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:

<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>

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.

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.
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1 INTRODUCTION

1.1 Documentation – Fig. 1.1
Documentation for the EXFG Oxygen Analyzer System is shown in Fig. 1.1.

1.2 Certification
The EXFG Interface Electronics Unit is certified to the ATEX Directive and CENELEC Standards BS EN50014 and BS EN50018 flameproof II 2G EExd IIB T6 (Tem ~20°C to +50°C). Baseefa03ATEX0385.

Certificates are available for inspection and/or copies can be obtained on application to the Company.
1.3 System Overview – Fig. 1.2
The EXFG Interface Electronics Unit is an explosion-proof, wall mounted device designed specifically for use with EXFG Oxygen Probes.

It can be sited in an area in which explosive atmospheres are present in quantities that require special precautions for the construction and use of electrical apparatus.

The unit provides temperature control for the EXFG probe heater and incorporates a fail-safe over-temperature trip. It also converts millivolt signals received from the EXFG probe zirconia cell (25% to 0.25% O₂) into a 4 to 20mA output signal for retransmission to a 4680 or 4685 Series Transmitter. In addition, the unit is fitted with over-temperature and under-temperature alarm contacts which relate to fault conditions.

Span/zero calibration controls located at the side of the casting can be accessed and adjusted without infringing the flameproof integrity of the unit.
2.1 Checking the Code Number – Fig. 2.1

Fig. 2.1 Checking the Code Number

<table>
<thead>
<tr>
<th>EXFG Interface Electronics Unit</th>
<th>EXFG/ 0 0 0 X X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface Electronics</td>
<td>None</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For EXFG Probe</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mains Supply</td>
<td>None</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>230V 50/60Hz</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>115V 50/60Hz</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarms</td>
<td>None</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>None 4600 (if used without 4600 Transmitter)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4600 (Logic)</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table. 2.1 Code Number Interpretation
3 MECHANICAL INSTALLATION

3.1 Siting Requirements – Fig. 3.1

Caution. When siting the EXFG Interface Electronics Unit choose a location free from excessive vibration.

A – Maximum Distance of EXFG Interface Electronics Unit to EXFG Probe

Maximum distance
19.69 to 32.81 ft (6 to 10 m)
with single or dual conduit

Up to 328.1 ft (100 m)
with special dual cables

B – Within Temperature Limits

C – Within Environmental Limits

Caution. 50°C is the certified maximum ambient temperature.

Fig. 3.1 Siting Requirements
3 MECHANICAL INSTALLATION

3.2 Mounting – Figs. 3.2 and 3.3

Warning. Installation and repair must be carried out only by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment.

Fig. 3.2 Overall Dimensions

Note. Mount the unit at a level which allows easy access for connection and disconnection.

Fig. 3.3 Mounting

Fix instrument to wall using suitable fixings (3/8in. or M12)

Mark fixing centers (see Fig. 3.2)

Drill suitable holes

Dimensions in inches (mm)

<table>
<thead>
<tr>
<th>Component</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>14.96 (380)</td>
</tr>
<tr>
<td>Height</td>
<td>14.37 (365)</td>
</tr>
<tr>
<td>Min. Distance (for door clearance)</td>
<td>11.81 (300)</td>
</tr>
<tr>
<td>Width</td>
<td>6.02 (153)</td>
</tr>
<tr>
<td>Height</td>
<td>6.69 (170)</td>
</tr>
<tr>
<td>Width</td>
<td>16.14 (410)</td>
</tr>
<tr>
<td>Height</td>
<td>2.56 (65)</td>
</tr>
</tbody>
</table>

3M ELECTRICAL INSTALLATION
## ELECTRICAL INSTALLATION

**Warning.** Before making any connections, ensure that the power supply, any high voltage-operated control circuits and high common mode voltages are switched off.

### 4.1 Conduit/Cable and Gland Specifications

#### 4.1.1 EXFG Interface Electronics Unit to EXFG Probe

Refer to Table 4.1 for conduit, special cable and gland specifications.

**Caution.**
- Installation and repair must be carried out only by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment. The specifications detailed in Table 4.1 are for system electrical requirements only.
- All cables must be suitable for flameproof ‘d’ type enclosures for mechanical construction.
- EEx d glands used on the Interface Electronics Unit must be of the EEx d ‘Barrier Gland’ type (because the enclosure is over 2 litres volume).

<table>
<thead>
<tr>
<th>Single Conduit – combined signal and power</th>
<th>Dual Conduit – separate signal and power</th>
<th>Dual Cable – separate signal and power</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19.68ft (6m) length</strong></td>
<td><strong>19.68ft (6m) length</strong></td>
<td><strong>Length to order</strong></td>
</tr>
<tr>
<td><strong>or</strong></td>
<td><strong>and</strong></td>
<td><strong>(maximum length 328.1ft (100m))</strong></td>
</tr>
<tr>
<td><strong>32.81ft (10m) length</strong></td>
<td><strong>and</strong></td>
<td><strong>Special signal cable, steel-wire</strong></td>
</tr>
<tr>
<td><strong>Signal/power conduit assembly fitted</strong></td>
<td><strong>and</strong></td>
<td><strong>armoured (part no. EXFG/0194)</strong></td>
</tr>
<tr>
<td>with M25 flameproof certified EEx d barrier</td>
<td><strong>and</strong></td>
<td><strong>supplied with M25 flameproof</strong></td>
</tr>
<tr>
<td>glands each end (part no. EXFG/0060)</td>
<td><strong>and</strong></td>
<td><strong>certified EEx d barrier glands for</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and</strong></td>
<td><strong>each end (part no. B11274)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and</strong></td>
<td><strong>special power cable, steel-wire</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and</strong></td>
<td><strong>armoured and screened, 3-core</strong></td>
</tr>
<tr>
<td></td>
<td><strong>and</strong></td>
<td><strong>(part no. EXFG/0195)</strong></td>
</tr>
</tbody>
</table>

| **Table 4.1 Conduit/Cable and Gland Specifications – EXFG Interface Electronics Unit to EXFG Probe** |
4 ELECTRICAL INSTALLATION...

...4.1 Conduit/Cable and Gland Specifications

4.1.2 EXFG Interface Electronics Unit to EXFG 4600 Transmitter Unit
Refer to Table 4.2 for cable and gland specifications.

<table>
<thead>
<tr>
<th>Gland Specification</th>
<th>Cable Specifications</th>
<th>Gland Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20 flameproof certified EEx d barrier gland (not supplied)</td>
<td><strong>Signal cable</strong> (not supplied) 16/0.2, 4-core copper, overall screened, flameproof (two pairs) Max. loop resistance 750Ω</td>
<td>4680 M20 Uncertified (fitted) 4685 No gland required</td>
</tr>
<tr>
<td>M20 flameproof certified EEx d barrier gland (not supplied)</td>
<td><strong>Mains power cable</strong> (not supplied) 3-core, 0.5mm² copper (min.)</td>
<td>4680 M20 Uncertified (fitted) 4685 No gland required</td>
</tr>
</tbody>
</table>

Table 4.2 Cable and Gland Specifications – EXFG Interface Electronics Unit to EXFG 4600 Transmitter

4.2 Access to Terminals – Fig. 4.1

1. Remove flange bolts (16)
2. Insert bolt from underside of flange and screw in to break the seal between the lid and the base
3. Open casing

Warning. The flange faces are flameproof paths and must be free from damage. If faces are damaged in any way the EXFG Interface Electronics Unit must be returned to the manufacturer for replacement.

Fig. 4.1 Access to Terminals
4.3 Conduit and Cable Connections

4.3.1 Single Conduit Connections – Fig. 4.2

- Temperature Alarm Output (M20) and \( \text{O}_2 \) 4 to 20mA Retransmission (M20)
- Mains Power Entry (M20) Not Used (blanked during manufacture)

Fig. 4.2 Single Conduit Connections
...4.3 Conduit and Cable Connections

4.3.2 Dual Conduit Connections – Fig. 4.3

Fig. 4.3 Dual Conduit Connections
...4 ELECTRICAL INSTALLATION

...4.3 Conduit and Cable Connections

4.3.3 Dual Cable Connections – Fig. 4.4

Warning. When fitting barrier glands, the manufacturers instructions must be followed. Screens on cables must be isolated from the gland metalwork and chassis earth.

Fig. 4.4 Dual Cable Connections
4.4 Selecting the Mains Voltage – Fig. 4.5

**Warning.** Ensure both mains voltage switches are set to the same voltage before power is applied to the EXFG Interface Electronics Unit – see Section 4.6.

**Fig. 4.5 Selecting the Mains Voltage**
4.5 Re-sealing the Cover after Connection – Fig. 4.6

**Warning.** Ensure all electrical connections have been made correctly before re-sealing and securing the cover. Do not switch on mains power until the cover has been re-sealed and secured with all 16 (SS Grade A2–70) cover bolts tightened evenly to approx. 10Nm. There should be no visible gap in the joint between lid and base. If in doubt check that a 0.2mm feeler gauge does not fit into the gap at any point.

![Fig. 4.6 Securing the Cover](image)

1. Remove bolt from rear of casing
2. Apply sufficient grease (part no. CG5317) to flange to form a weatherproof seal
3. Close casing
4. Ensure grease is visible around entire flange, then remove excess grease and use a feeler gauge to ensure the gap between the lid and the base is less than 0.15mm
5. Insert and tighten flange bolts to approximately 10Nm

4.6 Switching Power On – Fig. 4.7

**Information.**
- Ensure the Probe has been installed and connected correctly – see Sections 3 and 4 of the EXFG Probe Guide.
- If a 4680 or 4685 Transmitter is used, ensure that it has been installed and connected correctly as detailed in Sections 3 and 4 of the EXFG Transmitter Guide. Before switching the transmitter on, refer to Section 5 for Controls and Displays and Section 6 for Operation (Instrument Start-up).
- The EXFG Interface Electronics Unit has no independent ON/OFF switch and must be powered-up from the mains switch.

After switching power on, allow the probe to operate for a minimum of 1 hour to reach the correct operating temperature.

In normal operation, the power LED illuminates within approximately 15 minutes of switching on (according to the local temperature at the probe heater) and the heater LED flashes evenly.

![Fig. 4.7 LED Indication of Operating Temperature](image)
5 SYSTEM CALIBRATION

It is recommended that an air-based calibration is carried out when commissioning the system. An additional span calibration provides the ultimate system accuracy, but is only necessary if span errors are suspected. The EXFG system can be calibrated in situ by applying test gasses to the test gas inlet on the EXFG Probe and adjusting the reading on the EXFG Interface Electronics Unit display to give the correct output.

Note. It is not necessary to open the flameproof enclosure on either the EXFG Probe or the EXFG Interface electronics Unit to calibrate the system.

To calibrate the EXFG system carry out the following procedures:

a) Switch power on and allow the probe to operate for a minimum of 1 hour to stabilize – see Fig.4.7.
b) Remove the cover plate to allow access to the Zero and Span controls – see Fig. 5.1.
c) Carry out an air based calibration as described in Fig. 5.2.
d) If necessary, carry out a span gas calibration as described in Fig. 5.3.
e) Refit the cover plate over the Zero and Span controls – see Fig. 5.1.
f) Refit the test gas blanking plug – see Fig. 5.2. The test gas blanking plug must be a gas tight fit to prevent incorrect probe readings.

5.1 Tools Required
Medium crosshead screwdriver
M4 Allen key
Zero (air) and span test gases (3000cc/min flow rate)

5.2 Access to the Zero and Span Controls – Fig. 5.1
Adjust the Zero Screw… …until the correct value is displayed

Fig. 5.2 Zero Calibration

1. Remove the dust cap, attach the test gas pipe and apply air at 3000cc/min for 10 minutes or remove the probe from the duct and allow it to stabilize in normal atmosphere

2. Adjust the Zero Screw… …until the correct value is displayed

Fig. 5.3 Span Calibration

1. Attach the test gas pipe and apply span gas within the range 0.25% to 5% O₂ in N₂ at 3000cc/min, for 10 minutes

2. Adjust the Span Screw… …until the correct value is displayed

- refer to Fig. 5.4 to obtain the correct value of output v. test gas O₂%
Formula
\[ mA\text{ out} = [8(1.397940009 - \log(O_2\%))] + 4 \]

Fig. 5.4 Displayed Value (mA) v. Percentage Oxygen
### 6 FAULT FINDING

**Warning. Never** open the EXFG Interface Electronics Unit in the presence of a flammable atmosphere.

<table>
<thead>
<tr>
<th>LED INDICATION</th>
<th>CONDITION</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="LED OFF" /></td>
<td>a) Normal operation (approximately 15 minutes after power up).</td>
<td>N/A</td>
</tr>
<tr>
<td><img src="image" alt="LED ON" /></td>
<td>a) Over temperature trip has operated.</td>
<td>Check trip thermocouple for open circuit and control thermocouple wiring for short circuit or reversed connections. When fault has been rectified, press and release RESET button – see Fig. 5.1.</td>
</tr>
<tr>
<td><img src="image" alt="LED FLASHING" /></td>
<td>a) Cell under temperature.</td>
<td>If heater l.e.d. is lit continuously (not flashing) 15 minutes after switching on, check for faults c), d) and e).</td>
</tr>
<tr>
<td><img src="image" alt="LED FLASHING" /></td>
<td>b) Probe heater still warming up.</td>
<td>If heater l.e.d. is lit continuously (not flashing) 15 minutes after switching on, check for faults c), d) and e).</td>
</tr>
<tr>
<td><img src="image" alt="LED FLASHING" /></td>
<td>c) Heater open circuit.</td>
<td>Replace heater assembly – see Section 8.5*.</td>
</tr>
<tr>
<td><img src="image" alt="LED FLASHING" /></td>
<td>d) Thermocouple leads shorted or reversed.</td>
<td>Check thermocouple wiring – see Section 7.1.1*.</td>
</tr>
<tr>
<td><img src="image" alt="LED FLASHING" /></td>
<td>e) Heater loop resistance too high.</td>
<td>Check the heater extension lead resistance by removing the heater wires at the H H terminals and measuring the resistance across the wires which should be between 22Ω and 28Ω – see Section 4.3.</td>
</tr>
<tr>
<td><img src="image" alt="LED OFF" /></td>
<td>a) Control thermocouple open circuit if l.e.d fails to flash after 15 minutes of power on.</td>
<td>Check control thermocouple for open circuit – see Section 7.1.1*.</td>
</tr>
<tr>
<td><img src="image" alt="LED OFF" /></td>
<td>a) No power to heater.</td>
<td>Check probe control thermocouple for open circuit – see Section 7.1.1*. Check fuse in heater circuit – see Fig. 4.5. Check wiring (open circuit). Check heater loop resistance – see step e) above.</td>
</tr>
<tr>
<td><img src="image" alt="LED OFF" /></td>
<td>a) No power to Interface Electronics Unit.</td>
<td>Check mains power supply.</td>
</tr>
<tr>
<td><img src="image" alt="LED OFF" /></td>
<td>b) Failure of internal power supply.</td>
<td>Check operation of Interface Electronics Unit power supply.</td>
</tr>
</tbody>
</table>

*Refer to the EXFG Probe Guide for section references.

### Key to LED Indication

- LED OFF
- LED ON
- LED FLASHING (EVENLY)

**Fig. 6.1 Fault Finding Chart**
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 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.
Tel: +1 (0) 775 850 4800
Fax: +1 (0) 775 850 4808

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.