

Gas Detector

FEATURES

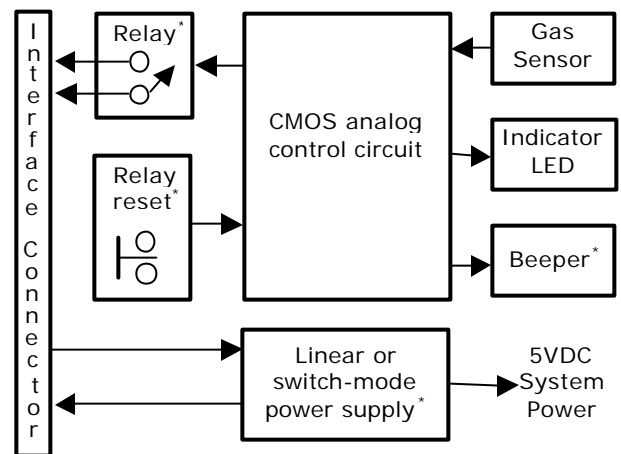
- Long life MOS sensor
- Combustible & refrigerant gas versions
- 0-80% LEL measurement (combustibles)
- 10 seconds start-up time
- <2 seconds alarm response time
- <10 seconds alarm recovery time
- LED power/alarm indicator
- 80 dB alarm beeper
- Optional NO or NC dry relay
- Manual reset or auto-resetting relay operation
- Field-adjustable calibration via trimpot
- Each device factory pre-calibrated
- 9VDC @ 200mA (1.8W) operation (I1)
- Optional 7-40VDC input power version (I2)
- Optional 7-60VDC input power version (I3)
- 61mm x 48mm x 26mm circuit-only size
- 74mm x 56mm x 26mm enclosed size

DESCRIPTION

Knowz™ detectors are dc-powered analog gas monitors intended for safety applications. The devices are suitable for monitoring combustible gases up to 80% L.E.L. One version permits the detection of refrigerant gas leaks at 500 ppm (typical). Versions are available with an integrated relay that provides dry (electrically isolated) contacts. Units may be ordered with normally open or normally closed relay contacts. Relays may be auto resetting such that they deactivate when the gas presence is removed, or may be latching to require a button press for deactivation. The devices are suitable for temperatures ranging from -20 to +70 degrees Celsius and humidity ranging from 5% to 100% R.H. (non-condensing). Devices are factory calibrated for alarm accuracy in ambient conditions (25 deg. Celsius/40% R.H.) The devices operate at 9VDC and consume about 1.8W (linear supply versions). Wide input supply versions are available that employ more power efficient switch mode supplies. Custom form factors, connector types and mounting provisions are available by special order.



BLOCK DIAGRAM



*Optional

1 - FUNCTIONAL DESCRIPTION

1.1 - OVERVIEW

Neodym Knowz™ gas detectors comprise of a CMOS control chip, a MOS gas sensing element, a red power/alarm indicator LED and various optional signaling devices such as an alarm beeper and a dry relay. Standard devices operate with 9VDC (unregulated) input power. Wide input supply versions are available that accept 7-40VDC (or 7-60VDC).

Each time that power is applied the device enters a brief warm-up state (during which time the detector may alarm and reset). After about 10 seconds of warm-up active gas sensing operations may commence.

The control circuit is configured such that increasing gas sensor signal levels trigger an oscillator comprised of CMOS logic gates. The trigger point is established by a trimpot. Once triggered, the oscillator modulates the alarm beeper and indicator LED. Oscillator pulses are integrated to activate the relay coil (if used). Optional hold/release circuitry keeps the relay in a latched state until power is removed or a reset button is pressed.

1.2 – SYSTEM COMPONENTS

This section describes the function of various Knowz™ system components. Certain items may not be present depending on the options selected at order time.

SENSOR (Standard)

The employed gas-sensing element is a metal-oxide semiconductor (MOS) type offering high sensitivity to the target gas, rapid response/recovery time, no “inverted response” at high gas concentrations, modest power requirements and long life. Gas sensing is performed on a diffusion basis.

ALARM TRIMPOT (Standard)

This control is used to establish the alarm

trigger level during calibration. The calibration procedure entails exposing the sensor to a reference gas concentration and adjusting the trimpot to trigger the alarm at the concentration of interest.

LED (Standard)

A 5mm red light-emitting diode is used to provide visual indication of power and alarm status. A steady red indicates that power is applied. A blinking red indicates that the alarm trigger point has been reached.

BEEPER (Optional)

This piezzo transducer is used to provide audible indication when the alarm trigger point has been reached. The beeper is silent during the normal state and beeps at a ½ second rate during the alarm state.

RELAY (Optional)

Various relay types and modes are available. These include SPST (single-pole normally open or normally closed) types and SPDT types with a common, normally open and normally closed contact set. All contacts are electrically isolated from the detector electronics (dry).

Latched mode operation is only available with the SPDT type. The SPST normally-closed type is recommended for power failure detection.

RESET BUTTON (Optional)

This user control is used to manually reset a latched relay in non-auto-resetting relay versions.

INTERFACE CONNECTOR(S) (Standard)

Various interface connectors are used to apply power and connect to the relay contacts. Please see the INTERFACE section for details.

1.3 – PERFORMANCE SPECIFICATIONS

Note: The following parameters apply under the Functional Operating Conditions stipulated in the Electrical Specifications section.

TABLE 1.3.1.1 – Combustible gas sensing characteristics (Combustible gas models)

Parameter	Min	Typ	Max	Unit	Note
Sensing range	-	-	80	%LEL	
Accuracy	+/- 5	+/- 2	-	%LEL	1
Warm-up time	-	10	-	Sec.	
Alarm response time	-	2	4	Sec.	
Alarm recovery time	-	10	20	Sec.	

Notes: 1. Accuracy specified at 20% LEL, 25 deg. Celsius, 40% R.H.

TABLE 1.3.1.2 – Refrigerant gas sensing characteristics (Refrigerant gas models)

Parameter	Min	Typ	Max	Unit	Note
Sensing range	-	-	3,000	PPM	1
Accuracy	+/- 400	+/- 200	-	PPM	2
Warm-up time	-	10	-	Sec.	
Alarm response time	-	2	4	Sec.	
Alarm recovery time	-	10	20	Sec.	

Notes: 1. R-21, R-22, R-113 & R-134a
2. Accuracy specified at 2000 PPM, 25 deg. Celsius, 40% R.H.

TABLE 1.3.2.1 – Sensing environmental requirements (All models)

Parameter	Min	Typ	Max	Unit	Note
Relative humidity	5	-	100	% R.H.	1
Operating temperature	-20	-	+70	Deg. C.	
Altitude/pressure	0.8	-	1.2	Atmos.	
Flow rate	-	-	3	m/sec.	2
Atmospheric oxygen	10	21	30	% vol.	

Notes: 1. Non-condensing
2. Devices are factory calibrated in static air flow conditions

1.4 – USE, CARE & MAINTENANCE

Knowz™ sensors can provide reliable indications for many years if properly handled and maintained. To derive the maximum serviceable lifetime from the device, please observe the following recommendations.

CHECK CALIBRATION PRIODICALLY

The only direct method to check accuracy and proper operation is via exposure of the sensor to a reference gas concentration and observing it to alarm correctly. Devices are delivered factory calibrated, but the accuracy of the unit can and will degrade over time – especially if used in corrosive or hostile environments. It is recommended that calibration checking should be performed as often as is practical and no less frequently than once every six months.

GENERATING REFERENCE GAS

The recommended method for generating calibration test gas mixtures is to dilute pure target gas with clean, normal air in a leak-free chamber of fixed, known volume. A simple procedure is to inject a specific amount of pure target gas using a syringe into a sealed plastic lunch container. EG 50cc of pure target gas injected into a chamber with a net volume of 5 liters produces a concentration of 10,000 ppm. Gentle shaking or an enclosed fan may be used to assure proper dispersion of the gas mixture. In applications where it is impractical to immerse the detector in such a gas mixture, a pump or aspirator may be used to flow the gas mixture over the sensor. Locate the sensor away from the injection port to avoid high concentration gas plumes from saturating the sensor.

NO DESICCATED PRE-MIX CAL GAS

Pre-mixed calibration test gas that has been stripped of moisture content and designed for other sensing chemistries is not appropriate for Knowz™ testing and calibration. The employed MOS sensor requires a minimum 10% R.H. moisture content to operate properly.

NOT A GENERAL LEAK DETECTOR

The device is to be used as a monitor in safety applications where high concentration gas releases are rare. If the device is employed as a general leak detector and is exposed to saturation levels of gas, the sensor may be permanently damaged.

INTEFERENCE GAS

The employed MOS sensor is not specific to any one gas. Detectors calibrated for (EG) hydrogen applications will read accurately in the presence of homogeneous hydrogen gas/air mixtures, but will also produce readings in the presence of other inorganic and organic vapors. Heterogeneous gas mixtures generally have a synergistic effect on the sensor, and in the absence of a target gas presence, the interference gases will manifest themselves as 'false' readings.

AVOID BUMP TESTING

Do not use bursts of high gas concentrations to test whether the sensor is 'alive'. Especially avoid exposing the sensor to blasts of butane gas – EG from a disposable cigarette lighter. The proper testing procedure is to expose the sensor to a reference gas whose concentration is stable and falls within the rated sensing range. A properly operating device will alarm at the preset alarm trigger concentration within the limits of the specified accuracy.

AVOID SENSOR OBSTRUCTION

The sensor samples the atmosphere based on the diffusion of gas through the mesh into the internal cavity. Please locate the sensor such that it is not pressed against a surface that will obstruct gas flow, and do prevent materials such as dust and lint from clogging the sensor mesh.

PROPER PLACEMENT

For earliest warning of a possible gas hazard, locate the detector nearest to the most likely source of the gas leak. Also take into account the relative density of the gas of interest. In

the cases of hydrogen and methane that are lighter than air, the module should be located above the leak source. The opposite applies in the case of propane.

AVOID EXPOSURE TO SILICONE VAPORS

Sealants such as caulking compounds, hoses, etc. may contain silicones. These items may continue to off-gas silicone vapors indefinitely, even after full curing – and especially under high temperature conditions. Extra care should be taken when testing the sensor in environmental chambers – many of which use silicones for thermal insulation. The effect of silicone vapors on the sensor is to make it gradually more sensitive to hydrogen, and **less** sensitive to methane, propane and other large-molecule gases.

OTHER DELETERIOUS AGENTS

Avoid exposure to high concentrations (>5,000 ppm) of carbon monoxide (CO). Such exposures lead to short-term sensor poisoning that manifest themselves as elevated gas readings. Recovery from high CO exposures entails several hours of burning-off in clean air.

Avoid exposure to high concentrations (>50,000 ppm) of halogen family hydrocarbons such as solvents and refrigerant gases. As with elemental halogen family gases, they can corrode the sensor, lead to short-term poisoning, and reduce the sensor lifetime.

Avoid exposure to other corrosive environments such as salt-containing sea spray. For coastal and marine applications, modules are available with acrylic conformal coating to preserve circuit lifetime. However, the buildup of a salt crust over the sensor mesh will impede gas diffusion and will affect reliability.

NO STRONG ELECTROMAGNETIC FIELDS

While the circuit is relatively low impedance, avoid locating the sensor in the immediate vicinity (<10 cm) of strong and fluctuating field sources such as fans, pumps, motors, RF transmitters, etc. Close proximity to such fields may result in spurious gas alarms. Also, make sure that the detector's power supply is adequately decoupled from fluctuations caused by the switching of large external loads.

2 - INTERFACE

2.1 – ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Note: Maximum ratings are the extreme limits to which the device can be exposed without permanent damage. The devices are not guaranteed to operate properly beyond maximum ratings.

TABLE 2.1.1.1 - Absolute Maximum Ratings – 9VDC input models (I1)

Parameter	Symbol	Value	Unit
Supply voltage	V_{SUP}	14	VDC

TABLE 2.1.1.2 - Absolute Maximum Ratings – 7-to-40VDC/60VDC input models (I2 & I3)

Parameter	Symbol	Value	Unit
Supply voltage	V_{SUP}	45	VDC
12 Models:		60	
13 Models:			

FUNCTIONAL OPERATING RANGE

Note: Sensing accuracy deteriorates rapidly outside the specified operating voltage range. Permanent device damage may occur above the specified operated voltage range.

TABLE 2.1.2.1 – Operating Range – 9VDC input models (I1)

Parameter	Symbol	Value	Unit
Operating voltage range	V_{CC}	8 to 12	VDC

TABLE 2.1.2.2 – Operating Range – 7-to-40VDC/60VDC input models (I2 & I3)

Parameter	Symbol	Value	Unit
Operating voltage range	V_{SUP}	7 to 40	VDC
12 Models:		7 to 60	
13 Models:			

TEMPERATURE RATINGS

TABLE 2.1.3 - Temperature Ratings

Parameter	Symbol	Value	Unit
Storage temperature (all models)	t_{STG}	-40 to +125	Deg. C.
Operating temperature range	t_{OP}	-20 to +70	Deg. C.

POWER CONSUMPTION

TABLE 2.1.4.1 – Supply current (I1 linear models & I2/I2 switch mode models)

Parameter	Symbol	Min	Typ	Max	Unit
Supply current					
I1 model - $V_{SUP} = 9VDC$:	I_{SUP}	-	165	200	mA
I2/I3 models - $V_{SUP} = 12VDC$:		-	100	120	
I2/I3 models - $V_{SUP} = 24VDC$:		-	50	60	

DEVICE RATINGS

TABLE 2.1.5 – Device ratings

Parameter	Symbol	Min	Typ	Max	Unit
Beeper (piezzo) sound level at 30cm		-	80	-	dB
Sealed reed relay (SPST)					
Switch voltage:		-	200	-	VDC
Switch current:		-	0.5	-	A
Carry current:		-	1.2	-	A
Contact resistance:		-	0.15	-	Ohm
Insulation resistance:		-	10^{10}	-	Ohm
Sealed DIP relay (SPDT)					
Switch voltage:		-	-	220	VDC
Switch current:		-	-	2	A
Carry current:		-	-	3	A
Contact resistance:		-	-	0.05	Ohm
Insulation resistance:		-	-	10^8	Ohm

2.2 – INTERFACE CONNECTIONS

CONNECTOR TYPES

TABLE 2.2.1 – Interface connector types

Model	Power supply connection	Relay Contacts	Relay Type	Figure
K1	2.1mm center-neg. radial jack	3mm 2-terminal block	SPST	2.2.1
K2	2.1mm center-neg. radial jack	3mm 3-terminal block	SPDT	2.2.2
K3	Integrated 2mm 5-pin power & relay contacts header		SPST/SPDT	2.2.3

PIN CONNECTIONS

FIGURE 2.2.1 – “K1” SPST connections

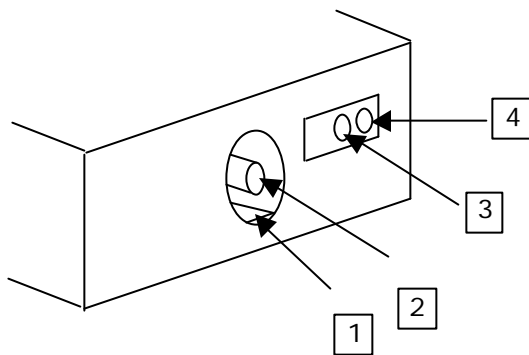


FIGURE 2.2.1 – “K2” SPDT connections

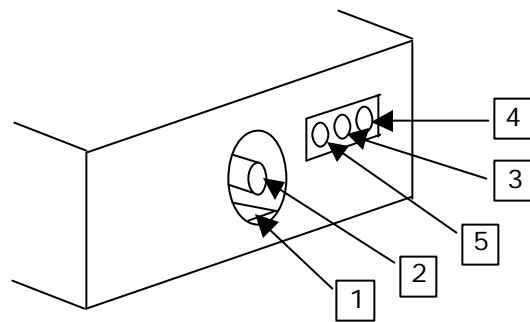
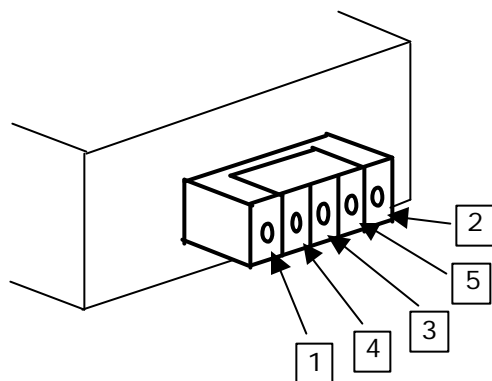


FIGURE 2.2.1 – “K3” signal connections



Connector (shown) part no. DF3-5P-2DS (Hirose)

Mating crimp receptacle part no. DF3-5S-2C

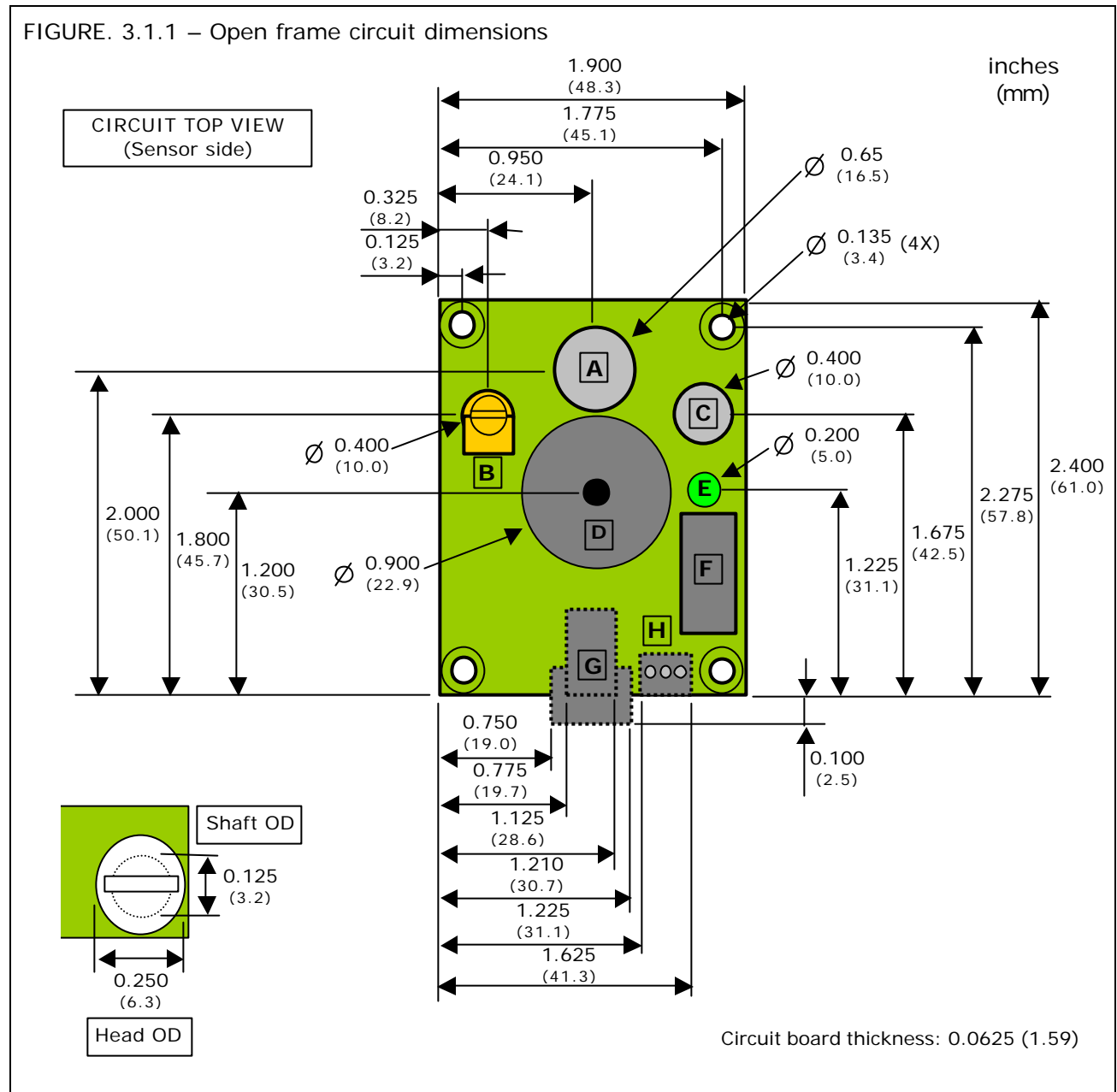
Table 2.2.1 – SPST relay signal definitions

Pin	Symbol	Function
1	V_{SUP}	Input power (+)
2	GND	Power ground
3	RELAY1	Relay contact #1
4	RELAY2	Relay contact #2

Table 2.2.2 – SPDT relay signal definitions

Pin	Symbol	Function
1	V_{SUP}	Input power (+)
2	GND	Power ground
3	R_{COM}	Relay common
4	R_{NO}	Relay Norm. open
5	R_{NC}	Relay Norm. closed

3.1 – PHYSICAL DIMENSIONS – OPEN FRAME



COMPONENT CLEARANCES		SYMBOL	DEVICE	INCHES	MM
<p>The table on the right lists the height above the surface of the circuit board of the indicated components.</p> <p>Allow 0.400 (10.0) below the circuit board for bottom-mounted components. Stand-offs 0.500 (12.7) in length are recommended.</p>		A	Gas sensor	0.400	10.2
		B	Calibration trimpot	0.200	5.0
		C	Reset pushbutton	0.550	14.0
		D	Beeper	0.375	9.5
		E	LED	0.550	14.0
		F1	SPST relay	0.285	7.3
		F2	SPDT relay	0.375	9.5
		G1	Radial power jack	0.425	10.8
		G2	Integrated connector	0.175	4.5
		H	Terminal block	0.315	8.0

3.2 – PHYSICAL DIMENSIONS - ENCLOSED

FIGURE. 3.2.2.1 – Enclosure dimensions (“K3” connector shown)

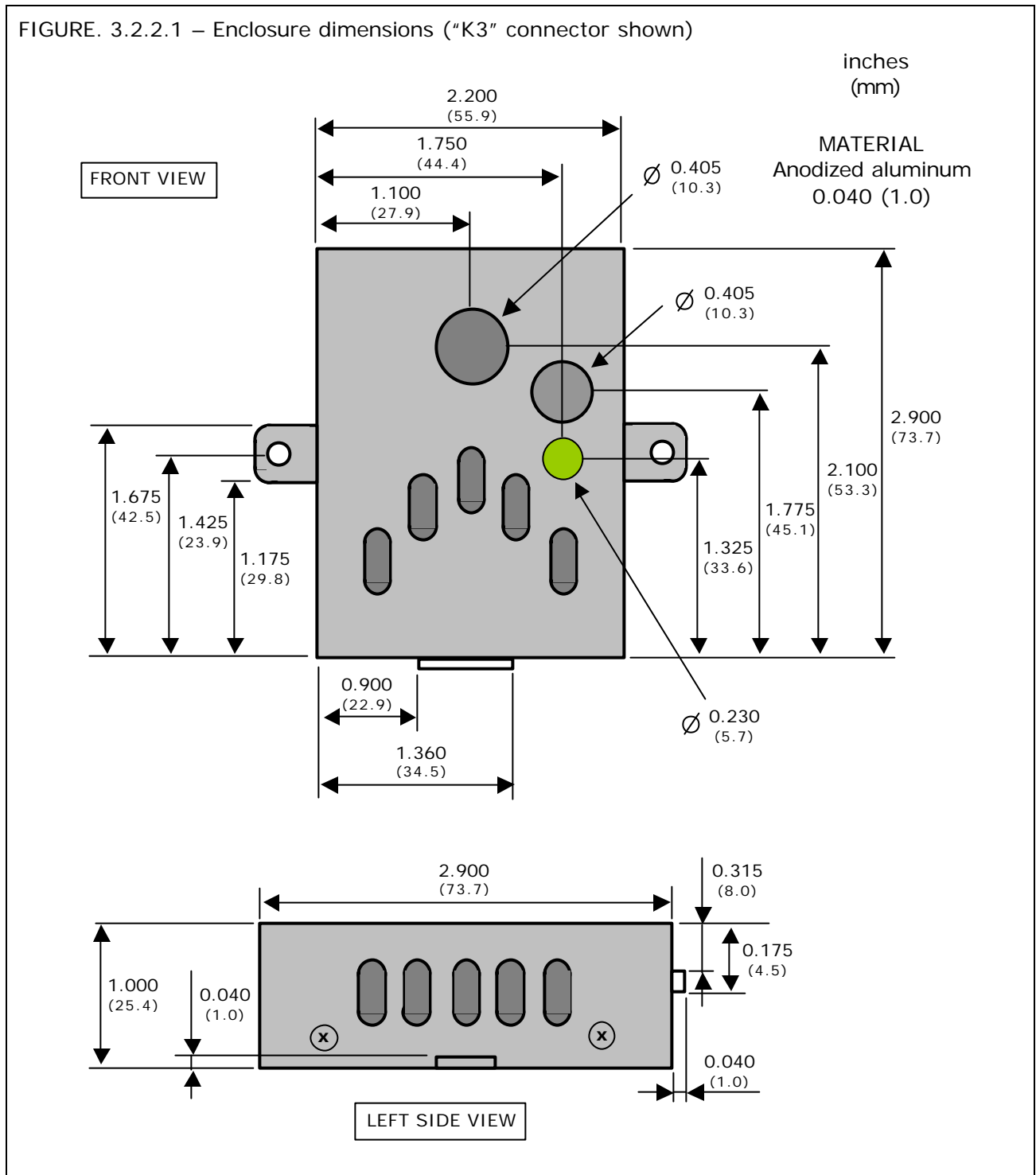
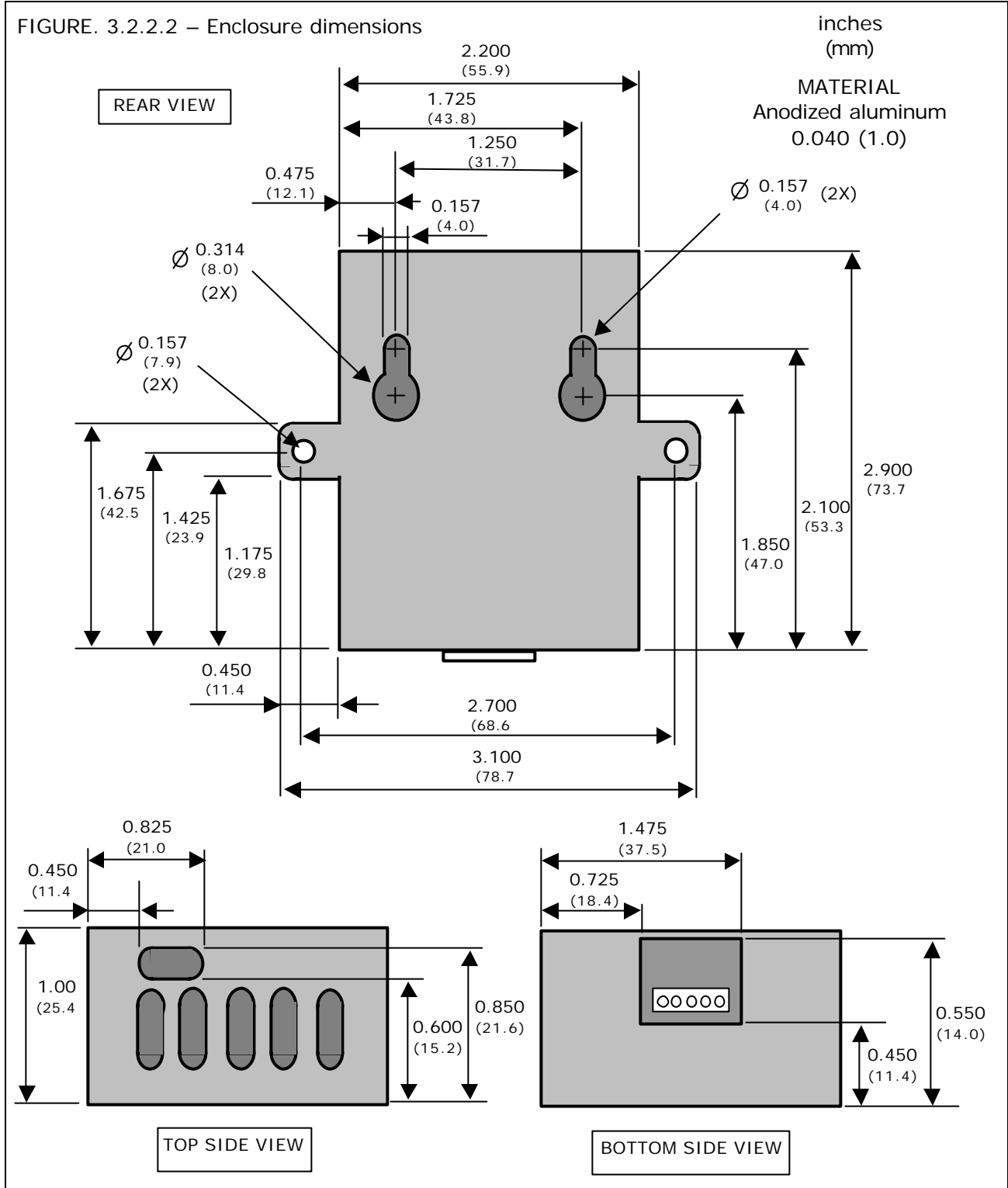
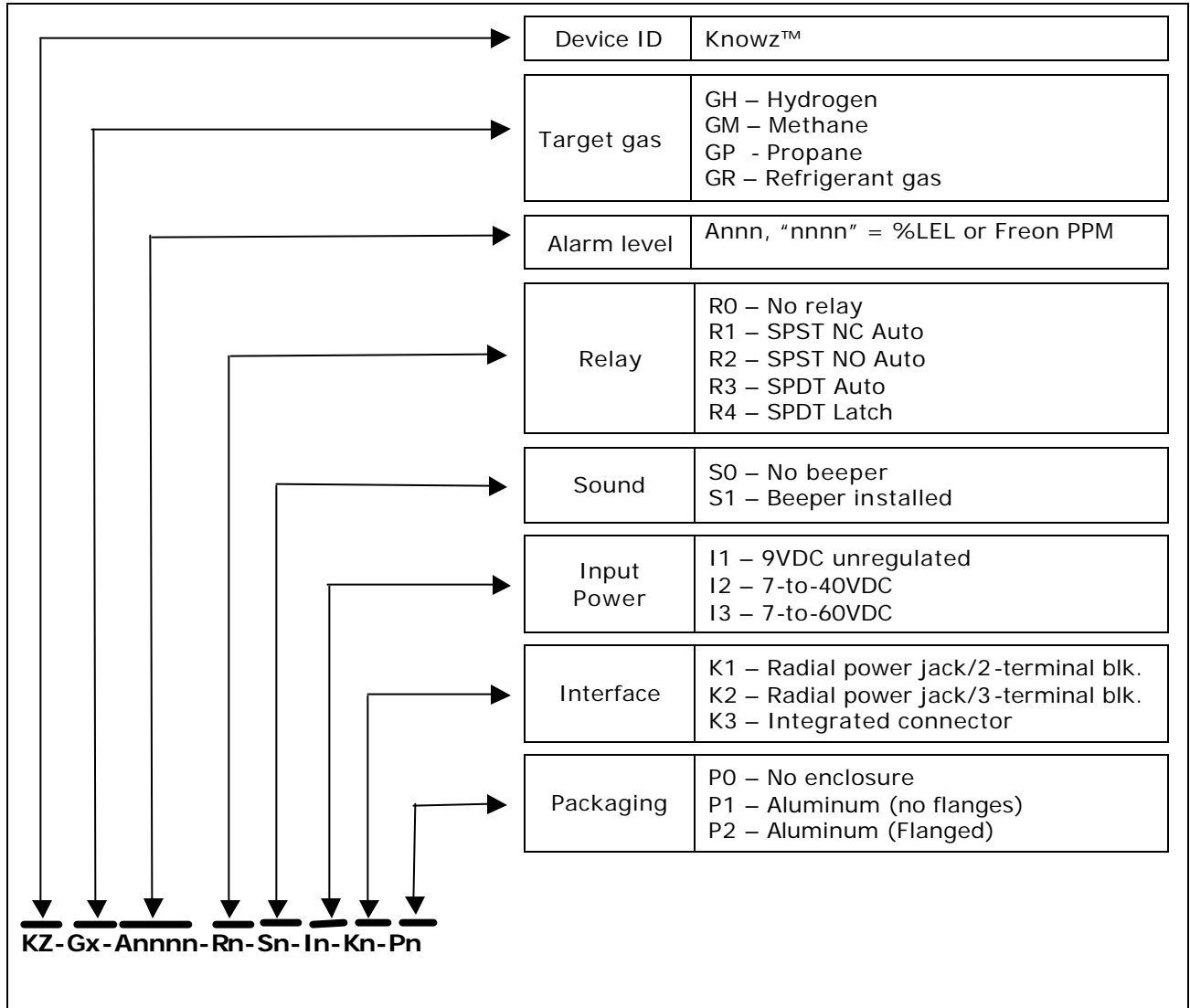


FIGURE. 3.2.2.2 – Enclosure dimensions



4 – SALES & TECHNICAL SUPPORT

4.1 – PART NUMBERING



4.2 – CONTACT INFORMATION

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