

# Axiom Series Refrigerant Gas Detector

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## User Manual



Dynament is part of Process Sensing Technologies (PST)

As customer applications are outside of PST control, the information provided is given without legal responsibility. Customers should test under their own conditions to ensure the equipment is suitable for the intended application(s). We adopt a continuous development program which sometimes necessitates specification changes without notice. For technical assistance or enquiries about other options, please contact us here: [sensors@processsensing.com](mailto:sensors@processsensing.com)

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## Safety Information – Read First

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Read and understand this manual in conjunction with the relevant data sheet before using the Axiom detector. When Axiom is employed to detect flammable gas, it is the customer's responsibility to ensure the product is used safely in accordance with local regulations concerning explosive safety. This is not an Intrinsically Safe or Ex Flameproof device.

## Axiom A2L Detector

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### Description

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Dynamant infrared detectors operate by using the NDIR (Non-Dispersive Infrared) principle to monitor the presence of the target gas. The detector contains a long life tungsten filament infrared light source, an optical cavity into which gas diffuses, temperature compensated pyroelectric infrared detectors, an integral semiconductor temperature sensor and electronics to process the signals from the pyroelectric detector .

The detector can be configured for digital or analogue outputs.

In analogue mode either 4-20mA or 0.2-4V output modes may be chosen. An Open Collector output is also available when configured in either of the analogue modes.

In digital mode, the detector can be configured to communicate over Modbus using either RS232(TTL) or RS485 as the physical protocol.

The R454B variant of Axiom is certified to UL60335-2-40 4<sup>th</sup> Edition Annex LL.

### Power Supply

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The Axiom detector is designed to operate with a supply voltage of between 5V and 24V and draws a maximum of 600mW. Power is applied on the V+ and GND connections of the USB interface.

### Detector Mounting

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Under normal operation Axiom should be mounted with the gas inlet facing down, as shown below:



## Detector warm-up

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The detector takes approximately 45 seconds to warm up after power is supplied. The detector is held at -250% of the full-scale output during this time. In 4-20mA mode, the output will be forced to 2.5mA and the Open Collector Output will be active during this time. In 0.2-4.0V mode, the output will be 0V and the Open Collector output will be active during this time.

## Analogue output

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The analogue output of the detector is proportional to the measured gas level. The analogue output can be configured to be a 4-20mA or a 0.2-4.0V configuration. This configuration is carried out during manufacture and cannot be changed afterwards.

### 4-20mA Mode

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The analogue output range is 4mA to 20mA for zero gas to FSD. Fault modes are indicated by a mA output of 2.5mA.

The table below shows the analogue output for a detector that is configured in 4-20mA mode.

Gas Reading (% of detector range)	Analogue output (mA)
0	4.00
10	5.60
20	7.20
30	8.80
40	10.40
50	12.00
60	13.60
70	15.20
80	16.80
90	18.40
100	20.00
Warmup / Fault	2.50

## 0.2-4.0V Mode

The analogue output range is 0.2V to 4V for zero gas to FSD.

The table below shows the analogue output for a detector that is configured in 0.2-4.0V mode.

Gas Reading (% of detector range)	Analogue output (V)
0	0.20
10	0.40
20	0.80
30	1.20
40	1.60
50	2.00
60	2.40
70	2.80
80	3.20
90	3.60
100	4.00
Warmup / Fault	0V

## Technical Specifications

<b>Operating Voltage</b>		
5 - 24VDC		
<b>Operating Power</b>		<b>Alarm Level</b>
0.5W average		Based on refrigerant (5% LFL for R454B)
<b>Vibration &amp; EMC</b>		<b>IP Rating</b>
Certified UL60335-2-40 Annex LL		IP54
<b>Accuracy @ alarm point</b>		<b>Pressure</b>
± 3%		80 to 110kPa
<b>Response Time</b>		<b>Warm Up Time</b>
<15s (to alarm level)		45s
<b>Operating temperature range</b>		
-40 °C to +75 °C (-40 °F to 167 °F)		
<b>Humidity range</b>		
0 to 100% RH non-condensing		
<b>Digital Outputs</b>		
RS485 Modbus	RS232 UART	USB 2.0
<b>Analog Outputs</b>		
4-20mA	0.2-4.0V	Open Collector
<b>Lifetime</b>		<b>Weight</b>
15 years		50 grams

## Serial communications

The detector has UART and RS485 interfaces, allowing communication with multiple devices in a serial manner. The serial interface allows the user to monitor gas levels, temperature, and other parameters. The communications protocol used is Modbus. **Please consult the separate Modbus protocol user guide for full details.**

### Device Data (Read Only)

Register	Protocol Address	Alternative Protocol Address	Name	Description	Data type
30,017	30,016	16	Batch/Serial Number	10 ASCII characters	Char
30,018	30,017	17			
30,019	30,018	18			
30,020	30,019	19			
30,021	30,020	20			
30,049	30,048	48	Firmware Version Major		Integer 16-bit
30,050	30,049	49	Firmware Version Minor		Integer 16-bit
30,051	30,050	50	Firmware Version Build		Integer 16-bit

### Current Values (Read Only)

**IMPORTANT NOTE:** These values are changing every measurement cycle, so always read the two corresponding registers in one Modbus command.

Register	Protocol Address	Alternative Protocol Address	Name	Description	Data type
30,065	30,064	64	Gas reading valid	Set to 1 if the gas reading value is a valid reading or 0 if the unit is in a fault condition or still warming up and the gas reading is therefore not valid	Integer 16-bit
30,066	30,065	65	Gas Reading 1	Sent as a 32 bit value over two consecutive 16 bit registers (MSB first) which forms an IEEE 754 format 32 bit floating point decimal number	Float 32-bit
30,067	30,066	66			
30,068	30,067	67	Gas Reading Status Flags	32 bit word spread over two consecutive registers (MSB first) which forms 32 individual bits of status information	Float 32-bit
30,069	30,068	68			
30,086	30,085	85	Temperature reading valid	Set to 1 if the temperature reading value is a valid reading or 0 if not	Integer 16-bit
30,087	30,086	86	Temperature Reading (in °C)	Value of temperature as a decimal number in degrees centigrade. Sent as a 32 bit value over two consecutive 16 bit registers (MSB first) which forms an IEEE 754 format 32 bit floating point number	Float 32-bit
30,088	30,087	87			

Axiom can be configured to operate at 4 different baud rates – 38400, 19200, 9600 and 4800. 19200 baud is the default setting.

## Logic levels

In RS232(TTL) mode, care must be taken to keep signal logic levels under 5V. Any higher voltage will damage the detector microcontroller.

## Fault indication

The analogue output is driven to the fault level when an internal fault is detected.

## Voltage output

The 0.2-4.0V output will be driven to 0V in the event of a fault.

## 4-20mA

The 4-20mA output will be driven to 2.5mA in the event of a fault.

## Serial Data

The gas readings in the live data are set to -250% of the full-scale during fault conditions. The status flags are set according to the actual fault.

Each of the 4 Status flag registers are 16 bits long and work as bit fields. This means that each of the 16 bits indicates a different fault. Status Flag 4 is inverted because during EEPROM initialisation the memory is set to 0xFFFF which would cause all status flags to raise.

Status Flags 1	Bit Mask	Fault Description
Signal Noise	0000 0000 0000 0100	Checks that the raw count is stable. Signal will be considered noisy if noise appears for more than 5 sec.
Detector 1 Fault	0000 0000 0100 0000	This flag indicated there is a fault with detector1. It gets triggered when a peak cannot be found. This typically happens along with FLAG_SIGNAL_TIMEOUT.
Reference Fault	0000 0000 1000 0000	This flag indicated there is a fault with reference1. It gets triggered when a peak cannot be found. This typically happens along with FLAG_SIGNAL_TIMEOUT.
ADC Overrange	0000 0010 0000 0000	This flag is set when the ADC reads a value that is too high; this occurs before it hits the maximum value. This does not just happen because of signal spikes, normally that is filtered out. What typically causes this, is when there is a significant change in the detector environment (for example if you blow on the detector). This increases the dc bias of the signal which pushes the signal to the upper limits of the ADC and clips the signal.

Status Flags 2	Bit Mask	Fault Description
Warm Up	0000 0000 0100 0000	This flag will tell the user that the detector has warmed up. By default, this is set to 45 seconds, except for an extreme environment, the detector should be warm by then.
Max Gas Limit Exceeded	0000 0001 0000 0000	This flag indicates that the gas has exceeded the full scale of the detector. This error can be ignored.

## Calibration

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Axiom A2L detectors do not require field calibration.

## Maintenance

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Dynament infrared detectors, like any other detectors, require regular maintenance in terms of inspection to prevent a build-up of dust or dirt or any other contamination that might prevent gas from entering the detector.

Maintenance should include cleaning of the housing within which the detector is mounted, a good design will afford some level of protection for the Axiom detector.

## Handling precautions

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Axiom incorporates ESD protection circuitry. However, it is recommended that care is taken not to touch the USB-C connector during handling.

Axiom should not be exposed to corrosive gases.

## Disposal

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Axiom should be disposed in accordance with local disposal requirements.

## Warranty

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Infrared detector warranty and lifetime are given in the detector data sheet, a typical statement is as follows:

All Dynament Axiom detectors carry a **five-year** warranty against defects in materials and workmanship. The warranty is invalidated if the detectors are used under conditions other than those specified in the relevant data sheet.

Particular attention should be paid to the following criteria:

- Observe the correct supply polarity
- Do not exceed the maximum rated supply voltage of 24V
- Do not solder directly to the detector connector
- Do not expose the detector to corrosive gases



## Appendix

### Wiring Guide

Axiom can be factory configured in 4 different output modes:

#### OPTION 1

Analogue  
4-20mA

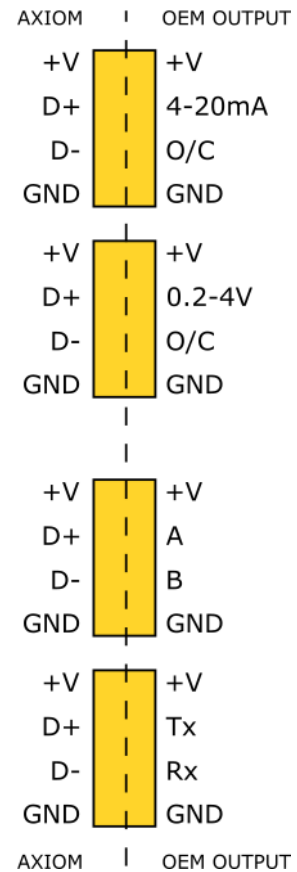
0.2-4V

#### OPTION 2





Digital

RS485

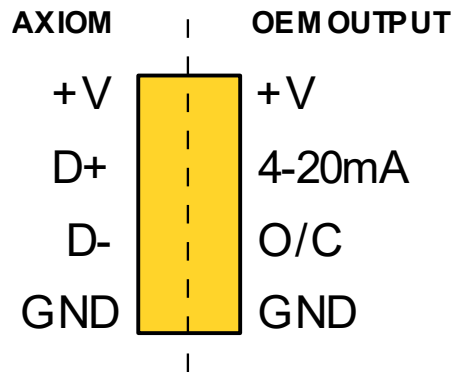
RS232



When a bare ended USB cable is used, the contacts follow the colour code below:

Colour	Axiom Contact
 Red	5-24V DC
 White	D-
 Green	D+
 Black	0V

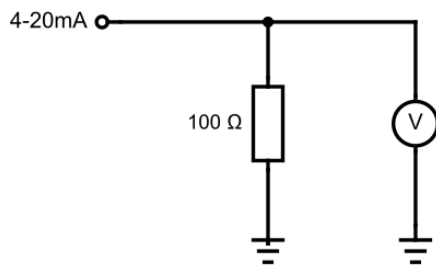
4-20mA



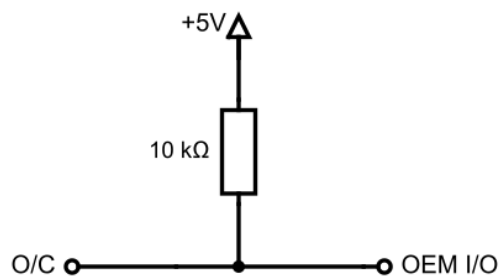
Connection	Function
+V	5.0 - 24V Input
D+	4-20mA Output with fault indication (2.0mA = Fault) 100Ω recommended Load Resistor
D-	Open Collector Output Active Low 100mA maximum load 5.5V maximum voltage
GND	System 0V

Recommended Output Circuit

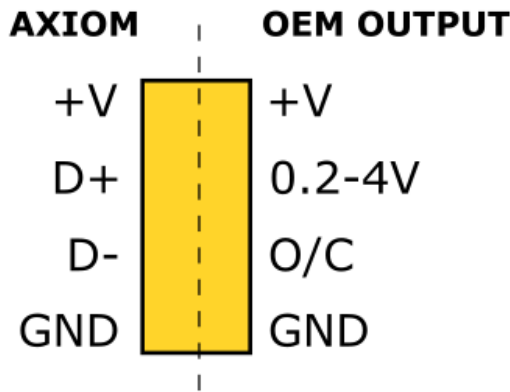
4-20mA



Open Collector



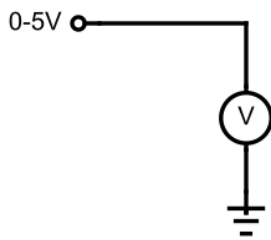
0.2-4.0V



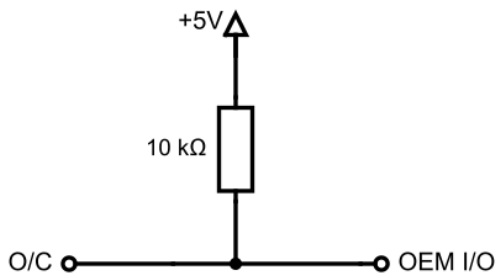
Connection	Function
+V	5.0 – 24V Input
D+	0.2-4.0V Output (0.1V minimum)
D-	Open Collector Output Active Low 100mA maximum load 5.5V maximum voltage
GND	System 0V

Recommended Output Circuit

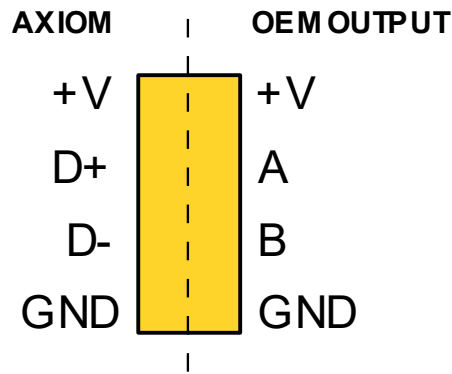
0.2-4.0V



Open Collector

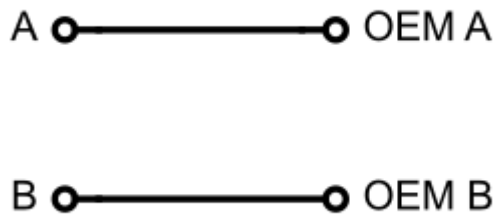


**RS485**

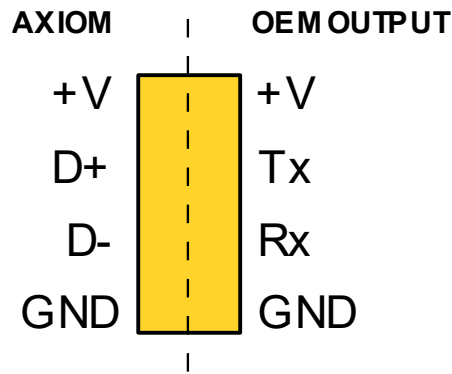


Connection	Function
+V	5.0 - 24V Input
D+	RS485 A
D-	RS485 B
GND	System 0V

**Recommended Output Circuit**

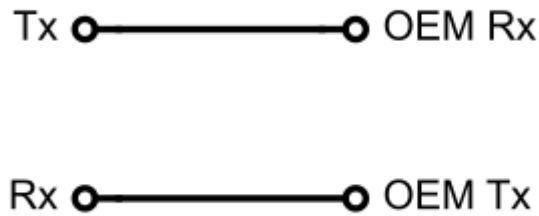


**RS232 (TTL)**



Connection	Function
+V	5.0 - 24V Input
D+	RS232 Tx 3.3V TTL
D-	RS232 Rx 3.3V TTL
GND	System 0V

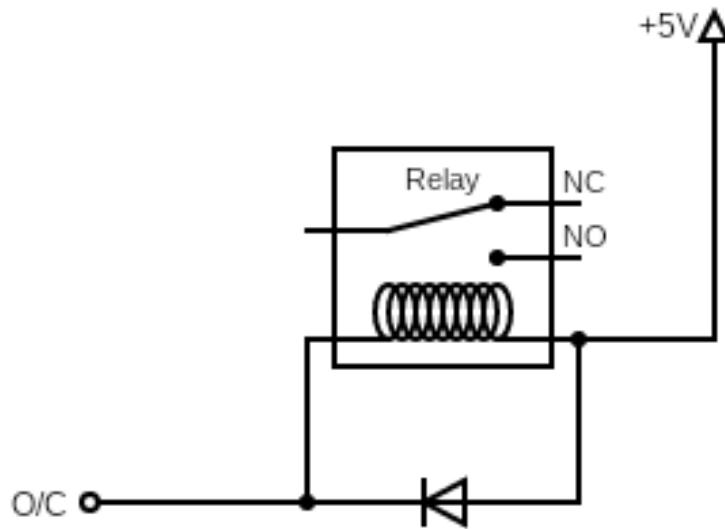
**Recommended Output Circuit**



## Using the Open Collector Output to Drive a Relay

Axiom’s Open Collector output can be used to drive a relay when connected as shown below.

To do this, use the connect the relay coil between the Open Collector output (D-) and a 5V supply. On alarm or fault the Open collector output will be driven low, completing the circuit through the coil, and energising the relay.

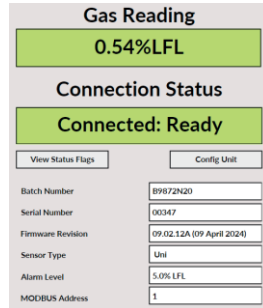


Please note that the maximum permitted voltage on the Open Collector contact is **5.5V** and the maximum current that can be sunk into the contact is **100mA**.

For applications that require switching of a 24V load or higher currents, Dynament can provide an Axiom Bridge accessory.

## Axiom Diagnostic Tool (ADT)

Axiom Diagnostic Tool (ADT) requires USB-C to USB PC cable connection. Axiom diagnostic information is available through a PC application, providing real time gas reading, access to configuration settings (baud rate, Modbus address) and detailed fault information to assist with service and maintenance.



## Axiom Bridge

Dynament offers the Axiom Bridge, an optional interface board.

Axiom Bridge features a USB-A connector and screw terminals, and is provided with a USB-C to USB-A cable to simplify integration into existing systems.

Furthermore, The Axiom Bridge features two LED status indicators **Green** for power and **Red** for fault indication and alarm, and an Open Collector output capable of switching loads up to 40V / 600mW. The Axiom Bridge offers an optional on-board 10A relay and enclosure.