

USER MANUAL

IR PLUS

Infrared Hydrocarbon Detector
with Intelligent Heated Optics

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PROLOGUE

IR PLUS CONCEPT

Thank you for choosing the new IR Plus. At Crowcon, we understand the importance of reliable and robust localized gas monitoring systems, especially for the harshest environments.

The IR Plus is a compact, heated infrared gas detector designed for rapid and fail-safe detection of hydrocarbon gases and vapors. It features dual-wavelength IR sensor technology housed in a durable 316 stainless steel package, ensuring optimal performance in extreme conditions. To minimize effects of condensation on windows and mirrors, the IR Plus incorporates an intelligent heater and a hydrophobic STAY-CLIR coating on optical components.

Compatible with any 4-20mA control system, the IR Plus can also be integrated into an RS485 Modbus addressable network, with optional HART-enabled communications. It operates efficiently with just 5.5 Watts of power.

The IR Plus boasts a compact diffusion gas chamber and an effective weatherproof cap, providing excellent response speed. The weatherproof cap, designed using flow modeling software, allows for remote gassing and testing without the need for a test cap.

The display enables both local and remote monitoring of readings from the IR Plus. It can be directly attached to the IR Plus or connected via an Intrinsically Safe (IS) Barrier module using temporary or permanent cabling. Figure 2 illustrates the available options.

For more information about other accessories for the IR Plus, please refer to Figure 2.

SAFETY INFORMATION

The IR Plus detector must be installed, operated and maintained in strict accordance with these instructions, warnings, label information, and within the limitations stated.

- The rear nut on IR Plus must be kept tightly closed during operation. Do not attempt to remove the rear nut until power to the detector is isolated - otherwise ignition of a flammable atmosphere can occur. Before removing the nut for maintenance or servicing, check that the surrounding atmosphere is free of flammable gases or vapours. Do not open until several minutes after the power has been removed.
- Due to the heating elements within IR Plus, please ensure the product has been de-powered and sufficiently cooled down prior to conducting any maintenance work.
- Maintenance operations must only be performed by qualified service personnel.
- Only genuine **Crowcon** replacement parts must be used; substitute components may invalidate the certification and warranty of the IR Plus.
- IR Plus must be protected from extreme vibration, and direct sunlight in hot environments as this may cause the temperature of the IR Plus to rise above its specified limits and cause premature failure.
- IR Plus will not detect hydrogen, ammonia or carbon dioxide.
- The equipment must be earthed using the cable gland and steel wire armoured cable.
- Certification for Zone 21/22 dust environments: IR Plus only (without Fixed Display or IS Barrier module) may be used in environments that may contain hazardous dusts (Zones 21 or 22).
- IR Plus with an IS Barrier module may be used in Zones 21 or 22 provided the ambient temperature remains below 40°C and a remote display is installed/used outside the hazardous area only.
- IR Plus with a Fixed Display cannot be installed in a Zone 21 or 22 area.

ATEX & IECEx SPECIFIC CONDITIONS OF USE

1. The flamepaths are not to be repaired
2. IR Plus must only be mounted horizontally ($\pm 15^\circ$)

NOTE: The purchaser should make Crowcon aware of any External effects or Aggressive substances that the equipment may be exposed to.

PRODUCT OVERVIEW

IR Plus is an advanced infrared gas detector with intelligent heated optics designed for detecting hydrocarbon gases in the range 0 to 100%LEL (Lower Explosive Limit: the minimum concentration in air at which ignition can occur).

IR Plus is a certified Flameproof (Ex d) detector suitable for use in ATEX Zone 1 or Zone 2 hazardous areas. Please refer to the certification label on the top of the Detector to identify the type of certification that relates to the product supplied.

NOTE: If no certification label is fitted to the IR Plus, the detector is not certified for use in hazardous areas.

IR PLUS GAS DETECTOR	IR PLUS GAS DETECTOR WITH DISPLAY	IR PLUS GAS DETECTOR WITH REMOTE DISPLAY
 II 2GD SIL Sira 12ATEX1206X SGS23ATEX0114X IECEX SGS 23.0057X Ex db IIC T6 Gb (Tamb = -40° C to +60° C) Ex db IIC T4 Gb (Tamb = -40° C to +70° C) Ex tb IIC T135° C Db Ex tb IIIC T135oC Db (Tamb = -40°C to +70°C)	 II 2G SIL Sira 12ATEX1206X SGS23ATEX0115X IECEX SGS 23.0058X Ex db ia IIC T4 Gb (Tamb = -40° C to +70° C)	 II 2GD SIL Sira 12ATEX1206X SGS23ATEX0115X IECEX SGS 23.0058X Ex db ia IIC T4 Gb (-40°C to +70°C) Ex tb ia IIIC T135°C Db (-40°C to +40°C))

1. INTRODUCTION

1.1 GENERAL

The configuration of each IR Plus is identified by a label fitted on the main body. Please quote the product name, part number and serial number when contacting Crowcon for advice or spares.

1.2 PRODUCT DESCRIPTION

IR Plus consists of a main body of 316 stainless steel, an antistatic weatherproof cover over the optics and gas measurement chamber and an electronics assembly. A Fixed Display Module can also be fitted. Instructions for fitting the Fixed Display appear in display manual (M07061).

NOTE: The Display Module may only be fitted to a 'Display Ready' IR Plus. Please contact Crowcon for additional information. An optional connection spigot gland can be supplied to allow IR Plus to be fitted directly to auxiliary junction boxes with M20 cable entry.

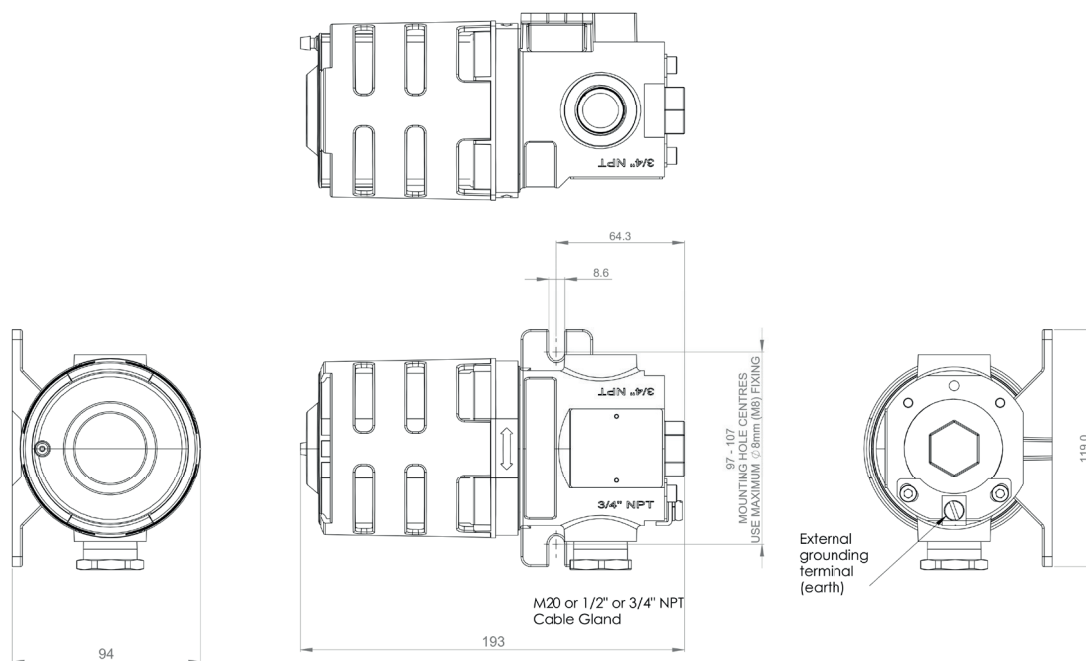


Figure 1: IR Plus dimensioned view - All dimensions in millimetres

NOTE: The IR Plus body is supplied with either two cable entries; M20 or 3/4" NPT. One of the cable entries to the IR Plus product will be sealed using a certified plug. The IR Plus must be installed with both cable entries sealed: one with a cable gland, the other with a certified IP66 rated stopping plug or cable gland.

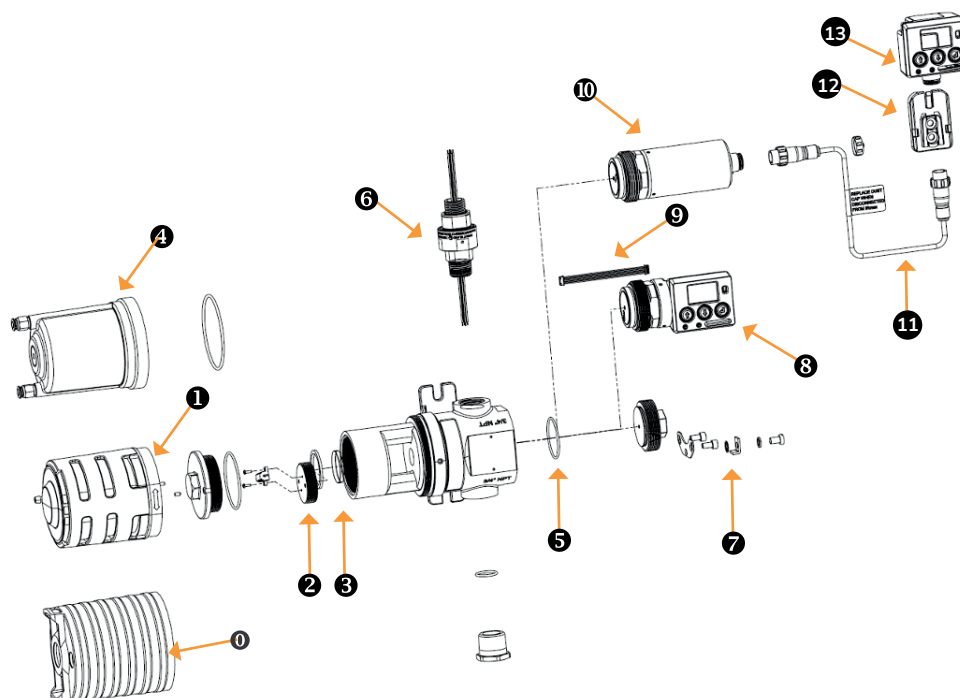


Figure 2: IR Plus exploded view

1. Test cap (C011401)
2. Weatherproof cap (M041165)
3. Mirror retainer
4. Mirror (C011408)
5. Flow adaptor (C011402)
6. O-ring for rear plug, Fixed Display or IS Barrier module (M04940)
7. M20 Spigot gland ATEX/IECEX (S012147)
8. Retaining plate & bolts for rear plug, Fixed Display or IS Barrier module
9. Fixed Display Module
10. Fixed Display or IS Barrier Connecting lead (E07987)
11. IS Barrier Module
12. Remote Display or access box lead (E07988/E08005)
13. Remote Display mounting bracket (M03833)
14. Remote Display (C011161 or C011162)

2. INSTALLATION

2.1 WARNING

This detector is designed for use in Zone 1 and Zone 2 hazardous areas. Certification is dependent upon the accessories fitted and ambient operating temperature. Please refer to the specifications section for certification details. Installation must be in accordance with the recognised standards of the appropriate authority in the country concerned.

- For further information please contact Crowcon. Prior to carrying out any installation work ensure local regulations and site procedures are followed.
- The equipment must be earthed using the cable gland and steel armoured cable.
- Do not attempt to fit a Fixed Display to an IR Plus not supplied for the purpose. Detectors supplied for use with a display are certified Exd db ia, and must be operated either with a Fixed Display containing an IS barrier, or with a Remote Display or IS Hand-Held Calibrator connected via a Crowcon IS Barrier module.
- Detectors supplied without a display are certified Ex db and cannot be retro- fitted for use with a Fixed Display.

2.2 LOCATION

The IR Plus should be mounted where the gas to be detected is most likely to be present. The following points should be noted when locating gas detectors:

- To detect gases which are lighter than air, such as methane, detectors should be mounted at high level. To detect heavier-than-air gases, such as flammable vapours, detectors should be mounted at low level. Consider also the likely temperature of the gases within the local environment. Hot gases tend to rise, and cold gases tend to fall. If this contradicts with the heavier than air lighter than air placement instruction, please contact Crowcon customer service for positioning information.
- When locating detectors consider the possible damage caused by natural events e.g. rain or flooding. For detectors mounted outdoors in very hot regions Crowcon recommend the use of a sunshade (see Section 5)
- Consider ease of access for functional testing and servicing.
- Consider how the escaping gas may behave due to natural or forced air currents. Mount IR Plus in ventilation ducts if appropriate (see Section 5)
- Consider the process conditions. For example, butane is normally heavier than air, but if released from a process which is at an elevated temperature and/or pressure, the gas may rise rather than fall.

The placement of sensors should be determined following advice of experts having specialist knowledge of gas dispersion and the plant processing equipment as well as safety and engineering issues. The agreement reached on the locations of sensors should be recorded.

2.3 STORAGE

The product must be stored observing the following precautions. There is no limit on the amount of time that the detector can be stored.

- Store in the originally supplied carton.
- Store in an indoor, clean and dry environment.
- Store between -25°C and 60°C.
- Store at 50-60% relative humidity nominally.
- Protected from extreme vibration and/or shock.
- Protected against high temperatures due to direct sunlight.

2.4 MOUNTING

IR Plus can be mounted in four ways:

1. Directly using the mounting lugs with suitable 2x M8 fixings. (Not recommended on weak surfaces)
2. Using the Crowcon wall mounting bracket with direct field cable connection (4-20mA operation only).
3. Using the Crowcon pipe mounting bracket with direct field cable connection (4-20mA operation only).
4. Using the optional Crowcon auxiliary junction box with the spigot gland.

NOTE: Optional parts are listed in Section 5.

NOTE: IR Plus should be installed at the designated location with the sensor barrel horizontal $\pm 15^\circ$ (orientation shown on (Figure 1)). This ensures that dust or water will not collect on the optical components.

2.5 CABLING DIRECTLY TO THE IR PLUS

This option is suitable for 4-20mA operation only.

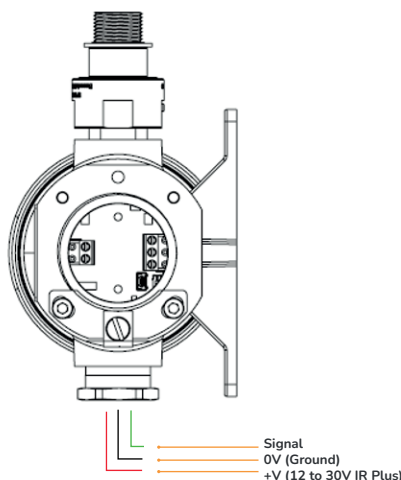


Figure 3: Field cable connections on the IR Plus

Connect field cables using a certified gland via the chosen cable entry on the IR Plus body (M20 or 3/4" NPT), as indicated in Figure 3. Crowcon recommends cable glands are installed pointing downwards.

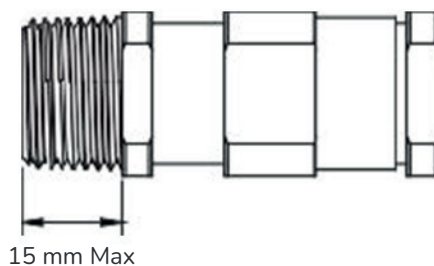


Figure 4: Thread length specification

Ensure that cable glands with the appropriate Ex d certification are used, and that the thread length does not exceed the length specified in the diagram (Figure 4).

2.5.1 TERMINAL DESIGNATION

With the IR Plus oriented as shown in Figure 1 (a M20 cable entry at the top), the 3-core field cable should be terminated using the removable connector as follows:

- +ve terminal: +ve supply from the control card.
- Sig terminal: Signal/Sense from control card.
- 0 V terminal: -ve supply from the control card.

The 6-pin connector on the left of the PCB is for servicing and/or connection of a Fixed Display or IS Barrier module

2.5.2 INSTALLING IR PLUS USING A MOUNTING BRACKET

IR Plus can be mounted directly using the built-in mounting lugs on IR Plus or wall mounting brackets (C011404) or pipe mounting brackets (C011405).

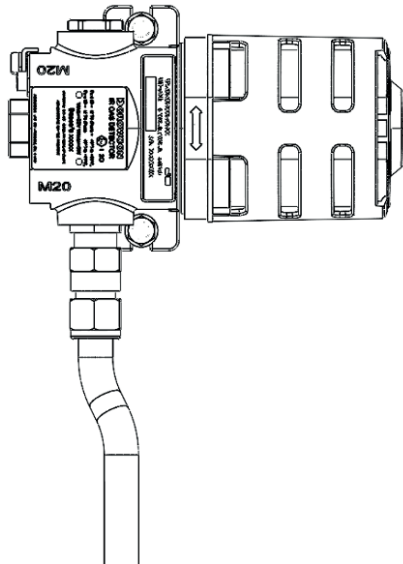


Figure 5: IR Plus with a mounting bracket and cable gland

- If the IR Plus is to be mounted on a flat surface, mark and drill two holes using the mounting bracket as a template. Loosely fix two parts of the bracket using fixings suitable for the wall/surface.
- Secure the two bracket fixings so that the IR Plus is held firmly in place.
- Once the IR Plus is securely fixed in place, remove the IR Plus rear nut to enable access to the cable terminals.
- Prepare the field cable – Crowcon recommends 1.5 mm² Steel Wire Armoured (SWA) cable. Other cable types may be used provided they are compatible with Ex d certified glands. Fit a suitably certified Ex d cable gland, pass the cable conductors through the body of the IR Plus and screw in the cable gland. Secure the gland and ensure the cable armour is grounded to the cable gland and the IR Plus body. NB. Don't forget to re-fit the rear nut after installing the cable.
- The retaining plate (item 7 on Figure 2) must be securely fitted to prevent any risk of the rear nut (or Fixed Display or IS Barrier module accessory) vibrating loose.

2.6 INSTALLING USING A SPIGOT GLAND AND AUXILIARY JUNCTION BOX

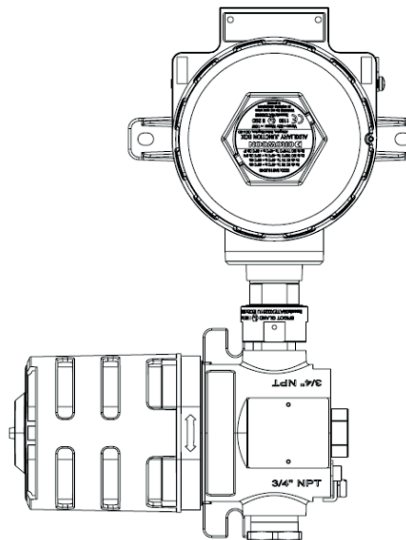


Figure 6: IR Plus connected to the auxiliary junction box

To fit to an auxiliary junction box:

- Carefully remove the outer section of the spigot gland (Figure 2)
- Screw the narrow end of the spigot gland into the auxiliary junction box.
- Raise the IR Plus to the auxiliary junction box and pass the wires through the assembly and into the auxiliary junction box. Secure the IR Plus by screwing the collar tightly to the cable gland. Tighten grub screw.
- The main body of the IR Plus can be swivelled horizontally at any angle, provided it is mechanically secure, does not interfere with other equipment and is accessible for maintenance.
- Refer to Section 2.6 for instructions on wiring. See also Figure 3.

2.7 CABLING REQUIREMENT

Cabling to IR Plus must be in accordance with the recognised standards of the appropriate authority in the country concerned and meet the electrical requirements of the IR Plus.

Crowcon recommends the use of steel wire armoured (SWA) cable and suitable explosion proof glands must be used. Alternative cabling techniques, such as steel conduit, may be acceptable provided appropriate standards are met.

The maximum recommended cable length is 3.4 km (see Table 1).

IR Plus requires a dc supply of 12-30Vdc. Ensure there is a minimum of 12V at the IR Plus from the control panel, taking into account the voltage drop due to cable resistance at a peak power of 5.5W.

A 1.5mm² cable will typically allow cable runs up to 3.0km. Table 1 below shows the maximum cable distances for typical cable parameters. Any cabling should be suitable for a temperature of at least 95°C

NOTE: Resistance column data reflects only a single direction, though outlined calculations of maximum distances double the resistance parameter to account for transmission to and from the detector.

C.S.A.	Resistance	Max. Distance > 20 V	Max. Distance 18 to 20 V
mm ²	(Ohms per km)	(km)	(km)
1.5	16.5	1.2	0.65
2.5	9.01	2.2	1.2
4	5.6	3.4	1.9

Table 1 - Maximum cable distances for typical cables

2.8 CONNECTIONS AND SETTINGS

All connections described are with reference to the terminal block mounted within IR Plus connector main body. The terminals on the IR Plus connector PCB are marked '+', 'sig' and '0 V'. Correct polarity should be observed when connecting the IR Plus to control equipment.

IR Plus is factory set as a 'current sink' device unless otherwise specified when ordering. To reset to 'current source', remove the back nut and move the link on the terminal PCB from the 'sink position to the 'source' position, as shown in Figure 7

NOTE: The external grounding terminal is only to be used where local authorities permit or require such a connection. Where possible, to limit radio frequency interference, the auxiliary junction box and cable armour should be grounded at the control panel (safe area) only to avoid earth loops.

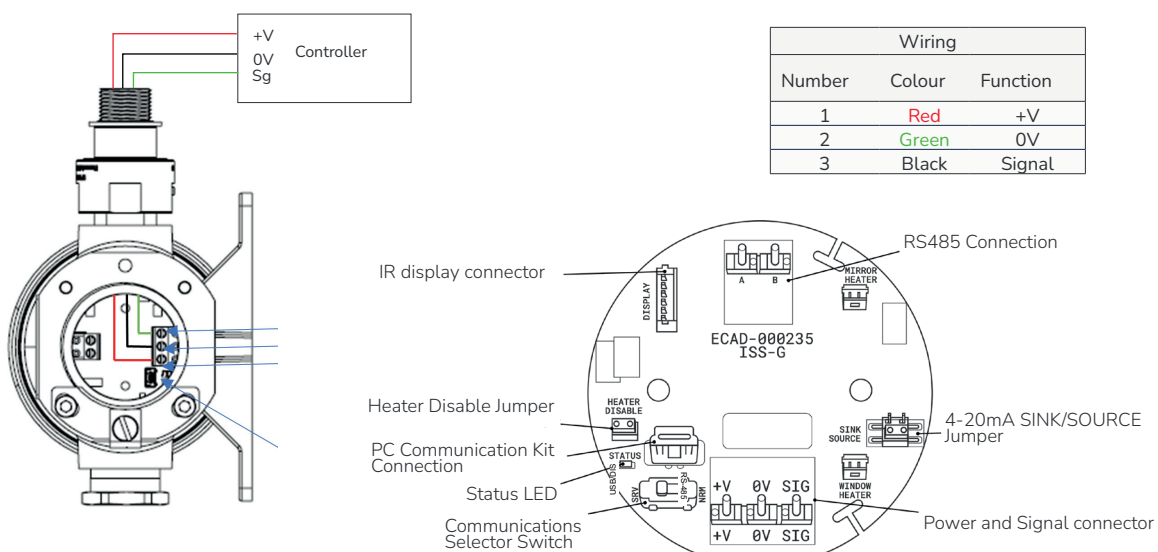


Figure 7: Sink/source jumper location

The 4-20mA signal can be set to current 'Sink' or 'Source' using the pins and jumper link shown in Figure 7. Set to current 'Sink' by fitting the jumper link to 'Sink' position as shown on the right-hand photograph. Set to current 'Source' by fitting the jumper link to the 'Source' position as shown on the right-hand photograph. IR Plus will be set to current 'Sink' unless specified otherwise when ordering.

NOTE: LED indication: An LED is fitted to the terminal PCB to indicate the current operating status. Refer to [Section 6](#) for more information.

COMMUNICATIONS SWITCH

The IR Plus detector is fitted with a communications switch to toggle between different modes.

NOTE: 4-20mA output is not affected by this switch.



Left: USB or Display



Right: RS-485

The Left position enables communications to a Fixed or Remote Display. The Right position must be selected when the detector is to communicate with a control system via the RS-485 connector.

3. OPERATION

3.1 WARNING

NOTE: Prior to carrying out any work ensure local regulations and site procedures are followed. Never attempt to open the IR Plus or auxiliary junction box when flammable gas is present. Ensure that the associated control panel is inhibited so as to prevent false alarms.

3.2 COMMISSIONING PROCEDURE

1. Check that:
 - a. The cable connections are correct
 - b. The supply voltage is set at the control card as 18 to 30 V. The voltage measured at the IR Plus PCBA terminals or within the Exe auxiliary junction box (if used) **must be** between 12 V and 30 V.
 - c. The source/sink jumper on IR Plus PCBA is set in the right position as required by the control system.
2. Once powered up leave IR Plus for 2 hours before attempting zero/cal. This delay is to ensure thermal stability.

NOTE: IR Plus will be fully operational from 30 seconds after power is applied.

NOTE: The analogue output signal will become active approximately five seconds after power is applied to the detector. The signal will initially be at the level configured as its 'Power-on Inhibit': 1mA for approx 50secs until normal mA output is resumed.
3. Ensure clean air (i.e. no hydrocarbon gas) before zeroing. Zero reading at control card (refer to control card instructions).
4. Fit a test cap over weatherproof cover to isolate measurement chamber from ambient air. Such a cap is available from **Crowcon** (C011401). Connect test gas (50% LEL nom) and apply at 1 litre-per-minute flow.
5. After 90 seconds adjust cal/span on control card so that display reads 50% LEL, or matches concentration of test gas applied. The IR Plus itself should not require calibration.
6. Remove gas and test cap. Re-check zero.
7. At installation, or after the mirror has been changed, the IR Plus can be zeroed and calibrated either using a Display accessory (see Section 5) or via a PC communications kit (see the IR Plus Accessories manual).

NOTE: IR Plus will be supplied calibrated in accordance with the LFL values defined in ISO/IEC 80079-20-1:2017 (where, for example 100% LFL Methane = 4.4% volume).

NOTE: It is recommended that the test cap is used for initial commissioning. Subsequent tests may be conducted by applying gas to the weatherproof cap remotely via the pipe spigot (thus avoiding the need to directly access the IR Plus). Testing without the test cap (i.e. directly via the weatherproof cap) can be performed provided local windspeed is below 2 metres/second. The flow rate of the gas must be greater than 2.0 litre/minute.

3.3 ROUTINE MAINTENANCE

Site practices will dictate the frequency with which detectors are tested. **Crowcon** recommends that **IR Plus** is gas tested every 12 months.

In the event of an electronic failure please consult your local IR Plus representative.

Test interval:	Crowcon recommends gas testing IR Plus every 12 months. Refer to the procedures in 60079-29-2 to determine an appropriate calibration interval.
Remote calibration via pipe:	Wind speed should be less than 2.0 metres per second. If greater, use the calibration cap to prevent gas dilution.
Cleaning of optics:	Is not recommended unless the IR Plus is in obscuration fault. If the window or mirror becomes contaminated, clean carefully with the IPA impregnated wipes and/or the soft cloth supplied in the mirror cleaning kit (see Section 5)
Mirrors:	If the mirror is damaged, obtain a mirror replacement kit (see Section 5). The IR Plus must always be zeroed and calibrated after mirror replacement.

If condensation starts to cause faults replace mirror (optical coating may be damaged).

3.4 MIRROR REPLACEMENT

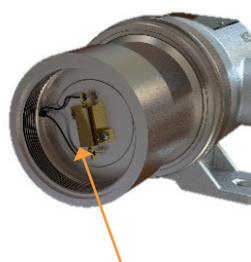
NOTE: The PCB's within the detector must under no circumstances be removed. Replacement is only possible by returning the detector to Crowcon UK. Loosening the PCB retaining bolts and/or removing and re-fitting PCBs WILL invalidate the linearisation, calibration and temperature compensation of the detector leading to incorrect gas readings. Warranty will be voided if evidence of PCB removal is found.

In the event of the IR Plus mirror becoming damaged or corroded, a replacement of the mirror is advised. Follow the below instructions;

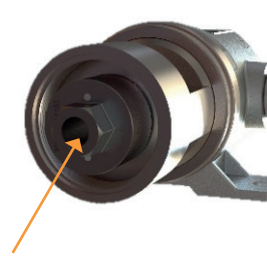
1. Ensure the control system/alarms are inhibited.
2. De-power the IR Plus detector.
3. Remove the weatherproof cap.
4. Loosen the two grub-screws from the end cover plate.
5. Un-screw and remove the heating resistor and move to one-side. (Spare screws are supplies within the mirror replacement kit)
6. Unscrew the mirror retainer plate using the mirror retainer assembly tool and guide.
7. Dispose of the mirror and mirror seal
8. Fit the replacement mirror securely and seat the mirror seal around. Do Not Touch the Mirror Surface.
9. Tighten the mirror retainer plate to the 15Nm torque using a torque wrench. Note: Not accurately torquing the retainer plate may lead to inaccurate readings and/or cracked mirror. Refit the mirror heater and end cover plate back into their original locations.
10. The detector must now be Production Zeroed, and Field Calibrated using Detectors Pro software.



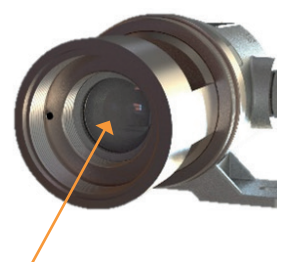
Grub Screw



Heating Resistor



Mirror Retainer Assembly
Tool



Mirror Seal & Mirror

4. SPECIFICATION

Enclosure material	316 Stainless Steel
Dimensions (Detector only)	194mm x 119mm x 94.2mm (7.6 x 4.7 x 3.7 ins)
Weight	IR Plus 4.1kg (9.0lbs) IR Plus with Fixed Display 4.5kg (9.92lbs) IR Plus with IS Barrier 4.9kg (10.8lbs) Remote Display 0.2kg (0.4lbs)
Response Time (T90)	4 seconds (with flow adaptor & 10 l/min) 27 seconds (with flow adaptor & 1 l/min)
Temperature Performance Accuracy	-20°C to +50°C, <+/- 10%LEL -40°C to -20°C and +50°C to +75°C, <+/- 15%LEL
Operating voltage	12 VDC to 30 VDC
Power	< 5.5 W
Inrush Current	210 mA @24V
Output	3-wire 4-20 mA (Sink or Source) - Updated once per second. Warning output is 2 mA for 75% to 90% obscuration when gas reading <10% LEL. Fault for >= 90% obscuration <= 1.0 mA. Obscuration level is not configurable by customer. RS-485 Modbus (standard), HART 7 (optional)
Fault signal	<3.6 mA and/or >21mA
Maximum cable loop resistance	80 Ohms (relative to -ve terminal)
4-20mA Maximum Load Resistance	350 Ohms
Connection/Port Entries	2 x M20 or 2 x ¾"NPT cable gland entry
Operating temperature	-40°C to +70°C (-40°F to 158°F)
Operating Humidity	0-100% condensing (for temperature changes of up to 30 °C/hour)
Warm-Up Time (Heaters Enabled)	2 Hours
Degree of protection	IP66 (EN60529) IP ratings do not imply that the equipment will detect gas during and after exposure to those conditions
Hazloc Standards ATEX & IECEx	EN/EN IEC 60079-0 EN/IEC 60079-1 EN/IEC 60079-11 EN/IEC 60079-31 IR Plus (no display): ⊕ II 2 GD Ex db IIC T4 Gb (Tamb = -40°C to +70°C) Ex db IIC T6 Gb (Tamb = -40°C to +60°C) Ex tb IIIC T135°C Db (Tamb = -40°C to +70°C) IR Plus with Fixed Display ⊕ II 2 G Ex db ia IIC T4 Gb (-40°C to +70°C) IR Plus with IS Barrier module (for remote display): ⊕ II 2 GD Ex db ia IIC T4 Gb (-40°C to +70°C) Ex tb ia IIIC T135°C Db (-40°C to +40°C)

Hazloc Certificate No.	IR Plus (no display): ATEX - SGS23ATEX0114X IECEX - SGS 23.0057X INMETRO - UL-BR 24.1422X IR Plus with fixed Display & IS Barrier (for remote display): ATEX - SGS23ATEX0115X IECEX - SGS 23.0058X INMETRO - UL-BR 24.1423X
Functional Safety	SIL2 IEC 61508 EN 50402
Performance	IEC EN 60079-29-1
EMC Compliance	EN50270, FCC CFR47 Part 15B, ICES-003
Estimated working life	15 years (assumes annual proof test)

5. ACCESSORIES AND SPARE PARTS

5.1 ACCESSORIES

Part Numbers	Name	Description	Illustration
C011401	Test cap	Fits over the standard weather cap to enable calibration where local air speed exceeds 2 metres per second.	
C011404	Wall Mounting Kit	Enables mounting to a wall.	
C011410	Mesh Filter	Stainless steel mesh filter with 100 micron pore-size. Fits within standard weather-cap to protect optical components in very dusty environments. This accessory increases the response time of IR Plus.	
C011405	Pipe Mounting Kit	Enables mounting to a 2" (50 mm) pipe.	
C011406	Junction Box Mounting Kit	Enables mounting of IR Plus and junction box to a 2" (50 mm) pipe	
C011403	Sun shade	Can be fitted to IR Plus to protect against elevated temperatures due to direct sunlight and/or to extend the detectors footprint for detecting lighter than air gases.	
C011407	Duct mounting kit	Enables monitoring of ducts from 300 mm to 3000 mm, and air-flow between 2 m/s and 20 m/s.	

C011402	Flow adaptor	For gas sampling and process line monitoring applications	
C011301/2	Remote Access box	GRP (glass-fibre reinforced polyester) enclosure for use as described above. (Suitable for use in onshore and offshore environments)	
S012827	PC communication kit	Communications module, software and lead to enable configuration and service of IR Plus via PC	
S012147	Spigot gland (M20)	Required for connecting IR Plus to an auxiliary junction box. 5-wire, ATEX & IECEx	
S012295	M20 316SS Exd Junction Box	ATEX/IECEx certified 316SS Exd junction box with 2 cable entries. Fitted with 5-way terminal block suitable for 2.5mm ² cables. Enables IR Plus to be connected on an RS-485 Modbus network. (requires spigot gland)	
C03579	Spanner	Essential for Fixed IR Display Module and IS Barrier Module installation. Simplifies tightening of the threaded collar that connects Fixed display or IS Barrier to IR Plus	
C011210	Mirror cleaning kit	Contains IPA impregnated wipes and microfibre cloth	
C01197	M20 GRP Exe Junction Box	ATEX/IECEx certified GRP Exe junction box with one cable gland entry (left side). Fitted with a 6-way terminal block suitable for 2.5mm ² cables. Provides compliance with NORSOK standards which stipulate detectors must have an Exe cable termination area. (requires spigot gland)	
C011411	Remote Gas Box	ABS gas tube termination box to facilitate remote calibration	
C011412	Gas Tube	Gassing tube to connect Remote gas box to IR Plus gas inlet port	
C011161/1	Remote Display	Supplied within a glass reinforced nylon housing (requires a connecting cable)	

C011161	Remote Display Kit	Supplied within a glass reinforced nylon housing (requires a connecting cable) and includes 1.5m connecting cable	
C011162/1	Remote Display with local HART	Supplied within a glass reinforced nylon housing (requires a connecting cable). Local HART enabled for testing and diagnostics via hand-held HART communicator	
C011162	Remote Display with local HART Kit	Supplied within a glass reinforced nylon housing (requires a connecting cable) and includes 1.5m connecting cable. Local HART enabled for testing and diagnostics via hand-held HART communicator	
E07988	1.5 metre connecting cable	To connect remote Display or Remote Access box to IR Plus via IS Barrier	
E08005	3 metre connecting cable	To connect remote Display or Remote Access box to IR Plus via IS Barrier	

5.3 SPARES

Refer to Figure 2 for details of spare parts.

6. FAULT FINDING

6.1 ERRORS SIGNALLLED BY LED

WARNING: The LED indicator is intended for installation and service use only and is located inside the flameproof enclosure. In order to see it, a permit is required to open the enclosure.

WARNING: The LED fitted to the terminal PCB can help identify faults. Its position is shown on Figure 6. The table below shows how to interpret what is wrong for each pattern of flashes.

LED Pattern	Detector Status	Action
Regular flash each second.	Healthy.	Regular flash each second.
On with short blips off.	Detector in start-up	Wait 10 seconds.
Fast flash on and off or irregular flash pattern.	Supply voltage too low or too high.	Ensure the IR Plus supply voltage is correctly set. Ensure measurement is made directly at the detector terminals.
Permanently on.	Fault, host or i-module error.	Power-cycle the IR Plus, if fault persists, return to Crowcon.
Two long flashes followed by a short flash.	Fatal error; lamp or detector fault.	Return to Crowcon.
Fast double flash each second	Fatal error, module or configuration fault	Check the detector configuration using PC communications kit software. Check power supply. If fault persists, return to Crowcon.
Short blip each second.	Optics obscured.	Check window and mirror, clean if necessary. Re-zero IR Plus and check calibration.

6.2 ANALOGUE OUTPUT

IR Plus will remain in Fault state and “Service required” will also be shown on the display (if fitted) if the analogue output signal has failed or is not connected to a control system or load resistor. IR Plus actively monitors the 4-20mA analogue output signal to verify it is in range. If the signal is out of range the detector will go into fault and the output will be set to 1mA. Thus, when testing a detector it is essential that it is either connected to a control panel or a 100 ohm load resistor is connected between the ‘0V’ and ‘Sig’ terminals (detector set to ‘Source’ mode) or between the ‘Sig’ and ‘+V’ terminals (detector set to ‘Sink’ mode).

7. RS485 MODBUS CONFIGURATION

7.1 GENERAL

This section explains how to use IR Plus detectors in a Modbus configuration. RS485 enabled as standard with IR Plus. Up to 32 IR Plus detectors can be linked in star or bus configurations as described below. Connections to the RS-485 terminals can be made directly, or via a spigot gland and auxiliary junctions box.

Please note that the Fixed Display or IS Barrier cannot be used simultaneously with RS485 communication. The IR Plus has five field terminals . The terminals are:

1	Positive supply	12 V to 30 V above 0 V
2	0 V	Return and RS485 reference
3	4-20 mA signal	Source or Sink signal (optional)
4	RS485 B	RS485 differential signal
5	RS485 A	RS485 differential signal

The signals on the RS485 terminals conform to the EIA/TIA-485 standard, which means that the common mode range is -7V to +12V with respect to the 0V terminal.

Note that not all RS485 manufacturers agree on the polarity of the A and B signals. If the wiring does not work one way, users should switch the RS485 A&B wires. There is no risk in making the wrong connection.

The communication settings are 9600 bps, two stop bits and no parity.

When compiling an interface for a control system, it is important to consider the amount of time it takes for the system to collect information from each detector in turn. The fastest speed at which multiple detectors can be polled is 14 detectors per second; practical conditions may reduce this to 7 per second. Users must ensure that the arrangement allows alarm signals to be registered within acceptable time limits.

It is also important to ensure that the system can supply enough power to keep all the detectors working. To calculate the amount of power required in a linear bus connection (see Section 7.3) and cabling requirements (see Section 2.6)

For full Modbus instructions, contact Crowcon.

7.2 WIRING TOPOLOGY

Only a linear bus connection method may be used for IR Plus . Refer below.

7.2.1 LINEAR BUS CONNECTION

In a bus-connected topology all IR Plus are wired to a linear arrangement, usually with the control panel at one end. A classic situation is a tunnel installation, with IR Plus installed at regular intervals (see Figure 8).

To wire the installation, two 110 ohm-terminating resistors should be fitted: one at each physical end of the bus. As the 4-20mA signals cannot be shared, an additional conductor is required on each wiring hop. If none of the 4-20mA signals are being used, then only four conductors are required.

This section explains how to use IR Plus detectors in a Modbus configuration. RS485 is enabled as standard with IR Plus. Up to 32 IR Plus detectors can be linked in a bus configuration only as described below.

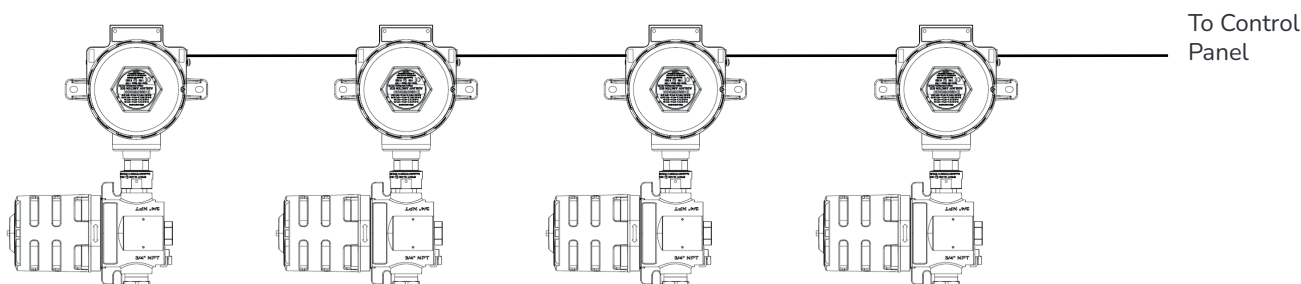


Figure 8: Linear Bus Connection

7.3 CABLING REQUIREMENT

7.3.1 CALCULATING THE MINIMUM LEVEL OF POWER REQUIRED

The more IR Plus detectors connected to the linear bus, the greater the power required to run the system. To calculate the power required for a particular setup, it is necessary to know the cable resistance between each pair of detectors. A current of a maximum 0.45A must be allowed for each 'hop' between each sensor (this assumes its highest power configuration).

The voltage to be applied can be calculated by estimating the voltage drop across each 'hop' – at the end at least 12V must remain to ensure that the last IR Plus functions correctly.

Contact Crowcon for advice in specific cases. Alternatively, follow the steps outlined below and the sample calculation shown in the next section.

1. The voltage must not fall below 12V, so start the calculation by setting the voltage at the last IR Plus in the line at that value.
2. Each IR Plus may draw up to 0.45A. Calculate the cable voltage loss of the first 'hop' between detectors by taking the 'aggregate current' to be 0.45A, and multiply this by the cable resistance of the 'hop' between the last and the last but one IR Plus.
3. Add this voltage drop to the initial 12V to get the lowest acceptable voltage at the last but one IR Plus. Add 0.45A to the value for the 'aggregate current' to get to 0.90A, the minimum current running through the last but one 'hop' of the bus. Multiply this by the cable resistance for the last but one 'hop' to get the next voltage drop.
4. Repeat this process for each IR Plus, accumulating the voltage losses that will occur between each IR Plus.
5. The maximum detector voltage of 30V DC must not be exceeded.

7.3.2 SAMPLE CALCULATION

As an example, here are the results of the calculation for six IR Plus detectors' detectors spaced equally 250m metres apart on cable with cross-sectional area of 1mm². Each hop has a resistance of 4.6 ohms.

	Supply Voltage	Supply Current
Detector 1	12.00 V	0.45 A
Detector 2	12.22 V	0.90 A
Detector 3	12.65 V	1.35 A
Detector 4	13.31 V	1.80 A
Detector 5	14.18 V	2.25 A
Detector 6	15.27 V	2.70 A
Detector 7	16.57 V	3.15 A
Detector 8	18.10 V	3.45 A
Detector 9	19.77 V	3.75 A
Detector 10	21.58 V	4.05 A

Detector 11	23.54 V	4.35 A
Detector 12	25.65 V	4.58 A
Panel Supply	27.87 V	5.00 A

Table 2 - Sample Calculations

8. FUNCTIONAL SAFETY MANUAL

8.1 INTRODUCTION

The following sections provide detail on the certification of IR Plus in accordance with the IEC 61508 and EN 50402 Functional Safety standards. Information is given on the features considered in the safety case, maintenance requirements and data to enable IR Plus to be integrated into Safety Instrumented System (SIS).

8.2 IR PLUS SAFETY FUNCTION

To measure the concentration of flammable gas and indicate the measurement by means of a 4-20mA output. Failures in respect of the safety function will be detected by the hardware and associated firmware. They will be revealed as an output signal of less than 3.6mA or more than 21mA updated once per second.

8.3 FUNCTIONAL SAFETY DATA

Parameter name	Symbol	Equation / source	IR Plus	IR Plus with HART
Proof Test Interval	TI	As defined by Crowcon	8760 hours max	
Mean Time To Repair	MTTR	As defined by Crowcon	8 hours	
Mean Repair Time	MRT	As defined by Crowcon	8 hours	
Type A/B	Type A	As defined in IEC61508-2	Type B	
Total failures	λ	From FMEA	4.94E-07	4.96E-07
Safe diagnosed failures	λ_{SD}	From FMEA	0.00E+00	
Safe undiagnosed failures	λ_{SU}	From FMEA	1.20E-10	
Dangerous diagnosed failures	λ_{DD}	From FMEA	4.86E-07	4.88E-07
Dangerous undiagnosed failures	λ_{DU}	From FMEA	7.74E-09	
Diagnostic coverage	DC	$\lambda_{DD} / (\lambda_{DU} + \lambda_{DD})$	98%	
Safe Failure Fraction	SFF	$(\lambda_{SD} + \lambda_{SU} + \lambda_{DD}) / \lambda$	98%	
Channel equivalent down time	t_{CE}	$(\lambda_{DU} / \lambda_D) \left(\frac{T}{2} + MTTR \right) + (\lambda_{DD} / \lambda_D) MTTR$ Where $\lambda_D = \lambda_{DU} + \lambda_{DD}$	7.66E+01	7.93E+01
PFD _{AVG} (using IEC 61508-6 equation)	PFD _{AVG}	$(\lambda_{DU} + \lambda_{DD}) t_{CE}$	3.79E-05	3.94E-05
SIL capability		Safety Integrity Level	SIL 2	

8.4 HARDWARE CONFIGURATION

Route 1H (Hardware fault tolerance and Safe Failure Fraction) has been used to assess hardware safety integrity level.

8.5 FIRMWARE CONFIGURATION

Assessment of the Product firmware has been made to the requirements given in IEC 61508:3 2010.

8.6 SYSTEMATIC FAILURES

Route 1S (as specified in IEC 61508:2 2010 paragraph 7.4.2.2c) is used for compliance with the requirements of avoidance of systematic failures.

8.7 DIAGNOSTIC INTERVAL

Most diagnostic functions are continuously monitored.

Tests of the system watchdog are to be accomplished during the annual proof test by power cycling the instrument: IR Plus must be power-cycled annually (ie have the 24Vdc supply removed and re-applied) as part of the maintenance programme for the product. (refer also to section 3.2)

8.8 CONSTRAINTS

Failure rates are constant.

A proof test conducted at least once a year will identify all un-revealed failures. Repairs have a mean time to repair of 8 hours.

It is assumed that the user makes use of the diagnostic facility provided via the display accessory and/or PC interface in order to minimise potential product down time.

Reliability assessment is a statistical process for applying historical failure data to proposed designs and configurations. It therefore provides a credible target/estimate of the likely reliability of equipment assuming manufacturing, design and operating conditions identical to those under which the data was collected. It is a valuable design review technique for comparing alternative designs, establishing order of magnitude performance targets and evaluating the potential effects of design changes. The actual predicted values cannot, however, be guaranteed as forecasting the precise number of field failures which will actually occur, since this depends on many factors outside the control of a predictive exercise.

Failure rates (symbol λ), for the purpose of this prediction, are assumed to be constant with time. Both early and wear-out related failures would decrease the reliability but are assumed to be removed by burn in and preventive replacement respectively.

The Probability of failure on demand is the likelihood that the system will be in a failed state at a random moment. This is synonymous with the steady state unavailability which is given by:

Unavailability = $(\lambda \times \text{MDT}) / (1 + (\lambda \times \text{MDT}))$ which approximates to, $\lambda \times \text{MDT}$ for small values of $\lambda \times \text{MDT}$ where λ is the failure rate and MDT is the Mean Down Time.

This is consistent with the expression for Availability given as: $\text{MTBF} / (\text{MTBF} + \text{MDT})$

The failure rates used, and thus the derived availabilities are those credibly associated with a well proven design after a suitable period of reliability growth.

8.9 ENVIRONMENTAL

Environmental constraints:

The product shall be operated over a maximum ambient temperature range of -40°C to +70 °C.

The product shall be stored over a maximum ambient temperature range of -40°C to +80 °C.

The product shall be operated over a maximum ambient Relative Humidity range of 0% to +100% condensing for temperature changes of up to 30 °C/hour.

The product has an Ingress Protection rating of IP66 according to the definitions within standard EN60529.

The product is designed for continuous operation.

8.10 HARDWARE FAULT TOLERANCE

The HFT is 0.

8.11 SYSTEMATIC CAPABILITY

The IR Plus is of Class SC2.

8.12 CLASSIFICATION

The IR Plus is a type B component.

8.13 PROOF TEST

Proof Test must be performed at least once per year, depending on operating conditions. More frequent Proof Testing should be considered when operating under: -

- Elevated temperature
- High humidity
- Vibration
- Dust and Optical Contamination
- Risk of chemical degradation

Proof test asserts conditions to trigger the Safety Function outputs and Diagnostic Function outputs so the user can verify they are working correctly.

To Proof Test section 8.13 items must be performed (refer to the full manual as required):-

8.13.1 VISUAL INSPECTION OF GAS PATH

Inspect the gas path to the product to ensure no blockages are present.

8.13.2 VISUAL INSPECTION OF WIRING

Inspect external wiring to ensure there are no signs of damage.

8.13.3 CALIBRATE (ZERO GAS)

Using Detectors Pro, set the zero setting in clean air.

8.13.4 CALIBRATE (CALIBRATION GAS)

Using Detectors Pro, set the gas calibration level in calibration gas.

8.13.5 TEST ANALOGUE OUTPUT OPERATION

(Confirms Analogue Output's Safety Function and Diagnostic Function are functioning).

Using Detector Pro ->Test->Analogue Output->Ramp with No Alarm to test the Analogue Output reads correctly at the associated output monitor (usually a control panel).

Check that increasing the analogue output from the lowest reading to the highest reading will also increase the output current through the following points.

(Items in brackets for a Methane IR Sensor)

Minimum ramp value (~0mA)	(e.g. -100% LEL)
Zero gas value (~4mA)	(e.g. 0% LEL)
Mid gas range value (~12mA)	(e.g. 50% LEL)
Maximum Sensor Range gas (~20mA)	(e.g. 100% LEL)

Maximum ramp value (~24mA)

(e.g. 200% LEL)

8.13.6 POWERDOWN AND RESTART

At the end of the test the detector should be powered down for 5 secs and then restarted. The internal LED should be checked that within 1 minute it indicates normal operation, showing that powerup tests have all passed.

8.14 EXAMPLE PROOF TEST RECORD SHEET

Item	Test	Description	Outcome
8.13.1	Visual Inspection of Gas Path	Inspect gas path	
8.13.2	Visual Inspection of Wiring	Inspect external wiring	
8.13.3	Calibrate (Zero Gas)	Zero in clean air	
8.13.4	Calibrate (Calibration Gas)	Calibrate in gas	
8.13.5	Test Analogue Output Operation	~0mA / ~4mA / ~12mA / ~20mA / ~24mA observed	
8.13.6	Restart and normal operation	LED indicates normal operation	

Table 4 - Example Proof Test Record Sheet

9. ACCESSORIES

9.1 INTRODUCTION

Crowcon IR detectors protect facilities against flammable gas hazards.

The following section contains instructions for the use of the IR Plus accessories. Section 5 lists the Accessories and spare parts for IR Plus. [See Section 4 Specification.](#)

9.2 WALL MOUNT

The Wall Mount kit is used to enable the IR Plus detector to be mounted to a wall or other flat surface.

9.2.1 KIT CONTENTS

Wall mount bracket & screws.

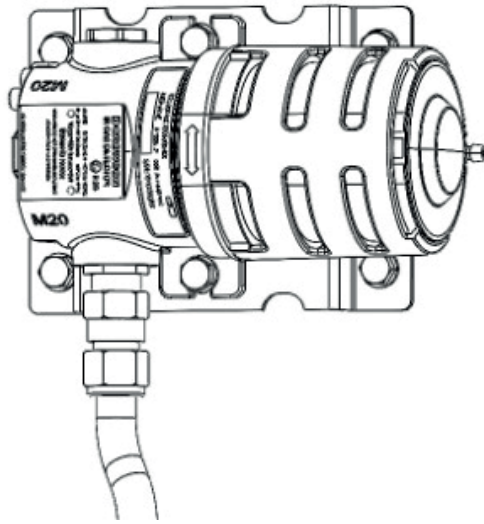


Figure 9: IR Plus Wall Mount

Use the screws supplied to fix the bracket to the body of the detector. The wall mount may be fitted to IR Plus supplied with or without a Fixed Display or IS Barrier.

9.2.2 SPECIFICATION

Material: AISI 316 Stainless Steel Sheet (SS)

9.3 PIPE MOUNT

The Wall Mount kit is used to enable the IR Plus detector to be mounted to a wall or other flat surface.

9.3.1 KIT CONTENTS

Mounting Brackets & screws.

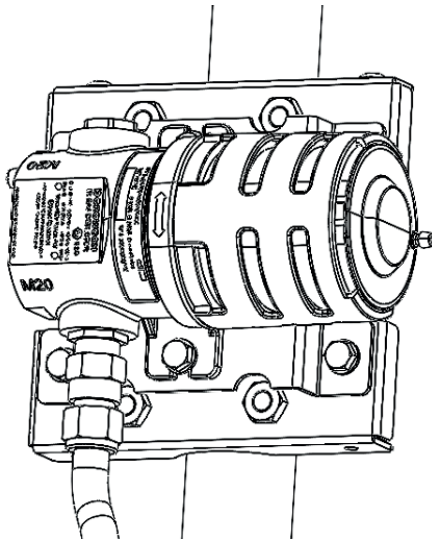


Figure 10: IR Plus Pipe Mount

Use the screws supplied to fix the bracket to the body of the detector. The pipe mount may be fitted to IR Plus supplied with or without a Fixed Display or IS Barrier module.

9.3.2 SPECIFICATION

Material: AISI 316 Stainless Steel Sheet (SS)

9.4 SUNSHADE

The Sunshade should be installed to protect the detector from getting too hot due to exposure to strong direct sunlight and/or extend the footprint of the detector for lighter than air gases.

9.4.1 KIT CONTENTS

Sunshade & Rivets

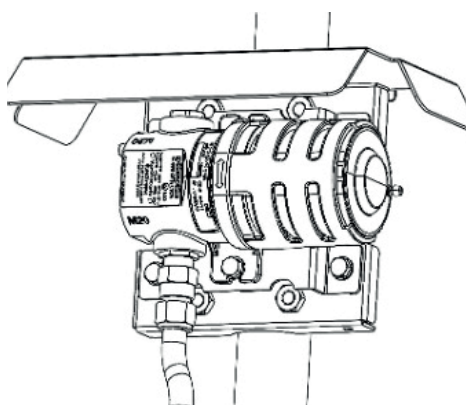


Figure 11: IR Plus Sunshade (fitted to the pipe mount)

Use the rivets supplied to fix the bracket to the body of the detector. Attach the sunshade to the bracket using remaining screws. The sunshade may be fitted to IR Plus supplied with or without a Fixed Display or IS Barrier module.

The sunshade is designed to fit to the pipe mounting bracket only as illustrated above.

9.5 DUCT MOUNTING KIT

The duct mounting kit is designed to be used with IR Plus for monitoring potentially hazardous gases within ventilation ducts.

The air flow rate within the duct must be between 0.5 metres and 20 metres per second.

9.5.1 KIT CONTENTS



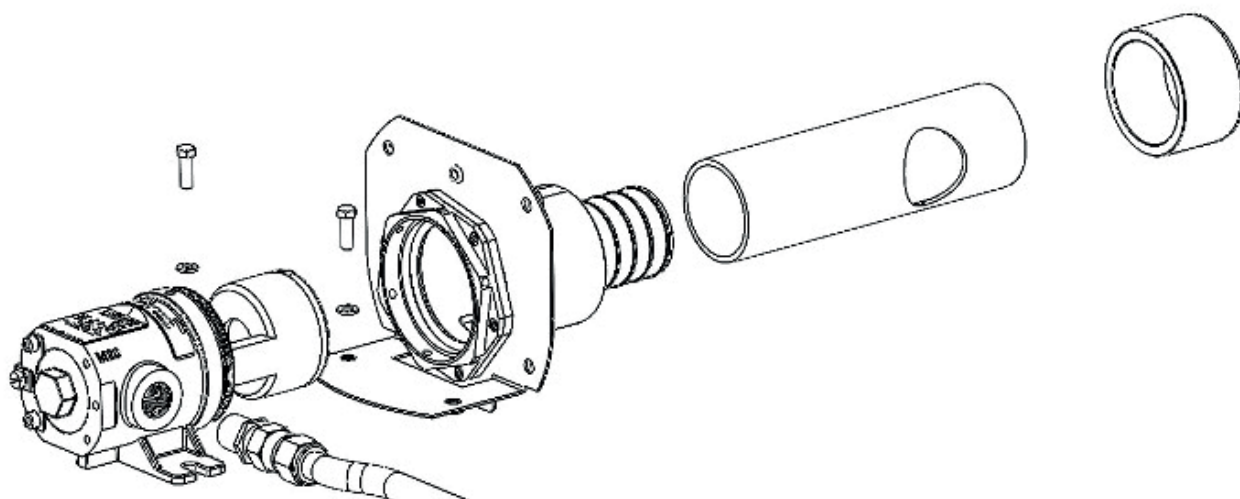


Figure 12: IR Plus Duct Mount Kit

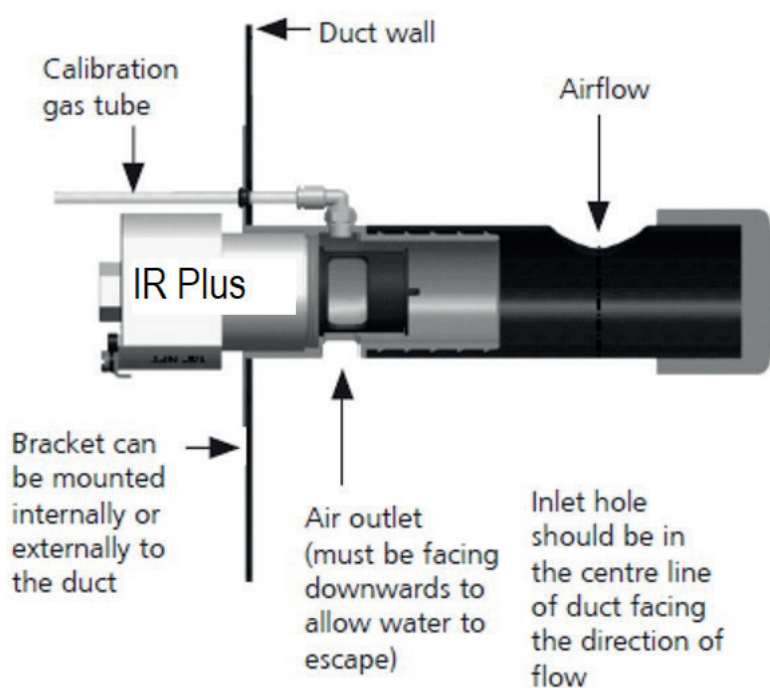


Figure 13: Duct Mount Illustration

9.5.2 INSTALLATION

1. A standard 1m length of sampling tube is supplied. Cut the open end so the tube is the correct length: the gas entry window is half way across the duct.
2. To avoid the adverse effects of turbulence, the duct mounting kit should be installed in the centre of a straight section of duct which has a length at least six times its width. If the section of duct is shorter, the adequacy of the flow should be tested with a mix of gas and air in the duct.
3. Check the air flow direction in the air duct system.
4. Use the end boss to mark up the duct ready for drilling the required holes as indicated on Figure 13. Make sure that the centre line is positioned equidistant from the two edges of the duct.

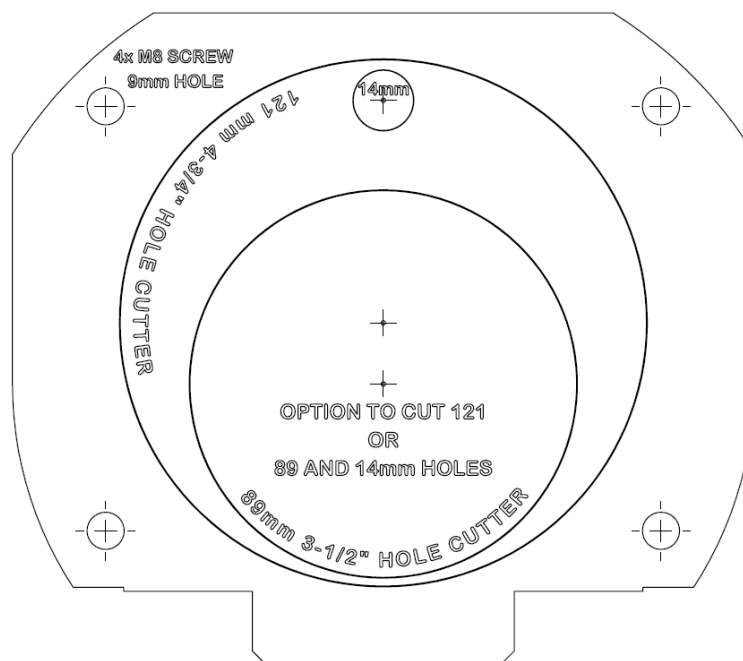
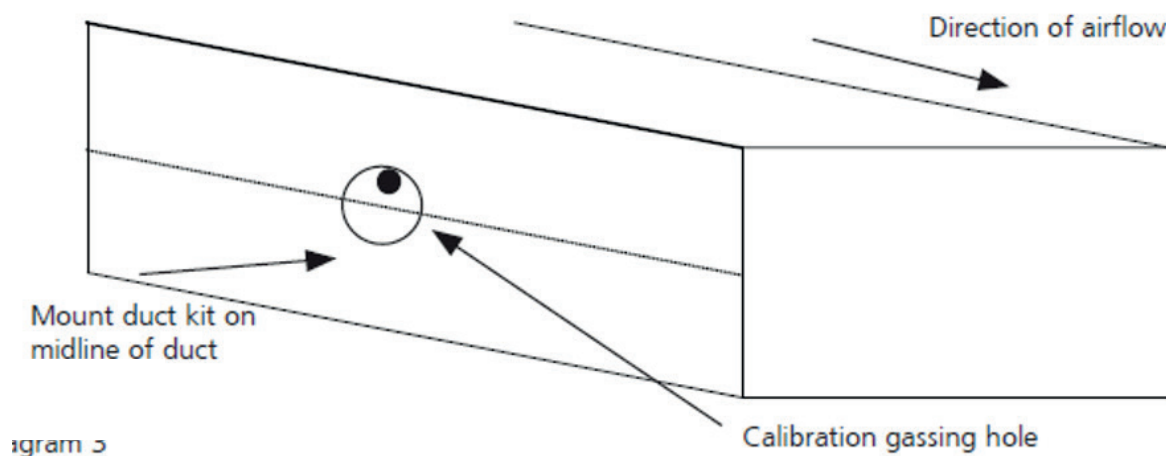


Figure 14: Duct Illustration & Drilling Template

1. Check that the midline hole indicated corresponds to the direction of the flow in the air duct.
2. Using a centre punch, mark the six centres indicated (Figure 14). At each corner, there needs to be a hole for a screw. In the centre, the hole needs to be big enough to accommodate the duct boss. If remote testing is required, there has to be an extra hole at the top as shown on Figure 14.
3. Remove burrs and sharp edges around the six holes.
4. The next step is to attach the duct tube to the duct mount boss. This has to be done in such a way that the inlet to the pipe faces the airflow, while the air outlet faces downwards for drainage, and the test gassing hole is vertically above the main ring. This is to ensure that the drain hole of the plate is below the pipe. Plan this carefully to ensure the orientation will be correct.
5. Fit the nuts provided and tighten.
6. Secure the casting to the duct using suitable bolts.
7. Remove and discard the detector's weatherproof cover to reveal a suitable thread for attaching the IR Plus to the duct boss. Install the IR Plus by screwing it into the duct boss (about 3 turns).
8. Connect the cable as instructed in the installation, operating, and maintenance instruction manual supplied with the detector.
9. **CHECK THAT THERE IS NO AIR LEAKAGE INTO THE SAMPLING CHAMBER FROM OUTSIDE THE DUCT, THROUGH THE PROBE JOINTS, CABLE GLANDS OR COVER GASKET. USE PTFE ON THE IR PLUS THREAD IF REQUIRED.**

9.5.3 TESTING AND COMMISSIONING

Calibrate the detector according to its instructions. Test the operation of the duct probe by introducing a gas and air mix into the

duct. This step is particularly important if the length of the section of duct is less than six times its width.

WARNING: It is essential to ensure that procedures are in place to prevent people and/or equipment being affected by any test gas introduced into the ventilation system.

9.5.4 SPECIFICATION

Air speeds: 0.5 m (1.6 ft)/s to 20m (65.6 ft)/s
Operating temperature range: 0°C to 60°C

9.6 AUXILIARY JUNCTION BOX

An IR Plus gas detector can be installed using an auxiliary junction box. Cast from 316 stainless steel and available with two M20 or 1/2" NPT cable entries, the auxiliary junction box is ATEX and IECEx certified for use in zone 1 or 2 hazardous areas. The auxiliary junction box provides ample space for connecting field cables - see the dimensioned drawing (Figure 15), and must be used where RS485 Modbus enabled versions of IR Plus are to be used and multi-dropped in addressable networks.

A spigot gland must be used to connect the detector to the auxiliary junction box.

Unused cable entries on the auxiliary junction box must be sealed using a certified blanking

Plus detectors can be linked only in a bus configuration as described below.

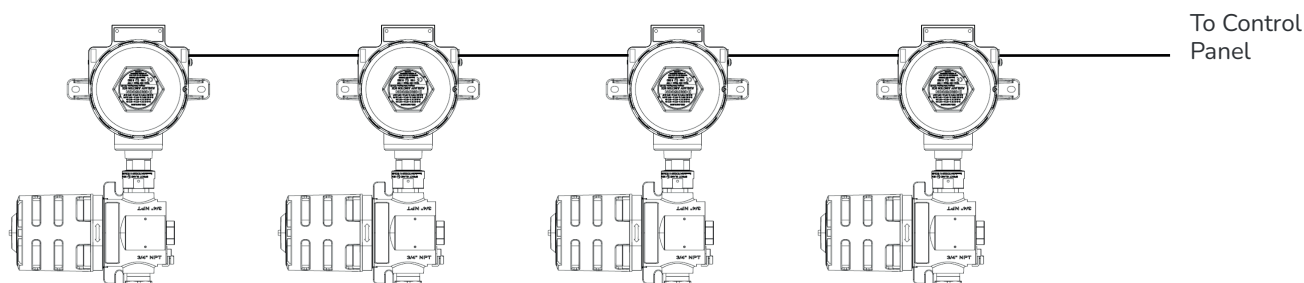


Figure 15: Multi-Drop Illustration

If the IR Plus are to be multi-dropped into an addressable network, RS485 Modbus enabled IR Plus must be connected to auxiliary junction boxes as shown in Figure 15.

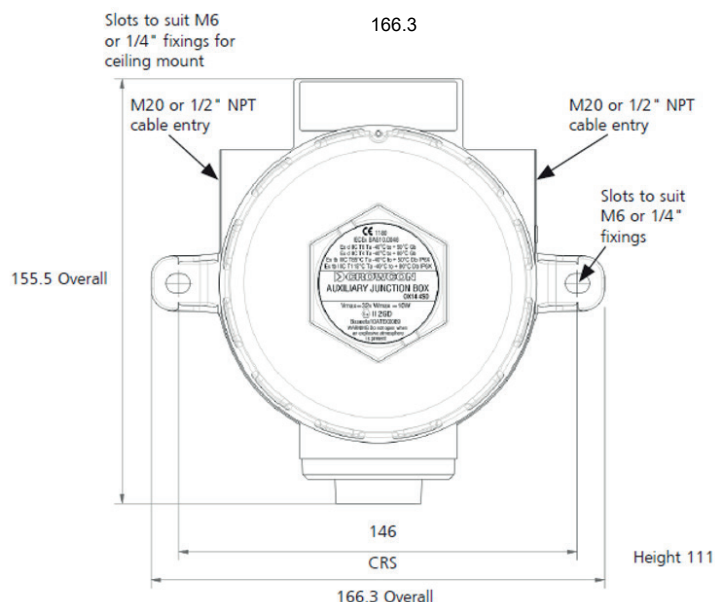


Figure 16: Auxiliary junction box showing dimensions in millimetres

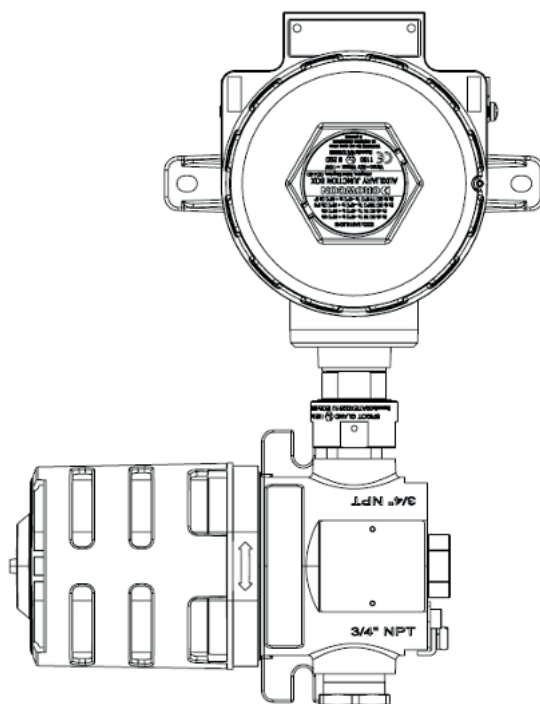


Figure 17: Detector assembled on an auxiliary Junction box

9.6.1 INSTALLATION

9.6.2 MOUNTING

The auxiliary junction box should be installed at the designated location with the detector entry pointing down (Figure 16)

9.6.3 CABLING REQUIREMENT

The spigot gland has five wires running through it to enable the user to connect one end to the detector and the other end to the junction box. Correct connection of wires at each end can easily be achieved through colour coding of the wires (Figure 17)

9.6.4 HOW TO FIT IR PLUS TO A JUNCTION BOX

1. Carefully remove the outer section 1 of the spigot gland (see Figure 18).
2. Screw the narrow end 2 of the spigot gland into the auxiliary junction box.
3. Raise the detector to the auxiliary junction box and pass the wires through the assembly and into the auxiliary junction box. Secure the detector by screwing the collar tightly to the cable gland. Tighten grub screw 3.
4. The main body of the detector can be swivelled horizontally at any angle, provided it is mechanically secure, does not interfere with other equipment and is accessible for maintenance.

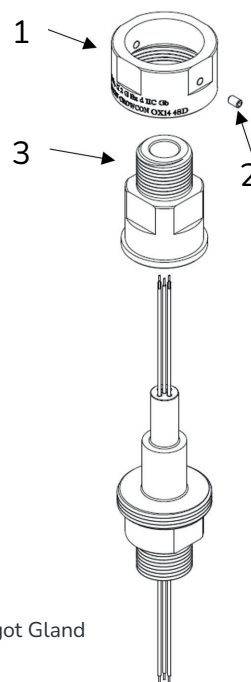


Figure 18: Spigot Gland

9.6.5 FIELD CABLE TERMINATION

Field cables must be terminated to the auxiliary junction box using Ex d certified cable glands suitable for the type of cable used.

9.7 EXE JUNCTION BOX PIPE MOUNT

The Junction box mounting kit enables the mounting of an IR Plus and Exe Junction Box to be mounted to a pipe. An optional Sunshade is also compatible with the junction box mounting bracket as illustrated below.

9.7.1 KIT CONTENTS

Brackets & screws.

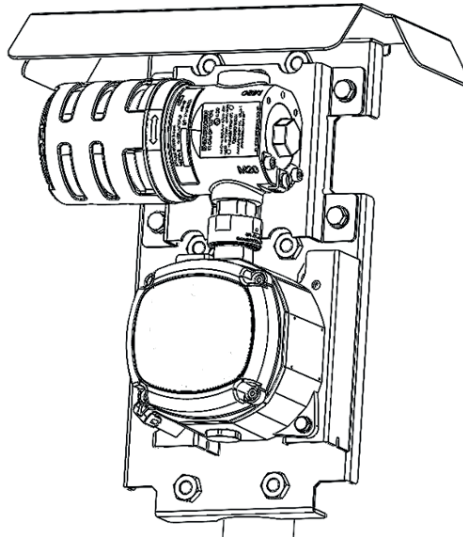


Figure 19: IR Plus Junction Box Mounting

Use the screws supplied to fix the bracket to the body of the detector. The pipe mount may be fitted to IR Plus supplied with or without an IR Display module.

9.7.2 SPECIFICATION

Material: AISI 316 Stainless Steel Sheet (SS)

9.8 PC COMMUNICATIONS KIT

The IR Plus can be linked to a computer using a PC communications kit, a small unit with appropriate power and data input and output ports.

Connecting the detector to a PC opens up the possibility of uploading data from the detector, as well as performing other functions such as zeroing and calibration.

NOTE: The PC communications kit is not certified for use in a hazardous area. For monitoring the IR Plus in a hazardous area, choose a model incorporating the Fixed Display or Remote Display (requires an IS Barrier version).

The kit contains the communications module (shown in section 9.8.1), USB and Molex connection leads, and CD containing PC communications kit software and manual in pdf format.

Separate versions of the PC communications kit are supplied for the IREX and IRmax. They are not interchangeable.

NOTE: The PC communications kit is only capable of supplying power to an IRmax connected. IR Plus units must be powered via an external source and not through the PC Communications box.

9.8.1 USING THE PC COMMUNICATION KIT

1. Install the Detectors Pro on to a computer from the Crowcon Website.
2. Connect the PC communications module to computer. The computer will provide power to the communications module via the USB cable.
3. Connect the PC communications module to the detector. Power to the detector must be supplied directly from a DC supply and not through the comms kit power cable.
NOTE: Ensure communications switch on the IR Plus terminal PCBA is set to 'SRV' position.
4. Launch the Detectors Pro. The computer will detect the communications module and the interface can be used to monitor and control the detector.

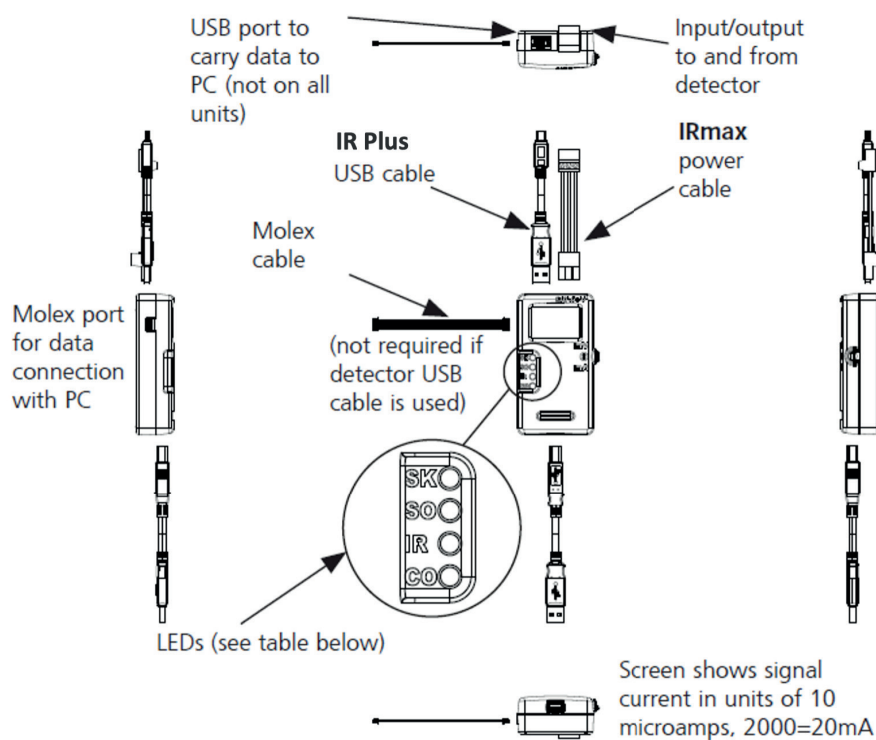


Figure 20: IR Plus PC Communications Kit

10. WARRANTY

This equipment leaves our factory fully tested and calibrated. If within the warranty period of five years from despatch, the equipment is proved to be defective by reason of faulty workmanship or material, we undertake at our option either to repair or replace it free of charge, subject to the conditions below..

Warranty Procedure

To facilitate efficient processing of any claim, please visit the following web-page and provide the information listed below: <https://www.crowcon.com/help-and-advice/customer-support/warranty>

- Your company name, contact name, phone number and email address.
- Description and quantity of goods being returned, including any accessories.
- Instrument serial number(s).
- Reason for return.

You will receive a warranty reference number which must be clearly shown on the address label when the goods are returned.

The guarantee will be rendered invalid if the detector is found to have been altered, modified, dismantled, tampered with, or has not used Crowcon spares for replacement parts or has been serviced or repaired by any party not authorised and certified by Crowcon to do so. This warranty does not cover degraded/damaged mirror which must be replaced in accordance with the instructions on routine maintenance section of this manual.

Warranty Disclaimer

Crowcon accept no liability for consequential or indirect loss or damage howsoever arising (including any loss or damage arising out of the use of the detector) and all liability in respect of any third party is expressly excluded. This warranty does not cover the accuracy of the calibration of the unit or the cosmetic finish of the product. The unit must be maintained in accordance with the instructions in this manual.

The warranty on replacement consumable items supplied under warranty to replace faulty items, will be limited to the unexpired warranty of the original supplied item.

Crowcon reserves the right to determine a reduced warranty period, or decline a warranty period for any sensor supplied for use in an environment or for an application known to carry risk of degradation or damage to the sensor.

Our liability in respect of defective equipment shall be limited to the obligations set out in the guarantee and any extended warranty, condition or statement, express or implied statutory or otherwise as to the merchantable quality of our equipment or its fitness for any particular purpose is excluded except as prohibited by statute. This guarantee shall not affect a customer's statutory rights.

Crowcon reserves the right to apply a handling and carriage charge whereby units returned as faulty, are found to require only normal calibration or servicing, which the customer then declines to proceed with..

Product Use:

Every effort has been made to ensure the accuracy of this document at the time of printing. In accordance with the company's policy of continued product improvement Crowcon Detection Instruments Limited reserves the right to make product changes without notice. The products are routinely subject to a programme of testing which may result in some changes in the characteristics quoted. Technical information contained in this document or otherwise provided by Crowcon are based upon records, tests, or experience that the company believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Many factors beyond Crowcon Detection Instruments' control and uniquely within user's knowledge and control can affect the use and performance of a Crowcon product in a particular application.

As the products may be used by the client in circumstances beyond the knowledge and control of Crowcon Detection Instruments Limited, we cannot determine the relevance of these to an individual customer's application. It is the clients' sole responsibility to carry out the necessary tests to evaluate the usefulness of the products and review all applicable regulations and standards to ensure their safety of operation in a particular application.

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Unless an additional warranty is specifically stated on the applicable Crowcon product packaging or product literature, Crowcon warrants that each Crowcon product meets the applicable Crowcon product specification at the time of shipment. **CROWCON MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE.** If the Crowcon product does not conform to this warranty, then the sole and exclusive remedy is, at Crowcon's option, replacement of the Crowcon product or refund of the purchase price.

Limitation of Liability:

Except where prohibited by law, Crowcon will not be liable for any loss or damage arising from the Crowcon product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

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