Searchline Excel
Infrared Gas Detectors
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 the UK, 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 BS EN 60079-14:2008 & IEC 60079-14:2007. Refer to BS EN 60079-29-2:2007 & IEC 60079-29-2:2007 in the UK 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 energy emitted by the Searchline Excel is less than 20mW/mm².
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 Limited 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 Limited 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.

Honeywell Analytics Limited 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 further details are required that do not appear in this manual, contact Honeywell Analytics Limited or one of their agents.
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1. INTRODUCTION

Searchline Excel is a hydrocarbon gas detection system that is available in two versions:

- **Searchline Excel Open-Path Gas Detector**
- **Searchline Excel Cross-Duct Gas Detector**

For information regarding the Cross-Duct Excel please refer to the Searchline Excel Cross-Duct Technical Handbook, part number 2104M0520.

Searchline Excel Open-Path Gas Detector (OPGD) consists of a Transmitter unit that sends an infrared beam to a Receiver unit up to 200 metres away, and can be located where a flammable hydrocarbon gas cloud is likely to occur.

The detector operates on the principle of infrared (IR) absorption. Gases absorb light at specific wavelengths depending on their molecular composition. Hydrocarbon gases absorb in the infrared region of the spectrum. If a cloud of hydrocarbon 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 Searchline Excel Transmitter unit produces the infrared light, and the Receiver unit features optical detectors and signal processing electronics. Each unit is housed in a robust stainless steel housing. The Receiver produces a 4 - 20mA analogue output equivalent to 0 - 5 LEL.m (Lower Explosive Limit metres) of gas.

**NOTE: THE INFRARED BEAM IS INVISIBLE AND EYE SAFE**

Searchline Excel is designed for use in the most demanding environments/applications and provides a sensitive, fast and reliable response. The sophisticated open-path technology provides immunity to sunlight and minimises the effects of environmental factors such as rain, fog, ice, snow and condensation.

The Transmitter and Receiver units incorporate heated optics designed to minimise the build up of humidity, condensation, snow or ice on the glass windows, that could obscure the optics in extreme conditions.

The system is microprocessor controlled with integral self-diagnostics and fault finding facilities.

Local communication between an operator/technician and the gas detector system is made via an associated Handheld Interrogator that uses the Receiver’s inbuilt RS485 serial link. The interrogator provides the user with a menu-style interface to select and invoke commands for commissioning and configuring the system, and for viewing the system state and measurements.

The interrogator is connected to the Receiver via one of Honeywell Analytics' DX/DVC100 (M) series types of Termination Unit, or via other types of junction box using the optional SHC Protection Device. The DX/DVC100(M) Termination Units feature an active digital interface that allows a remotely located control centre to monitor the gas detector's signal output and perform basic commands using the Modbus Remote Terminal Unit (RTU) protocol over an RS485 link.
This handbook consists of the following parts:

- **Chapter 1** Introduction
- **Chapter 2** System Description
- **Chapter 3** Installation And Operation
- **Chapter 4** Maintenance
- **Chapter 5** Problem Solving
- **Chapter 6** Specifications
- **Chapter 7** Certification
- **Appendix A** Handheld Interrogator
- **Appendix B** Glossary
- **Appendix C** Accessories & Spare Parts

**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**

- Searchline Excel Open-Path Infrared Gas Detector Basic Installation Guide
  Part No: 2104M0510
- DX100 Series Termination Units Technical Handbook
  Part No: 2104M0701
- DVC100 (M) MK2 Termination Unit Installation Guide
  Part No: 2104M0409
2. OVERVIEW

2.1 INTRODUCTION

Each type of Searchline Excel gas detector consists of two units, a Transmitter and a Receiver. This separate Transmitter/Receiver configuration provides the most reliable basis for open path gas detection.
There are three ranges of Searchline Excel gas detector. These are:

<table>
<thead>
<tr>
<th>Open-Path</th>
<th>Short Range</th>
<th>5 – 40m</th>
<th>(15ft – 130ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Range</td>
<td>20 – 120m</td>
<td>(65ft – 390ft)</td>
<td></td>
</tr>
<tr>
<td>Long Range</td>
<td>120 – 200m</td>
<td>(390ft – 650ft)</td>
<td></td>
</tr>
</tbody>
</table>

When designing an installation for Searchline Excel it is important that the correct range of the gas detector for each path to be monitored is selected and specified.

The Transmitter and Receiver are each mounted upon robust, adjustable mounting brackets. These brackets bolt to a mounting plate, which is designed to accommodate a variety of junction boxes, accessories and mechanical mounting configurations. The small size and flexibility of Searchline Excel and its mounting arrangements are intended to make correct installation design as simple as possible. Installation details are given in Chapter 3.

2.2 TRANSMITTER

The Searchline Excel Transmitter produces an intense, collimated infrared beam which is produced by a Xenon arc flashlamp.

The flashlamp’s infrared output is collimated using mirrors which enables a more uniform beam (no chromatic aberrations) to be produced and hence reduces alignment sensitivity. In order to prevent annoying visible flashes, the visible emissions from the flashlamp are blocked by a filter.

The Transmitter’s flashlamp is pulsed at precisely 4Hz, each pulse lasting for approximately one microsecond. The precise timing and extremely short duration of these pulses give the Transmitter a very distinctive signature. This distinctive signature makes it easy for the Receiver to distinguish Searchline Excel Transmitter pulses from both natural and artificial sources of infrared radiation.

**NOTE:**  THE INFRARED BEAM IS INVISIBLE AND EYE SAFE.

The medium and long range Transmitters contain a higher power flashlamp and larger optics than the standard short range unit. The resulting infrared beam is many times brighter which allows for a considerable increase in operating range.
The Transmitter window is heated to minimise condensation, frosting and the build up of snow. 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).

### 2.3 RECEIVER

The Searchline Excel Receiver collects infrared radiation from the Transmitter and performs measurements to enable hydrocarbon gases in the beam path to be detected.

Infrared radiation is collected by a single, silicon lens, which is common to both the sample and reference measurement channels. This radiation is divided by a beamsplitter and fed to two filtered detectors, sample and reference.

The sample detector input is filtered at wavelengths where strong infrared absorption is exhibited by the target gas. The reference detector input is filtered at nearby wavelengths, where strong infrared absorption is *not* exhibited by the target gas. By calculating the ratio of the sample to reference signal it is possible to measure the quantity of gas in the beam, whilst compensating for the effects of rain, fog, dirt etc.
2. OVERVIEW

The solid state, photovoltaic detectors used in Searchline Excel provide an exceptional dynamic range and superb temperature and long term stability. These features contribute strongly to the solar immunity and stability of Searchline Excel.

The Receiver contains all of the electronics necessary to amplify, condition and process the signals received by the infrared detectors. The advanced signal processing of Searchline Excel employs two microprocessors.

One microprocessor, the Digital Signal Processor (DSP), is used to perform the necessary intensive signal processing calculations.

The other microprocessor, the microcontroller, controls the overall function of the unit and performs the final calculations to determine the correct gas reading and output state.

The primary output of the Receiver is a signal in the range 4 - 20mA and is available as either source or sink options. For most applications, the output is calibrated for a range of 0 to 5 LEL m. (See Appendix B for the explanation of LEL m and other terms)

The Receiver also features an RS485 output which is used to communicate with the associated SHC1 Handheld Interrogator. The SHC1 is used to perform final alignment, commissioning, functional testing and diagnostic procedures.

The Receiver window is heated to minimise condensation, frosting and the buildup of snow. The level of heating applied is controlled by the microcontroller and is adjusted from zero to maximum depending on the window temperature.

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

2.4  ADJUSTABLE MOUNTINGS

The adjustable mountings are:

- Purpose-built for Transmitter and Receiver.
- Robust.
- Rigid and stable.
- Made from stainless steel.
- Fully adjustable for alignment

*Coarse and fine settings in both horizontal and vertical planes.*

*Adjustment range:*

- Vertical  ±45°
- Horizontal  ±90°

Alignment details are given in **Chapter 3.**
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.

Searchline Excel has been designed, engineered and customer tested to be the most robust, reliable Open-Path Gas Detector (OPGD) available to date.

The design and technology employed in Searchline Excel makes it far more resistant to the adverse effects of the operating environment and non-ideal installation engineering than previous generations of OPGDs.

With careful consideration of the intended operating environment and the installation design, the installer/operator can maximise the reliability, availability and performance achieved with Searchline Excel.

Before designing or specifying an installation for Searchline Excel, 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 Gas Detectors. For this reason, Searchline Excel 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 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. INSTALLATION AND OPERATION

3.2 SITING AND MOUNTING

3.2.1 General
When designing an installation for a Searchline Excel 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.

3.2.2 Location for Best Coverage
Guidance on the positioning of gas detectors to provide the best detection coverage is contained
in BS EN 60079-29-2:2007 & IEC 60079-29-2:2007 and other national Codes of Practice. It is
recommended that the installation designer consults these Codes of Practice when determining
where detectors are to be located. In general, the following positions usually provide the best
results:

- Below potential leak sources for gases that are heavier than air.
- Above potential leak sources for gases that are lighter than air.
- Near to leak sources, along the expected leak trajectory, taking account of the
  prevailing wind direction and any other factors which will influence propagation
  of the leak.
- Between possible leak sources and any potential sources of ignition.

Location to Maximise Reliability and Availability
Care in choosing the location of Excel detectors can contribute significantly to the overall
reliability and availability.

When locating units, attempt to avoid areas where they 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 +/- 0.5°. 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.

Intense Heat - Excel is certified and specified for operation in environments up to
+65°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’s 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.
3. INSTALLATION AND OPERATION

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.

Note: The heated optics have not been evaluated as part of the performance testing relating to the FM approval and therefore are not considered part of the performance approval.

Deluge and Flooding - Searchline Excel is rated IP66/67 and as such will not be damaged by occasional deluge or flooding. However, during such instances the unit will completely lose its IR signal and will enter the BEAM-BLOCK/FAULT state. Also, when the deluge/flooding subsides, there is the possibility that contaminants will be left on the windows. Therefore, it is recommended that Excel units be located away from areas particularly prone to deluge or flooding.

Areas Prone to Subsidence and Settling - Where possible, it is recommended that Excel units are not mounted on structures located where problems with subsidence, settling or thawing of permafrost are known to cause significant movement. If such locations cannot be avoided, the foundations of the mounting structure should be engineered to minimise any angular movements.

Areas Prone to Earthquakes - In locations prone to earthquakes, there is a chance that during or after an earthquake, the units of an Excel gas detector will become misaligned with respect to each other. Provided that the Excel units do not suffer from direct mechanical impact damage during an earthquake, they should remain undamaged by such events. Anti-vibration mounts are unlikely to be of any benefit and are not recommended. After an earthquake it is recommended that Excel gas detectors are visited and their alignment be checked.

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.

Intense Electromagnetic Fields - Searchline Excel complies with EN61000-6-3:2007 and EN61000-6-2:2005 (Industrial levels) 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 EN61000-6-3:2007 and EN61000-6-2:2005. 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.

3.2.3 Beam Path

The Transmitter and Receiver units windows should face each other across the area to be protected and, depending on the range of the Transmitter in use, should be the following distance apart:
3. INSTALLATION AND OPERATION

<table>
<thead>
<tr>
<th>Excel Gas Detector type</th>
<th>Path length between units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Range</td>
<td>5 - 40m</td>
</tr>
<tr>
<td>Medium Range</td>
<td>20 - 120m</td>
</tr>
<tr>
<td>Long Range</td>
<td>120 - 200m</td>
</tr>
<tr>
<td>(15 - 130ft)</td>
<td>(65 - 390ft)</td>
</tr>
<tr>
<td>(390 - 650ft)</td>
<td></td>
</tr>
</tbody>
</table>

The beam path and immediate surrounds should be kept free of obstructions that might hinder the free movement of air in the protected area or block the infrared beam. A clear beam path of 20cm diameter or greater is recommended. In particular, for optimum availability, avoid areas affected by the following.

- a. Steam vents and plumes
- b. Smoke stacks and chimneys
- c. Walkways and personnel areas
- d. Splash and spray, e.g. from moving equipment, cooling towers, etc.
- e. Parking, loading, cranes, vehicle temporary stops, e.g. bus stops, road junctions, etc.
- f. Vegetation, e.g. shrubs, bushes, branches, etc. - if currently clear, movement due to weather and future growth or planting must be considered

Note: Where c. and e. cannot be avoided, consider indicating the beam by marking the walkway or road with paint.

Notes:

1. In order to fit the alignment telescope, used during the alignment process, a clear accessible arc of at least 50cm radius is required close to the unit’s cowling as shown.
2. A clear beam path of at least 10cm radius or greater is recommended.
3. INSTALLATION AND OPERATION

3.2.4 Supporting Structure

The Transmitter and Receiver units should be fixed to a stable supporting structure using the mounting plates supplied.

*Note: The maximum movement of the supporting structure under all anticipated operating conditions must be ±0.5°.*

If either unit is to be free standing and not mounted to existing supports or structures, and the height above the ground is no more than 3m, the supporting structure shown is recommended:

*Note: The pipe can be filled with concrete to provide extra robustness if necessary.*

3.2.5 Orientation

Searchline Excel is solar immune and therefore there is no need to take account of the sun’s movement when considering orientation.

When positioning the units do not install them with the optical axis at an angle greater than 45° to the horizontal. This is to avoid dirt/water buildup on the windows.
3. INSTALLATION AND OPERATION

3.3 ELECTRICAL CONNECTIONS

3.3.1 General

All ranges of Searchline Excel comply with the EMC requirements 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:

Any earthing regime employed must avoid earth loops.

The following information is provided to assist with proper earthing of Searchline Excel:

- Searchline Excel has an earth wire (green and yellow) for connection to protective earth. This is connected to the enclosure and isolated from the other wires. Maximum voltage between earth and the other wires is 350 V.
- There is an earthing point on the outside of the Searchline Excel enclosure for connection to protective earth.
- Searchline Excel does not require an “instrument earth” connection.

In addition, consider the following points:

General recommendations

1. In general, correctly engineered star earthing arrangements minimise earth current crosstalk and noise, improving the reliability and performance of instrumentation.
2. The use of a single, screened / shielded cable for each field device ensures good screening / shielding and reduces crosstalk.

Field Cabling

1. The entire length of the field cabling connected to a unit should be screened / shielded. The screen / shield should be connected to a low noise instrument earth at one end.
2. The screens / shields of field cabling must not be connected in a manner that creates earth loops or that will result in the screens / shields carrying large currents from heavy plant or equipment.
3. If armoured cable is being used it is necessary to prevent the armour becoming connected to the screen / shield.
4. For installations where the field cable conductors run through conduit or armour connected to protective earth, the conduit or armour should not be considered as a sufficient screen / shield. A separate cable screen / shield, connected to a low noise instrument earth should be employed.
5. The field cabling conductors should have sufficient cross sectional area to ensure that the minimum supply voltage at the field device is 18 Vdc.
3. INSTALLATION AND OPERATION

Maximum voltages

1. Any earthing arrangement employed should ensure that the maximum peak voltage between the unit’s case earth and any field cable conductor is less than 350 V. This includes conditions where transient surge voltages are generated by lightning or the switching of heavy electrical plant. Earthing arrangements that employ multiple protective earths or earth grids significantly increase the likelihood of large transient surge voltages being generated between a unit’s case earth and the field cable conductors. If it is suspected that voltages between the unit’s case earth and any field cable conductor may exceed 350 V it is strongly recommended that surge suppression devices be installed close to the unit.

Note: Suitable, certified surge suppression devices include MTL’s TP-48-I-NDI and Pepperl & Fuchs’ FN-LB-1. Surge suppression devices should be checked regularly and replaced if necessary.

Interference and noise

1. For installations in Europe, all electrical equipment connected to the system should comply with EN50270. For non-European installations, electrical equipment connected to the system should comply with applicable national or international EMC standards.

2. Any electrical interference induced onto the conductors of a 4–20 mA loop by the installation must be kept below the levels necessary to comply with the requirements of EN60079-29-1 or other applicable gas detector performance requirements / standards. In practice, this means that peak noise currents induced on the current loop should be no greater than ±0.25 mA.

3. The 0 V rail of the control card/control system is often directly connected to one side of the 4-20 mA current sensing resistor. Electrical noise on this rail is therefore directly connected to the 4-20 mA input. In order to avoid additional noise being induced on the 0 V rail, it should not be commoned with the protective earth, which frequently carries a high level of electrical noise.

4. Ideally, the 24 V supply reaching units should be free from large transients, fluctuations or high frequency noise.

5. In order to reduce the likelihood of radio frequency interference affecting the operation of units it is recommended that neither units nor their cabling are installed in close proximity to the antennae of high powered radio, radar or satellite communication equipment.
3. INSTALLATION AND OPERATION

3.3.2 Receiver Connections via DVC100(M) MK2

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.

**Note:** Using metal cable glands may connect the armour of the cable to the Excel Body.
3. INSTALLATION AND OPERATION

3.3.3 Receiver Connections via DX100(M)

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.

Note: The Dx100(M) is housed in a metal enclosure.

3.3.4 Transmitter Connections

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.

Note: Using metal cable glands may connect the armour of the cable to the Excel Body.
3. INSTALLATION AND OPERATION

3.3.5 Remote Installations

For remote or difficult-to-access installations, the DVC100(M) MK2 or DX100(M) can be positioned in a convenient location by using an intervening junction box (e.g. Hawke/Bartec) attached to the receiver's mounting plate. Alternatively an SHC Calibrator Connector System (part number 2104B6250) can be used that enables connection of the SHC1 up to 10 meters from the receiver.

A maximum cable length of 1km between the unit and the DVC100(M) MK2 or DX100(M) is permissible (RS485 compliant).

The connections are as follows.

**Wiring with DVC100(M) MK2**

![Diagram of wiring connections]

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.
3. INSTALLATION AND OPERATION

Wiring with DX100(M)

See also DX100 Termination Unit's technical Handbook.

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.
3. INSTALLATION AND OPERATION

3.4 POWER SUPPLY

3.4.1 General

The Searchline Excel 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.

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

<table>
<thead>
<tr>
<th>Unit Type</th>
<th>Maximum Power Consumption (W)</th>
<th>Maximum Cable Length (m) with 1.5mm² Conductors (12 ohms/km)</th>
<th>Maximum Cable Length (m) with 2.5mm² Conductors (7.6 ohms/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver (All ranges)</td>
<td>8</td>
<td>550</td>
<td>900</td>
</tr>
<tr>
<td>SR Transmitter,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Turbo heating enabled)</td>
<td>5</td>
<td>900</td>
<td>1,400</td>
</tr>
<tr>
<td>SR Transmitter,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Turbo heating disabled)</td>
<td>3.5</td>
<td>1,300</td>
<td>2,000</td>
</tr>
<tr>
<td>MR/LR Transmitter,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Turbo heating enabled)</td>
<td>13</td>
<td>600</td>
<td>950</td>
</tr>
<tr>
<td>MR/LR Transmitter,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Turbo heating disabled)</td>
<td>10</td>
<td>820</td>
<td>1,300</td>
</tr>
</tbody>
</table>

Notes:

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

Terminal sizes: DVC100(M) MK2 0.5mm² - 4mm² (20AWG - 12AWG)
                DX100(M) 0.5mm² - 4mm² (20AWG - 12AWG)
                Honeywell Analytics
                Junction Box 00780-A-0100 0.5mm² - 6mm² (20AWG - 10AWG)

3.4.2 Power Supply Connections - Turbo heating Disabled

When connected as shown in section 3.3.4 Transmitter Connections all ranges of Transmitter have 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, reduced power consumption can be achieved 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.
3. INSTALLATION AND OPERATION

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.

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 function.

3.5 UNPACKING

(1) Carefully unpack the equipment, observing any instructions that may be printed on or contained within the packaging.

(2) Check the contents for damage and against the packing note for deficiencies.

In the event of damage or loss in transit, notify the carrier and Honeywell Analytics or your local agent immediately.

The gas detector consists of the following items:

Where alternative component sizes are given the size depends on the version of unit, i.e. mid/long range version or short range version.
3. INSTALLATION AND OPERATION

2 x Mounting Plates
2 x Mounting Brackets (with grub screws)

2 x Pivot Blocks (with grub screws)
4 x Adjustment Clamps (with grub screws)

4 x Nuts
6 x Mounting Bracket Fixing Bolts, Internal Lock Washers and Plain Washers (M10 or M12)

8 x Junction box Mounting Bolts
2 x Isolation Kits

4 x Spring Washers (M12 or M16)
3. INSTALLATION AND OPERATION

Basic Installation Guide

2 x Allen (Hex) Keys (3mm)

(3) Ensure that the installer/end user of the equipment receives the technical documentation (operating instructions, manuals, etc.) contained in the packaging.
3. INSTALLATION AND OPERATION

3.6 INSTALLATION PROCEDURE

3.6.1 General

Searchline Excel is designed to allow installation and alignment to be performed by a single technician.

The installation procedure is split into mechanical installation and electrical installation. Each unit needs to be mounted to a supporting structure before making the electrical connections.

3.6.2 Mechanical Installation

The mechanical installation procedure applies to both the Receiver and the Transmitter.

(1) Ensure that the gas detector equipment supplied is compatible with the required application (i.e. short, medium or long range).

(2) Fit the mounting bracket and isolation kit to the mounting plate for the unit as shown:

(3) Fit the mounting plate to the supporting structure.

*The plate can be fitted in one of the following ways:*

- With bolts directly to a flat surface.
- With U-bolts (2 off) to a single 150mm diameter pipe or pole.
- With U-bolts (4 off) to two 55mm diameter pipes or poles, 166mm apart.

Identify the required mounting holes from the following drawing and table:
3. INSTALLATION AND OPERATION

Notes:
1. **Drawing is not** to scale.
2. **Mounting plate fixing holes are clear.** Searchline Excel gas detector component mounting holes are tapped.
3. **The mounting plate fixings are not supplied.**

<table>
<thead>
<tr>
<th>Identity</th>
<th>Quantity</th>
<th>Size</th>
<th>Used For</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>7.5mm</td>
<td>Dual 2&quot; pipe or pole mounting, flat surface mounting.</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>9.5mm</td>
<td>Single 6&quot; pole, flat surface mounting, Dual 2.5&quot; ID pipe.</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>M6 tapped</td>
<td>00780-A-0100 junction box mounting</td>
</tr>
</tbody>
</table>

60x45° 2 POSNS
6mm thick stainless steel plate
## 3. INSTALLATION AND OPERATION

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>3</td>
<td>M6 tapped</td>
<td>DVC100(M) junction box mounting.</td>
</tr>
<tr>
<td>D1</td>
<td>2</td>
<td>M6 tapped</td>
<td>DVC100 (M) MK2 junction box (used in conjunction with bottom two D holes)</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>M10 tapped</td>
<td>DX100(M) junction box mounting.</td>
</tr>
<tr>
<td>F</td>
<td>2</td>
<td>M6 tapped</td>
<td>Killark/Akron junction box mounting.</td>
</tr>
<tr>
<td>G</td>
<td>4</td>
<td>M6 tapped</td>
<td>Sun/heat shade mounting.</td>
</tr>
<tr>
<td>H</td>
<td>3</td>
<td>M8 tapped</td>
<td>Short range Transmitter and all Receiver brackets.</td>
</tr>
<tr>
<td>J</td>
<td>3</td>
<td>M10 tapped</td>
<td>Medium/Long range Transmitter mounting bracket.</td>
</tr>
<tr>
<td>K</td>
<td>2</td>
<td>M10 tapped</td>
<td>XNX Universal Transmitter</td>
</tr>
</tbody>
</table>

The following drawings show typical mountings:

![Mounting Plate Fixed to Flat Surface](image)

- M8 mounting bolt - 4-off (not supplied) using B holes

![Mounting Plate Fixed to Single Pipe/Pole](image)

- 6in. U-bolt - 2-off (not supplied) using B holes
3. INSTALLATION AND OPERATION

Mounting Plate Fixed to Twin Pipes/Poles

(4) Fit an adjustment clamp to the unit’s pivot block mounting stud so that it sits on the stud’s shoulder. The correct orientation for the pivot blocks and clamps is as follows:

(5) Tighten the adjustment clamp’s grubscrews until they just grip the unthreaded part of the stud.

(6) Fit the pivot block to the mounting bracket using a clamp nut and washer (M12 or M16). The correct orientation for the pivot blocks and mounting brackets is as follows:

*Do not fully tighten the nut (Refer to 3.73).*
3. INSTALLATION AND OPERATION

Ensure that the adjustment clamp’s stub lever is approximately centrally positioned between the mounting bracket’s grubscrews. Adjust the screws if required.

(7) Fit an adjustment clamp to the unit’s mounting stud so that it sits on the stud’s shoulder. The correct orientation for the adjustment clamp is as follows:

![Image of adjustment clamp and mounting stud]

(8) Tighten the adjustment clamp’s grubscrews until they just grip the unthreaded part of the unit’s mounting stud.

(9) Fit the unit to the pivot block using a clamp nut and washer (M12 or M16).

*Do not fully tighten the nut (Refer to 3.73).*

At this point position the units on their mountings so that their optical windows face each other as shown:

![Image of units on mountings]

Ensure that the adjustment clamp’s stub lever is approximately centrally positioned between the pivot block's grub screws. Adjust the screws if required.

(10) Fit a suitable junction box, e.g. DVC100(M) MK2 or DX100(M) or other suitable type of junction box, to the mounting plate. A typical installation with junction boxes is as follows:
3. INSTALLATION AND OPERATION

Note: For information about alternative types of junction box see section 3.6.2 Electrical Installation.

(11) Measure and record the distance (in metres) between the Transmitter and Receiver units. This distance is required later in the alignment procedures.

3.6.2 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 3.7 Alignment and Commissioning. If the units are to be installed with junction boxes other than DVC/DX100(M) types, ensure that the boxes have:

a. M20 cable gland entries for ATEX/IECEx units, or 3/4 NPT for UL and CSA/FM

b. terminals for five wires and an earth.

(2) Remove the M20 blanking plugs (if fitted) and attach the Searchline Excel 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. INSTALLATION AND OPERATION

3.7 ALIGNMENT AND COMMISSIONING

WARNING
Do not attempt to view the Sun through the optical telescope.

3.7.1 General

In order to avoid unnecessary problems, alignment and commissioning of Searchline Excel gas
detectors should only be performed by personnel trained by Honeywell Analytics.

To ensure optimum performance the gas detector Transmitter and Receiver units must be
accurately aligned with a clear line of sight between them.

The Transmitter unit is first aligned with the Receiver using a telescope attached to the body of
the unit. A telescope is then fitted to the Receiver and the alignment procedure repeated.

The Handheld Interrogator is then attached to the Receiver to finally commission the equipment
and, depending on the type of Receiver, may need to be used to assist in fine-tuning the
alignment.

The procedure can be performed by a single technician.

Each gas detector unit features a mounting assembly that allow both coarse and fine mechanical
adjustment in the horizontal and vertical directions as shown in the subsequent diagram.

Initial coarse mechanical adjustment is first carried out by means of large clamping nuts and
with the help of an alignment telescope.
3. INSTALLATION AND OPERATION

Fine adjustment is then achieved by means of mounting bracket and pivot block grubscrews which move levers on the adjustment clamps, fitted to the pivot block and unit studs, and hence the unit.

After initial mechanical setup the units are powered up and the mechanical alignment can be optimised and verified electronically by means of the associated Handheld Interrogator linked to the Receiver.

By entering the operating range of the gas detector the Interrogator then provides reassurance that the alignment has been performed successfully. The gas detector cannot be put into service until it is.

The following equipment is used to carry out the alignment and commissioning:

- Alignment Telescope(s) suitable for the distance between the units (see Appendix C - Accessories & Spare Parts).
- SHC1 Handheld Interrogator (see Appendix C - Spare Parts).
- Optional SHC Protection Device (see Appendix C - Accessories & Spare Parts) - see Note 8.
- Appropriate plastic test filters (see Chapter 5, section 5.1.2).
- 3mm hex (Allen) key.
- 19mm spanner (with additional 24mm spanner for mid/long range gas detectors).

Notes:

1. Ideally, carry out the alignment procedure on a clear day.
2. Get familiar with the workings of the adjustable parts of the gas detector before proceeding with the alignment procedure, see section 3.7.4.
3. The alignment telescopes use the same datum used when the unit was aligned in the factory to ensure precise field alignment.
4. The telescopes incorporate eye relief adjustment for comfortable viewing.
5. Keep telescope mirrors and optics clean.
6. Do not try to adjust the cross-hairs using the telescope’s elevation and windage adjusters as they have been factory set.
7. If a telescope is damaged or misaligned it will need to be returned to the factory for repair or realignment.
8. The SHC Protection Device is only required if connecting the SHC1 Handheld Interrogator via a junction box other than a DVC100(M) MK2 or DX100(M).
### 3. INSTALLATION AND OPERATION

#### 3.7.2 Alignment Procedure

The following summarises the alignment procedure:

- **Basic gas detector alignment**, see section 3.7.3.
- **Accurate alignment of Transmitter and Receiver using the appropriate alignment telescope**, see section 3.7.4.
- **Power-up and verify alignment using SHC1 Handheld Interrogator linked to the Receiver**, see section 3.7.5.

#### 3.7.3 Basic Gas Detector Alignment

The basic procedure for aligning the Transmitter and Receiver units is the same.

1. Loosen the two clamping nuts and four adjustment clamp screws on the Transmitter and Receiver units until the units move freely in all axes.
2. Point the Transmitter and Receiver units so that they face each other across the area to be protected.
3. Tighten the clamping nuts and adjustment clamp grubscrews on each unit until the unit cannot be moved by hand.

   *This is the last time that these clamp nuts and grubscrews should need to be tightened. Further tightening later on will affect the fine adjustment and should be avoided.*

*Note: The unit can still be moved by the adjustment screws.*

#### 3.7.4 Accurate Alignment

The procedure for accurately aligning the Transmitter and Receiver units is the same.

Before making any adjustments consult the following table to ensure that the correct type of telescope is used with the Excel units that are to be aligned.

<table>
<thead>
<tr>
<th>Excel Type</th>
<th>Type of <strong>Trident</strong> telescope that can be used</th>
<th>SHC1 Handheld Interrogator required to finalise alignment?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trident Excel</strong></td>
<td>Latch-type</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Bayonet-type</td>
<td>No</td>
</tr>
<tr>
<td><strong>Non-Trident Excel</strong></td>
<td>Latch-type</td>
<td>Yes</td>
</tr>
</tbody>
</table>

To tell the difference between the two types of Excel look at the front face of the units. The Trident-type Excel units have three small pads on their front face, the non-Trident types do not.

These pads provide three contact points (hence the term Trident) for the alignment telescope assembly datum mount to ensure accurate fixing of the telescope so that subsequent alignment of the gas detector units is precise.

The following diagrams illustrate the differences.
After deciding from the table which alignment telescope to use for the Excel units being aligned, the telescope assembly must be fitted to each of the units in turn starting with the Transmitter. There are two ways of attaching the telescope to the Excel units - using latches or using a bayonet fitting. Depending on the type supplied refer to the relevant procedure described subsequently.

The bayonet style telescope is used on both the Transmitter and Receiver of the short range Excel. The bayonet-style telescope is also used on the Receiver of the medium and long range Excels. The latch-style telescope is used on the medium and long range Excel Transmitters.

**Latch-style telescope assembly**

This telescope assembly consists of a telescope and mirror assembly attached to a datum mount that features a latching mechanism. It can be used with either the Trident or non-Trident types of Excel units.

When used with the non-Trident Excel the alignment may also need to be fine-tuned and then verified using the SHC1 Handheld Interrogator.

The latches are used to lock the whole assembly onto the body of the Excel unit. Before securing the latches the telescope can be rotated to a convenient viewing position. To remove the telescope assembly reverse the following fitting procedure.

(a) Fit the datum mount of the alignment telescope securely over the cowl of the unit as shown so that the face of the mirror is visible. 

*Ensure the datum mount is fully home on the cowling.*

(b) Undo the latches on the alignment telescope’s mounting latch assembly and rotate the assembly so that the parallel support bar fits underneath the unit as indicated by arrow 2.
3. INSTALLATION AND OPERATION

(c) Locate the latch mounting hooks behind the back of the unit.

(d) Rotate the telescope to a comfortable viewing position, and then secure the latches as indicated by arrow 3.

A horizontal viewing position is the easiest to interpret.

Now align the units by continuing with step 5.

Note: Take care when undoing the latches to remove the alignment telescope not to touch the springs.
3. INSTALLATION AND OPERATION

**Bayonet-style Trident-type telescope assembly**

*Caution: This type of telescope assembly must only be used with Trident-type Excel units.*

This type of telescope assembly consists of a telescope and mirror attached to a datum mount. The mount features a bayonet fitting for attaching the assembly to the Excel unit.

The datum mount has a handle for rotating and locking the whole assembly over the cowl and onto the Excel unit's body.

Before tightening the datum mount the telescope can be rotated to a convenient viewing position.

To remove the telescope assembly reverse the following mounting procedure.

(a) Align the telescope's two datum mount bayonet slots with the two locating pins on the cowl of the unit as shown.

(b) Push the telescope datum mount fully home onto the two pins on the cowl.

(c) Without disturbing the datum mount use one hand to rotate the telescope to a comfortable viewing position and hold it in that position.

*A horizontal viewing position is the easiest to interpret.*
(d) With the other hand use the datum mount's locking handle to rotate the bayonet fitting in a clockwise direction until it is securely locked onto the cowl. The fitting is held tightly against the face of the cowl by means of hidden compression springs.

After attaching the telescope assembly align the units by continuing with step 5.

(5) Align the Excel unit using the two sets of assembly adjustment screws so that the cross-hairs viewed through the alignment telescope are centred on the window of the other Excel unit.

View the image with the eye placed approximately 3 inches from the viewfinder.
3. INSTALLATION AND OPERATION

Use a viewing position that ensures that the full circular view is in sight. An ellipse will appear when slightly off axis.

Caution: Do not try to adjust the cross-hairs using the telescope's elevation and windage adjusters as they have been factory set.

(6) Tighten and loosen each pair of adjustment screws sequentially in the horizontal and vertical directions until the setting is correct.

(7) When correctly adjusted, tighten both adjustment screws simultaneously. Ensure there is minimum movement whilst locking the assembly.

(8) Check alignment and repeat steps 5 to 7 as necessary.

(9) Remove the telescope assembly from the unit by reversing the fitting instructions.

(10) Carry out the final commissioning procedures described in the next sub-section.
3. INSTALLATION AND OPERATION

3.7.5 Commissioning the Gas Detector

This process consists of the following steps:

- Connect the Handheld Interrogator to the gas detector
- Power-up the gas detector and check/set the mode of the Interrogator for operation with the installed Excel gas detector
- Set the gas detector real-time clock
- Complete the alignment process
- Finish up

**Connecting the Interrogator**

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

- via a Honeywell Analytics DVC100(M) MK2 or DX100(M) Junction Box - connect the Interrogator directly to the junction box via its IS socket, e.g.
3. INSTALLATION AND OPERATION

- via another type of junction box, e.g. Honeywell Analytics Junction Box Part Number 00780-A-0100 - 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.

Powering Up

(1) Apply power to the Excel Transmitter and Receiver units.

(2) Press and hold the (Enter) key on the Interrogator keypad for at least two seconds.
This section is only relevant to handheld software versions 4VO and greater.

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 - SHC1 EXCEL
Interrogator
```

(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
```

*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.*

**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.
3. INSTALLATION AND OPERATION

(4) Press **Enter** on the keypad and an initial set time display similar to the following appears:

```
\[ \begin{array}{c}
\text{Time 09:26} \\
\wedge \quad 09 \\
\text{v}
\end{array} \]
```

_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.

```
\[ \begin{array}{c}
\text{Time 09:26} \\
\wedge \quad 09:26 \\
\text{v}
\end{array} \]
```

(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:

```
\[ \begin{array}{c}
\text{Date 20APR03} \\
\wedge \quad 20 \\
\text{v}
\end{array} \]
```

_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._

**Complete the alignment process**

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

(2) Press **Enter** on the Interrogator keypad.

_This displays the **Calibrate** menu._

(3) Select **Install** from the **Calibrate** menu.

(4) Press **Enter** on the keypad.
3. INSTALLATION AND OPERATION

The following is displayed:

<table>
<thead>
<tr>
<th>System Type</th>
<th>Minimum Range (m)</th>
<th>Maximum Range (m)</th>
<th>Step Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Range</td>
<td>5</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Medium Range</td>
<td>20</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td>Long Range</td>
<td>120</td>
<td>200</td>
<td>1</td>
</tr>
</tbody>
</table>

The second line shows the current gas detector type:

- **Short Range**
  - 5 - 40m (15 - 130ft)
- **Medium Range**
  - 20 - 120m (65 - 390ft)
- **Long Range**
  - 120 - 200m (390 - 650ft)

(6) Press **Enter** on the keypad.

The current path length setting in metres similar to the following is now displayed.

<table>
<thead>
<tr>
<th>Path Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>∧ nnnn ∨</td>
</tr>
</tbody>
</table>

(7) Set the actual path distance (measured in metres) between the Transmitter and Receiver units, using the up and down keys on the keypad.

The minimum and maximum path length entry options for each gas detector are:

(9) When finished press **Enter** on the keypad.

A self-test routine is started and the display shows the following message:

<table>
<thead>
<tr>
<th>Self Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please Wait</td>
</tr>
</tbody>
</table>

When the test is successfully finished the following message is displayed for at least three seconds:

| Checks Passed |

The screen then changes to show a display similar to the following.

| SIG: ■ |
| TGT: ■ |

Note: If this screen shows a numerical value the alignment is not sufficient. Refer back to 3.72.

The first line of the display shows the magnitude of the current **signal** level as a horizontal bar graph - **SIG**:
3. INSTALLATION AND OPERATION

The second line of the display shows the magnitude of the current target signal level as a horizontal bar graph - TGT:

Important Notes:

1) The overall objective of alignment is to maximise the SIG level. Maximised SIG corresponds to optimal alignment.

2) The Instrument Assisted Alignment (IAA) system only allows Excel to be initialised if the SIG level is greater than or equal to the TGT level when Enter is pressed.

3) The smallest TGT signal level that is initially set will be equivalent to 70% (0.700) of the signal expected for the installation’s path length.

4) The TGT level will increase gradually if the current SIG level is larger than the TGT level. The TGT signal level only ever increases. If the current SIG level falls below the TGT level, TGT will remain at its previous highest value. In order to initialise the gas detector the SIG level must be brought back above the TGT level.

5) If the SIG level is less than 50% of the expected level, the bar graphs are not displayed. Instead both SIG and TGT levels are displayed as numbers.

(10) Now carry out one of the procedures described under Options.

Options

The next procedure to be followed depends on the type of alignment telescope and mounting initially used to set up the Excel gas detector.

Bayonet-style Trident-type telescope assembly

If this type of alignment telescope was used with a Trident-type Excel gas detector, there is no need to further optimise the alignment using the SHC1 Handheld Interrogator.

When the SIG and TGT bar graphs are displayed on the SHC1 screen, SIG will always be greater than TGT and installation can proceed to the next stage by pressing Enter and following step 12.

Latch-style Trident-type telescope assembly

If this type of alignment telescope was used with a Trident-type Excel gas detector, there is no need to further optimise the alignment using the SHC1 Handheld Interrogator.

If this type of alignment telescope was used with a non-Trident Excel it may be necessary to further optimise the alignment in the following way in order to achieve best performance.

(a) After the SIG and TGT bar graphs are displayed on the SHC1 screen as previously described, let the TGT level reach its initial maximum by waiting for approximately 10 seconds.

During this time the TGT level will move up towards the current SIG level.

(b) Whilst watching the SIG level closely, make a small mechanical adjustment in either the horizontal or vertical alignment and note whether the SIG level goes up or down.

(c) If the SIG level goes up, make another small mechanical adjustment in the same direction as before.
3. INSTALLATION AND OPERATION

(d) If the SIG level goes down, change the direction of adjustment. Maximise the SIG level by making small adjustments in only one plane at a time.

(e) When the SIG level has been maximised in one plane, make small adjustments in the other plane until SIG has been maximised in this plane.

(f) Repeat steps (b) to (e) until the SIG level has been maximised in both planes. At this point, SIG must be bigger than the initial TGT level and any adjustment either side of the current alignment must result in a reduction in signal level. If not, repeat steps (b) to (e) until these requirements have been met.

(g) Lock off the alignment by placing a hex (Allen) key in the pair of grub-screws which control adjustment in a particular plane and simultaneously rotating them in opposite directions.

(h) Repeat this for the other pair of grub-screws.

(i) Press Enter and the signal levels are checked. With the SIG level is greater than the TGT level, the signal check should pass and the screen should display the following message:

```
Signals OK
```

Notes:

1. If SIG is less than the TGT value the following message is displayed:
```
Low Signal
Enter to Retry
```

2. If SIG is more than the TGT value the screen shows the bar graph screen again.

(12) When the following message is displayed press Enter:
```
Signals OK
```

The display changes to show the following instruction:
```
Ensure Zero Gas
Then Press Enter
```

Ensure there is a gas-free atmosphere.

(13) Press Enter on the keypad. The following message is displayed for three seconds:
```
Zero Calibration OK
```
3. INSTALLATION AND OPERATION

The following message is displayed for three seconds:

Installation
Complete

The following message is then displayed:

Press Enter to
Release 4-20

(14) Press Enter on the keypad.
The following message is displayed for three seconds:

4-20 Released

The display then changes to show the Calibrate menu. The Searchline Excel gas detector is now on-line.

This completes the final part of the gas detector alignment procedure.

3.7.6 Finishing Up

To finish the alignment process carry out the following procedure:

(1) Select Power Off from the Interrogator Main menu.
(2) Press (Enter) on the keypad.

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

Notes:
1. The SHC1 Handheld Interrogator powers down automatically after five minutes of non-use.
2. Fast power off and auto power off are disabled when any menu option is selected that modifies the unit’s configuration.
(3) Disconnect the Interrogator from the gas detector, reversing the process described at the beginning of section 3.7.5.

3.8 SYSTEM CONTROLLER CALIBRATION

This procedure is used to set up the system controller using the Searchline Excel gas detector. A chosen fixed output signal is sent from the Excel 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 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.
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(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
```

(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
```

(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
```

(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.*

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

3.9 INSTALLATION CHECKS/TESTS

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

- Searchline Excel 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 is explosion protected by a certified, flameproof enclosure. Carefully read the safety warnings, cautions and certification details in this handbook and the Basic Installation Guide. 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 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

<table>
<thead>
<tr>
<th>SEARCHLINE EXCEL: INSTALLATION CHECK LIST</th>
<th>2104P1003</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMER/OPERATOR</td>
<td></td>
</tr>
<tr>
<td>SITE/FACILITY</td>
<td></td>
</tr>
<tr>
<td>SYSTEM TYPE:</td>
<td></td>
</tr>
<tr>
<td>SR</td>
<td>MR</td>
</tr>
<tr>
<td>GAS TABLE:</td>
<td></td>
</tr>
<tr>
<td>METHANE</td>
<td>ETHANE</td>
</tr>
<tr>
<td>PENTANE</td>
<td>PROPYLENE</td>
</tr>
<tr>
<td>DETECTOR LOCATION:</td>
<td></td>
</tr>
<tr>
<td>TAG NO. (RX):</td>
<td>TAG NO. (TX):</td>
</tr>
<tr>
<td>SER NO. (RX):</td>
<td>SER NO. (TX):</td>
</tr>
<tr>
<td>MOD STATE (RX):</td>
<td>MOD STATE (TX):</td>
</tr>
<tr>
<td>CERTIFICATION:</td>
<td></td>
</tr>
<tr>
<td>CHECK/TEST RX:</td>
<td>CHECK/TEST TX:</td>
</tr>
<tr>
<td>RECIEVER</td>
<td>TRANSmitter</td>
</tr>
<tr>
<td>Mount Rigidity</td>
<td>Mount Rigidity</td>
</tr>
<tr>
<td>Vibration</td>
<td>Vibration:</td>
</tr>
<tr>
<td>Excess Heat</td>
<td>Excess Heat:</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Supply Voltage:</td>
</tr>
<tr>
<td>Earthing</td>
<td>Earthing:</td>
</tr>
<tr>
<td>RFI/EMC</td>
<td>RFI/EMC:</td>
</tr>
<tr>
<td>Contaminants:</td>
<td>Contaminants:</td>
</tr>
<tr>
<td>BEAM OBSTRUCTIONS / BLOCKS:</td>
<td></td>
</tr>
<tr>
<td>(cont.)</td>
<td></td>
</tr>
<tr>
<td>TEST FILTER:</td>
<td>Response:</td>
</tr>
<tr>
<td>Pass:</td>
<td>Fail:</td>
</tr>
<tr>
<td>4-20mA LOOP INTEGRITY</td>
<td>Pass:</td>
</tr>
<tr>
<td>Fail:</td>
<td>Untested:</td>
</tr>
<tr>
<td>FAULT / WARNING LOG:</td>
<td>Clear:</td>
</tr>
<tr>
<td>Faults/Warnings:</td>
<td>Faults/Warnings:</td>
</tr>
<tr>
<td>(cont.)</td>
<td></td>
</tr>
<tr>
<td>INSTALLATION SATISFACTORY:</td>
<td>Yes:</td>
</tr>
<tr>
<td>No:</td>
<td>Signed:</td>
</tr>
<tr>
<td>INSTALLED BY (PRINT)</td>
<td>DATE:</td>
</tr>
<tr>
<td>IF INSTALLATION UNSATISFACTORY, REASONS</td>
<td></td>
</tr>
<tr>
<td>RECOMMENDATIONS</td>
<td></td>
</tr>
<tr>
<td>CUSTOMER NOTIFIED:</td>
<td></td>
</tr>
<tr>
<td>SYSTEM STATUS:</td>
<td>Operational:</td>
</tr>
<tr>
<td>Nonoperational:</td>
<td></td>
</tr>
</tbody>
</table>

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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, e.g.  
* Nam F3 Platform, North Sea

**Operating Range**

Enter the distance (preferably in metres), between the Transmitter and the Receiver.

**Detector Location**

Enter the location/position of the detector, e.g.  
* West Corridor, HIVAC Building1

**Tag No**

Enter the Tag No, or equivalent, that has been allocated to the Excel Receiver and Transmitter units.

**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, UL, CSA, FM, IECEx

**Mount Rigidity**

Check that the units have been mounted securely to the supporting structure. Check that the supporting structure is sufficiently rigid to maintain alignment in the anticipated operating conditions. A maximum angular movement of ±0.5° is allowable.

As an approximate guideline, a sufficiently rigid mount/supporting structure will only move a few millimetres (not more than ±6mm) when leaning body weight against it.

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,  
  Mounting pole too thin

**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.
3. INSTALLATION AND OPERATION

If there is the possibility that such vibration sources could or are causing unacceptable movement, enter a brief description, e.g.

*Turbine nearby,*

*Below conveyor*

**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.

*Direct sun, Kuwait,*

*Flare-stack 2 metres away*

**Supply Voltage**

Check that the supply voltage applied to the unit is within the specified 18V to 32V range 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 is extremely immune to RFI/EMI, complying 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).*
3. INSTALLATION AND OPERATION

**Contaminants**
Assess the installation and its surroundings 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

**Beam Obstruction/Blocks**
Ideally, a clear path of at least 20cm diameter should be provided between the Transmitter and the Receiver. Enter any obstructions which encroach into this path, e.g.

- Process pipes,
- Tree branches

Assess the installation and the beam path for potential sources of beam blockage. These could include personnel walking in the beam, parking vehicles, moving machinery/plant, growing vegetation etc.
If there is a realistic possibility that they could cause a significant problem, enter a brief description, e.g.

- Personnel in corridor,
- Loading bay vehicles

**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, the unit's displayed response and mark the Pass or Fail box.
The acceptable responses to test filters for different gas tables are detailed in section 5.1.2.

**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.

**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.
3. INSTALLATION AND OPERATION

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.
Unit mounted on single scaffold pole. Excessive movement,

Beam path obscured by pipes, insufficient received signal levels,
Unit overheated by intense Kuwaiti sunlight

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

Mounting pole requires bracing/stiffening,
Pipes obscuring beam to be moved, or detector relocated.
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 Open-Path Gas Detector requires little maintenance other than occasional cleaning. Depending on the local regulations and site conditions, cleaning and functional testing of the gas detector can be carried out as described in the following sub-sections. The gas detector should remain powered during these procedures.

**Caution:** *Searchline Excel does not contain any user serviceable parts. Do not open either the Transmitter or Receiver unit. 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 units.*

1. Inspect the Searchline Excel units, junction box and cabling for signs of physical damage.
2. Using the SHC1 Handheld Interrogator inhibit the Searchline Excel 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 Calibration menu.*
3. Clean any dust or dirt from the Searchline Excel windows using soapy water and a soft cloth.
4. Using the SHC1 Handheld Interrogator release the Searchline Excel signal output. *The output can be released by pressing ESC followed by ↓ on the keyboard.*
5. Using the SHC1 Handheld Interrogator re-zero the unit. *See Appendix A for details about how to use the Interrogator.*

### 4.2 FUNCTIONAL TESTING (Plastic Test Filters)

The test filter set 2104N2999 can be used with all Mod states of Searchline Excel units, however they have been specifically designed to work with open path Excel units of Mod state 7 (or higher).

Testing of Mod state 6 (or lower) open path Excel units should continue to be performed using the original plastic test filters, with the results to be anticipated detailed in Issue 8/9 of the Technical Handbook, 2104M0506.

For information on testing Mod state 6 (or lower) Excel units refer to the test filter addendum 2104M0523.

The procedures for using these functional test filters on Mod state 7 or higher Excel units are detailed as follows:-

1. Ensure the area is free from gas.
2. Connect the SHC-1 Handheld Interrogator to the unit to be tested.
3. Select DISPLAY from the Calibration menu.
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4) For new units, refer to supplied test certificate for factory response to test filter recommended.

5) For other units, slide a suitable functional test filter (see tables below) into the cowling at the front of the receiver.

<table>
<thead>
<tr>
<th>Receiver Gas Calibration</th>
<th>Low Test Filter</th>
<th>Response</th>
<th>High Test Filter</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>C or D</td>
<td>0.5 – 1.1 LEL.m</td>
<td>F</td>
<td>1.5 – 2.8 LEL.m</td>
</tr>
<tr>
<td>Ethane</td>
<td>C or D</td>
<td>0.6 – 1.3 LEL.m</td>
<td>F</td>
<td>1.5 – 2.7 LEL.m</td>
</tr>
<tr>
<td>Propane</td>
<td>B or C</td>
<td>0.5 – 1.2 LEL.m</td>
<td>F</td>
<td>1.6 – 2.9 LEL.m</td>
</tr>
<tr>
<td>Butane</td>
<td>B or C</td>
<td>0.6 – 1.4 LEL.m</td>
<td>E</td>
<td>1.4 – 2.9 LEL.m</td>
</tr>
<tr>
<td>Pentane</td>
<td>A</td>
<td>0.6 – 1.1 LEL.m</td>
<td>D</td>
<td>1.2 – 2.2 LEL.m</td>
</tr>
<tr>
<td>Hexane</td>
<td>B or C</td>
<td>0.6 – 1.5 LEL.m</td>
<td>E</td>
<td>1.4 – 3.0 LEL.m</td>
</tr>
<tr>
<td>Ethylene</td>
<td>B or C</td>
<td>0.5 – 1.3 LEL.m</td>
<td>F</td>
<td>1.8 – 3.4 LEL.m</td>
</tr>
<tr>
<td>Propylene</td>
<td>A</td>
<td>0.5 – 1.0 LEL.m</td>
<td>D</td>
<td>1.0 – 1.9 LEL.m</td>
</tr>
<tr>
<td>Butadiene</td>
<td>A</td>
<td>0.5 – 1.0 LEL.m</td>
<td>D</td>
<td>1.0 – 1.9 LEL.m</td>
</tr>
<tr>
<td>Methanol</td>
<td>D</td>
<td>0.5 – 0.9 LEL.m</td>
<td>E</td>
<td>1.0 – 2.2 LEL.m</td>
</tr>
<tr>
<td>Ethanol</td>
<td>B or C</td>
<td>0.6 – 1.4 LEL.m</td>
<td>E</td>
<td>1.5 – 3.1 LEL.m</td>
</tr>
</tbody>
</table>

6) If this is the first time that the unit has been tested with this particular test filter, record the gas reading that is produced. This reading should be used to verify correct operation in the future.

7) If this is not the first time that the unit has been tested with this particular filter, note the gas reading it produces and compare it to the original value recorded for this unit when tested with this filter. Provided that the reading is within ±0.5 LEL.m of the original value, the unit is working correctly. If the unit is working correctly, proceed to step 15.

8) If the gas reading is not within the expected range it is possible that the unit needs cleaning or re-zeroing.

9) Remove the test filter from the cowling.

10) Using a damp, lint-free cloth, clean the windows of the transmitter and the receiver.

11) Using the SHC-1 in CALIBRATE menu, re-zero the unit.

12) Re-insert the chosen test filter into the cowling in front of the receiver.

13) Verify that the reading produced by the test filter is now within ±0.5 LEL.m of the reading originally obtained with this filter. If the gas reading is still not within the expected range, check the system alignment (see section 3 of the Excel manual, 2104M0506) and repeat the test in step 7.

14) Remove the test filter from the cowling.

15) Release the unit under test from INHIBIT by selecting the MAIN menu option.

16) Disconnect the SHC-1 Handheld from the unit being tested.
4. MAINTENANCE

4.3 CALIBRATION CHECK USING THE GASSING CELL

The gassing cell is designed to allow easy calibration checking using a high concentration test gas as opposed to the standard plastic test filters. The integrated LEL.m reading of the gas concentration in the cell can be calculated using the following formula:

\[ \text{Int(lel.m)}_{xl} = \text{L}_{\text{cell}} \times (\text{Conc}_{\text{gas}} / \text{LEL}_{\text{gas}}) \]

where:

- \( \text{Int(lel.m)}_{xl} \) = Integrated LEL.m reading output by Searchline Excel in LEL.m.
- \( \text{L}_{\text{cell}} \) = Length of cell in metres.
- \( \text{Conc}_{\text{gas}} \) = Gas concentration in %v/v.
- \( \text{LEL}_{\text{gas}} \) = Lower Explosion Limit of the gas in %v/v.

The test gas must be the same as the test gas used during the factory calibration of the Searchline Excel unit and ideally the concentration should be between 2 and 5 LEL.m and never below 1 LEL.m.

**Note:** Where a different test gas is used, the typical value for cross-sensitivity is not sufficiently precise to enable valid calibration checks to be performed using the Gassing Cell, however, response tests can be easily performed with the plastic Test Filters as described in section 5.1.2.

**WARNING**

Take the necessary precaution to ensure safety when dealing with these high concentration gasses.

The gassing cell supplied by Honeywell Analytics (Part No: 2104B2326) is 0.15m long and the following table outlines the response expected when using this gassing cell:

<table>
<thead>
<tr>
<th>Gas type</th>
<th>LEL Concentration of the gas</th>
<th>Concentration applied</th>
<th>Calculated response with 0.15m gas cell.</th>
<th>4-20mA output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>5.0 %v/v</td>
<td>100 %v/v</td>
<td>3 LEL.m</td>
<td>13.6mA</td>
</tr>
<tr>
<td>Ethane</td>
<td>3.0 %v/v</td>
<td>50 %v/v</td>
<td>2.5 LEL.m</td>
<td>12mA</td>
</tr>
<tr>
<td>Propane</td>
<td>2.0 %v/v</td>
<td>50 %v/v</td>
<td>3.75 LEL.m</td>
<td>16mA</td>
</tr>
<tr>
<td>Butane</td>
<td>1.5 %v/v</td>
<td>50 %v/v</td>
<td>5 LEL.m</td>
<td>20mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gas type</th>
<th>LEL Concentration of the gas</th>
<th>Concentration applied</th>
<th>Calculated Response</th>
<th>4-20mA output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene</td>
<td>2.7%</td>
<td>54%</td>
<td>3 LEL.m</td>
<td>13.6mA</td>
</tr>
<tr>
<td>Propylene</td>
<td>2.0%</td>
<td>50%</td>
<td>3.75 LEL.m</td>
<td>16mA</td>
</tr>
<tr>
<td>Butadiene</td>
<td>2.1%</td>
<td>42%</td>
<td>3 LEL.m</td>
<td>13.6mA</td>
</tr>
</tbody>
</table>
4. MAINTENANCE

WARNING
These gases are flammable and/or toxic.
Take appropriate precautions when handling.

To get the best accuracy when using the gassing cell:

1. Connect the gassing cell to the Searchline Excel.
2. Zero Searchline Excel with the empty gassing cell.
3. Apply the test gas to the gassing cell and allow sufficient time to fully flush the cell without pressurising it and check that the Searchline Excel output stabilises.
4. Check the Searchline Excel output is as indicated in the above table ±5% fsd.
5. Remove the gassing cell.

Note: Pentane cannot be used with the gassing cell. At normal temperatures, this substance does not vapourise sufficiently to give a useful signal in the short path of the gassing cell.

4.4 DISPLAY GAS READING

This procedure displays details about the current gas/gas table. Carry out the following procedure:

1. Connect the SHC1 Handheld Interrogator to the gas detector. 
   See Connecting the Interrogator to the Searchline Excel Gas Detector in section 3.7.6.
2. Switch on the SHC1 Handheld Interrogator. 
   See Powering Up in section 3.7.6.
3. Select DISPLAY from the Main menu by pressing the ▲ (up) and ▼ (down) keys on the keypad to navigate through the menu options.
4. Press ↓ on the Interrogator keypad to display the Display menu.
5. Select GAS READING from the Display menu.
6. Press ↓ on the keypad.

A display similar to the following is now displayed.

![Display Example]

The first line of the display shows the name of the gas or its identifier in a special gas table.
4. MAINTENANCE

The second line shows the gas reading and measurement units along with a gas detector status indicator.

The status character at the end of the second line indicates one of the following:

/ - Normal Operation
A spinning line shows the unit is in the fully active state.

| - Inhibit State
A stationary line shows the unit is in the Inhibited state.

w - Active Warning

F - Active Fault

B - Beam Blocked

(7) Switch off the Interrogator (see section 3.7.7 Finishing Up) and disconnect it from the gas detector.

4.5 ALIGNMENT TELESCOPE

To clean the telescope lens/mirror:

(1) Moisten the surface of the lens/mirror by breathing on it.

(2) Using a soft tissue or lens cloth, lightly wipe the lens/mirror dry with a minimum number of strokes.

The wiping material may be slightly dampened with a lens cleaning fluid as sold in any camera store.

4.6 OPERATIONAL MAINTENANCE (FM)

As required as a criterion for the FM Performance Approval, routine operational verification is recommended once within a three month period and is required once within a six month period using one of the following methods.

**WARNING**

The following procedure will indicate a gas reading. Ensure that any executive action has been inhibited prior to starting and completing the procedure.

- Following the procedure described in section 4.2 insert a known test filter in the beam path. Record the response to the test filter and verify that the response is within the tolerance for stability and repeatability.
- Following the procedure described in section 4.3, test the unit’s response to high %V/V gas in a gassing cell. Verify that the response is within the tolerance for stability and repeatability.
5. PROBLEM SOLVING

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

The alignment kit includes:

• SHC1 Handheld Interrogator
• alignment telescope
• 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 does not contain any user serviceable parts. Do not open either the Transmitter or Receiver unit. 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 DVC100(M) MK2 or 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.

<table>
<thead>
<tr>
<th>Fault/Problem</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output is 0mA</td>
<td>Unit is in FAULT condition</td>
<td>Connect the SHC1 Interrogator to the unit and use its DIAGNOSTIC menu options to ascertain the reason for the FAULT report.</td>
</tr>
<tr>
<td></td>
<td>Beam block</td>
<td>Check that beam path is clear from the Transmitter to the Receiver. Remove any obstruction if present.</td>
</tr>
<tr>
<td></td>
<td>Transmitter or Receiver misaligned</td>
<td>1) Connect the SHC1 Handheld Interrogator to the unit and check the signal levels. 2) If signal levels are low, use the telescope and Interrogator to optimise Receiver alignment. 3) If signal levels remain low after re-aligning Receiver, check the Transmitter alignment using telescope. 4) Re-zero the unit after alignment. See Appendix A.5.3.4.</td>
</tr>
</tbody>
</table>
## 5. PROBLEM SOLVING

<table>
<thead>
<tr>
<th>Fault/Problem</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| **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 for use with the controller that it is connected to. |                                                                                              |
| **Heavy contamination of optics**    | Check the Transmitter and Receiver windows for build up of contamination. Clean the windows if required. Re-zero unit. |                                                                                              |
| **Very low visibility along beam path due to dense fog, blizzard or sand-storm conditions** | 1) Check that the Transmitter can be seen from the Receiver. If Transmitter can be seen, even with some difficulty, low visibility is unlikely to be the problem.  
2) If the Transmitter cannot be seen from the Receiver, very low visibility could be the problem. Wait until visibility improves and verify that the unit then returns to operational status. |                                                                                              |
| **Output is 2.5mA (BEAM BLOCK)**    | Beam path is blocked                                                   | Check that the beam path is clear from the Transmitter to Receiver. Remove any obstruction if present. |
| **Transmitter or Receiver misaligned** | 1) Connect SHC1 Interrogator to unit and check signal levels.  
2) If signal levels are low, use the telescope and SHC1 Interrogator to optimise Receiver alignment.  
3) If signal levels remain low after re-aligning Receiver, check the Transmitter alignment using the telescope.  
4) Re-zero the unit after alignment. See Appendix A.5.3.4. |                                                                                              |
| **Output is 3mA (LOW SIGNAL)**      | **Heavy contamination of optics**                                     | Check the Transmitter and Receiver windows for build up of contamination. Clean windows if required. Re-zero the unit. |
| **Transmitter or Receiver misaligned** | 1) Use the telescope and Interrogator to optimise Receiver alignment.  
2) If signal levels remain low after re-aligning Receiver, check the Transmitter alignment using the telescope.  
3) Re-zero the unit after alignment. See Appendix A.5.3.4. |                                                                                              |
| **Output is 2mA (INHIBIT)**         | **Unit has been inhibited by the Interrogator**                       | Release output from INHIBIT state using SHC1 Interrogator.                                                                                         |
| **Unit executing power-up routine** | 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.) |                                                                                              |
## 5. PROBLEM SOLVING

<table>
<thead>
<tr>
<th>Fault/Problem</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| Comms Error reported by Interrogator software | Wrong communication mode selected on the Interrogator | 1) Select **Change Mode** option on the Interrogator.  
2) Change the communication mode to **Excel**. |
| Interrogator software version is incompatible with Excel software version | Version **1V00** Interrogator software to be Excels running **1V0** software.  
Version **2V0** Interrogator software can be used with Excels running **2V0** software or higher.  
Version **3V0** and **3V1** Interrogator software can be used with Excels running **3V0** software or higher.  
The latest version of Interrogator software is greater than **4V0**. This version works with **3V0** and higher Excels, Optima and Optima Plus. CSA/FM versions of the SHC-1 are programmed with version **4V1** of the interrogator software, which displays the units of measurement for the Cross-Duct version as %LEL/m. |
| Incorrect communication connection | 1) Check that Interrogator is correctly plugged into the IS socket on the DVC100(M) or 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) or 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.4.3. |
| Installation Failed message when attempting initialisation | The installation has failed to meet the acceptable criteria of the Instrument Assisted Alignment (IAA) check | 1) Check that the signal levels reaching the Receiver are greater than 0.7 and less than 2.0.  
2) Check that the correct range has been entered for the installed path length.  
3) Check that the alignment of the Receiver has been fully optimised.  
The received signals must be peaked up to the maximum achievable. Adjusting the alignment until the signals are just above the minimum signal threshold and then leaving it at that is poor practice and will not always result in an installation that passes the IAA check criteria.  
4) Check the alignment of the Transmitter.  
5) Check that there are no objects obscuring part or all of the beam path.  
6) Check that the windows of both the Receiver and the Transmitter are clean.  
7) Check that the structures that the Transmitter and Receiver are mounted on are stable and free from significant angular movement/vibration.  
8) Check that there is no gas in the beam - which prevents successful zeroing.  
9) Installation will fail in conditions of low visibility or fluctuating atmospheric transmission - which degrade signal quality. Do not attempt installation during conditions of heavy rain, snow or fog. |
## 5. PROBLEM SOLVING

<table>
<thead>
<tr>
<th>Fault/Problem</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>No signal or very low signal at Receiver</td>
<td>Receiver misaligned</td>
<td>Re-align the Receiver, first using the telescope and then using the Interrogator.</td>
</tr>
<tr>
<td></td>
<td>Transmitter misaligned</td>
<td>Re-align the Transmitter using the telescope.</td>
</tr>
<tr>
<td></td>
<td>The beam path has become obscured</td>
<td>Check that the beam path is clear from Transmitter to Receiver. Remove any obstruction if present.</td>
</tr>
</tbody>
</table>
|                                        | No output from Transmitter                  | 1) Check that the Transmitter is flashing. Alternatively, listen for a distinct ticking sound when the lamp flashes.  
Note: The infrared beam is invisible and eye safe.  
2) If the Transmitter is not flashing, check that the +24V supply is reaching the Transmitter correctly. |
| Unit does not respond exactly as expected to | Plastic test filters are only an approximate simulation of gas | Searchline Excel units are calibrated on real gas. This results in a variation of the response test filters of different Excel units to plastic test filters. See section 5.1.2.  
1) Check that the response to the test filters is within the limits stated in this handbook. See section 5.1.2.  
2) Check that the value being used for response testing corresponds correctly to the target gas that the unit has been calibrated for. |
|                                        | Receiver misaligned                        | 1) Use the telescope and Interrogator to optimise Receiver alignment.  
2) Re-zero unit.                                                                                   |
|                                        | Contamination of windows                    | 1) Check the Transmitter and Receiver windows for build up of contamination. Clean windows if required. See Chapter 5.  
2) Re-zero unit.                                                                                   |
|                                        | Drift of unit’s zero position               | 1) Verify that there is no gas in the beam path.  
2) Re-zero the unit.                                                                             |
| 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 | Searchline Excel does not report negative gas readings on the 4-20mA.  
1) Configure controller/PLC to interpret and present currents below 4mA correctly, or,  
2) Familiarise operators with the interpretation of sub-4mA output currents from Excel as follows:  
FAULT: 0mA  
INHIBIT: 2mA  
BEAM-BLOCK: 2.5mA*  
LOW SIGNAL: 3mA*  
3) Reconfigure the INHIBIT, BEAM-BLOCK and LOW SIGNAL currents output by the Excel unit. |
## 5. PROBLEM SOLVING

<table>
<thead>
<tr>
<th>Fault/Problem</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Receiver misaligned</td>
<td>1) Re-align the Receiver, first using the telescope and then using the Interrogator. 2) Re-zero the unit.</td>
</tr>
<tr>
<td><strong>Neg Gas Reading</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contamination of windows</strong></td>
<td></td>
<td>1) Check the Transmitter and Receiver windows for build up of contamination. Clean windows if required. See Chapter 5. 2) Re-zero the unit.</td>
</tr>
<tr>
<td><strong>Negative drift of unit’s zero position</strong></td>
<td></td>
<td>Re-zero the unit.</td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Receiver misaligned</td>
<td>1) Re-align the Receiver, first using the telescope and then using the Interrogator. 2) Re-zero the unit.</td>
</tr>
<tr>
<td><strong>Baseline Drift</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contamination of windows</strong></td>
<td></td>
<td>1) Check the Transmitter and Receiver windows for build up of contamination. Clean windows if required. 2) Re-zero the unit.</td>
</tr>
<tr>
<td><strong>Drift of unit’s baseline</strong></td>
<td></td>
<td>Re-zero the unit</td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Unit has been operated at a temperature outside its specified and certified range</td>
<td>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.)</td>
</tr>
<tr>
<td><strong>Bad Temperature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Incorrect supply voltage reaching unit</td>
<td>1) Check that the +24V supply voltage is reaching the unit (it should be between +18V and +32V). 2) Identify the cause of incorrect supply voltage reaching the unit and rectify.</td>
</tr>
<tr>
<td><strong>Supply Fault</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Fault on the unit’s digital PCB</td>
<td>If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.</td>
</tr>
<tr>
<td><strong>DSP Fault</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>A fault has been detected in the NV-RAM</td>
<td>If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.</td>
</tr>
<tr>
<td><strong>NV-RAM Fault</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>The time and date record being stored by the Real Time Clock (RTC) has been lost</td>
<td>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.</td>
</tr>
<tr>
<td><strong>RTC Fault</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diagnostics report</strong></td>
<td>Voltage reference fault detected</td>
<td>If this fault is displayed when the unit is interrogated, it cannot be remedied in the field.</td>
</tr>
</tbody>
</table>
## 6. SPECIFICATIONS

### 6.1 SYSTEM

#### OPEN-PATH

<table>
<thead>
<tr>
<th>Available Gases</th>
<th>Methane*, Ethane*, Propane*, Butane*, Pentane, Ethylene, Propylene, Butadiene * FM Performance Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0 - 5 LELm</td>
</tr>
<tr>
<td>Recommended</td>
<td>Low 1 LELm</td>
</tr>
<tr>
<td>Alarm Setting</td>
<td>High 3 LELm</td>
</tr>
<tr>
<td>Minimum Alarm</td>
<td>0.5 LELm</td>
</tr>
<tr>
<td>Setting</td>
<td></td>
</tr>
<tr>
<td>Path Length</td>
<td>Short Range: 5 - 40m (15 - 130ft)</td>
</tr>
<tr>
<td></td>
<td>Medium Range: 40 - 120m (130 - 390ft)</td>
</tr>
<tr>
<td></td>
<td>Long Range: 120 - 200m (390 - 650ft)</td>
</tr>
<tr>
<td>Speed of Response</td>
<td>T90 less than 3 seconds</td>
</tr>
<tr>
<td>Output Signal</td>
<td>4 – 20 mA</td>
</tr>
<tr>
<td></td>
<td>Normal operation (linearised 0 – 5 LELm)</td>
</tr>
<tr>
<td></td>
<td>0 mA Fault</td>
</tr>
<tr>
<td></td>
<td>2 mA Inhibit</td>
</tr>
<tr>
<td></td>
<td>2.5 mA Beam block*</td>
</tr>
<tr>
<td></td>
<td>3 mA Low signal</td>
</tr>
<tr>
<td></td>
<td>21 mA Overrange</td>
</tr>
</tbody>
</table>

*Searchline Excel will indicate Beam Block after 30 s without signal. After a further 120 s it will indicate Fault. These values are programmable; please refer to Appendix A for details. To comply with FM performance approval, the maximum value for Time to Block is 200 s.

Note: For safety reasons, if Searchline Excel loses signal while measuring a gas reading above its internal Alarm threshold (default 1 LELm) it will not indicate beam block. Instead it will hold the previous gas reading until it is again able to measure the current gas concentration. Operator intervention may be required to remove a blockage from the beam.

<table>
<thead>
<tr>
<th>Operating and Storage Temperature</th>
<th>40°C to +65°C (-40°F to +150°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>0 – 99%RH Non-condensing</td>
</tr>
<tr>
<td>Pressure</td>
<td>91.5kPa – 105.5kPa (915 – 1055mBar, non-compensated)</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.4 LELm</td>
</tr>
<tr>
<td>Temperature Drift (-40°C to+65°C)</td>
<td>±0.2 LELm @ zero</td>
</tr>
<tr>
<td></td>
<td>±0.5 LELm @ 3LELm</td>
</tr>
<tr>
<td>Warm-up Time</td>
<td>Less than 5 minutes (operational), Less than 1 hour (fully stabilised)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>18 to 32Vdc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Consumption *</th>
<th>Turbo heating activated (below 0°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
<td>Short Range: 3.5/5” W max 8W maximum</td>
</tr>
<tr>
<td>Receiver</td>
<td>Medium / Long Range: 10/13” W max.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intrush Current</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
<td>Short Range: &lt; 0.3 A Medium/Long Range: &lt; 0.9 A</td>
</tr>
<tr>
<td>Receiver</td>
<td>&lt; 0.6 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enclosure Material</th>
<th>316 Stainless Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Transmitter: 3.5kg Medium / Long Range: 7.0kg</td>
</tr>
<tr>
<td></td>
<td>Receiver: 3.5kg</td>
</tr>
<tr>
<td>Vibration</td>
<td>2 – 60Hz, maximum peak to peak amplitude 1mm FM 10 - 30 Hz, 1 mm; 31 - 150 Hz, 2g.</td>
</tr>
<tr>
<td>Divergence/</td>
<td>Short Range: ±0.5° (<del>±35cm at 40m) Medium Range: ±0.5° (</del>±105cm at 120m) Long Range: ±0.5° (~±175cm at 200m)</td>
</tr>
<tr>
<td>Misalignment</td>
<td>Tolerance</td>
</tr>
<tr>
<td></td>
<td>IP rating</td>
</tr>
<tr>
<td></td>
<td>EN 50270 / Immune to FM Modulated Portable Radio Transmitters (5 W at 1 m, 150-179 MHz and 450-470 MHz)</td>
</tr>
</tbody>
</table>
6. SPECIFICATIONS

6.2 DETECTABLE GASES

The Searchline Excel Open-Path gas detector (short, medium and long range) will detect the following hydrocarbon gases, individually or in a mixture, in the range 0-5 LEL.m:

<table>
<thead>
<tr>
<th>Gas</th>
<th>LEL (% v/v)</th>
<th>FM Performance Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ATEX / IECEx</td>
<td>UL / CSA / FM Units</td>
</tr>
<tr>
<td>Methane</td>
<td>CH₄</td>
<td>4.4 5.0</td>
</tr>
<tr>
<td>Ethane</td>
<td>C₂H₆</td>
<td>2.5 3.0</td>
</tr>
<tr>
<td>Propane</td>
<td>C₃H₈</td>
<td>1.7 2.0</td>
</tr>
<tr>
<td>Butane</td>
<td>C₄H₁₀</td>
<td>1.4 1.5</td>
</tr>
<tr>
<td>Pentane</td>
<td>C₅H₁₂</td>
<td>1.4 1.4</td>
</tr>
<tr>
<td>Ethylene</td>
<td>C₂H₄</td>
<td>2.3 2.7</td>
</tr>
<tr>
<td>Propylene</td>
<td>C₃H₆</td>
<td>2.0 2.0</td>
</tr>
<tr>
<td>Butadiene</td>
<td>C₄H₆</td>
<td>1.4 1.4</td>
</tr>
</tbody>
</table>

Searchline Excel Raw Gas Response Before Linearity Correction

Cross-sensitivity to other gases
7. CERTIFICATION

7.1 GENERAL
The Searchline Excel system is certified to Ex d and has the following ATEX, IECEx, UL, FM and CSA approvals for worldwide acceptance:

**ATEX & IECEx**

II 2G, Ex d IIC T5 ($T_{amb}$ -40 to +65°C) Gb
Ex d IIC T6 ($T_{amb}$ -40 to +40°C)

Certificate Numbers:
Open Path Short Range Transmitter, and Receivers: BAS98ATEX2165X.
Open Path Long Range/Mid Range Transmitters: BAS98ATEX2299X.
Open Path Short Range Transmitter, and Receivers: IECEx BAS 09.0100X
Open Path Long Range/Mid Range Transmitters: IECEx BAS 09.0101X

**UL**

Class I Groups B, C, D
Class I Zone 1 AEx d IIB + Hydrogen (Amb -40°C to +65°C)
File No. E91044

**CSA**

Class I Div 1 groups B, C, D, T5 and
Exd IIC T5 (Amb -40 to +65°C)
File No. LR 48148-38

**FM**

Class I Div 1 groups B, C, D & T5
(Tamb -40 to +65°C)
Performance approved ANSI/ISA-12.13.04/FM6325 for Methane, Ethane, Propane and Butane

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 the following European regulations: EN50270:2006. Searchline Excel is Immune to FM Modulated Portable Radio Transmitters (5 W at 1 m, 150-179 MHz and 450-470 MHz).
7. CERTIFICATION

7.2 ATEX & IECEx

7.2.1 Transmitter Details
Open-Path

Transmitter
Ex d IIC T5 (-40 to +65 °C) Gb
Ex d IIC T6 (-40 to +40 °C)
Ex II 2G
V max. = 32V

M25 gland
Ex e, Ex d, IECEx d & IECEx d Certified.
(customer supply)

Standard Junction Box
Ex e, Ex d, IECEx d & IECEx d Certified.

Note: Later units will be ½" NPT

Flexible Conduit 900mm long
Ex e, Ex d, IECEx d & IECEx d Certified.
(see table of Conduit Technical Characteristics)

7.2.2 Receiver Details
Open-Path

Receiver
Ex d IIC T5 (-40 to +65 °C) Gb
Ex d IIC T6 (-40 to +40 °C)
Ex II 2G
V max. = 32V

Certified M25 blank fitted

DVC100(M) MK2 Termination Unit
Ex II 2G Ex ia e m IIC T5 (-40 to +65°C)
V max. = 32V
Cable glands M20/M25

M20 gland Ex e, Ex d, IECEx d & IECEx d Certified.

Certified M20 blank fitted

Flexible Conduit 900mm long
(see table of Conduit Technical Characteristics)

1/2" NPT gland

IS Cable
Length 15m max.

SHC1 Handheld Interrogator
Ex ia IIC T4 (-40 to +40°C)
7. CERTIFICATION

7.2.3 Conduit Technical Characteristics

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

7.2.4 Certification Labels Receiver and Short Range Transmitter

![Diagram of certification label]

- **Identification number of ATEX notified body**
- **CE mark**
  - Conforms to all applicable European directives
- **Explosion protection mark and equipment group and category**
- **Product name and part number**
- **Certified ambient temperature**
- **Modification status**
- **Warning**
- **Certification code as EN60079-0:2006 and EN60079-1:2004**
- **Serial number**
- **Certification numbers**
7. CERTIFICATION

Certification Label - Mid Range Transmitter

Certification Label - Long Range Transmitter
7. CERTIFICATION

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
3. Entries: any suitably approved Ex e, Ex d, IECEx e & IECEx d CABLE GLAND/CABLE
4. Entries must be sealed to provide a degree of protection of at least IP54.
5. Sensor entry: either directly connected or via suitable gland - see Note 3.
7. CERTIFICATION

7.2.5 System Diagram

NOTES:

1. THE ELECTRICAL CIRCUIT IN THE HAZARDOUS AREA MUST BE CAPABLE OF WITHSTANDING AN AC TEST VOLTAGE OF 5000V RMS AND 50C, AND WITHSTANDING A PERIOD OF 1 MINUTE WITHOUT BREAKDOWN.

2. THE INSTALLATION MUST COMPLY WITH NATIONAL REQUIREMENTS FOR INTRINSIC SAFETY (Ex i) (e.g. 92/38/EEC, IEC 60079-14).

3. WIRING FROM THE HANDHELD CALIBRATOR TO THE TERMINATION UNIT IS NOT TO EXCEED 15 METRES MAX.

4. SUPPLY ENTRY: ANY SUITABLY APPROVED EX e, Ex d, IECEx e AND IECEx d types. CABLE 50V d.c. MAX. 5.0 AMPS d.c. MAX.

5. THE INSTALLATION MUST COMPLY WITH NATIONAL REQUIREMENTS FOR INCREASED SAFETY (Ex i) (e.g. 92/38/EEC, IEC 60079-17).

6. THE SENSOR ENTRY MUST BE SEALED TO PROVIDE A DEGREE OF PROTECTION OF AT LEAST IP54.

7. APPARATUS WHICH IS UNSPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, OR CONTAIN IN NORMAL OR ABNORMAL CONDITIONS, A SOURCE OF POTENTIAL WITH RESPECT TO EARTH IN EXCESS OF 250V R.M.S. OR 250V D.C.

8. THE SENSOR FITTED MUST BE CERTIFIED BY ANY ATEX/IECEx APPROVED BODY AS EITHER Ex d or Ex e II & MUST MAINTAIN A DEGREE OF PROTECTION OF AT LEAST IP54 TO THE INSIDE OF THE TERMINATION UNIT & BE CAPABLE OF WITHSTANDING THE 7.2.5 IMPACT REQUIREMENT FOR Ex i & BE SUITABLE FOR DIRECT CONNECTION TO AN ATEX OR ATEX ENTRY.

THIS DRAWING IS PART OF A CERTIFIED PRODUCT. NO MODIFICATION PERMITTED WITHOUT REFERENCE TO CERTIFYING AUTHORITY.
7. CERTIFICATION

7.2.6 ATEX Special Conditions of Safe Use

7.2.6.1 Receiver and Short Range Transmitter
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.

7.2.6.2 Mid and Long Range Transmitters
The integral supply cables must be mechanically protected and terminated in a suitable terminal or junction facility.
7. CERTIFICATION

7.3 UL

7.3.1 Transmitters

Open-Path

Transmitter
Class I Div 1 Groups B, C & D and
Class I Zone 1 AEx d IIB +
H2 (Tamb -40 to +65 C)

UL approved explosion
proof junction box

UL approved M20/
½ NPT adaptor

Note: Later units
¼" NPT threaded
without adaptor

Flexible conduit (customer supplied)
- must conform with the relevant US
installation codes of practice

7.3.2 Receivers

Open-Path

Receiver
Class I Div 1 Groups B, C, D
Class I Zone 1 AEx d IIB + H2
(Tamb -40 to +65°C)

UL approved M20/0.5in. NPT adaptor
Note: Later units ¼" NPT threaded without adaptor

Flexible conduit (customer supplied)
- must conform with the relevant US
installation codes of practice
(see Control Drawing 2104E0045)

Conduit seal required
(see OEM J/B details)

DX100/DX100 (M) UL
Termination Unit
Class I Div 1
Groups B, C, D
(Tamb -25 to +40°C)

IS Cable
Length 15m max.

SHC1 Handheld
Interrogator
Class I Div 1
Groups B, C, D
(Tamb -50 to +40°C)

Conduit seal required
within 6" of enclosure
(see OEM details for J/B)
7. CERTIFICATION

7.3.3 System Diagram

With DX100 Termination Unit
7. CERTIFICATION

With DX100 (M) Termination Unit

NOTES:

1. APPARATUS WHICH IS UNSPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN, INTERNAL STORAGE WITH RESPECT TO EARTH IN EXCESS OF 250V rms OR 250V d.c.

2. WIRING FROM THE HANDHELD CALIBRATOR (SHC1) TO THE TERMINATION UNIT (DX100) IS NOT TO EXCEED 15 METRES MAX.

3. INSTALL EQUIPMENT INCLUDING FIELD WIRING IN ACCORDANCE WITH ARTICLES OF THE NATIONAL ELECTRICAL CODE FOR DIVISION 1 HAZARDOUS LOCATIONS.

NOTE 1

APPARATUS WHICH IS UNSPECIFIED EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN, INTERNAL STORAGE WITH RESPECT TO EARTH IN EXCESS OF 250V rms OR 250V d.c.

NOTE 2

WIRING FROM THE HANDHELD CALIBRATOR (SHC1) TO THE TERMINATION UNIT (DX100) IS NOT TO EXCEED 15 METRES MAX.

NOTE 3

INSTALL EQUIPMENT INCLUDING FIELD WIRING IN ACCORDANCE WITH ARTICLES OF THE NATIONAL ELECTRICAL CODE FOR DIVISION 1 HAZARDOUS LOCATIONS.
7. CERTIFICATION

7.4 CSA/FM

FM Approval

Complies with ANSI/ISA-12.13.04/FM6325 for Methane, Ethane, Propane and Butane (Short Range, Medium Range and Long Range Open Path Systems)

7.4.1 Transmitters

CSA Transmitter:
Class I Div 1 Groups B, C & D T5  
and Exd IIC T5 (Tamb -40 to +65°C)

FM Transmitter:
Class I Div 1, Groups B, C & D (-40 to +65°C)

7.4.2 Receivers

CSA Receiver:
Class I Div 1 Groups B, C, D, T5 & Exd IIC T5  
(Tamb -40 to +65°C)

FM Receiver:
Class I Div 1 Groups B, C & D  
(-40 to +65°C)

Flexible conduit (customer supplied) - must conform with the relevant US and Canadian installation codes of practice (conduit seal required within 30” of transmitter)
7. CERTIFICATION

CSA Receiver:
Class I Div 1 Groups B, C, D
T5 Ex d IIC T5
(Tamb -40 to +65°C)

FM Receiver:
Class I Div 1 Groups B, C & D
(-40 to +65°C)

CSA approved M20/0.5in. NPT adaptor

Note: Later units 1/2” NPT threaded without adaptor

DX100/DX100(M) CSA/FM Termination Unit Class I Div 1 Groups B, C, D (Tamb -55 to +40°C)

SHC1 Handheld Interrogator CSA/FM Class I Div 1 Groups B, C, D (Tamb -55 to +40°C)

Conduit seal required within 6” of enclosure (see OEM details for J/B)

Solid conduit (customer supplied) - must conform with the relevant US and Canadian installation codes of practice (conduit seal required within 30” of transmitter)

IS Cable Length 15m max.
7. CERTIFICATION

CSA/FM Certification Label

Short Range Transmitter

Receiver

Medium/Long Range Transmitter

Alternative 'MID' or 'LONG' for other versions
7. CERTIFICATION
7. CERTIFICATION

With DX100 (M) Termination Unit
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 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.
- **Down** Move to the next menu option, list item, or decrease a displayed data value.
- **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 Open-Path system are given in Chapter 3. The diagram shows a typical example.

*Note: If not connecting to a DVC100 series or DX100 series termination unit the SHC Protection Device must be used.*
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
```

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.

CAUTION

Only use batteries specified below.
Replace the battery only in a Safe Area.

To replace the battery in the Hand-Held Interrogator SHC-1 proceed as follows:

ONLY USE DURACELL MN1604 TYPE 6LR61

(1) Remove the Interrogator from its protective pouch.
(2) Using a 2.5mm allen hexagonal key, loosen the four screws on the rear cover of the Interrogator.
3) Carefully lift the front half of the Interrogator away from the rear cover, ensuring the flexible connector connecting the keypad to the electronics module is not damaged.

4) Unclip the old battery and fit the new battery in position (re-use the protective sleeve).

5) Carefully replace the front half of the Interrogator back into the rear cover, ensuring the flexible connector lies flat.

6) Using a 2.5mm allen hexagonal key, tighten the four screws on the rear cover of the Interrogator.

When the battery reaches end of life, take it to a collection point designated by local authorities.

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:
APPENDIX A - HANDHELD INTERROGATOR

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.

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.
APPENDIX A - HANDHELD INTERROGATOR

Gas reading.
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 inhibit state.
Active Warning.
Active Fault.
Beam Block.
Alarm

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.
bbbbbb 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.

Note: The year 2000 is displayed as 00.
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 4-20mA output to be inhibited during their operation. Where this occurs then the following sequence is automatically added to the affected operation.

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:

where: 

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

<table>
<thead>
<tr>
<th>Display Text</th>
<th>System Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Range</td>
<td>40m range system</td>
</tr>
<tr>
<td>Medium Range</td>
<td>120m range system</td>
</tr>
<tr>
<td>Long Range</td>
<td>200m range system</td>
</tr>
</tbody>
</table>

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:

where:  nnnn  The path length in metres.

The following ranges of path length can be entered for the system types:

<table>
<thead>
<tr>
<th>System Type</th>
<th>Minimum Range (m)</th>
<th>Maximum Range (m)</th>
<th>Step Size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Range</td>
<td>5</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Medium Range</td>
<td>20</td>
<td>120</td>
<td>1</td>
</tr>
<tr>
<td>Long Range</td>
<td>120</td>
<td>200</td>
<td>1</td>
</tr>
</tbody>
</table>
APPENDIX A - HANDHELD INTERROGATOR

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

Press Enter to Perform checks

This message is displayed during the self test process after pressing Enter.

Processing Data Please Wait

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

Checks Passed

Alignment
This starts the alignment process.
The following message is displayed:

Press Enter to Align Unit

This message displays the system output and reference signal values.

SIG:
MAX:

where: ■ A bar graph representing the current signal magnitude - SIG:
■ A bar graph representing the target signal - TGT:

Important Notes:
1) The overall objective of alignment is to maximise the SIG level. Maximised SIG corresponds to optimal alignment.
2) The Instrument Assisted Alignment (IAA) system only allows Excel to be initialised if the SIG level is greater than or equal to the TGT level when Enter is pressed.
3) The smallest TGT signal level that is initially set will be equivalent to 70% (0.700) of the signal expected for the installation’s path length.
4) The TGT level will increase gradually if the current SIG level is larger than the TGT level. The TGT signal level only ever increases. If the current SIG level falls below the TGT level, TGT will remain at its previous highest value. In order to initialise the gas detector the SIG level must be brought back above the TGT level.
5) If the SIG level is less than 50% of the expected level, the bar graphs are not displayed. Instead both SIG and TGT levels are displayed as numbers.
APPENDIX A - HANDHELD INTERROGATOR

Options

The approach to mechanical alignment depends on the type of alignment telescope and mounting initially used to set up the Excel gas detector, also see Chapter 3.

Bayonet-style Trident-type telescope assembly

If this type of alignment telescope was used with a Trident-type Excel gas detector, there is no need to further optimise the alignment using the SHC1 Handheld Interrogator.

When the SIG and TGT bar graphs are displayed on the SHC1 screen, SIG will always be greater than TGT and installation can proceed to the next stage by pressing Enter and following step 12.

Latch-style telescope assembly

If this type of alignment telescope was used with a non-Trident Excel it may be necessary to further optimise the alignment in the following way in order to achieve best performance.

(a) After the SIG and TGT bar graphs are displayed on the SHC1 screen as previously described, let the TGT level reach its initial maximum by waiting for approximately 10 seconds.

*During this time the TGT level will move up towards the current SIG level.*

(b) Whilst watching the SIG level closely, make a small mechanical adjustment in either the horizontal or vertical alignment and note whether the SIG level goes up or down.

(c) If the SIG level goes up, make another small mechanical adjustment in the same direction as before.

(d) If the SIG level goes down, change the direction of adjustment. *Maximise the SIG level by making small adjustments in only one plane at a time.*

(e) When the SIG level has been maximised in one plane, make small adjustments in the other plane until SIG has been maximised in this plane.

(f) Repeat steps (b) to (e) until the SIG level has been maximised in both planes.

*At this point, SIG must be bigger than the initial TGT level and any adjustment either side of the current alignment must result in a reduction in signal level. If not, repeat steps (b) to (e) until these requirements have been met.*

(g) Lock off the alignment by placing a hex (Allen) key in the pair of grub-screws which control adjustment in a particular plane and simultaneously rotating them in opposite directions.

(h) Repeat this for the other pair of grub-screws.

(i) Press Enter and the signal levels are checked.

Provided that the SIG level is greater than the TGT level, the signal check should pass on to the next stage of installation.
APPENDIX A - HANDHELD INTERROGATOR

Initialisation
This starts the initialisation process. The following message is displayed:

Press Enter to Initialise Unit

This message is displayed during the initialisation process after pressing Enter.

Processing Data
Please Wait

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

Unit Initialised

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
\[\wedge \text{hh:mm} \vee\]

where: hh Hours.
mm Minutes.

When first displayed only the current hour is shown.
All settings are adjusted by means of the \(\wedge\) and \(\vee\) 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
\[\wedge \text{dd/mm/yy} \vee\]

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

Notes:
1. The time and date will not be updated unless both are entered and accepted without error.
2. The year 2000 is displayed as 00.
APPENDIX A - HANDHELD INTERROGATOR

**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
^ mmmmm ➾
```

where:  

```
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: mmmmm mA
Press Enter
```

where:  

```
Analogue output current previously set.
```

**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
```
APPENDIX A - HANDHELD INTERROGATOR

Show Status

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

```
ccccccccccccccccccc
ssssssss
```

where:
- `cccccccc...` Title of the calibration status field.
- `ssssssss` 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:

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

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.

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:

\[
\text{F-hh:mm DD/MM/YY}
\]
\[
\text{eeeeeeeeeeeeee}
\]

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 5, Problem Solving.

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

**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.

<table>
<thead>
<tr>
<th>Display Text</th>
<th>Fault Description</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>ERR_EXCEL_LOG_ALARM</td>
<td>The Excel log has become damaged.</td>
</tr>
<tr>
<td>Bad Temperature</td>
<td>ERR_EXCEL_TEMPERATURE_LIMIT</td>
<td>Unit has been operated at a temperature outside its specified and certified range.</td>
</tr>
<tr>
<td>Baseline Drift</td>
<td>ERR_EXCEL_DRIFT_LIMIT</td>
<td>Drift of unit’s baseline.</td>
</tr>
<tr>
<td>Beam Blocked</td>
<td>ERR_EXCEL_BEAM_BLOCKED</td>
<td>The infrared beam between the Transmitter and Receiver has become blocked.</td>
</tr>
<tr>
<td>Neg Gas Reading</td>
<td>ERR_EXCEL_NEGATIVE_DRIFT</td>
<td>Negative drift of gas detector’s zero position.</td>
</tr>
<tr>
<td>Not Installation</td>
<td>ERR_EXCEL_BAD_INSTALLATION</td>
<td>Incorrect gas detector installation has occurred.</td>
</tr>
<tr>
<td>Overrange</td>
<td>ERR_EXCEL_OVERRANGE</td>
<td>An overrange signal has occurred.</td>
</tr>
<tr>
<td>Power Failed</td>
<td>ERR_EXCEL_LOG_POWER_FAIL</td>
<td>The gas detector has suffered an internal power failure.</td>
</tr>
<tr>
<td>Reset Occurred</td>
<td>ERR_EXCEL_RESET</td>
<td>A gas detector reset has occurred.</td>
</tr>
<tr>
<td>Time Adjusted</td>
<td>ERR_EXCEL_LOG_TIME_ADJUST</td>
<td>The Excel log time has been changed.</td>
</tr>
<tr>
<td>Uncalibrated</td>
<td>ERR_EXCEL_UNCALIBRATED</td>
<td>The gas detector requires calibration.</td>
</tr>
<tr>
<td>Volt Ref Fault</td>
<td>ERR_EXCEL_VOLTAGE_REF_FAIL</td>
<td>Voltage reference fault detected.</td>
</tr>
</tbody>
</table>
APPENDIX A - HANDHELD INTERROGATOR

**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:

```
ccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccccc
## APPENDIX A - HANDHELD INTERROGATOR

<table>
<thead>
<tr>
<th>Gas Configuration Parameters</th>
<th>Display Text</th>
<th>Min Value</th>
<th>Max Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas ID</td>
<td>Gas Ident</td>
<td>0</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>1 = Methane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 = Ethane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 = Propane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 = Butane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 = Pentane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 = Hexane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 = Methane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 = Ethane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 = Propane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 = Butane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 = Pentane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 = Hexane (%UEGm)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>20 = Methane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 = Ethane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22 = Propane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23 = Butane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 = Pentane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25 = Hexane</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26 = Ethylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 = Propylene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28 = Butadiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29 = Ethanol</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 = Methanol</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31 = Methane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>32 = Ethane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>33 = Propane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>34 = Butane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35 = Pentane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36 = Hexane (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>37 = Ethylene (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38 = Propylene (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>39 = Butadiene (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 = Ethanol (%UEGm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>41 = Methanol (%UEGm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gas Units</th>
<th>Gas Units</th>
<th>LELm,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PPMm,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UEGm, or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VVm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>%LEL (Cross-Duct only)</td>
</tr>
</tbody>
</table>

| Effective Full Scale | Gas Full Scale | 0.1 | 100000 | 0.05 |
APPENDIX A - HANDHELD INTERROGATOR

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:

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

* To comply with FM performance approval, the maximum value for Time to Block is 200 s.

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:

<table>
<thead>
<tr>
<th>Installation Configuration Parameters</th>
<th>Display Text</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Type</td>
<td>System Type</td>
<td>Short Range</td>
</tr>
<tr>
<td>Path Length</td>
<td>Path Length</td>
<td>5m min.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5m min.</td>
</tr>
</tbody>
</table>

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.
APPENDIX A - HANDHELD INTERROGATOR

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.
- sssssssssssssss  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.
A.7 SPECIFICATION

A.7.1 HAND-HELD INTERROGATOR SHC-1 SPECIFICATION

CERTIFICATION:

ATEX & IECEEx: EN60079-0:2012, EN60079-11:2012
IEC60079-0:2011
IEC60079-11 2011
ATEX: Baseefa03ATEX0073.
IECEEx: BAS 09.0120

II 2G Ex ia IIC T4 Gb
Tamb -40°C to +40°C

OPERATING TEMPERATURE RANGE: 0°C to +40°C
(DMT evaluated: -25°C to +55°C)

STORAGE TEMPERATURE RANGE: -10°C to +40°C

OPERATING HUMIDITY: 0 to 99% RH

DIMENSIONS:
Long: 190mm
Depth: 40mm
Width: 80mm

WEIGHT: 0.5kg

MATERIAL: Stainless Steel ANSI 316

Honeywell Analytics Ltd
Poole BH17 0RZ UK

CALIBRATOR TYPE SHC 1
II 2G Ex ia IIC T4 Gb
(Tamb -40°C to +40°C)
Baseefa03ATEX0073X

IECEEx BAS 09.0120
PART No. 04230-A-XXXX
SER. No. 0X/XXXX

READ AND UNDERSTAND MANUAL BEFORE USE.

Mod. 1 2 3 4 5 6 7 8 9
APPENDIX A - HANDHELD INTERROGATOR

A.7.2 SHC PROTECTION DEVICE

WARNING
Not Certified for use in hazardous areas.
Not DMT evaluated.

OPERATING TEMPERATURE RANGE:  40°C to +65°C
OPERATING HUMIDITY:  0 to 99% RH

DIMENSIONS:
Lead Length:  Long:  670mm
Box Dimensions:  Long:  78mm
                        Depth:  39mm
                                 Width:  59mm

WEIGHT:  0.2kg
MATERIAL:  High Impact ABS

A.7.3 TERMINATION UNIT DVC100M MK2 SPECIFICATION

CERTIFICATION:
ATEX & IECEx:  EN60079-0, EN60079-7, EN60079-11,
                EN61241-18, IEC60079-0:2004 Ed.4,
                IEC60079-11:2006 Ed.5, IEC60079-18:2004
                Ed.2 AND IEC60079-7:2001 Ed.3.
                EEx ia IIC T6 amb -40°C to +65°C

OPERATING TEMPERATURE RANGE:  -40°C to +65°C
(DMT evaluated: -25°C to +55°C)

STORAGE TEMPERATURE:  -10°C to +40°C

OPERATING HUMIDITY:  0 to 99% RH
(DMT evaluated: 5% to 90% RH)

DIMENSIONS:
Long:  160mm
Depth:  90mm
Width:  160mm

WEIGHT:  2.0kg
MATERIAL:  DMC reinforced polyester

EMC COMPLIANCE:  EN50270, susceptibility to 20V/m
(DMT evaluated up to 3V/m)
APPENDIX B - GLOSSARY

B.1 TERMINOLOGY

Ex d
Flame proof or explosion proof within the confines of European standards EN60079-0 and EN60079-1. 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 European standards EN60079-0 and EN60079-7 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.

B.2 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:
LEL.m monitoring is particularly beneficial while the Excel gas detector is protecting the perimeter of a plant or process, often reducing the quantity of point detectors required. The open path LEL.m system has the ability to detect leaks that point detectors may miss due to prevailing or changing wind directions, and can provide early warning of a dilute gas cloud when point detectors may not register any gas presence.

To decide on alarm set points, it is recommended that the user firstly determine the size of gas cloud that they wish to protect against, then set the alarm point to a fraction not greater than 60% of that cloud size. For example, to protect against a 5 m cloud, set the alarm point ≤ 3 LELm.

B.3 ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX</td>
<td>European Hazardous Area Approval</td>
</tr>
<tr>
<td>CSA</td>
<td>Canadian Standards Association</td>
</tr>
<tr>
<td>DSP</td>
<td>Digital Signal Processor</td>
</tr>
<tr>
<td>EMC</td>
<td>Electro-Magnetic Compatibility</td>
</tr>
<tr>
<td>FM</td>
<td>Factory Mutual</td>
</tr>
<tr>
<td>IAA</td>
<td>Instrument Assisted Alignment</td>
</tr>
<tr>
<td>IECEx</td>
<td>International Hazardous Area Approval</td>
</tr>
<tr>
<td>IP</td>
<td>Ingress Protection</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>IS</td>
<td>Intrinsically Safe</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower Explosive Limit</td>
</tr>
</tbody>
</table>

APPENDIX B - GLOSSARY
# APPENDIX B - GLOSSARY

<table>
<thead>
<tr>
<th>LR</th>
<th>Long Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR</td>
<td>Medium Range</td>
</tr>
<tr>
<td>NPT</td>
<td>National Pipe Thread</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>SHC</td>
<td>Sieger Handheld Calibrator</td>
</tr>
<tr>
<td>SR</td>
<td>Short Range</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratories</td>
</tr>
</tbody>
</table>
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. Open-Path Transmitters and Receivers do not include mounting plates and brackets.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Searchline Excel Short Range 5m – 40m (15ft - 130ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>02104-N-4011</td>
<td>Short range system 5m to 40m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Source</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-4041</td>
<td>Short range system 5m to 40m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Sink</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-5012</td>
<td>Short range system 5m to 40m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates, brackets, DX100M and Junction Box, Current Source</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-5042</td>
<td>Short range system 5m to 40m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates, brackets, DX100M and Junction Box, Current Sink</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-6012</td>
<td>Short range system 5m to 40m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates, brackets, DX100M and Junction Box, Current Source</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-6042</td>
<td>Short range system 5m to 40m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates, brackets, DX100M and Junction Box, Current Sink</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Searchline Excel Medium Range 40m – 120m (130ft - 390ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>02104-N-4021</td>
<td>Medium range system 40m to 120m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Source</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-4051</td>
<td>Medium range system 40m to 120m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Sink</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-5022</td>
<td>Medium range system 40m to 120m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Source</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-5052</td>
<td>Medium range system 40m to 120m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Sink</td>
</tr>
<tr>
<td>Part Number</td>
<td>02104-N-6022</td>
<td>Medium range system 40m to 120m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Source</td>
</tr>
</tbody>
</table>
## APPENDIX C - ACCESSORIES & SPARE PARTS

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>02104-N-6052</td>
<td>Medium range system 40m to 120m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Sink</td>
</tr>
<tr>
<td>02104-N-4031</td>
<td>Long range system 120m to 200m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Source</td>
</tr>
<tr>
<td>02104-N-4061</td>
<td>Long range system 120m to 200m ATEX complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, 1 DVC100M MK2 digital junction box, 1 junction box Current Sink</td>
</tr>
<tr>
<td>02104-N-5032</td>
<td>Long range system 120m to 200m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Source</td>
</tr>
<tr>
<td>02104-N-5062</td>
<td>Long range system 120m to 200m UL complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Sink</td>
</tr>
<tr>
<td>02104-N-6032</td>
<td>Long range system 120m to 200m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Source</td>
</tr>
<tr>
<td>02104-N-6062</td>
<td>Long range system 120m to 200m CSA/FM complete TXR and RXR system, fully wired with flexible conduit, SS316 mounting plates and brackets, DX100M, Junction Box. Current Sink</td>
</tr>
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### Alternate Calibrations

**Excel calibration gas table. Additional costs for non standard calibrations**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>2104D5001</td>
<td>METHANE / LELm</td>
</tr>
<tr>
<td>2104D5002</td>
<td>ETHANE / LELm</td>
</tr>
<tr>
<td>2104D5003</td>
<td>PROPANE / LELm</td>
</tr>
<tr>
<td>2104D5004</td>
<td>BUTANE / LELm</td>
</tr>
<tr>
<td>2104D5005</td>
<td>PENTANE / LELm</td>
</tr>
<tr>
<td>2104D5021</td>
<td>ETHYLENE / LELm</td>
</tr>
<tr>
<td>2104D5022</td>
<td>PROPYLENE / LELm</td>
</tr>
<tr>
<td>2104D5023</td>
<td>BUTADIENE / LELm</td>
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</tbody>
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### Alignment Kits

<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>02104-N-4006</td>
<td>Short range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for ATEX approved systems</td>
</tr>
<tr>
<td>02104-N-4007</td>
<td>Long and medium range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for ATEX approved systems</td>
</tr>
<tr>
<td>02104-N-5006</td>
<td>Short range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for UL approved systems</td>
</tr>
<tr>
<td>02104-N-5007</td>
<td>Long and medium range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for UL approved systems</td>
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</table>
### APPENDIX C - ACCESSORIES & SPARE PARTS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>02104-N-6006</td>
<td>Short range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for CSA/FM approved systems</td>
</tr>
<tr>
<td>02104-N-6007</td>
<td>Long and medium range alignment and conformity kit including handheld interrogator, telescope, carry case and test filters for CSA/FM approved systems</td>
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### Accessories

#### Handheld Interrogator and accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>04230-A-1001</td>
<td>Hand Held Interrogator ATEX Certified (4V0 software) for Optima, Optima Plus and Excel</td>
</tr>
<tr>
<td>2104B2351</td>
<td>Hand Held Interrogator UL Certified (4V0 software) for Optima, Optima Plus and Excel</td>
</tr>
<tr>
<td>2104B2354</td>
<td>Hand Held Interrogator CSA/FM Certified (4V0 software) for Optima, Optima Plus and Excel</td>
</tr>
<tr>
<td>2108B1455</td>
<td>Hand Held EEPROM upgrade (4V0)</td>
</tr>
<tr>
<td>04320-A-1025</td>
<td>SHC Protection Device Module and Lead</td>
</tr>
<tr>
<td>2104B6250</td>
<td>SHC Calibrator Connector System 10m</td>
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#### DVC/DX Interfaces

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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<tbody>
<tr>
<td>2104B6212</td>
<td>DVC100M MK2 Termination Unit ATEX with MODBUS capability</td>
</tr>
<tr>
<td>2104B2382</td>
<td>DX100M XP Termination Unit UL/CSA/FM with MODBUS capability</td>
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</tbody>
</table>

#### Installation Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2104D0295</td>
<td>Sun/Heat Shade (Deluge Cover)</td>
</tr>
<tr>
<td>210-190-045</td>
<td>Killark Junction Box (excludes terminals)</td>
</tr>
<tr>
<td>2992A0071</td>
<td>Conduit Assembly for Excel UL certified</td>
</tr>
<tr>
<td>0230-0069</td>
<td>Stainless Steel enclosure NEMA 4X 3/4&quot; NPT UL</td>
</tr>
<tr>
<td>02104-N-9880</td>
<td>Upgrade to Nickel Plated Glands</td>
</tr>
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#### Gas Test Equipment

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2104N2999</td>
<td>Excel Test filters kit &amp; Manual</td>
</tr>
<tr>
<td>2104B2326</td>
<td>Gassing Cell</td>
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#### Spares

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>2104B2391</td>
<td>Short Range Telescope (bayonet fitting)</td>
</tr>
<tr>
<td>2104B2322</td>
<td>Medium / Long Range Telescope (callipers)</td>
</tr>
<tr>
<td>210-190-003</td>
<td>Short Range Alignment Case</td>
</tr>
<tr>
<td>2104B0300</td>
<td>Searchline Excel Isolation Kit Short Range</td>
</tr>
<tr>
<td>2104B0310</td>
<td>Searchline Excel Isolation Kit Medium/Long Range</td>
</tr>
<tr>
<td>2104B2301</td>
<td>Mounting Bracket Short Range &amp; Insul. Kit</td>
</tr>
<tr>
<td>2104B2302</td>
<td>Mounting Bracket Long Range &amp; Insul. Kit</td>
</tr>
<tr>
<td>2104D0237</td>
<td>Mounting Plate</td>
</tr>
<tr>
<td>2104B2071</td>
<td>Short Range Transmitter Incl Conduit ATEX</td>
</tr>
<tr>
<td>2104B2081</td>
<td>Med Range Transmitter Incl Conduit ATEX</td>
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</table>
## APPENDIX C - ACCESSORIES & SPARE PARTS

<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>2104B2091</td>
<td>Long Range Transmitter Incl Conduit ATEX</td>
</tr>
<tr>
<td>2104B2111</td>
<td>Receiver Std Version Short Range ATEX</td>
</tr>
<tr>
<td>2104B2112</td>
<td>Short Range Receiver Sink ATEX</td>
</tr>
<tr>
<td>2104B2131</td>
<td>Medium Range Receiver Source ATEX</td>
</tr>
<tr>
<td>2104B2132</td>
<td>Medium Range Receiver Sink ATEX</td>
</tr>
<tr>
<td>2104B2151</td>
<td>Receiver Standard Version Long Range ATEX</td>
</tr>
<tr>
<td>2104B2152</td>
<td>Long Range Receiver Sink ATEX</td>
</tr>
<tr>
<td>2104B3001</td>
<td>Short Range Transmitter Incl Approved Adaptor UL</td>
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<tr>
<td>2104B3011</td>
<td>Medium Range Transmitter UL</td>
</tr>
<tr>
<td>2104B3021</td>
<td>Long Range Transmitter UL</td>
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<tr>
<td>2104B3101</td>
<td>Receiver Standard Version Short Range UL</td>
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<tr>
<td>2104B3102</td>
<td>Short Range Receiver Sink UL</td>
</tr>
<tr>
<td>2104B3111</td>
<td>Medium Range Receiver Source UL</td>
</tr>
<tr>
<td>2104B3112</td>
<td>Medium Range Receiver Sink UL</td>
</tr>
<tr>
<td>2104B3121</td>
<td>Long Range Receiver Source UL</td>
</tr>
<tr>
<td>2104B3122</td>
<td>Long Range Receiver Sink UL</td>
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<tr>
<td>2104B3201</td>
<td>Short Range Transmitter CSA/FM</td>
</tr>
<tr>
<td>2104B3211</td>
<td>Medium Range Transmitter CSA/FM</td>
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<tr>
<td>2104B3221</td>
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<tr>
<td>2104B3301</td>
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<tr>
<td>2104B3302</td>
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<td>Medium Range Receiver Source CSA/FM</td>
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<td>Medium Range Receiver Sink CSA/FM</td>
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<td>2104B3321</td>
<td>Long Range Receiver Source CSA/FM</td>
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<tr>
<td>2104B3322</td>
<td>Long Range Receiver Sink CSA/FM</td>
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**Manuals (Hard Copy)**

*Note: Electronic copies of the manuals are supplied on CD with each instrument*

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>2104M0506</td>
<td>Searchline Excel and Cross Duct Technical Handbook (English)</td>
</tr>
<tr>
<td>2104M0510</td>
<td>Searchline Excel Installation Guide (English)</td>
</tr>
<tr>
<td>2104M0409</td>
<td>DVC100(M) MK2 Termination Unit Quick Start Guide Guide (English)</td>
</tr>
<tr>
<td>2104M0701</td>
<td>DX100 Series Termination Units Technical Handbook (English)</td>
</tr>
<tr>
<td>2104M0523</td>
<td>Searchline Excel Test Filter Leaflet (English)</td>
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