The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company’s products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company, and is indicative of our dedication to quality and accuracy.

Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 "Safety requirements for electrical equipment for measurement, control, and laboratory use". If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

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**

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 Communications Department.

Health and Safety

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

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. 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 address on the back cover, together with servicing and spares information.
AquaMaster™ is a range of high performance electromagnetic flowmeters for the measurement of electrically conductive fluids and are normally supplied as factory configured, calibrated systems.

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 which forms part of the GSM-equipped version of this product. If the unit purchased has GSM-capability, read Appendix A on page 30 before selecting a location.
2 MECHANICAL INSTALLATION

2.1 Unpacking

Fig. 2.1 Unpacking

2.2 Installation Conditions – Figs. 2.1 to 2.17

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 Straight Pipe Requirements

Fig. 2.7 Fluid Level

Fig. 2.8 Within Temperature Limits

Fig. 2.9 Shade
Supports < 2 m (78 in)

IP68 (NEMA 6P/ENCLOSURE 6P)
Accrued Time ≤ 9 Months

For access to batteries, display and communication connector.

Adequate Protection Plate (Recommended)

Backfill (Recommended)

Fig. 2.10 Above Ground
Fig. 2.11 Temperature Difference
Fig. 2.12 Within Environmental Rating
Fig. 2.13 Underground
Fig. 2.14 Cable Routing
Fig. 2.15 Gasket Fitting
Fig. 2.16 Separation of Sensors
Fig. 2.17 Access to Transmitter
2.3 Transmitter Dimensions – Fig. 2.18

Dimensions in millimeters (inches)

- Transmitter Mounting Plate:
  - Installation and wiring access: 300 (11.8) minimum, 450 (17.7) preferred
  - Allowance for cable bend – each side: 130 (5.1) – standard, 230 (9) – armored
  - 146 (5.75) x 125 (4.9)
  - Ø6.5 (¹/₄)
  - 150 (5.9)
  - 170 (6.7)

- Remote Antenna:
  - 50mm

- Integral Antenna:
  - 50mm

Fig. 2.18 Transmitter Dimensions

Fig. 2.19 GSM Antenna Installation
2.4 GSM-equipped Transmitters

2.4.1 GSM Antenna Installation – Figs. 2.19 and 2.20

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 'Commissioning test for signal strength' in the Quick Reference Guide for the AquaMaster S with GSM (IM/AMG–QRG).

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, will give a good indication of local signal strength. For GSM and logger download services, a minimum of two visible signal strength indicator 'bars' are recommended. For SMS text, a minimum of one 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 is mounted 50mm below the chamber cover, which must be plastic – see Fig. 2.19
- Ensure the antenna will not become submerged under water – see Fig. 2.19.
- Metallic enclosures will seriously degrade the signal. If an enclosure is used it must be non-metallic.
- Do not mount the antenna closer than 50mm to any solid wall or surface – see Fig 2.20.
- Do not mount the antenna beneath a solid surface (e.g. metal cover, floor/ceiling, etc).

![Fig. 2.20 GSM Antenna Installation](image)
2.4.2 Connecting a Remote Antenna – Fig. 2.21

1. If the transmitter is not fixed in any way, arrange or hold it with the top cover uppermost.

2. Wash off any loose dirt from the case using plain water.

3. Remove the transmitter top cover and battery mounting tray – see Fig. 3.12.

4. Pass the antenna cable through a spare cable gland.

5. Attach the antenna cable plug securely to the antenna connector.

6. Tighten the cable gland.

7. Refit the battery mounting tray and the transmitter top cover – see Fig. 3.12.

Fig. 2.21 Connecting a Remote Antenna
2.4 GSM-equipped Transmitters
2.4.3 Installing a SIM Card – Fig. 2.22

1. If the transmitter is not fixed in any way, arrange or hold it with the top cover uppermost.

2. Wash off any loose dirt from the case using plain water.

3. Remove the transmitter top cover and battery mounting tray – see Fig. 3.12.

4. Slide to unlock and open the SIM card holder cover.

5. Insert the SIM card, contact side down and bevelled edge first, into the SIM card holder.

6. Close the SIM card holder cover and slide into locked position.

7. Refit the battery mounting tray and the transmitter top cover – see Fig. 3.12.

Fig. 2.22 Installing a SIM Card
3.1 Bonding/Grounding – Figs. 3.1 to 3.9

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

**Notes.**
- The flow sensor must not be connected to a ground spike.
- For bonding connections use $\geq 4 \text{mm}^2$ (<10 AWG) cable.
- Sensors $\leq 80$ mm do not require grounding rings.
- Connect the transmitter ground connection to the flowmeter body ground – see Figs 3.6 and 3.7.

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**Key for Figs. 3.1 to 3.9**

<table>
<thead>
<tr>
<th>Metal Pipes</th>
<th>Plastic Pipes</th>
</tr>
</thead>
</table>

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![Fig. 3.1 All Metal Pipe, Including Lined Metal Pipe.](image1)

![Fig. 3.2 Metal Pipe With Flange Adaptor](image2)
Fluid Contact Rings

Fig. 3.3 Flanged Metal Pipe to Plastic Pipe

Fluid Contact Rings

Fig. 3.4 Metal Pipe With Plastic Make-Up Insert

Fluid Contact Rings

Fig. 3.5 All Plastic Pipe
Fig. 3.6 Battery Powered Transmitter Mounted in a Chamber

Fig. 3.7 Mains or Battery Powered Transmitter in Roadside Cabinet with Local Ground
Caution. Do NOT ground Cathodically Protected Systems.

Insulated connecting wire (not included). Must be adequately rated to carry cathodic currents.

Fig. 3.8 Pipelines With Cathodic Protection, DN ≥ 100mm
Insulated connecting wire (not included). Must be adequately rated to carry cathodic currents.

Caution. Do NOT ground Cathodically Protected Systems.

Fig. 3.9 Pipelines With Cathodic Protection, DN 40mm to 80mm
3.2 Connections

3.2.1 Sensor Terminal Box Connections (Remote Versions only)

**Caution.** (Remote versions)
- Remove foil screens completely, and plastic/foil screens and any fillers
- Twist the three screen wires together and sleeve them.
- Keep cable pairs twisted.
- Make connections only as shown.
- Maintain Environmental Protection at all times.
- Conduit connections must provide cable entry sealing.

**CABLE**

<table>
<thead>
<tr>
<th>ABB</th>
<th>Belden 8777</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Violet</td>
<td>7 White</td>
</tr>
<tr>
<td>6 Blue</td>
<td>6 Black</td>
</tr>
<tr>
<td>5 Sleeved Grounds</td>
<td>5 Sleeved Grounds</td>
</tr>
<tr>
<td>4 Yellow</td>
<td>4 Red</td>
</tr>
<tr>
<td>3 Orange</td>
<td>3 Black</td>
</tr>
<tr>
<td>2 Red</td>
<td>2 Green</td>
</tr>
<tr>
<td>1 Brown</td>
<td>1 Black</td>
</tr>
</tbody>
</table>

**Maximum Cable Lengths**
- STT 4000 Series: ≤80m
- STT 4005 Series: ≤250m
- Belden 8777: ≤80m

**Caution.** With Belden Cable 8777, ensure that the black wires are not interchanged, and remain with the associated twisted pair.

![Fig. 3.10 Sensor Terminal box Connections (Remote Version)](image)

3.2.2 Environmental Protection

**Warning.**
- Potting materials are toxic – use suitable safety precautions.
- Read the manufacturers instructions carefully before preparing the potting material.
- The remote sensor terminal box connections must be potted immediately on completion to prevent the ingress of moisture.
- Check all connections before potting – see ELECTRICAL INSTALLATION.
- Do not overfill or allow the potting material to come into contact with ‘O’ rings or grooves.
- Do not let potting material enter conduit, if used.

![Fig. 3.11 Potting the Terminal Box](image)
3.2.3 Transmitter Connections – Figs. 3.12 to 3.15

Caution.
- To ensure cable glands seal, use cable of diameter 2 to 6mm (0.08 to 0.24 in) [M16] only.
- Ensure cable glands are tightened after wiring. However, overtightening a plastic cable gland will break it and destroy its sealing property. It is recommended that cable glands are tightened fingertight initially, then a further $\frac{1}{2}$ to $\frac{3}{4}$ turn applied using a suitable spanner.
- Ensure that ‘O’ ring seals and mating surfaces are clean, to maintain environmental rating.
- For IP68 protection where the transmitter could be submerged, the termination area must be potted – see Section 3.3.9.

Note. The batteries are mounted in the lid of early style transmitters.
Caution. (Remote versions)
- Remove foil screens completely, and plastic/foil screens and any fillers
- Twist the three screen wires together and sleeve them.
- Keep cable pairs twisted.
- Make connections only as shown.
- Maintain Environmental Protection at all times.
- Conduit connections must provide cable entry sealing.

Fig. 3.13 Transmitter Connections (Glands/Conduit Entry)
Fig. 3.14 Sensor Cable Connections (Gland/Conduit, Remote version)

Caution. With Belden Cable 8777, ensure that the black wires are not interchanged and remain with the associated twisted pair.

Note. This arrangement is an option.

Fig. 3.15 Sensor Cable Connections (Connector, Remote version)
3.3 Input/Output Connections

Caution.
- Refer to SPECIFICATION for Input/Output ratings.
- Inductive loads must be suppressed or clamped to limit voltage swings
- Operation of outputs is programmable – see Quick Reference Programming Guide for details.
- External isolators are not normally required as the pulse and alarm circuit is electrically separated from all other AquaMaster connections.
- Capacitive loads must be inrush current limited.
- Fully-floating pulse outputs may be subject to static damage, e.g. connecting to a floating datalogger, unless 'COM' is operated within its galvanic isolation range (±35 V) from earth. Recommended protection for floating output systems is to wire 'COM' to '0V'.

3.3.1 Frequency Outputs – Fig. 3.16

![Frequency Output Connections Diagram](image)

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

3.3.2 Alarm Interface – Fig. 3.17

![Alarm Output Connections Diagram](image)

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

Alarm functions are available only with product software versions: ≥ 1.1 (Release 1) ≥ 2.1 (release 2). See Programming Guide to determine software version.
### 3.3.3 MIL Connector Input/Output Connections (Option) – Fig. 3.18

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
<th>Color (Output Cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>O/P 1</td>
<td>Forward Pulses or Forward &amp; Reverse Pulses</td>
<td>Orange</td>
</tr>
<tr>
<td>E</td>
<td>O/P 3</td>
<td>Alarm Output</td>
<td>White/Red</td>
</tr>
<tr>
<td>F</td>
<td>O/P 2</td>
<td>Reverse Pulses or Direction Indicator</td>
<td>Blue</td>
</tr>
<tr>
<td>G</td>
<td>O/P Com†</td>
<td>Common</td>
<td>Drain Wire/Screen</td>
</tr>
<tr>
<td>H</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>I/P Gnd</td>
<td>Input Common</td>
<td>White</td>
</tr>
<tr>
<td>K</td>
<td>I/P+</td>
<td>Contact Input</td>
<td>Violet</td>
</tr>
<tr>
<td>L</td>
<td>RXD</td>
<td>Receive data (serial input connection) #</td>
<td>Turquoise</td>
</tr>
<tr>
<td>M</td>
<td>TXD</td>
<td>Transmit data (serial output connection) #</td>
<td>Brown</td>
</tr>
<tr>
<td>N</td>
<td>RTS</td>
<td>Request to send #</td>
<td>Red/Black *</td>
</tr>
<tr>
<td>P</td>
<td>CTS</td>
<td>Clear to send #</td>
<td>Yellow/Red *</td>
</tr>
<tr>
<td>R</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>RI</td>
<td>Ring Indicator #</td>
<td>Yellow</td>
</tr>
<tr>
<td>U</td>
<td>–</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Serial GND</td>
<td>Comms Ground #</td>
<td>Green</td>
</tr>
</tbody>
</table>

# When Remote Comms. Option is fitted

* Not fitted on older cables

† Note Caution regarding fully floating outputs. Recommended protection for floating output systems is to connect G to J.

---

Fig. 3.18 MIL Connector Connections
3.3.4 MIL Connector Input/Output (Option) – AquaMag™ x10 Pulse Output Compatibility

Where an existing installation has been wired to operate from the x10 outputs of an AquaMag™, the wiring of the AquaMaster™ connector can be altered to suit – see Fig. 3.19.

**Note.** Some data logger leads contain components which convert forward and reverse pulses into a single pulse line with a direction signal. Such leads will NOT work with AquaMaster and are unnecessary as AquaMaster directly provides the correct signals for these loggers.

Fig. 3.19 MIL Connector Input/Output Connections

3.3.5 ScanReader Interface (Option) – Fig. 3.20

**2-Wire Pad Connection**

Reading Pad

1.5 m to 40 m

Recommended Cable ABB STT4009 (or equivalent)

**3-Wire Transponder Connection**

Transponder

<table>
<thead>
<tr>
<th>Cable Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green +V</td>
</tr>
<tr>
<td>Red Data</td>
</tr>
<tr>
<td>Black 0V</td>
</tr>
</tbody>
</table>

3-terminal PCB WADX2026

Fig. 3.20 ScanReader Connections
3.3.6 Local Computer Connection – Fig. 3.21

Connected to 9-pin Serial Data socket on PDA or PC via 'Laplink' lead/adaptor

ABB Limited
Part No.WEBC2000

Current Style

9-pin female (direct to PC)

9-pin male (for link lead to Psion)

Fig. 3.21 Local Computer Connections
3.3.7 Remote Computer Connection – Fig. 3.22

<table>
<thead>
<tr>
<th>AquaMaster Signal (DTE)</th>
<th>Modem (DCE) Plug</th>
<th>Terminal/PC (DTE) Socket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>DB9</td>
<td>DB25</td>
</tr>
<tr>
<td>RXD</td>
<td>RXD</td>
<td>2</td>
</tr>
<tr>
<td>TXD</td>
<td>TXD</td>
<td>3</td>
</tr>
<tr>
<td>RTS</td>
<td>RTS</td>
<td>7</td>
</tr>
<tr>
<td>CTS</td>
<td>CTS</td>
<td>8</td>
</tr>
<tr>
<td>RI</td>
<td>RI</td>
<td>9</td>
</tr>
<tr>
<td>GND</td>
<td>GND</td>
<td>5</td>
</tr>
</tbody>
</table>

* Also mates with PDA 'PC-Link cables

*This interface operates only with external power applied to the transmitter.***

Fig. 3.22 RS232 Connections
3.3.8 Power Supply Connection – Fig. 3.23

**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.

![Transmitter Label](image1)

**Transmitter End View**

![Diagram](image2)

*Fig. 3.23 Power Supply Connections*
3.3.9 Pressure Transducer (Optional)
Optional pressure transducer cables are available for a range of pressures and cable lengths.

**Caution.** Use only the pressure transducer supplied with the transmitter. Use of other pressure transducers will require alteration of the pressure span and zero factors in the transmitter – see Quick Reference Programming guide.

3.3.10 Environmental Protection

**Warning.**
- Potting materials are toxic – use suitable safety precautions.
- Read the manufacturers instructions carefully before preparing the potting material.

**Caution.**
- For IP68 protection against water ingress, pot the termination area on the metal transmitter versions.
- Check all connections and operations before potting – see ELECTRICAL INSTALLATION.
- Do not overfill or allow the potting material to come into contact with O-rings or grooves; allow for inserting battery tray.
- Do not let potting material enter conduit(s), if used.
- Insert battery tray into potting before it sets and pull through the battery connection wires, thereby ensuring they are above the potting level.
- Keep unit upright whilst potting sets (minimum – two hours).
4 START-UP AND OPERATION

**Warning.**
- The lithium battery used in this device may present a risk of fire or chemical burns if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate.
- Replace battery with an ABB supplied part only. Use of another battery may present a risk of fire or explosion.
- Dispose of used batteries promptly. Keep away from children.
- Dispose of used batteries 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.

**Note.** Each battery must be connected to the cable from the same side of the termination area as the battery position.

4.1 Connecting Batteries
The AquaMaster is supplied with one or two batteries, but not connected. To connect see Fig. 4.1.

**Note.** GSM-equipped transmitters are supplied with the batteries connected but in transportation mode – refer to the label attached to the equipment.

4.2 Start-up
Remove any plastic film from the AquaMaster light sensitive display window before commencing normal operation.
When electrical power is connected, or the plastic film is removed from the display window with electrical power connected, the AquaMaster performs a self-test operation. If successful, 'Pass' is indicated in the display window.
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.
AquaMaster Transmitter
Current Model (top cover removed)

1) Remove the top cover of the transmitter – see Fig. 3.12.
2) Connect the battery or batteries to the wire connector(s) inside the top of the transmitter unit.
3) Push the connection(s) into the recess as shown ensuring that the wires are NOT lying on the mating surface.
4) Fit the cover and ensure the screws are tightened fully.

Previous Model (batteries in top cover)

1) Remove the top cover of the transmitter – see Fig. 3.12.
2) Slide out the connector from behind the battery clip.
3) Connect the battery or batteries to the wire connector(s) inside the top of the transmitter unit.
4) Ensure that the end of the battery with the connection wires is pushed up against the inside end of the top cover.
5) Push the connection centrally behind the battery clip to secure the battery.
6) Fit the cover and ensure the screws are tightened fully.

Fig. 4.1 Connecting Batteries
4.3 Display Activation

For normal operation, activate the light sensitive display by first covering the display area totally. On removing the covering, the display activates and cycles through the programmed set of display measurements.

With external AC power applied, the display is permanently active.

Information. For the use of local or remote serial communication and how to alter the displayed set of measurements, or instrument setup, see the Quick Reference Programming Guide.

4.4 Replacing a Battery – Fig. 4.3

Note. Each battery must be connected to the cable from the same side of the termination area as the battery position in the battery holder or lid. For dual battery units, replace only the battery indicated by the battery legend described on the following page.
Normal Operation
If both batteries are good, no battery icons are displayed.

Replace Battery
When a single, steady battery icon is shown, replace the cell on the side indicated – in this example, the right-hand battery. Wait approximately three seconds after disconnecting the battery before connecting the new battery. DO NOT change a battery if its associated icon is flashing.

Replace Both Batteries
Important. If both batteries require replacement, first change the cell indicated by the steady icon – in this example, the left battery. The flashing icon indicates the battery currently in use.

4.4.1 Spares Kits.

Transmitter
Current Model (flat cover version)
   Battery Kit comprises 1 battery and one seal ........ MEFA 9947
   Lid assembly ......................................................... MEFA 9948

Previous Model (domed cover version)
   Battery Kit comprises 1 battery and one seal ........ MEFA 9949
   Lid Assembly ........................................................ MEFA 9950
4.4.2 Battery Changing Procedures – Figs 4.3, 4.4 and 4.5

**Note.** Before changing batteries in a dirty environment it is recommended that, in order to minimize contamination, the new O-ring is fitted to the new lid assembly (or cleaned lid assembly from a previous installation) in a clean area, and the lid sealed in a polythene bag.

1. If the transmitter is not fixed in any way, arrange or hold it with the top cover uppermost.
2. Wash off any loose dirt from the case using plain water.
3. Remove the top cover of the transmitter (see Fig. 3.12) to expose the batteries.
4. Clean the O-ring mating surface around the opening into the transmitter body using a wet tissue.
5. Unclip the appropriate battery from the tray and disconnect the lead at the connector; dispose of the battery in the approved manner.
6. Fit a new battery from the battery kit into the clips.
7. Ensure that the connector is tucked in the recess and that the wires are NOT lying on the O-ring mating surface.
8. Fit new silica gel bag; dispose of existing bag.
9. Fit the new O-ring (supplied with the battery) into a new or recycled lid assembly.
10. Fit the new cover and ensure the screws are tightened fully.

Finally – remove and discard the O-ring seal from the removed lid assembly, wash the lid under running water (using a brush if necessary), dry it and seal it in a polythene bag for later re-use.

Fig. 4.3 Battery Changing Procedure (current version transmitter)
1. Clean the transmitter with plain water. Small amounts of soiling may be removed with a wet tissue.

2. Remove the transmitter top cover (see Fig. 3.12) to reveal the batteries clipped in the cover.

3. Wipe the O-ring mating area around the opening into the transmitter body with a wet tissue.

4. Slide out the connector from behind the battery clip of the battery to be replaced and pull apart.

5. Remove the battery and dispose of it in the approved manner.

6. Slide out the other connector from behind the battery clip and unclip the remaining battery but do not disconnect it.

7. Unscrew the retaining straps (one shown) and retain the old lid (see ‘Finally’ below).

8. Fit a new O-ring (supplied with the battery) into a new or recycled lid assembly.

9. Attach the retaining straps (removed in 7) to the new/recycled lid.

10. Fit the current battery into the clip and push the connection centrally behind the clip to secure the battery.

11. Repeat step 10 using the new battery from the kit supplied, and fit the cover ensuring the screws are tightened fully.

Finally – remove and discard the O-ring seal from the removed lid assembly, wash the lid under running water (using a brush if necessary), dry it and seal it in a polythene bag for later re-use.

Fig. 4.4 Battery Changing Procedure (early version transmitter)
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. ABB 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 properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.

2. Switch off the cellular terminal or mobile before boarding an aircraft. 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, or 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.

Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.
APPENDIX B - AQUAMASTER BLOCK DIAGRAM

Sensor

Transmitter

Optional Power Supply

Optional GSM Modem

Optional RS232 Communication Port

Pulse/Alarm Circuits

Common

Processor

Measurement System

Display

Local Configuration Adaptor

Pressure Transducer

Part No. WEBC2000
**SPECIFICATION**

### Battery-powered Meters – Flow Requirements per ISO 4064 (Standard Version)

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### AC-powered Meters – Flow Requirements per ISO 4064 (Standard Version)

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### Battery-powered Meters – Flow Requirements per CEN pr 14154 and latest ISO4064 (Standard Version)

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### AC-powered Meters – Flow Requirements per CEN pr 14154 and latest ISO4064 (Standard Version)

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### Flow Requirements per CEN pr 14154 (Bulk Revenue Version)

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<td>400 (1760)</td>
<td>80 (350)</td>
<td>12 (53)</td>
</tr>
<tr>
<td>300</td>
<td>12</td>
<td>1200 (5280)</td>
<td>600 (2640)</td>
<td>120 (530)</td>
<td>18 (79)</td>
</tr>
</tbody>
</table>

Performance Specification with CEN pr 14154 and ISO 4064
Wetted Materials

Screw end meters
Brass

Flanged meters
Electrodes – stainless steel 316L
Lining
Suitable for potable water (UKWFBS listed)

Pressure limitations
As flange rating

Conductivity
>50µS/cm

End Connections

Thread end connections
15mm – G 3/4 in. B 3/4 in. NPSM
20mm – G 1 in. B 1 in. NPSM
25mm – G 1 1/4 in. B 1 1/4 in. NPSM

40 to 300mm (1.5 to 12 in.) flanged
BS4504/ISO 7005 – PN16, PN10
ANSI B16.5 1.5 Class 150
AS 2129 Tables C, D and E
AS 4087/14, AS4087/16
JIS to BS2210, 5k, 10k and 30k
BS10 Tables D and E

350 to 600mm (14 to 24 in.) flanged
BS4504/ISO 7005 – PN10, PN16
BS10 Table D & E
AS 2129 Tables D and E
AWWA C207 Class B and D
ANSI B16.5 1.5 Class 150 (<24 in.)
AS4087/14, AS4087/16

Pressure Loss

<table>
<thead>
<tr>
<th>Flowrate</th>
<th>Pressure Loss (Bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 3 (CEN)</td>
<td>&lt; 0.63</td>
</tr>
<tr>
<td>ISO 4064 Q_{max}</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>ISO 4064 Q_{n}</td>
<td>&lt; 0.075</td>
</tr>
<tr>
<td>ISO 4064 Q_{v/2}</td>
<td>&lt; 0.019</td>
</tr>
</tbody>
</table>

Transmitter

Mounting
Integral with sensor
or
Remote up to 200m (650 ft)

Housing
IP68 (NEMA 6P) Aluminum Alloy with Glass Window

Electrical connections
20/16mm plastic glands, 20mm armored or accepts 1/2 in. NPT threaded or military style plug & socket

Sensor cable
ABB cable supplied as standard
SWA cable available on application

Power supply
Battery life @ 0 to 50°C (32 to 122°F)
1 battery – typically 1.2 years
2 batteries – typically 3 years, extended life is possible to give, say, 5 years for two cells with a small degradation in response time and slightly increased measurement uncertainty, contact ABB for details.

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, the life of one battery would, typically, be 1.25 years; for a once-daily data download of a 15 minute data log, the life of one battery would be, typically, 1.1 years.

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage Rating (V)</th>
<th>Frequency (Hz)</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>85 to 265</td>
<td>47 to 440</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Battery</td>
<td>3.6 (Lithium)</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Temperature Ranges

Note. Operation outside ambient temperature limits of 0 to 50°C (32 to 122°F) reduces battery capacity and shortens battery life.
...SPECIFICATION

...Transmitter

Pulse and alarm outputs
Three bidirectional solid state switches with common isolation ±35V DC 50mA
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 50Hz maximum, 50% nominal duty cycle

Serial data communications
Local Port  RS232 compatible via ABB lead (Option)
Remote Port (Option)  RS232 with RI, RTS and CTS handshaking for connection to a modem or computer

Telemetry applications using remote serial data communications
External Vodaphone VVADS Radio Pad
X25 compatible network interface via RP5, 6, 7 or similar radiopad
External PSTN modem
Modern PSTN modems which store configuration setup on non-volatile memory (for configuration information contact ABB)
External GSM modem
Siemens M20T, TC35 or similar compatible modems (for configuration information contact ABB)
Internal GSM modem
Dual Band GSM; fully programmable schedule for battery operation and Automated Meter Reading

Pressure System – External Transducer
Pressures range absolute
10, 16bar or 300 lb/in²
Connection
Standard quick-fit male probe
MIL style connector
Operating temperature range
–20 to 70°C (–4 to 158°F)
Accuracy (typical)
±0.4% of range
Thermal error band (typically 100°C [212°F])
±1.5% span
Cable length
1, 5, 10 or 20m (3, 16, 32 or 65 ft)

Logger details

<table>
<thead>
<tr>
<th>Logger Function</th>
<th>Logger 1</th>
<th>Logger 2</th>
<th>Logger 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow &amp; Pressure</td>
<td>Forward</td>
<td>Flow &amp;</td>
<td>Forward</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pressure</td>
<td>Reverse,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tariffs &amp;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Net Flow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Totals</td>
</tr>
<tr>
<td>No. of Records</td>
<td>8831</td>
<td>11361</td>
<td>366</td>
</tr>
<tr>
<td>Logging Interval</td>
<td>15 to 65500s (adjustable)</td>
<td>24 hours (fixed)</td>
<td></td>
</tr>
<tr>
<td>Typical Capacity</td>
<td>3 months @15min.</td>
<td>–7 days @ 1 min.</td>
<td>1 year</td>
</tr>
<tr>
<td>Mode</td>
<td>Cyclic</td>
<td>Cyclic</td>
<td>Cyclic</td>
</tr>
<tr>
<td>Use ABB LogMaster</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Use Technology (PMAC)</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Use Primayer Primeware</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
<tr>
<td>Use OSI PI Database/ CBV (WADIS) System</td>
<td>✔</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

Response Time (Programmable)

Minimum
1s (mains-powered)
15s (battery-powered)

Languages
English
French
German
Spanish
Italian
Dutch
Other languages can be added via Windows download Program (contact ABB)

GSM Antenna

Mounting
Integral with transmitter
or
Remote (1m cable)

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,
Mounting

Sensor Electrodes

Pipe Conditions

>5 x pipe dia. minimum

>2 x pipe dia. minimum

Flow Direction

Default Settings Table

<table>
<thead>
<tr>
<th>Configuration Parameter</th>
<th>Default European</th>
<th>Default North American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Factor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pulse Units</td>
<td>m³</td>
<td>Ugal</td>
</tr>
<tr>
<td>Totalizer Units</td>
<td>m³</td>
<td>Ugal</td>
</tr>
<tr>
<td>Full Scale Flow</td>
<td>ISO 4064 Qn</td>
<td>ISO 4064 Qn</td>
</tr>
<tr>
<td>Flow Units</td>
<td>m³/h</td>
<td>MUGD</td>
</tr>
<tr>
<td>Velocity Units</td>
<td>m/s</td>
<td>ft/s</td>
</tr>
<tr>
<td>Date Format from Country Code</td>
<td>DD/MMYY</td>
<td>MM/DDYY</td>
</tr>
<tr>
<td>Flow Response Time (s)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Pressure Display Type</td>
<td>Gauge</td>
<td>Gauge</td>
</tr>
<tr>
<td>Display Flow Rate</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Display Forward Total</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Display Reverse Total</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Display Net Total</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Display Pressure</td>
<td>Yes (if ordered with Pressure Tx)</td>
<td>Yes (if ordered with Pressure Tx)</td>
</tr>
<tr>
<td>Display Date</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Display Velocity</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pressure Upper Range (bar)</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Logger 1 Interval (s)</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>Logger 2 Interval (s)</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>Output Option Pulse Forward</td>
<td>Pulses Forward</td>
<td>Pulses Forward</td>
</tr>
<tr>
<td>Output Option Pulse Reverse</td>
<td>Pulses Reverse</td>
<td>Pulses Reverse</td>
</tr>
<tr>
<td>Profile Factor</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Probe Insertion Factor</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Sensor Specification (nominal dimensions)

15 to 25mm (0.5 to 1 in.) – Screw Ends

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in.)</th>
<th>Connection</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm in.</td>
<td>A</td>
<td></td>
<td>kg</td>
</tr>
<tr>
<td>15</td>
<td>0.5</td>
<td>119 (4.7)</td>
<td>G 3/4 in. B or 7/8 in. NPSM</td>
</tr>
<tr>
<td>20</td>
<td>0.75</td>
<td>127 (5)</td>
<td>G 1 in. B or 1 in NPSM</td>
</tr>
<tr>
<td>25</td>
<td>1.0</td>
<td>127 (5)</td>
<td>G 1 1/4 in. B or 1 1/4 in. NPSM</td>
</tr>
</tbody>
</table>

40 to 300mm (1.5 to 12 in.) – Flanged

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in.)</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm in.</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>40</td>
<td>1.5</td>
<td>176 (7)</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>176 (7)</td>
</tr>
<tr>
<td>65</td>
<td>2.5</td>
<td>219 (8.6)</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
<td>219 (8.6)</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
<td>230.5 (9.1)</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
<td>281 (11.1)</td>
</tr>
<tr>
<td>200</td>
<td>8</td>
<td>402 (15.8)</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>440 (17.3)</td>
</tr>
<tr>
<td>300</td>
<td>12</td>
<td>480 (18.9)</td>
</tr>
</tbody>
</table>

350 to 600mm (14 to 24 in.) – Flanged

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in.)</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm in.</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>350</td>
<td>14</td>
<td>513 (20.2)</td>
</tr>
<tr>
<td>400</td>
<td>16</td>
<td>570 (22.4)</td>
</tr>
<tr>
<td>450</td>
<td>18</td>
<td>632 (24.9)</td>
</tr>
<tr>
<td>500</td>
<td>20</td>
<td>686 (27.0)</td>
</tr>
<tr>
<td>600</td>
<td>24</td>
<td>772 (30.4)</td>
</tr>
</tbody>
</table>
PRODUCTS & CUSTOMER SUPPORT

Products
Automation Systems
• for the following industries:
  – Chemical & Pharmaceutical
  – Food & Beverage
  – Manufacturing
  – Metals and Minerals
  – Oil, Gas & Petrochemical
  – Pulp and Paper

Drives and Motors
• AC and DC Drives, AC and DC Machines, AC motors to 1kV
• Drive systems
• Force Measurement
• Servo Drives

Controllers & Recorders
• Single and Multi-loop Controllers
• Circular Chart, Strip Chart and Paperless Recorders
• Paperless Recorders
• Process Indicators

Flexible Automation
• Industrial Robots and Robot Systems

Flow Measurement
• Electromagnetic Flowmeters
• Mass Flow Meters
• Turbine Flowmeters
• Flow Elements

Marine Systems & Turbochargers
• Electrical Systems
• Marine Equipment
• Offshore Retrofit and Refurbishment

Process Analytics
• Process Gas Analysis
• Systems Integration

Transmitters
• Pressure
• Temperature
• Level
• Interface Modules

Valves, Actuators and Positioners
• Control Valves
• Actuators
• Positioners

Water, Gas & Industrial Analytics Instrumentation
• pH, conductivity, and dissolved oxygen transmitters and sensors
• ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine analyzers.
• Zirconia oxygen analyzers, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.

Customer Support

We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

United Kingdom
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

United States of America
ABB Inc
Instrumentation Division
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company’s published specification. Periodic checks must be made on the equipment’s condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.
The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

Printed in UK (07.05)
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