



Searchline Excel Cross-Duct Infrared Gas Detector

Safety

Ensure that you read and understand these instructions **BEFORE** operating the equipment.

Please pay particular attention to the Safety Warnings.

WARNINGS

1. The Searchline Excel gas detector is certified for and intended for use in potentially hazardous areas. Install and use the Searchline Excel gas detector in accordance with the latest regulations.
2. **For installations in Europe, the Code of Practice SELECTION, INSTALLATION AND MAINTENANCE OF ELECTRICAL APPARATUS FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES should be strictly observed. General recommendations are given in EN 60079-14:2008 & IEC 60079-14:2007. Refer to EN 60079-29-2:2007 & IEC 60079-29-2:2007 in Europe or the appropriate local or national regulations.**
3. For installations in North America, the national Electrical Code (NFPA 70 - 1990) or later issues should be strictly observed.
4. Elsewhere, the appropriate local or national regulations should be used.
5. The Searchline Excel gas detector must be properly earthed to protect against electrical shock and minimise electrical interference. For electrical installation design considerations refer to Section 3.
6. Operators must be fully aware of the action to be taken if the gas concentration exceeds an alarm level.
7. Dismantling or repair of equipment should be carried out in the safe area only.
8. Test gases may be toxic and/or combustible. Refer to Material Safety Sheets for appropriate warnings.
9. Do not drill holes in any housing as this will invalidate the explosion protection.
10. In order to maintain electrical safety, the unit must not be operated in atmospheres with more than 21% oxygen.
11. Ensure that the bolts which secure flameproof enclosures are fully tightened. The securing bolts used are made from a special certified grade of steel. Only bolts supplied by Honeywell Analytics should be fitted for this purpose.
12. Do not open the enclosure in the presence of an explosive atmosphere.
13. The transmitter unit contains high voltages when operational. These are discharged when the unit is removed from its enclosure.
14. The conduit and cable glands fitted to Searchline Excel should not be modified. If, however, it becomes necessary to make modifications they must comply with the relevant national Codes of Practice.
15. The optical energy emitted by the Searchline Excel is less than 20mW/mm².
16. Searchline Excel Cross-Duct should only be used to detect gas mixtures where methane is the main constituent (>70%) and the balance is C₂ - C₆ hydrocarbons.

Safety

Cautions

1. Use only approved parts and accessories with the Searchline Excel gas detector.
2. To maintain safety standards, commissioning and regular maintenance of the Searchline Excel gas detector should only be performed by qualified personnel.

Important Notices

1. Honeywell Analytics can take no responsibility for installation and/or use of its equipment if this is not done in accordance with the appropriate issue and/or amendment of the manual.
2. The user of this manual should ensure that it is appropriate in all details to the exact equipment to be installed and/or operated. If in doubt, the user should contact Honeywell Analytics for advice.
3. Effect of explosive atmosphere on materials.

Searchline Excel is made from materials which exhibit good resistance to corrosive and solvative substances. The Exd enclosures are made from 316 stainless steel and the explosion protected windows are made from toughened soda lime glass. Honeywell Analytics are not aware of any significant effects of explosive atmospheres upon these materials. Contact Honeywell Analytics or one of their agents for specific queries.

Special Conditions of Use

In order to comply with the ATEX / IECEx Certification, the following special conditions of use must be adhered to: -

1. The integral supply cables must be mechanically protected and terminated in a suitable terminal or junction facility.
2. The cover fixing screws shall be stainless steel grade 12.9 minimum, grade A2-80 or grade A4-80 (only use Honeywell supplied screws)

Every effort has been made to ensure the accuracy of this document, however, Honeywell Analytics can assume no responsibility for any errors or omissions in this document or their consequences.

Honeywell Analytics would greatly appreciate being informed of any errors or omissions that may be found in the content of this document.

For information not covered in this document, or if there is a requirement to send comments/corrections about this document, please contact Honeywell Analytics using the contact details given on the back page.

Honeywell Analytics reserve the right to change or revise the information supplied in this document without notice and without obligation to notify any person or organisation of such revision or change. If information is required that does not appear in this document, contact the local distributor/agent or Honeywell Analytics.

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1. Introduction

The Searchline Excel Cross-Duct Gas Detector is an open path infrared gas detector for methane.

It will detect hydrocarbon gas mixtures where methane is the main constituent (>70% of the composition with the balance being C₂ - C₆ hydrocarbons). For other gas mixtures please contact Honeywell Analytics for advice.

Searchline Excel Cross-Duct is specifically designed for use where the path length is between 0.5 and 5 metres for applications such as air intake ducts. It consists of a Transmitter and Receiver unit, and a separate Heated Reflector Panel.

The detector operates on the principle of infrared (IR) absorption. If a cloud of methane gas is present, part of the infrared light is absorbed by the gas, causing a reduction in the signal received that is proportional to the amount of gas in the beam.

The detector output signal is proportional to 0-100%LEL (Lower Explosive Limit) of gas.

Searchline Excel Cross-Duct is suitable for use in **Zone 1 or 2 hazardous areas (International) and for Class 1 Division 1 or 2 area applications (North America).**

Note: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.

This handbook consists of the following parts:

- **Chapter 1** **Introduction**
- **Chapter 2** **Overview**
A brief description of the system components
- **Chapter 3** **Installation and Operation**
Important information regarding detector positioning, electrical connections, power supply requirements, mechanical installation and commissioning, including an installation check list
- **Chapter 4** **Maintenance**
Regular maintenance requirements and instructions for functional checks
- **Chapter 5** **Problem Solving**
- **Chapter 6** **Specifications**
- **Chapter 7** **Certification**
- **Appendix A** **Handheld Interrogator**
- **Appendix B** **Glossary**
- **Appendix C** **Accessories & Spare Parts**

1. Introduction

Information notices

The types of information notices used throughout this handbook are as follows:



WARNING

Indicates hazardous or unsafe practice that could result in severe injury or death to personnel.

Caution: Indicates hazardous or unsafe practice which could result in minor injury to personnel, or product or property damage.

Note: Provides useful/helpful/additional information.

If more information beyond the scope of this technical handbook is required please contact Honeywell Analytics.

Associated Documents

DX100 Series Termination Units Technical Handbook Part No: 2104M0701

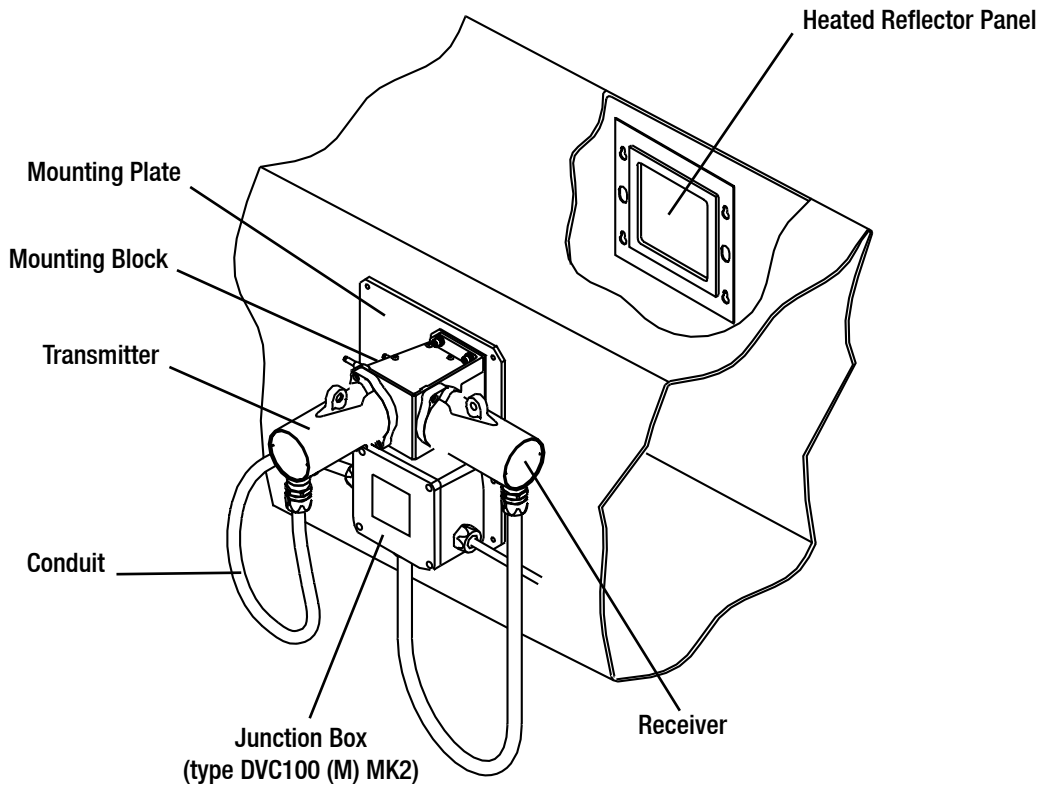
DVC100(M) MK2 Termination Unit Quick Start Guide Part No: 2104M0409

2. Overview

2.1 Introduction

Searchline Excel Cross-Duct gas detector consists of a Transmitter and Receiver unit, and a Heated Reflector Panel. The Transmitter and Receiver unit generates and detects the infrared beam. The Heated Reflector Panel is mounted at the opposite side of the duct to reflect the beam from the Transmitter back to the Receiver.

Note: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.



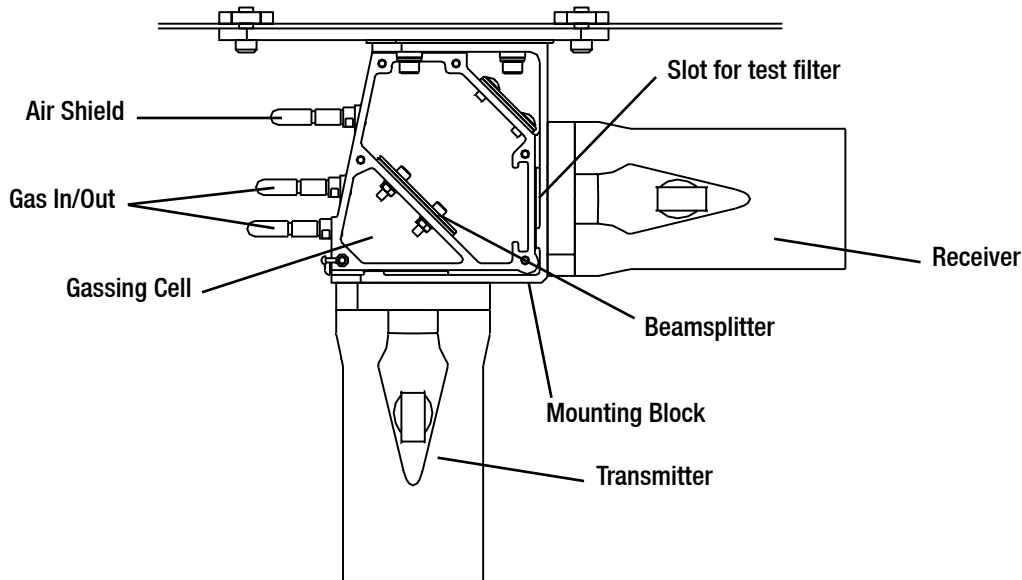
There are two ranges of Searchline Excel Cross-Duct gas detector. These are:

Version	Path Length (m)	Path Length (ft)	Certification
Short Range:	0.5 — 2.5m	(20in — 8ft)	ATEX, IECEx, UL
Long Range:	2.5 — 5m	(8ft — 15ft)	ATEX, IECEx

The long range gas detector uses a larger Reflector Panel than the short range version.

2. Overview

2.2 Transmitter and Receiver Unit



2.2.1 Transmitter

The Transmitter produces an intense, collimated infrared beam from a Xenon arc flashlamp. The Transmitter window is heated to minimise condensation and frosting. During particularly cold operating conditions, the heating of the Transmitter window is increased to turbo levels. The turbo mode can be disabled if not required.

Electrical connections to the Transmitter are made via wires which run through the protective, flexible conduit. There are three Transmitter wires, red (+24V), black (0V) and green/yellow (GND).

Note: The infrared beam is invisible and eye safe.

2.2.2 Receiver

The Receiver collects infrared radiation from the Transmitter and performs measurements to enable methane gas in the beam path to be detected.

The Receiver output signal is 4 - 20mA available as a source or sink option. The output is calibrated for a range of 0 to 100% LEL methane.

*Note: The detector uses the duct width in the calculation of gas reading – it is essential that this is specified correctly during installation (See **Appendix B.2** for the explanation of how open path gas detectors measure gas concentration)*

Output signal levels below 4mA are used to indicate Fault (0mA), Inhibit (2mA), Beam Blocked (2.5mA) and Low Signal (3mA).

The Receiver communicates with the SHC1 Handheld Interrogator using an RS485 output. The SHC1 is used to perform commissioning, functional testing and diagnostic procedures.

The Receiver window is heated to minimise condensation and frosting.

Electrical connections to the Receiver are made via wires which run through the protective flexible conduit. There are six Receiver wires, red (+24V), black (0V), white (4 - 20mA), orange (RS485 A), blue (RS485 B) and green/yellow (GND).

2. Overview

2.2.3 Mounting Block

The Transmitter and Receiver are factory aligned and fixed to a mounting block. They should not be disassembled. The mounting block has a top cover which can be removed to clean the Transmitter and Receiver windows. Inside the mounting block there is an angled window (the beamsplitter) which reflects the beam into the Receiver.

The mounting block has two features for functional checking - a gas cell and a slot for plastic test filters.

2.3 Heated Reflector Panel

The Heated Reflector Panel consists of a retro-reflector sealed in a double-glazed unit, with an integral heater to minimise condensation and frosting.

The Reflector Panel should be mounted opposite the Transmitter and Receiver unit, and perpendicular to the beam.

The Reflector requires a nominal 24V power supply.

3. Installation and Operation

3.1 Introduction

WARNING

The national Code of Practice regarding selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres must be complied with at all times.

Before designing or specifying an installation for Searchline Excel Cross-Duct, it is strongly recommended that the installation design authority reads all of this chapter and considers how the information and recommendations provided can be applied to their installation(s).

If you have any queries concerning your installation design, contact Honeywell Analytics or your local agents.

Honeywell Analytics is committed to ensuring that customers achieve reliable operation of their Searchline Excel Cross-Duct Gas Detectors. For this reason, Searchline Excel Cross-Duct should only be installed by fully trained personnel (trained by Honeywell Analytics or a Honeywell Analytics authorised trainer).

This training will provide the installer with a clear understanding of the Searchline Excel Cross-Duct product and the associated accessories and tools. It will also provide familiarity with the installation, alignment and commissioning procedures, plus installation assessment skills to identify potential problem areas.

For each installation, an installation check sheet should be completed and returned to Honeywell Analytics or their agents. Details of this check sheet are given at the end of this chapter.

Note: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.

3.2 Siting and Mounting

3.2.1 General

When designing an installation for a Searchline Excel Cross-Duct gas detector it is important to give consideration to where it is to be located, what potential sources of problems may be encountered in this location and how the unit is to be mounted and supported.

Caution: The Transmitter, Receiver and Reflector Panel units have heated windows to minimise condensation and frosting. However, partial obscuration of the Reflector and in particular liquid water condensation on the Reflector can cause negative drift, which has the effect of raising the alarm threshold. Wherever possible protect the Searchline Excel Cross-Duct from dirt and condensation by mounting well inside the duct and ideally downstream of filters/dampers.

3.2.2 Location for Best Coverage

The placement of gas detectors should be determined following the advice of experts having specialist knowledge of gas dispersion, experts having knowledge of the process plant system and equipment involved, safety and engineering personnel. The agreement reached on the location of detectors should be recorded.

3. Installation and Operation

3.2.3 Location to Maximise Reliability and Availability

For optimum performance, take care to avoid areas where the units may be adversely affected by the following:

Vibration - Angular vibration of the structure to which Excel units are attached should be kept to less than $\pm 0.5^\circ$. Where possible, avoid locations where high levels of vibration will be directly induced into the mounting structure. If close proximity to significant sources of vibration is unavoidable, take steps to reduce coupling of this vibration and maximise the rigidity of the mounting structure.

Mounting Rigidity - The duct wall thickness should be suitable to maintain rigidity of the Searchline Excel Cross-Duct mounting to within $\pm 0.5^\circ$.

Intense Heat - Excel is certified and specified for operation in environments up to $+65^\circ\text{C}$. If sources of intense heat (flarestacks, intense sunlight, etc.) are present, a sunshade (Part No: 2104B2323) or similar shield should be fitted to the unit to protect it from excessive heating.

Sources of Heavy Contamination - Avoid locations where high levels of contaminants will persistently be blown onto the unit windows. Potential sources of heavy contamination include generator/turbine exhausts, flarestacks, drilling equipment, process vents/chimneys etc. If sources of heavy contamination cannot be avoided, consider fitting extra shielding and/or providing good access for more routine cleaning.

Snow and Ice in Ambients Below -20°C - The heated optics on Excel units will melt snow or ice on the windows in ambient temperatures down to approximately -20°C . Below this temperature, snow or ice blown onto the window will not be melted until the ambient temperature rises. If long-term, outdoor operation in very cold climates is intended, it is recommended that extra shielding/covers are employed to prevent snow/ice from being blown onto the windows and building up.

Accidental Impact - Locations where there is a significant likelihood of equipment, personnel or moving objects accidentally knocking Excel units out of alignment should where possible be avoided. If such locations cannot be avoided, measures including improved mechanical protection and warning notices should be considered. Since the Transmitter and Receiver protrude from the duct wall, adequate precautions should be taken to protect personnel.

Intense Electromagnetic Fields - Searchline Excel Cross-Duct complies with EN50270 and as such is well protected from interference by electromagnetic fields. However, locations in close proximity to radio/radar transmitters, heavy electrical plant and high voltage power cables may experience field strengths in excess of those specified in the standard. Where possible, such locations should be avoided or units should be installed as far as possible from the source of the electromagnetic field. Measures including additional screening, filtering and transient suppression may also be of benefit in such locations.

To ensure optimum performance, do not cover the Excel with insulation, and allow free air movement around the unit.

3.2.4 Beam Path

The path of the infrared beam inside the duct is unlikely to be affected by obstructions, however, consideration should be given to avoid:

- Steam vents
- Splash and spray

3. Installation and Operation

3.2.5 Orientation

The Searchline Excel Cross-Duct units should be mounted on vertical, flat surfaces such that the optical axis is horizontal. Ensure the surface is rigid and stable. Fit additional supports prior to installation if necessary (see note on Vibration, above).

The Heated Reflector Panel should be mounted directly opposite, and perpendicular to the optical axis of the Transmitter and Receiver unit. If the duct walls are not exactly vertical or parallel, the position of the cut out for the retro panel must be adjusted to compensate.

It is not advisable to install the Cross-Duct Excel on the top or bottom of the duct. In this orientation the Reflector Panel or the Transmitter and Receiver unit will be vulnerable to the build up of contamination.

3.2.6 Access for Cleaning

Searchline Excel Cross-Duct Transmitter and Receiver unit and Heated Reflector Panel will need to be cleaned regularly. In the case of the Reflector Panel it may need to be removed from the duct to clean the window. It is advisable to provide an access point in the duct, adjacent to the reflector panel, to allow it to be cleaned.

3.3 Electrical Connections

3.3.1 General

Searchline Excel Cross-Duct complies with the EN50270. In order to maintain compliance with these standards it is essential that the electrical installation of Excel is engineered correctly.

Electrical installation standards vary for different countries, companies and applications and it is the responsibility of the installation design authority to determine the applicable standards and ensure compliance with them. When designing electrical installations for Excel, Honeywell Analytics recommend that the installation design authority considers the following:

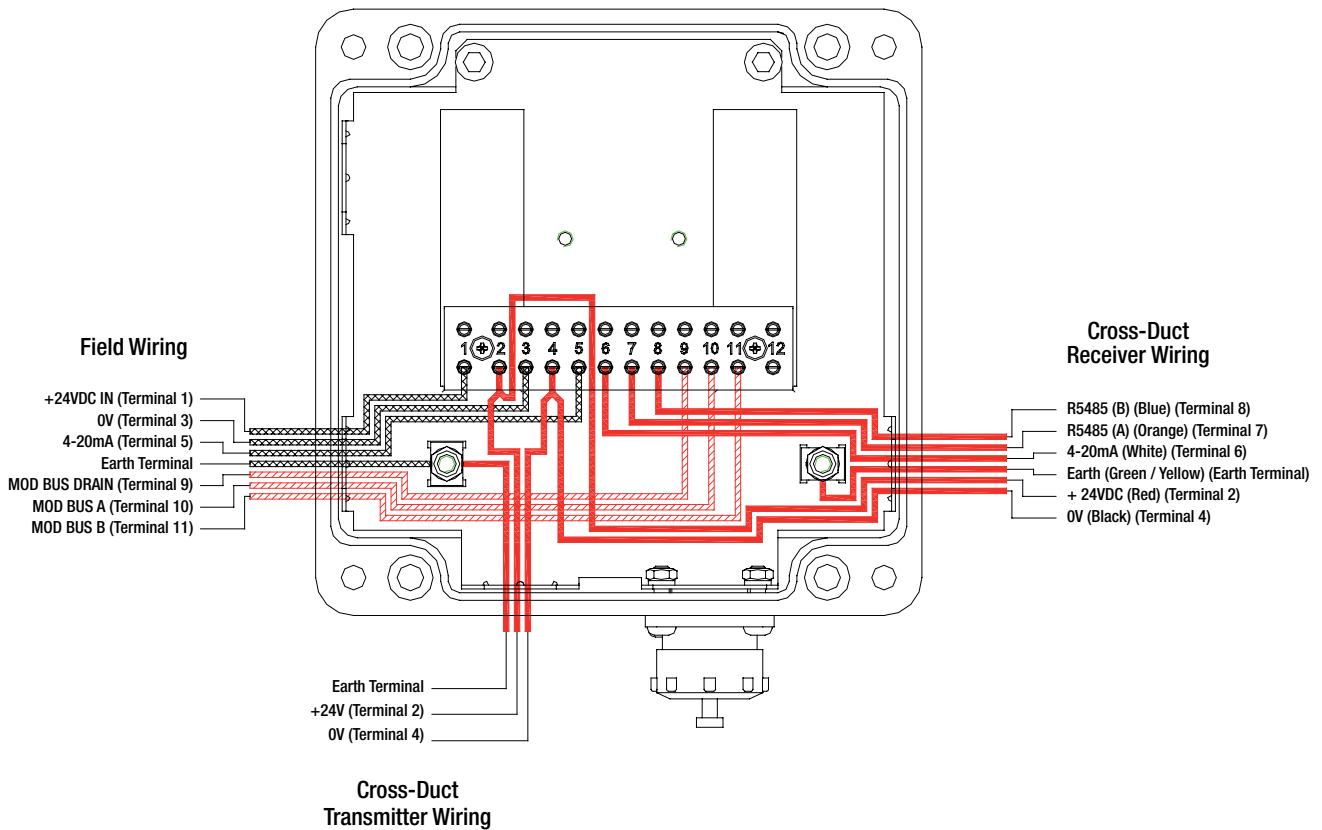
- a. The unit cases should not, if possible, be connected to electrically noisy (dirty) metalwork or conductors. Preferably, the case (internally connected to the green/yellow GND wire) should be connected to a low noise instrument (clean) earth. See also para e. below. In order to facilitate electrical isolation of the Searchline Excel from a noisy earth an isolation kit is supplied. This kit should be fitted as standard unless local regulations forbid this.
- b. The entire length of the field cabling connected to each unit should be fully shielded. This should be connected to a low noise (clean) earth.
- c. The low noise instrument (clean) earth system should only be connected to safety earth (usually dirty) at a single point on the entire site/installation. This connection should be made in such a manner that it does not introduce noise onto the low noise instrument earth. Star earthing arrangements minimise earth current crosstalk.
- d. The shields of the field cabling should not be connected such that earth loops are produced, or in a manner that will result in the shields carrying large currents from heavy plant or equipment.
- e. Ideally, the field cable shield should be connected to the unit's green/yellow GND wire, providing a single, continuous earth shield. This connection must not be allowed to complete an earth loop.
- f. The earth bonding arrangement must ensure that the maximum peak voltage between the unit case earth and any field cable conductor is less than 350V. Voltages in excess of this can cause permanent damage to the unit's RFI protection filters.
- g. The use of a single, screened cable for each gas detector ensures maximum screening and minimum crosstalk. Cabling arrangements which use a single cable for connecting a number of field devices compromise screening, increase the potential for crosstalk and prevent implementation of true star earthing.

3. Installation and Operation

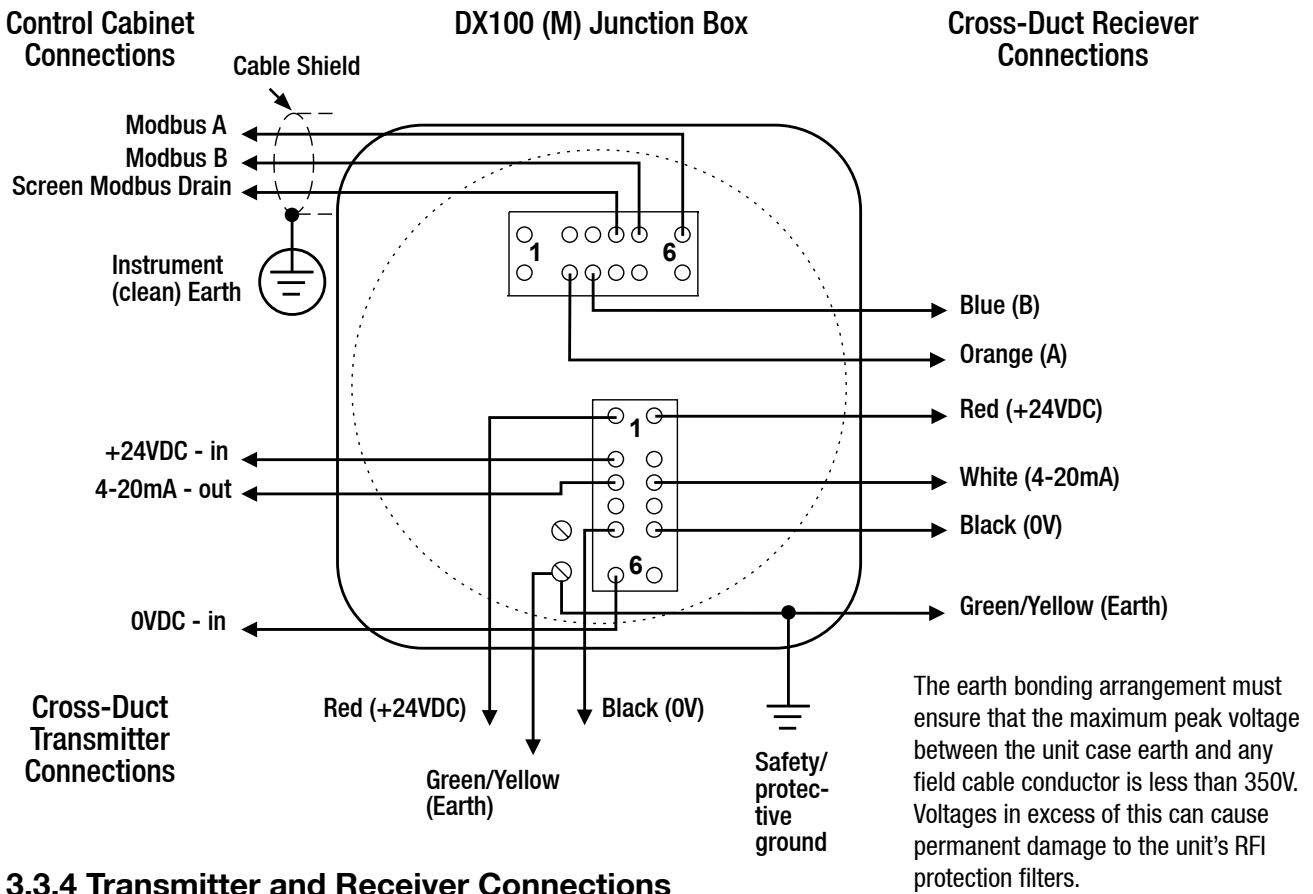
- h. Any electrical interference induced onto the 4 - 20mA loop conductors by the installation must be kept below the levels necessary to comply with the general requirements of EN 60079-29-2 and IEC 60079-29-2. In practice, this means that peak noise currents induced on the current loop should be no greater than $\pm 0.25\text{mA}$
- j. The 0V rail of the control card/control system is directly connected to one side of the 4 - 20mA current sensing resistor. Electrical noise on this rail is therefore directly connected to the 4 - 20mA input. In order to avoid additional noise being induced on the 0V rail, it should not be commoned with the safety earth/ground, which frequently carries a high level of electrical noise.
- k. All electrical equipment connected to the gas detector should comply with EN50270.
- l. The 24V supply should be free from large transients and fluctuations.
- m. The field cabling conductors should have sufficient cross sectional area to ensure that the minimum supply voltage applied to the gas detector is 18V.
- n. Searchline Excel Cross-Duct Receivers should not be installed in close proximity to the antennae of high powered radio, radar and satellite communication equipment.

3.3.2 Transmitter and Receiver Connections via DVC100 (M) MK2

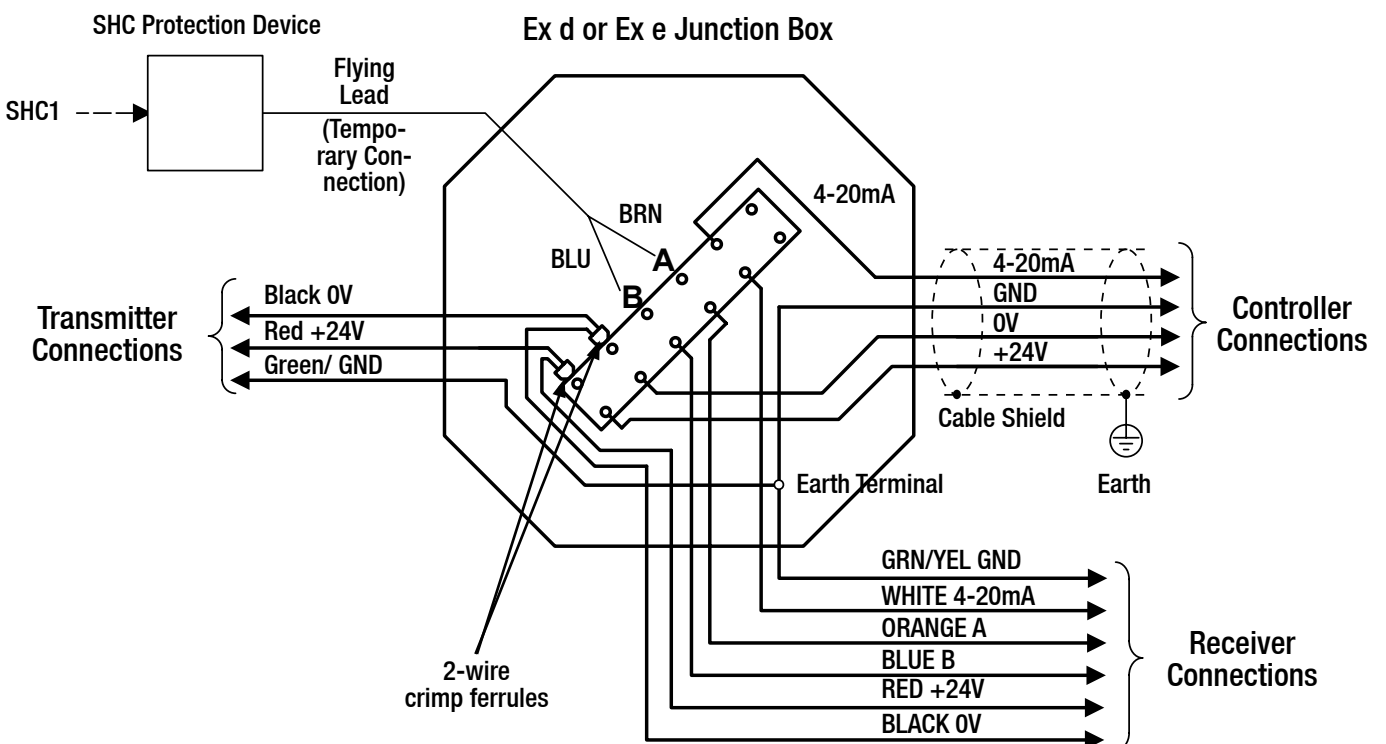
3.3.3 Transmitter and Receiver Connections via DX100 (M)



3. Installation and Operation



3.3.4 Transmitter and Receiver Connections



3. Installation and Operation

3.3.5 Remote Installations

For remote or difficult-to-access installations, the DVC100 (M)/ DX100 (M) can be positioned in a convenient location by using an intervening junction box (e.g. PL6I2/AKRON/Killark) attached to the Transmitter and Receiver unit's mounting plate.

A maximum cable length of 1km between the unit and the DVC100 (M)/ DX100 (M) is permissible (RS485 compliant).

3.4 Power Supply

3.4.1 General

The Searchline Excel Cross-Duct gas detector is designed to be operated from a nominal 24V DC supply. The supply voltage at the terminals must be within the range 18 to 32V for the Transmitter and Receiver unit, and within the range 18 to 28V for the Heated Reflector Panel.

3.4.1.1 Transmitter and Receiver Unit

The Transmitter and Receiver unit maximum power consumption and cable lengths are as follows:

Unit Type	Maximum Power Consumption (W)	Maximum Cable Length (m) with 1.5mm ² Conductors (12 ohms/km)	Maximum Cable Length (m) with 2.5mm ² Conductors (7.6 ohms/km)
Transmitter and Receiver	13	340	540

Notes:

- Control room supply voltage assumed to be +24V.
- Standard configuration of the Transmitter is with turbo heating enabled.

Terminal sizes:	DVC 100 (M)	0.5mm ² - 4mm ² (20AWG - 12AWG)
	DX100 (M)	0.5mm ² - 4mm ² (20AWG - 12AWG)
	HA Junction Box 00780-A-0100	0.5mm ² - 6mm ² (20AWG - 10AWG)

3.4.1.2 Heated Reflector Panel

The Heated Reflector Panel requires 18-28Vdc supply voltage. Because it is a resistive heater, the power consumption depends on the supply voltage. Power consumption can be calculated as follows: -

$$\text{Power} = \frac{V^2}{R} \quad \text{where } V \text{ is the supply voltage and } R \text{ is the resistance of the heater}$$

To ensure sufficient heating over a wide range of supply voltage, two connection options are available, which use different heater resistances depending on the supply voltage available (>20V or 18-20V).

3. Installation and Operation

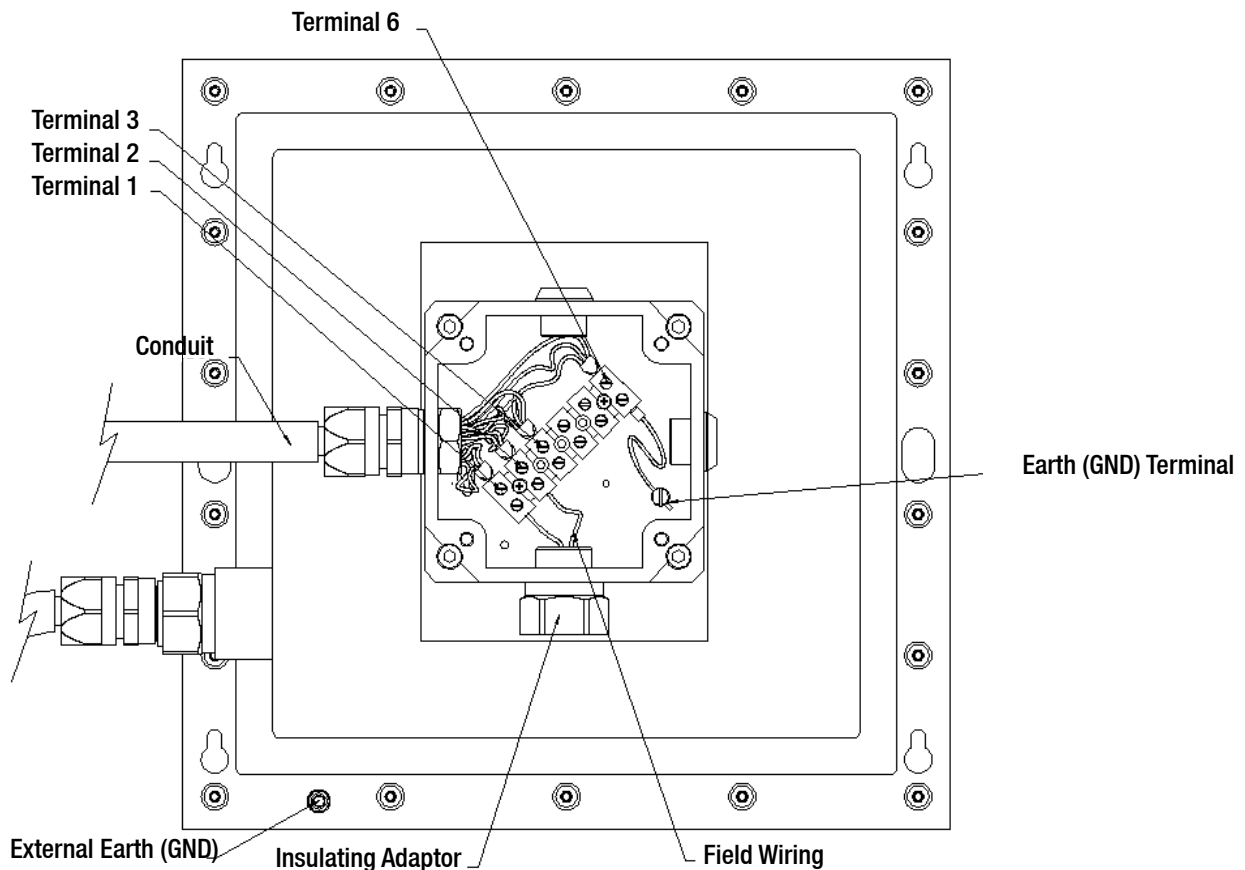
Short Range Heated Reflector Panel (Part numbers 2104B0715, 2104B0717)

Terminal Identification	Wire Colour	Customer Connection (>20V)	Customer Connection (<20V)	Heater Resistance (R)
1	White	0V	0V	
2	Black or Brown	>20Vdc		100Ω
3	Blue		18-20Vdc	68Ω
6	Green	Earth	Earth	

Long Range Heated Reflector Panel (Part number 2104B0716)

Terminal Identification	Wire Colour	Customer Connection (>20V)	Customer Connection (<20V)	Heater Resistance (R)
1	White	0V	0V	
2	Black or Brown	>20Vdc		33Ω
3	Blue		18-20Vdc	23Ω
6	Green	Earth	Earth	

Important: If the Transmitter and Receiver unit shares a power supply cable with the Heated Reflector Panel, a check must be made to verify that a minimum voltage of 18V is available at the Transmitter and Receiver when the Reflector Panel is operating.



3. Installation and Operation

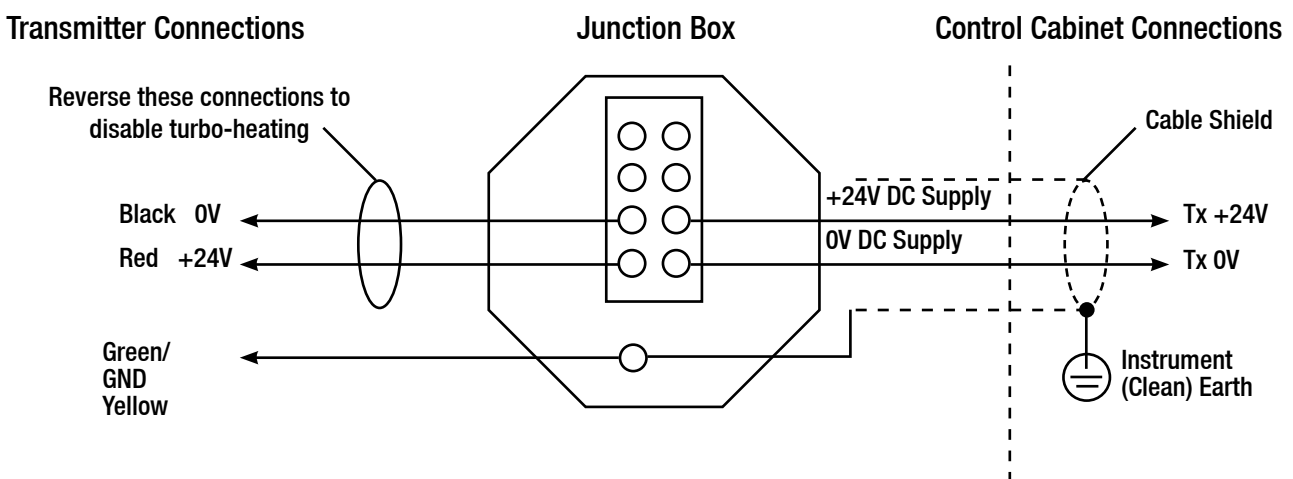
3.4.2 Power Supply Connections - Turbo heating Disabled

When connected as shown in section 3.3 **Transmitter and Receiver Connections** the Transmitter has turbo heating mode enabled.

This means that during conditions of low ambient temperature, additional heating power is applied to the unit's window to minimise condensation, frosting and snow buildup.

If the application/installation does not require turbo heating, power consumption can be reduced by disabling this mode.

The turbo heating is disabled by reversing the power supply connections to the Transmitter as shown in the following diagram. All other connections remain the same.



Notes:

1. Only Transmitters have turbo mode heating which can be disabled. The Receiver uses proportional heating, which cannot be disabled.
2. Even with turbo mode heating disabled the Transmitter window still receives standard levels of heating.
3. Do not reverse the Receiver power supply connections. This will not damage the unit, but the unit will not work.

3. Installation and Operation

3.5 Installation Procedure

3.5.1 General

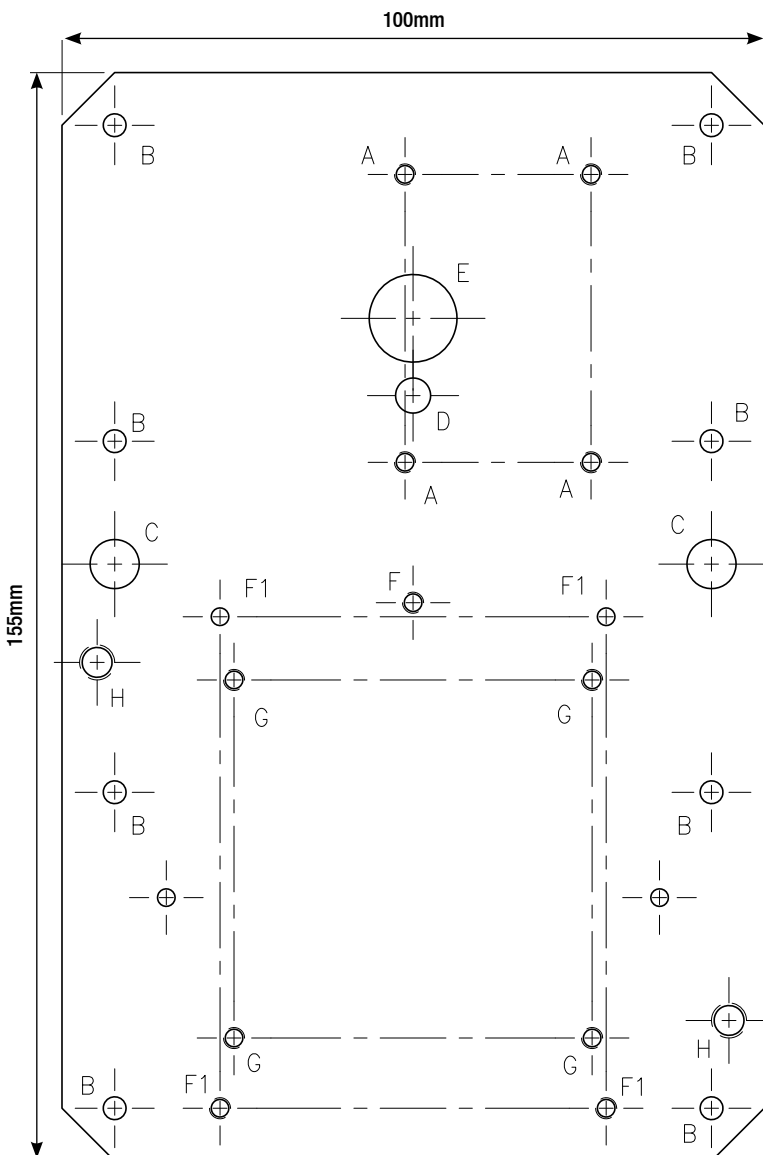
Installing the Searchline Excel Cross-Duct is done in two stages. First the duct is prepared, and the Excel components mechanically fixed in place. Secondly, the electrical wiring is connected. The Transmitter and Receiver assembly must be fully assembled and mounted to the duct structure before making the electrical connections.

3.5.2 Mechanical Installation

Verify that the equipment to be installed is correct for the type of installation required (i.e. short or long range.)

3.5.2.1 Transmitter and Receiver Unit

Identify the holes in the mounting plate using the following drawing and table:



Identity	Quantity	Size	Used for
A	4	M6 tapped	Mounting block mounting
B	8	6.5mm	Mounting plate to support bar mounting
C	2	14mm	Clearance for support bar fixing nuts
D	1	10mm	Drain for mounting block
E	1	25mm	Cross-Duct optical measurement path
F	1	M6 tapped	DVC100 (M) junction box mounting (used in conjunction with bottom two F1 holes)
F1	4	M6 tapped	DVC100 (M) MK2 junction box mounting
G	4	M6 tapped	BARTEC junction box mounting
H	2	M10 tapped	DX100 (M) junction box mounting

NOTE: If unused, the top two F1, top two G and the F holes should be blanked off to avoid leakage from the duct. Use the 5 off M6 x 8 screws, single coil washers and plain washers supplied.

3. Installation and Operation

- (1) Stick the supplied self-adhesive mounting plate cut-out template onto the duct wall in the position chosen for the Transmitter and Receiver unit.

Note: The intersection of the bold lines on the template (point X) corresponds with the centre of the unit's infrared beam.

- (2) At this stage it is advisable to mark the corresponding position for the Reflector Panel on the opposite side of the duct. Stick the Reflector Panel cut-out template to the outside of the duct wall opposite the Transmitter and Receiver.

Ensure that point X on the Reflector Panel template is directly opposite point X on the mounting plate template.*

- (3) Drill 10 mounting holes (diameter 7mm) in the positions marked G on the Transmitter and Receiver unit template.

- (4) Cut a rectangular aperture in the duct wall.

Follow outline H.

- (5) Check that the path from the aperture to the opposite wall of the duct is clear and unobstructed.

- (6) Measure the distance (in metres) across the duct.

Record this distance as it is required later during commissioning.

- (7) Insert the two mounting plate support bars through the aperture and attach them to the inside of the duct, using an M6 nut and washer screwed onto the stud in each support bar.

Check that the threaded holes in the support bars line up with the holes drilled in the duct.

- (8) Attach the mounting plate, Transmitter and Receiver unit and junction box assembly.

Use M6 x 20 cap head screws and washers for the mounting plate.

- (9) Run the Transmitter and Receiver conduits into the junction box cable entries. (see 3.5.3 (2)).

3.5.2.2 Heated Reflector Panel

- (1) If not already in place, stick the Reflector Panel cut-out template to the outside of the duct wall opposite the Transmitter and Receiver.

Ensure that point X is directly opposite point X on the mounting plate template. This ensures that the beam from the Transmitter hits the centre of the reflector.*

- (2) Drill six mounting holes (7mm diameter) in the positions marked J on the template.

- (3) Following outline K, cut a square aperture in the duct wall.

- (4) Insert the two Reflector Panel support bars through the aperture and attach them to the inside of the duct, using an M6 nut and washer screwed onto the stud in each support bar.

Check that the threaded holes in the support bars line up with the holes drilled in the duct.

- (5) Fit four M6 x 20 cap head screws into the holes in the support strips leaving approximately 5mm of thread exposed on the outside of the duct.

- (6) Slot the retro-reflector assembly over the heads of the screws and allow its weight to be supported on the exposed sections of thread.

- (7) Tighten the four screws to clamp the retro-reflector assembly in position.

3. Installation and Operation

3.5.3 Electrical Installation

- (1) Isolate all associated power supplies and ensure that they remain OFF until the instruction in the commissioning procedure to apply power.

See section 3.6 Commissioning. If the units are to be installed with junction boxes other than DVC100(M)/DX100 (M) types, ensure that the boxes have:

- a. M20 cable gland entries for BASEEFA units, or 3/4 NPT for UL
- b. terminals for five wires and an earth.

- (2) Remove the M20 blanking plugs (if fitted) and attach the Searchline Excel Cross-Duct Transmitter and Receiver cables to their junction box.

Fit the locking rings (if supplied) before terminating the cables in the junction box.

- (3) Fit approved cable glands to the junction box cable entries.

Use sealing washers where necessary to maintain the ingress protection rating.

- (4) Fit approved blanking plugs to all unused cable entries.

- (5) Make electrical connections. See section 3.3.

3.6 Commissioning

3.6.1 General

During commissioning the SHC1 Handheld Interrogator is used to communicate with the Searchline Excel Cross-Duct. Full details of the SHC1 Handheld Interrogator can be found in **Appendix A**.

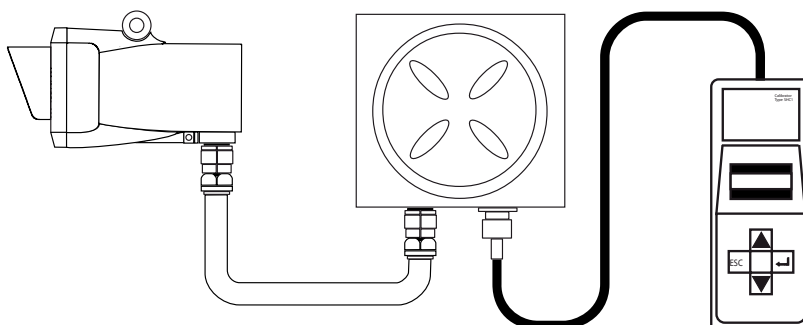
The commissioning process consists of the following steps:

- **Connect the Handheld Interrogator to the gas detector**
- **Power up the gas detector and set the interrogator for operation with Excel**
- **Set the Excel real time clock**
- **Initialise the Excel gas detector**
- **Functional check with test filters**
- **Finish**

3.6.2 Connecting the Interrogator

Connect the SHC1 Handheld Interrogator to the gas detector in one of the following ways:

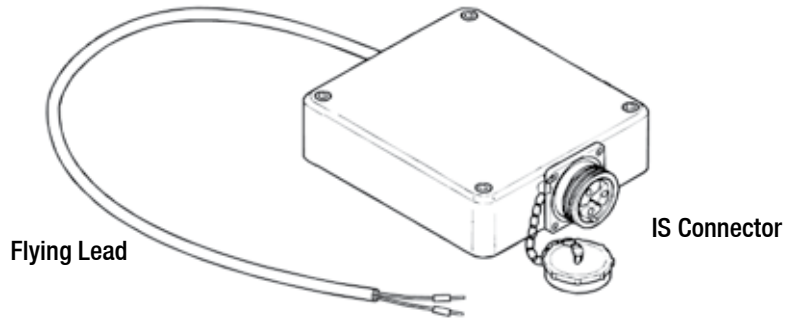
- via a Honeywell Analytics DVC100 (M)/ DX100 (M) Junction Box - connect the Interrogator directly to the junction box via the IS socket, e.g.



3. Installation and Operation

- via another type of junction box, e.g. Hawke PL612 - using the SHC Protection Device.

See the following diagram and description and **Appendix C - Spare Parts**

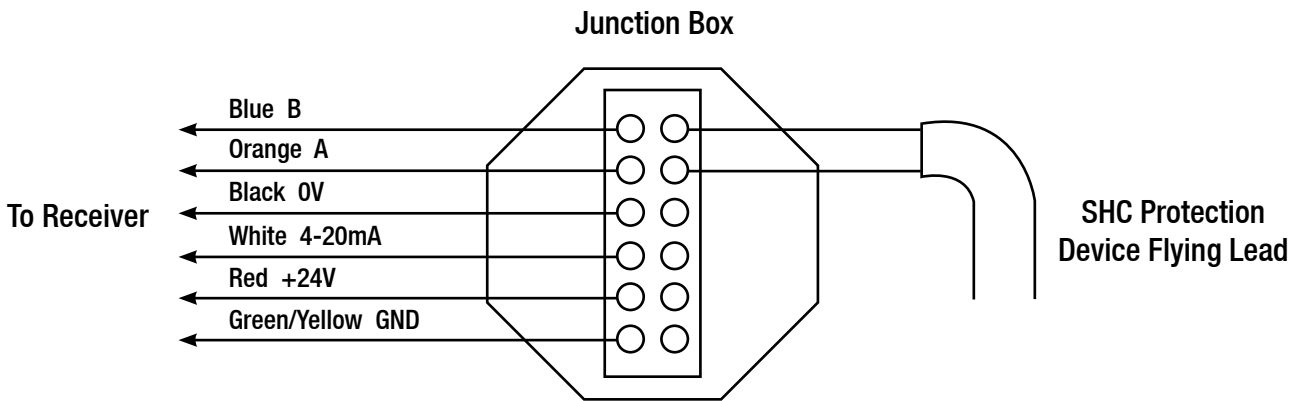


Notes:

1. The protection device must always be used for this type of connection.
2. A hot work permit may be required for this procedure.

Carry out the following procedure to connect using the protection device.:


- (1) Isolate all power supplies.
- (2) Remove the cover of the junction box.
- (3) Hard wire the flying lead of the SHC Protection Device to the communications link terminals in the box as shown:

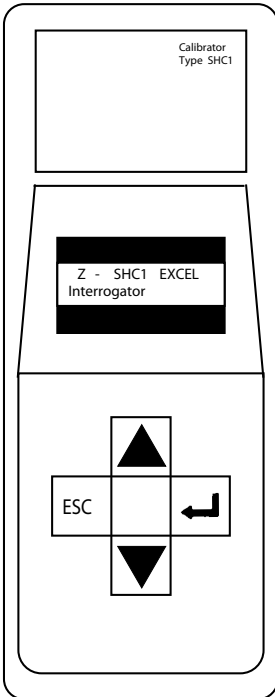


- (4) Connect the Interrogator to the IS connector on the end of the SHC Protection Device.

3. Installation and Operation

3.6.3 Power Up

- (1) Apply power to the Searchline Excel Cross-Duct Transmitter and Receiver and Heated Reflector Panel units.
- (2) Press and hold the (Enter)  key on the Interrogator keypad for at least two seconds. *This switches on the unit.*



Note: Full details of the SHC1 Handheld Interrogator can be found in Appendix A.

The Interrogator displays the following start-up message for approximately three seconds:

```

Z - SCH1 Excel
Interrogator 4V0
    
```

- (3) Quickly check the type of connected detector shown on the top line of the message.
*The display shows **Excel** or **Optima+** or **Optima**.*
- (4) If the unit displays **Optima+** or **Optima** immediately press the **ESC** key on the keypad.
*The **ESC** key must be pressed within 3 seconds to have any effect. Also see **Appendix A**, section 5.6.*
*This toggles the Interrogator mode between **Excel**, **Optima Plus** and **Optima**.*
*The start-up message is updated and displayed again for 3 seconds then the unit displays the **Main** menu, which is the top level of its Interrogator's menu style interface, as follows:*

```

Main
^ Display v
    
```

The first line of the display shows the current level in the menu tree and the second line displays a sub-menu title, action or data.

3. Installation and Operation

3.6.4 Setting the Real-Time Clock

The gas detector clock needs to be initially set so that faults, events, etc., can be accurately recorded and tracked for diagnostic purposes.

- (1) Select **Calibrate** from the **Main** menu by pressing the ▲ (up) and ▼ (down) keys on the keypad to navigate through the menu options.
- (2) Press ↵ (Enter) on the Interrogator keypad to display the Calibrate menu.
- (3) Select **Set Time/Date** from the **Calibrate** menu.
- (4) Press **Enter** on the keypad and an initial set time display similar to the following appears:

Time 09:26		
△	09	▽

The top line shows the current time and the second line shows the new hours setting.

- (5) Set the hour using the up and down keys on the keypad.
- (6) Press **Enter** on the keypad and the new minutes setting is now displayed on the second line.

Time 09:26		
△	09:26	▽

- (7) Set the minutes using the up and down keys on the keypad.
- (8) Press **Enter** on the keypad and the display for setting the date now appears as follows:

Date 20APR03		
△	20	▽

The second line shows the new day setting.

- (9) Set the day using the up and down keys on the keypad.
- (10) Press **Enter** on the keypad and the new month setting is then displayed.
- (11) Repeat the procedure to set the month and year.
- (12) When complete press **Enter** on the keypad to return to the **Calibrate** menu.

Notes:

1. *The time and date will not be updated unless both are entered and accepted without error.*
2. *Pressing **ESC** on the keypad at any time, aborts the current setting immediately and returns to the previous setting or menu option.*

3. Installation and Operation

3.6.5 Initialising the Searchline Excel Cross-Duct Gas Detector

In this part of the procedure details about the gas detector must be entered so that the Interrogator can then complete the commissioning of the gas detector using the correct data.

- (1) Select CALIBRATE from the Main menu.

Press the ▲ and ▼ keys on the keypad to navigate through the menu options..

- (2) Press ↵ on the interrogator keypad to display the calibrate menu

- (3) Select INSTALL from the calibrate menu.

- (4) Press ↵ on the interrogator keypad and the following is displayed:

```

System Type
^  Duct Mount  v
  
```

The gas detector type cannot be changed.

- (7) Press ↵ on the keypad and the current path length setting in metres is displayed, e.g.

```

Path Length
^      2.5      v
  
```

- (8) Set the path distance (in metres, to the nearest 0.1metre) between the transmitter and receiver unit and the reflector panel.

Use the ▲ and ▼ keys on the keypad.

Note: Do not double the distance, enter only the duct width.

IMPORTANT – THE PATH LENGTH IS USED TO CALCULATE THE GAS READING. ENSURE THAT IT IS ENTERED CORRECTLY

- (9) Press ↵ on the keypad and the following message is displayed:

```

Self Test
Please Wait
  
```

When finished the interrogator displays the following message for at least three seconds:

```

Checks Passed
  
```

The following message is now displayed:

```

SIG: █████
TGT: █████
  
```


No alignment adjustments are provided. If the mechanical installation is satisfactory Searchline Excel Cross-Duct can now be initialised.

3. Installation and Operation

(10) Press  on the keypad and the display shows:

Signals OK

Ensure Zero gas
then press Enter

(11) Press  and the display will show the following message whilst the unit is initialising:


Zero Cal OK

When the gas detector has completed initialisation, the following message is displayed for three seconds:

Installation
complete

The display changes to show:

Press Enter to
release 4-20mA

(12) Press  on the keypad. The installation is now complete.

If Excel does not initialise, check that:

- *the actual duct width agrees with the value entered in step 8 above.*
- *the reflector panel is clean and fitted securely.*
- *the reflector panel is mounted opposite the Transmitter and Receiver unit, and perpendicular to the beam*

*For further help see **Chapter 5, Problem Solving.***

3. Installation and Operation

3.6.6 Functional check

Carry out a functional check using plastic test filters (part number 2104N3000). Plastic test filters inserted in the measuring path produce infrared absorption which approximates that of methane gas.

The functional test filters supplied for testing Searchline Excel Cross-Duct do not have a specified gas reading range. Instead, they are marked with letters B to H, with the reading produced by each filter increasing from filter B to filter H.

The procedure for testing a Searchline Excel Cross-Duct using the functional test filters is as follows:-

- (1) Select DISPLAY from the Calibrate menu. (This inhibits the Searchline Excel Cross-Duct output).
- (2) Remove the top cover from the mounting block.

The cover is retained by 3 x M4 captive bolts, and a chain attaches the lid to the mounting block when opened. There are no electrical hazards inside the mounting block and a hot work permit is NOT required.

- (3) Insert a suitable functional test filter (see table below) into the slot in the mounting block in front of the receiver.

Duct Width	Minimum Test Filter	Recommended Test Filter
0.5 - 0.75m	B	B
0.75 - 1.0m	B	C
1.0 - 1.5m	C	D
1.5 - 2.0m	D	E
2 - 3m	E	F
3 - 4m	F	G
4 - 5m	F	H

- (4) Record the gas reading that is produced. This reading should be treated as correct and should be used to verify correct operation in the future.
- (5) Remove the test filter and replace the top cover of the mounting cell.
- (6) Using the SHC1 Handheld Interrogator release the Searchline Excel signal output.

*The output can be released by pressing **ESC** followed by ↵ on the keyboard*

3.6.7 Finish

To finish the commissioning process:

- (1) Select the Power Off option from the interrogator **Main** menu
- (2) Press ↵ on the keypad

*Alternatively, press the ↵ and **ESC** keys simultaneously for a fast power off.*

Notes:

1. *The SHC1 Handheld Interrogator powers down automatically after five minutes of inactivity in order to preserve battery life.*
2. *The fast power off facility and auto power off are disabled when a menu option is selected that modifies the unit's configuration.*

- (3) Disconnect the interrogator from the Excel gas detector, reversing the steps described in section 3.6.2.

3. Installation and Operation

3.7 System Controller Calibration

This procedure is used to set up the system controller using the Searchline Excel Cross-Duct gas detector. A chosen fixed output signal is sent from the gas detector to the system controller allowing calibration of the 0 - 100% scale of the controller without having to use gas. The steps use procedures described in the previous section.

To calibrate the controller carry out the following procedure:

- (1) Connect the Interrogator to the gas detector.

See **Connecting the Interrogator to Searchline Excel Cross-Duct Gas Detector**.

- (2) Turn on the Interrogator.

See **Powering Up**.

- (3) Select **Calibrate** from the main menu.

Press the up and down keys on the keypad to navigate through the menu options.

- (4) Press **Enter** on the Interrogator keypad and the **Calibrate** menu is displayed.

- (5) Select **Force 4-20** from the **Calibrate** menu.

- (6) Press **Enter** on the keypad and a display similar to the following appears:

```

4-20 current
^      4.5 mA      v

```

- (7) Use the up and down keys on the keypad to set the displayed output current to the desired value.

The values can be changed in steps of 0.1mA in the range 1mA to 21mA.

- (8) Press **Enter** on the keypad.

This selects the currently displayed value and forces the gas detector to output that current. Once complete a display similar to the following appears:

```

Fixed 4-20 mA
^ Press Enter v

```

- (9) Carry out checks on the controller by following the instructions in the controller documentation.

- (10) When checks are complete press ↵ on the Interrogator keypad and the following display appears:

```

Press Enter to
^ Release 4-20 v

```

- (11) Press **Enter** on the keypad.

The following message is displayed:

```

4-20 Released

```

The fixed output is released and the gas detector returns to normal operation.

3. Installation and Operation

(12) Turn off the Interrogator and disconnect it from the gas detector.

Note: The recommended alarm level settings for Searchline Excel Cross-Duct are as follows:-

Operating range	Minimum low alarm	Maximum high alarm
0.5m - 2.0m	20%LEL	40%LEL
2.0m – 5.0m	10%LEL	30%LEL

3.8 Installation Checks/ Tests

The following information is for the guidance of personnel carrying out installation checks/tests on Searchline Excel Cross-Duct. In general it should be noted that:

- Searchline Excel Cross-Duct should only be installed by fully trained personnel, trained by Honeywell Analytics or an authorised Honeywell Analytics trainer.
- Detailed information concerning installation, alignment and commissioning is provided in this Technical Handbook.
- Searchline Excel Cross-Duct is explosion protected by a certified, flameproof enclosure.
- Carefully read the safety warnings, cautions and certification details in this handbook.
- Ensure that they have been complied with, before and during the installation.
- A copy of the subsequent **Installation Check Sheet** should be completed for each Searchline Excel Cross-Duct gas detector installed. In order to help Honeywell Analytics to provide efficient assistance/ service in the event of problems, the sheet should be returned to Honeywell Analytics or to one of their agents.

3. Installation and Operation

Searchline Excel Cross-Duct: Installation Check Sheet										
CUSTOMER/OPERATOR										
SITE / FACILITY										
SYSTEM TYPE:	Short Range				Long Range	OPERATING RANGE				
GAS TABLE:	METHANE									
DETECTOR LOCATION:										
TAG NO. (TX/RX):					TAG NO. (Reflector):					
SER NO. (TX/RX):					SER NO. (Reflector):					
MOD STATE (TX/RX):		MOD STATE (Reflector)		CERTIFICATION:						
CHECK/TEST		TRANSMITTER/RECEIVER			CHECK/TEST		REFLECTOR			
Mount Rigidity					Mount Rigidity					
Vibration:					Vibration:					
Excess heat:					Excess Heat:					
Supply Voltage:					Supply Voltage					
Earthing:					Earthing:					
RFI/EMC					RFI/EMC					
Contaminants:					Contaminants:					
BEAM OBSTRUCTIONS / BLOCKS:										
(cont.)										
TEST FILTER:	(B – H)	Response :		%LEL	Pass:		Fail:			
4-20 mA LOOP INTEGRITY		Pass:		Fail:		Untested:				
FAULT / WARNING LOG:		Clear:		Faults / Warnings:						
(cont.)										
INSTALLATION SATISFACTORY:		Yes:		No:		SIGNED:				
INSTALLED BY (PRINT)						DATE:				
IF INSTALLATION UNSATISFACTORY, REASONS										
RECOMMENDATIONS										
						CUSTOMER NOTIFIED:				
SYSTEM STATUS:		Operational:						Non operational:		

3. Installation and Operation

The following notes are to help the installer enter the correct information onto the check sheet.

Site/Facility

Enter the name and geographical location of the site/facility.

Operating Range

Enter the distance (preferably in metres), between the Transmitter and Receiver unit and the Heated Reflector Panel.

Detector Location

Enter the location/position of the detector

Tag No

Enter the **Tag No**, or equivalent, that has been allocated to the Transmitter and Receiver unit and the Reflector Panel.

Mod State

Enter the **Mod State** of the units as indicated on their certification/product labels.

Certification

Enter the certification of the units, e.g.

ATEX, IECEX, UL

Mount Rigidity

When pushed hard and released, the mount/supporting structure should return quickly to its original position and should not wobble or sway. If the mount/ support is unacceptable, briefly describe the problem, e.g.

Mount wobbles unacceptably

Vibration

Check the installation and its close surrounds for potential or existing sources of excessive vibration. Such sources could include heavy plant/machinery, turbines, generators etc.

Excess Heat

Check the installation and its surrounds for potential sources of excessive heat. The unit is specified up to +65°C. Potential sources of excessive heat include direct sunlight in hot climates, flare-stacks, generator/turbine exhausts and steam vents.

Enter a brief description, e.g.

Flare-stack 2 metres away

3. Installation and Operation

Supply Voltage

Check that the supply voltage applied to the unit is within the specified 18V to 32V range (Transmitter and Receiver) or 18 to 28V range (Heated Reflector Panel) and is stable. Enter the supply voltage and stability, e.g.

**22.5V, stable,
19V, +2V fluctuation**

Earthing

Inspect the earth connections to the units. If the unit is connected to local metalwork or the safety/general use earth, enter 'Local Safety'. If the unit has been isolated from local metalwork/ earths and is connected to a clean, instrument earth, enter Instrument earth. (See section 3.3, **Electrical Connections**).

RFI/EMC

Assess the installation, cabling and its close surrounds for known/potential sources of excessive RF/ Electromagnetic Interference. Such sources could include radio/radar transmission antennae, high voltage switch-gear, large electrical generators/motors etc.

Searchline Excel Cross-Duct complies with the most stringent requirements specified in EN50270. It is therefore more likely that the field cabling will pick up interference directly on the 4 - 20mA and 0V connections and that this will affect the reading received at the control room.

Enter brief details of known/potential EMI sources that are within five metres of the gas detector and/or its cabling. If cable is unscreened or inadequately protected, note concerns.

Examples of the sort of information to enter are:

**10m cable, unscreened, Radar, 2m from Receiver,
Cable routed over 400kW generator**

(See section 3.3 **Electrical Connections**).

Contaminants

Assess the installation and its surrounds for sources of contaminants that could build up on the unit's windows. Such contaminants could include oil mist, heavy sea spray, drilling mud, dirty exhaust fumes, wave splash etc.

If there is a realistic possibility that such contaminants could cause a significant problem, enter a brief description, e.g.

**Drilling mud spray,
Diesel generator exhaust**

Test Filter

After completing the installation procedure, enter the **DISPLAY** mode and test the gas detector response with a plastic test filter. Enter the nominal value of the test filter, and the unit's displayed response. When testing in future, use the same test filter and compare the response to the value obtained at installation. See Chapter 4, Maintenance.

4 - 20mA Loop Integrity

Test the 4 - 20mA loop integrity by forcing the unit to output a known current and monitoring this at the control room or with a multimeter inserted into the loop. Mark the appropriate box.

3. Installation and Operation

Fault/Warning Log

Check the fault/warning log. In order for the unit to complete installation satisfactorily, the **ACTIVE FAULTS** log must be **CLEAR**. Use the Handheld Interrogator to diagnose and remedy all **ACTIVE FAULT**.

Wherever possible, it is recommended to **CLEAR** any **ACTIVE WARNINGS**, since these may lead to faults in the future.

Faults/Warning

Enter any **ACTIVE FAULTS** or **ACTIVE WARNINGS** that could not be cleared from the log, e.g.

BEAM BLOCK, E_ZERO_NOT_CALIBRATED

Installation Satisfactory

Only fully trained personnel trained by Honeywell Analytics or Honeywell Analytics authorised trainers can declare an installation satisfactory. Mark the **YES** box and sign the form if:

- a. having completed the installation and testing, the unit is operating correctly, and
- b. in the trained installer's opinion, the unit should continue to operate reliably in this installation/ operating environment providing that nothing significant about the installation/environment is changed.

If the unit is **not** operating correctly or there are aspects of the installation/ operating environment which in the trained installer's opinion could or will result in unreliable operation, mark the **NO** box.

Reasons for declaring an installation unsatisfactory could include:

**excessive movement/vibration of unit's mounting,
received signal levels too low,
supply voltage too low,
4 - 20mA loop integrity faults,
unclearable active faults,**

any prevailing or probable condition which is known to unacceptably reduce reliability or availability

If Installation is Unsatisfactory, Reasons

Briefly state the principal reasons why the installation is unsatisfactory, e.g.

Excessive movement, insufficient received signal levels, Unit overheated by intense sunlight

Recommendations

Briefly describe the recommended actions which need to be performed in order to make the installation satisfactory, e.g.

**Mounting requires bracing/stiffening,
Provide correct supply voltage**

Customer Notified

Make sure that the relevant customer/operator is notified of the installation problem(s). Mark box accordingly.

System Status

Upon leaving, note the gas detectors status, i.e. operational or nonoperational.

4. Maintenance

The Searchline Excel Cross-Duct maintenance should include regular cleaning of the Transmitter and Receiver unit windows and the Heated Reflector Panel, re-zero of the Cross-Duct unit and functional test using Test Filters (2104N3000).

Note: The objective is to keep the windows clean. The rate of build up of contamination depends on local site conditions. It is recommended that the installation is closely monitored during the first few weeks of operation to establish how frequently cleaning will be required.

Depending on the local regulations and site conditions, cleaning and functional testing of the gas detector can be carried as described in the following sub-sections. The gas detector should remain powered during these procedures.

Caution: Searchline Excel Cross-Duct does not contain any user serviceable parts. Do not open or disassemble the Transmitter and Receiver unit (other than as instructed), or the Heated Reflector Panel. The warranty of units which have been opened is invalidated.

Note: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.

4.1 Inspection and Cleaning

Caution: Do not use solvents or abrasives on the Searchline Excel Cross-Duct units.

(1) Inspect the Searchline Excel Cross-Duct units, junction boxes and cabling for signs of physical damage.

(2) Using the SHC1 Handheld Interrogator inhibit the Searchline Excel Cross-Duct signal output.

*Since the signal output may vary during cleaning, due to the optical path being disturbed, it is important to inhibit the analogue output. The quickest way to inhibit the Excel output is to select **DISPLAY** from the **Calibrate** menu.*

(3) To access the Transmitter and Receiver windows, and the beamsplitter, remove the top cover from the mounting block.

*The cover is retained by 3 x M4 captive bolts, and a chain attaches the lid to the mounting block when opened. There are no electrical hazards inside the mounting block and a hot work permit is **NOT** required.*

(4) Clean any dust or dirt from the Transmitter and Receiver windows and the beamsplitter using soapy water or window cleaner and a soft cloth.

(5) Replace the top cover of the mounting block.

(6) Loosen the fixings which secure the Heated Reflector Panel and remove it from the duct wall.

(7) Clean any dust or dirt from the Heated Reflector Panel using soapy water or window cleaner and a soft cloth.

(8) Replace the Reflector Panel on the duct wall and tighten fixings.

(9) Using the SHC1 Handheld Interrogator release the Searchline Excel signal output.

The output can be released by pressing ESC followed by  on the keyboard.

(10) Re-zero the system (see section 4.2).

To reduce the need for cleaning, it is possible to connect a supply of compressed air to the Air Shield port on the mounting block (see diagram in section 4.3). The air shield port is the one closest to the duct. By flowing clean air into the mounting block (which then moves out into the duct), the build up of contamination inside the mounting block will be reduced. It is essential that this air supply is oil and dirt free. Precautions such as a filter and a liquid trap should be installed in the air-line.

4. Maintenance

4.2 Re-zero

- (1) Using the SHC1 Handheld Interrogator, select **CalSensor** from the **Calibrate** menu. The analogue output will be inhibited. (See Appendix A for details about how to use the Interrogator).

Note There must be no gas in the system beam path whilst this procedure is carried out.

- (2) The following message is displayed:

```
Ensure Zero Gas
Press Enter
```

- (3) Press Enter. The following message is displayed while the calibration operation is being performed:

```
Processing Data
Please Wait...
```

- (4) If the calibration is successful, the following message is displayed for a period of three seconds:

```
Zero Calibrated
```

- (5) Using the SHC1 Handheld Interrogator release the Searchline Excel signal output.

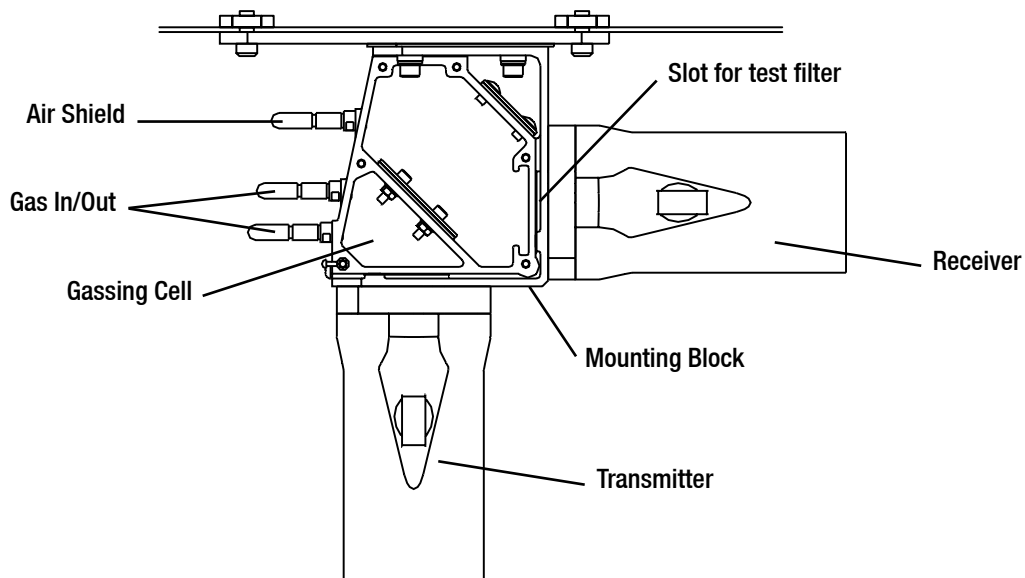
The output can be released by pressing ESC followed by ↵ on the keyboard.

4.3 Functional Checking

4.3.1 Functional Checking with Gassing Cell (Short Range versions only)

Searchline Excel Cross-Duct incorporates a built in gassing cell for functional test purposes. In order to use the gassing cell, the mounting block lid must be in place, to maintain a gas tight seal.

Before using the gassing cell for the first time, remove the ends of the plastic nozzles (with a knife or wire cutters). Rubber end caps are used to seal the tubes afterwards.



4. Maintenance

To get the best accuracy when using the gassing cell:

- (1) Ensure that the gassing cell contains fresh air, and perform a zero calibration on the Excel
- (2) Apply the test gas and allow sufficient time to fully fill the gassing cell and check that the Searchline Excel Cross-Duct output stabilises.

A flow rate of less than 0.5 litres per minute is advisable, to avoid pressurising the gassing cell.

- (3) For a methane calibrated unit tested with 100%v/v methane (UL version) or 88%v/v methane (ATEX, IECEx version), the expected reading can be calculated from:

$$\text{Gas reading} = 100\%LEL / (2 \times \text{duct width})$$

A few examples are shown in the following table, and the tolerance to be applied is $\pm 20\%$ of reading or $\pm 10\%LEL$ (whichever is greater). The variability in the readings is due to a number of factors such as variation in air pressure, flow rate, and tolerances in the gas composition.

Test Gas UL version	Test Gas ATEX, IECEx version	Duct Width	Expected Reading
100% v/v Methane	88%v/v Methane	0.5m	100%LEL \pm 20%LEL
100% v/v Methane	88%v/v Methane	0.8m	60%LEL \pm 12%LEL
100% v/v Methane	88%v/v Methane	1.0m	50%LEL \pm 10%LEL
100% v/v Methane	88%v/v Methane	1.5m	33%LEL \pm 10%LEL
100% v/v Methane	88%v/v Methane	2.0m	25%LEL \pm 10%LEL
100% v/v Methane	88%v/v Methane	2.5m	20% LEL \pm 10%LEL

- (4) After checking the reading, ensure that the gas is flushed out of the gassing cell, with clean air or nitrogen, until the reading returns to zero.
- (5) Finally replace the rubber caps over the gassing ports.

WARNING:

Tests gases may be flammable and/or toxic. Take appropriate precautions when handling

WARNING:

Take the necessary precautions to ensure safety when dealing with high concentration gases

4.3.2 Functional Checking with Test Filters

Functional checking of the Searchline Excel Cross-Duct can also be done using plastic test filters (part number 2104N3000). Plastic test filters inserted in the measuring path produce infrared absorption which approximates that of methane gas. For the procedure see section 3.6.6.

Compare the gas reading to the original value recorded for this unit when tested with this filter. Provided that the reading is within $\pm 15\%$ LEL of the original value, the unit is working correctly.

If the gas reading is not within the expected range it is possible that the unit needs cleaning or re-zeroing. **See section 4.1.**

5. Problem Solving

The majority of gas detector problems/faults can be diagnosed and corrected using the installation kit.

The installation kit includes:

- **SHC1 Handheld Interrogator**
- **set of functional test filters**

An electrical multimeter is also useful when diagnosing electrical/wiring problems.

Refer to the troubleshooting tables in this chapter for a list of problems, possible causes and actions.

Caution: Searchline Excel Cross-Duct does not contain any user serviceable parts. Do not open or disassemble the Transmitter and Receiver unit, or the Heated Reflector Panel. The warranty of units which have been opened is invalidated.

Note: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.

RS485 Modbus signal errors may occur when Excel is connected via a DX100 (M) Termination Unit and is interrogated/commanded from a network control centre. For troubleshooting these issues refer to the **DX100 Series Termination Units Technical Handbook**.

If, after following the recommendations in this section, the problem persists, please make available the following information before contacting Honeywell Analytics:

- **Installation Check Sheet**
See **Chapter 3**.
- **Any error message**
Displayed on the Handheld Interrogator screen.
- **Any error code**
Displayed on the Handheld Interrogator screen.

Fault/Problem	Causes	Remedies
No mA output	Electrical installation problem	1) Check that the +24V supply is reaching the unit. Voltage at the unit should be between +18V and +32V. 2) Check cables and connections to the unit, especially the 4-20mA loop connections. 3) Check that the unit has the correct type of 4-20mA output sink/source for use with the controller that it is connected to.
Output is 0mA (nominal)	Unit is in FAULT condition	Connect the SHC1 Interrogator to the unit and use its DIAGNOSTIC menu options to ascertain the reason for the FAULT report.
	Beam block	Check that beam path is clear from the Transmitter and Receiver to the Reflector. Remove any obstruction if present.
	Heavy contamination of optics	Check the Transmitter and Receiver windows and the Heated Reflector Panel for build up of contamination. Clean the windows if required. Re-zero unit.
Output is 2.5mA. (BEAM BLOCK)	Beam path is blocked	Check that beam path is clear from the Transmitter and Receiver to the Reflector. Remove any obstruction if present.
Output is 3mA (LOW SIGNAL)	Heavy contamination of optics	Check the Transmitter and Receiver windows and the Heated Reflector Panel for build up of contamination. Clean the windows if required. Re-zero unit.

5. Problem Solving

Output is 2mA (INHIBIT)	Unit has been inhibited by the Interrogator	Release output from INHIBIT state using SHC1 Interrogator.
	Unit executing power-up routine	<ol style="list-style-type: none"> 1) Wait for 1 minute. When power-up routine is completed satisfactorily the unit's output should exit the INHIBIT state. 2) If unit remains in INHIBIT, check the +24V supply is reaching the unit. If the voltage is below +18V or is fluctuating above and below +18V, the unit may be being prevented from completing power-up. (This is an electrical installation problem.)
Comms Error 99 reported by Interrogator software	Wrong communication mode selected on the Interrogator	<ol style="list-style-type: none"> 1) Select Change Mode option on the Interrogator. 2) Change the communication mode to Excel
	Interrogator software version is incompatible with Excel software version	<p>Version 1V0 Interrogator software to be used with Excels running 1V0 software.</p> <p>Version 2V0 Interrogator software can be used with Excels running 2V0 software or higher.</p> <p>Version 3V0 and 3V1 Interrogator software can be used with Excels running 3V0 software or higher.</p> <p>The latest version of Interrogator software is 4V0. This version works with 3V0 and higher Excels, Optima and Optima Plus.</p>
Comms Error 100 reported by Interrogator software	Incorrect communication connection	<ol style="list-style-type: none"> 1) Check that Interrogator is correctly plugged into the IS socket on the DVC100(M)/DX100(M) junction box. 2) Check that the RS485 A and B wires from the Excel unit have been connected to the correct terminals inside the DVC100(M)/DX100(M) junction box
	Excel unit is not powered up	Check that the +24V supply is reaching Excel unit correctly. The Supply voltage at unit should be between +18V and +32V.
	Interrogator battery low	Check the Interrogator battery and replace if low. See Appendix A. Section A.4
Interrogator Installation Failed message when attempting initialisation	The installation has failed to meet the acceptable criteria for signal levels	<ol style="list-style-type: none"> 1) Check that the signal levels reaching the Receiver are greater than 0.7 and less than 1.5. If not, check that the Reflector Panel is mounted opposite the Transmitter and Receiver unit and perpendicular to the beam. 2) Check that the correct range has been entered for the installed path length. 3) Check that there are no objects obscuring part or all of the beam path. 4) Check that the windows of the Receiver and Transmitter and the Heated Reflector Panel are clean. 5) Check that the structures that the Transmitter and Receiver are mounted on are stable and free from significant angular movement/vibration. 6) Check that there is no gas in the beam - which prevents successful zeroing.

5. Problem Solving

No signal or very low signal at Receiver	The beam path has become obscured	Check that the beam path is clear from Transmitter and Receiver to the Reflector Panel. Remove any obstruction if present.								
	No output from Transmitter	<p>1) Check that the Transmitter is flashing. When viewed on the axis, an orange flash can be seen coming from the Transmitter. Alternatively, listen for a distinct ticking sound when the lamp flashes.</p> <p><i>Note: The infrared beam is invisible and eye safe.</i></p> <p>2) If the Transmitter is not flashing, check that the +24V supply is reaching the Transmitter correctly.</p>								
Unit does not respond exactly as expected to test filters	Plastic test filters are only an approximate simulation of gas	<p>Searchline Excel units are calibrated on real gas. This results in a variation of the response of different Excel units to plastic test filters. See section 3.6.6</p> <p>1) Check that the response to the test filters is within the limits stated in this handbook compared to the response obtained at initial installation. See section 4.3.2</p> <p>2) Check that the correct test filter is being used.</p>								
	Contamination of windows	<p>1) Check the Transmitter and Receiver and Heated Reflector Panel windows for build up of contamination. Clean windows if required. See Chapter 4.</p> <p>2) Re-zero unit.</p>								
	Drift of unit's zero position	<p>1) Verify that there is no gas in the beam path.</p> <p>2) Re-zero the unit</p>								
Unit appears to be reporting a negative gas reading on the 4-20mA	Misinterpretation of INHIBIT, BEAM-BLOCK or LOW SIGNAL currents that are output on the 4-20mA	<p>Searchline Excel does not report negative gas readings on the 4-20mA.</p> <p>1) Configure controller/PLC to interpret and present currents below 4mA correctly, or</p> <p>2) Familiarise operators with the interpretation of sub 4mA output currents from Excel as follows:</p> <table style="margin-left: 40px;"> <tr> <td>FAULT</td> <td>0mA</td> </tr> <tr> <td>INHIBIT</td> <td>2mA</td> </tr> <tr> <td>BEAM-BLOCK</td> <td>2.5mA</td> </tr> <tr> <td>LOW SIGNAL</td> <td>3mA, or</td> </tr> </table> <p>3) Reconfigure the INHIBIT, BEAM-BLOCK and LOW SIGNAL currents output by the Excel unit.</p>	FAULT	0mA	INHIBIT	2mA	BEAM-BLOCK	2.5mA	LOW SIGNAL	3mA, or
FAULT	0mA									
INHIBIT	2mA									
BEAM-BLOCK	2.5mA									
LOW SIGNAL	3mA, or									
Diagnostics report Neg Gas Reading	Contamination of windows	<p>1) Check the Transmitter and Receiver and Heated Reflector Panel windows for build up of contamination. Clean windows if required. See Chapter 4.</p> <p>2) Re-zero the unit.</p>								
	Negative drift of unit's zero position	Re-zero the unit								
Diagnostics report Baseline Drift	Contamination of windows	<p>1) Check the Transmitter and Receiver and Heated Reflector Panel windows for build up of contamination. Clean windows if required. See Chapter 4.</p> <p>2) Re-zero the unit.</p>								
	Drift of unit's baseline	Re-zero the unit								

5. Problem Solving

Diagnostics report Bad Temperature	Unit has been operated at a temperature outside its specified and certified range	<ol style="list-style-type: none"> 1) When Ex certified equipment is operated outside its certified range, its type approval certification is invalidated along with its warranty. Such equipment should be removed from service in potentially explosive atmospheres. 2) Investigate the cause of the excessive temperature excursion and take steps to prevent recurrence. (e.g. fit sunshade or heat-shield, or relocate detector, etc.)
Diagnostics report Supply Fault	Incorrect supply voltage reaching unit	<ol style="list-style-type: none"> 1) Check that the +24V supply voltage reaching the unit (it should be between +18V and +32V). 2) Identify the cause of incorrect supply voltage reaching the unit and rectify.
Diagnostics report DSP Fault	Fault on the unit's digital PCB	If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.
Diagnostics report NV-RAM Fault	A fault has been detected in the NV-RAM	If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.
Diagnostics report RTC Fault	The time and date record being stored by the Real Time Clock (RTC) has been lost	<ol style="list-style-type: none"> 1) Re-enter the time and date using the Interrogator. 2) Cycle the power applied to the unit. 3) Verify that the time and date record was maintained after cycling the power.
Diagnostics Report Volt Ref Fault	Voltage reference fault detected	If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.

6. Specifications

6.1 System

Available Gases	Methane				
Range	0 - 100%LEL UL version - LEL level 5%v/v ATEX, IECEx version – LEL level 4.4%v/v				
Minimum Low Alarm Setting	20%LEL (0.5 – 2.0m)	10%LEL (2.0 - 5.0m)			
Maximum High Alarm Setting	40%LEL (0.5 – 2.0m)	30%LEL (2.0 – 5.0m)			
Path Length	Short Range 0.5 - 2.5m Long Range 2.5 - 5.0m				
Speed of Response	T90 less than 1 second				
Output signal	4 — 20mA Normal operation (0 —100%LEL)	0mA Fault	2mA Inhibit	2.5mA Beam block Configurable	3mA Low signal Configurable
Operating Temp.	The Searchline Excel Cross-Duct operating temperature range is -40 °C to 50 °C (-40 °F to 122 °F). An internal duct temperature of up to 60 °C (140 °F) is acceptable, provided the ambient temperature outside the duct at the Transmitter and Receiver unit is within the operating range.				
Humidity	0 — 99%RH Non-condensing				
Pressure	91.5kPa — 105.5kPa (915 — 1055mBar, non-compensated)				
Repeatability	±10%LEL (<1metre duct width) ±2.5%LEL (1 - 5metre duct width)				
Temperature Drift (-40°C to+65°C)	±10%LEL @ zero ±15%LEL @60%LEL				
Warm-up Time	Less than 5 minutes (operational), Less than 1 hour (fully stabilised)				
Power Supply	Receiver and Transmitter: 18 to 32V, Heated Reflector Panel: 18 to 28V				
Power Consumption	Tx/Rx total: 13W maximum		Reflector: supply voltage dependent		
Enclosure Material	316 Stainless Steel				
Weight	Tx/Rx including mounting plate 13kg Reflector panel 5kg (short range) 10kg (long range)				
Vibration	2 — 60Hz, maximum peak to peak amplitude 1mm.				
Divergence/ Misalignment Tolerance	Tx/Rx ±1.5° Reflector Panel ±5° (at 5m)				
IP rating	IP66 and 67				

6.2 Response to other gases


Searchline Excel Cross-Duct is a methane gas detector. It should only be used to detect gas mixtures where methane is the main constituent (>70%) and the balance is C₂ - C₆ hydrocarbons.

7. Certification

7.1 General

The Searchline Excel Cross-Duct Transmitter and Receiver unit is certified to Ex d and has the following ATEX, IECEx and UL approvals for worldwide acceptance:

ATEX, IECEx

 II 2 G Ex d IIC T5 (Tamb -40 to +65°C) Gb
Ex d IIC T6 (Tamb -40 to +40°C)

Certificate numbers:

BAS98ATEX2165X

IECEx BAS 09.0100X

UL


Class 1 Groups B, C, D

Class 1 Zone 1 AEx d IIB + Hydrogen (Amb -40°C to +65°C)

File No. E91044

The Searchline Excel Cross-Duct Heated Reflector Panel is certified to Ex d and has the following ATEX and UL approvals for worldwide acceptance:

ATEX

 II 2 G Ex d IIC Gb T3 (Tamb -40 to +60°C)

Certificate number:

Baseefa06ATEX0226X

UL

Class 1, DIV 1, Groups B, C, D

Tamb -40 to +60°C

File No. E91044

The Searchline Excel system has been designed, built and tested to meet the latest European standards for Radio Frequency Immunity (RFI). It has been tested and approved to BS EN 50270.

7. Certification

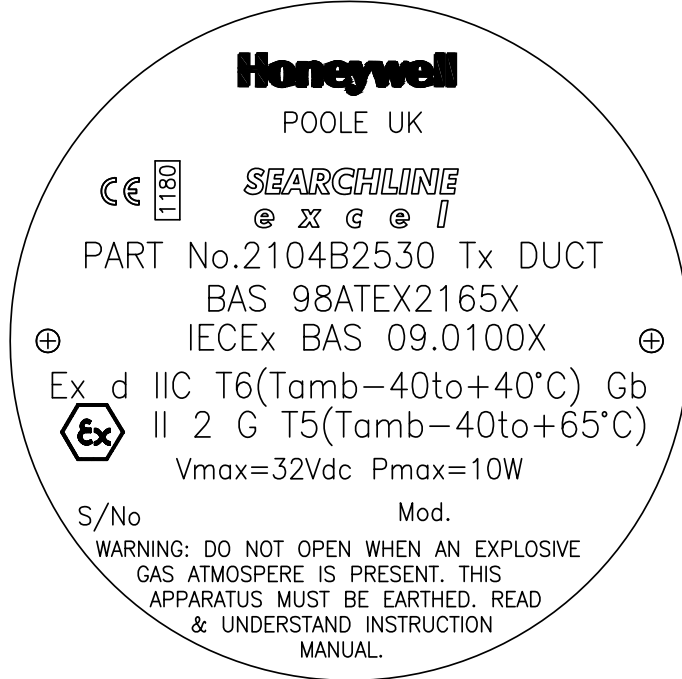
7.2 Conduit Technical Characteristics (ATEX, IECEx version)

Ingress Protection	IP66 and 67.
Temperature Rating	-40 to +105°C.
Construction	A helically wound galvanised steel core with cotton packing and enhanced oil resistant PVC covering. Covering material displays good resistance to dilute acids, alkalis and hydrocarbon products.
Colour	Grey
Electrical Flash Voltage	More than 24kV.
Insulation Resistance	More than 100M ohms.
Connector Pull off Classification	FRG04: Heavy.
Conductor Crush Classification	FRG04: Heavy.
Flame Propagation	Flame dies in less than 30 seconds after ignition source is removed.
Approvals	Bureau Veritas.

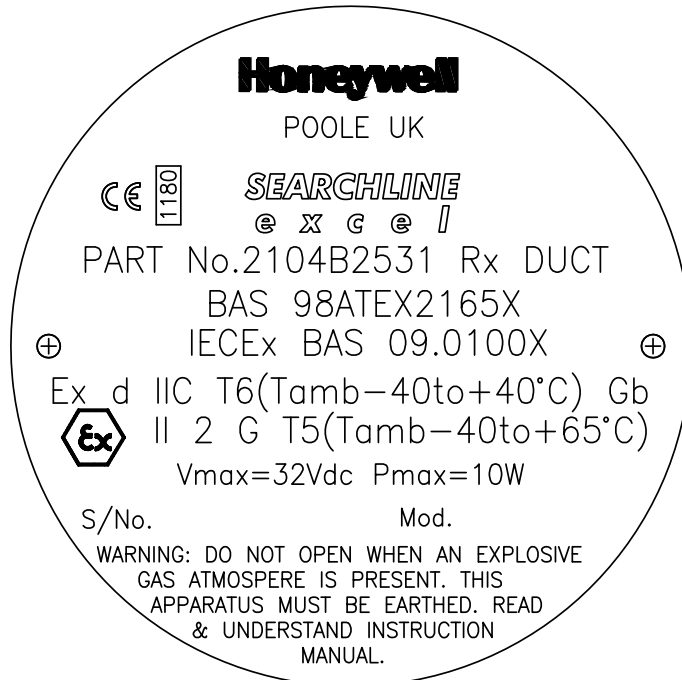
7. Certification

7.3 Certification Labels ATEX, IECEx

7.3.1 Transmitter



7.3.2 Receiver



7. Certification

7.3.3 Heated Reflector Panel

HONEYWELL ANALYTICS LTD

BH17 0RZ Made in UK

2104B0715

CONTAINS:

REFLECTOR PANEL HEATER

 **II2G Exd IIC Gb T3 (-40°C ≤ ta ≤ +60°C)**

Baseefa 06ATEX0226X

 **0518**

SN:??/????

HONEYWELL ANALYTICS LTD

BH17 0RZ Made in UK

2104B0716

CONTAINS:

REFLECTOR PANEL HEATER

 **II2G Exd IIC Gb T3 (-40°C ≤ ta ≤ +60°C)**

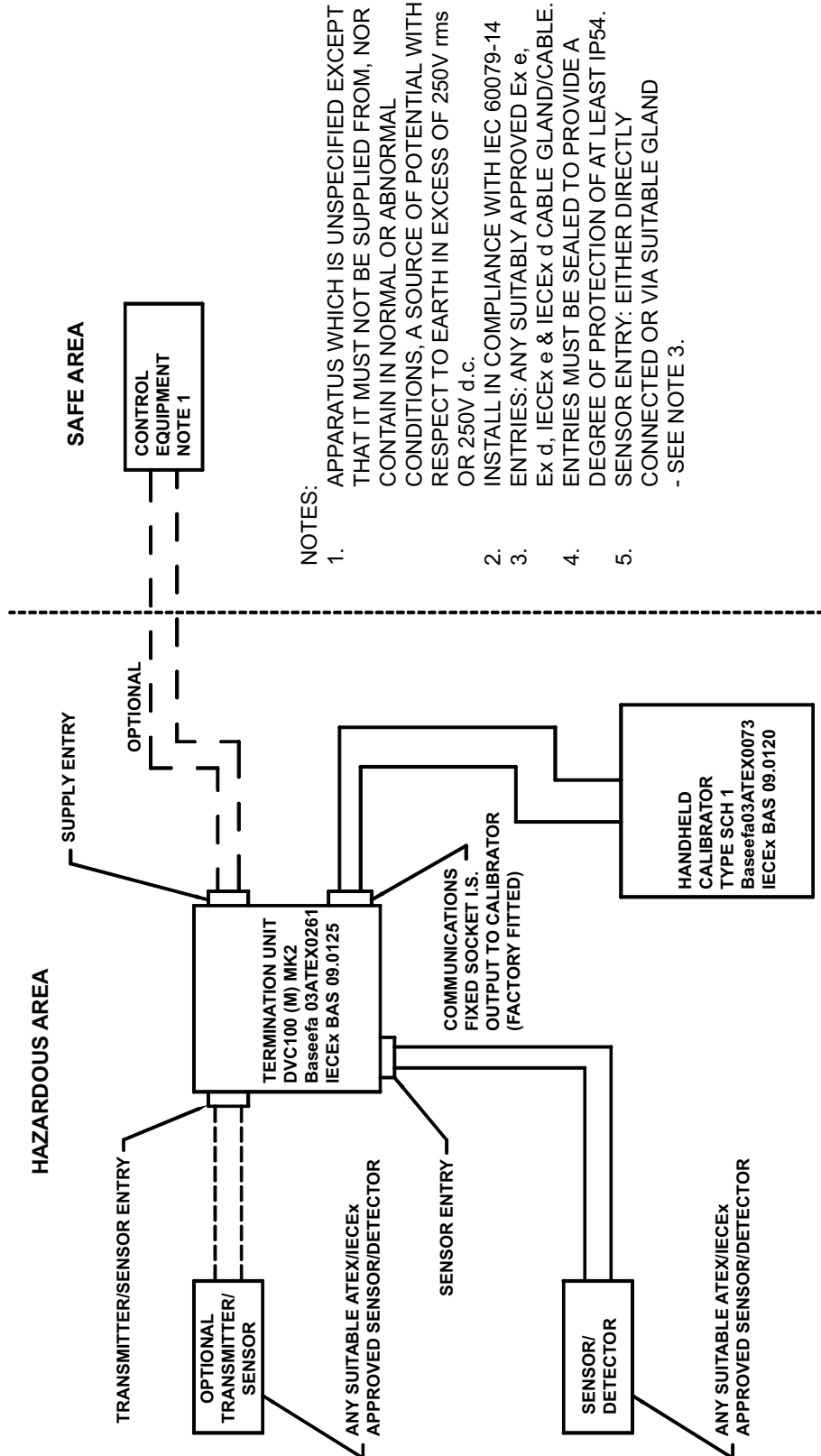
Baseefa 06ATEX0226X

 **0518**

SN:??/????

7. Certification

7.3.4 System Diagram



NOTES:

1. APPARATUS WHICH IS UNSPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN IN NORMAL OR ABNORMAL CONDITIONS, A SOURCE OF POTENTIAL WITH RESPECT TO EARTH IN EXCESS OF 250V rms OR 250V d.c.
2. INSTALL IN COMPLIANCE WITH IEC 60079-14 ENTRIES: ANY SUITABLY APPROVED Ex e, Ex d, IECEx e & IECEx d CABLE GLAND/CABLE. ENTRIES MUST BE SEALED TO PROVIDE A DEGREE OF PROTECTION OF AT LEAST IP54.
3. SENSOR ENTRY: EITHER DIRECTLY CONNECTED OR VIA SUITABLE GLAND - SEE NOTE 3.
- 4.
- 5.

7. Certification

7.3.5 ATEX Special Conditions of Safe Use

7.3.5.1 Transmitter and Receiver

The integral supply cables must be mechanically protected and terminated in a suitable terminal or junction facility.

The cover fixing screws shall be grade 12.9 minimum.

7.3.5.2 Heated Reflector Panel

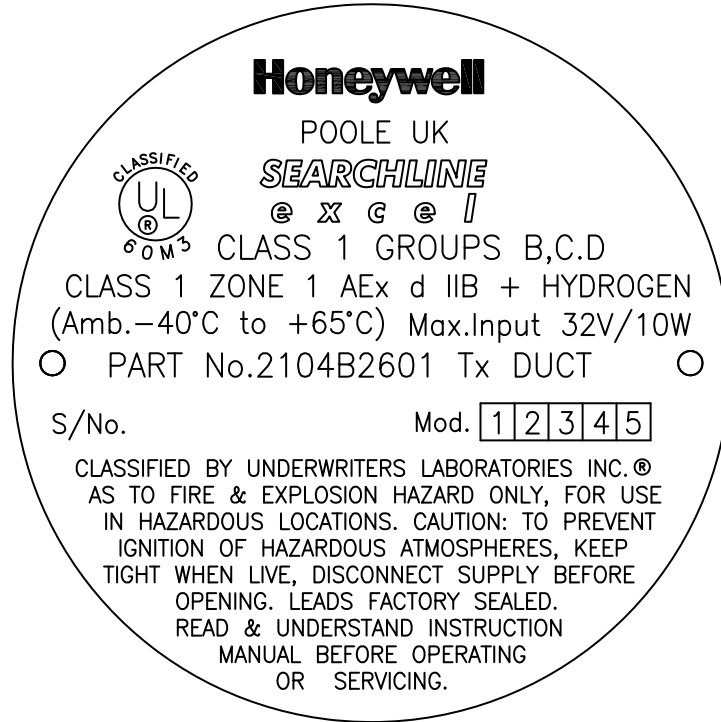
The integral supply cables must be mechanically protected and terminated in a suitable terminal or junction facility.

In addition to the integral earth conductor, external equipotential bonding may be maintained via the rear mounting thread.

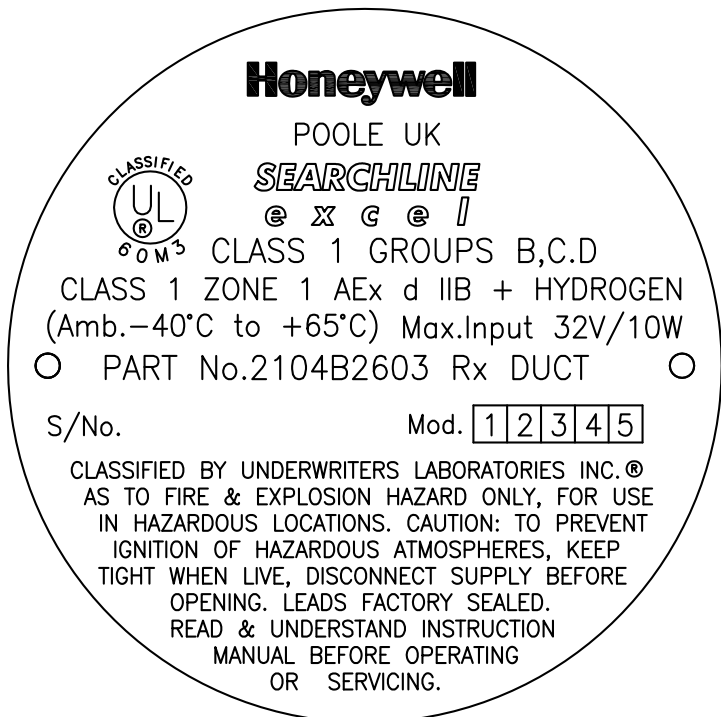
7. Certification

7.4 Certification labels UL

7.4.1 Transmitter



7.4.2 Receiver



7. Certification

7.4.3 Heated Reflector Panel

HONEYWELL ANALYTICS LTD
POOLE BH17 0RZ UK
REFLECTOR PANEL HEATER



PART No. 2104B0717

CLASS 1, DIV 1, GROUPS B, C, D

Tamb -40°C TO +60°C

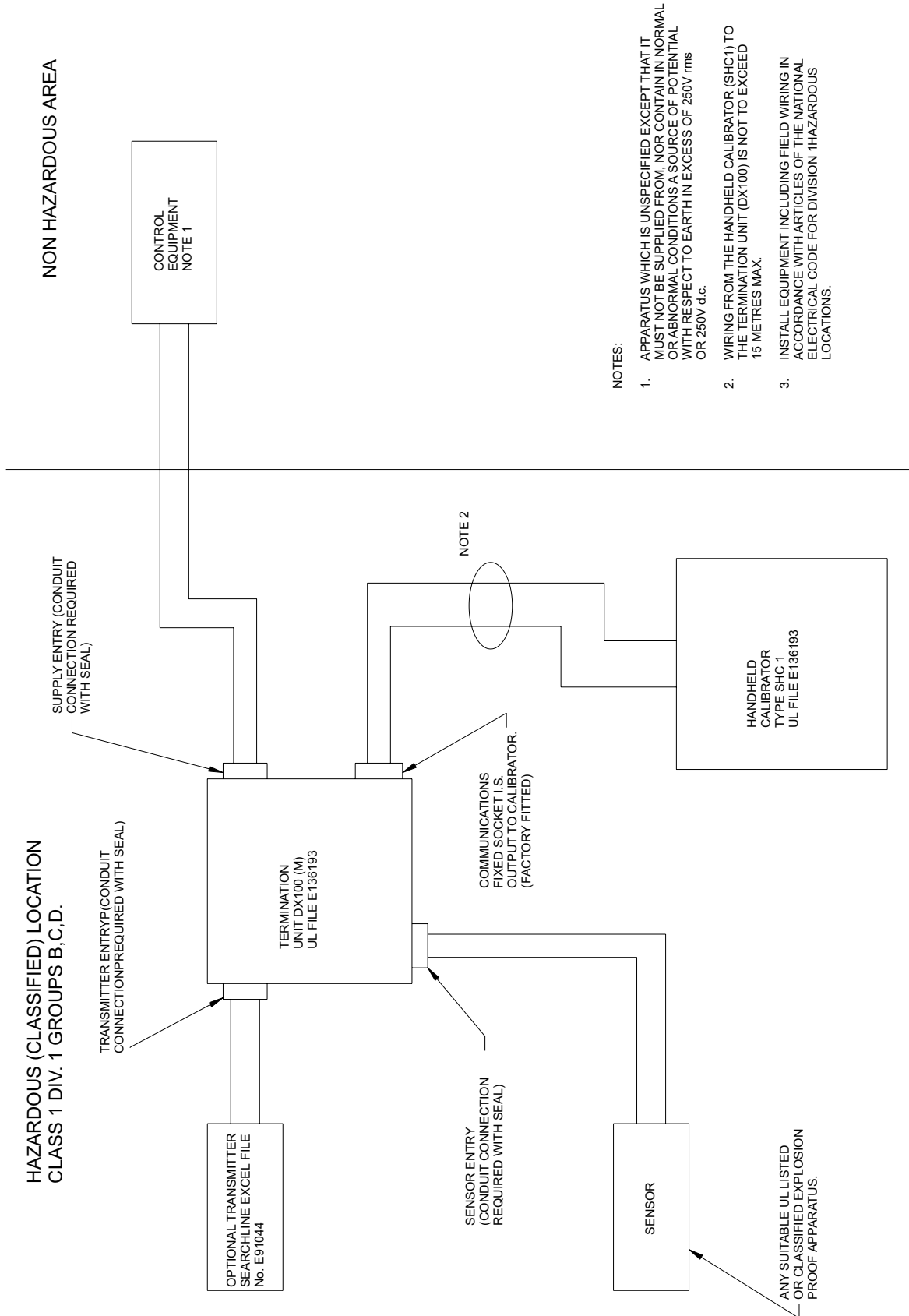
S/No.

MOD RECORD					
1	2	3	4	5	6

LEADS FACTORY SEALED. READ &
UNDERSTAND INSTRUCTION MANUAL
BEFORE OPERATING OR SERVICING.

7. Certification

7.4.4 System Diagram With DX100(M) Termination Unit



8. Warranty Summary

Honeywell Analytics warrants the Searchline Excel Cross-Duct against defective parts and workmanship and will repair or (at its option) replace any instruments which are or may become defective under proper use within 36 months from date of shipment from Honeywell Analytics.

This warranty does not cover consumable items, normal wear and tear or damage caused by accident, abuse, improper installation, poisons, contaminants or abnormal operating conditions. Under no circumstances shall Honeywell Analytics liability exceed the original purchase price paid by the buyer for the product.

Any claim under the Honeywell Analytics Product Warranty must be made within the warranty period and as soon as reasonably possible after a defect is discovered. In the event of a warranty claim please contact your local Honeywell Analytics Service representative.

This is a summary, for full warranty terms please refer to the Honeywell Analytics "General Statement of Limited Product Warranty" available upon request.

Appendix A - Handheld Interrogator

A.1 Introduction

This appendix provides reference information about the SHC1 Handheld Interrogator.

The interrogator provides the user end of a two-way communication link between the Excel system and the operator.

It features facilities which let the operator configure, align, functionally test and diagnose faults in the system.

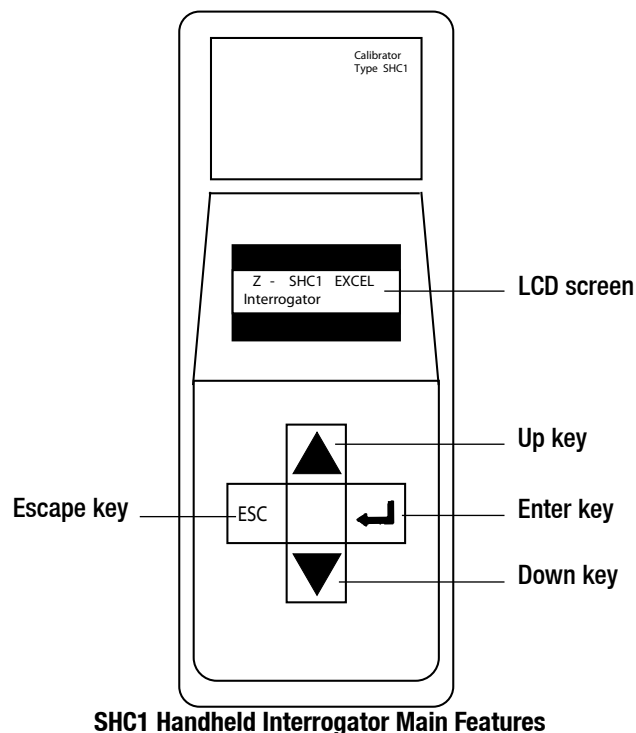
The appendix gives:

- an overview of the interrogator features
- information about how to connect the interrogator to the Excel systems
- basic user tasks, including switching on/off and changing the battery
- a detailed description of the menus which the interrogator provides
- problem solving information if trouble occurs when using the interrogator

Details of how to use the interrogator for different tasks with the system are given in **Chapter 3** and **Chapter 4** of this handbook.

A.2 Overview

The interrogator consists of an LCD screen and four keypad buttons. It links to the Excel Receiver unit via an IS connector on the end of a flexible cable connected to the associated junction box.



Appendix A - Handheld Interrogator

The interrogator is powered by a standard 9V battery and has a management system which reduces power consumption by placing the unit in an idle mode when it is waiting for user input or for a communication operation to complete.

The interrogator also features a 2k byte non-volatile RAM (NV-RAM) split into two sections. These sections are used to store the current operating mode and a backup copy.

Liquid Crystal Display Screen

This screen consists of a two-line, 16-character dot-matrix liquid crystal display (LCD). The screen displays messages which communicate information from/to the user.

It displays a menu system that enables the user to select the command mode for the system, and can also display information about the system configuration and its settings, plus any error messages.

Keypad Buttons

The four keypad buttons are used to provide operator input in response to messages shown on the display.

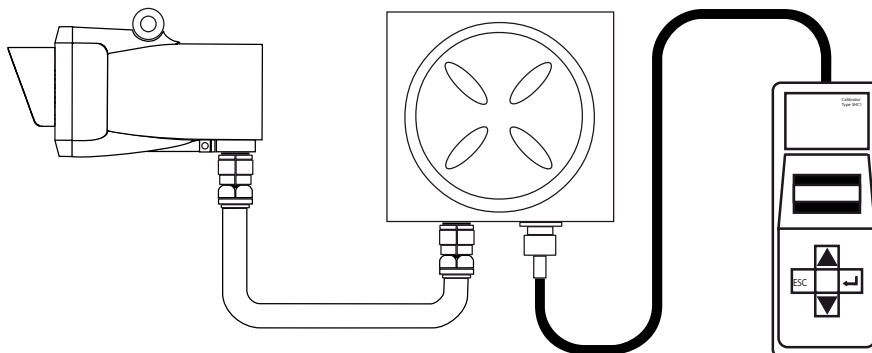
This includes menu option selections and changing parameter values. The four buttons are:

▲	Up	Move to the previous menu option, list item, or increase a displayed data value. Move to the next menu option, list item, or decrease a displayed data value.
▼	Down	
ESC	Escape	Quit the current menu level or operation and return to the previous menu, e.g. stop displaying a list, abort a command. No change if already at the top level.
↵	Enter	Select, i.e. Invoke/accept, the currently displayed menu option, list item, data value, or configuration change.

Note: If the ▲ and ▼ keys are used to advance beyond the end of a list a wrap around to the other end of the list occurs.

A.3 Connection to System

Details of how to connect the interrogator to the Searchline Excel Cross-Duct are given in **Chapter 3**. The diagram shows a typical example.



Note: If connecting via a non-HA junction box then the SHC Protection Device needs to be used.

Appendix A - Handheld Interrogator

A.4 Basic User Tasks

Switching On

- (1) Press  for two seconds.

The unit recalls its previously set operating mode, i.e. **EXCEL**, **OPTIMA** or **OPTIMA PLUS**, and displays the following message for approximately three seconds:

```

Z - SHC1 Excel
Interrogator 4V0
```

The unit then displays the top level of the menu style interface in the following way:

```

Main Display
^                               v
```

During use the first line of the display shows the current level in the menu tree.

The second line displays the sub menu title, action to be invoked, or data value to be checked/changed.

Note: To change the operating mode at switch-on, e.g. from **OPTIMA** to **EXCEL**, press the **ESC** key whilst the initial message is displayed. This changes the mode and re-displays the message.

Switching Off

- (1) Select the Power Off option from the Main Menu,

Alternatively press the  and **ESC** buttons simultaneously for a fast power off.

Notes:

1. The unit powers down automatically after five minutes of non-use.
2. The fast power off facility and auto power off are disabled when a menu option is selected that modifies the interrogator's configuration.

Changing the Battery


To fit/replace the battery proceed as follows:

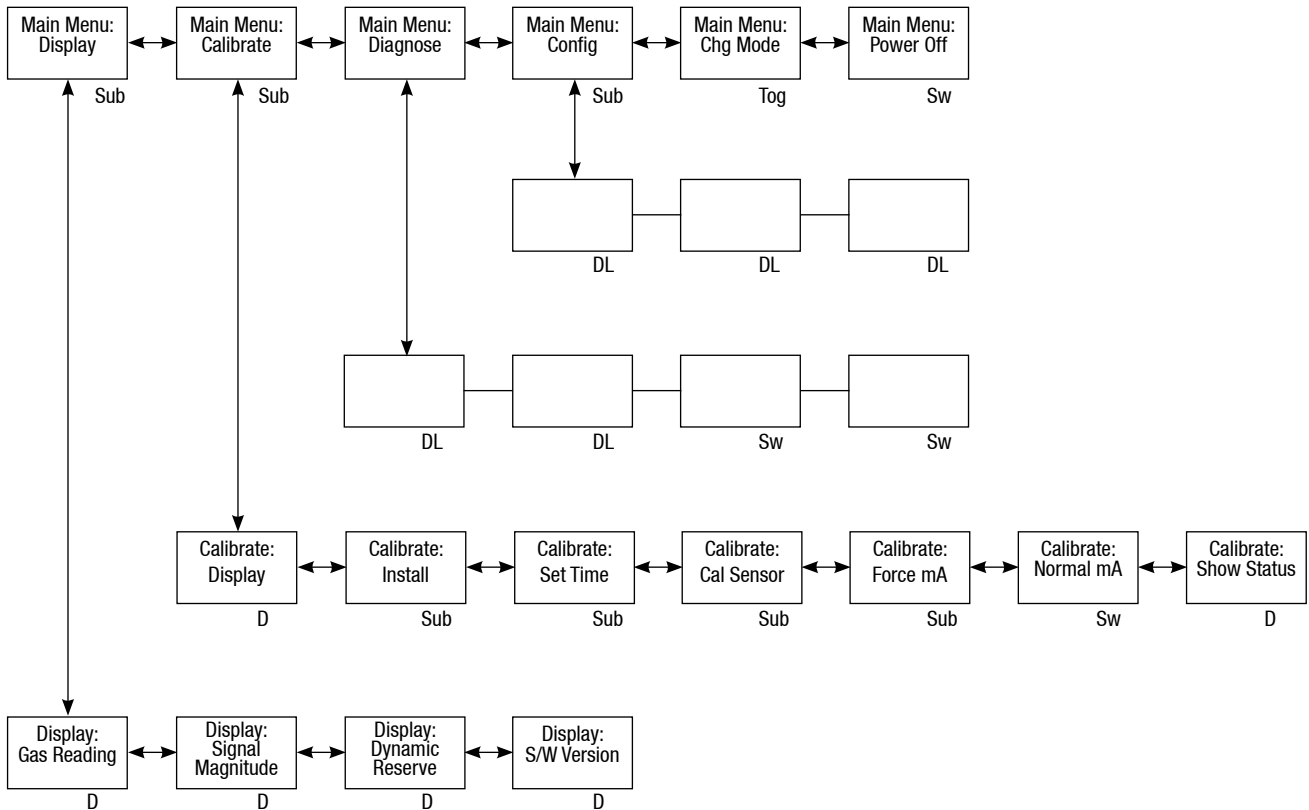
- (1) Loosen the four rear cover screws.
Use a 2.5mm Allen hexagon key.
- (2) Carefully lift the front half of the interrogator away from the rear cover.
Ensure that the flexible connector between the keypad and the electronics module is not damaged.
- (3) Unclip and remove the battery.
- (4) Fit the new battery, reuse the protective sleeve.
- (5) Carefully refit the front half of the interrogator to the rear cover.
Ensure that the flexible connector lies flat.
- (6) Tighten the four rear cover screws.

Appendix A - Handheld Interrogator

A.5 Menus

The interrogator top level menu structure and menu choices are as follows.

All menu options are implemented by pressing the keypad  key. The menu options and types are shown in the diagram:



where:

- D** a single set of data is displayed.
- DL** a list of data is displayed - use the ▲ and ▼ keys to navigate the entries in the list.
- Sub** another menu of options is displayed when this choice is selected - use the ▲ and ▼ keys to navigate the sub menu choices.
- Sw** the displayed option is immediately activated.
- Tog** the displayed option is toggled between three choices using the ▲ and ▼ keys.

Chapter 3 and **Chapter 4** of this handbook describe how the Interrogator and menus are used when the system is being installed/in use.

Appendix A - Handheld Interrogator

A.5.1 Main Menu

This menu consists of the following sub menu options:

Display	Display gas and other unit readings.
Calibrate	Install and calibrate the system, force the analogue output, show the calibration coefficients or show the instrument status.
Diagnose	Inspect the fault and warning logs, perform a self-test or perform a soft reset.
Config	Read the configuration parameters of the unit, update the user configuration parameters.
Chg Mode	Toggle the operating mode of the interrogator.
Power Off	Switch the interrogator off.

A.5.2 Display Menu

This sub menu displays gas and other unit readings. It has the following options:

Gas Reading	Display the gas type and system status.
Signal magnitude	Show the level of the sample and reference signals.
Dynamic Reserve	Shows the acceptable drop in signal level before beam block occurs as a percentage of the current signal level.
S/W Version	Displays the system software version and the current time and date.

Gas Reading

Display the gas type and system status. The display is in the following format:

```

Excel gggggggg
rrrrrr uuuu /
```

where:	gggggggg	Gas name. For a special gas table this shows <Gnnn> where nnn is the identifier.
	rrrrrr	Gas reading.
	uuuu	Measurement units.
	/	This is a status character which indicates one of the following:
	/ -	A spinning line shows the system is operating normally i.e. in a fully active state.
	-	A stationery line shows the system is in an inactive state.
	W -	Active Warning.
	F -	Active Fault.
	B -	Beam Block.
	A -	Alarm

Appendix A - Handheld Interrogator

Signal Magnitude

Show the level of the sample and reference signals. The display is in the following format:

```
Sample: aaaaaaa
Ref: bbbbbbb
```

where: **aaaaaaa** Signal magnitude for the sample channel.
 bbbbbbb Signal magnitude for the reference channel.

Dynamic Reserve

Shows the acceptable drop in signal level before beam block occurs as a percentage of the current signal level. The display is in the following format:

```
Dynamic Reserve:
xxx.xx %
```

where: **xxx.xx** The acceptable drop in signal level before beam block measured as a percentage of the current signal level.

S/W Version

Displays the system software version and the current time and date. The display is in the following format:

```
Excel S/W vvVvv
hh:mm dd/mm/yy
```

where: **vvVvv** Version number of the Excel system software.
 hh.mm System time as hours and minutes.
 dd/mm/yy System date as day of the month, month number and the last two digits of the year.

A.5.3 Calibrate Menu

This sub menu is used when installing and calibrating the system. It has the following options:

- Display** Display system readings.*
- Install** Direct the alignment and initialisation of the system.*
- Set Time** Set the system real time clock time and date.
- Cal Sensor** Calibrate the system zero.*
- Force mA** Fix the 4-20mA analogue output at a selected level.
- Normal mA** Restore the analogue output to its normal output state.
- Show Status** Show the calibration and configuration status of the system.

The options marked with an asterisk, (*), require the system's analogue 4-20 output to be inhibited during their operation. Where this occurs then the following sequence is automatically added to the affected operation.


Appendix A - Handheld Interrogator

Before the selected sub menu operation is started the following message is displayed for at least three seconds:

```
Inhibiting 4-20
Please Wait
```

The analogue output is inhibited and the chosen sub menu operation proceeds. After the sub menu operation is completed, or aborted by pressing the **ESC** key, the following message is displayed:

```
Press Enter To
Release 4-20
```

Press  to release the 4-20 receiver output and the following message will be displayed for three seconds:

```
4-20 Released
```

Display

Display system readings. This choice is the same as the **GAS READING DISPLAY** option on the **DISPLAY MENU**.

Notes:

1. *The 4-20 output is inhibited during the display. See the earlier description.*
2. *No spinning line is displayed as the receiver is not in a fully activated state.*

Install

This choice is used to complete the alignment and commissioning operations after the system is mechanically and electrically installed. It provides a sequential set of operations to:

- **view the system type**
- **set the system path length**
- **perform a system self test**
- **check system alignment**
- **initialise the system and make it live**

Note: The 4-20 output is inhibited during this procedure. See the earlier description.

System Type

The initial display after Install is chosen is in the following format:

```
System Type
tttttttt
```

Appendix A - Handheld Interrogator

where: **ttttttt** System type. The system type displayed is one of the following:

Display Text	System Type
Duct Mount	0.5 - 5m range system

Note: *It is not possible to change the system type. This is set during calibration and configuration of the unit at the factory.*

Path Length

The following message is displayed:

```

Path Length
^      nnnn      v
    
```

where: **nnnn** The path length in metres.

The following ranges of path length can be entered:

System Type	Minimum Range (m)	Maximum Range (m)	Step Size (m)
Duct Mount	0.5	5	0.1

Self Test

This starts the system self test process. The following message is displayed:

```

Self Test
Please Wait
    
```

When finished the interrogator displays the following message for at least three seconds:

```

Checks Passed
    
```

The following message is now displayed:

```

SIG: [REDACTED]
TGT: [REDACTED]
    
```

Alignment

No alignment adjustments are provided for the Searchline Excel Cross-Duct. If the mechanical installation is satisfactory Searchline Excel Cross-Duct can now be initialised.

Press **Enter** on the keypad and the display shows:

```

Signals OK
    
```

Appendix A - Handheld Interrogator

Ensure Zero Gas
then press Enter

Press **Enter** and the display will show the following message:

Zero Cal OK

This message is displayed for three seconds at the end of a successful initialisation process.

Installation
complete

Note: The Searchline Excel system is **live** after a successful initialisation.

Set Time

This option lets you set the system's time and date.

The initial display after **SET Time** is chosen is in the following format:

Time HH:MM
 ▲ hh:mm ▼

where: **hh** Hours.
 mm Minutes.

When first displayed only the current hour is shown.

All settings are adjusted by means of the ▲ and ▼ keys on the keypad. After setting the hour the minutes are displayed.

After the time has been entered then the same process is used to set the date which is displayed in the following format:

Date DD/MM/YY
 ▲ dd/mm/yy ▼

Appendix A - Handheld Interrogator

where: **dd** Day.
 mm Month.
 yy Last two digits of the year.

Note: The time and date will not be updated unless both are entered and accepted without error.

Cal Sensor

This menu option zeros the system.

Notes:

1. *The 4-20 output is inhibited during this procedure. See the earlier description.*
2. *There must be no gas in the system beam path whilst this procedure is carried out. The following message is displayed:*

Ensure Zero Gas
Press Enter

The following message is displayed while the calibration operation is being performed:

Processing Data
Please Wait...

If the calibration is successful, the following message is displayed for a period of three seconds:

Zero Calibrated

Force mA

This option allows the system s analogue output signal to be adjusted to a fixed level, e.g. when setting up a system controller. The following message is displayed:

O/P current mA
▲ mmmmmm ▼

where: **mmmmm** Current to output.

This is adjusted using the ▲ and ▼ keys over the range 1mA to 21mA in steps of 0.1mA. After adjustment the output is forced to the set level and the following message is displayed:

Fixed: mmmmmm mA
 Press Enter

where: **mmmmm** Analogue output current previously set.

Appendix A - Handheld Interrogator

Normal mA

This menu option returns the system to its normal analogue output state, irrespective of its previous state. If successful, the following message is displayed for three seconds:

4-20mA Released

Show Status

This menu option displays the calibration and configuration status of the system. The status information is displayed in the following format:

cccccccccccccccc

where: **cccccccc...** Title of the calibration status field.
 sssssssss Current state of calibration.

The different settings from the list are selected using the ▲ and ▼ keys on the keypad.

The calibration status fields and values are given below:

Calibration Status Fields	Display Text	False State	True State
Temperature Cal.	Temp Sensor	Uncalibrated	Calibrated
Zero Calibration	Zero Ratio	Uncalibrated	Calibrated
Span Calibration	Span Sensitivity	Uncalibrated	Calibrated
4-20mA Calibration	Analogue Output	Uncalibrated	Calibrated
Det. Temp. Comp.	T Compensation	Uncalibrated	Calibrated
Det. Sens. Comp.	Det Sensitivity	Uncalibrated	Calibrated
Installation	Installation	Required	Complete
Valid Date Time	Date and Time	Estimated	Set
Loop Test	Analogue Check	Failed	Passed

A.5.4 Diagnose Menu

This sub menu has the following options:

- Active Faults** Display the active faults in the system.
- Active Warns** Display the active warnings in the system.
- Self Test** Perform a diagnostic system self test.
- Soft Reset** Reset the system.

Active Faults

This menu option displays operational faults when the system is in service.

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If there are one or more faults present, then the faults are displayed one at a time.

Use the ▲ and ▼ keys to navigate the list.

If no active faults are present the display shows the following for three seconds:

None Present

The Diagnose sub menu is then displayed.

If there are one or more faults present, the display shows:

F-hh:mm DD/MM/YY
 eeeeeeeeeeeeeeeee

- where:
- F** Indicates that the message displayed is a fault.
 - hh:mm** Time the fault occurred.
 - DD/MM/YY** Date the fault occurred.
 - eeeeeee** Fault description. See the following table for a list of error messages.

See also **Chapter 6, Problem Solving.**

Display Text	Fault Description	Meaning
Bad 4-20mA Loop	ERR_EXCEL_LOOP_FAULT	A fault has occurred in the 4-20mA signal loop.
DSP Fault	ERR_EXCEL_DSP_FAULT	Fault on the gas detector's digital PCB.
Hardware Fault	ERR_EXCEL_HW_FAULT	A hardware fault has occurred.
NV-RAM Fault	ERR_EXCEL_FRAM_FAULT	A fault has been detected in the unit's NV-RAM.
RTC Fault	ERR_EXCEL_RTC_FAULT	The time and date record stored by the RealTime Clock (RTC) has been lost.
Software Fault	ERR_EXCEL_SW_FAULT	An gas detector software error has occurred.
Supply Fault	ERR_EXCEL_SUPPLY_FAULT	Incorrect supply voltage reaching the gas detector.

Active Warns

This menu option displays the active warnings in the system. They are displayed in the same way as described for **Active Faults** except that a **W** is displayed instead of **F** on the first line of the display.

Display Text	Fault Description	Meaning
Alarm	ERR_EXCEL_LOG_ALARM	The Excel log has become damaged.
Bad Temperature	ERR_EXCEL_TEMPERATURE_LIMIT	Unit has been operated at a temperature outside its specified and certified range.
Baseline Drift	ERR_EXCEL_DRIFT_LIMIT	Drift of unit's baseline.
Beam Blocked	ERR_EXCEL_BEAM_BLOCKED	The infrared beam between the Transmitter and Receiver has become blocked.
Neg Gas Reading	ERR_EXCEL_NEGATIVE_DRIFT	Negative drift of gas detector's zero position.
Not Installation	ERR_EXCEL_BAD_INSTALLATION	Incorrect gas detector installation has occurred.

Appendix A - Handheld Interrogator

Overrange	ERR_EXCEL_OVERRANGE	An overrange signal has occurred.
Power Failed	ERR_EXCEL_LOG_POWER_FAIL	The gas detector has suffered an internal power failure.
Reset Occurred	ERR_EXCEL_RESET	A gas detector reset has occurred.
Time Adjusted	ERR_EXCEL_LOG_TIME_ADJUST	The Excel log time has been changed.
Uncalibrated	ERR_EXCEL_UNCALIBRATED	The gas detector requires calibration.
Volt Ref Fault	ERR_EXCEL_VOLTAGE_REF_FAIL	Voltage reference fault detected.

Self Test

This option lets you start a system diagnostic self test.

The following message is displayed during the self test process:

```
Processing Data
Please Wait
```

The following message is displayed for three seconds at the end of a successful self test process.

```
Checks Passed
```

Soft Reset

This option lets you reset the system.

This message is displayed during the reset process:

```
Processing Data
Please Wait
```

The following message is displayed for three seconds when the process is completed:

```
Unit Reset
```

A.5.5 Config Menu

This sub menu lets you check the configuration parameters of the unit and update the user configuration parameters. It has the following options:

- Show Gas** Show the gas related configuration parameters.
- Show Config** Show the user related configuration parameters.
- Show Install** Show the installation related configuration parameters.

Show Gas

This option displays the useful gas table configuration parameters in the following way:

```
CCCCCCCCCCCCCCCC
VVVVVVVVVV
```

Appendix A - Handheld Interrogator

where: **ccccccc...** Title of the configuration setting.
 vvvvvvvv Setting value.

Note: The settings are not field configurable:

Gas Configuration Parameters	Display Text	Min Value	Max Value	Step Size
Gas ID	Gas Ident	0 1 = Methane all other IDs shown as G<nnn>	255	1
Gas Units	Gas Units	%LEL (Cross-Duct only)		
Effective Full Scale	Gas Full Scale	0.1	100000	0.05

Show Config

This option displays the configuration parameters the user can set in the same way as for the Show Gas option. The configurable settings and values are shown in the following table:

Configuration Parameters	Display Text	Min Value	Max Value	Step Size	Default Values
Protocol Address	Digital Address	0	255	1	0
Time to Block	Block Warn Time	5s	600s	5s	30
Time to Fault	Block Fault Time	0s	600s	5s	120
Max Response	Maximum T90	1s	60s	1s	60
Analogue Style	Analogue Mode	Alarm or Continuous			C
Inhibit Current	Inhibit mA	0mA	3mA	0.05mA	2.0
Block Current	Blocked mA	0mA	4mA	0.05mA	2.5
Low Signal Current	Low Signal mA	0mA	4mA	0.05mA	3.0
Low Signal Level	Low Signal %	0%	90%	1%	33%
Alarm Threshold	Alarm Threshold	10%	100%	1%	20%
Report fault due to blockage	RPRT Blocked Fault	Enable or Disable			E

Show Install

This option displays the installation configuration parameters in the same way as for the Show Gas option. The configurable settings and values are shown below:

Installation Configuration Parameters	Display Text	Description		
Path Length	Path Length	0.5m min	5m max	0.1m steps

Appendix A - Handheld Interrogator

A.5.6 Chg Mode

This menu option toggles the operating mode of the interrogator between Excel, Optima and Optima Plus to match the gas detector it is attached to. When invoked the mode is displayed in the identification banner (the same as the one displayed when the unit is switched on) for three seconds as follows:

```
Z - SHC1 aaaaaa
Interrogator 4V0
```

where: **aaaaaa** The type of gas detector that the interrogator is currently set to, i.e. **Excel, OPTIMA or OPTIMA PLUS.**

A.5.7 Power Off

This menu option switches the interrogator off.

Alternatively press the **↵** and **ESC** buttons simultaneously for a fast power off.

Notes:

1. The unit powers down automatically after five minutes of non-use.
2. The fast power off facility and auto power off are disabled when a menu option is selected that modifies the unit's configuration.

A.6 PROBLEM SOLVING

Interrogator problems that occur during communication with the system or as a result of a command failure will be displayed in the following format:

```
Error: eee
ssssssssssssssss
```

where: **eee** Error code.
sssssss... Textual description of the error.

If an error message of this kind is displayed note down the error code and text description and contact Honeywell Analytics.

Appendix B - Glossary

B.1 Terminology

Ex d

Flame proof or explosion proof within the confines of the European series of standards EN60079. An enclosure that can withstand the pressure developed during the internal explosion of an explosive mixture and that prevents transmission of the explosion to the explosive atmosphere surrounding the enclosure.

Ex e

Increased safety within the confines of the European series of standards EN60079 applied to electrical apparatus that does not produce arcs or sparks in normal service, in which additional measures are applied so as to give increased security against the possibility of excessive temperatures.

Instrument Assisted Alignment (IAA)

A method of commissioning the Excel system using the associated electronic Handheld Interrogator device. The process will not allow the Excel system to initialise unless the alignment of the Receiver and Transmitter is correct and the signal strength is correct.

IS

Intrinsically safe, apparatus in which the circuits themselves are incapable of causing ignition of a flammable gas.

Lower Explosive Limit (LEL)

The volume of flammable gas or vapour in air below which an explosive gas atmosphere will not be formed.

RS485

An industry-wide serial communication link protocol.

Turbo heating

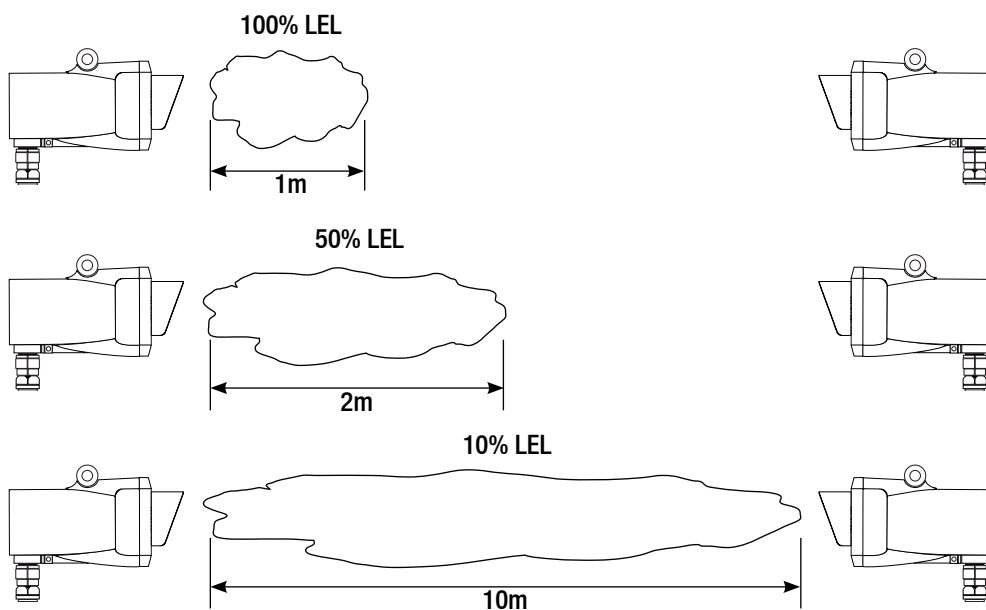
Increased Transmitter window heating at low operating temperatures.

Appendix B - Glossary

B.2 Open Path Detector Measurement Units

Open path detectors measure the amount of gas present in the beam. However, they cannot discriminate between a low concentration gas cloud over a large area and a high concentration gas cloud in a small area. Generally, gas readings of LEL.m (Lower Explosive Limit metres) are used. LEL.m is calculated by multiplying the size of a gas cloud by its concentration.

An open path alarm set at 1 LEL.m would be triggered by any of the situations shown below:



The Searchline Excel Cross-Duct operates with a very short path length, making it reasonable to assume that the gas concentration is uniform across the duct. Therefore Searchline Excel Cross-Duct uses the duct width to convert the measured gas reading from LEL.m to %LEL. It is important that the duct width is entered correctly during commissioning otherwise the detector could report a significant under or over read of gas concentration.

B.3 Abbreviations

EMC	Electro-Magnetic Compatibility
IAA	Instrument Assisted Alignment
IP	Ingress Protection
IR	Infrared
IS	Intrinsically Safe
LEL	Lower Explosive Limit
NPT	National Pipe Thread
RFI	Radio Frequency Interference
UL	Underwriters Laboratories

Appendix C - Accessories & Spare Parts

C.1 System Units

The following table lists the different types of system units and provides the part numbers for the various certification options.

All types of Transmitters and Receivers include conduit and glands.

Short Range 0.5m – 2.5m	
2104N0011	Short range cross duct system 0.5m to 2.5m. ATEX approved, current source with DVC100M MK2 interface box and single tile heated reflector panel
2104N0031	Short range cross duct system 0.5m to 2.5m. ATEX approved, current sink with DVC100M MK2 interface box and single tile heated reflector panel
2104N1010	Short range cross duct system 0.5m To 2.5m. UL approved, current source including single tile heated reflector panel
2104N1030	Short range cross duct system 0.5m To 2.5m. UL approved, current sink including single tile heated reflector panel
Long Range 2.5m – 5.0m	
2104N0021	Long range cross duct system 2.5m to 5.0m. ATEX approved, current source with DVC100M MK2 interface box and four tile heated reflector panel
2104N0041	Long range cross duct system 2.5m to 5.0m. ATEX approved, current sink with DVC100M MK2 interface box and four tile heated reflector panel

C.2 General

Accessories	
Handheld Interrogator and accessories	
04230-A-1001	Hand Held Interrogator ATEX Certified (4V0 software) for Optima, Optima Plus and Excel
2104B2351	Hand Held Interrogator UL Certified (4V0 software) for Optima, Optima Plus and Excel
2108B1455	Hand Held EEPROM upgrade (4V0)
04320-A-1025	SHC Protection Device Module and Lead
2104B6250	SHC Calibrator Connector System 10m
DVC/DX Interfaces	
2104B6212	DVC100M MK2 Termination Unit ATEX with MODBUS capability
2104B2382	DX100M XP Termination Unit UL with MODBUS capability
Installation Accessories	
2104D0295	Sun/Heat Shade (Deluge Cover)
00780-A-0100	Honeywell Analytics Junction Box
210-190-045	Killark Junction Box (excludes terminals)
2992A0071	Conduit Assembly for Excel UL certified
0230-0069	Stainless Steel enclosure NEMA 4X 3/4" NPT UL
02104-N-9880	Upgrade to Nickel Plated Glands

Appendix C - Accessories & Spare Parts

Gas Test Equipment	
2104N3000	Searchline Excel Cross-Duct Test filters kit & Manual
2108D0271	Remote Gassing Pipe
Manuals (Hard Copy)	
<i>Note: Electronic copies of the manuals are supplied on CD with each instrument</i>	
2104M0520	Searchline Excel Cross-Duct Technical Handbook (English)
2104M0409	DVC100(M) MK2 Termination Unit Quick Start Guide Guide (English)
2104M0701	DX100 Series Termination Units Technical Handbook (English)
2104M0524	Searchline Excel Cross-Duct Test Filter Leaflet (English)
Cross-Duct	
2104B0715	Heated Reflector Panel for Short Range ATEX
2104B0717	Heated Reflector Panel for Short Range UL Certified
2104B0716	Heated Reflector Panel for Long Range ATEX
2104D2537	Retro-reflector mounting plate for Long Range
2104D2536	Retro-reflector mounting plate for Short Range
2104D2505	Mounting plate, Cross-Duct, Stainless Steel
2104D2506	Support strap, Cross-Duct mounting plate
2104D2542	Support strap, Cross-Duct retro-reflector for Long Range
2104D2541	Support strap, Cross-Duct retro-reflector for Short Range

Find out more

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