CELL GUARD

Manual

Generation 1

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Revision History

Revision	Comment	Author	Date
0.1	Creation of Document – Draft (missing CAN messages details)	Joe Holdsworth	21-Mar-2022
0.2	Production pre release	Joe Holdsworth	20-Sep-2022
1	First Release	Joe Holdsworth	22-Sep-2022
1.1	Change default CAN speed to 500kbps, notes on alerts for gas	Joe Holdsworth	30-Sep-2022
1.2	Added wiring example	Joe Holdsworth	06-Feb-2023
2.0	Rename to Cell Guard install for energy storage systems	Joe Holdsworth	29-Mar-2023
3.0	Renaming of CAN messages	Joe Holdsworth	17-Apr-2023

Contents

System Overview

Cell Guard is a CAN based sensor that can measure absolute pressure, air temperature, Volatile Organic Compounds (VOC's), absolute air water content, relative humidity, dew point temperature and acceleration.

The configurable CAN bus speed and address along with the supplied CAN DBC file allows easy integration into almost any battery systems to detect early failures due to cell venting or formation of moisture within a battery pack. The unit features a low power mode in which it monitors the environment but does not transmit on CAN unless a threshold is reached at which point it reverts to normal mode. It also features a low side drive function pin capable of 500mA that can be triggered if a programmable threshold is reached.

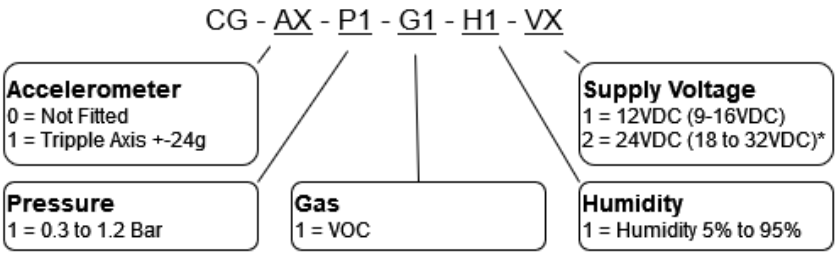
The 5-pin automotive rated Molex Nano-Fit Power connector, small size and mass allows easy interface into most vehicles and energy storage systems. The unit is developed in accordance with ISO26262 and has been tested to automotive standards which include: ISO7637-2 2011, ISO 17650- 2 2012 and ISO 17650-4 2010.

Sensor Options

Part Number Ordering Details

Default Part Number: **CGA0P1G1H1V1**

*18 to 32VDC is not tested to ISO standards



Unit Specification

Sensor

Pressure Sensor	Range	0.3 to 1.2	Bar
	Resolution	0.0001	Bar
	Accuracy (0.3 to 1.1 Bar)	0.0005	Bar
	Max Update Rate	50	Hz
Air Temperature [1]	Range	-40 to 125	˚C
	Resolution	1	˚C
	Accuracy	1 (2 at 24VDC)	˚C
	Max Update Rate	5	Hz
Volatile Organic Compounds (VOC's)	Range	0 to 65535	Raw
		0 to 6553.5	ppm
	Accuracy (Worse Case)	15 [2]	%
	Max Update Rate	1	Hz
Absolute Humidity [3]	Range	0 - 35000	mg/m^3
	Resolution	70	mg/m3
	Accuracy (Worse Case)	3	%FSS
	Max Update Rate	5	Hz
Dew Point	Range	0-100	˚C
	Resolution	0.5	˚C
	Accuracy (Worse Case)	-2	˚C
	Max Update Rate	5	Hz
Relative Humidity	Range	0-100	%
	Resolution	0.5	%
	Accuracy (Worse Case)	-2	%
	Max Update Rate	5	Hz
Accelerometer [4]	Range	-24 to +24	g
	Resolution	0.001	g
	Accuracy (Worse Case)	0.01	g
	Max Update Rate	400	Hz

TABLE 1 SENSOR PERFORMANCE

Environmental

Environment	[5] Operating temperature	-20 to +70	˚C

TABLE 2 ENVIRONMENTAL PERFORMANCE

Mechanical

Mass		15	grams
Dimensions	Height x Width x Length	11.5x55x63	mm

TABLE 3 MECHANICAL PERFORMANCE

Electrical

CAN	Baud Rates [6]	1000, 500, 250, 125	kbps
	Address Range [7]	1 (0x01) to 2042 (0x7FA). Default = 0x30A	decimal (Hex)

Power	Voltage Range	9 to 16 (18 to 32 for 24V Ver)	V
	Current (silent mode/low power)	35mA (7.5 mA)	mA @ 12V
Output Pin	Voltage Range [8]	9 to 32	V
	Current	500	mA
	Type	Low Side Drive	NA

TABLE 4 ELECTRICAL PERFORMANCE

Connection

Connector	
MF (family)	Molex (Nano Fit)
On Unit	1053131205
Mating	1053071205
Crimp	1053001200
Pin Outs	
Pin No.	**Function**
1	Ground
2	Supply Voltage
3	CAN Low
4	CAN High
5	SW Configured Function [9]

TABLE 5 CONNECTION INFORMATION

[1] Air Temperature accuracy is dependent on installation, heat from the sensor itself can affect this

[2] % of meas. value, sensor drift is 1.3% of measured value per year of operation, 90% of the sensors will be within the typical accuracy tolerance

[3] Humidity accuracy valid from 0 to 80 deg C IC temperature

[4] Not normally fitted, only on variant with accelerometer option selected

[5] For the VOC the stated accuracy is achievable between -10 and 50 deg C. Nominal max temperature range is -20 to 55degC for maximum life, absolute max for sensor die temperature is 70 deg C (air temp can be greater)

[6] The default settings are 500kbps and start address 778 (0x30A), the unit has no CAN termination

[7] The unit uses 4 CAN address which are in consecutive order from address that the unit is set to

[8] the function pin is protected to transients up to 40VDC but is not current limited, please ensure load is not above 500mA

[9] The function of this pin is assigned when configuring the unit please refer to the manual

Mating Connector

Manufacturer: Molex

Family: Nano-Fit

Part No.: 1053071205

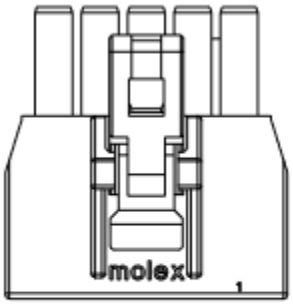


FIGURE 1 MATING CONNECTOR - PIN 1 IS RIGHT HAND SIDE (TOP-DOWN VIEW)

Crimps

Crimp Part No. : 205300-XXXX

Crimp Tool Part No.: 638276000

Nano-Fit Terminal Position Assurance (TPA) Retainer Part No.: 105325-XXXX

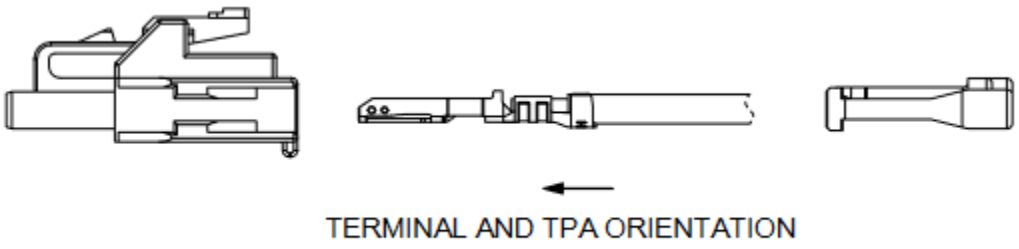


FIGURE 2 CONNECTOR CRIMP DETAILS

CAN Termination

The unit does not have a termination resistor.

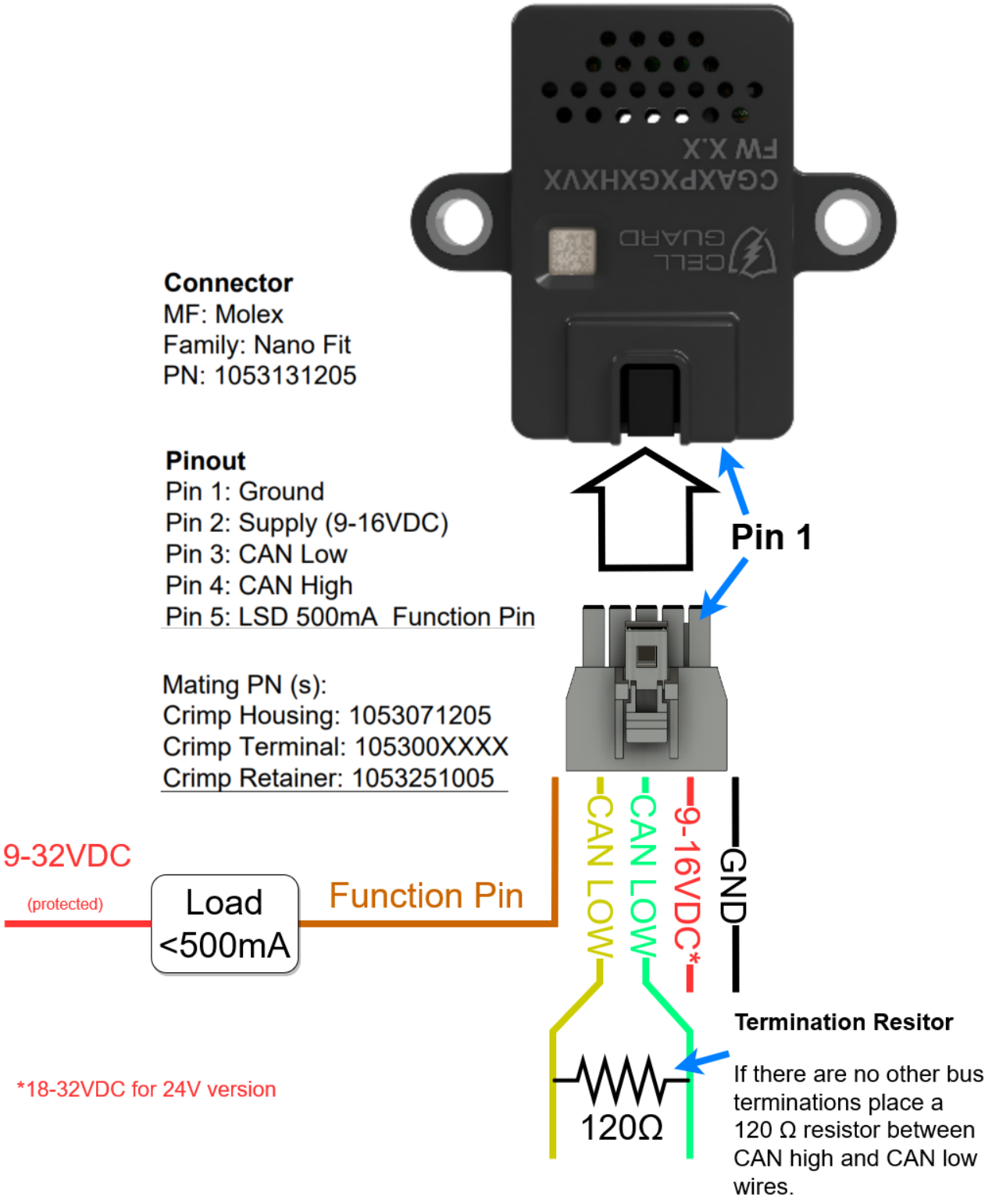


FIGURE 3 WIRING EXAMPLE

Mechanical

Mounting

Mount using 2 x M5 bolts with torque setting 4Nm for dry (3Nm Lube).

Mount near breather port (if possible and fitted) and/or where vented gases are expected to travel. Mount so moisture does not pool around sensor. Mount away from anticipated direction of cell vent (not directly over the venting cell).

Recommend 1 sensor per 80 liters of free air volume or 1 per half height 19 inch rack.

Dimensions

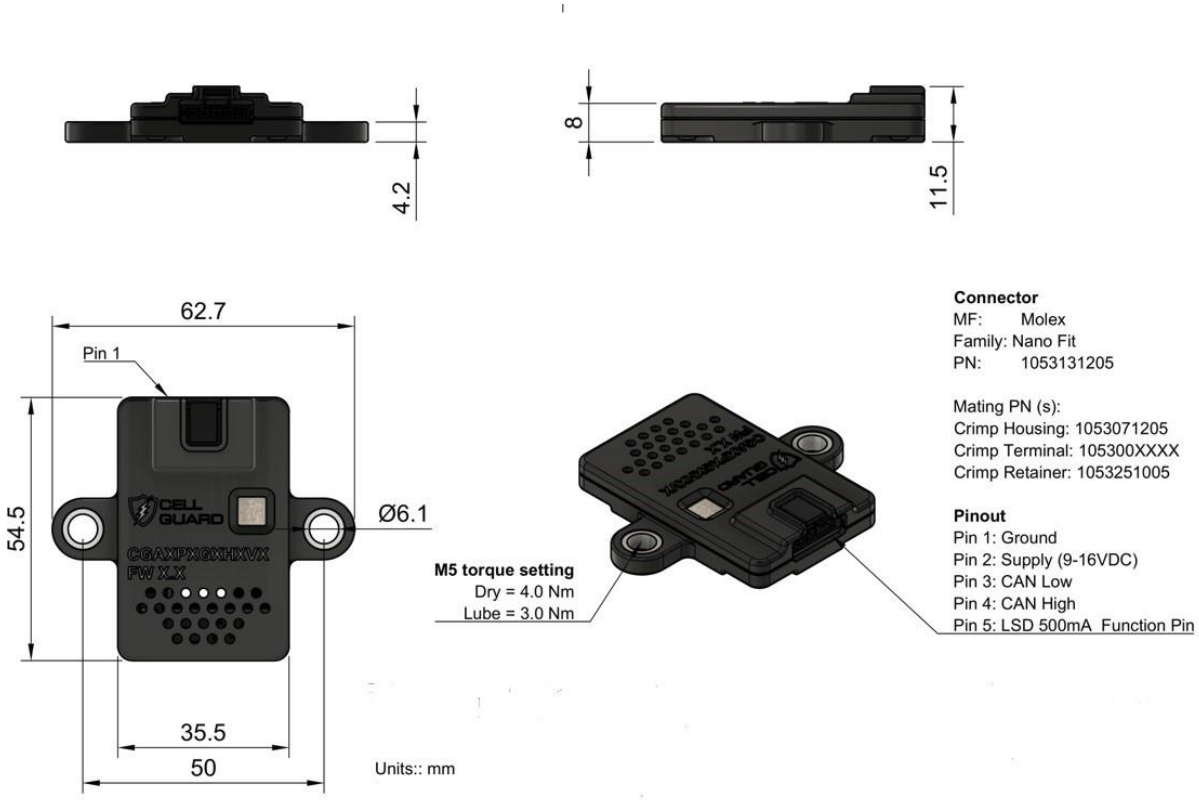


FIGURE 4 SENSOR DIMENSIONS

Suggested Installation

Install inside the battery enclosure near breather port (if fitted), avoid installing where moisture might pool, do not install immediately in path of anticipated battery vent direction (this may damage the sensor before it can detect a vent).

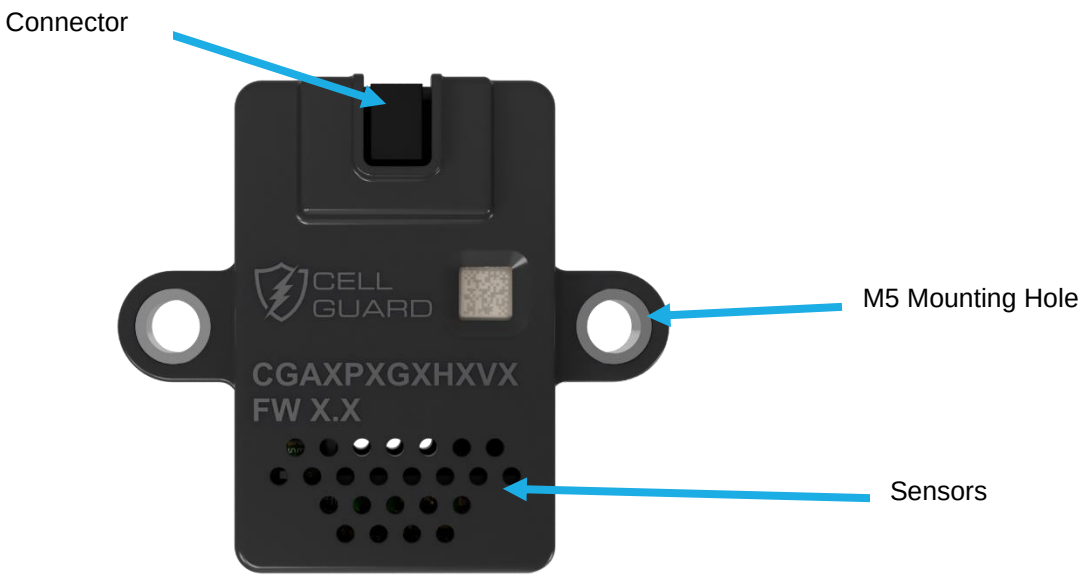


FIGURE 5 EXTERNAL FEATURES

Quick Start Guide

This section gives a quick overview of how to change settings on the device.

To see Default settings the unit ships with, please refer to the CAN Message Summary section.

Step 1: Power Up Unit

Make sure power and CAN is connected to the device using the pin outs as previously described in table 5.

If the CAN bus is unterminated or the unit is the only node on the CAN bus, please place a 120Ohm resister between CAN high and CAN low lines.

Apply 9-16VDC to the unit with a supply capable of 50mA.

Step 2: Connect CAN Tool

1. Ideally use a CAN tool such as PCAN or CANalyser.
2. Make sure the CAN bus connection settings in the tool match the settings specified in the unit's default settings section e.g. 11bit address and 1MBit CAN bus speed.
3. Import the unit's DBC or symbols file into the CAN tool.
4. Start the CAN interface on the computer.
5. If connection is successful, the CAN Heartbeat message will appear from the unit. If not, then check the following.
    a. The unit has power.
    b. The CAN connection settings are correct.
    c. The CAN bus is terminated correctly.
    d. The CAN high and low lines are the correct way round.

Below shows the default message output from the unit. **Please take note of the Unique ID value and the Key value**. these will be required when entering setup mode or saving any changes to the setup. Please be aware that the key value changes each time a valid enter setup command has been received.

CAN-ID (hex)	Len...	Symbol	Data	Cycle Ti...	Count
30A	8	BSS_Config.x00_Heartbeat	Unique_ID = 4315220 Key = 34039 Unit_ID = 0 Fault_VOC = OK Fault_Humidity = OK Mode = Normal Mode Fault_EEPROM = OK Fault_Pressure = OK Alert_Flag = Off	999.0	10256
30B	8	BSS_Gas	Gas_Raw_ADC = 29396 count VOC_Calculated_ppm = 0.3 ppm Fault_Gas_Sensor_Error_Code = 0 VOC_ppm_Ready = True Alert_Flag_VOC = Off Alert_Flag_Gas_Raw = Off	999.0	10256
30C	8	BSS_Moisture_and_Temp	Air_Temperature = 25 deg C Absolute_Humidity = 9472 mg/m^3 Dew_Point_Temperature = 10.5 deg C Relative_Humidity = 38.5 % Fault_Humidity_Chk_Sum = OK Fault_Humidity_Cmd = OK Humidity_Rst_Detected = False Humidity_Heater_On = False Fault_Humidity_Sensor_Comms = OK Alert_Flag_RH = Off Alert_Flag_Dew_Point = Off Alert_Flag_Temperature = Off	200.0	51284
30D	5	BSS_Pressure	Absolute_Pressure = 1026.056 mBar Fault_Pressure_Last_Update = OK Fault_Pressure_Sensor_Comms = OK Alert_Flag_Pressure = Off	8.8	979502

FIGURE 6 DEFAULT CAN MESSAGE OUTPUT

Step 3: Enter Setup Mode

1. The Heartbeat message should give:
    a. A Unique ID value.
    b. A Key value.
    c. The unit ID sending the heartbeat message.
    d. The run mode - this should be ‘Normal’ if the unit has just powered up.
    e. Unit fault information
    f. Alert flag if a threshold has been exceeded, by default alerts are turned off to begin with.
2. Take note of both the Unique ID value and the Key value.
3. Create a Setup Mode message as defined in the CAN DBC, this message is multiplexed with the units heartbeat message.
4. Populate the Unique ID and Key field in the setup message with the values noted from the heartbeat message.
5. Send the ‘Enter Setup Mode’ Command to the unit -this should only be sent once.
6. The next Heartbeat message received from the unit should have the run mode changed to ’Setup mode’. If does not happen check your unique ID and Key value match those in the heartbeat message.
7. Once in setup mode the unit can be configured.
8. Any changes that have been made will not be applied until a ‘Save Setup’ command has been sent.
9. To cancel any changes prior to the ‘Save Setup’ command, send the ‘Cancel Setup’ command or power cycle the device.

Step 4: Change a Setting

To change a setting the unit has to be in setup mode, once in setup mode send the correct CAN message to the unit, for example to change the CAN start Address send *x0F_Cmd_Set_CAN_Start_Address* making sure the unit unique ID field is set correctly and the CAN address field is set correctly. Once the message is sent a confirmation *x10_Resp_CAN_Start_Address* message will be sent back from the sensor confirming the change.

Step 5: Save Setup

To apply any configuration changes, send the ‘Save Setup’ command with the Unique ID and Key value field populated with the current value in the heartbeat message.

Note: The Key value changes each time a successful message has been received, any changes to the unit will not be applied until a ‘Save Setup’ command has been sent.

Step 6: Reset to Factory Defaults

To restore factory settings, send a reset to factory settings CAN message to the unit.

Step 7: Calibrate the Sensors

The unit comes factory calibrated. It is still possible to alter the baseline reading for the VOC parts per million calculations, this can be done through the CAN interface once in setup mode.

Power Modes

There are 2 power modes which can be set by sending the ***x12_Cmd_Set_Low_Power_Mode*** command to the unit, unlike every other setting on the unit, the unit does **not** need to be in setup mode for these commands to work. On power cycle the unit will always default to normal mode.

1. **Normal** – the unit will transmit data at each sensors set update rate.
2. **Low power –** the unit turns stops transmitting CAN data until it is commanded back to Normal mode, power cycled or if a threshold has been configured and is detected.

Threshold Detection and Alerts

The unit supports threshold detection of certain parameters. By default, threshold detection is turned off, to configure threshold detection the unit must be in setup mode which is accessed via a CAN command.

Parameters Supporting Threshold Detection

1. Pressure
2. VOC ppm
3. VOC Raw ADC
4. Relative Humidity
5. Dew Point
6. Air Temperature

Once a threshold has been detected and if the function is enabled, the relevant threshold flag will be set in the CAN messages. If the unit is in low power mode it will wake up, if the alert IO is turned on for that parameter the function pin will trigger.

Alert Flag Types

1. Off – not enabled
2. On – threshold flag and if set IO will trigger if threshold is reached, flag and IO will clear once value falls below the threshold.
3. Latching - threshold flag and if set IO will trigger if threshold is reached and will not clear unless a CAN command is sent to the unit. The flag will also be set between power cycles.

Setting a Threshold, Alert & Function Pin

There are several options when setting threshold detection for each parameter, the first thing is to establish the threshold values, these do not all have to be populated as they are enabled or disabled via flags.

Threshold Types

1. Maximum value above which alert flag will be set
2. Minimum value below which alert flag will be set
3. Rate of change between readings above which alert flag will be set (the rate of change can be negative as well as positive)

Alert Flag

An alert flag setting is available for each threshold type (min, max, rate of change) and can be set to off, on, or latching.

Function Pin

The function pin can be set to on or off and if on will trigger if any of the alert flags are on (i.e. a threshold is detected), the pin is a low side drive capable of 500mA, it is not current limited so please ensure that the load is not more that 500mA, maximum withstand voltage is 40VDC.

Gas Threshold Detection Notes

The function pin and alerts for the gas sensor will only become operable after the sensor is ready (after ~20 seconds of power being applied).

CAN Message Format

Can Messages Identifier: 11bit

Data Format (all messages): Intel.

Termination: Unterminated (no 120 Ohm termination resistor)

Default CAN Bus Speed: 1MBps

Default CAN Start Address (decimal): 0x30A (778)

CAN Message Summary

The unit uses up to 4 CAN message ID's.

Default CAN Address Hex (Decimal)	Message Name	Description	Default Frequency Sent from Unit (milliseconds)	Frequency To Unit (milliseconds)
0x30A (778)	CG_Config	Used to send and receive configuration settings and values from the unit. This address is also used by the unit to send its heartbeat message. Functionality is selected by changing the multiplexor value field in this message	1000ms (Heartbeat)	User dependant
0x30B (779) [1 + Config Address]	CG_Gas	VOC ppm, raw value and sensor status	1000ms	NOT APPLICABLE
0x30C (780) [2 + Config Address]	CG_Water_and_Temp	Absolute humidity, dew point, relative humidity output, air temp and sensor status	200ms	NOT APPLICABLE
0x30D (771) [3 + Config Address]	CG_Pressure	Absolute pressure output and sensor status	20ms	NOT APPLICABLE

TABLE 6 CAN MESSAGE OUTPUT SUMMARY

CG_Config (0x30A[default])

Configuration CAN Message

CAN Address: Please see unit's default CAN start address details in the CAN Message Format section.

Overview: This CAN message is used to send configuration commands to the unit and is also used to receive configuration data from the unit and a heartbeat message with an overview of the units status.

Format: Intel

Layout:

Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit integer	Unique ID	The unit's unique identifier, enabling the user to distinguish between multiple units on the same CAN bus.
3	Unsigned 8 bit integer	Message Type	This field is a multiplexor used to identify the message type. Mux values 0x00(0) to 0x29 (41) are common across all units. Please refer to the common CAN message section. Mux values 0x30(42) to 0xFF (255) change depending on sensor type. Please refer to the unit specific CAN message section.
4-7 (length can vary depending on message type)	Variable	Variable	The remaining 4 bytes are used depending on the command or data being sent back from the unit, not all 8 bytes are populated in every message.

TABLE 7 CAN CONFIGURATION MESSAGE

CG_Config CAN Message Types

Overview: These are the multiplexor message IDs that populate byte 3 of the configuration CAN message. The multiplexor messages highlighted in grey cells only work if the unit is in Setup mode.

Hex (Decimal) Value	Purpose	CAN DBC Name	Description
0x00 (0)	Heartbeat	x00_Heartbeat	Message that gets sent out to indicate the unit is alive on the CAN bus, it's status and what the unit type is.
0x01 (1)	Enter Setup	x01_Cmd_Enter_Setup	Command sent to unit to put it into setup mode, **the unit needs to be in setup mode to make any configuration changes to the unit.**
0x02 (2)	Save Setup	x02_Cmd_Save_Setup	Command to save any configuration changes that have been made whilst the unit was in Setup mode. **To apply any configuration changes this needs to be sent!** The unit reboots after this message is received.
0x03 (3)	Cancel Setup	x03_Cmd_Cancel_Setup	Command to cancel any changes that have been made in the current Setup mode.
0x04 (4)	Reset Unit to Factory Defaults	x04_Cmd_Rst_to_Factory_Defaults	Resets the unit to factory defaults.
0x05 (5)	Power cycle device	x05_Cmd_Reboot_Device	Any settings not saved will be lost
0x06 (6)	Get Unit Statistics	x06_Cmd_Get_Info_and_Errors	Request that the unit sends its statistics
0x07 (7)	Reset Unit Statistics	x07_Cmd_Rst_Info_and_Errors	Request that the unit's statistics be reset
0x08 (8)	Get Unit ID	x08_Cmd_Get_Unit_ID	The unit replies with the current ID that has been set.
0x09 (9)	Set Unit ID	x09_Cmd_Set_Unit_ID	Sets the ID of the unit so if there is more than 1 unit on the CAN bus they can be distinguished.
0x0A (10)	Unit ID response	x0A_Resp_Unit_ID	The unit's reply to a request for its unit ID (this message is only used by the unit and should not be sent to the unit)
0x0B (11)	Get the CAN bus speed	x0B_Cmd_Get_CAN_Bus_Speed	Request the unit to send the current CAN bus speed. [1]
0x0C (12)	Set the CAN bus speed	x0C_Cmd_Set_CAN_Bus_Speed	Set the unit's CAN bus speed.
0x0D (13)	CAN bus speed response	x0D_Resp_CAN_Bus_Speed	The unit's response message indicating the current CAN bus speed.[1]
0x0E (14)	Get the CAN start address	x0E_Cmd_Get_CAN_Start_Address	Request the unit to send the current CAN start address. [1]
0x0F (15)	Set the CAN start address	x0F_Cmd_Set_CAN_Start_Address	Set the unit's CAN bus start address.
0x10 (16)	CAN bus start address response	x10_Resp_CAN_Start_Address	The unit's response message indicating the current CAN

			bus start address for the unit.[1]
Hex (Decimal) Value	**Purpose**	**CAN DBC Name**	**Description**
0x11 (17)	Get Low Power mode	x11_Cmd_Get_Unit_Mode	Gets the current unit mode
0x12 (18)	Set Low Power mode	x12_Cmd_Set_Unit_Mode	Sets the unit mode
0x13 (19)	Low Power mode response	x13_Resp_Unit_Mode	The unit's mode
0x17 (20)	Firmware Version	x17_Resp_Firmware_Version	The firmware version on the unit
0x18 (21)	Power Cycle Count	x18_Resp_Pwr_Cycle_Cnt	The number of times the unit has been turned on
0x1A (26)	EEPROM Write Count	x1A_Resp_EEPROM_Write_Cnt	The number of times EEPROM has been written to
0x1B (27)	MCU Statistics	x1B_Resp_MCU_Stats	Watchdog resets and other information
0c1C (28)	CAN Transceiver Statistics	x1C_Resp_CAN_Tran_Stats	Information on the CAN transceiver
0x20 (32)	Clear latched alert flags	x20_Cmd_Clear_Latch_Alert_Flags	Clear any latched alert flags
0x21 (33)	Clear latched alert flags command received	x21_Resp_Clear_Latch_Alert_Flags	Confirms that latched flag clear command has been received
0x30 (48)	Get the Gas sensor update rate	x30_Cmd_Get_Gas_Update_ms	Get Gas sensor update rate
0x31 (49)	Set gas sensor update rate	x31_Cmd_Set_Gas_Update_ms	Set Gas sensor update rate
0x32 (50)	The current update rate	x32_Resp_Gas_Update_ms	The gas sensor current update rate
0x33 (51)	Get the Water and Temperature sensor update rate	x33_Cmd_Get_W_and_T_Update_ms	Get Water and Temperature sensor update rate
0x34 (52)	Set Water and Temperature sensor update rate	x34_Cmd_Set_W_and_T_Update_ms	Set Water and Temperature sensor update rate
0x35 (53)	The current update rate	x35_Resp_W_and_T_Update_ms	The Water and Temperature sensor current update rate
0x36 (54)	Get the Pressure sensor update rate	x36_Cmd_Get_Pressure_Update_ms	Get Pressure sensor update rate
0x37 (55)	Set Pressure sensor update rate	x37_Cmd_Set_Pressure_Update_ms	Set Pressure sensor update rate
0x38 (56)	The current update rate	x38_Resp_Pressure_Update_ms	The Pressure sensor current update rate
0x3C (60)	Get if the Gas message is on or off	x3C_Cmd_Get_Gas_Msg_On	Get if the CAN message is sent or not
0x3D (61)	Set if the Gas message is on or off	x3D_Cmd_Set_Gas_Msg_On	Set if the CAN message is sent or not
0x3E (62)	Gas message is on or off unit response	x3E_Resp_Gas_Msg_On	Response if the CAN message is sent or not
0x3F (63)	Get if the Water and Temperature message is on or off	x3F_Cmd_Get_W_and_T_Msg_On	Get if the CAN message is sent or not
0x40 (64)	Set if the Water and Temperature message is on or off	x40_Cmd_Set_W_and_T_Msg_On	Set if the CAN message is sent or not
0x41 (65)	Water and Temperature message is on or off unit response	x41_Resp_W_and_T_Msg_On	Response if the CAN message is sent or not
0x42 (66)	Get if the Pressure message is on or off	x42_Cmd_Get_Pressure_Msg_On	Get if the CAN message is sent or not
0x43 (67)	Set if the Pressure message is on or off	x43_Cmd_Set_Pressure_Msg_On	Set if the CAN message is sent or not

0x44 (68)	Pressure message is on or off unit response	x44_Resp_Pressure_Msg_On	Response if the CAN message is sent or not
0x45 (69)	Gets the baseline ADC value that the VOC ppm calculation is based on	x45_Cmd_Get_Gas_Baseline	Gets the baseline ADC value that the VOC ppm calculation is based on
0x46 (70)	Sets the baseline ADC value that the VOC ppm calculation is based on defined by the user	x46_Cmd_Set_User_Gas_Baseline	Sets the baseline ADC value that the VOC ppm calculation is based on defined by the user
0x47 (71)	Sets the baseline ADC value that the VOC ppm calculation is based on using the current ADC value	x47_Cmd_Set_Curr_Gas_Baseline	Sets the baseline ADC value that the VOC ppm calculation is based on using the current ADC value
0x48 (72)	The current ADC value used as the baseline for the VOC ppm calculation	x48_Resp_Gas_Baseline	The current ADC value used as the baseline for the VOC ppm calculation
0x49 (73)	Get Pressure Alert settings	x49_Cmd_Get_Pressure_Alert	Get Pressure Alert settings
0x4A (74)	Set Pressure Alert Settings	x4A_Cmd_Set_Pressure_Alert	Set Pressure Alert Settings
0x4B (75)	Unit's response containing pressure alert settings	x4B_Resp_Pressure_Alert	Unit's response containing pressure alert settings
0x4C (76)	Get Gas Alert settings	x4C_Cmd_Get_Gas_VOC_Alert	Get Gas Alert settings
0x4D (77)	Set Gas Alert Settings	x4D_Cmd_Set_Gas_VOC_Alert	Set Gas Alert Settings
0x4E (78)	Unit's response containing Gas alert settings	x4E_Resp_Gas_VOC_Alert	Unit's response containing Gas alert settings
0x4F (79)	Get Gas ADC Alert settings	x4F_Cmd_Get_Gas_ADC_Alert	Get Gas ADC Alert settings
0x50 (80)	Set Gas ADC Alert Settings	x50_Cmd_Set_Gas_ADC_Alert	Set Gas ADC Alert Settings
0x51 (81)	Unit's response containing Gas ADC alert settings	x51_Resp_Gas_ADC_Alert	Unit's response containing Gas ADC alert settings
0x52 (82)	Get Relative Humidity Alert settings	x52_Cmd_Get_RH_Alert	Get Relative Humidity Alert settings
0x53 (83)	Set Relative Humidity Alert Settings	x53_Cmd_Set_RH_Alert	Set Relative Humidity Alert Settings
0x54 (84)	Unit's response containing Relative Humidity alert settings	x54_Resp_RH_Alert	Unit's response containing Relative Humidity alert settings
0x55 (85)	Get Dew Point Alert settings	x55_Cmd_Get_Dew_Point_Alert	Get Dew Point Alert settings
0x56 (86)	Set Dew Point Alert Settings	x56_Cmd_Set_Dew_Point_Alert	Set Dew Point Alert Settings
0x57 (87)	Unit's response containing Dew Point alert settings	x57_Resp_Dew_Point_Alert	Unit's response containing Dew Point alert settings
0x58 (88)	Get Air Temperature Alert settings	x58_Cmd_Get_Air_Temp_Alert	Get Air Temperature Alert settings
0x59 (89)	Set Air Temperature Alert Settings	x59_Cmd_Set_Air_Temp_Alert	Set Air Temperature Alert Settings
0x5A (90)	Unit's response containing Air Temperature alert settings	x5A_Resp_Air_Temp_Alert	Unit's response containing Air Temperature alert settings

TABLE 8 CONFIGURATION MESSAGE TYPES

[1] If the value has been reconfigured but not saved the unit will send the reconfigured value.

Heartbeat – CG_Config Multiplexor x00_Heartbeat

Overview

This CAN message is used to output the unit's high-level status including alert flags and errors

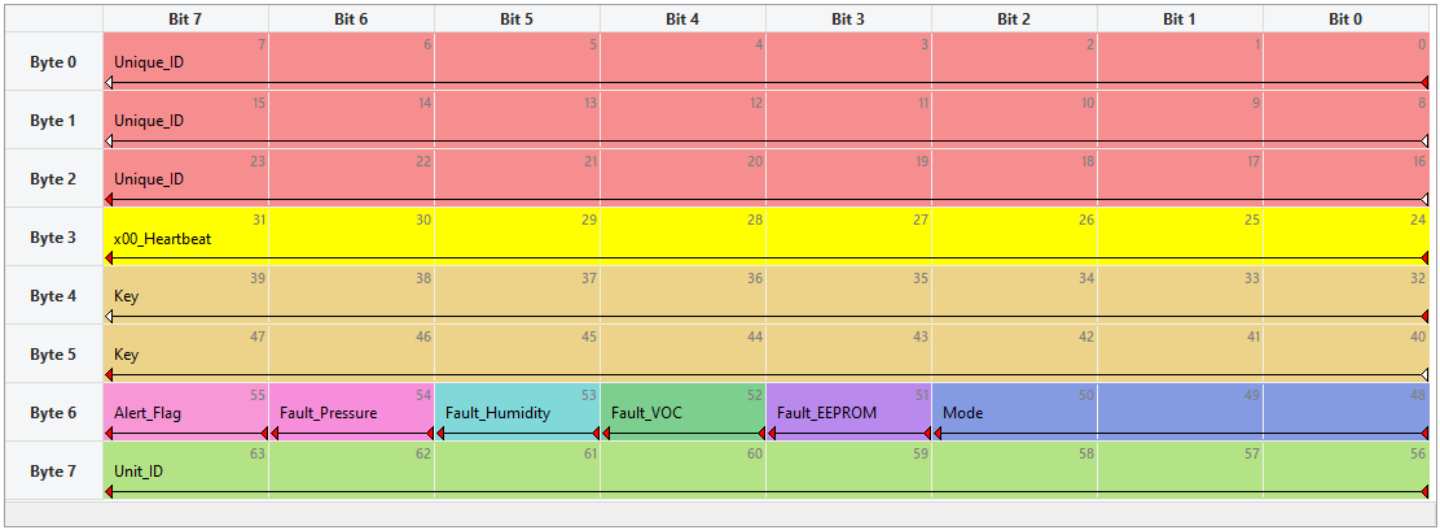
Default settings

- CAN Start Address + 0 = (0x30A by default)
- Message Multiplexor value: 0x0
- Output rate is set to 1000ms

Format

- Intel
- 8 bytes in length

Layout



Byte(s)	Data Type	Name	Description
0 – 2	Unsigned 24 bit	Unique_ID	The unit's unique ID code, this cannot be changed
3	Enumeration	Multiplexor	The multiplexor value, for this message, Heartbeat it is 0x0, please see Table 8 Configuration Message Types for possible values
4 – 5	Unsigned 16 bit	Key	The key code required to enter setup or save any settings, this key changes please use the current stated key.
6 – bit 0-2	Enumeration	Mode	The unit's mode: 1. Normal 2. Setup 3. Silent – CAN is turned off and unit will wake if commanded to, power cycled or a threshold is detected
6 – bit 3	bit	Fault_EEPROM	Fault detected with EEPROM
6 – bit 4	bit	Fault_VOC	Fault detected with VOC sensor
6 – bit 5	bit	Fault_Humidity	Fault detected with Humidity sensor
6 – bit 6	bit	Fault_Pressure	Fault detected with Pressure sensor
6 – bit 7	bit	Alert_Flag	One of the alert flags have been set
7	Unsigned 8 bit	Unit_ID	A user configurable ID to identify multiple units if they are on the same CAN bus

TABLE 9 HEART BEAT CAN MESSAGE

CG_Gas (0x30B [default])

Overview

This CAN message is used to output the unit's gas measurement values of Volatile Organic Compounds (VOC) in parts per million, the raw gas sensor output, error codes and alert flags.

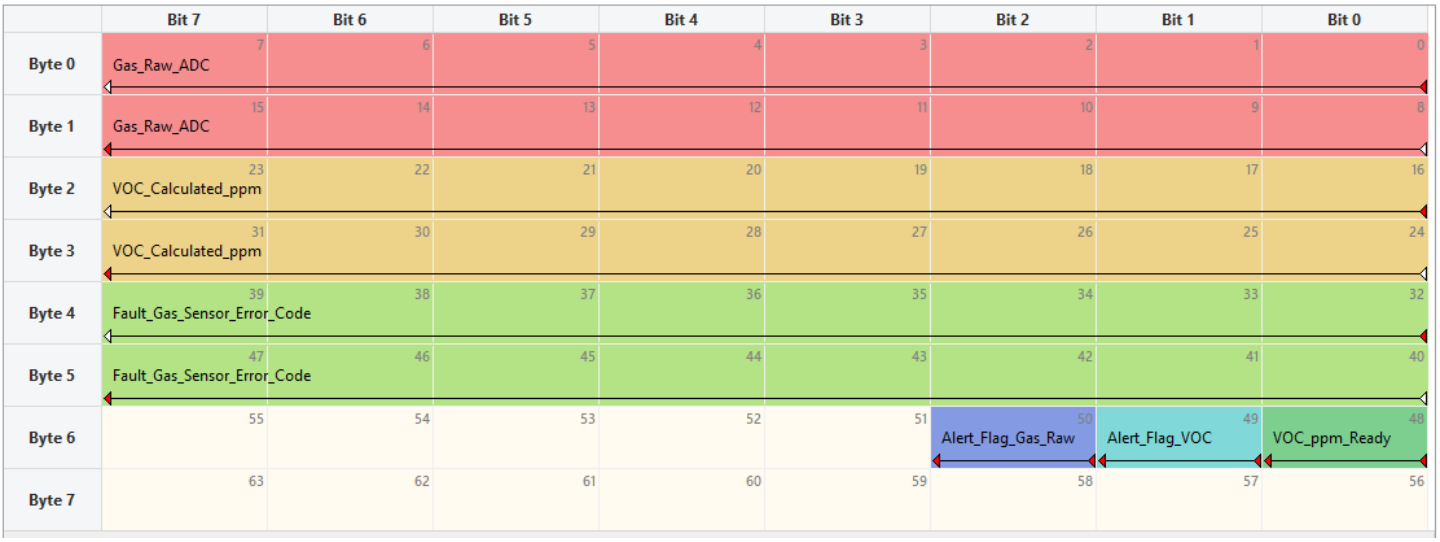
Default settings

- CAN Start Address + 1 = (0x30B by default)
- Output rate is set to 1000ms

Format

- Intel
- 8 bytes in length

Layout



Byte(s)	Data Type	Name	Description
0 – 1	Unsigned 16 bit	Gas_Raw_ADC	Raw Gas sensor ADC value 0 to 65535
2 – 3	Unsigned 16 bit	VOC_Calculated_ppm	Calculated VOC value 0 to 6553.5 ppm
4 – 5	Unsigned 16 bit	Fault Gas Sensor Code	0x000 (0) – OK 0x100 (256) – Write Error 0x200 (512) – Read Error 0x300 (768) – TxFrameError 0x400 (1024) – RxFrameError 0x500 (1280) - ExecutionError
6 – bit 0	bit	VOC_ppm_Ready	The senor takes 20 seconds to stabilize on first power up, this flag indicates when the senor is ready
6 – bit 1	bit	Alert_Flag_VOC	Alert flag for VOC threshold detection
6 – bit 2	bit	Alert_Flag_Gas_Raw	Alert flag for Raw Gas ADC threshold detection

TABLE 10 GAS CAN MESSAGE

CG_Moisture_and_Temp (0x30C [default])

Overview

This CAN message is used to output the unit's air water content and air temperature information.

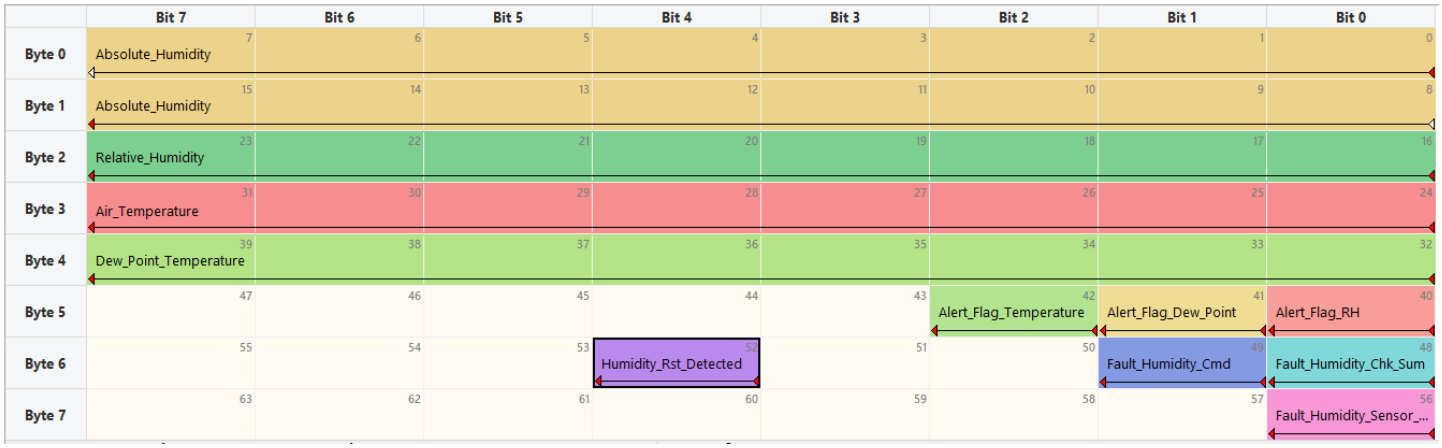
Default settings

- CAN Start Address + 2 = (0x30C by default)
- Output rate is 100ms

Format

- Intel
- 8 bytes in length

Layout



Byte(s)	Data Type	Name	Description
0 – 1	Unsigned16 bit	AbsoluteHumidity	Absolute humidity Measured from 0 – 65535 mg/m^3
2	Decimal 9 bit	RelativeHumidity	Relative humidity 0 to 100%
3	Decimal 9 bit	AirTemperature	Air temperature -40 to 150 Deg C
4	Decimal 9 bit	DewPointTemperature	Dew point temperature - -0 to 127.5 Deg C Temperature of object onto which condensation will start forming at
5 – bit 0	bit	Alert_Flag_RH	Alert flag for Relative Humidity threshold detection
5 – bit 1	bit	Alert_Flag_Dew_Point	Alert flag for Dew Point threshold detection
5 – bit 2	bit	Alert_Flag_Temperature	Alert flag for Air Temperature threshold detection
6 – bit 1	bit	Fault_Humidity_Chk_Sum	Checksum error on read from humidity sensor
6 – bit 2	bit	Fault_Humidity_Cmd	Command message error to humidity sensor
6 – bit 4	bit	Humidity_Rst_Detected	The humidity sensor reset itself
7 – bit 0	bit	Fault_Humidity_Sensor_Comms	Fault with communication to Humidity sensor

TABLE 11 HUMIDITY AND AIR TEMPERATURE CAN MESSAGE

CG_Pressure (0x30D [default])

Overview

This CAN message is used to output the unit's absolute pressure reading in millibar, it is extremely sensitive between 300mbar and 1200mbar.

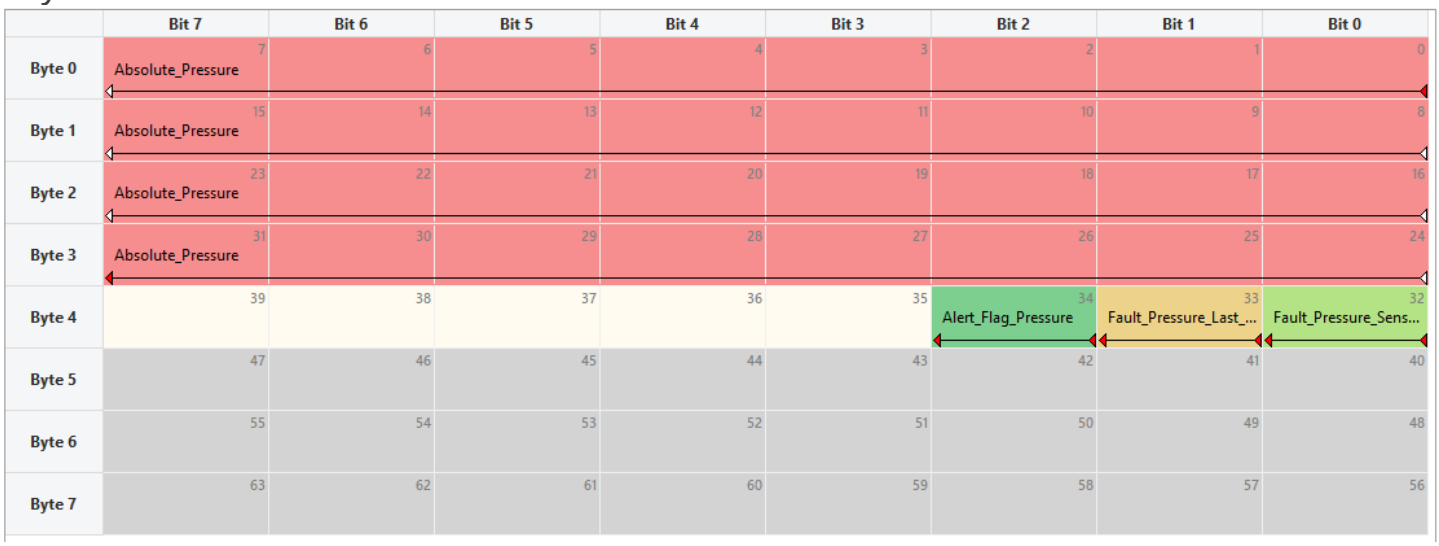
Default settings

- CAN Start Address + 3 = (0x30D by default)
- Output rate is 20ms

Format

- Intel
- 5 bytes in length

Layout



Byte(s)	Data Type	Name	Description
0 – 3	Unsigned 32 bit	Absolute_Pressure	Measures from 300mbar to 1200 mbar
4 – bit 0	bit	Fault_Pressure_Sensor	Pressure sensor fault detected
4 – bit 1	bit	Fault_Pressure_Last_Update	Error with reading pressure sensor
4 – bit 2	bit	Alert_Pressure_Flag	Alert flag for pressure threshold detection

TABLE 12 PRESSURE CAN MESSAGE

List of Tables

List of Figures

End of Document