

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

**BS EN ISO 9001**



Cert. No. Q5907

**EN 29001 (ISO 9001)**



Lenno, Italy – Cert. No. 9/90A



Stonehouse, U.K.

## Use of Instructions



### **Warning.**

An instruction that draws attention to the risk of injury or death.



### **Note.**

Clarification of an instruction or additional information.



### **Caution.**

An instruction that draws attention to the risk of damage to the product, process or surroundings.



### **Information.**

Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

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 Marketing 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.

---

# CONTENTS

---

<b>1 INTRODUCTION .....</b>	<b>1</b>
<b>2 MECHANICAL INSTALLATION .....</b>	<b>2</b>
2.1 Unpacking .....	2
2.2 Installation Conditions .....	2
2.3 Mechanical Installation .....	4
2.3.1 Transmitters .....	4
<b>3 ELECTRICAL INSTALLATION .....</b>	<b>5</b>
3.1 Grounding .....	5
3.2 Connections .....	6
3.2.1 Sensor Terminal Box Connections (Remote Versions only) .....	6
3.2.2 Environmental Protection .....	6
3.2.3 Transmitter Connections .....	7
3.3 Input/Output Connections .....	10
3.3.1 Frequency Outputs .....	10
3.3.2 Alarm Interface .....	10
3.3.3 MIL Connector Input/Output Connections (Option) .....	11
3.3.4 MIL Connector Input/Output (Option) – AquaMag™ x10 Pulse Output Compatibility ..	12
3.3.5 ScanReader Interface (Option) .....	12
3.3.6 Local Computer Connection .....	13
3.3.7 Remote Computer Connection .....	14
3.3.8 Power Supply Connection ...	15
3.3.9 Pressure Transducer (Optional) .....	16
3.3.10 Environmental Protection .....	16
<b>4 START-UP AND OPERATION .....</b>	<b>17</b>
4.1 Connecting Batteries .....	17
4.2 Start-up .....	17
4.3 Display Activation .....	19
4.4 Replacing a Battery .....	19
4.4.1 Spares Kits. ....	20
4.4.2 Battery Changing Procedures .....	21
<b>APPENDIX – AQUAMASTER BLOCK DIAGRAM .....</b>	<b>24</b>

---

# 1 INTRODUCTION

---

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.

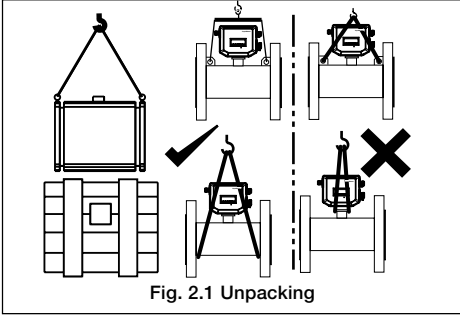


## Warning.

- Installation and maintenance must only be carried out by suitably trained personnel.
- All relevant sections of this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.

## 2 MECHANICAL INSTALLATION

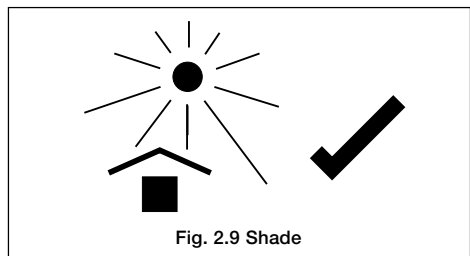
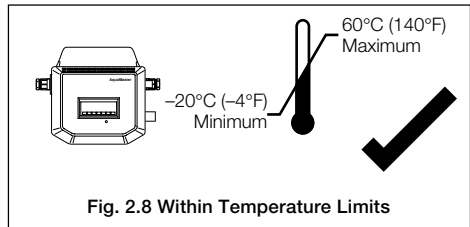
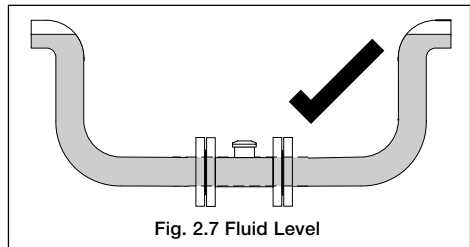
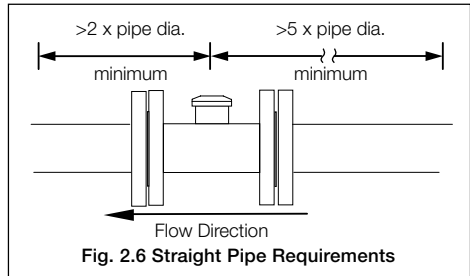
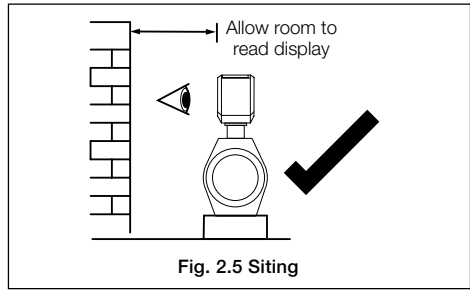
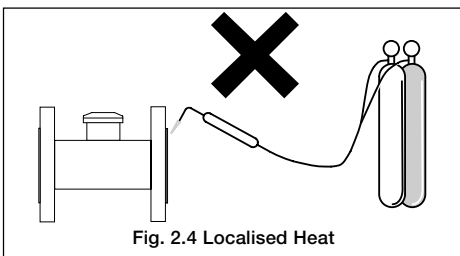
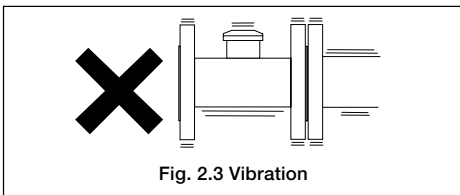
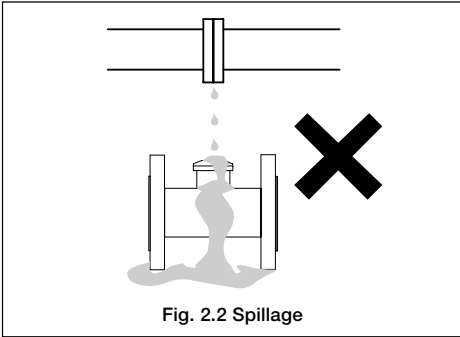
### 2.1 Unpacking

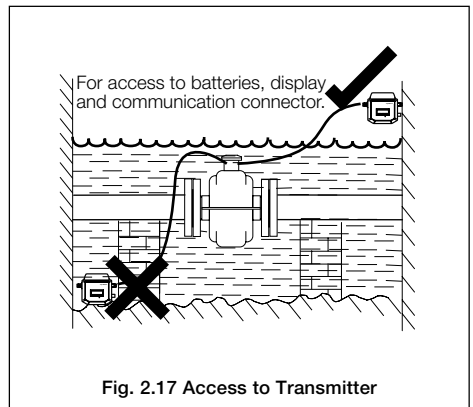
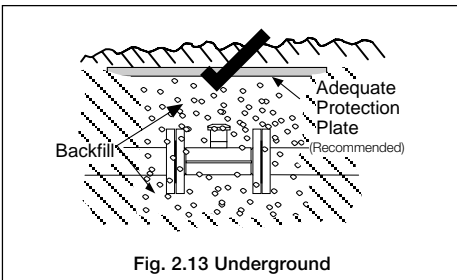
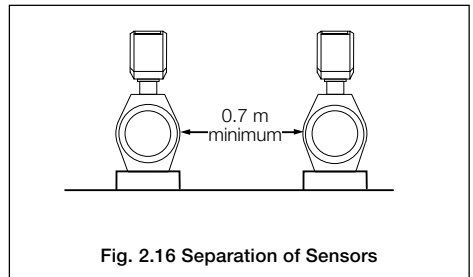
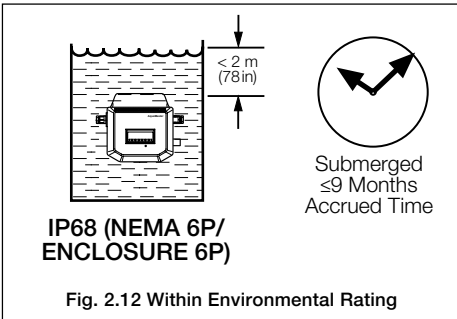
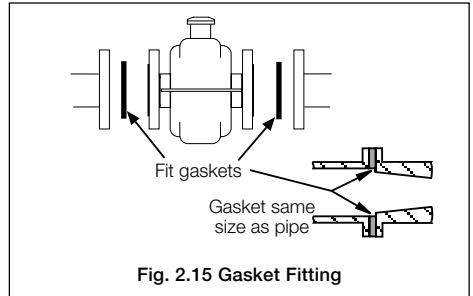
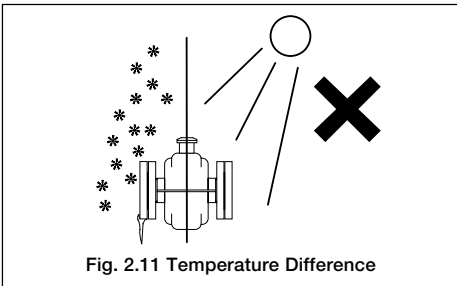
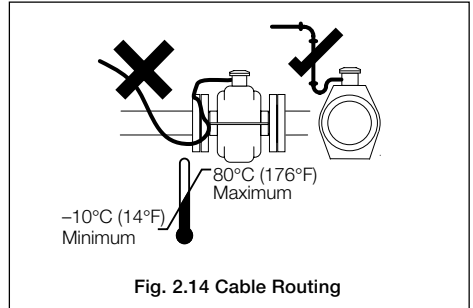
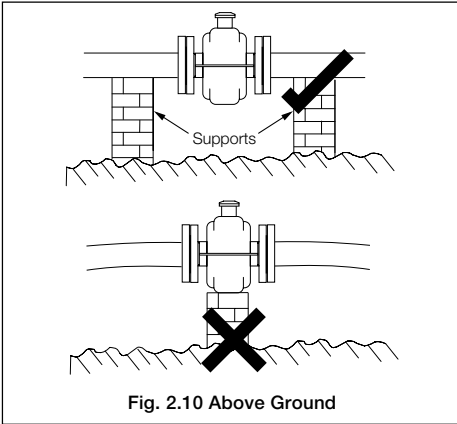


### 2.2 Installation Conditions



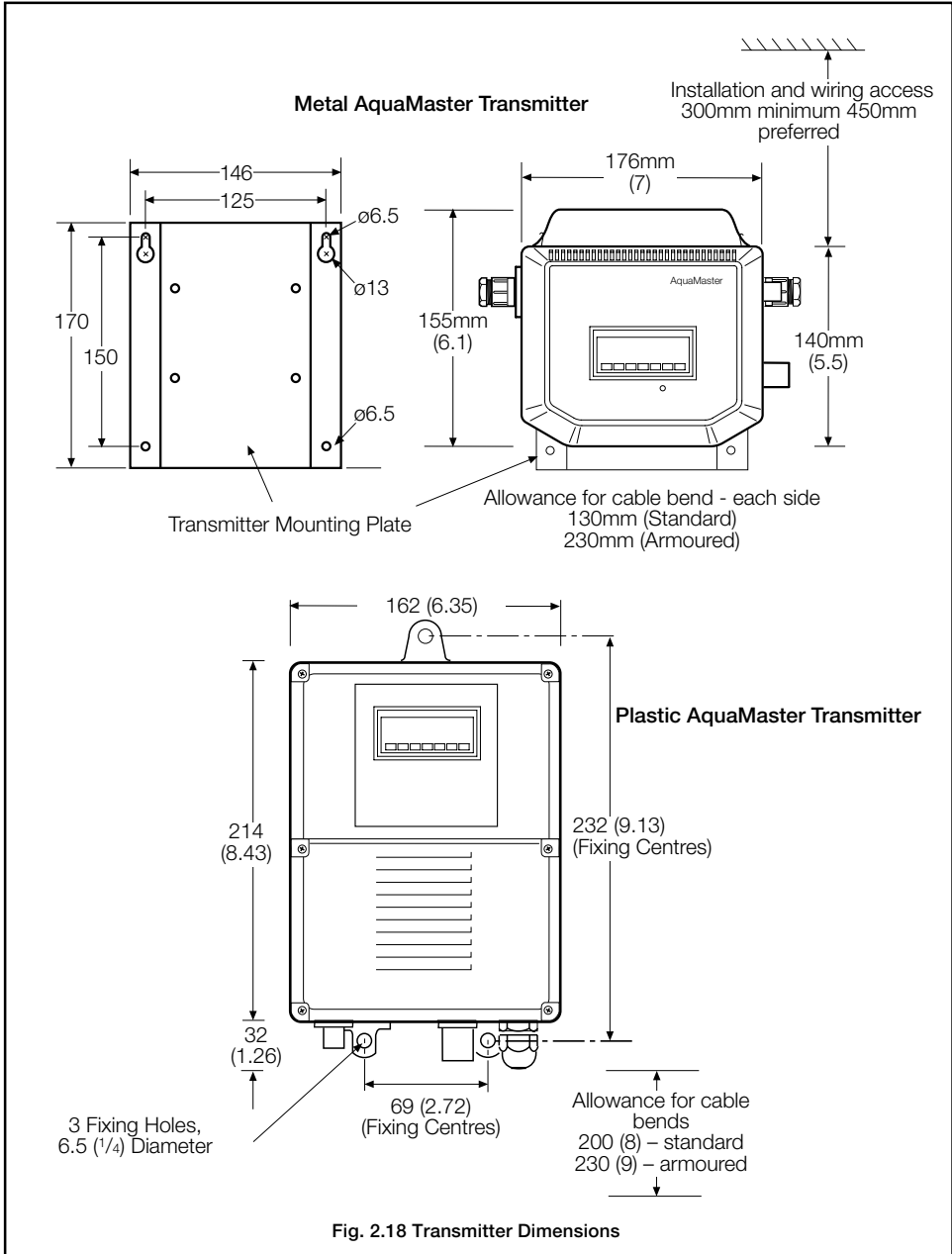
**Caution.** Do **NOT** exceed the maximum working pressure marked on the equipment.





2.3 Mechanical Installation

2.3.1 Transmitters

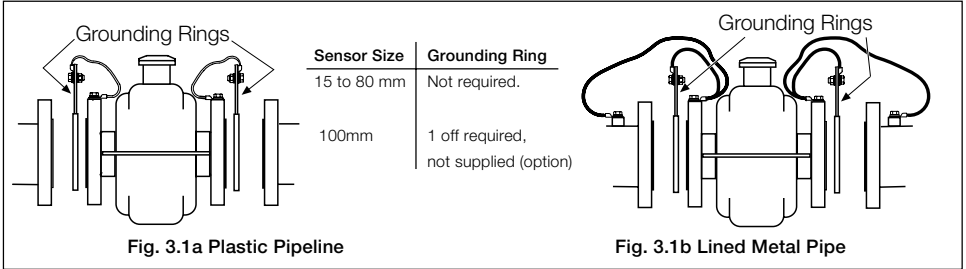


### 3 ELECTRICAL INSTALLATION

#### 3.1 Grounding – Figs. 3.1 to 3.4

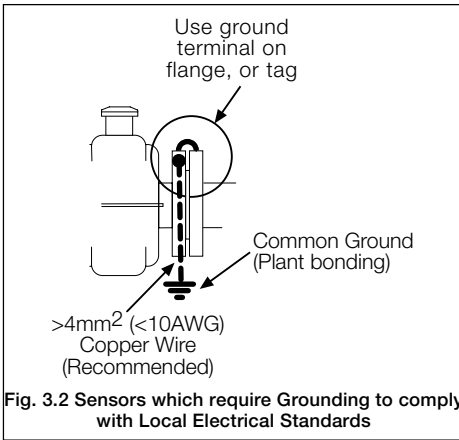


**Note.** The requirement is to electrically bond the sensor to the pipeline/fluid. Diagrams illustrate methods that meet the requirement.

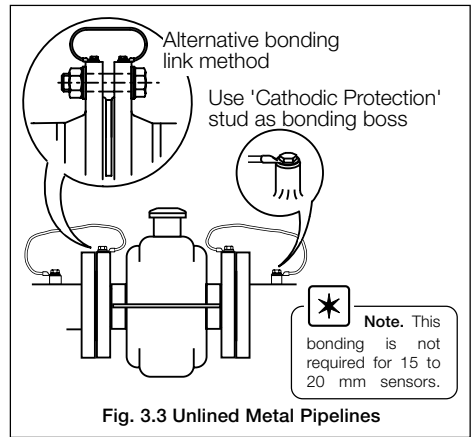


**Fig. 3.1a Plastic Pipeline**

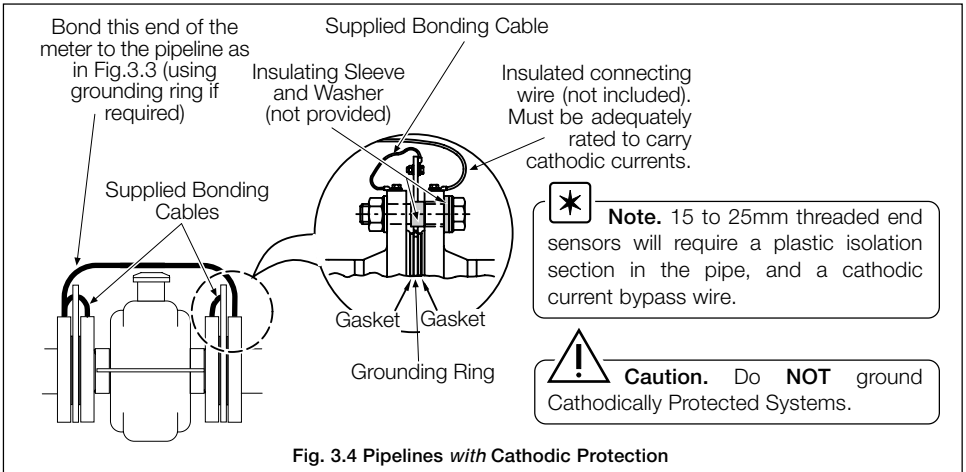
**Fig. 3.1b Lined Metal Pipe**



**Fig. 3.2 Sensors which require Grounding to comply with Local Electrical Standards**



**Fig. 3.3 Unlined Metal Pipelines**



**Fig. 3.4 Pipelines with Cathodic Protection**

## ...3 ELECTRICAL INSTALLATION

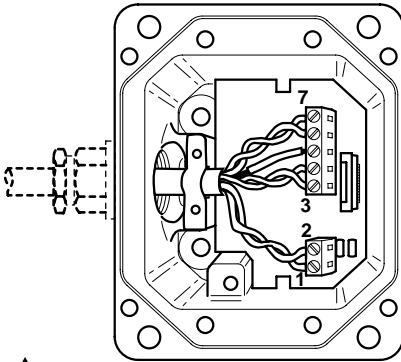
### 3.2 Connections

#### 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

##### ABB

- 7 Violet
- 6 Blue
- 5 Sleeved Grounds
- 4 Yellow
- 3 Orange

##### Belden 8777

- 7 White
- 6 Black
- 5 Sleeved Grounds
- 4 Red
- 3 Black

- 2 Red
- 1 Brown

- 2 Green
- 1 Black

#### Maximum Cable Lengths

- STT 4000Series: ≤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. 3.5 Sensor Terminal box Connections (Remote Version)

#### 3.2.2 Environmental Protection

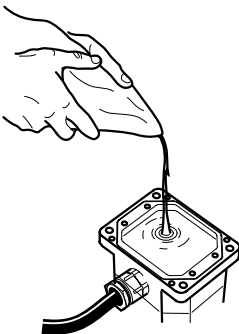


Fig. 3.6 Potting the Terminal Box



#### 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.

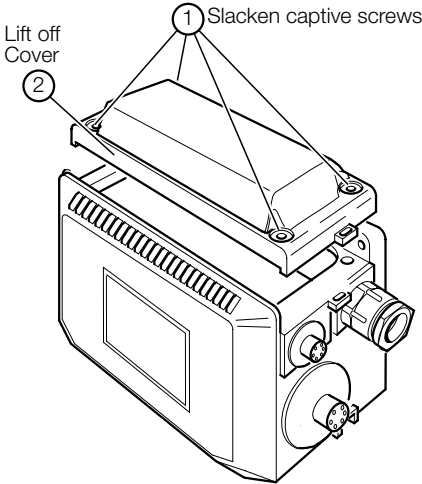


### 3.2.3 Transmitter Connections



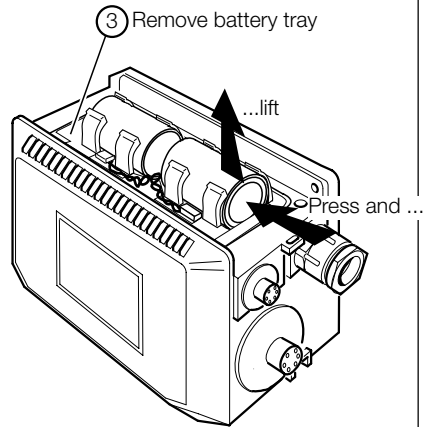
**Caution.**

- 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 finger-tight 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.



**Metal AquaMaster Transmitter**

**Note.** Batteries are mounted in the lid of previous style transmitters.



**Plastic AquaMaster Transmitter**

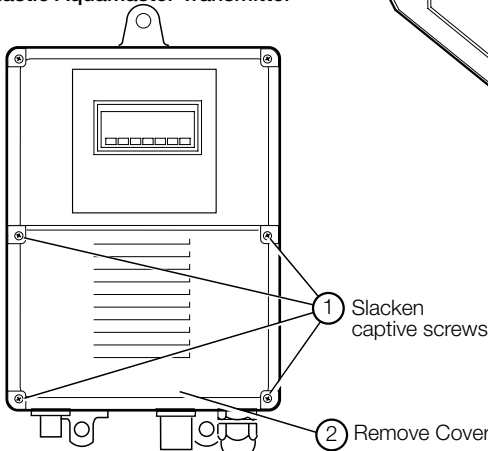
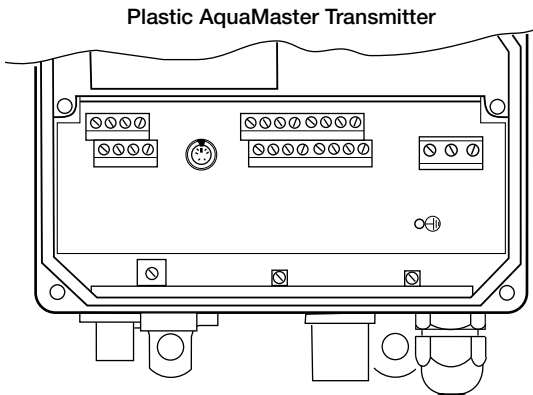
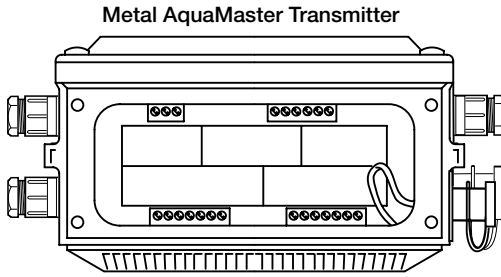


Fig. 3.7 Transmitter Connection Terminal Access

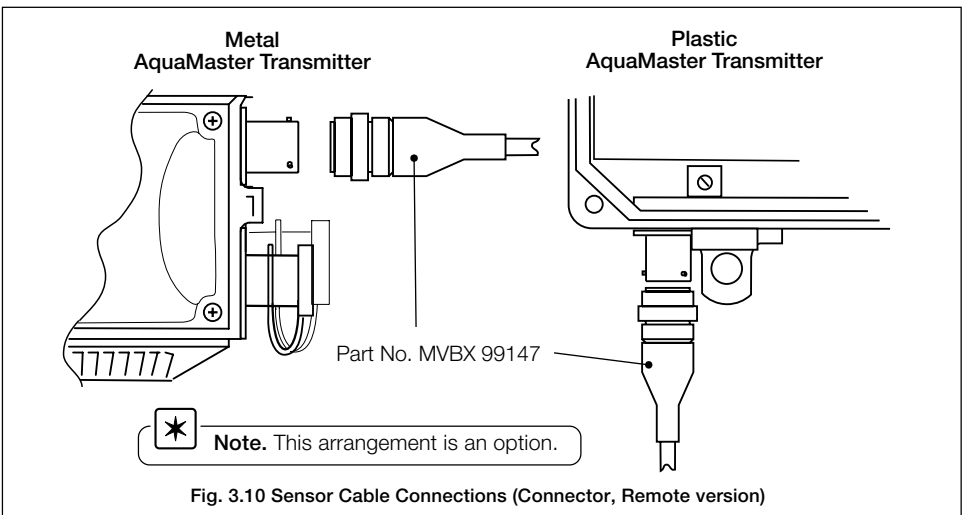
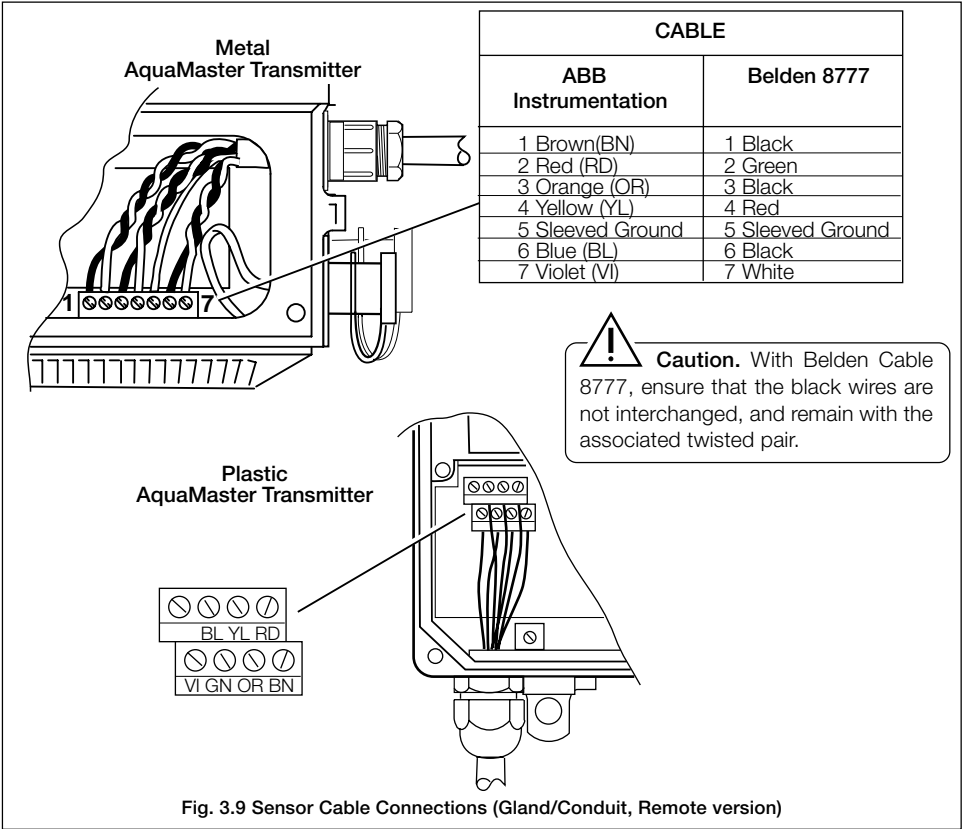


**Fig. 3.8 Transmitter Connections (Glands/Conduit Entry)**



**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.



### 3.3 Input/Output Connections



**Caution.**

- Refer to SPECIFICATION SHEET 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 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 ( $\pm 35$  V) from earth. Recommended protection for floating output systems is to wire "COM" to "0V".

#### 3.3.1 Frequency Outputs – Fig. 3.11

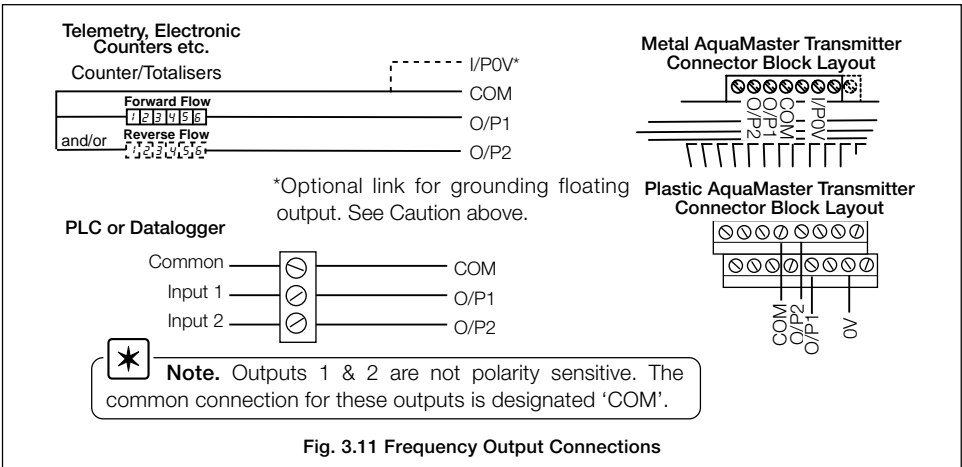


Fig. 3.11 Frequency Output Connections

#### 3.3.2 Alarm Interface – Fig. 3.12

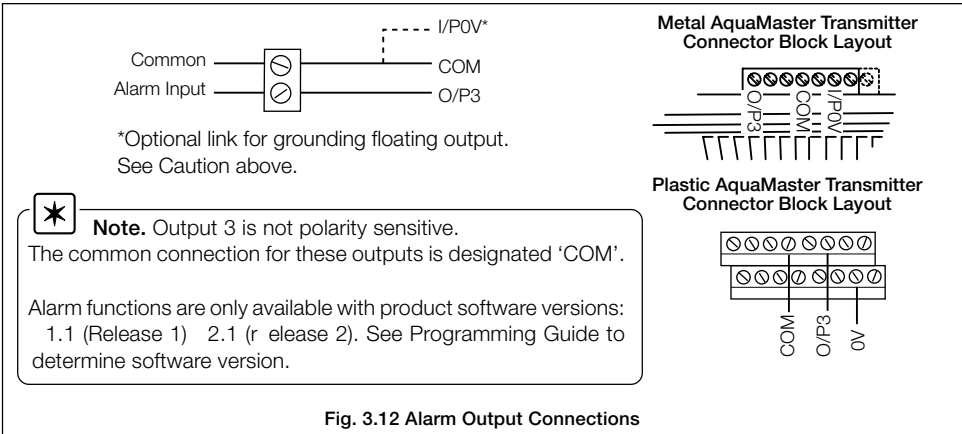


Fig. 3.12 Alarm Output Connections

3.3.3 MIL Connector Input/Output Connections (Option) – Fig. 3.13

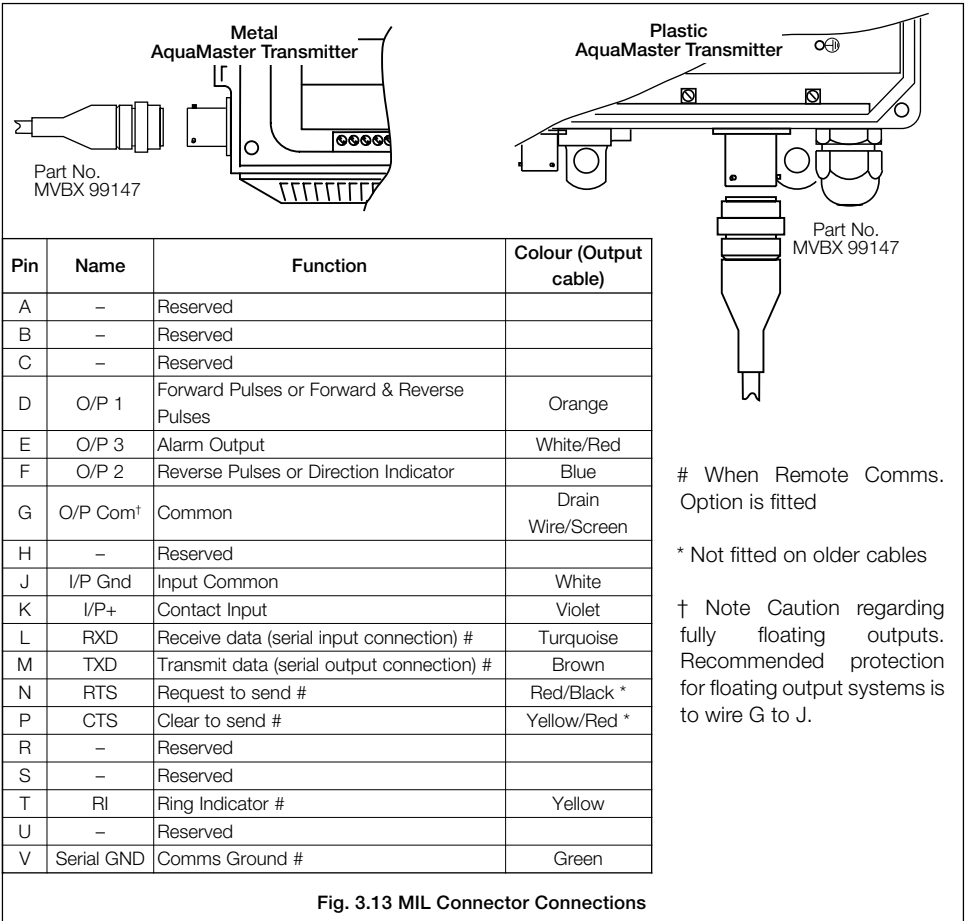


Fig. 3.13 MIL Connector Connections

### 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, as shown in Fig. 3.14.

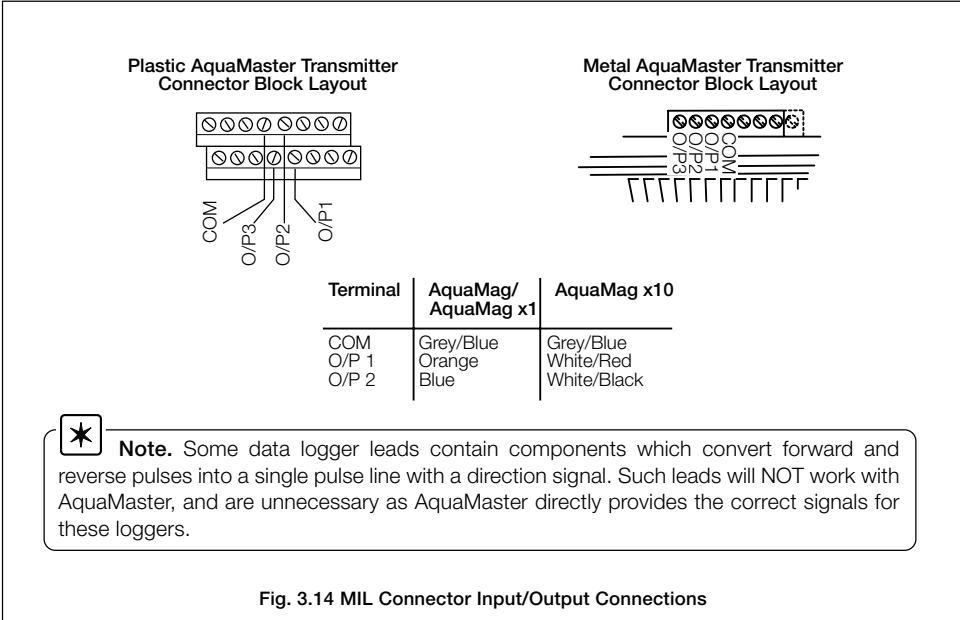


Fig. 3.14 MIL Connector Input/Output Connections

### 3.3.5 ScanReader Interface (Option) – Fig. 3.15

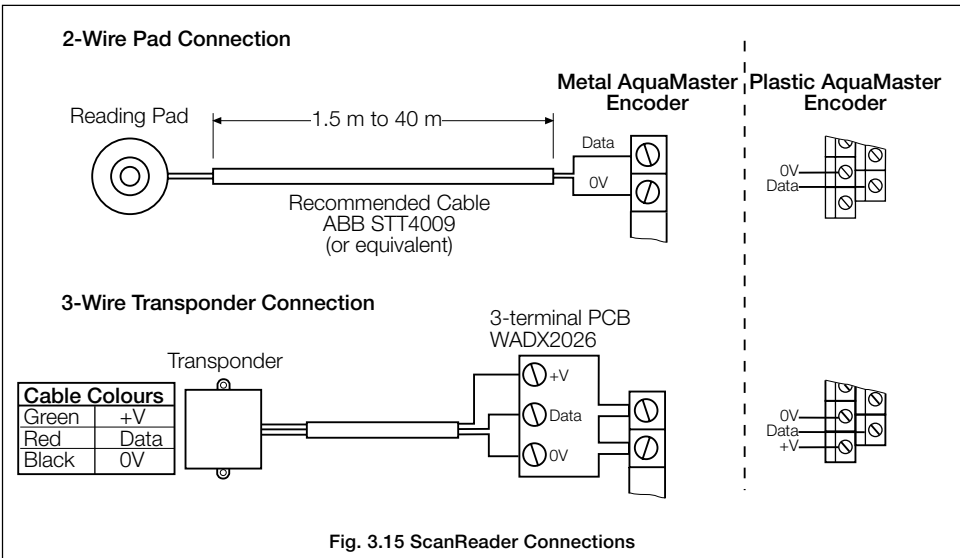
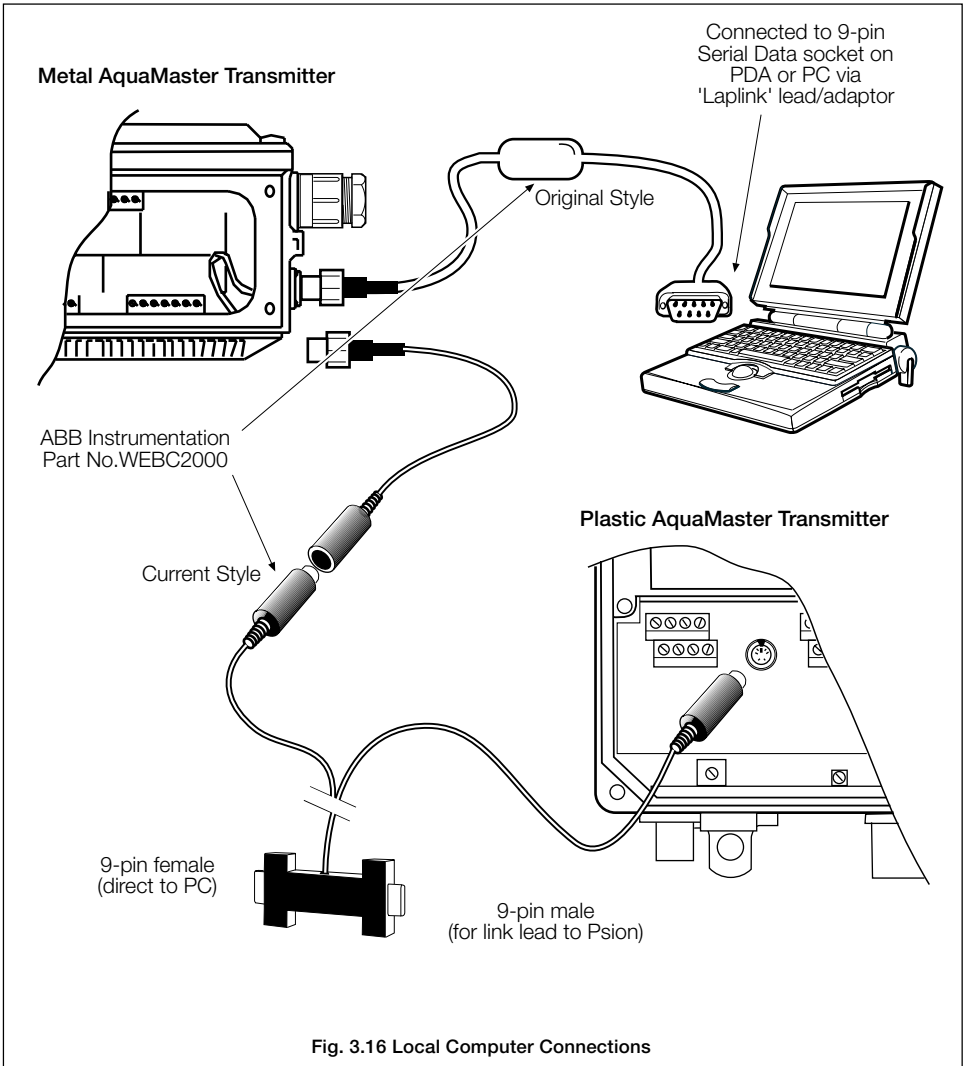


Fig. 3.15 ScanReader Connections

3.3.6 Local Computer Connection – Fig. 3.16



3.3.7 Remote Computer Connection – Fig. 3.17

AquaMaster Signal (DTE)	Modem (DCE) Plug *			Terminal/PC (DTE) Socket		
	Name	DB9	DB25	Name	DB9	DB25
RXD	RXD	2	3	TXD	3	2
TXD	TXD	3	2	RXD	2	3
RTS	RTS	7	4	CTS	8	5
CTS	CTS	8	5	RTS	7	4
RI	RI	9	22	–	NC	NC
GND	GND	5	7	GND	5	7

\* Also mates with PDA \*PC-Link cables

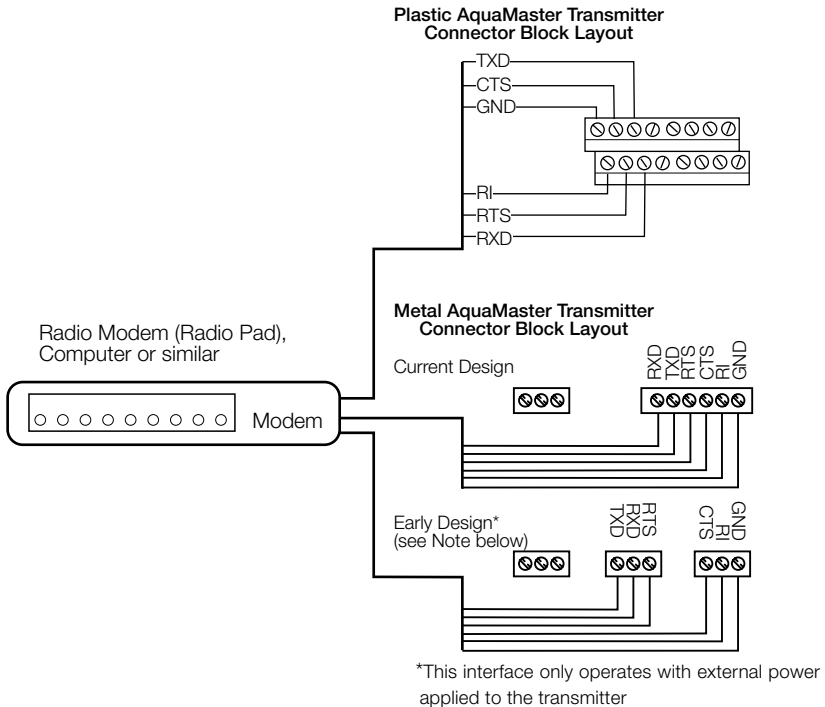


Fig. 3.17 RS232 Connections



3.3.8 Power Supply Connection – Fig. 3.18



**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 practises.

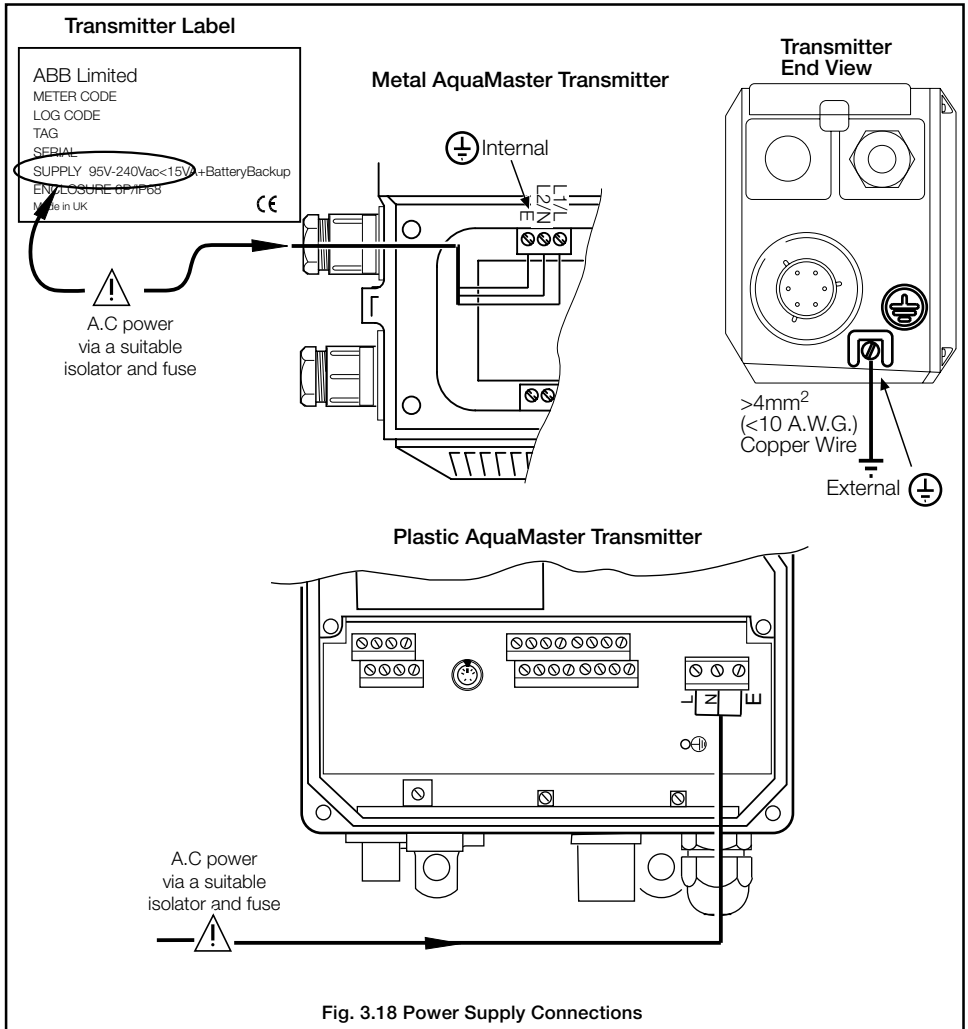
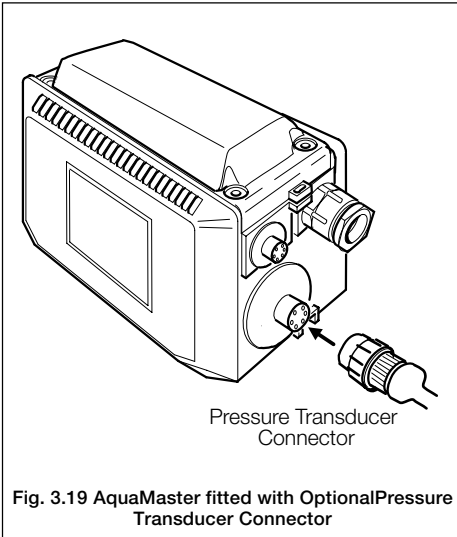


Fig. 3.18 Power Supply Connections

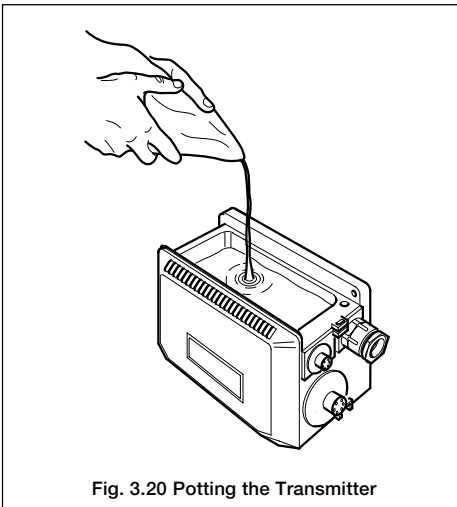
### 3.3.9 Pressure Transducer (Optional)

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



**Caution.** Ensure that only the pressure transducer supplied with the transmitter is used. 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, making allowance for inserting battery tray.
- Do not let potting material enter conduit, 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.
- Unit should be kept upright whilst potting sets (at least two hours).

---

## 4 START-UP AND OPERATION

---



### **Warning.**

- The lithium battery used in this device may present a risk of fire or chemical burn if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate.
- Replace battery with an ABB Instrumentation part only. Use of another battery may present a risk of fire or explosion
- Dispose of used battery promptly. Keep away from children.
- Dispose of used batteries in accordance with your local regulations.
- Where possible, recycle used batteries.
- Contact your 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 has been supplied with one or two batteries, but not connected. To connect see Fig. 4.1

### 4.2 Start-up

If the AquaMaster is received with a protective plastic film over the display window, remove this film before commencing normal operation.

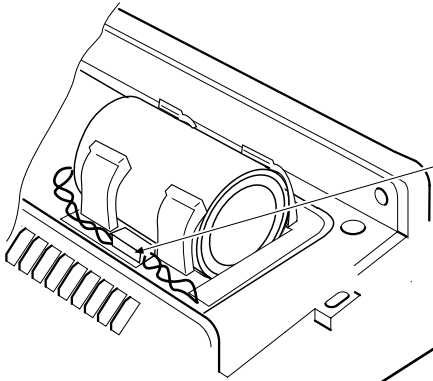
When the power is connected or the plastic film is removed, the AquaMaster performs a self test operation, and indicates a successful completion with "Pass" displayed.

If the display shows "Err 1", remove all power, check the sensor wiring and apply power.

If the display shows "Err 2 or 3", contact ABB Service.

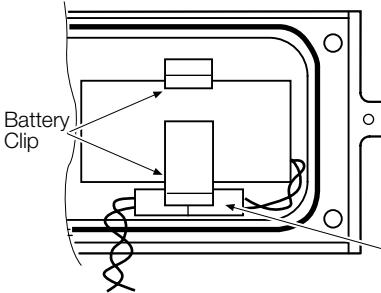
### Metal AquaMaster Transmitter

Current Model (top cover removed)



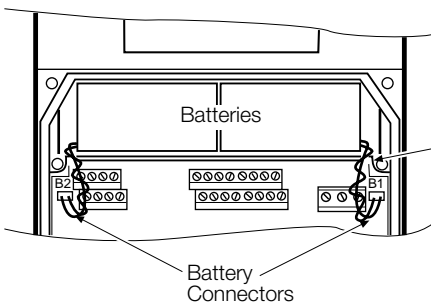
- 1) Remove the top cover of the transmitter – see Section 3.2.3.
- 2) Connect the battery or batteries to the wire connector(s) inside the top of the transmitter unit.
- 3) Push the connection(s) into the recess as shown ensuring that the wires are NOT lying on the mating surface.
- 4) Fit the cover and ensure the screws are tightened fully.

Previous Model (batteries in top cover)



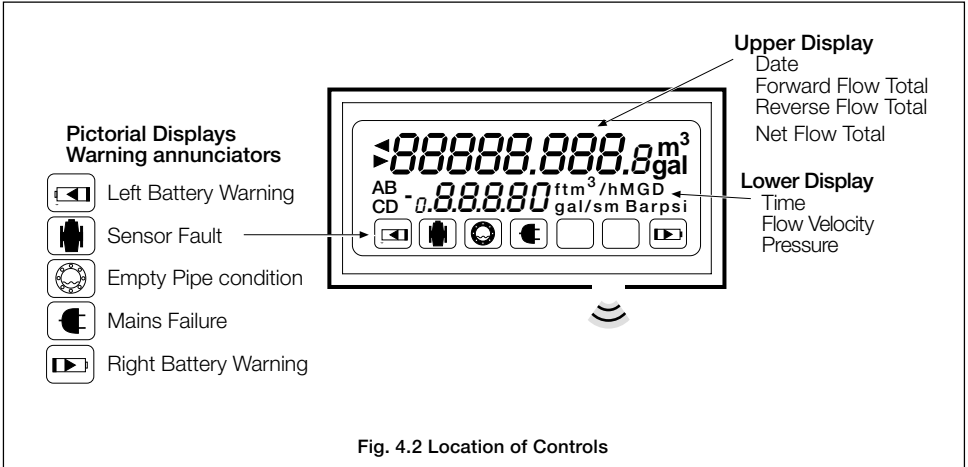
- 1) Remove the top cover of the transmitter – see Section 3.2.3.
- 2) Slide out the connector from behind the battery clip.
- 3) Connect the battery or batteries to the wire connector(s) inside the top of the transmitter unit.
- 4) Ensure that the end of the battery with the connection wires is pushed 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.

### Plastic AquaMaster Transmitter



- 1) Remove the front cover of the transmitter – see Section 3.2.3.
- 2) Connect the battery or batteries to the wire connector(s) to the terminals on the pcb.
- 3) Ensure that the battery wires are located in the slots indicated to avoid trapping them under the cover.
- 4) 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 a.c. power applied, the display is permanently activated.

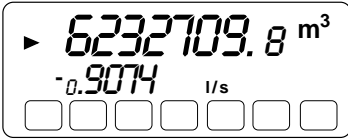


**Information.** For the use of local or remote serial communication and how to alter the displayed set of measurements, or instrument setup, see the Quick Reference Programming Guide.

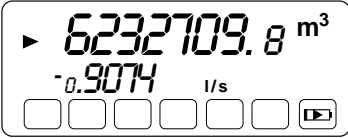
### 4.4 Replacing a Battery – Fig. 4.3



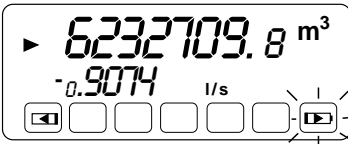
**Note.** Each battery must be connected to the cable from the same side of the termination area as the battery position in the battery holder or lid. For dual battery units, replace only the battery indicated by the battery legend described on the following page.



Normal Operation  
If both batteries are good, then no battery alarm is indicated.



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

##### Metal 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

##### Plastic Transmitter

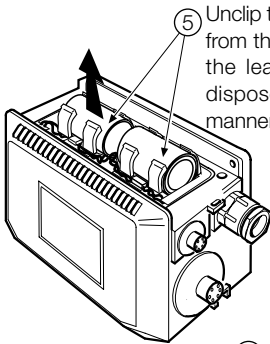
Replacement Battery ..... WABC 2001

## 4.4.2 Battery Changing Procedures – Figs 4.3, 4.4 and 4.5



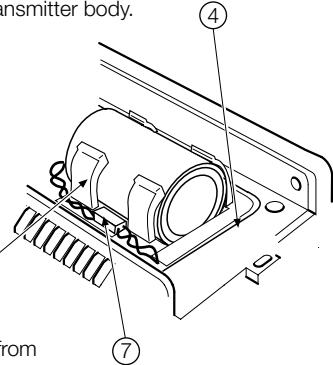
Note. Before changing batteries in a dirty environment it is recommended that the new 'O'-ring is fitted to the new lid (or cleaned lid from a previous installation) in a clean area, then re-sealed in a poly bag. This should minimise contamination by dirty fingers during the following procedures.

- ① If the transmitter is not fixed in any way arrange or hold it with the top cover uppermost.
- ② Using plain water, wash off any loose dirt from the case.
- ③ Remove the top cover of the transmitter – see Section 3.2.3 – to expose the batteries.



⑤ Unclip the appropriate battery from the tray and disconnect the lead at the connector; dispose of in the approved manner.

Using a “wet” tissue wipe the ‘O’-ring mating surface around the opening into the transmitter body.



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** – the removed lid assembly is to be washed under running water, using a brush if necessary, dried and sealed in a plastic bag for later re-use. Dispose of old ‘O’-ring seal.

Fig. 4.3 Battery Changing Procedure (current version of metal transmitter)

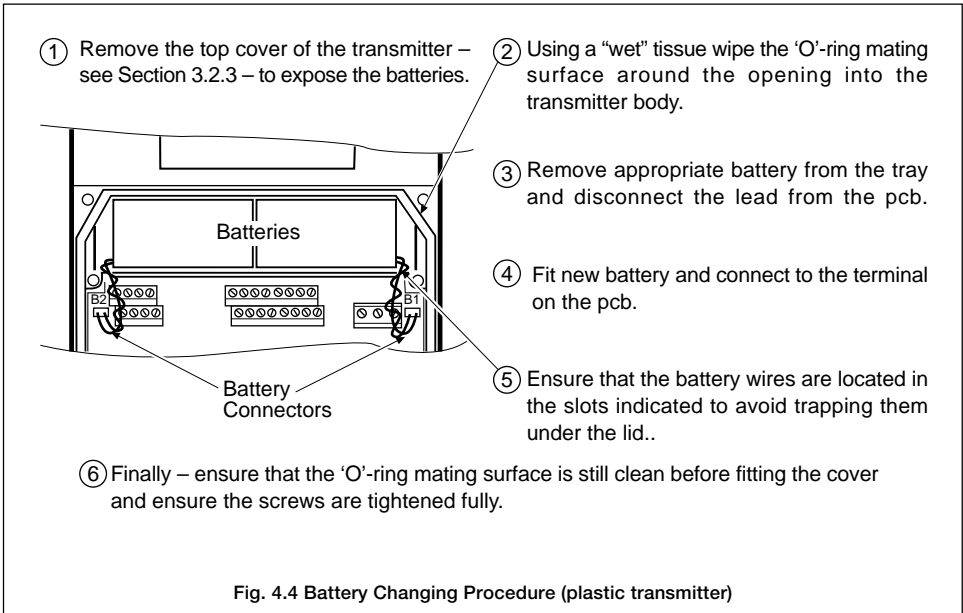
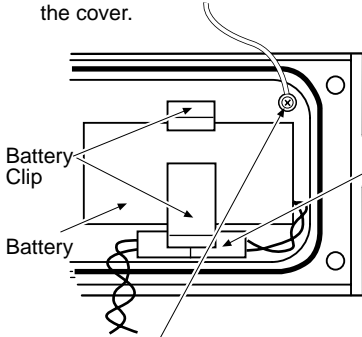


Fig. 4.4 Battery Changing Procedure (plastic transmitter)



- ① Use plain water to wash off any loose dirt from the transmitter. Small amounts of soiling may be removable with a “wet” tissue alone.
- ② Remove the top cover of the transmitter – see Section 3.2.3 to reveal the batteries clipped in the cover.



- ③ Using a “wet” tissue wipe the ‘O’ ring mating area around the opening into the transmitter body.
- ④ Slide out the connector from behind the battery clip of the flat battery 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 the new ‘O’-ring (supplied with the battery) into a new or recycled lid assembly.
- ⑨ Attach the the restraining 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.

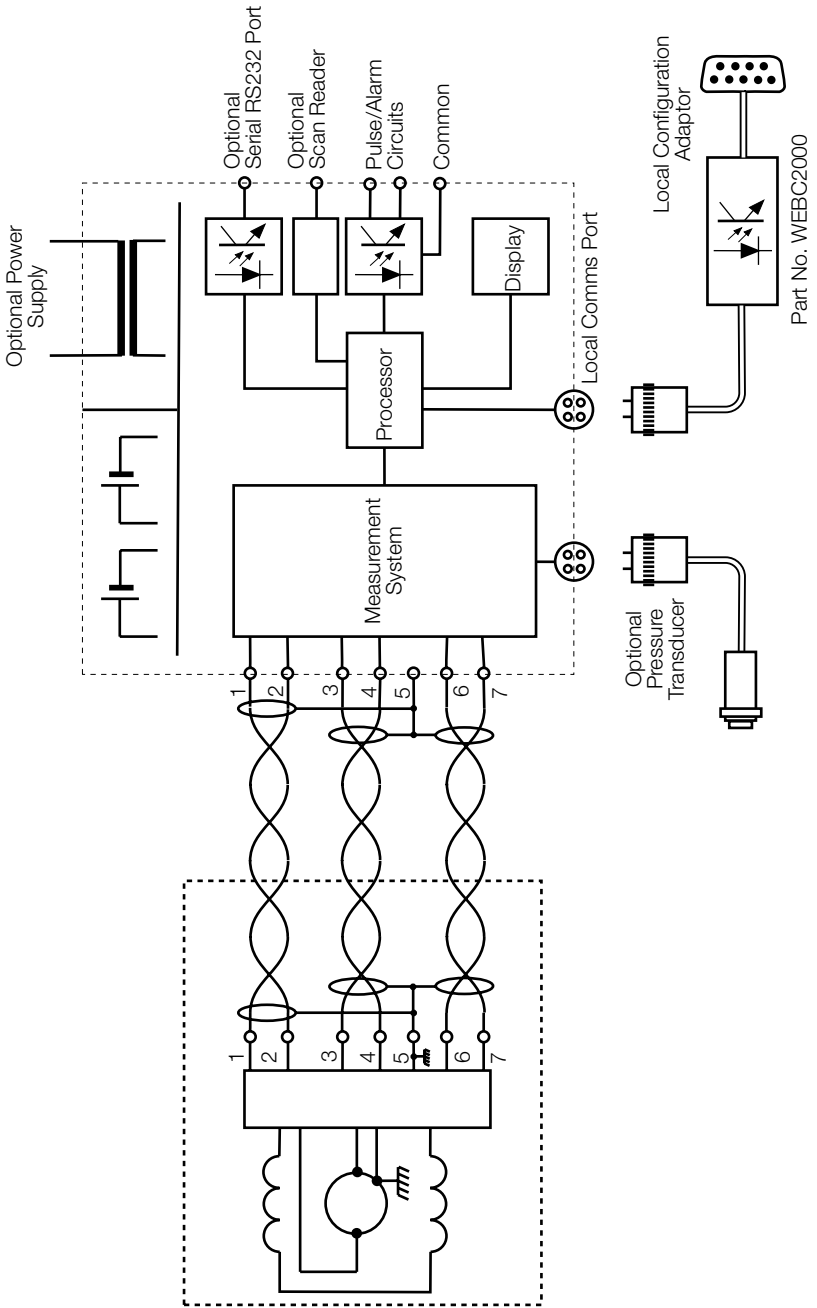
**Finally** – the removed lid assembly is to have the ‘O’-ring discarded, be washed under running water, using a brush if necessary, dried and sealed in a plastic bag for later re-use.

Fig. 4.5 Battery Changing Procedure (previous version of metal transmitter – domed cover)

# APPENDIX – AQUAMASTER BLOCK DIAGRAM

Sensor

Transmitter



# 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 Magnetic Flowmeters**
- **Mass Flow Meters**
- **Turbine Flowmeters**
- **Wedge Flow Elements**

### Marine Systems & Turbochargers

- **Electrical Systems**
- **Marine Equipment**
- **Offshore Retrofit and Referbishment**

### 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 our Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

### United Kingdom

ABB Ltd  
Tel: +44 (0)1453 826 661  
Fax: +44 (0)1453 827 856

### United States of America

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 operating and maintenance records relating to the alleged faulty unit.

---

**ABB** has Sales & Customer Support expertise  
in over 100 countries worldwide

[www.abb.com](http://www.abb.com)

The Company's policy is one of continuous product  
improvement and the right is reserved to modify the  
information contained herein without notice.

© ABB 2002

Printed in UK (04.02)



**ABB Limited**  
Stonehouse,  
Gloucestershire. GL10 3TA  
UK  
Tel: +44 (0)1453 826 661  
Fax: +44 (0)1453 827 856

**ABB Inc.**  
125 E. County Line Road  
Warminster, PA 18974  
USA  
Tel: +1 215 674 6000  
Fax: +1 215 674 7183