RS485 communications driver must be fitted to the host computer. It is strongly recommended that the interface has galvanic isolation to protect the computer from lightning damage and increase signal immunity to noise pick-up if the data is to be taken over long distances.

3.4.3 Pull-up and Pull-down Resistors / Polarization

To prevent false triggering of slaves when the master (host computer) is inactive, pull-up and pull-down resistors must be fitted to the RS485 interface at the host computer – see Fig. 3.15.

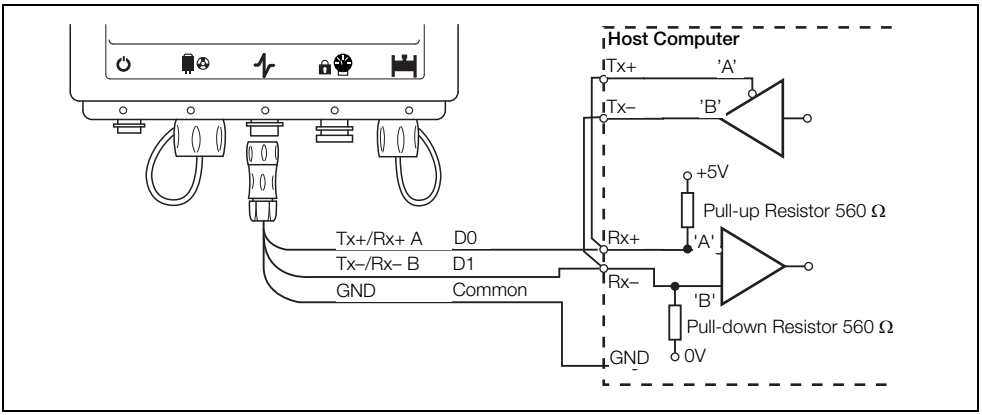


Fig. 3.15 Host Computer Interface

3.4.4 Termination Resistor

To minimize transmission line travelling wave reflections caused by impedance discontinuities at the end of the described RS485-cable a Line Termination is required near each of the 2 ends of the 'Bus' as described in the MODBUS over Serial Line – Specification and Implementation Guide V1.02 – see page 25.

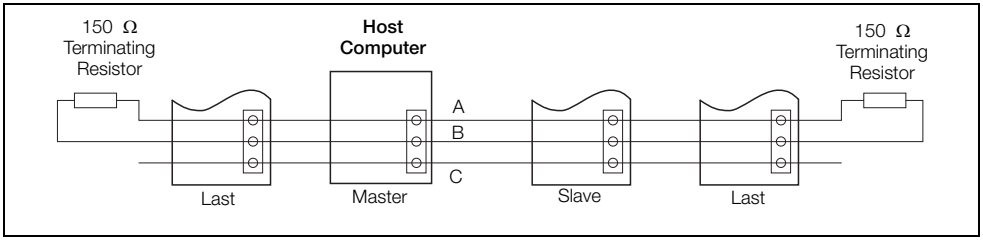


Fig. 3.16 Termination Resistor Location

3.4.5 Cable Properties

An RS485-MODBUS configuration without repeater has one trunk cable or 'Bus', along which devices are connected directly (daisy chaining) or by short 'tap' cables. The use of repeaters between several RS485-MODBUS is also possible.

The end-to-end length of the trunk cable must be limited. The maximum length depends on the Baud rate, the cable (gauge, capacitance or characteristic impedance), the number of loads on the daisy chain and the network configuration (2-wire or 4-wire).

For 9600 Baud rate and AWG26 (or wider) gauge, the maximum length is 1000 m (3280 ft.). Where 4-wire cabling is used as a 2-wire cabling system the maximum length must be divided by 2.

The 'tap' cables must be short, never more than 20 m (65.6 ft.). If a multi-port tap is used with n derivations, each one must have a maximum length of 40 m (131 ft.) divided by n.

The maximum serial data transmission line length for RS485 systems is 1200 m (3937 ft.). The lengths of cable that can be used are determined by the cable type, typically:

- Up to 6 m (19.7 ft.) – standard screened or twisted pair cable.
- Up to 300 m (984 ft.) – twin twisted pair with overall foil screen and an integral drain wire – for example, Belden 9502 or equivalent.
- Up to 1200 m (3937 ft.) – twin twisted pair with separate foil screens and integral drain wires – for example, Belden 9729 or equivalent.

Category 5 cables may be used for RS485-MODBUS to a maximum length of 600 m (1968 ft.).

For the balanced pairs used in an RS485-system, a characteristic impedance with value higher than 100 Ω is preferred especially for 19200 and higher Baud rates.

3.5 Power Supply Connections

Warning.

- Disconnect the supply from any cables being terminated on the transmitter.
- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.

Note.

- Power supply connections / earthing arrangements are identical for cathodically-protected remote transmitter systems. For cathodically-protected integral transmitter systems, follow cathodic installation practices.
- AquaMaster 3 has 3 power supply options:
  - Mains power – see Section 3.5.1
  - Battery power – see Section 3.5.2, page 29
  - Renewable energy – see Section 3.5.3, page 30

3.5.1 Mains Power Supply

Note. Before making connections, check the Data label to confirm power supply requirements.

Mains power requirements:

- 110 to 240 V AC, 50 / 60 Hz @ <3 VA
- Cable length 3 m (9.8 ft.)
- Protected by a fused isolator, rating – mains, anti-surge 3 A.

Make connections as shown in Fig. 3.17.

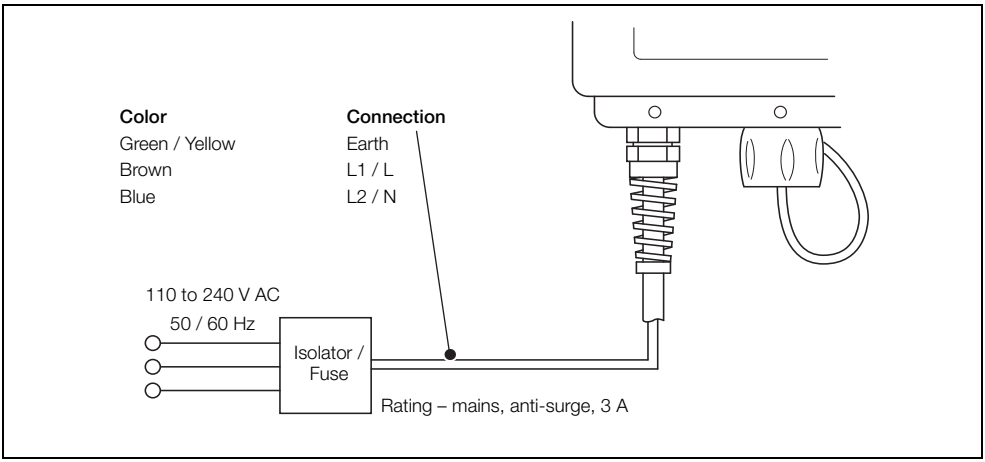


Fig. 3.17 Connecting a Mains Power Supply

3.5.2 Battery Power Supply

Note. Before making connections, check the Data label to confirm power supply requirements.

AquaMaster 3 can be supplied with an optional battery pack.

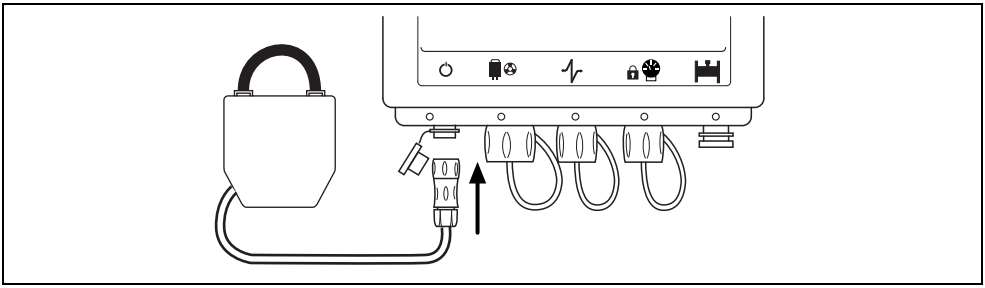


Fig. 3.18 Connecting a Battery Supply

3.5.3 Renewable Energy Supply

Notes.

- Before making connections, check the Data label to confirm power supply requirements.
- An output regulator can be omitted if the off load-voltage is below V in max.
- Renewable energy generators do not operate at maximum capacity, e.g. low wind speeds, coating of the solar panel with dust and wildlife droppings, short daylight periods in winter etc. For these reasons, in some installations, generators with a capacity greater then the specified 5 W minimum should be used. Contact ABB for a technical note, giving guidance on the selection of suitable sized generators for AquaMaster 3.

Renewable energy supply requirements:

- Input 12 V (nominal)
- V in max. 22 V DC
- V in min. 6 V DC
- Solar panel or wind generator 5 W or greater

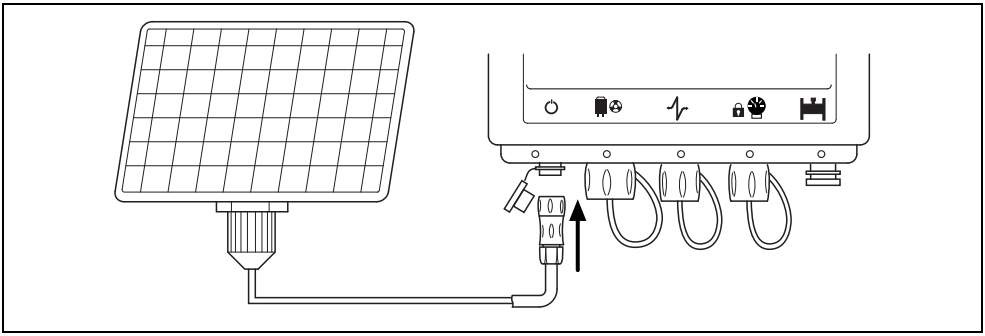


Fig. 3.19 Connecting a Renewable Energy Supply

4 Start-Up and Operation

Warning.

- The battery pack used by AquaMaster 3 may present a risk of fire or chemical burns if mistreated. Do not recharge, disassemble, heat above 100 °C (212 °F) or incinerate.
- Replace battery pack with an ABB-supplied part only. Use of another battery may present a risk of fire or explosion.
- Dispose of all battery packs promptly. Keep away from children.
- Dispose of battery packs in accordance with local regulations.
- Where possible, recycle used batteries.
- Contact the local environmental authority for further information regarding disposal or recycling schemes for used batteries.
- Operation at elevated temperatures (>45 °C [113 °F]) significantly shortens the battery capacity and life.

4.1 Start-up

To start the AquaMaster 3 for the first time:

1. Connect the external power source; mains / battery or renewable power source – see Section 3.5, page 28.
2. Remove transportation label.
3. Cover the display area for a few seconds.
4. Uncover the display area. The display is activated, the AquaMaster 3 performs a self-test and begins communication with the sensor.

   A successful connection is indicated by the message 'Pass' in the display window and normal flowmeter operation commences.

Notes.

- If the display shows 'Err 1', check the sensor wiring. If the fault is rectified, the transmitter restarts automatically.
- If the display shows 'Err 2 or 3', contact ABB.

4.2 Display Activation

To activate the display during normal operation:

1. Cover the display area for a few seconds.
2. Uncover the display area. The display is activated and the AquaMaster 3 cycles through the programmed set of display measurements.

Note. To use local or remote serial communications, for instructions on how to alter the displayed set of measurements and for meter setup, refer to COI/FET2XX–EN.

4.3 Display Information

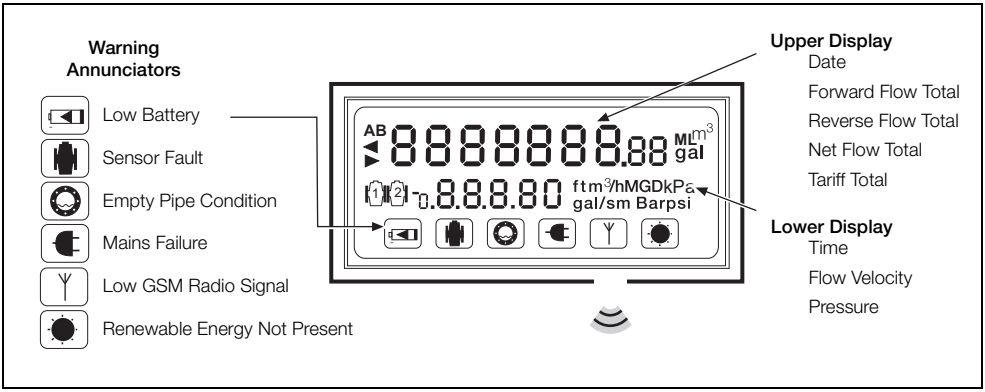


Fig. 4.1 AquaMaster 3 Display Information

4.4 Servicing Plugs and Sockets

To ensure long and reliable service life for the plugs and sockets on AquaMaster 3 Flow Transmitters, ABB recommend regular treatment of the gold connector pins.

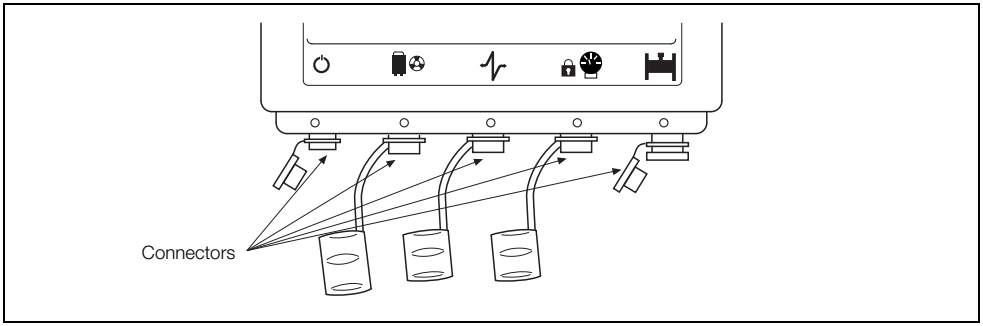


Fig. 4.2 Transmitter Sockets (MIL Style)

4.4.1 Service Intervals

Treat all connectors:

- at 3-year intervals
- when the battery pack is changed
- when the installation is visited for other reasons (such as CalMaster 2 Verification)

4.4.2 Equipment Required

Cleaners are available from your local ABB representative. To purchase supplies directly or for local distributor details please go to the following website:

http://store.caig.com/

Material details are:

Description	Part No.
DeoxIT® – Contact Cleaner & Rejuvenator DeoxIT® – Mini-spray, 5 % solution, flushing action, 14 g (Applications = 150 approx.)	D5MS–15
DeoxIT® GOLD – Contact Enhancer, conditioner & Protector DeoxIT® GOLD G5 Mini Spray 5 % solution, 14 g, flushing action and safe on plastics (Applications = 150 approx.)	G5MS–S

4.4.3 Preparation

Item	Precaution
Real-time Clock	This procedure may result in the loss of the real-time clock. Once the treatment is complete, check and if necessary, re-program the real-time clock and date – see section 4.4.8, page 36.
Transmitters with Data Loggers	This procedure may result in the loss of logger contents on transmitters fitted with data loggers. To prevent data loss, download logger data before treating the connector pins.

4.4.4 Disconnection

Before DeoxIT treatment disconnect ALL cables in the following order:

1. Battery pack / power
2. Sensor
3. Pressure transducer (if fitted)
4. Outputs
5. Communications cable (if connected)

Uncap unused connectors.

4.4.5 Order of Treatment

To minimize disruptive effects of repeatedly breaking and making connections perform the following order of treatment using the Stage 1 and Stage 2 processes for each plug and socket in turn:

1. Treat sensor connector and cable (ensure battery is disconnected at this point).
2. Treat battery connector and cable (ensure sensor is disconnected at this point).
3. Treat all other peripheral connections and cables.

4.4.6 Stage 1 – Oxide Removal and Cleaning

To remove existing oxide and clean the pins:

1. Apply a short burst (around 0.5 s duration) of DeoxIT DN5 spray to the metal surfaces of the connectors and to the gold connector pins.

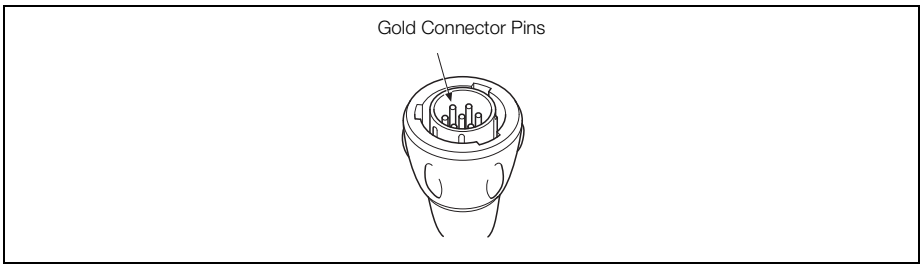


Fig. 4.3 Cleaning the Gold Connector Pins

2. Connect a corresponding male / female connector to the connector under test 5 times.
3. Wait 10 seconds.
4. Reapply one short burst (around 0.5 s duration) of DeoxIT DN5 spray to the metal surfaces.
5. Allow any residue to run out of connector.
6. Wait 30 seconds for the application to dry.

Note. The surfaces may not appear completely dry after this time as a protective layer is left behind when the carrier evaporates.

4.4.7 Stage 2 – Oxide Prevention

To prevent oxide build-up:

1. Apply a very short burst (not more than 0.5 s duration) of DeoxIT Gold GN5 spray to the metal surfaces.

   Avoid unnecessary spraying onto transmitter housing.
2. Wait 10 seconds.
3. Reapply one very short burst (not more than 0.5 s duration) of DeoxIT Gold GN5 spray to the metal surfaces.
4. Allow any residue to run out of connector.
5. Wait 30 seconds for the application to dry.

> **Note.** The surfaces may not appear completely dry after this time as a protective layer is left behind when the carrier evaporates.

4.4.8 Completion Tasks

To complete servicing of the plugs and sockets:

1. Reconnect peripheral devices in this order.
   a. Sensor
   b. Pressure transducer (if fitted)
   c. Outputs
   d. Communications
   e. Battery pack / power
2. Refit protective caps on unused connection sockets.
3. For transmitters with built-in loggers and no GSM, re-program the real-time clock and date – see Programming Guide (COI/FET2XX–EN).

4.5 Accessories / Spares Kits

Common

MRBX9969	Close-coupled mounting kit
WEBC2100	AquaMaster 3 local communications adapter
WEBC2003/01	Remote GSM aerial kit 1 m (3.3 ft.)
WEBC2003/05	Remote GSM aerial kit 5 m (16.4 ft.)
B20433	4-pin MIL – renewable power connector
B20434	7-pin MIL – RS485 MODBUS and RS232 connector
WABC2100	Remote battery pack (M_nO_2)
WABC2010	Sensor cable assembly 0.5 m (1.6 ft.), for integral / close-coupled
WABC2010/01	Sensor cable assembly 1 m (3.3 ft.), for remote
WABC2010/05	Sensor cable assembly 5 m (16.4 ft.), for remote
WABC2010/10	Sensor cable assembly 10 m (32.8 ft.), for remote
WABC2010/20	Sensor cable assembly 20 m (65.6 ft.), for remote
WABC2010/30	Sensor cable assembly 30 m (98.4 ft.), for remote
WABC2010/40	Sensor cable assembly 40 m (131.2 ft.), for remote
WABC2010/50	Sensor cable assembly 50 m (164.0 ft.), for remote
WABC2010/60	Sensor cable assembly 60 m (196.8 ft.), for remote
WABC2010/70	Sensor cable assembly 70 m (229.6 ft.), for remote
WABC2010/80	Sensor cable assembly 80 m (262.4 ft.), for remote
WABC2010/01	Output cable 1 m (3.3 ft.)wire-ended
WEBC2011/M	Output cable for Technolog Cello (MIL)
WEBC2012/M	Output cable for Technolog Cello (Brad Harrsion)
WEBC2013/M	Output cable for RADCOM Multilog
WEBC2014/M	Output cable for Primayer Xilog
WEBC2006/M	Output cable 2x19-way MIL
WEBC2024	Connector security plug – pack of 5
WEBC2100	RS232 to USB cable
WEBC2101	RS485 to USB cable
WABX2000/05	Pressure cable assembly 16 bar (232 psi), 5 m (16.4 ft.)
WABX2000/10	Pressure cable assembly 16 bar (232 psi), 10 m (32.8 ft.)

Adapter Cable / Upgrade Kits

WABC2035	Sensor adapter kit (M16 Plastic to MIL)
WABC2036	Pressure adapter kit (M16 Plastic to MIL)
WABC2022/M	Sensor upgrade kit (M20 Plastic to MIL)
WABC2023/M	Sensor upgrade kit (M20 Armoured to MIL)
WABC2024/M	Sensor adaptor kit (M20 Plastic to MIL)
WABC2025/M	Sensor adaptor kit (M20 Armoured to MIL)
WABC2026/M	Sensor adaptor kit (½ in. NPT blanked to MIL)
WABC2104/05	Scanreader cable assembly 5 m (16.4 ft.)
WABC2104/10	Scanreader cable assembly 10 m (32.8 ft.)
WABC2104/20	Scanreader cable assembly 20 m (65.6 ft.)
WABC2104/30	Scanreader cable assembly 30 m (98.4 ft.)

5 Specification

Specification – flowmeter

Battery- or renewable energy powered reduced bore meters – flow specifications

					OIML Class 2 specification			OIML Class 1 specification		
Size		Q_4	Q_3	$Q_{(0.5\%)}$	Q_2	Q_1	R	Q_2	Q_1	R
mm	in.	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)		m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
15	1/2	5 (22)	4 (18)	0.24 (1.05)	0.026 (0.110)	0.016 (0.070)	250	0.04 (0.176)	0.025 (0.11)	160
20	3/4	7.9 (34.8)	6.3 (28)	0.37 (1.62)	0.04 (0.176)	0.025 (0.110)	250	0.063 (0.277)	0.04 (0.176)	160
25	1	12.5 (55)	10 (44)	0.6 (2.64)	0.064 (0.281)	0.04 (0.176)	250	0.1 (0.44)	0.063 (0.277)	160
40*	1 1/2	31 (138)	25 (110)	1.5 (6.6)	0.16 (0.704)	0.1 (0.44)	250	0.25 (1.10)	0.16 (0.704)	160
50*	2	50 (220)	40 (176)	2.4 (10.56)	0.26 (1.14)	0.16 (0.70)	250	0.4 (1.76)	0.25 (1.10)	160
65	2 1/2	79 (347)	63 (277)	3.7 (16.29)	0.40 (1.76)	0.25 (1.10)	250	0.63 (2.77)	0.4 (1.76)	160
80*	3	125 (550)	100 (440)	5.9 (25.97)	0.64 (2.81)	0.4 (1.76)	250	1 (4.40)	0.63 (2.77)	160
100*	4	200 (880)	160 (700)	9.4 (41.38)	1.0 (4.4)	0.64 (2.81)	250	1.6 (7.04)	1 (4.40)	160
125	5	200 (880)	160 (700)	9.4 (41.38)	1.0 (4.4)	0.64 (2.81)	250	1.6 (7.04)	1 (4.40)	160
150*	6	500 (2200)	400 (1760)	23.5 (103.46)	2.56 (11.27)	1.6 (7.04)	250	4 (17.61)	2.5 (11)	160
200*	8	788 (3470)	630 (2770)	37 (162.90)	4.0 (17.61)	2.5 (8.8)	250	6.3 (27.73)	3.9 (17.17)	160
250*	10	1250 (5500)	1000 (4400)	60 (260)	6.4 (28.18)	4 (17.6)	250	10 (44)	6.3 (27.73)	160
300*	12	2000 (8810)	1600 (7040)	90 (400)	10.2 (44.91)	6.4 (28.18)	250	16 (70.44)	10 (44)	160
350	14	2000 (8810)	1600 (7040)	110 (484.3)	16 (70.44)	10 (44.02)	160	41 (180.5)	25 (110)	63
400	16	3125 (13760)	2500 (11010)	170 (748.48)	25 (110)	15.6 (68.68)	160	63 (277.4)	40 (176)	63
450	18	3125 (13760)	2500 (11007)	170 (748.48)	25 (110)	15.6 (68.68)	160	63 (277.4)	40 (176)	63
500	20	5000 (22010)	4000 (17610)	270 (1188.72)	40 (176.11)	25 (110)	160	100 (440.3)	63.5 (279.6)	63
600	24	7875 (34670)	6300 (27740)	420 (1849.20)	63 (277.38)	39 (171.71)	160	160 (704.4)	100 (440.3)	63

* OIML R49 version available to Class 1 and Class 2

Note. Note. OIML R49–1 allows Class 1 only for meters with $Q_3 \geq 100$ m^3 / h. Meters outside this range were tested to Class 1 accuracy and passed.

Battery- or renewable energy powered full bore meters – flow specifications

				Class 2 specification		
DN	Q_4	Q_3	$Q_{(0.5\%)}$	Q_2	Q_1	R
	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
25	20 (88)	16 (70)	1.1 (4.83)	0.16 (0.70)	0.10 (0.44)	160
40	50 (220)	40 (176)	2.7 (11.9)	0.4 (1.76)	0.25 (1.10)	160
50	79 (348)	63 (277)	4.2 (18.5)	0.63 (2.77)	0.4 (1.76)	160
65	125 (550)	100 (440)	6.7 (29.5)	1.0 (4.40)	0.63 (2.77)	160
80	200 (880)	160 (704)	10.7 (47.1)	1.6 (7.04)	1.0 (4.40)	160
100	313 (1378)	250 (1100)	16.7 (73.5)	2.5 (11.00)	1.6 (7.04)	160
150	788 (3469)	630 (2733)	42 (184.9)	6.3 (27.73)	3.9 (17.2)	160
200	1,250 (5503)	1,000(4402)	67 (294.9)	10.0 (44.02)	6.3 (27.73)	160
250	2,000 (8805)	1,600 (7044)	107 (471.1)	16.0 (70.44)	10 (44.02)	160
300	3,125 (13759)	2,500 (11007)	167 (735.3)	25.0 (110.07)	15.6 (68.68)	160

AC-powered reduced bore meters – flow specifications

					OIML Class 2 specification			OIML Class 1 specification		
Size		Q_4	Q_3	$Q_{(0.25\%)}$	Q_2	Q_1	R	Q_2	Q_1	R
mm	in.	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)		m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
15	1/2	5 (22)	4 (18)	0.11 (0.48)	0.010 (0.044)	0.006 (0.026)	630	0.016 (0.070)	0.010 (0.04)	400
20	3/4	7.9 (35)	6.3 (28)	0.18 (0.79)	0.016 (0.070)	0.010 (0.044)	630	0.025 (0.11)	0.016 (0.070)	400
25	1	12.5 (55)	10 (44)	0.29 (1.27)	0.025 (0.11)	0.016 (0.070)	630	0.04 (0.176)	0.025 (0.11)	400
40*	1 1/2	31 (138)	25 (110)	1.5 (6.6)	0.063 (0.28)	0.040 (0.176)	630	0.1 (0.44)	0.063 (0.28)	400
50*	2	50 (220)	40 (176)	1.5 (6.6)	0.1 (0.44)	0.063 (0.277)	630	0.16 (0.70)	0.1 (0.44)	400
65	2 1/2	79 (247)	63 (277)	1.8 (6.2)	0.16 (0.7)	0.1 (0.44)	630	0.25 (1.10)	0.16 (0.70)	400
80*	3	125 (550)	100 (440)	3 (13.2)	0.3 (1.32)	0.16 (0.70)	630	0.4 (1.76)	0.25 (1.10)	400
100*	4	200 (880)	160 (700)	4.6 (20.25)	0.41 (1.8)	0.25 (1.10)	630	0.64 (2.82)	0.4 (1.76)	400
125	5	200 (880)	160 (700)	4.6 (20.25)	0.41 (1.8)	0.25 (1.10)	630	0.64 (2.82)	0.4 (1.76)	400
150*	6	500 (2200)	400 (1760)	11.4 (50.19)	1 (4)	0.63 (12.77)	630	1.6 (7.04)	1.0 (4.40)	400
200*	8	788 (3470)	630 (2770)	18 (79.25)	1.6 (7)	1.0 (4.40)	630	2.5 (11)	1.6 (7.04)	400
250*	10	1250 (5500)	1000 (4400)	29 (127.7)	2.5 (11)	1.6 (7.04)	630	4 (17.6)	2.5 (11)	400
300*	12	2000 (8810)	1600 (7040)	46 (202)	4.1 (18)	2.5 (11)	630	6.4 (28.18)	4 (17.6)	400
350	14	2000 (8810)	1600 (7040)	80 (352)	6.4 (28.18)	4 (17.6)	400	12.8 (56.35)	8 (35.22)	200
400	16	3125 (13760)	2500 (11007)	125 (550)	10 (44)	6.3 (27.73)	400	20 (88.05)	12.5 (55.03)	200
450	18	3125 (13760)	2500 (11007)	125 (550)	10 (44)	6.3 (27.73)	400	20 (88.05)	12.5 (55.03)	200
500	20	5000 (22010)	4000 (17610)	200 (880)	16 (70.44)	10 (44)	400	32 (140.9)	20 (88.05)	200
600	24	7875 (34760)	6300 (27740)	315 (1387)	25.2 (110.9)	15.8 (69.56)	400	50.4 (221.9)	31.5 (138.7)	200

* OIML R49 version available to Class 1 and Class 2

Note. Note. OIML R49–1 allows Class 1 only for meters with $Q_3 \geq 100$ m^3 / h. Meters outside this range were tested to Class 1 accuracy and passed.

AC-powered full bore meters – flow specifications

				Class 2 specification		
DN	Q_4	Q_3	$Q_{(0.25\%)}$	Q_2	Q_1	R
	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	m^3 / h (Ugal / min)	
25	20 (88)	16 (70)	1.6 (7)	0.08 (0.35)	0.05 (0.22)	315
40	50 (220)	40 (176)	4 (17.6)	0.2 (0.88)	0.13 (0.57)	315
50	79 (348)	63 (277)	6.3 (27.7)	0.32 (1.41)	0.20 (0.88)	315
65	125 (550)	100 (440)	10 (44)	0.5 (2.20)	0.32 (1.41)	315
80	200 (880)	160 (704)	16 (70.4)	0.81 (3.56)	0.51 (2.24)	315
100	313 (1378)	250 (1100)	25 (110)	1.3 (5.72)	0.79 (3.47)	315
150	788 (3469)	630 (2733)	63 (277)	3.2 (14.09)	2.0 (8.80)	315
200	1,250 (5503)	1,000(4402)	100 (440)	5.1 (22.45)	3.2 (14.09)	315
250	2,000 (8805)	1,600 (7044)	160 (704)	8.1 (35.66)	5.1 (22.45)	315
300	3,125 (13759)	2,500 (11007)	250 (1100)	12.7 (55.91)	7.9 (34.78)	315

Specification – sensor

Wetted materials

Screw-end meters
Brass and stainless steel 316L

Flanged meters
Electrodes – stainless steel 316L

Potable water approvals

	WRAS Listed	NSF Approved	ACS
MM/GA	✔	Pending	DN40 to 300, excluding DN65 and 125
MM/GF	✔	✔	✘

Pressure limitations
As flange rating
PN25 Max Process Temp 50 °C (122 °F)
PN40 Max Process Temp 40 °C (104 °F)
OIML / MID Approved Meters 16 bar (232 psi)

Pressure equipment directive 97/23/EC
This product is applicable in networks for the supply, distribution and discharge of water and associated equipment and is therefore exempt.

Environmental Protection
Rating
IP68 (NEMA 6P) to 10 m (33 ft.)
Buriable (sensor only) to 5 m (16 ft.)

Conductivity
>50 µS/cm

End connections

Thread-end connections (MM/GA)
15 mm – ISO 228 G $^3/_4$ in. B $^3/_4$ in. NPSM
20 mm – ISO 228 G 1 in. B 1 in. NPSM
25 mm – ISO 228 G $1^1/_4$ in. B $1^1/_4$ in. NPSM

40 to 300 mm (1.5 to 12 in.) flanged (MM/GA)
EN1092-1 / ISO 7005 – PN10, PN16
ANSI B16.5 Class 150
AS 2129 Tables C, D, E and F
AS 4087 PN14, PN16, PN21
JIS to BS2210, 10k

350 to 600 mm (14 to 24 in.) flanged (MM/GA)
EN1092-1 / ISO 7005 – PN10, PN16
AS 4087 PN14, PN16, PN21
AS 2129 Tables C, D
JIS to B2210 5k and 10k

25 to 300 mm (1 to 12 in.) flanged (MM/GF)
EN1092-1 / ISO 7005 – PN10, PN16
ANSI B16.5 Class 150
AS 4087, PN16

OIML R49 approval (MM/GA only)

Size range and flow specification
See specification table

Accuracy class
1 and 2

Environmental class
T50 0.1 °C to 50 °C (32.18 °F to 122 °F)

Pressure loss class
< 0.63 bar

Minimum upstream pipe
0 D

Minimum downstream pipe
0 D

Orientation
Any

MID Approval
Approved to directive 2004/22/EC

Specification – transmitter

Mounting

Directly on sensor

or

Remote up to 200 m (650 ft.)

Housing

IP68 (NEMA 6P)

Stainless steel housing in a Thermoplastic outer cover with window, encapsulated with polyurethane-based resin

Electrical connections

IP68 plug and socket, mains cable

Sensor cable

ABB cable supplied as standard

SWA cable available (via adaptor box) on application

Mains supply

85 to 265 V AC @ <3 VA

Connection cable: approx. 3 m (10 ft.)

Mains power failure backup time: approx. 5 days

Renewable power

Solar or wind

Input voltage: 6 to 22 V DC @ <5 W

Note. Renewable energy generators do not operate at maximum capacity, for example, low wind speed, coating of the solar panel, short daylight periods. As a consequence some installations will require generators with a capacity greater than the specified 5 W minimum.

Max. current: 200 mA

Backup power time up to 3 weeks (dependent on operating conditions)

External battery pack

IP68 (NEMA 6P)

Manganese alkaline battery life:
0 to 45 °C (32 to 113 °F) typically 5 years

Lithium battery pack life:
0 to 60 °C (140 °F) typically 10 years

Battery life is shorter with GSM, depending on how frequently it is used and for what period. For example, used once per day for SMS automated reporting of data logged at 15 minute intervals, the life of a battery pack would be typically reduced by 20 %

Backup power time

Approximately 1 minute

Pulse and alarm outputs

Three bidirectional solid state switches with common isolation

±35 V DC 50 mA

Output 1 forward only or forward plus reverse pulses

Output 2 reverse pulses or direction indicator

Output 3 Alarm indicates any problem with measurement or with power

Pulse output 50 Hz maximum, 50 % nominal duty cycle

Communications options

Serial data communications

Local Port RS232
Note. on battery and renewable energy versions frequent use of the RS232 port considerably reduces battery / standby life.

RS485 MODBUS

MODBUS RTU slave

Baud rates: 1200, 2400, 4800, 9600 or 19200
RS485: 2-wire + ground signalling
Low power shut-off mode after 10 s of inactivity

Encoder interface (non-logging versions only)

Function

Remote reading of totalizer and serial no.

Protocol

ABB encoder

Connections

2-wire for inductive pads
(max. cable length 80 m [260 ft])

3-wire for AMR

Compatible readers

Severn Trent Services Smart reader

ABB or Elster SR100 and SR50

Logicon Versaprobe

Itron ERT

Compatible inductive pads

Starpad

ABB

Telemetry applications (option)

GSM / SMS Modem

Mounting:

Internal

Frequency bands:

Quad band: 850 / 900 / 1800 / 1900 MHz

Functions:

SMS auto report of flow and optionally pressure logger data (typically 1 s or 1 min. average)

SMS report frequency: typically daily

SMS alarm reporting at time of event, for example power loss, limited to 1 per day

SMS configuration of flowmeter

SMS diagnosis of flowmeter

SMS total / tariff auto report

GSM Antenna (option)

Quad band operation:

850 / 900 / 1800 / 1900 M Hz

Mounting:

Integral with transmitter or remote.

Antenna environmental:

IP66 (NEMA4) waterproof for accidental submersion

Note. The GSM does not operate with integral antenna under water.

General advice is to mount the antenna as high as possible, always outside of any metal enclosure and not under the surface of the ground.

Pressure system – external transducer (option)

Pressure range

16 bar Abs.

Connection

Standard quick-fit male probe connector via an adapter cable

Operating temperature range

–20 (ambient) to 70 °C (–4 to 158 °F)

Protect the sample and transducer from freezing.

Accuracy (typical)

±0.4 % of range

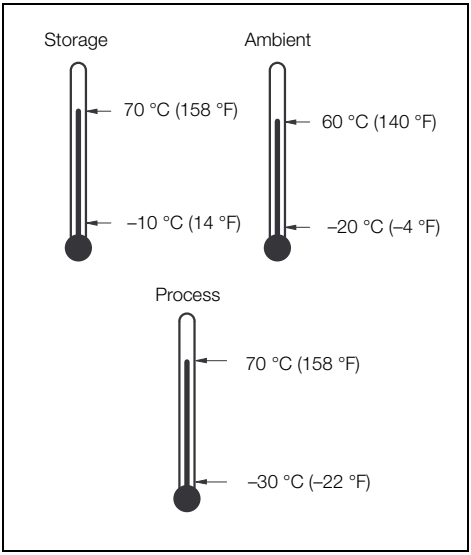
Thermal error band (typically 100 °C [212 °F])

±1.5 % span

Cable length

5 or 10 m (16 or 33 ft.)

Temperature ranges



Operation outside ambient temperature limits of 0 to 45 °C (32 to 113 °F) reduces battery capacity and shortens battery life.

Response time (programmable)

Minimum

1 s (mains-powered)

15 s (battery-powered + external renewable energy)

Device languages

English

French

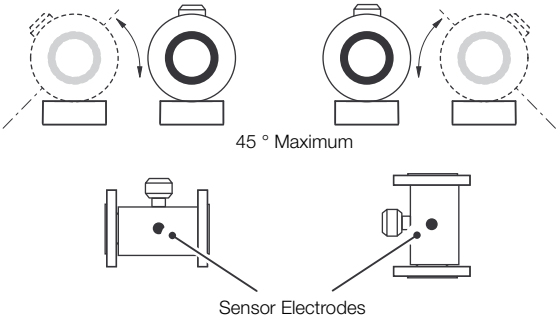
German

Spanish

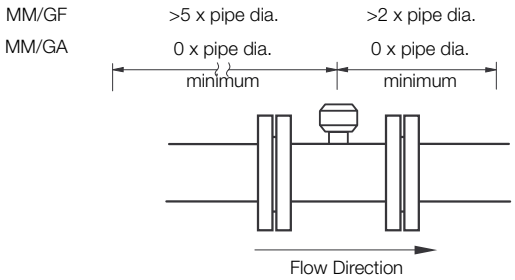
Italian

Dutch

Mounting



Pipe conditions



Pressure loss (MM/GA only)

Flow Rate	Pressure Loss in bar (psi)
Q^3	<0.63 (9.1)
$Q^3/2$	<0.16 (2.3)

Logger details (option)

	Logger		
	1	**2**	**3**
Logger Function	**Flow & Pressure**	**Flow & Pressure**	**Forward, Reverse, Tariffs & Net Flow Totals**
No. of Records	8831	11361	732
Logging Interval	15 to 65500 s (adjustable)		24 hr (fixed)
Typical Capacity	3 months @15 min	7 days (approx.) @ 1 min	2 year

Software availability

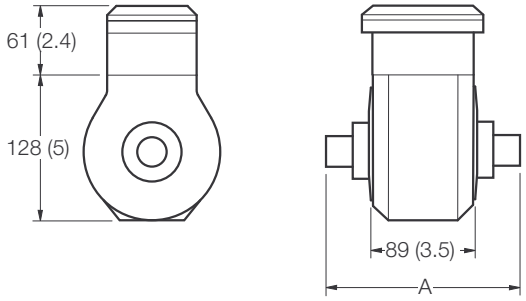
Software	Direct RS232	SMS (Text)
ABB LogMaster	✔	✘
Technolog (PMAC)	✔	✘
Primayer Primeware	✔	✘
OSI PI Database or Capula	✔	✘
Hydreka (Winfluid)	✔	✘
Mobile phone text	✘	✔
AutoChart	✘	✔
Areal (Tokapi)	✘	✔
ABB Logger Server	✘	✔
EcoTech	✘	✔
Q Tech	✘	✔

Sensor Specification (Nominal Dimensions)

15 to 25 mm (1/2 to 1 in.) – Screw Ends (MM/GA)

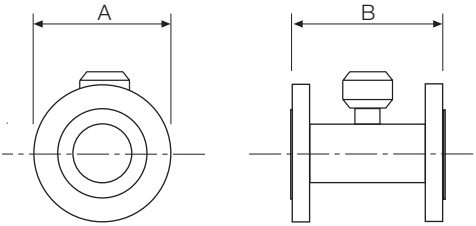
Meter Size		Dimensions mm (in.)		Approx. Weight	
mm	in.	A	Connection	kg	lb
15	1/2	119 (4.7)	G 3/4 in. B or 3/4 in. NPSM	2.5	5
20	3/4	127 (5)	G 1 in. B or 1 in. NPSM	2.5	5
25	1	127 (5)	G 1 1/4 in. B or 1 1/4 in. NPSM	2.5	5

Dimensions in. mm (in.)



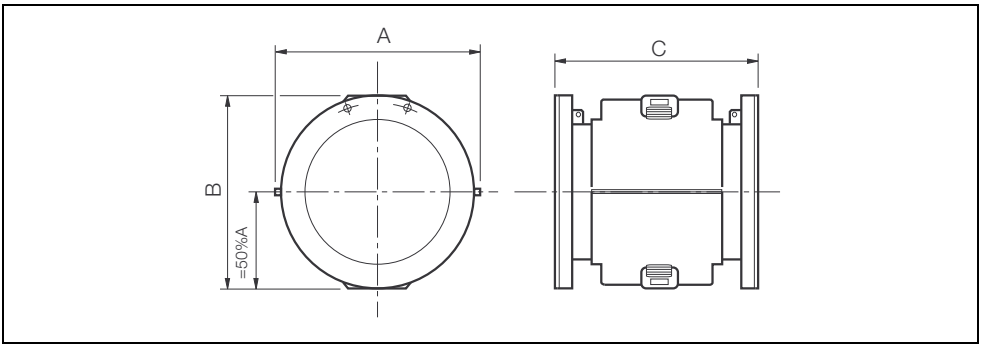
40 to 300 mm (1 1/2 to 12 in.) – Flanged (MM/GA)

Meter Size		Dimensions mm (in.)		Approx. Weight	
mm	**in.**	**A**	**B**	**kg**	**lb**
40	1 1/2	150 (5.9)	200 (7.9)	11	24
50	2	165 (6.5)	200 (7.9)	12	27
65	2 1/2	219 (8.6)	200 (7.9)	13	29
80	3	200 (7.9)	200 (7.9)	18	40
100	4	220 (8.6)	250 (9.8)	25	55
125	4	220 (8.6)	250 (9.8)	25	55
150	6	285 (11.2)	300 (11.8)	31	68
200	8	340 (13.3)	350 (13.8)	48	106
250	10	405 (15.9)	450 (17.7)	75	165
300	12	460 (18.1)	500 (19.7)	112	247



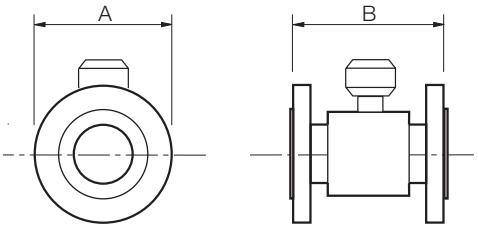
350 to 600 mm (14 to 24 in.) – Flanged (MM/GA)

Meter Size		Dimensions mm (in.)			Approx. Weight	
mm	in.	A	B	C	kg	lb
350	14	513 (20.2)	520 (20.5)	550 (21.7)	100	220
400	16	570 (22.4)	576 (22.7)	600 (23.6)	115	253
450	18	632 (24.9)	627 (24.7)	698 (27.5)	160	352
500	20	686 (27.0)	679 (26.7)	768 (30.2)	217	455
600	24	772 (30.4)	770 (30.3)	918 (36.1)	315	693



25 to 300 mm (1 to 12 in.) – Full Bore (MM/GF)

Meter Size		Dimensions mm (in.)		Approx. Weight	
mm	in.	A	B	kg	lb
25	1	115 (4.5)	200 (7.9)	7	15
40	1½	150 (5.9)	200 (7.9)	9	20
50	2	165 (6.5)	200 (7.9)	10	23
65	2½	185 (7.3)	200 (7.9)	18	40
80	3	200 (7.9)	200 (7.9)	18	40
100	4	230 (9.0)	250 (9.8)	24	54
150	6	285 (11.2)	300 (11.8)	38	84
200	8	345 (13.6)	350 (13.8)	37	81
250	10	410 (16.1)	450 (17.7)	60	132
300	12	485 (19.1)	500 (19.7)	70	154



DS/FET2XX-EN

Appendix A Hazardous Area Protection

A.1 GSM-Equipped Units – Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of this GSM cellular terminal. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. The Company assumes no liability for customer failure to comply with these precautions.

1. When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy. The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is shielded properly. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while the mobile is on.
2. Switch off the cellular terminal or mobile before boarding an aircraft. Remove the SIM card before shipping. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.
3. Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
4. Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden when you suspect that it may cause interference or danger.

Note. Cellular terminals or mobiles operate using radio signals and cellular networks cannot be guaranteed to connect in all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls.

To make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.

Notes