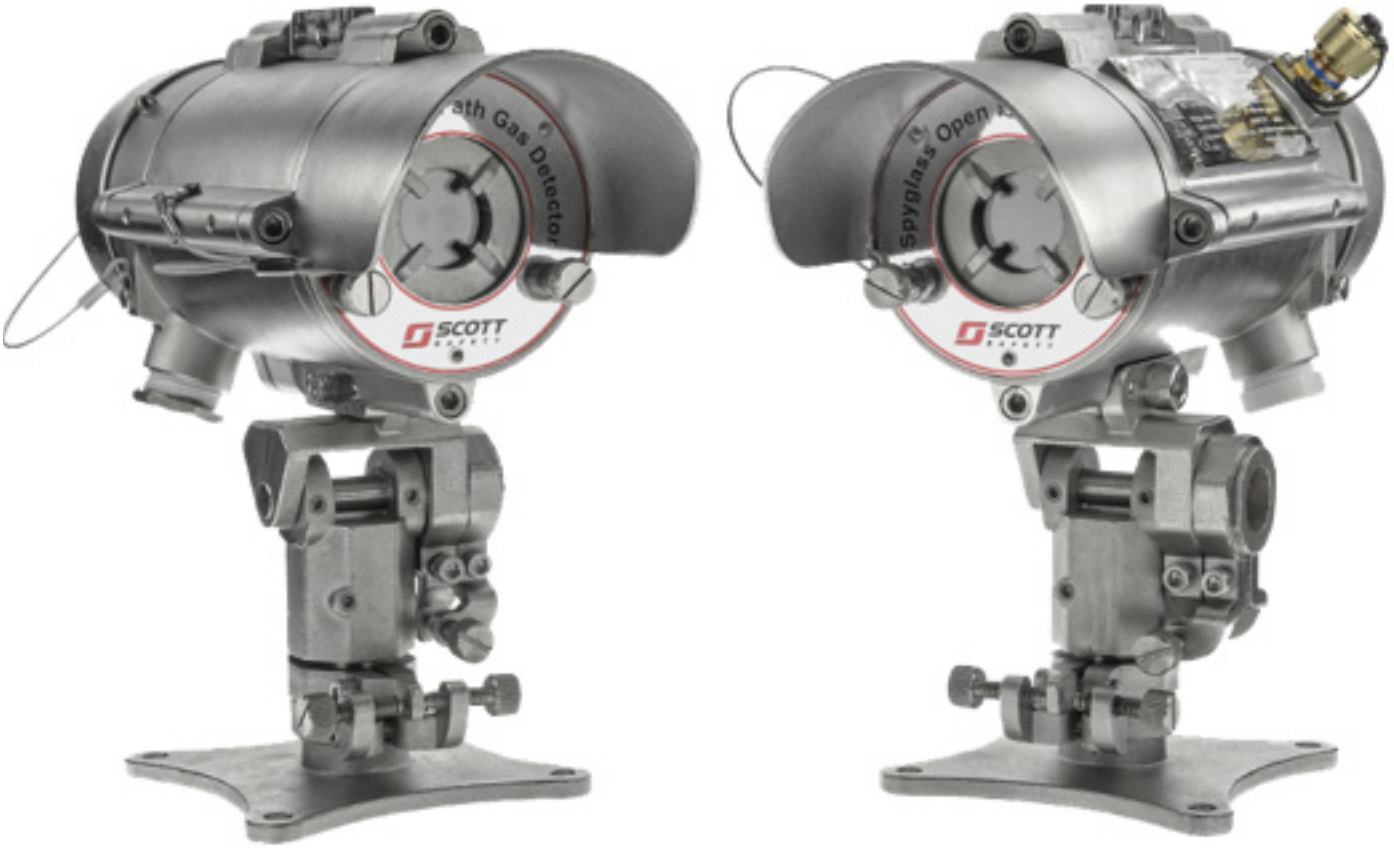
SPYGLASS

Open Path Combustible Gas Detector

USER GUIDE



WARNING: All individuals who have or will have responsibility for using, maintaining, or servicing this product must read this entire manual carefully. Failure to use this equipment properly could result in serious injury or death.

087-0051, Rev C/October 2017

REVISION TABLE

Rev. No.	Rev. Date	Reason
A		Initial Release
B		Added INMETRO (Brazil) part numbers
C	October 2017	Update to reflect current product release; reformatted document; changed logo

RELATED PRODUCT DOCUMENTATION

Document Name	Purpose	Document ID
WinHost	Software to change the required functions and for maintenance of the unit.	087-0052
I.S. Handheld Unit	Device to change the required functions and for maintenance of the unit.	087-0053
HART Communicator	Device to change the required functions and for maintenance of the unit, using HART protocol.	0870054

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The international transport of this device is regulated under United States export regulations and may be regulated by the import regulations of other countries.

WARRANTY STATEMENT

SCOTT SAFETY Agrees to extend to Purchaser/Distributor a warranty on the SCOTT SAFETY supplied components of the Spyglass products. SCOTT SAFETY warrants to Purchaser/Distributor that the products are free from defects in materials and workmanship for a period of three (3) years, commencing with the date of shipment from SCOTT SAFETY. SCOTT SAFETY expressly excludes damage incurred in transit from the factory or other damage due to abuse, misuse, improper installation, or lack of maintenance or "Act of God" which are above and beyond its control. SCOTT SAFETY will, upon receipt of any defective product, transportation prepaid, repair or replace it at its sole discretion if found to have been defective when shipped. Said repair or replacement is SCOTT SAFETY'S sole liability under this warranty and SCOTT SAFETY'S liability shall be limited to repair or replacement of the component found defective and shall not include any liability for consequential or other damages. The customer is responsible for all freight charges and taxes due on shipments both ways. This warranty is exclusive of all other warranties express or implied.

CAUTION: The Source and Detector are not field-repairable due to the meticulous alignment and calibration of the sensors and the respective circuits. Do not attempt to modify or repair the internal circuits or change their settings, as this will impair the system's performance and void the Scott Safety product warranty.

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1. ABOUT THIS GUIDE

1.1. Guide Overview

This user guide describes the Spyglass Open-Path Gas Detection System and its features and provides instructions on the installation, operation and maintenance.

This guide includes the following chapters and appendices:

- Chapter 2. INTRODUCTION
- Chapter 3. TECHNICAL DESCRIPTION
- Chapter 4. OPERATIONAL MODES
- Chapter 5. TECHNICAL SPECIFICATIONS
- Chapter 6. INSTALLATION INSTRUCTIONS
- Chapter 7. OPERATING INSTRUCTIONS
- Chapter 8. MAINTENANCE INSTRUCTIONS
- Chapter 9. TROUBLESHOOTING
- Chapter APPENDIX A - WIRING CONFIGURATIONS
- Chapter APPENDIX B - ACCESSORIES
- Chapter APPENDIX C - SIL-2 FEATURES.

1.2. Warnings and Cautions

WARNING: FOLLOW THE APPLICABLE WARNINGS AND CAUTIONS INDICATED HERE. FAILURE TO USE THIS EQUIPMENT PROPERLY MAY RESULT IN SERIOUS INJURY OR DEATH.

WARNING: ONLY QUALIFIED PERSONNEL (AS DEFINED ACCORDING TO LOCAL, COUNTY, STATE, FEDERAL, AND INDIVIDUAL COMPANY STANDARDS) MAY OPERATE AND SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS USER GUIDE COMPLETELY BEFORE OPERATING OR SERVICING.

WARNING: WHEN IN DOUBT, VACATE THE AREA IMMEDIATELY. VACATE THE AREA IMMEDIATELY IF THE DEVICE INDICATES A WARNING OR ALARM CONDITION. KNOW AND UNDERSTAND YOUR COMPANY'S SAFETY PROTOCOLS.

WARNING: ENSURE THE ATMOSPHERE IS FREE FROM COMBUSTIBLE AND/OR TOXIC GASES PRIOR TO STARTING ANY OF THE PROCEDURES.

WARNING: WHEN THE PRIMARY DEVICE IS OFF LINE, ENSURE YOU HAVE ANOTHER ON LINE DEVICE TO ACTIVELY DETECT GASES. THE DEVICE MAY BE OFF LINE DUE TO, BUT NOT LIMITED TO, CALIBRATION, INSTALLATION, MAINTENANCE, TROUBLESHOOTING, CONFIGURATION, WIRING AND OTHER ACTIVITIES.

WARNING: IF THE DEVICE DOES NOT FUNCTION AS DESCRIBED HEREIN, REMOVE IT FROM SERVICE AND MARK FOR MAINTENANCE. ONLY USE SCOTT SAFETY REPLACEMENT PARTS.

WARNING: ONLY USE THE DEVICE TO MONITOR THE ATMOSPHERE FOR THE GASES AND CONCENTRATIONS FOR WHICH IT IS SET-UP TO DETECT.

WARNING: PERIODICALLY TEST FOR CORRECT OPERATION OF THE SYSTEM'S ALARM EVENTS BY EXPOSING THE DEVICE TO A TARGETED GAS CONCENTRATION ABOVE THE HIGH ALARM SET POINT.

WARNING: CALIBRATION IS CRITICAL. PERFORM PERIODIC CALIBRATIONS THAT TAKE INTO ACCOUNT THE DEVICE USE AND ENVIRONMENTAL CONDITIONS. CALIBRATE WITH KNOWN TARGET GASES AT START-UP AND CHECK ON A REGULAR SCHEDULE.

CAUTION: Verify that the cover, internal PCBs, and field wiring are securely in place before applying power and operating.

CAUTION: Do not expose the device to electrical shock or continuous severe mechanical shock.

CAUTION: Do not use a device with a damaged enclosure is damaged or missing components.

CAUTION: Protect the device from dripping liquids and high power sprays.

CAUTION: Device will not operate without power applied. It only detects gases when powered.

2. INTRODUCTION

This section provides general information about the Spyglass system.

2.1. Product Overview

The Spyglass Model 20, 40, 100 and 200 IR Open-Path Gas Detectors employ an advanced Xenon flash source and integrated electronics package, both housed in improved, stainless steel housings to provide high quality, high performance, fast response, line of sight gas monitoring. This high quality is backed by 3 year warranty for the complete Spyglass system and 10 years for the Xenon flash source bulb.

Spyglass detects ambient combustible gases over a path length of up to 660ft. (200 m), even in harsh environments where dust, fog, rain, snow or vibration can cause a high reduction of signal. The Spyglass series can maintain operation in up to 90% signal obscuration and 30.5 degrees of misalignment.

Constructed of stainless steel, Spyglass has heated optical windows to improve performance in icing, snow, and condensation conditions. The programmable functions are available through an RS 485 or a HART port used with Host software supplied by Scott Safety and a standard PC or an I.S handheld unit.

The Spyglass source and detector unit enclosures are ATEX and IECEx approved Exd flameproof with an integral segregated rear, Exe terminal compartment which avoids exposing the sensors and electronics to surrounding environment. The detector also has a plug interface for connection to handheld PC or HART handheld, which is intrinsically safe. Hence the combined approval - Ex db eb ib [ib Gb] IIB+H2 T4 Gb, Ex tb IIIC T135°C Db IP66.

This manual contains a full description of the Spyglass Model 20, 40, 100 and 200 IR Open-Path Gas Detectors and their features. It includes instructions on the installation, operation, maintenance, and troubleshooting.

WARNING: THE SPYGLASS SOURCE AND DETECTOR UNITS ONLY DETECT COMBUSTIBLE GASES, AND THEY ONLY DO SO WHEN USED TOGETHER. THEY DO NOT PROVIDE AN AUDIBLE OR VISIBLE ALARM. IN ORDER TO PRODUCE AN AUDIBLE OR VISIBLE ALARM, YOU MUST CONNECT THE SPYGLASS SYSTEM TO AN ALARM OR INTEGRATE THEM INTO A PLANT SYSTEM.

WARNING: FAILURE TO USE THIS EQUIPMENT PROPERLY COULD RESULT IN SERIOUS INJURY OR DEATH.

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3. TECHNICAL DESCRIPTION

This section contains a physical description of the Spyglass Open-Path Gas Detectors.

3.1. Features

- Long range gas detection up to 660ft (200m)
- Simultaneous detection of C1-C8 flammable gases
- High sensitivity and fast response to hydrocarbon gases
- Heated optics to improve performance in icing, condensation, and snow conditions
- Continuous operation in extreme and harsh environmental conditions
- Solar blind and immune to industrial environments
- Withstands extreme vibration conditions
- Standard 0-20 mA output
- HART Protocol: communication protocol
- RS-485 Output MODBUS compatible for PC communication network for a maximum of 247 systems
- Simple one person installation, alignment, and calibration
- ATEX & IECEx approved per:
  - ♦ Ex II 2 GD
  - ♦ Ex db eb ib [ib Gb] IIB+H2 T4 Gb
  - ♦ Ex tb IIIC T135°C Db IP66
- FM / FMC approved per:
  - ♦ Class I Div. 1 Group B, C and D
  - ♦ Class II/III Div. 1 Group E, F and G
- TUV approved per SIL2 requirements
- Functional approved per FM 6325
- Functional tested by FM per EN60079-29-4
- Programmable configuration via the handheld unit
- Fast connection to I.S. approved handheld diagnostic/calibration unit
- (3mA) "maintenance call"
- Warranty 3 years for the complete Spyglass system
- Warranty 10 years for Xenon flash bulb

3.2. Applications

The Spyglass Open-Path Gas Detectors monitor flammable gas concentration in various applications, such as:

- Petrochemical, pharmaceutical and other chemical storage and production areas
- Flammable and toxic chemical storage sites and hazardous waste disposal areas
- Refineries, oil platforms, pipelines, refueling stations and fuel storage facilities
- Hazardous loading docks, transportation depots, and shipping warehouses
- Engine rooms
- Compressor and pumping stations
- Test cells
- LNG-LPG Systems
- Offshore Floating Production Storage and Shipping vessels (FPSO), and fixed oil rigs.

3.3. Principle of Operation

The Spyglass system detects gases through dual spectral range monitoring, analyzing the absorption of radiation caused by gases in the atmosphere and comparing the ratio to background atmospheric absorption.

3.3.1. DEFINITIONS OF TERMS

The following list defines gas concentrations measurement terms that are used in this manual:

Table 3-1: Gas Concentrations Measurement Terms

Term	Description
LEL	Lower Explosive Limit: The minimum concentration of a substance (gas/vapor) in air mixture that can be ignited. This mixture is different for every gas/vapor, measured in % of LEL.
LEL.m	Integral of Concentration in LEL units (1 LEL = 100% LEL) and the operation distance in meters (m).

3.3.2. SPECTRAL FINGER PRINT

The Spyglass System detects each hazardous material at a specific wavelength selected according to its specific spectral absorption or "finger print". The detection process involves two separate filters: one transmitting radiation that is absorbed by a particular gas and one that is not sensitive to it.

3.3.3. OPTICAL PATH

Spyglass detects the presence of hazardous airborne vapors, gases, or aerosols in a monitored area when the defined substance crosses/enters the optical path between the radiation source unit and the detector.

Hazardous gases/vapors present in the atmosphere cause absorption of the radiation pulse in the optical path between the radiating source and the detector unit at some specific wavelengths. This causes a change in the signal intensity received by the detector, which translates the signal into an output related to the detector's measuring scale.

The system analyzes the defined open path at the spectral bands specific to the materials being monitored. The Automatic Gain Control (AGC) unit compensates for environmental disturbances such as fog, rain, etc., through a constant comparison with its dual spectral beam.

3.3.4. MICROPROCESSOR BASED

A built-in microprocessor analyzes the incoming signals. A sophisticated mathematical algorithm calculates between the various functions of the detected signal thresholds. Statistics, ratio algorithms, data communications, diagnostics, and other functions are performed.

3.3.5. GAS SENSITIVITY

The Spyglass detectors use wavelengths around 2.3μ spectral band to measure air flammability potential between the source and detector. At this wavelength, all hydrocarbon materials have an absorption peak. This enables the detector to achieve regular sensitivity of 0-5 LEL.m.

The Spyglass detects hydrocarbon gases including methane, ethylene, propane, ethane, butane, and so on.

3.3.6. GAS CALIBRATION

The Spyglass has three calibrations that can be changed by function setup:

- Gas 1 - 100% methane
- Gas 2 - 100% propane
- Gas 3 - 100% ethylene

The full scale of methane and propane is 5 LEL.m.

The full scale of ethylene is 8 LEL.m.

3.3.7. FLASH SOURCE

The Xenon flash source was originally developed and designed to overcome false alarms, which were experienced by early generations of the open path system. The new Spyglass detector models employ the latest generation of flash bulbs to provide even more power and extended operation life (10 years).

3.3.8. HEATED OPTICS

The Spyglass series includes heated optics for the detector and source. The heater increases the temperature of the optical surface by 5-8°F (3-5°C) above the ambient temperature to improve performance in icing, condensation and snow conditions. The heated optics are configured to automatically operate when the change in temperature requires the heating (default).

The heated optics can be defined as one of the following modes:

- Not operated (not an option on source unit)

- On continuously
- Automatic, per temperature change (default)

See Section 4.4. System Setup.

When operated per temperature change, the user can define the start temperature below which the window will be heated (default 41°F (5°C)). This temperature can be defined from 32°F (0°C) to 122°F (50°C). The heating will stop when the temperature is 27°F (15°C) above the start temperature.

3.3.9. HART PROTOCOL

The Spyglass uses the HART Protocol. HART Communication is a bi-directional industrial field communication protocol used to communicate between intelligent field instruments and host systems. HART is the global standard for smart instrumentation, and the majority of smart field devices installed in plants worldwide are HART-enabled. HART technology is easy to use and very reliable.

Through the HART connection, the Spyglass detectors are able to perform:

- Detector set-up
- Detector troubleshooting
- Detector health and status
- For more details, refer to the HART Manual 087-0054.

The HART communication can be connected on the 0-20mA line or through the I.S. connection with a standard handheld loaded with our host software and a special harness.

3.3.10. HANDHELD UNIT

The I.S.-approved handheld diagnostics unit (Part no. 8000450) is available to make installation and maintenance easier. This is an all-on-one diagnostic/calibration/interrogation plug-in unit that allows for one-person installation and maintenance.

The handheld unit can be used:

- For on-site function programming and set up changes to the detector.
- During installation, the handheld unit will display all the detector's parameters and confirm that the installation has been completed successfully. It is also required to perform the necessary zero calibration function
- For maintenance and troubleshooting - the handheld unit will provide recommendation of maintenance action to overcome and optimize the Detector's performance.

For more details, refer to Manual 087-0053.

3.3.11. MODBUS RS-485

For more advanced communications, the Spyglass detector series has an RS-485 MODBUS-compatible output that provides data communication from a network (up to 247 Detectors) to a host computer or universal controller for central monitoring. This feature enables easy maintenance, with local and remote diagnostic tools.

3.3.12. TILT MOUNT

The newly designed stainless steel tilt mount provides a smaller installation footprint that can conform to limited space constraints, while the sturdy construction maintains alignment even in constant vibration. The improved 'X' and 'Y' axis worm-gear adjustments provide quick and easy alignment for installation and maintenance procedures.

3.4. Product Certification

The Spyglass Open-Path Gas Detector is approved for the following certification:

- ATEX, IECEx
- FM / FMC
- SIL-2
- Functional Test
- Inmetro (UL) (pending)

3.4.1. ATEX, IECEX

The Spyglass is ATEX approved per SIRA 13ATEX1394X and IECEx per IECEx SIR 13.0166X per:

- ATEX II 2 GD

  Ex db eb ib [ib Gb] IIB+H2 T4 Gb

  Ex tb IIIC T135°C Db IP66
- T Ambient -55°C to +65°C

This product is suitable to use in hazardous zones 1 and 2 with IIB+H2 group vapors present, and zones 21 and 22 with IIIC combustible dust types.

3.4.2. FM / FMC

The Spyglass is approved to FM / FMC Explosion Proof per:

- Class I, Div. 1 Group B, C and D, T6 -58°F (-50°C) ? Ta ? 149°F (65°C)
- Dust Ignition Proof - Class II/III Div. 1, Group E, F and G.
- Ingress Protection - IP66 & IP68, NEMA 250 Type 6P.

IP68 is rated for 2 meter depth for 45 minutes.

3.4.3. SIL-2

The Spyglass is TUV approved for SIL2 requirements per IEC 61508.

The alert condition according to SIL-2 can be implemented by alert signal via 0-20mA current loop.

For more details and guidelines on configuring, installing, operating, and servicing, see SIL-2 Features, and TUV report no. 968/EZ 619.00/13.

3.4.4. FUNCTIONAL TEST

The Spyglass has functional approval per FM 6325 and was functional tested by FM per EN60079-29-4.

3.5. Models and Types

The Spyglass series includes 4 models with the same detector and a different source that gives the ability to get detection at distances of 7-200 meters.

Table 3-2: Kit Model Numbers and Installation Distances

Part Number	Description
8000481*	Spyglass Model 20 (7-20 m range), ATEX, M25
8000482*	Spyglass Model 20 (7-20 m range), ATEX, 3/4" NPT
8000483*	Spyglass Model 20 (7-20 m range), FM, M25
8000484*	Spyglass Model 20 (7-20 m range), FM, 3/4" NPT
8000485*	Spyglass Model 40 (15-40 m range), ATEX, M25
8000486*	Spyglass Model 40 (15-40 m range), ATEX, 3/4" NPT
8000487*	Spyglass Model 40 (15-40 m range), FM, M25
8000488*	Spyglass Model 40 (15-40 m range), FM, 3/4" NPT
8000489*	Spyglass Model 100 (35-100 m range), ATEX, M25
8000490*	Spyglass Model 100 (35-100 m range), ATEX, 3/4" NPT
8000491*	Spyglass Model 100 (35-100 m range), FM, M25
8000492*	Spyglass Model 100 (35-100 m range), FM, 3/4" NPT
8000493*	Spyglass Model 200 (80-200 m range), ATEX, M25
8000494*	Spyglass Model 20 (80-200 m range), ATEX, 3/4" NPT
8000495*	Spyglass Model 200 (80-200 m range), FM, M25
8000496*	Spyglass Model 200 (80-200 m range), FM, 3/4"NPT
8001124*	Spyglass Model 20 (7-20 m Range), INMETRO, M25
8001125*	Spyglass Model 20 (7-20 m Range), INMETRO, 3/4" NPT
8001126*	Spyglass Model 40 (15-40 m Range), INMETRO, M25
8001127*	Spyglass Model 40 (15-40 m Range), INMETRO, 3/4" NPT
8001128*	Spyglass Model 100 (35-100 m Range), INMETRO, M25
8001129*	Spyglass Model 100 (35-100 m Range), INMETRO, 3/4" NPT
8001130*	Spyglass Model 200 (80-200 m Range), INMETRO, M25
8001131*	Spyglass Model 200 (80-200 m Range), INMETRO, 3/4" NPT

*Each kit includes: Source, Detector, and two Tilt Mounts

Table 3-3: Individual Component Part Numbers

Part Number	Description
8000461	Spyglass Detector, ATEX, M25
8000462	Spyglass Detector, ATEX, 3/4" NPT
8000463	Spyglass Detector, FM, M25
8000464	Spyglass Detector, FM, 3/4" NPT
8000465	Spyglass Model 20 Source (7-20 m Range), ATEX, M25
8000466	Spyglass Model 20 Source (7-20 m Range), ATEX, 3/4" NPT
8000467	Spyglass Model 20 Source (7-20 m Range), FM, M25
8000468	Spyglass Model 20 Source (7-20 m Range), FM, 3/4" NPT
8000469	Spyglass Model 40 Source (15-40 m Range), ATEX, M25
8000470	Spyglass Model 40 Source (15-40 m Range), ATEX, 3/4" NPT
8000471	Spyglass Model 40 Source (15-40 m Range), FM, M25
8000472	Spyglass Model 40 Source (15-40 m Range), FM, 3/4" NPT
8000473	Spyglass Model 100 Source (35-100 m Range), ATEX, M25
8000474	Spyglass Model 100 Source (35-100 m Range), ATEX, 3/4" NPT
8000475	Spyglass Model 100 Source (35-100 m Range), FM, M25
8000476	Spyglass Model 100 Source (35-100 m Range), FM, 3/4" NPT
8000477	Spyglass Model 200 Source (80-200 m Range), ATEX, M25
8000478	Spyglass Model 200 Source (80-200 m Range), ATEX, 3/4" NPT
8000479	Spyglass Model 200 Source (80-200 m Range), FM, M25
8000480	Spyglass Model 200 Source (80-200 m Range), FM, 3/4"NPT
8001114	Spyglass Detector, INMETRO, M25
8001115	Spyglass Detector, INMETRO, 3/4" NPT
8001116	Spyglass Model 20 Source (7-20 m Range), INMETRO, M25
8001117	Spyglass Model 20 Source (7-20 m Range), INMETRO, 3/4" NPT
8001118	Spyglass Model 40 Source (15-40 m Range), INMETRO, M25
8001119	Spyglass Model 40 Source (15-40 m Range), INMETRO, 3/4" NPT
8001120	Spyglass Model 100 Source (35-100 m Range), INMETRO, M25
8001121	Spyglass Model 100 Source (35-100 m Range), INMETRO, 3/4" NPT
8001122	Spyglass Model 200 Source (80-200 m Range), INMETRO, M25
8001123	Spyglass Model 200 Source (80-200 m Range), INMETRO, 3/4" NPT

3.6. Description

The Spyglass series comprises two main units:

- The flash infrared source (transmitter)
- The infrared detector (receiver)

Spyglass detects gases over an open path transmitted from the flash source to the detector.

3.6.1. FLASH SOURCE UNIT

The flash source unit emits IR radiation pulses at the rate of two pulses per second. The pulse width (5-10µsec) is very powerful. A lens on the front of the source collimates the IR beam for maximum intensity. The front window contains a heater to improve performance in icing, condensation and snow conditions.

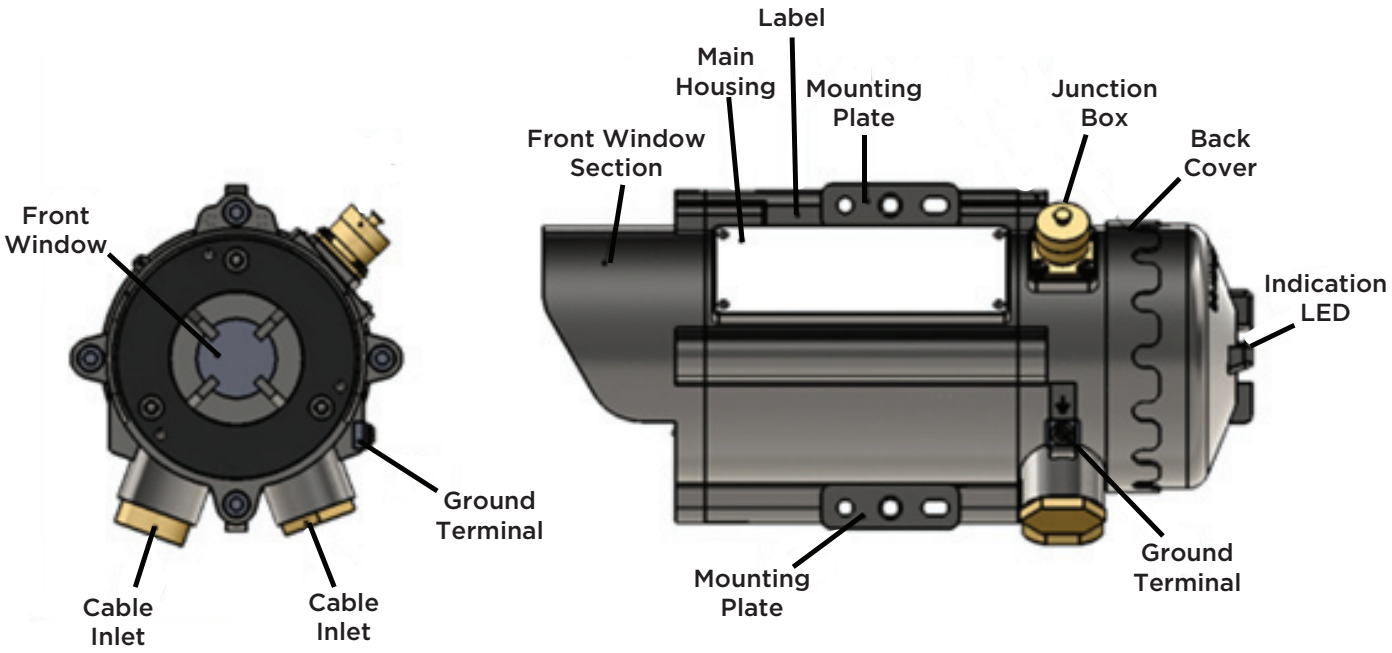

Figure 3-1: Flash Source Unit

The sources for models with range 7-20 m, 15-40 m and 35-100 m are the same electronically and optically. The only difference is in the apparatus. The source for range 80-200 m has different optics with different xenon lamp source.

3.6.2. DETECTOR UNIT

The detector receives the transmitted pulsed radiation signals from the flash source. The detector then amplifies the signals and feeds them into an analog-to-digital signal converter to be processed by the internal microprocessor. When the signals drop below a prescribed level, the internal microprocessor will compensate for them. This allows the detector to maintain the signal even in severe weather conditions. Finally, the detector sends the data to the output interface section.

The front window of the detector contains a heater to improve performance in icing, condensation and snow conditions.

One detector type works for all Spyglass models.

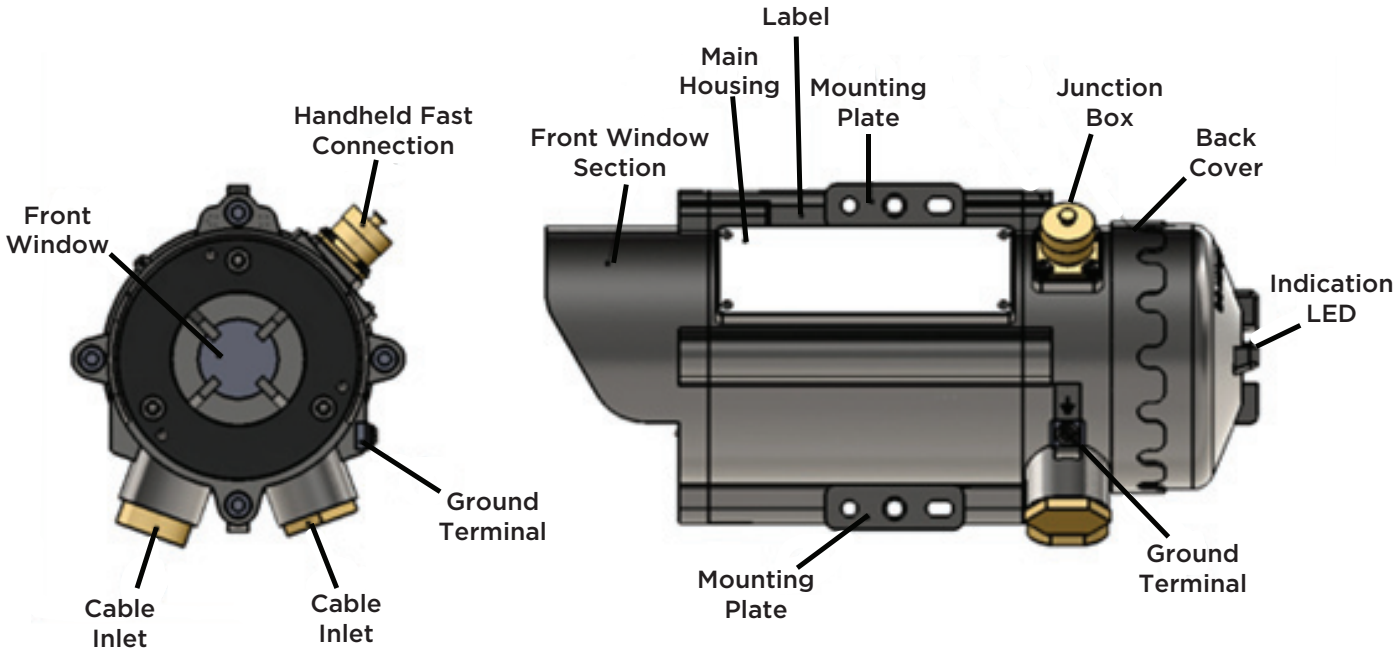

Figure 3-2: Detector Unit

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4. OPERATIONAL MODES

This section covers Spyglass' four different operational modes.

4.1. Operational Modes

The Spyglass detector has four operational modes:

- Normal Mode
- Maintenance Call Mode (3mA Output)
- Fault Mode
- Zero Calibration Mode (1mA Output)

4.1.1. NORMAL MODE

This mode is used for gas detection. In normal mode, the following statuses are possible:

- Normal - signal received from gas detection is at safe levels.
- Warning* - gases have been detected at warning levels.
- Alarm* - gases have been detected at alarm levels.

NOTE: For the standard 0-20mA output, the Warning and Alarm levels are not relevant. The user chooses these alarm levels at the controller. The output detector will be 4mA at zero reading and 20mA for full-scale reading.

Warning and Alarm states are relevant where the stepped 0-20mA output is used and will energize the warning and alarm relays.

*If the RS485 output is used, the detector changes its status from 'N' to 'W' at Warning level and to 'A' at Alarm.

4.1.2. MAINTENANCE CALL MODE (3MA OUTPUT)

This mode indicates low signal or low signal ratio. A variety of factors may cause this, including:

- a dirty window,
- misalignment,
- a poor source,
- one of the detectors' parameters at the 'limit' value.

The detector continues to function and reads any gas present, but provides a (3mA) pre-warning signal that indicates a required maintenance procedure.

4.1.3. FAULT MODE

Fault mode has three fault types:

- Fault 1 (2mA Output) - Blockage

  This fault occurs when detection is no longer possible due to blockage, very low signal, partial obscuration, or full beam block. You can restore the detector's proper operation (Auto reset) during operation by removing or resolving the condition caus-

ing the problem. Fault mode will occur after a delay of 60 seconds from the moment of the fault. This important delay gives the system time to eliminate momentary obscuration due to passing through the beam.

- Fault 2 (2.5mA) - Misalignment

  This occurs due to poor alignment.

- Low Voltage Fault (1mA Output)

  In this case, low supply voltage to the detector disables detection. The detector returns to proper operation only when proper voltage level is restored.

- Fault 2 (1mA Output) - Critical

  In this case, an electrical/software operational failure or a central device (memory, processor) fault disables the detection. Such a fault causes the detector to cease operation. In the case of fault in 0-20mA loop, the output will be 0mA.

4.1.4. ZERO CALIBRATION MODE (1MA OUTPUT)

This mode zeros the base level from which the detector will read gas. Only perform a zero calibration when the following conditions exist:

- No combustible gases are present
- A clear path exists between the flash source and detector
- Clear weather conditions exist

Always perform a zero calibration after installation, re-alignment, and window cleaning, using the handheld unit (or Host software on PC).

4.2. Visual Indicators

A 3-color LED indicator, located on the back side of the detector/source behind the back cover window, displays the detector's/source's status. See Figure 3-1: Flash Source Unit and Figure 3-2: Detector Unit, item 11.

The detector statuses are listed in Table 4-1: Detector LED Indications

Table 4-1: Detector LED Indications

Detector Status	LED Color	LED Mode
Fault	Yellow	4Hz - Flashing
Alignment/Standby	Yellow	1Hz - Flashing
Zero Calibration	Yellow	Constant
Normal	Green	1Hz - Flashing
Warning	Red	2Hz - Flashing
Alarm	Red	Steady

The source statuses are listed in Table 4-2: Source LED Indications.

Table 4-2: Source LED Indications

Source Status	LED Color	LED Mode
Fault	Yellow	4Hz - Flashing
Normal	Green	1Hz - Flashing

4.3. Output Signals

4.3.1. 0-20MA CURRENT OUTPUT

The 0-20mA output provides the detector status measurement showing a continuous reading of exact gas concentration. The 0-20mA functions as current sink, but it can be configured as source (see Appendix A). The maximum permitted load resistance for the 0-20mA output is 600ff.

Table 4-3: Standard (default) 0-20mA Current for the Gas Channel

Current Reading	Status and Description
0mA +0.3mA	Fault in 0-20mA loop
1mA 30.3mA	Zero Calibration (In Progress), Fault 2
2mA 30.3mA	Fault 1 (non-Critical)
2.5mA 3 0.3mA	Misalignment fault
3mA 30.3mA	"Maintenance Call"
4mA30.5mA	No gas present
4-20mA	Continuous measuring of gas concentration at a range between 0 and full scale. For methane and propane, this translates to 3.2mA per LEL.m, and for ethylene to 2mA per LEL.m.
21mA	Concentration is over the range limit (more than full-scale concentration).

4.3.2. RS-485 INTERFACE

The RS-485 input/output sends complete data information to a PC and receives data or control commands from the PC. The protocol is MODBUS compatible. The communication with the PC that is operated through the interface is executed only when used with appropriate host software.

4.4. System Setup

4.4.1. DETECTION FUNCTION PROGRAMMING

The Spyglass Series detectors incorporate several functions that can be set by the customer using:

- Host software. Refer to manual 087-0052 for programming instructions.

- Handheld unit (P/N 8000450). Refer to manual 087-0053 for programming instructions. The connection of the handheld to the detector is fast and intrinsically safe and allows function change with no need to open the detector.

4.4.2. DETECTION SETUP FUNCTION

See Section 4.4.3. DETECTOR DEFAULT SETUP for default settings.

Setup includes the following options:

4.4.2.1. Gas Calibration

Three gas types can be selected for maximum compatibility to the required measured gas(es):

- Methane - full scale 5 LEL.m.
- Propane - full scale 5 LEL.m.
- Ethylene - full scale 8 LEL.m.

These three calibrations are standard calibrations.

4.4.2.2. Zero Calibration

- Enable - zero calibration is performed according to background
- Disable - the detectors are not updated due to change of background

4.4.2.3. Address Setup

The detector provides up to 247 addresses that can be used in RS-485 communication link.

4.4.2.4. Heated Optic Operation

The heated optics for the detector unit can be defined as one of the following modes:

- OFF - not operated
- ON - operated continuously
- AUTO - on, per temperature change (default)

When operated per temperature change, the user can define the start temperature below which the window will be heated between 0 to 50°C. The detector will stop heating the window when the temperature will be 15°C above the defined temperature.

This feature relates to the detector only.

The source heated optic must be defined with the order in two options:

- Heated continuously.
- Start heating below 41°F (5°C). (default)

4.4.3. DETECTOR DEFAULT SETUP

The detector has 8 functions that can be programmed according to the customer requirement at factory or at customer facility using a software Host or a handheld unit. The standard set up is as follows:

Table 4-4: Detector Default Setup

Function	Setup
Gas Type	1
BG Zero Calibration	Enabled
0-20mA	Continuous
Heat Mode	Auto
Heat On	5

Table 4-5: Source Default Setup

Function	Setup
Heat Mode	Auto
Heat On	5

The Source default can be changed with the same Host.

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5. TECHNICAL SPECIFICATIONS

This section contains technical specifications for the Spyglass system.

5.1. General Specifications

Detected Gases: Simultaneous detection of Hydrocarbon flammable gases with molecular formulas C1-C8

Detection Distance Range: See Table 5-1: Detection Distance Range

Table 5-1: Detection Distance Range

Model Number	Minimum Installation Distance	Maximum Installation Distance
8000481	23 ft (7 m)	66 ft (20 m)
8000482		
8000483		
8000484		
8000485	50 ft (15 m)	132 ft (40 m)
8000486		
8000487		
8000488		
8000489	115 ft (35 m)	330 ft (100 m)
8000490		
8000491		
8000492		
8000493	265 ft (80 m)	660 ft (200 m)
8000494		
8000495		
8000496		

Response Time: 3 sec to T90

Spectral Response: 2.0 - 3.0 micron

Sensitvity Range:

		Full Scale LEL.m	Warning LEL.m	Alarm LEL.m
Gas 1	Methane	5	1	3
Gas 2	Propane	5	1	3
Gas 3	Ethylene	8	1.6	4.8

Field of View:	Line of Sight
Alignment Tolerance:	30.5º
Drift:	3 7.5% of the reading or 34% of the full scale (whichever is greater)
Minimum Detectable Level:	0.15 LEL.m
Temperature Range:	-67°F (-55°C) to +149°F (+65°C)
Immunity to False Alarm:	Does not produce false alarm and is not influenced by Solar Radiation, Hydrocarbon Flames and other external IR Radiation Sources

5.2. Electrical Specifications

Operating Voltage: 10-32 VDC

5.2.1. POWER CONSUMPTION±

Table 5-2: Detector and Source Maximum Power Consumption

	Without Heated Optic (Max)	With Heated Optic (Max)
Detector	200mA	250mA
Source	200mA	250mA

5.2.2. ELECTRICAL INPUT PROTECTION

The input circuit is protected against voltage-reversed polarity, voltage transients, surges, and spikes according to EN50270.

5.2.3. ELECTRICAL OUTPUTS

5.2.3.1. 0-20mA Current Output

The 0-20mA is an isolated sink option. Configure this output as Source (see APPENDIX A - WIRING CONFIGURATIONS). The maximum permitted load resistance is 600 ff.

5.2.3.2. Communication Network

The Detector is equipped with an RS 485-communication link that can be used in installations with computerized controllers. Communication is compatible with the MODBUS protocol:

- A widely used standard protocol
- Enables continuous communication between a single standard MODBUS controller (Master device) and a serial Network of up to 247 Detectors.
- Enables connection between different types of Scott Safety Detectors or other MODBUS devices to the same Network.

5.2.3.3. HART Protocol

The HART Protocol is a digital communication signal at low level on top of the 0-20mA.

This is a bi-directional field communications protocol used to communicate between intelligent field instruments and the Host System.

Through the HART Protocol the detector can:

- Display set-up
- Reconfigure set-up
- Display detector status and definition
- Perform detector diagnostic
- Troubleshoot

5.3. Mechanical Specifications

Enclosure:	The Detector, Source and tilt mount are St. St. 316 Electro chemical and passivized coating.		
Explosion Proof:	ATEX & IECEx	Ⓔx II 2 GD,	
		Ex db eb ib [ib Gb] IIB+H2 T4 Gb	
		Ex tb IIIC T135°C Db IP66	
	FM/FMC	Class I Div. 1Groups B, C, and D	
		Class II/III Div. 1 Groups E, F, and G	
		T6 -58°F (-50°C) <Ta < 149°F (65°C)	
Functional Testing:	Approved per FM 6325		
	Tested by FM per EN60079-29-4		
Water and Dust Tight:	IP 66 and IP 68		
	IP68 is rated for 2 meter depth for 45 minutes.		
	NEMA 250 type 6p		
Electrical Modules:	Conformal coated		
Electrical Connection:	(Two options - specified at time of order)		
	2 X M25 (ISO)		
	2 X 3/4" - 14NPT conduits		
Dimensions:	Detector	10.5 x 5.1 x 5.1 in	(267 x 130 x 130mm)
	Source	10.5 x 5.1 x 5.1 in	(267 x 130 x 130mm)
	Tilt Mount	4.7 x 4.7 x 5.5 in	(120 x 120 x 40mm)

Weight:	Detector	11 lbs	(5 kg)
	Source	11 lbs	(5 kg)
	Tilt Mount	4.2 lbs	(1.9 kg)

5.4. Environmental Specifications

The Spyglass system is designed to withstand harsh environmental conditions. The source and detector units compensate for adverse conditions while maintaining accuracy.

5.4.1. HIGH TEMPERATURE

Designed to meet MIL-STD-810C, method 501.1 procedure II.

Operating Temperature:	+149ºF (+65ºC)
Storage Temperature:	+149ºF (+65ºC)

5.4.2. LOW TEMPERATURE

Designed to meet MIL-STD-810C, method 502.1, procedure I.

Operating Temperature:	-4ºF (-20ºC)
Storage Temperature:	-40ºF (-40ºC)

5.4.3. HUMIDITY

Designed to meet MIL-STD-810C, method 507.1, procedure IV relative humidity of up to 95% for the operational temperature range.

5.4.4. SALT AND FOG

Designed to meet MIL-STD-810C, method 509.1 procedure I. Exposure to a 5% salt solution for 48 hours.

5.4.5. WATER AND DUST

- IP67 per EN60529
- IP66 per EN60529

Dust:	Totally protected against dust
Liquids:	Protected against immersion between 15 cm and 1m in depth. Protected against all water jets from all directions.

5.4.6. SHOCK AND VIBRATION

Vibration:	Designed to meet MIL-STD-810C, method 514.2, procedure VIII.
Mechanical Shock:	Designed to meet MIL-STD-810C, method 516.1, procedure I.

5.4.7. ELECTROMAGNETIC COMPATIBILITY (EMC)

This product is in conformance with EMC per EN50270:

Radiated Emission:	EN55022
Conducted Emission:	EN55022
Radiated Immunity:	EN61000-4-3
Conducted Immunity:	EN61000-4-6
ESD:	EN61000-4-2
Burst:	EN61000-4-4
Surge:	EN61000-4-5
Magnetic Field:	EN61000-4-8

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6. INSTALLATION INSTRUCTIONS

This chapter covers the installation procedure for the Spyglass system.

6.1. Introduction

The detector and flash source units can be installed and maintained with the use of general-purpose common tools and equipment. Only suitably qualified personnel should perform the installation procedure.

This section does not attempt to cover all of the standard practices and codes of installation. Rather, it emphasizes specific points of consideration and provides some general rules for suitably qualified personnel. Special safety precautions are stressed wherever applicable.

6.2. General Considerations

6.2.1. PERSONNEL

Only suitably qualified personnel, familiar with the local electrical codes and practices and trained for gas detection maintenance, should install the system. Only personnel with knowledge of electronics, and in particular wiring installation, should perform or supervise the wiring procedure.

6.2.2. TOOLS REQUIRED

Installation of the Spyglass system requires the following tools:

- Set of screwdrivers
- Set of hex keys/Allan wrenches (supply with commissioning kit)
- Voltage multi-meter

6.2.3. SITE REQUIREMENTS

The installation position of the Spyglass system must take into account whether the gas being monitored is heavier or lighter than air, as well as the individual site requirements. Always select a site that gives the detector a direct view to the source. Always mount each item in a secure and stable location, with minimal vibrations. Either mount the equipment in a location where nothing can knock it out of alignment, or guard it from physical impact.

6.2.4. THE SOURCE AND DETECTOR

Select the appropriate detector for the length of open path being monitored. To allow for aging of the source and a reduction of the IR signal due to adverse weather, we recommend using a detector that is not at the limit of its operating range.

Keep the open path between the source and detector and the immediate surroundings clear of obscuration that might hinder the free movement of air in the protected area or block the infrared beam.

6.2.5. GUIDANCE TIPS FOR GAS DETECTOR LOCATIONS

When selecting mounting locations in order to provide the best detection coverage, mount the detector and source:

- Below potential leak source for heavier than air gases

- Above potential leak sources for lighter than air gases
- Near to leak sources along the expected leak trajectory, taking into account prevailing wind directions
- Between leak source and potential ignition sources
- In area with expected heavy fog, rain, or snow, consider the effect of long range installation and install the detector at shorter range with the maximum intensity model available.

6.3. Preparations for Installation

Installation should comply with local, national and international regulations and norms as applicable to gas detectors and approved electrical devices installed in hazardous areas. Use general-purpose common tools and equipment to install the detectors.

The system should include the following (in addition to this manual):

- detector unit - (See Section 3.5. Models and Types)
- source unit - (See Section 3.5. Models and Types)
- two tilt mount bases - P/N 8000447
  - ♦ 1 base is used for the Detector
  - ♦ 1 base is used for the Flash Source
- Commissioning kit - P/N 800044

  The commissioning kit includes:
  - ♦ Function check filters - P/N 8000457, 8000458, 8000459, 8000460
  - ♦ Telescope kit - P/N 8000456

  The telescope kit is used during each Spyglass installation and then removed. You can reuse it for all other Spyglass installations on the site; therefore, only one set is required for several detectors.
- Handheld unit - P/N 8000450
- Other accessories are available (per the customer request):
  - ♦ Pole mount (U-Bolt 5 inch) - P/N 8000448
  - ♦ HART handheld diagnostic unit - P/N 8000451
  - ♦ HART handheld harness kit - P/N 8000452
  - ♦ USB/RS485 harness converter kit - P/N 8000453
  - ♦ Mini laptop kit - P/N 8000454
  - ♦ Sunshade - P/N 8000455

See details in APPENDIX B - ACCESSORIES.

Use the following procedure for preparing the installation of the Spyglass Gas Detector:

1. Verify the appropriate purchase order. Record the part number and the serial number of the detectors and source units and the installation date in the appropriate log book.
2. Open the container package immediately prior to detector installation and visually inspect the detectors, sources, and accessories.
3. Verify that all components required for the detector installation are readily available before commencing the installation. In the event that you cannot complete installation in a single session, secure and seal the detectors and conduits.
4. For wiring, use color-coded conductors or suitable wire markings or labels. Cross section of wire must be between 1mm^2 to 2.5mm^2 (18-14AWG). Base the selection of wire gauge on the number of detectors used on the same loop and the distance from the control unit. Max. Wire connection in the same terminal is two wire cross section of each wire is 1mm^2.

6.4. Certification Instructions

WARNING: DO NOT OPEN THE DETECTOR, EVEN WHEN ISOLATED, IN THE PRESENCE OF FLAMMABLE ATMOSPHERE. DOING SO COULD EXPOSE FLAMMABLE ATMOSPHERE TO A POSSIBLE IGNITION SOURCE RESULTING IN FIRE OR EXPLOSION. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH.

Use the following certification instructions:

- The cable entry point may not exceed 182°F (83°C); take suitable precautions when selecting the cable.
- The equipment may be used with flammable gases and vapors with apparatus groups IIA and IIB +H2 T4 in the ambient temperature range -67°F (-50°C) to +149°F (+65°C).
- Only suitably trained personnel may carry out the installation of this equipment, in accordance with the applicable code of practice e.g. EN 60079-14:1997.
- Only suitably trained personnel may carry out the inspection and maintenance of this equipment, in accordance with the applicable code of practice e.g. EN 60079-17.
- Only suitably trained personnel may carry out the repair of this equipment, in accordance with the applicable code of practice e.g. EN 60079-19.
- The certification of this equipment relies upon the following materials used in its construction:
  - ♦ Enclosure: 316L Stainless Steel
  - ♦ Window: Sapphire Glass
  - ♦ Seals: EPDM
- If the equipment is likely to come into contact with aggressive substances, then take suitable precautions to prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.

- ♦ Aggressive substances include, but are not limited to, solvents that may affect polymeric materials and acidic liquids or gases that may attack metals.
- ♦ Suitable precautions include, but are not limited to, regular checks as part of routine inspections or establishing from the material's data sheets that it is resistant to specific chemicals.

WARNING: DO NOT USE IF THE UNITS SHOW EVIDENCE OF CHEMICAL ATTACK, SUCH AS DISCOLORATION, CRACKING, OR OTHER DAMAGE TO DETECTOR OR COMPONENTS. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH.

- Special Conditions for safe use: Never use the Spyglass Open Path Gas Detectors & Flash Source Units as safety related devices in accordance with directive 94/9/EC.

6.5. Conduit/Cable Installation

The conduit and cable installation must comply with all local and federal electrical codes and the following guidelines:

1. To avoid water condensation in the detector/source, install the detector with the conduits/cable entries facing downwards.
2. Use flexible conduits/cables for the last portion connecting to the detector/source.
3. When pulling the cables through the conduits, ensure that they do not get tangled or stressed. Extend the cables about 12 inches (30cm) beyond the detector/source location to accommodate wiring after installation.
4. After pulling the conductor cables through the conduits, perform a continuity test.

6.6. Detector/Source Mounting

Mount the detector/source with the tilt mount kit, Model 8000447. The tilt mount enables the detector/source to rotate up to 45° in all directions, with fine alignment of up to 3°.

6.6.1. TILT MOUNT KIT

The tilt mount kit includes the following items:

Table 6-1: Tilt Mount Kit P/N 8000447

Item	Quantity	Type/Model
Tilt Mount	1	8000447
Screw	1	M10 X 1.5
Spring Washer	1	No. 10

6.6.2. DETECTOR/SOURCE INSTALLATION

(Refer to Figure 6-1: Tilt Mount and Figure 6-2: Detector/Source and Tilt Mount Assembly)

You can install the detector and the source in two ways using the same tilt mount.

To install the detector/source:

1. Place the tilt mount holding plate (item 1) in its designated location and secure it with (4) fasteners through four (4) 8.5mm dia. holes.

NOTE: Skip this step if the tilt mount is already installed.

NOTE: Removing the detector for maintenance purpose does not require removing the tilt mount.

2. Place the detector, with its conduit/cable inlets pointing downwards, on the detector holding plate of the tilt mount (item 2). Using Hex Key No. 7, secure the detector to the tilt mount with M10 x 1.5 screws and M10 spring washers (9, 10).
3. Repeat steps 1 - 2 to install the Source.

6.7. Detector Wiring

WARNING: PERFORM INSTALLATION WORK ONLY IN A NON-HAZARDOUS ENVIRONMENT. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH.

To install the Detector wiring:

1. Turn off power to the external wiring for the intended detector location to avoid shock and potential explosion hazards.
2. Release the back cover secure bolt (item 15, Figure 6-2:), and open the detector back cover (item 14, Figure 6-2:). The chamber is now revealed.
3. Remove the protective plug mounted on the Detector conduit/cable entry inlet; pull the wires through the Detector inlet (item 4, Figure 6-3: Detector with Cover Removed). Use a ¾" - 14NPT or M25x1.5 explosion-proof conduit connection / cable gland to assemble the cable / explosion-proof conduit to the Detector.
4. Connect the wires to the required terminals (item 2, Figure 6-3:) according to the wiring diagram. See 6.8. Flash Source Wiring and Figure A-1: Detector Wiring Terminal, Figure A-3: 0-20mA Sink 4-Wire, Figure A-4: 0-20mA Non-isolated Sink 3-Wire, and Figure A-5: 0-20mA Source 3-Wire.
5. Connect the grounding wire to the ground screw outside Detector (item 3. Figure 6-3:). The Detector must be well grounded to Earth Ground.
6. Place and secure the Detector back cover by screwing the cover and securing it using the secure bolt (item 15, Figure 6-2:).
7. Restore power to the external wiring for the unit.

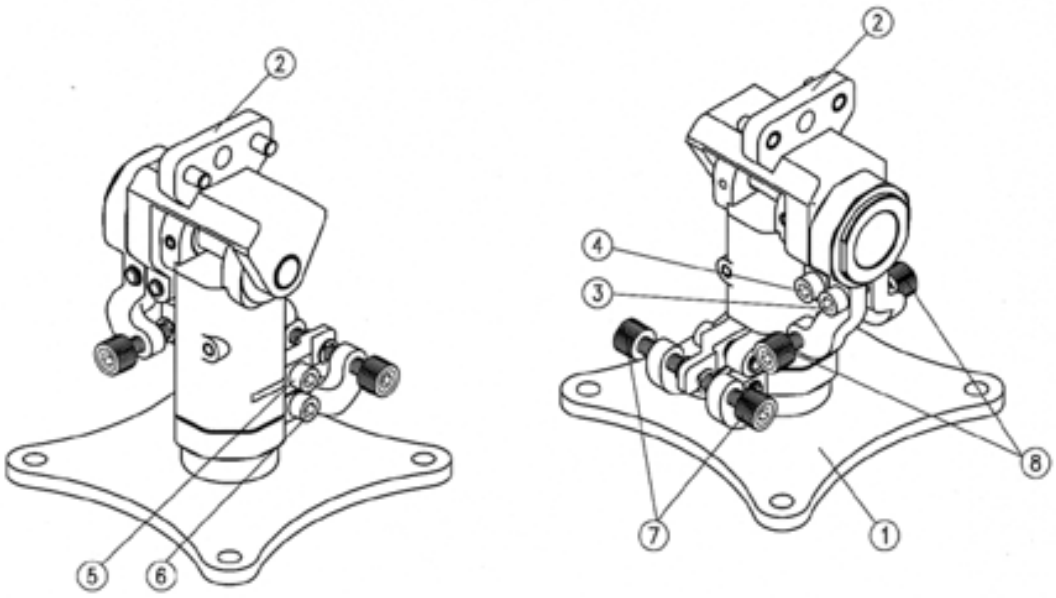

Figure 6-1: Tilt Mount

1	Tilt Mount Holding Plate	5	Vertical Fine Alignment Tightening Screw
2	Detector/Source Holding Plate	6	Vertical Crude Alignment Tightening Screw
3	Horizontal Crude Alignment Tightening Screw	7	Vertical Fine Alignment Screw
4	Horizontal Fine Alignment Tightening Screw	8	Horizontal Fine Alignment Screw

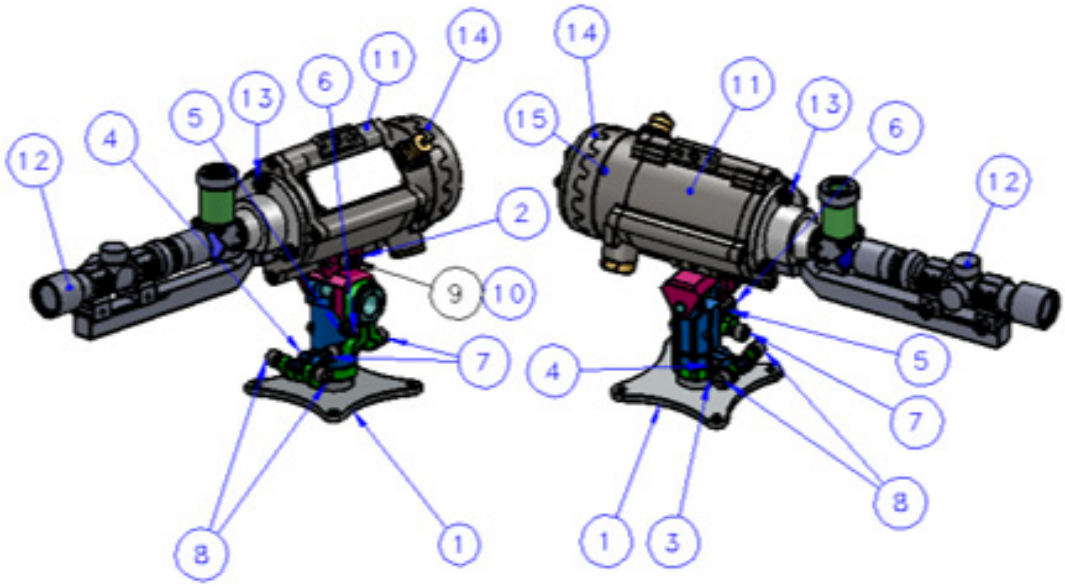

Figure 6-2: Detector/Source and Tilt Mount Assembly

1	Tilt Mount Holding Plate	9	Detector/Source Tightening Screw
2	Detector/Source Holding Plate	10	Detector/Source Tightening Washer
3	Horizontal Crude Alignment Tightening Screw	11	Detector/Source
4	Horizontal Fine Alignment Tightening Screw	12	Telescope
5	Vertical Fine Alignment Tightening Screw	13	Telescope Tightening Bolt
6	Vertical Crude Alignment Tightening Screw	14	Detector/Source Back Cover
7	Vertical Fine Alignment Screw	15	Detector/Source Back Cover Secure Bolt
5	Horizontal Fine Alignment Screw		

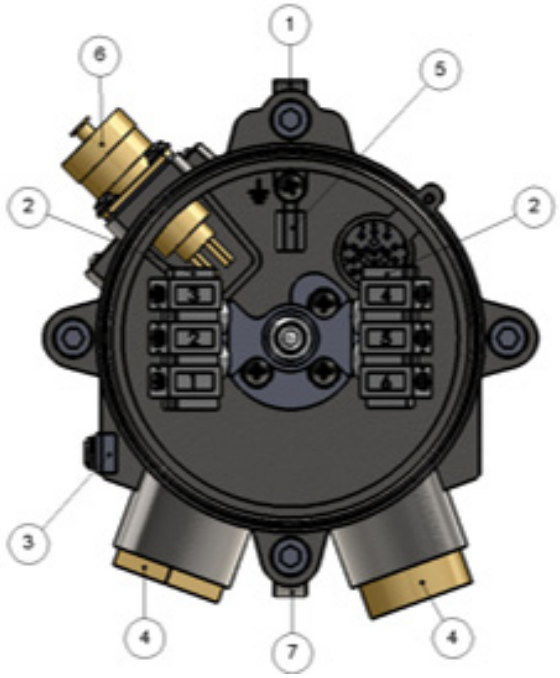

Figure 6-3: Detector with Cover Removed

1 Housing
2 Terminal Board
3 Ground Terminal
4 Inlet Conduit
5 Internal Ground Connection
6 Connection to Handheld Unit
7 Detector Holding Plate

6.7.1. DETECTOR TERMINAL WIRING

The Detector has six wiring terminals.

Table 6-2: describes the function of each electrical terminal of the detectors.

Table 6-2: Detector Wiring Options

Terminal Number	Function
1	Power +24VDC
2	Return +24VDC
3	0-20mA (Input)
4	0-20mA (Output)
5	RS-485 (+)
6	RS-485 (-)

6.8. Flash Source Wiring

To install the wiring:

1. Release the back screw bolt (item 15, Figure 6-2: Detector/Source and Tilt Mount Assembly), and open the source back cover (item 14, Figure 6-4:). The chamber is now revealed.
2. Remove the protective plug mounted on the source conduit/cable entry inlet; pull the wires through the source inlet (item 4, Figure 6-4: Source with Cover Removed. Using a ¾" - 14NPT or M25x1.5 explosion-proof conduit connection/cable gland, assemble the cable/explosion-proof conduit to the Detector.
3. Connect the wires to the required terminals (item 2, Figure 6-4:) according to the wiring diagram. See 6.8.1. SOURCE TERMINAL WIRING and Figure A-1: Detector Wiring Terminal).
4. Connect the grounding wire to the ground screw outside Detector (item 3, Figure 6-4:). Always ground the source to Earth Ground.
5. Place and secure the source back cover by screwing the cover and secure the back screw bolt.

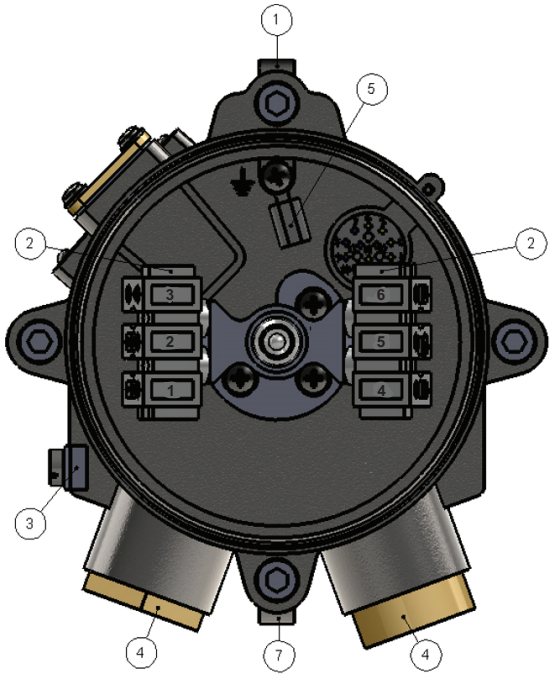

Figure 6-4: Source with Cover Removed

1	Housing	5	Internal Ground Connection
2	Terminal Board	6	N/A
3	Ground Terminal	7	Detector Holding Plate
4	Inlet Conduit		

6.8.1. SOURCE TERMINAL WIRING

The flash source contains six wiring terminals.

Table 11 describes the function of each electrical terminal of the source.

Table 6-3: Source Wiring Options

Terminal Number	Function
1	Power +24VDC
2	Return +24VDC
3	Spare
4	Spare
5	RS-485 (+)
6	RS-485 (-)

7. OPERATING INSTRUCTIONS

7.1. Spyglass Operation

Once the system is positioned, it will monitor for possible specified gases, automatically sending signals to a standard control panel or a PC. This section describes the alignment, calibration, and operation.

CAUTION: Accurate alignment is essential for proper operation of the Spyglass system.

7.2. Safety Precautions

After powering up, the detector requires minimal attention in order to function properly, but the following should be noted:

1. Follow the instructions in the manual; refer to the drawings and specifications issued by the manufacturer.
2. Do not open the detector/source housing while power is supplied.
3. Disconnect external devices, such as automatic extinguishing systems, before carrying out any maintenance task or warranty work.

7.3. Alignment of Unit

Using the telescope performs full alignment.

Alignment procedure should be performed in two stages: crude alignment and fine adjustment.

The telescope includes a periscope that consists of a prism and an ocular located vertical to the telescope assembly. This allows the user to observe into the opposite unit perpendicularly to the alignment when access from the rear of the unit is impossible. For installations where rear access is possible, the periscope is not necessary. In this case, it can be removed by releasing the periscope fastening screw.

NOTE: Prior to telescope installation, verify that the telescope and its sight mounting are free from any dirt to ensure proper alignment according to factory calibration.

NOTE: Do not attempt to change any factory calibration at the telescope or its mounting. This may prevent optimal alignment.

To align the unit (see Figure 7-1: Detector/Source and Tilt Mount Assembly):

1. Make sure that the detector and the flash source are installed properly. Section 6. INSTALLATION INSTRUCTIONS describes the installation instructions.
2. Remove the front shield using the two captive screws.
3. Install the telescope assembly (12) on the detector/source front. Fasten the telescope with tightening bolt (13).

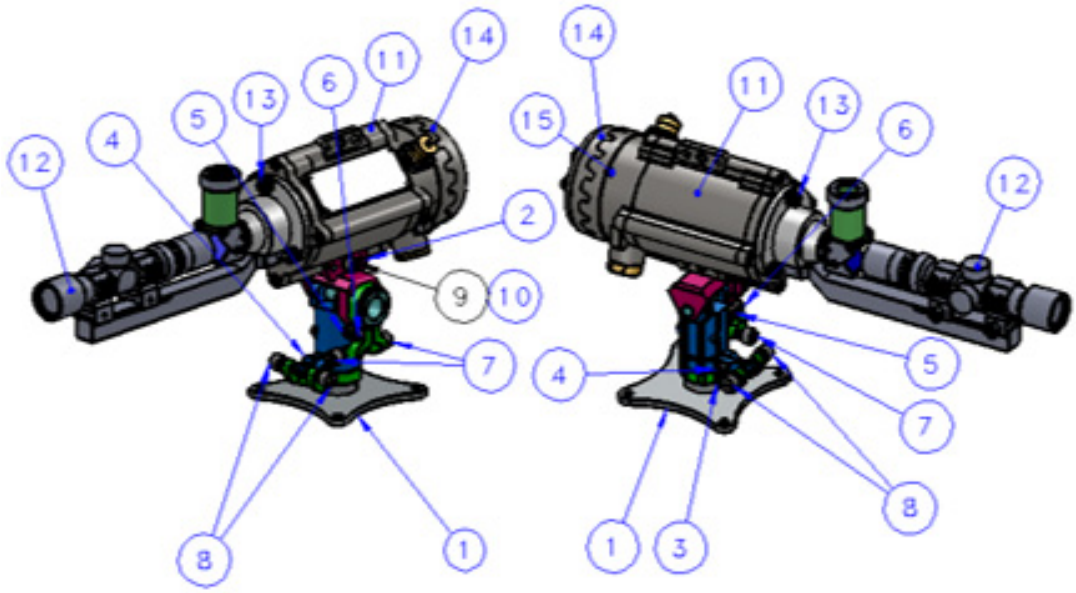

Figure 7-1: Detector/Source and Tilt Mount Assembly

1	Tilt Mount Holding Plate	9	Detector/Source Tightening Screw
2	Detector/Source Holding Plate	10	Detector/Source Tightening Washer
3	Horizontal Crude Alignment Tightening Screw	11	Detector/Source
4	Horizontal Fine Alignment Tightening Screw	12	Telescope
5	Vertical Fine Alignment Tightening Screw	13	Telescope Tightening Bolt
6	Vertical Crude Alignment Tightening Screw	14	Detector/Source Back Cover
7	Vertical Fine Alignment Screw	15	Detector/Source Back Cover Secure Bolt
5	Horizontal Fine Alignment Screw		

4. Perform the crude alignment as follows (refer to Figure 7-1:):

   A. Use ¼" Allen screw driver for all alignment screws.

   B. Loosen the vertical fine alignment tightening screw (5) and the vertical crude alignment tightening screw (6).

   C. Adjust the source horizontally to aim it approximately toward the detector.

   D. Tighten the vertical crude alignment tightening screw (6).

   E. Loosen the horizontal fine alignment tightening screw (4) and the horizontal crude alignment tightening screw (3).

   F. Adjust the source vertically to aim it approximately toward the detector.

   G. Tighten the horizontal crude alignment tightening screw (3).

5. Repeat step 4 for the detector.
6. Perform the fine alignment as follows (refer to Figure 7-1:):
   A. Aim the source to the detector within horizontal axis using the vertical fine adjustment screws (8).
   B. Make sure the telescope cross is pointing to the detector or source center of the front window (item 8).
   C. Tighten vertical fine alignment tightening screw (5).
   D. Aim within the vertical axis using the vertical fine adjustment screw (7).
   E. Tighten the horizontal fine alignment tightening screw (4).
   F. Make sure the telescope cross is pointing to the detector and source center of the window (8).
7. Repeat step 6 for the detector alignment.
8. Remove the telescope, and install the front shield.Powering up the System

CAUTION: Prior to any operation or maintenance, follow Section 7.2. Safety Precautions**.**

To power up the system:

1. Make sure that the source and detector are connected to power.
2. Make sure that the 4-20mA meter is connected to the detector.
3. Power up the system 18-32VDC.
4. After 60 seconds, the current meter will indicate 4mA.

NOTE: Always perform zero calibration after powering up the system (see Section 7.5. Zero Calibration).

7.4. Signal Verification

Perform the signal verification through the host software supplied by Scott Safety (refer to Manual 087-0052) or by Handheld unit (refer to Manual 087-0053).

7.4.1. SIGNAL VALUES LIMITATION

Table 7-1: describes the maintenance data channels limitation limits.

Table 7-1: Maintenance Channels Limit Values

Channel	Installation Distance			Maintenance
	Min	Med	Max	
Reference	1V Gain1	1V Gain2	1V Gain4	The minimum signal allowed is 2V at Gain9
Signal 1	1V Gain1	1V Gain2	1V Gain4	The minimum signal allowed is 2V at Gain9
Ratio 0	0.6 - 1.4	0.6 - 1.4	0.6 - 1.4	0.5 - 3
NQRat 0	0.95 - 1.05			Must be 0.95 - 1.05
LEL	0 LEL X m			0 LEL X m
Tempera-ture	Up to 25°C beyond room tempera-ture			Up to 25°C beyond room tem-perature
Voltage	32VDC > V > 18VDC			32VDC > V > 18VDC

NOTE: The installation information refers to the installation distance.

- Min: The minimum distance as defined on the model no.
- Med: Half of the maximum distance as defined on the model no.
- Max: The maximum distance defined on the model no.

7.5. Zero Calibration

Always perform zero calibration after:

- Installation
- Realignment
- Window cleaning
- Any change in detector or source position

Always perform precise alignment prior to the zero calibration procedure. Always perform zero calibration in good weather conditions, with insignificant gas concentrations in the surrounding environment, or indoors.

To perform the zero calibration procedure:

1. Switch from Normal to Alignment mode indication.
2. Switch from Alignment to Standby mode.
3. Switch from Standby to Zero Calibration mode. The 0-20mA output should now be at 1mA
4. Wait up to 60 seconds until the mode switches to Normal. The detector reading is now set to normal. The 0-20mA output should now indicate 4mA.

To switch between each mode, use the Host HART (refer to 087-0054), RS485 (refer to 087-0052 or 087-0053), or move the magnetic mode selector above the magnetic switch (Figure 7-2: Magnetic Mode Selector).

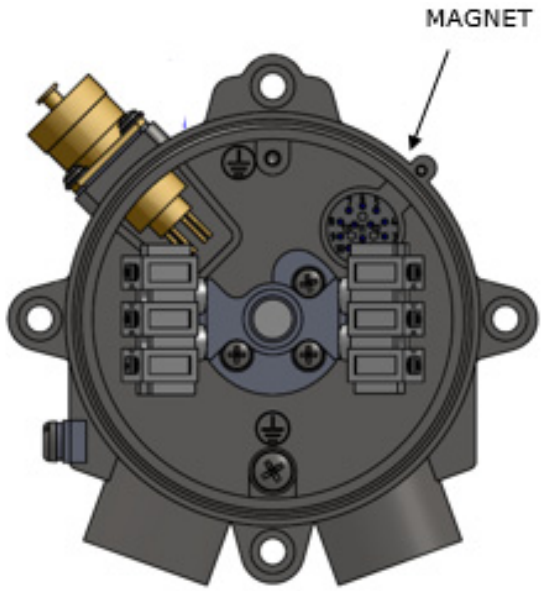

Figure 7-2: Magnetic Mode Selector

7.6. Functional Check of Unit

The Spyglass system has been calibrated at the factory for the user's specific gas or vapor detection requirements. The following procedure validates the functional operation of the system. The functional check filter is a convenient operational check used to confirm that response has not changed from previous readings. The filter is not used for calibration, which is unnecessary, nor does it equate to a particular quantity of gas.

CAUTION: Automatic activation or any external device that should not be activated during the calibration check should be disconnected.

NOTE: This functional verification procedure is for a standard 0-20mA output.

NOTE: Prior to starting the functional check, verify that the power to the units is on and that the current of the 0-20mA channel is stable. Record the reading.

To perform the functional check:

1. Position the functional check filter in front of the detector.
2. Center the functional check filter's window over the viewing window of the detector.
3. Wait 20 seconds.
4. Read the 0-20mA current. Determine the difference between the reading taken with and without the functional check filter. This difference is the 0-20mA current variance.
5. Record the 0-20mA current variance in the maintenance logbook. If the variance is more than a 30% change when compared to the previous check (see delivery form), repeat the alignment.

WARNING: IF THE UNIT DOES NOT SUCCESSFULLY PASS THE FUNCTIONAL CHECK, DO NOT USE IT. REPEAT TEST OR REPAIR AS NECESSARY. FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH.

8. MAINTENANCE INSTRUCTIONS

8.1. General Maintenance

The Spyglass series detectors require only simple periodic maintenance to provide satisfactory service and achieve maximum performance. The detector and source units can be maintained with the use of common tools and equipment. Record the periodic test results in a maintenance logbook with a copy of the delivery form inside.

8.2. Periodic Maintenance

Proper maintenance will allow the Spyglass system to retain maximum performance and reliability. Periodically perform the recommended cleaning of optical surfaces.

NOTE: Existing environmental conditions and the applications used ultimately determine the frequency of cleaning operations.

To perform periodic maintenance:

1. Keep the optical surfaces of the source and detector viewing windows as clean as possible, as they are active devices.
2. Always perform the alignment procedures each time the source or the detector unit has been opened or moved for any reason.
3. The Signal Verification Check corroborates the current signals from the flash source compared to that of previous alignments. Perform this check every 6-12 months. Always check the signal according to threshold levels (see 7.4. Signal Verification).
4. Always perform a functional check every 6 months (see 7.6. Functional Check of Unit)
5. Perform an alignment procedure only if the signals are below threshold value (see 7.4. Signal Verification)
6. Always perform a zero calibration (see 7.5. Zero Calibration) every time the detector or source is realigned or the windows are cleaned.

8.2.1. ROUTINE OPTICAL SURFACE CLEANING

The Spyglass system, being an optical device, must be kept as clean as possible. The optical surfaces concerned are the source and detector viewing windows.

To clean the optical window, proceed as follows:

1. Turn off the power to the Spyglass detector and source.
2. In places where dust or dirt has accumulated on the optical surface, clean the surface with a small, soft-bristle brush.
3. Wash the surfaces thoroughly with water and a mild non-abrasive detergent.
4. Rinse the glass surface thoroughly with clean water, ensuring no residue is left behind.
5. Dry the glass with a clean dry soft cloth.
6. Inspect the device, looking for damage to seals, discoloration, or other damage which may indicate a need for additional maintenance.

7. In the maintenance logbook, enter the date, the name of person who performed the maintenance service, and the name of the company.
8. Reconnect power to the Spyglass detector and source.
9. Perform a signal verification (see 7.4. Signal Verification).
10. Perform a zero calibration (see 7.5. Zero Calibration).
11. Perform a functional check (see 7.6. Functional Check of Unit)

8.2.2. SIGNAL VERIFICATION

The signal verification check determines the proper operation of the open path. It checks the alignment and cleanliness of the window or any problem in source or detector. Use the PC Host software to measure the signal verification.

Refer to Manual 087-0052 or use I.S handheld unit. Refer to Manual 087-0053 for non I.S HandHeld Unit.

8.2.3. FUNCTION CHECK OF UNIT

The Spyglass series detector has been calibrated at the factory per the user's specific gas or vapor detection requirements. This procedure validates the functional operation. The functional check must be done periodically. Refer to 7.6. Functional Check of Unit for instructions.

CAUTION: Disconnect automatic activation or any external device that should not be activated during the calibration check.

9. TROUBLESHOOTING

Table 9-1: Troubleshooting

Problem	Cause	Solution
"Maintenance call" status or R and S are below 2V DC at Gain 9	Poor alignment	Perform alignment
	Dirt on window	Clean window
	Poor light source	Replace light source
	Detector fault	Repair/replace detector
NQRat below the permitted limit	Gas in the path	Make sure that the path is clean and the weather conditions are good
NQRat above the permitted limit	Poor alignment	Perform alignment
Temperature higher than 25° C beyond the room temperature	Electronic problem	Repair/replace detector
Ratio1 and Ratio2 out of the limit	Poor alignment	Perform alignment
	Dirt on window	Clean window
	Detector fault	Repair/replace detector
Voltage less than 16V DC. The Detector at "V" fault	Low input voltage	Check the power supply and installation

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APPENDIX A - WIRING CONFIGURATIONS

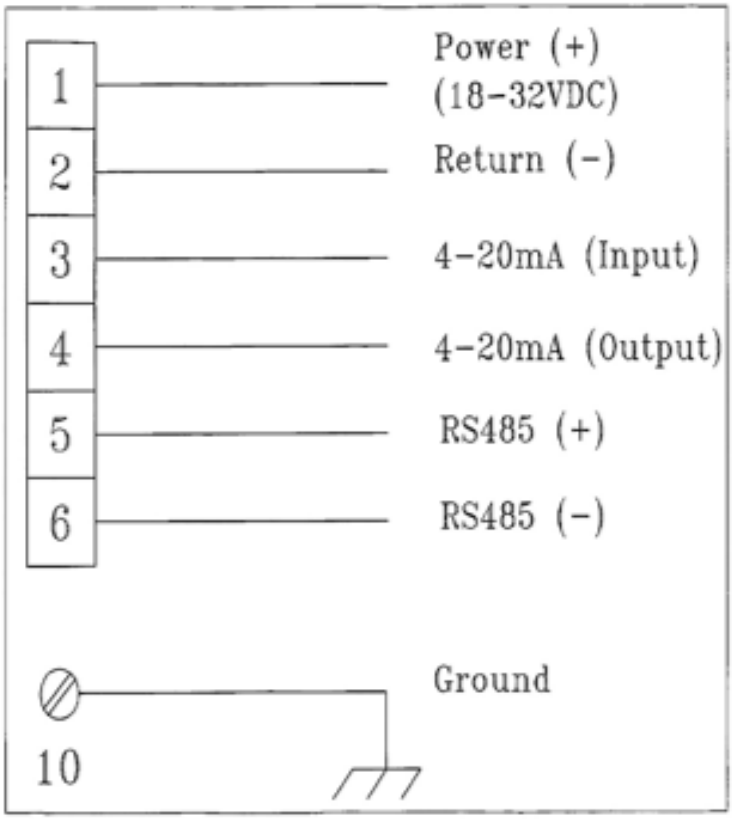

Figure A-1: Detector Wiring Terminal

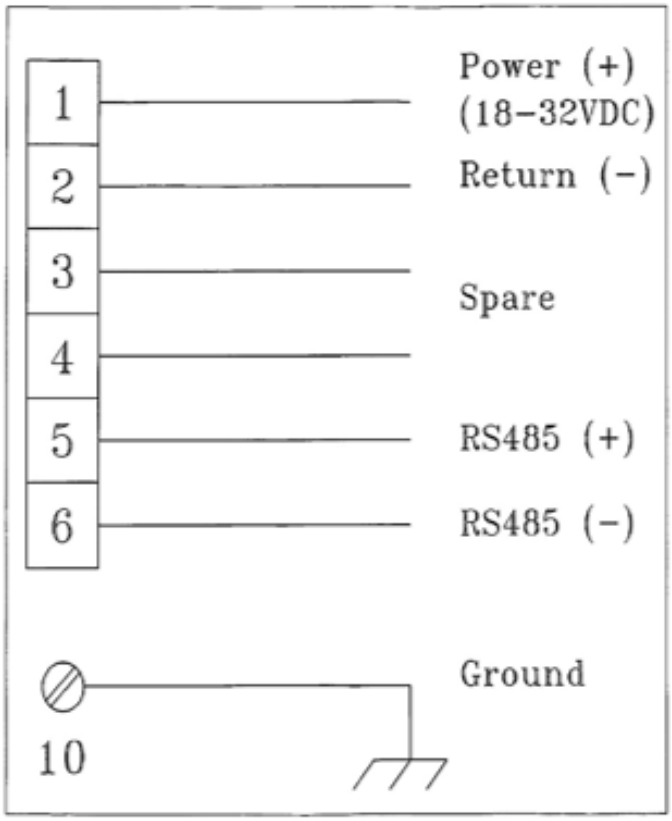

Figure A-2: Source Wiring Terminal

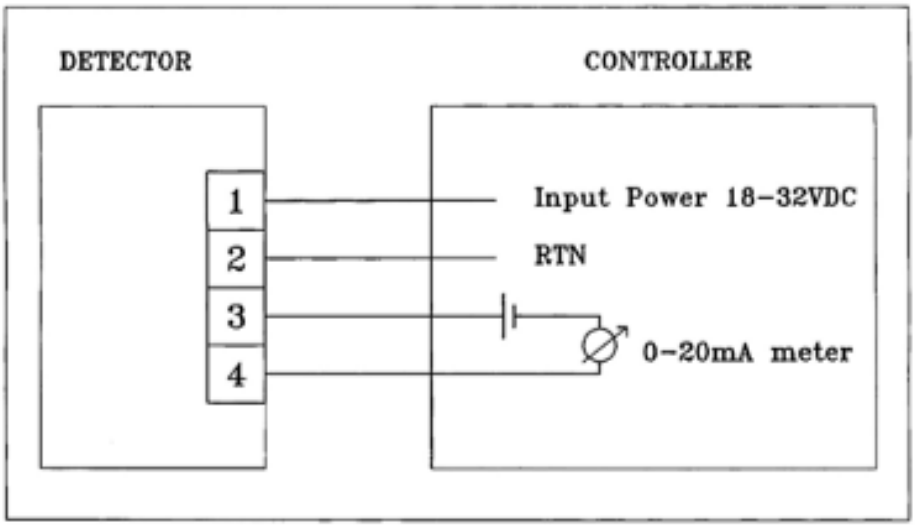

Figure A-3: 0-20mA Sink 4-Wire

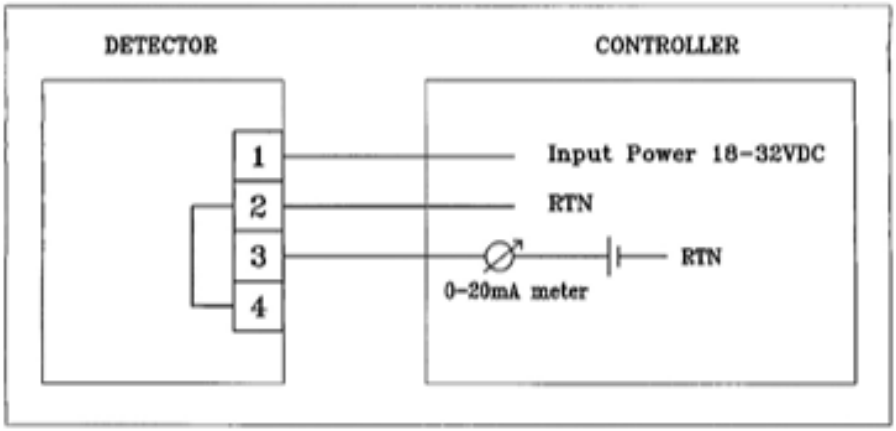

Figure A-4: 0-20mA Non-isolated Sink 3-Wire

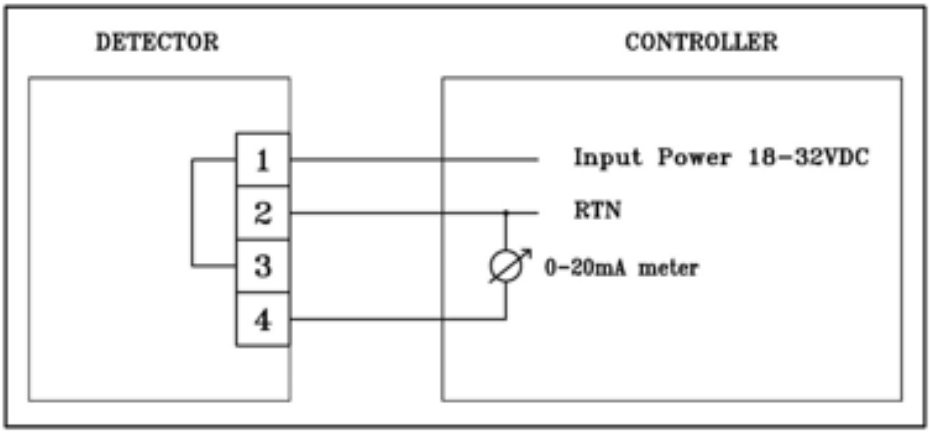

Figure A-5: 0-20mA Source 3-Wire

A.1. RS-485 Communication Network

By using the RS-485 network capability of the Spyglass detectors and additional software, it is possible to connect up to 32 Detectors in an addressable system with four (4) wires only (2 for power and 2 for communication). Using repeaters, the number of Detectors can be much larger (32 Detectors for each repeater) up to 247 on the same four (4) wires. When using the RS-485 network, it is possible to read each Detector status (FAULT, WARNING, and ALARM).

For more details, consult the factory.

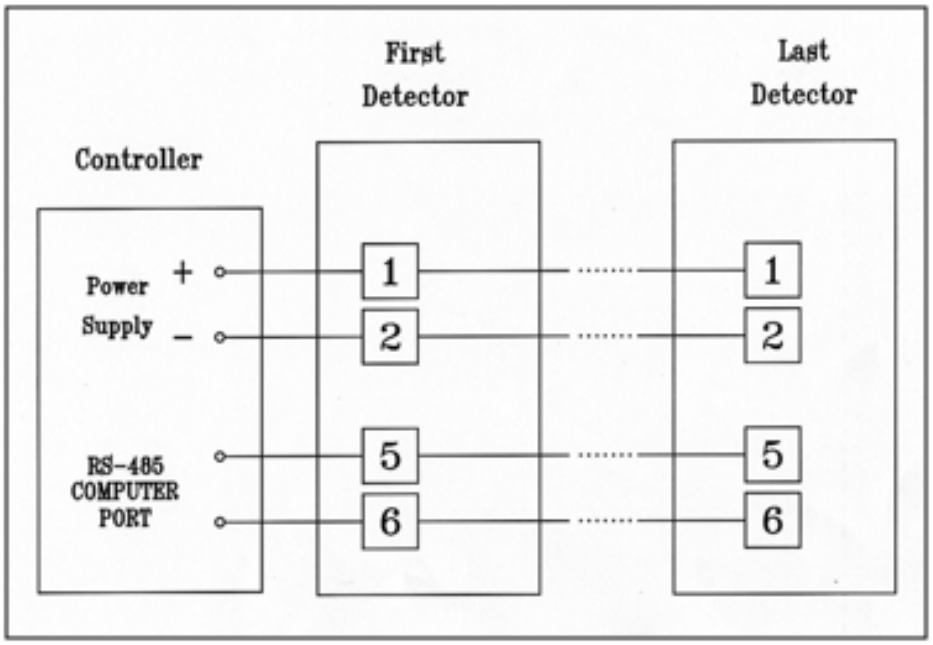

Figure A-6: RS-485 Networking for Wiring Option 3

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APPENDIX B - ACCESSORIES

B.1. Tilt Mount P/N 8000447

The Tilt Mounting Brackets allow accurate alignment of the detector/source for proper operation of the open path. The brackets give crude alignment of 330° and fine alignment of 35°.

B.2. Pole Mount (U-Bolt 5 inch) P/N 8000448

The U-bolt mount is available to facilitate 5″ pipe mounting.

B.3. Commissioning Kit P/N 8000449

The Commissioning/Alignment Kit unit is required for commissioning and future maintenance checks. Only one kit is required per site.

The kit includes an Alignment Telescope P/N 8000456, a Magnetic Mode Selector P/N 8000497, four Function Check Filters for system installation and periodic functional testing, along with socket keys for access to units.

B.4. RS485 Hand-Held Diagnostic Unit P/N 8000450

RS485 Hand-Held diagnostic unit, fitted with harness and converter to the quick plug connection (which provides easy and economical connection), will provide verification, status, and instructions for correcting the detector's parameters.

This is an I.S. approved Hand-Held with I.S. harness and converter to suit the detector and programmed with a special host for maintenance and commissioning.

B.5. HART Hand-Held Diagnostic Unit P/N 8000451

HART Hand-Held diagnostic unit fitted with harness to the quick plug connection which provides easy and economical connection. The HART Hand-Held will provide verification, status, and instructions for correcting the detector's parameters.

This is an I.S. approved Hand-Held with a special harness to suit the detector and a host for maintenance and commissioning.

B.6. HART Hand-Held Harness Kit P/N 8000452

A quick plug connection with harness which is connected on one side to a standard HART Hand-Held unit and includes Scott Safety host software that can be uploaded to an existing Hand-Held (does not include the Hand-Held).

B.7. USB/RS485 Harness Converter Kit P/N 8000453

The USB RS485 Harness Kit with RS485/USB converter, used with Scott Safety Host software, enables the user to connect to any available PC or laptop to re-configure settings or perform diagnostics on the Spyglass gas detector.

Refer to manual 087-0052 for programming instructions when using the USB RS485 Harness Kit.

B.8. Mini Laptop Kit P/N 8000454

The mini laptop, pre-loaded with Scott Safety software, enables the user to re-configure settings or perform diagnostics on all flame and gas detectors series.

Refer to manual 087-0055 for programming instructions when using the Mini Laptop Kit. The kit includes cable harness with RS485/USB converter. The mini laptop is programmed with maintenance Winhost for all detectors' type.

B.9. Sunshade P/N 8000455

The Sunshade is designed to protect the detector from the heat of the sun.

APPENDIX C - SIL-2 FEATURES

This appendix details the special conditions to comply with the requirements of EN 61508 for SIL-2.

The Spyglass Series Open Path Gas Detector can be used in low and high demand mode applications, sec IEC 61508-4:2010, Chapter 3.5.16.

C.1. Safety Relevant Parameters for Spyglass Open Path Gas Detector

Type:	B
Structure:	1oo1
HFT:	0
Main time to repair:	72 h
Ambient temperature:	max. 65 ? C
Proof-test-Interval:	52 weeks
S = 2056.1 fit	
D = 1976.1 fit	
DU = 114.8 fit	
SD = 1933.4 fit	
DD = 1861.4 fit	
SFF = 97%	DC = 94%
PFDavg = 6.45x 10-4	PFD%_SIL2 = 6,4 %
PFH = 1.15 x 10-7 1/h	PFH%_SIL2 = 11,5 %

C.2. General Conditions for Safe Use

- The Spyglass Series Open Path Gas Detector shall consist only of the approved hardware and software modules.
- The application advice and the limitations of the manual must be taken into consideration. For calibration and maintenance, the regional and national regulations have to be taken into consideration.
- The 24V power supply must fulfill the requirements for PELV / SELV of EN 60950.
- Never use the HART and RS 485 interfaces for the transmission of safety related data.
- The alert conditions according to SIL-2 can be implemented by an Alert signal via the 20ma current loop.
- After installation and configuration, the set-up parameters must be verified, and the function of the Spyglass Open Path Gas Detector must be checked completely.
- The alarm conditions of the transmitter must be checked periodically, together with the typical gas calibration checks. The Spyglass Open Path Gas Detector must be switched OFF and ON.

- The connected controller must monitor the 4-20mA signal current for values below 4mA and above 20 mA.
- Repair any defect in the Spyglass Open Path Gas Detector within 72 hours.

C.3. Abbreviations and Acronyms

Table C-1: Abbreviations and Acronyms

Abbreviation	Meaning
ATEX	Atmosphere Explosives
AWG	American Wire Gauge
BIT	Built-In Test
EMC	Electromagnetic Compatibility
EOL	End of Line
FOV	Field of View
HART	Highway Addressable Remote Transducer communication protocol
IAD	Immune at Any Distance
IECEx	International Electrotechnical Commission Explosion
IPA	Isopropyl Alcohol
IR	Infrared
JP5	Jet Fuel
Latching	Refers to relays remaining in the ON state even after the ON condition has been removed
LED	Light Emitting Diode
LPG	Liquefied Petroleum Gas
mA	MilliAmps (0.001 amps)
MODBUS	Master - Slave messaging structure
N.C.	Normally Closed
N.O.	Normally Open
N/A	Not Applicable
NFPA	National Fire Protection Association
NPT	National Pipe Thread
SIL	Safety Integrity Level
UNC	Unified Coarse Thread
VAC	Volts Alternating Current

APPENDIX D - TECHNICAL SUPPORT

For all technical assistance or support, contact:

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Pasadena, TX 77503
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Email: scottgastechsupport@tycoint.com
Web: http://www.scottsafety.com/

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