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.
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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 61010-1:2001-2 ‘Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use’ and complies with NIST and OSHA. 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:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>Warning – Refer to the manual for instructions</td>
</tr>
<tr>
<td>🚨</td>
<td>Caution – Risk of electric shock</td>
</tr>
<tr>
<td>⚡️</td>
<td>Protective earth (ground) terminal</td>
</tr>
<tr>
<td>⚡️</td>
<td>Earth (ground) terminal</td>
</tr>
<tr>
<td>⬌</td>
<td>Direct current supply only</td>
</tr>
<tr>
<td>⬌</td>
<td>Alternating current supply only</td>
</tr>
<tr>
<td>⬌</td>
<td>Both direct and alternating current supply</td>
</tr>
<tr>
<td>⬌</td>
<td>The equipment is protected through double insulation</td>
</tr>
</tbody>
</table>
1.3 Health & Safety

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

- 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 and any associated equipment in accordance with the relevant national and local standards.
- 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.
- Product liability – advice and assistance provided without charge is given in good faith but without liability.

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.
2 Introduction

WaterMaster™ is a range of high performance electromagnetic flowmeters for the measurement of electrically conductive fluids. Systems are normally supplied factory-configured and calibrated.

This manual provides end-user details for WaterMaster integral- and remote-transmitters and associated sensors.

2.1 Quality Control

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.

![UKAS Calibration Laboratory No. 0255](MT48/MT50/MT53/MT53)

*Fig. 2.1 UKAS Calibration Laboratory No. 0255*
3 Mechanical Installation

3.1 Unpacking

Caution. Visually inspect equipment for damage before installing. Do not install damaged or faulty equipment.

3.2 Installation Conditions

Caution. Do NOT exceed the maximum working pressure marked on the equipment.
Fig. 3.4 Localized Heat

Fig. 3.5 Siting

Fig. 3.6 Straight Pipe Requirements

Fig. 3.7 Fluid Level
Fig. 3.8 Within Temperature Limits

-20 °C
(-40 °F)
Min.

60 °C (140 °F) Max.

Fig. 3.9 Shade

Fig. 3.10 Above Ground

Supports
**Fig. 3.11 Temperature Difference**

Sensor Submersion: Continuous

Transmitter Submersion:
1 m (3.3 ft) <12 hours
Accrued time

IP68 (NEMA 6)

IP67 (NEMA 4X)

**Fig. 3.12 Within Environmental Rating**

**Fig. 3.13 Underground**

**Note.** For further details when burying flow sensors contact the ABB Service Organisation.
Fig. 3.14 Cable Routing

Fig. 3.15 Gasket Fitting

Fig. 3.16 Separation of Sensors

Fig. 3.17 Access to Transmitter
3.3 Overall Dimensions

3.3.1 Transmitter Dimensions

Fig. 3.18 Integral Transmitter Dimensions (Standard Gland Shown)

Fig. 3.19 Remote Transmitter Dimensions (Standard Gland Shown)

Note. Fix remote transmitter to a secure surface using 3 M5 screws (not supplied).
3.3.2 Sensor Dimensions

**Note.** Lay length – all sensors conform to ISO13359.

DN 3 to 32 Full Bore

![Diagram of sensor dimensions](image)

**Fig. 3.20 DN 3 to 32 Full Bore**

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DN</strong></td>
<td><strong>NPS/NB</strong></td>
</tr>
<tr>
<td>3 to 8</td>
<td>0.12 to 0.31</td>
</tr>
<tr>
<td>10</td>
<td>0.40</td>
</tr>
<tr>
<td>15</td>
<td>0.60</td>
</tr>
<tr>
<td>20</td>
<td>0.79</td>
</tr>
<tr>
<td>25</td>
<td>1.0</td>
</tr>
<tr>
<td>32</td>
<td>1.26</td>
</tr>
</tbody>
</table>

*Dimensions are approximate and vary depending on flange type

**Typical tolerance: +0/–3 mm (0.12 in)**

*Table 3.1 DN 3 to 32 Full Bore (PN/ANSI150)*
DN 40 to 300 Full Bore

![Fig. 3.21 DN 40 to 300 Full Bore]

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN NPS/NB</td>
<td>A*</td>
</tr>
<tr>
<td>40 1 1/2</td>
<td>150 (5.9)</td>
</tr>
<tr>
<td>50 2</td>
<td>165 (6.5)</td>
</tr>
<tr>
<td>80 3</td>
<td>200 (7.9)</td>
</tr>
<tr>
<td>100 4</td>
<td>230 (9.1)</td>
</tr>
<tr>
<td>150 6</td>
<td>280 (11.0)</td>
</tr>
<tr>
<td>200 8</td>
<td>345 (13.6)</td>
</tr>
<tr>
<td>250 10</td>
<td>405 (15.9)</td>
</tr>
<tr>
<td>300 12</td>
<td>460 (18.1)</td>
</tr>
</tbody>
</table>

*Dimensions are approximate and vary depending on flange type
Typical tolerances: **+0/–3 mm (0.12 in); ***+0/–6 mm (0.24 in)

Table 3.2 DN 40 to 300 Full Bore

DN 350 to 2200 Full Bore

![Fig. 3.22 DN 350 to 600 Full Bore]
### Table 3.3 DN 350 to 2200 Full Bore

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions in mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN</td>
<td>NPS/NB</td>
</tr>
<tr>
<td>350</td>
<td>14</td>
</tr>
<tr>
<td>400</td>
<td>16</td>
</tr>
<tr>
<td>450</td>
<td>18</td>
</tr>
<tr>
<td>500</td>
<td>20</td>
</tr>
<tr>
<td>600</td>
<td>24</td>
</tr>
<tr>
<td>700</td>
<td>27/28*</td>
</tr>
<tr>
<td>750</td>
<td>30</td>
</tr>
<tr>
<td>800</td>
<td>32</td>
</tr>
<tr>
<td>900</td>
<td>36</td>
</tr>
<tr>
<td>1000</td>
<td>39/40*</td>
</tr>
<tr>
<td>1100</td>
<td>42</td>
</tr>
<tr>
<td>1200</td>
<td>48</td>
</tr>
<tr>
<td>1400</td>
<td>54</td>
</tr>
<tr>
<td>1500</td>
<td>60</td>
</tr>
<tr>
<td>1600</td>
<td>66</td>
</tr>
<tr>
<td>1800</td>
<td>72</td>
</tr>
<tr>
<td>2000</td>
<td>78</td>
</tr>
<tr>
<td>2200</td>
<td>84</td>
</tr>
</tbody>
</table>

* Size is dependent on flange specification

Typical tolerances: **+0/–6 mm (0.24 in); ***+0/–10 mm (0.40 in)

Items **/*** DN700 up +0/–25 mm (1.0 in) if using WN flanges

---

Fig. 3.23 DN 700 to 2200 Full Bore
DN 15 to 25 Reduced Bore

**Fig. 3.24 DN 15 to 25 Reduced Bore – Remote Transmitter Mounting Options**

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in)</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1/2</td>
<td>119 (4.7)</td>
</tr>
<tr>
<td>20</td>
<td>3/4</td>
<td>127 (5)</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>127 (5)</td>
</tr>
</tbody>
</table>

*Table 3.4 DN 15 to 25 Reduced Bore – Threaded Ends*
**DN 40 to 300 Reduced Bore**

![Fig. 3.25 DN 40 to 300 Reduced Bore](image)

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>DN</th>
<th>NPS/NB</th>
<th>Dimensions mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A*</td>
</tr>
<tr>
<td>40</td>
<td>1/2</td>
<td>150 (5.9)</td>
<td>200 (7.9)**</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>165 (6.5)</td>
<td>200 (7.9)**</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
<td>200 (7.9)</td>
<td>200 (7.9)**</td>
</tr>
<tr>
<td>100</td>
<td>4</td>
<td>230 (9.1)</td>
<td>250 (9.8)**</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
<td>280 (11.0)</td>
<td>300 (11.8)**</td>
</tr>
<tr>
<td>200</td>
<td>8</td>
<td>345 (13.6)</td>
<td>350 (13.8)***</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>405 (15.9)</td>
<td>450 (17.7)***</td>
</tr>
<tr>
<td>300</td>
<td>12</td>
<td>485 (19.1)</td>
<td>500 (19.7)***</td>
</tr>
</tbody>
</table>

*Dimensions are approximate and vary depending on flange type
Typical tolerances: **+0/–3 mm (0.12 in); ***+0/–6 mm (0.24 in)

Table 3.5 DN 40 to 300 Reduced Bore
## DN 350 to 600 Reduced Bore

![Diagram of DN 350 to 600 Reduced Bore](image)

*Fig. 3.26 DN 350 to 600 Reduced Bore*

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Dimensions mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DN</strong></td>
<td><strong>NPS/NB</strong></td>
</tr>
<tr>
<td>350</td>
<td>14</td>
</tr>
<tr>
<td>400</td>
<td>16</td>
</tr>
<tr>
<td>450</td>
<td>18</td>
</tr>
<tr>
<td>500</td>
<td>20</td>
</tr>
<tr>
<td>600</td>
<td>24</td>
</tr>
</tbody>
</table>

*Dimensions are approximate and vary depending on flange type*

**Typical tolerances: +0/–6 mm (0.24 in)**

*Table 3.6 DN 350 to 600 Reduced Bore*
4 Electrical Installation

4.1 Grounding

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

**Note.**
- The flow sensor must not be connected to a ground spike.
- For bonding connections use ≥ 4mm² (< 10AWG) cable.

*Fig. 4.1 All Metal Pipe (Including Lined Metal Pipe)*

*Fig. 4.2 Metal Pipe with Flange Adaptor*
Fig. 4.3 Flanged Metal Pipe to Plastic Pipe

Fig. 4.4 Metal Pipe with Plastic Make-up Insert

Refer to Section 4.2, page 19

Fig. 4.5 All Plastic Pipe
4.2 Remote Transmitter/Sensor Arrangement

**Caution.** Do NOT ground cathodically protected systems.

**Note.** For bonding connections use $\geq 4\text{mm}^2$ ($< 10\text{AWG}$) cable.

---

**Fig. 4.6 Pipelines with Cathodic Protection**

**Fig. 4.7 Remote Transmitter in Roadside Cabinet**
4.3 Transmitter Terminal Connections

**Warning.** Isolate the transmitter from power supplies before removing the cover.

Referring to Fig. 4.8:

1. Slacken (but do not remove) the four transmitter cover screws (A).
2. Remove the transmitter cover.
3. Check that the power indicator LED (B) on the backplane is **not** lit.

**Warning.** If the power indicator LED (B) is lit, the transmitter is still powered up. Before continuing, isolate the transmitter power supply.

4. If screws (C) are not visible, access them by gently pulling the rotation lock (D) back and rotating the cartridge (E) until the cartridge screw access holes align with the cartridge screw heads.
5. Slacken the three cartridge screws and lift the cartridge (F) away from the housing.
Fig. 4.9 Cable Gland/Conduit Entry (Remote Transmitter Shown)
4.4 Cable Preparation (Remote Systems Only)

Caution. Maintain Environmental Protection at all times – See Section 4.5.2, page 24.

To prepare the cable for connection at the transmitter and sensor terminal blocks:
1. Remove the outer cable insulation and Mylar® wrap.
2. Ensure the drain wire is sleeved.
3. Cut the cable connection wires to the lengths shown in Figs 4.10 and 4.11, page 23.

4.5 Transmitter/Sensor Cable Connections

Caution.
- Make connections only as shown.
- Twist the screen wire of D1/TFE + D2 with the outer screen drain wire and sleeve them.
- For standard (non-cathodically protected) systems, connect the drain wire to the earth screw.
- For cathodically protected systems, connect the drain wire to terminal SCR, ensuring no braid or wires touch the exposed copper areas within the transmitter sensor cable wiring area.
- If an earth screw is not available at the transmitter enclosure, connect the drain wire to terminal SCR.
- Ensure the seal and mating surfaces are clean to maintain environmental rating.
- Conduit connections must provide cable entry sealing.
- Ensure cable glands are tightened after wiring. Do not overtighten the plastic cable glands to avoid destroying their sealing properties. Initially, tighten finger-tight, then a further 1/2 to 3/4 turn using a suitable spanner or wrench.
- Fit blanking plugs where required.
4.5.1 Sensor Cable Terminal Connections and Recommended Cable Lengths

**For Cathodically Protected Systems (or if the transmitter enclosure does not have an earth screw) connect the drain wire to terminal SCR.

Cut cables to 70 mm (2.75 in)

- M1 Brown
- M2 Red
- D1/TFE Orange
- D2 Yellow
- 3 Green (Sleeve)

**Drain Wire (Twisted with Screen from D1/TFE – Orange and D2 – Yellow)

Cut cables to 60 mm (2.35 in)

- S2 Blue
- E2 Blue (*Signal)
- E1 Violet (*Signal)
- S1 Violet (Screen)

**Drain Wire (Twisted with Screen Wire from D1/TFE – Orange and D2 – Yellow)

*Inner Wire

**For Cathodically Protected Systems connect the drain wire to terminal SCR.

Fig. 4.10 Sensor Cable Connections at Transmitter Terminal Block – Standard System (Non-cathodically Protected)

**For Cathodically Protected Systems connect the drain wire to terminal SCR.

Cut cables to 60 mm (2.35 in)

- S1 Violet (Screen)
- E1 Violet (*Signal)
- E2 Blue (*Signal)
- S2 Blue (Screen)
- 3 Green (Sleeve)
- D2 Yellow
- D1/TFE Orange
- SCR (Screen)
- M2 Red
- M1 Brown

Screen to Internal Earth

**Drain Wire (Twisted with Screen Wire from D1/TFE – Orange and D2 – Yellow)

*Inner Wire

**For Cathodically Protected Systems connect the drain wire to terminal SCR.

Fig. 4.11 Sensor Cable Connections at Sensor Terminal Block – Standard System (Non-cathodically Protected)
4.5.2 Environmental Protection

**Warning.**

- Potting materials are toxic. Read the manufacturers' instructions carefully before preparing the potting material and use suitable safety precautions.
- Power up and check all connections before potting.
- The remote sensor terminal box connections must be potted immediately on completion to prevent the ingress of moisture.
- 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).
4.6 Output Connections

**Caution.**
- Refer to page 37 for output ratings.
- Inductive loads must be suppressed or clamped to limit voltage swings.
- Operation of outputs is programmable.
- External isolators are not normally required as the pulse and alarm circuit is electrically separated from all other WaterMaster connections.

4.6.1 Frequency Outputs

**Note.** Outputs 1 and 2 are polarity sensitive. The common (negative) connection for these outputs is designated ‘COM’.
4.6.2 Alarm Outputs

Fig. 4.14 Alarm Output Connections

4.6.3 Current Output (4 to 20 mA)

Fig. 4.15 Current Output (4 to 20 mA)

Refer to IM/WMP for HART®-Protocol communication details
4.6.4 Test Point Access

**Note.** A typical DVM probe can access (fit) the PCB's test holes.

![Fig. 4.16 Transmitter PCB Board Test Point Access](image_url)
4.7 Power Supply Connections

Warning.
- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.
- Power must be connected via a suitable isolator and fused in accordance with relevant standards.
- When changing fuses F1 or F2, isolate the power supply and wait 20 s before opening the enclosure.
- Replace fuses with the correct part, see Fig 4.17 (AC power) and 4.18, page 29 (DC power).

4.7.1 AC Power Supply

### Fuse Supplier | Fuse Part Number
--- | ---
ABB | B20411
Bussmann | BK/ETF 250 mA
Wickmann | 19372 K250mA

*AC Fuse F1 250 mA Type T (see table below for suppliers)

- **Can be used as a Protective Earth (PE) if required by national standards**
- Power Supply Indicator LED
- Internal Earth Screws**
- External Earth Screw
- AC power via a suitable isolator and fuse
- >4 mm² (<10 AWG) Copper Wire

---

Fig. 4.17 AC Power Supply Connections
4.7.2 DC (and Low Voltage AC) Power Supply

Three configuration DIP switches are mounted on the transmitter backplane board. These are factory set as follows:

- Remote transmitter – all OFF
- Integral transmitter – SW3 ON

---

**Configuration DIP Switches**

<table>
<thead>
<tr>
<th>Configuration DIP Switches</th>
<th>DIP Switch Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1 – Read-only</td>
<td>SW1 – Read-only</td>
</tr>
<tr>
<td>SW2 – (Future Product)</td>
<td>SW2 – (Future Product)</td>
</tr>
<tr>
<td>SW3 – Internal Sensor Memory</td>
<td>SW3 – Internal Sensor Memory</td>
</tr>
</tbody>
</table>

---

**Fig. 4.18 DC (and Low Voltage AC) Power Supply Connections**

**Fig. 4.19 Configuration DIP Switches**
4.8 Refitting the Cartridge and Cover

**Warning.** Ensure the transmitter is isolated from power supplies before refitting the cover.

**Caution.** To avoid damaging the cartridge during refitting, do not overtighten the cartridge screws.

Referring to Fig. 4.20:

1. Confirm that the cartridge to be fitted is of the correct power supply type by checking the label A on the side of the cartridge:
   - AC cartridges have one black label on the cartridge side.
   - DC (and low voltage AC) cartridges have two red DC labels – one on the cartridge side and one on the cartridge rear plate.

2. Align the three cartridge screws B with the cartridge housing pillars and tighten the screws carefully until the cartridge is held in position.

3. If necessary, rotate the cartridge to the required orientation before refitting the cover – see Fig. 4.8, page 20 for details.

4. For high integrity/security installations, set DIP switch SW1 to the 'ON' (Read-only) position – see Fig. 4.19, page 29.

5. Align the transmitter cover with the housing and tighten the four cover screws C carefully.

6. For high integrity/security installations, fit anti-tamper seals to the security fixtures D.
5 Start-up and Operation

**Note.** This section describes the options available at the 'Easy Setup' menu. Refer to the Programming Manual (IM/WMP) for comprehensive details of all end-user menus and operating levels.

### 5.1 Navigating the Menus and Parameters

The four keys below the display are used to navigate through the menus and to execute all system commands and selections.

![Display and Keys](image)

**Fig. 5.1 Display and Keys**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Screen title at the current level/parameter</td>
</tr>
<tr>
<td>B</td>
<td>Main level icon</td>
</tr>
<tr>
<td>C</td>
<td>Menu level title</td>
</tr>
<tr>
<td>D</td>
<td>Prompt executed by pressing the key</td>
</tr>
<tr>
<td>E</td>
<td>Prompt executed by pressing the key</td>
</tr>
<tr>
<td>F</td>
<td>Left key – used for parameter navigation and to enter editable parameters</td>
</tr>
<tr>
<td>G</td>
<td>Up/Down keys – used to scroll through menu options and to increase/decrease values in editable parameters</td>
</tr>
<tr>
<td>H</td>
<td>Right key – used to accept/select parameter values/selections and exit sub-levels</td>
</tr>
</tbody>
</table>
5.2 Start-up Screens
At start-up, the type of screen displayed indicates the status of the system.

There are four common start-up screen types as follows:

System Start-up
At system start-up, a progress bar is displayed for the duration of the start-up period.

After this period, one of the four following screens is displayed according to the current status of the system.

No Sensor Connected
If no sensor is detected during start-up, an auto-recovery routine is run to look for the sensor. If no sensor is detected, this routine continues until it is stopped manually.

If 'Offline' is selected during auto-recovery (by pressing the key) the transmitter ceases to operate as a flowmeter and the following conditions apply at the transmitter:

- Plant and transmitter data can be configured.
- Sensor data cannot be configured.

Note. If this screen is displayed on an integral transmitter, check that DIP switch SW3 is in the 'ON' position (refer to Fig. 4.19, page 29).

Dual Sensor Memory
Integral and retrofit systems have the sensor memory mounted on the transmitter backplane board.

If two sensor memory types (integral and remote) are detected at start-up, the warning 'DUAL SENSOR MEMORY' is displayed.

To correct this condition, set DIP switch SW3 to the 'OFF' position (refer to Fig. 4.19, page 29).
Installation Changed

If the sensor data stored in the transmitter memory does not match the data of the connected sensor, the warning 'INSTALLATION CHANGED' is displayed.

The changed item(s) (transmitter or sensor) can be identified and data copied as follows:

Transmitter

Selecting this option copies plant and stack data from the sensor memory to the transmitter memory and loads the totalizer from the sensor memory.

It is used to make the following changes:

- Remote or integral cartridge change
- Remote Tx change
- New installation

Sensor

Selecting this option copies data from the transmitter memory to the sensor and loads the totalizer from the sensor memory.

It is used to make the following changes:

- Integral backplane change
- Sensor change
- Integral transmitter change

Process Display (Operator Page)

When the 'Process Display' (Operator Page) is displayed, normal operation is assumed.

To access menus at a permitted access level, press the key to display the 'Access Level' screen – see Section 5.3, page 34.
5.3 Security Levels and Password Access

At power-up, the 'Start-up Display' and 'Process Display' screens are activated in sequence.

<table>
<thead>
<tr>
<th>Note.</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Passwords at 'Standard' and 'Advanced' level can be set and changed by end-users.</td>
</tr>
<tr>
<td>- Access to the 'Service' level is reserved for factory-only personnel and not available to end-users.</td>
</tr>
</tbody>
</table>
| - To navigate from the 'Operator Page(s)' directly back to the menus, accept the default access level selection at the 'Access Level' screen and press the $key.

---

Operator Pages (Process Display)

When the start-up routine is completed, and if no changes have occurred since last start-up, the 'Process Display' (Operator Page) screen is displayed.

Press the $key to display the 'Access Level' screen where the level of user access is selected.

Access Level

Passwords are required for 'Standard' and 'Advanced' level access. Passwords are not required for 'Read Only' access. Select the permitted level of access and press the $key to display the 'Enter Password' screen (the 'Enter Password' screen is bypassed if 'Read Only' is selected).

Enter Password

Enter the password and press the $key to display menus available at the permitted access level.

<table>
<thead>
<tr>
<th>Note.</th>
</tr>
</thead>
</table>
| If a time-out occurs (5 minutes of no activity), enter the password again to access the menus.

---

5.3.1 Default Passwords

The WaterMaster transmitter is supplied with default passwords for access to 'Standard' and 'Advanced' level menus.

The two passwords are:

- 'Standard' access password: 2
- 'Advanced' access password: 3

Passwords can contain up to 5 characters and are not case sensitive.

<table>
<thead>
<tr>
<th>Note.</th>
</tr>
</thead>
</table>
| When allocating passwords, record a copy of each password and store in a safe location. It is not possible to interrogate the transmitter to 'recover' passwords once they have been set.

---
5.3.2 Entering Passwords
To select password characters and enter passwords:

1. Scroll to the 'Access Level' screen and select the required access level. Press the key to display the 'Enter Password' screen.
2. Use the and keys to scroll to and highlight the first password character to be selected.
3. Press the key to select the highlighted character (add it to the password set).
4. Use the and keys to highlight the next password character to be selected.
5. Repeat steps 2 to 4 until all characters have been added to the password.
6. Press the key to accept the password and display menus available at the requested access level.
5.4 Easy Setup

The 'Easy Setup' level is used to set the system up quickly and contains a series of options for users with 'Standard' and 'Advanced' access permission. Users with 'Read Only' access cannot make selections at this level.

To navigate the 'Easy Setup' parameters:

- Enter 'Easy Setup' by pressing the \[\text{Select}\] key at the 'Select' prompt.
- View and edit a parameter by pressing the \[\text{Edit}\] key at the 'Edit' prompt.
- Scroll parameter options by pressing the \[\text{Up}\] and \[\text{Down}\] keys (press and retain contact to scroll multiple options consecutively).
- Edit parameters by pressing the \[\text{Next}\] key at the 'Next' prompt to enter the text field and press the \[\text{Up}\] and \[\text{Down}\] keys to increase or decrease the value. Press the \[\text{OK}\] key at the 'OK' prompt to accept the new value.
- Accept a highlighted parameter by pressing the \[\text{OK}\] key at the 'OK' prompt.
- Exit the current parameter without changing the setting by pressing the \[\text{Cancel}\] key at the 'Cancel' prompt.
- Move to the next parameter by pressing the \[\text{Next}\] key at the 'Next' prompt.
- Exit 'Easy Setup' level by pressing the \[\text{Exit}\] key at the 'Exit' prompt on the 'Easy Setup' main level screen.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>[Default] Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>English, Deutsch, Français, Español, Italiano</td>
<td>[English] Selectable</td>
</tr>
<tr>
<td>Q (Flowrate) Unit</td>
<td>$m^3/s$, $m^3/min$, $m^3/h$, $m^3/d$, $ft^3/s$, $ft^3/min$, $ft^3/h$, $ft^3/d$, ugal/s, ugal/min, ugal/h, ugal/d, Mugal/d, igal/s, igal/min, igal/h, igal/d, bls/s, bls/min, bls/h, bls/d, hl/h, ml/s, ml/min, l/s, l/min, l/h, Ml/d,</td>
<td>[m³/h] Selectable</td>
</tr>
<tr>
<td>Qmax</td>
<td>Dependant on sensor size</td>
<td>[Factory set]</td>
</tr>
<tr>
<td>Volume &amp; Pulse Unit</td>
<td>$m^3$, l, ml, $ft^3$, hl, igal, ugal, bls, M, Mugal</td>
<td>Selectable</td>
</tr>
<tr>
<td>Pulse Width</td>
<td>0.09 to 2000.00 ms</td>
<td>[0.09 ms] Editable</td>
</tr>
<tr>
<td>Pulses / Unit</td>
<td>0.09 to 1,000,000.00 pulses/unit</td>
<td>[5] Editable</td>
</tr>
<tr>
<td>Damping</td>
<td>0.02 to 60 s</td>
<td>[3.00 s] Editable</td>
</tr>
<tr>
<td>Mains Frequency</td>
<td>50 or 60 Hz</td>
<td>[50 Hz] Selectable</td>
</tr>
</tbody>
</table>
6 Specification

Sensor – Functional Specification

Pressure limitations
As per flange rating

Temperature limitations

Ambient temperature
- Remote transmitter: -20 to 70 °C (-4 to 158 °F)
- Integral transmitter: -20 to 60 °C (-4 to 140 °F)

Process temperature: -6 to 70 °C (21 to 158 °F)

Environmental protection
Rating: IP68 (NEMA 6) to 10m (33 ft) depth with fully-potted terminal box

Conductivity
>5μS cm⁻¹

Transmitter mounting
Integral or remote

Electrical connections
20 mm glands
1/2 in NPT
20 mm armored glands

Sensor cable
ABB WaterMaster cable available in two forms – standard and armored
Maximum length 200 m (660 ft)

Sensor – Physical Specification

Wetted Parts

Lining material
Polypropylene (sizes DN40 to 200 [11/2 to 8 NB])
Elastomer (sizes DN250 to 2200 [10 to 84 NB])
WRAS listed
ACS and NSF61 approved (sizes DN40 to 200 [11/2 to 8 NB] pending)

Electrode material
Stainless steel 316 L
Hastelloy C
(Other electrode materials available on request)

Grounding rings
Not required

Protection plates
Not required

Installation conditions (recommended)
Upstream ≥ 5D
Downstream ≥ 2D

Pressure loss
<0.25 bar at Q3 (sizes DN40 to 200 [11/2 to 8 NB])
Negligible at Q3 (sizes DN250 to 2200 [10 to 84 NB])
Sensor – Physical Specification

Non-wetted Parts

Flange material
Carbon steel

Housing material
Carbon steel (sizes DN40 to 200 [1½ to 8 NB] and DN700 to 2200 [28 to 84 NB])
Plastic (sizes DN250 to 600 [10 to 24 NB])

Terminal box material
Polycarbonate or aluminium

Cable gland material
Plastic or brass

Transmitter – Functional Specification

Power supply

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Voltage Range</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mains</td>
<td>85 to 265 V AC</td>
<td>&lt;7 VA</td>
</tr>
<tr>
<td>Low voltage</td>
<td>24 V AC ±10% to 30%</td>
<td>&lt;7 VA</td>
</tr>
<tr>
<td>DC</td>
<td>24 V ±30%</td>
<td>&lt;0.4 A</td>
</tr>
</tbody>
</table>

Supply voltage fluctuations within the specified range have no effect on accuracy

Digital Outputs (3 off)

- Rating 30 V @ 220 mA, open collector
- Galvanically isolated
- Maximum output frequency 5250 Hz

1 off dedicated to Alarm/Logic, programmable function
2 off configurable to either Pulse/Frequency or Alarm/Logic function

Current output

- 4 to 20 mA or 4 to 12/20 mA
- Maximum loop resistance 750 Ω
- Galvanically isolated
- HART protocol Version 5.7
- Signal levels compliant with NAMUR NE 43 (3.8 to 20.5 mA)
- Low alarm 3.6 mA
- High alarm 21.8 mA

Additional accuracy

- ±0.1 % of reading
- Temperature coefficient Typically <±20 ppm/°C

Electrical connections

- 20 mm glands
- ½ in NPT
- 20 mm armored glands
Temperature limitations

  Ambient temperature          −20 to 60 °C (−4 to 140 °F)
  Temperature coefficient     Typically <±10 ppm/°C @ Vel ≥0.5 mls

Environmental protection

  Humidity: 0 to 100 %
  Rating: IP67 (NEMA 4X) to 1m (3.3 ft) depth

Tamper-Proof Security

  Write access prevented by internal switch combined with external security seals

Languages

  English
  French
  German
  Italian
  Spanish

Infrared service port

  USB adapter (accessory)
  USB 1.1. and 2.0 compatible
  Driver software for PC only
  Windows 2000, XP and Vista compatible

Housing material

  Power-coated aluminium glass window
7 Hazardous Area Protection & Conformance Certification

7.1 Hazardous Area Protection
FMc Class I, II, III Div 2, Groups A,B,C,D,F & G Ta=60°C for the transmitter and FMc Class I, II, III Div 2, Groups A,B,C,D,F & G Ta=70°C for the sensor (applied for).

7.2 Declaration of Conformance
Copies of CE and PED certification will be available on request.
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 and Strip Chart Recorders
- Paperless Recorders
- Process Indicators

Flexible Automation
- Industrial Robots and Robot Systems

Flow Measurement
- Electromagnetic Flowmeters
- Mass Flowmeters
- Turbine Flowmeters
- Wedge 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.

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

USA
ABB Inc.
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.