

T H E R M O M E T R I C S
A C O M M I T M E N T T O E X C E L L E N C E

Combination Sensor

Relative Humidity, Temperature,
Manifold Pressure and
Barometric Pressure



Thermometrics Combination Sensor is a smart combination intake manifold sensor capable of providing up to five measurements, including manifold humidity, manifold temperature, manifold pressure atmospheric pressure and atmospheric temperature. This sensor is designed for transportation applications that demand highly accurate and reliable measurements, with typical application within the intake air duct. Unique technology designed into the sensor provides unsurpassed accuracy in the marketplace.

Applications

- Heavy duty diesel engines
- On-road applications
- Off-road applications
- Generator sets

Features

- High accuracy temperature, pressure and humidity sensing elements
- CAN2.0 Communication per J1939
- Rugged design incorporates sensing elements with demonstrated reliability
- Customizable connector and mounting

Performance Specifications

Maximum Range

Ratings	Min	Max	Unit
Storage Temperature	-55	105	°C
Operating Temperature	-40	125	°C
Pressure	0	30	psi
Relative Humidity	0	100	%

Electrical Performance

Characteristic	Min	Typical	Max	Unit
Supply Voltage	8	12 or 24	32	Volts
Current Consumption		14	60 ¹	mA

1. Environmental recovery mode.

CAN Bus

Characteristic	Min	Typical	Max	Unit
Differential Output Voltage – Dominant ¹	1.5		3	V
Differential Output Voltage – Recessive ¹	-0.012		0.012	V
Voltage Range – CANH/CANL	-27		40	V
Voltage Input, Transient Pulse – CANH/CANL ²	-200		200	V
Unique Source Address ³		0xEB		
Bit Rate		250		Kbps
Update Rate (Repetition Rate)		100		ms

1. $R_L=60\Omega$.

2. Tested in accordance with ISO 7637, test pulses 1, 2, 3a, 3b, 5, 6 and 7.

3. Custom values are available.

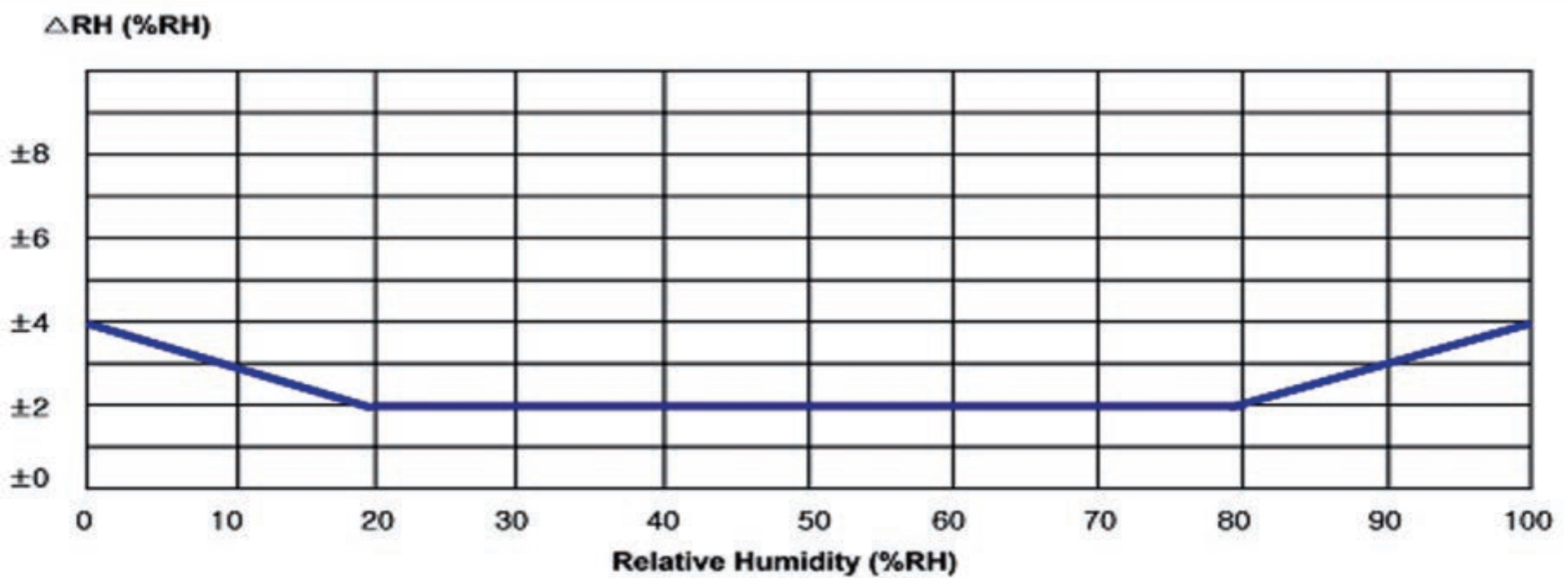
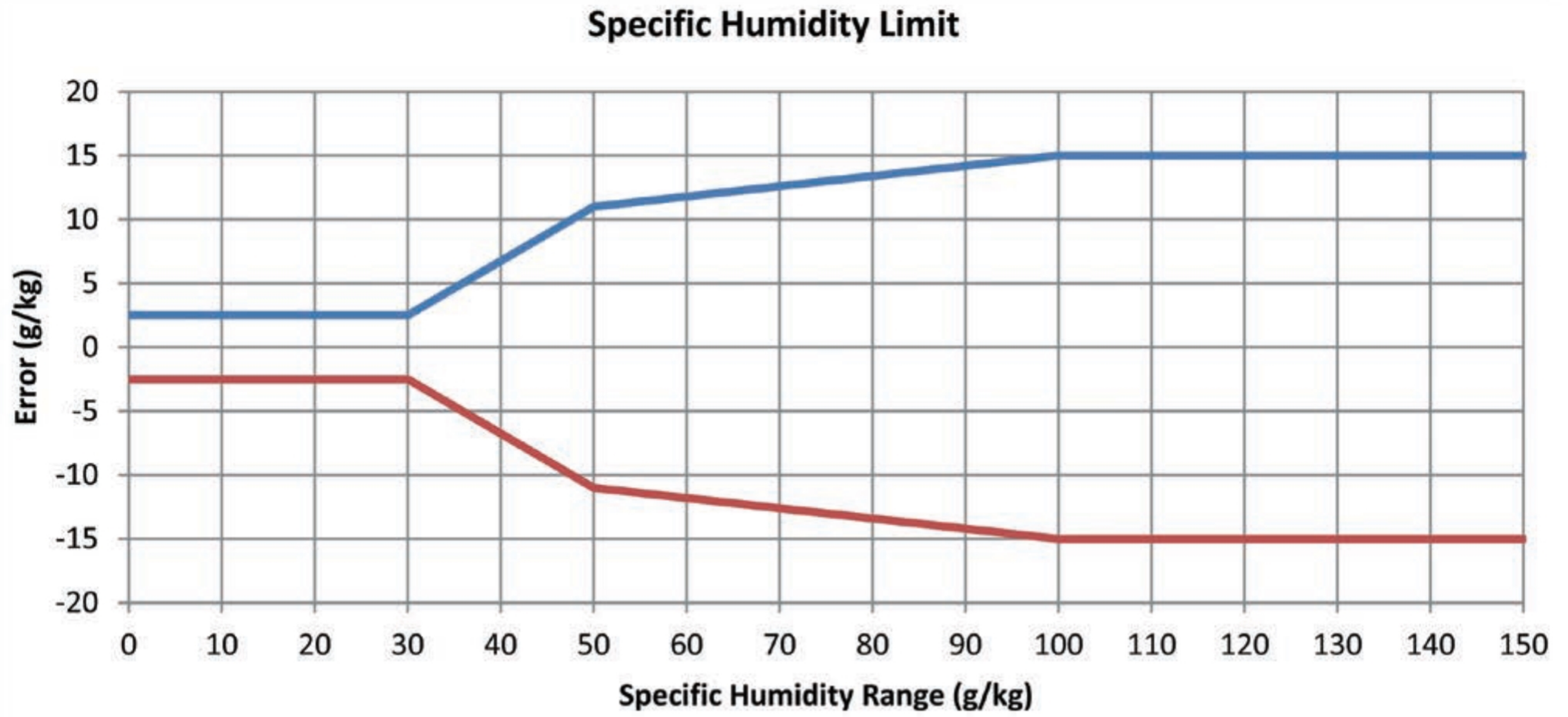
Humidity Performance

Characteristic	Min	Typical	Max	Units
Relative Humidity Accuracy ¹		±2	±4	%
Relative Humidity Response Time (τ 63%) ²		7	20	sec
Long Term Drift			0.5	%RH/YR
Specific Humidity Accuracy 100 to 150g/kg ¹			±15	g/kg
Specific Humidity Accuracy 30 to 100g/kg ¹		±11		g/kg
Specific Humidity Accuracy 0 to 30g/kg ¹			±2.5	g/kg

1. All operating conditions.

2. Measured at 25°C 1m/sec airflow from 33%RH to 90%RH.

Performance Specifications - continued



Pressure Performance

Characteristic	Min	Typical	Max	Unit
Barometric Pressure Accuracy – Ambient/Connector ^{1, 2, 4} (Full Scale)			±1.5	%
Manifold Pressure Accuracy – Ambient/Connector ^{2, 3, 4} (Full Scale)			±1.5	%
Manifold Pressure Accuracy relative to Barometric Pressure (Optional) ^{3, 5}		±0.1	±0.5	kPa
Pressure Response Time (τ 63%)		0.2	0.4	sec

1. Optional measurement
2. 15kPa to 120kPa Calibration Range. Custom ranges are available.
3. Pressure drop from ambient to manifold (tip) 0 to 15kPa max when using built-in optional barometric pressure sensor. Custom ranges are available.
4. All operating conditions.
5. Using barometric pressure option allows improved accuracy for measurements of pressure drop between barometric and manifold pressure.

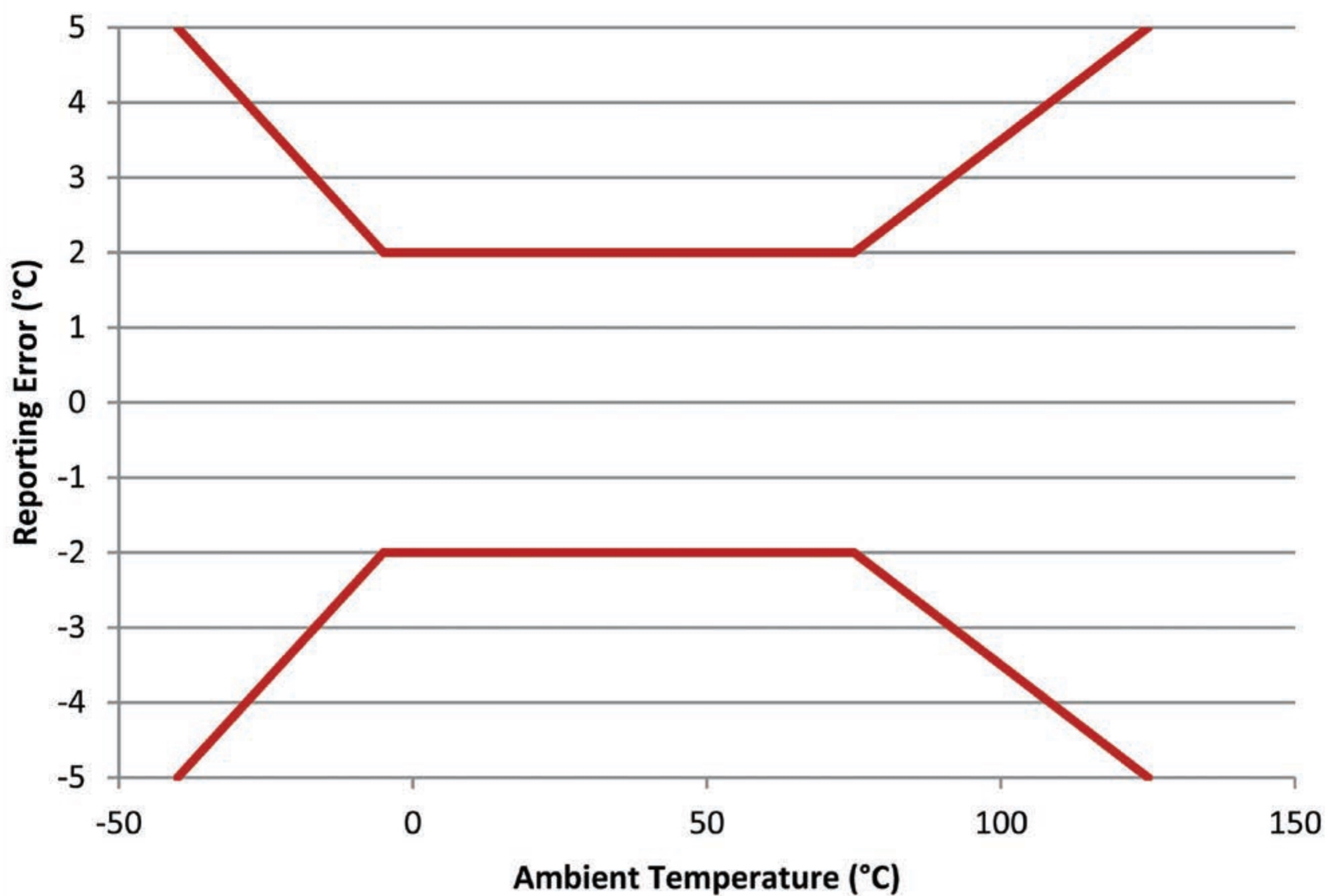
Performance Specifications - continued

Temperature Performance

Characteristic	Min	Typical	Max	Unit
Temperature Accuracy – Manifold/Tip		<±2	±5	°C
Temperature Response Time – Manifold/Tip (τ 63%) ¹		30	40	sec
Temperature Accuracy – Ambient/Connector		<±4	±5	°C
Temperature Response Time – Ambient/Connector (τ 63%) ¹		300		sec

1. 5m/s Airflow

Temperature Accuracy



CAN Communication

The sensor's 4-pin connection provides a CAN 2.0B and J1939 compliant interface. The standard bit rate and update rates may be customized per customer requirements. Sensor measurements are communicated using the following CAN messages:

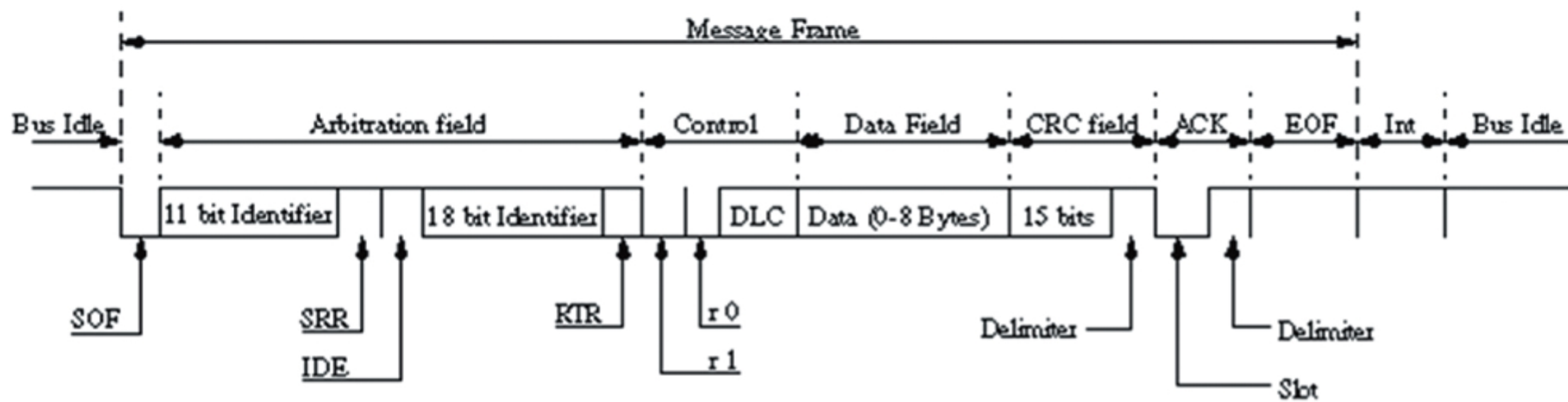
SPN	Parameter	Details
MESSAGE #1		
354	Relative Humidity	Data Length: 1 byte Resolution: 0.4 %/bit, 0 offset Data Range: 0 to 100 %
1172	Engine Turbocharger1 Compressor Intake Temperature	Data Length: 2 bytes Resolution: 0.03125 °C/bit, -273 °C offset Data Range: -273 to 1734.96875 °C
1176	Engine Turbocharger1 Compressor Intake Pressure	Data Length: 2 bytes Resolution: 1/128 kPa/bit, -250kPa offset Data Range: -250 kPa to 251.99 kPa
4490	Specific Humidity	Data Length: 2 bytes Resolution: 0.01 g/kg per bit, 0 offset Data Range: 0 to 642.55 g/kg
NA	Statuses Message	8 internal diagnostic messages
MESSAGE #2		
5581*	Calculated Ambient Air Temperature	Data Length: 2 bytes Resolution: 0.03125 °C/bit, -273 °C offset Data Range: -273 to 1734.96875 °C
5685*	Barometric Absolute Pressure (High Resolution)	Data Length: 2 bytes Resolution: 0.1 kPa/bit, 0 offset Data Range: 0 to 6425.5 kPa

* Optional Measurements

Status messages used for self-diagnostic are available upon request.

CAN 2.0B Message Structure

Data is transmitted and received using Message Frames, which carry data from a transmitting node to one, or more, receiving nodes. The CAN protocol supports the Extended CAN (Version 2.0B) Message Frame format.



CAN 2.0B Format Message Frame

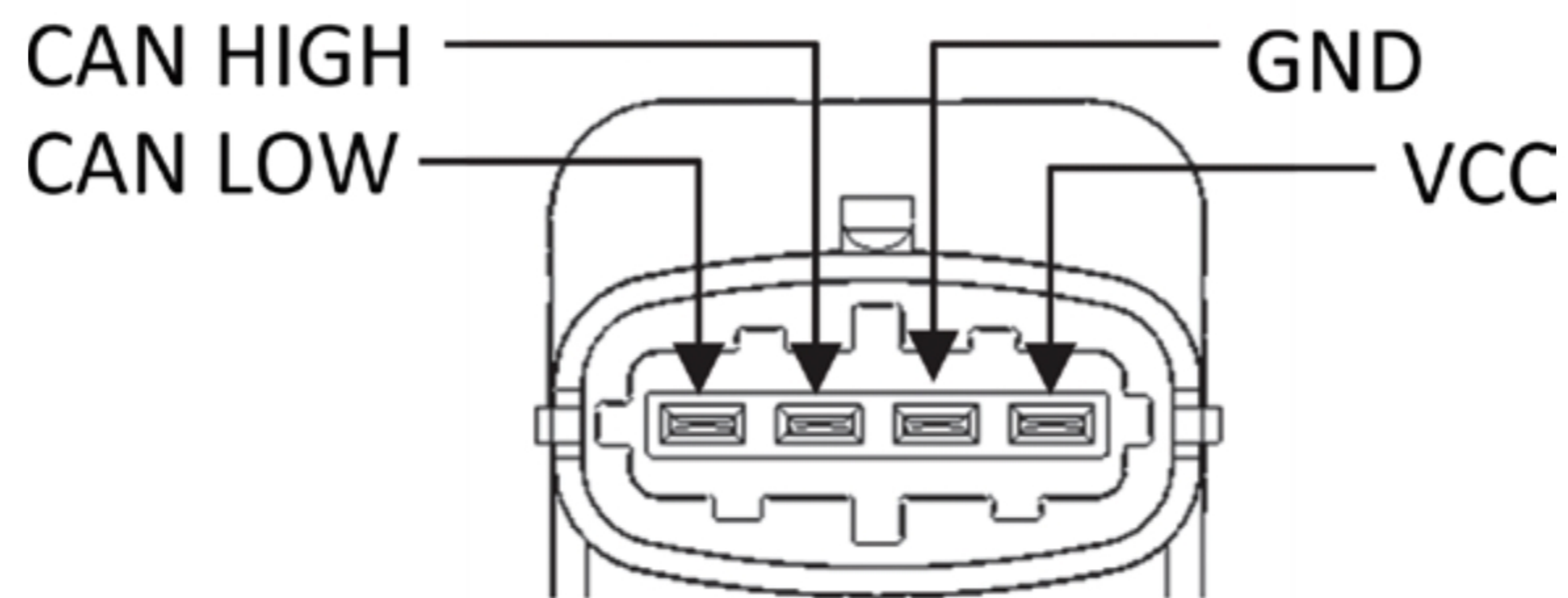
The CAN 2.0B format provides a twenty nine (29) bit identifier.

Mechanical Specifications

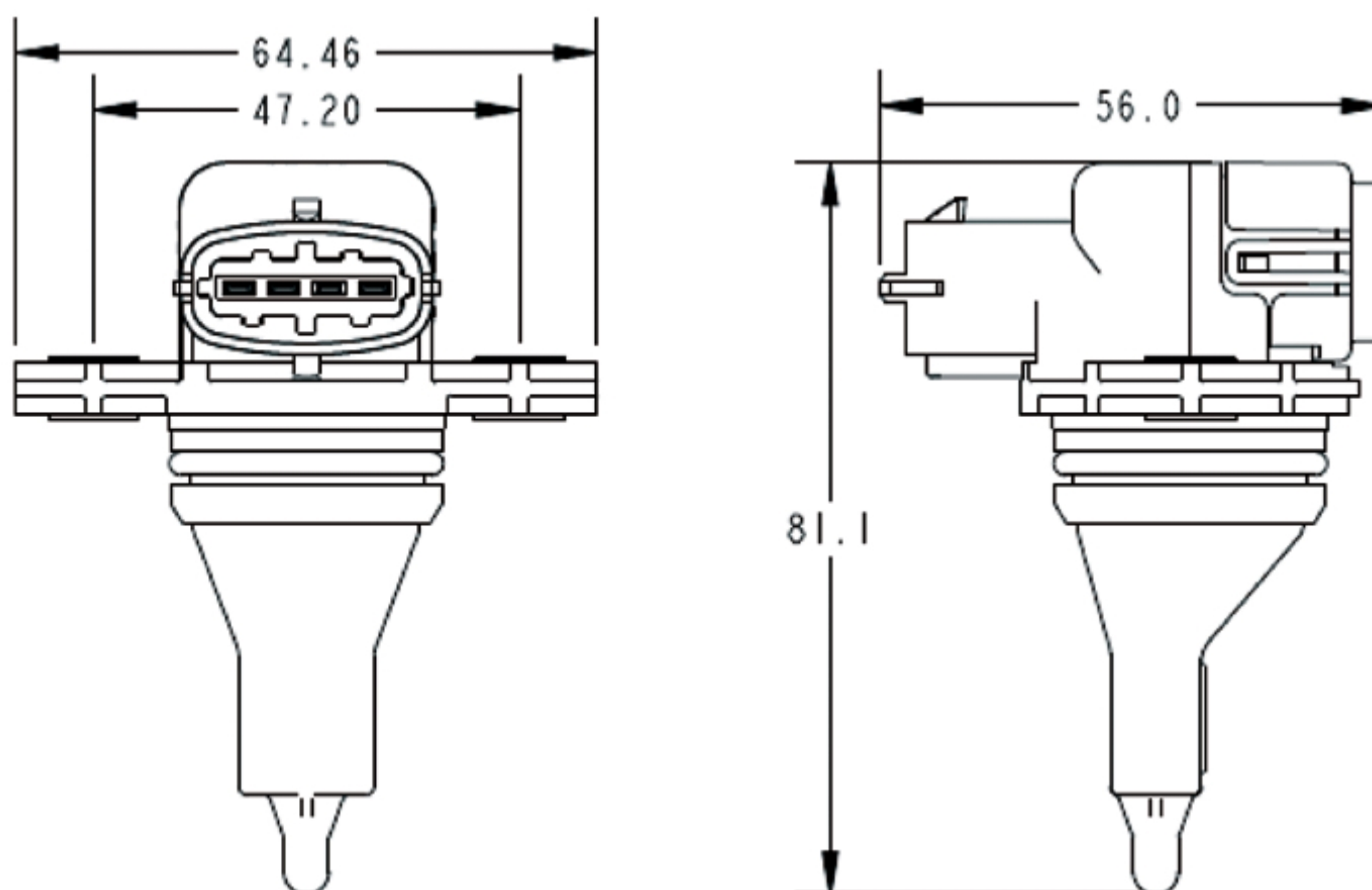
Connector Type	Bosch compact 1.1m 1 928 403 736 with BDK 2.8 gold plated terminal
Mating Connector	Bosch compact PN 1 928 403 736
Housing Material	PBT 30GF BLACK
Mass of Sensor	56 grams

CAN 2.0B Mechanical Specifications

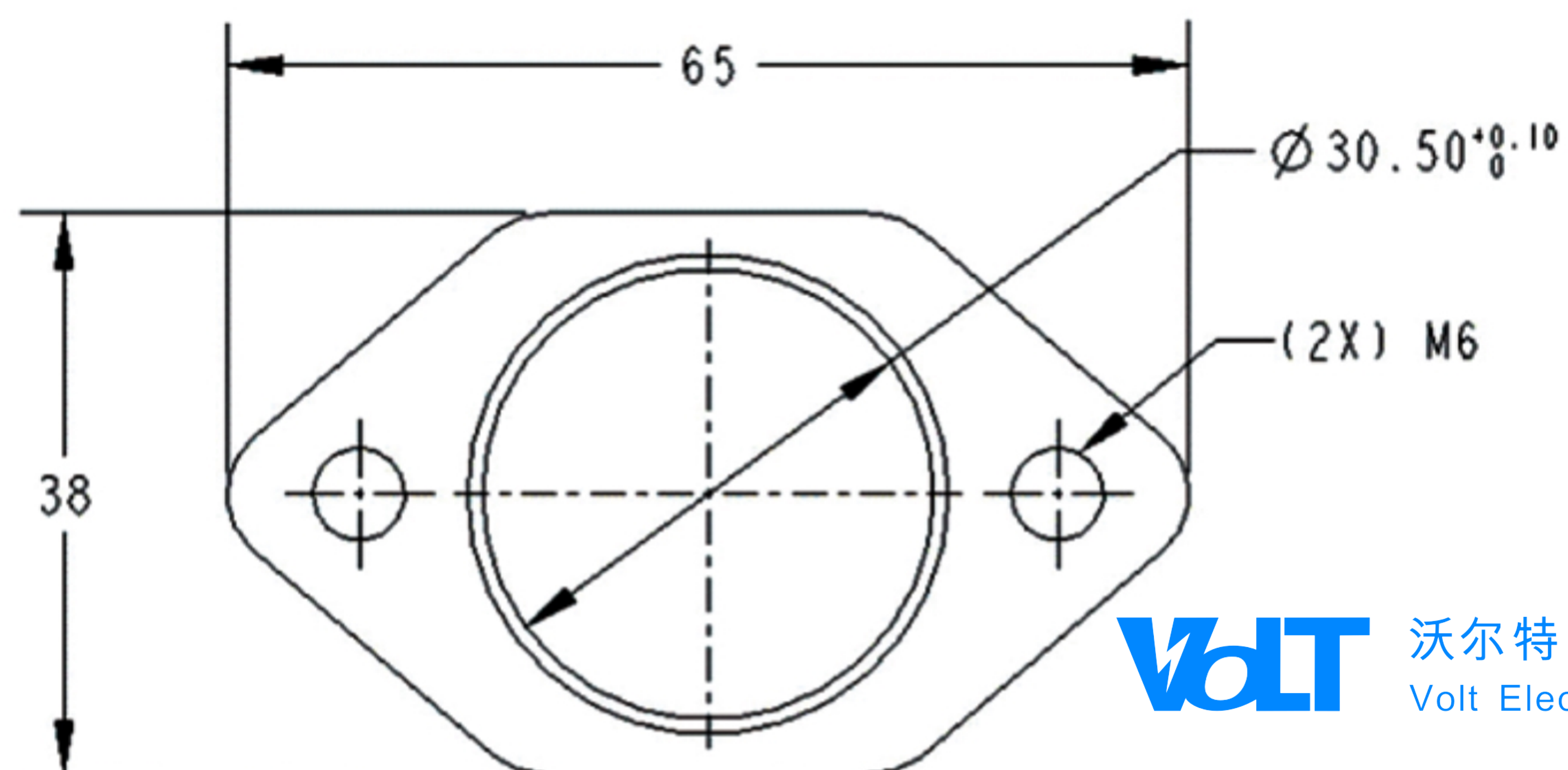
Connector Pin Out:



Housing Detail:



Mating Geometry:



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