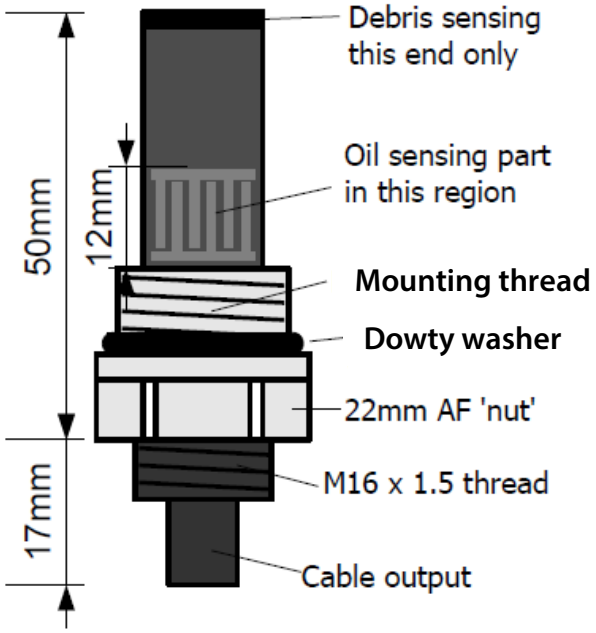
OIL CONDITION MONITORING SENSOR

User Manual

Contents

1. Product description

The Oil Condition Monitoring Sensor is designed to detect particles of metal in oil that have originated from worn or broken machinery such as gears. It attracts and collects this debris and records the amount collected. This serves as an early warning of impending mechanical failure. The active part of the Oil Condition Monitoring Sensor is the probe. This part is immersed in the oil being monitored. It has two sensing elements, a magnetic element at the head of the probe which detects ferrous material (debris) and a dielectric element at the foot of the probe which detects the presence of oil.



There are two product variants, both of which use the same sensing probe:

1. Standard Oil Condition Monitoring Sensor

   The probe is connected to an in-line electronics module:

2. Industrial Condition Monitoring Sensor

   The probe includes a remote display module:

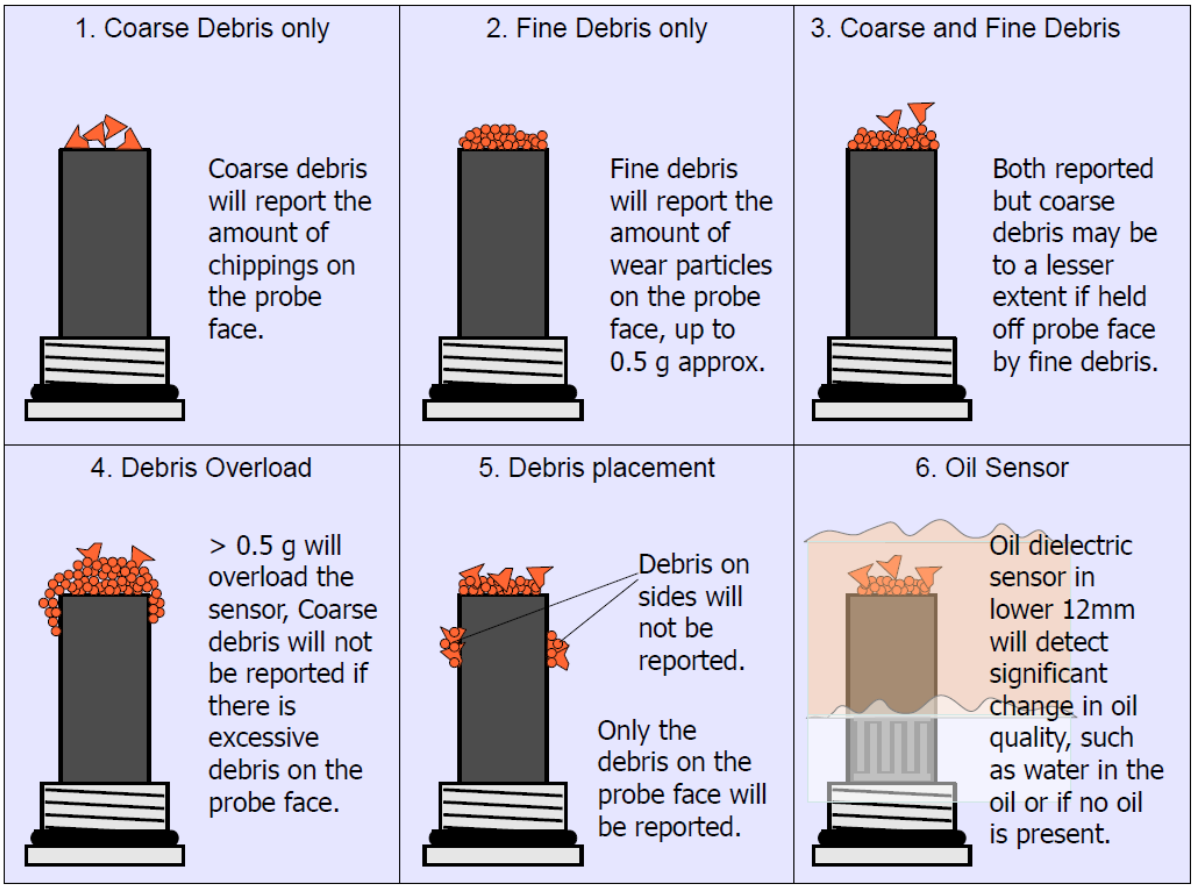
The Oil Condition Monitoring Sensor provides continuous real-time monitoring of ferrous debris that it captures from the lubricating oil.

Ferrous particles are deposited into the oil from gears, bearings and other metallic contacting surfaces. The presence of excessive ferrous debris provides an indication that an overload condition, lubricant contamination, lubricant degradation or lack of lubricant volume has caused the bearings and/or gears to begin to break down.

These ferrous particles take two forms. Firstly there are fine powder deposits which are the very early stages of wear. These are followed by larger chip or flakes which indicate more severe system degradation. The Oil Condition Monitoring Sensor can distinguish between these particles and reports them as "Fine" and "Coarse" on 2 separate channels.

The reporting of these features can provide an early indication of potential breakdowns and is key to implementing effective planned preventative maintenance.

The Oil Condition Monitoring Sensor attracts ferrous debris within the oil by means of a permanent magnet, non-ferrous debris may be deposited on the Sensor by other means, for example by mounting the sensor in a location where debris would normally gather. Electronics within the Oil Condition Monitoring Sensor detect the presence and type of debris, quantifying it as 'fine' (powdered) or 'coarse' (chippings) and reports a signal associated with the volume of each type of debris. Other functions of the sensor measure the temperature and the dielectric of the oil for the purpose of detecting a significant change in the dielectric value. Such changes will occur if the oil is not present (oil leak) or if the water content in the oil is significant.



Oil Condition Monitoring Sensor with coarse and fine debris attracted to the probe face.

2. Getting started

2.1 Configuration software

For setting up and configuring your Oil Condition Monitoring Sensor, Gill software can be downloaded from www.gillsc.com/support. Select the 4212 Industrial or 4212 Standard Oil Condition Monitoring Sensor from the "Select Product" dropdown list.

The minimum operating system requirements are:

- 32-bit (x86) or 64-bit (x64) processor
- Windows® 7 or later
- 1 Gb RAM
- 500 Mb disk space

2.2 Connection to a PC using the USB connection

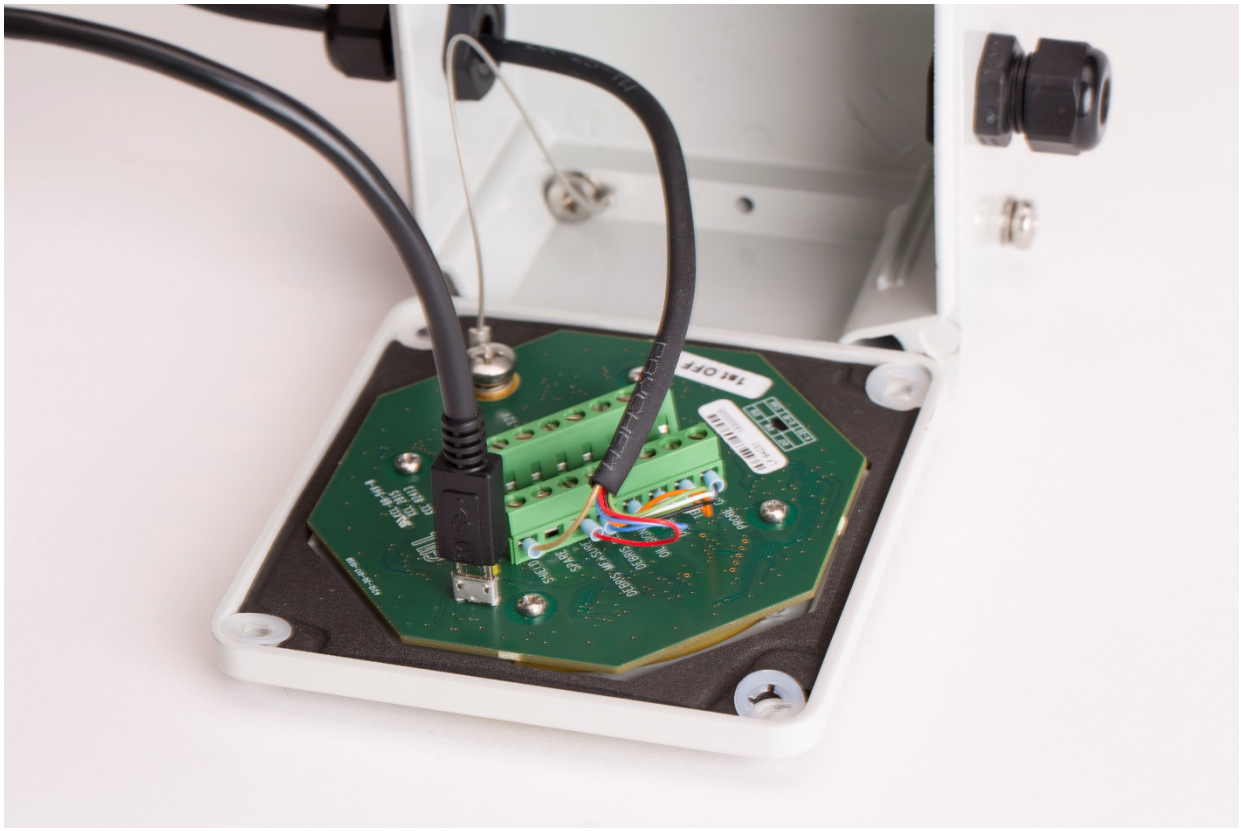
A micro USB port is provided for connection of the Oil Condition Monitoring Sensor to a PC for setup and configuration purposes.

Note - In order for the USB communications to occur the Oil Condition Monitoring Sensor must have power, as it cannot be powered from the USB socket.

Use the USB cable assembly (Gill Part Number 020-05880) for setup configuration of the Oil Condition Monitoring Sensor, plugging in the Micro USB connector to the Oil Condition Monitoring Sensor and the USB 2.0 connector to your PC. On completion of configuration, remove the cable assembly and re-assemble the lid ensuring any sealing gasket is correctly located and the screws are fully tightened during re-assembly.

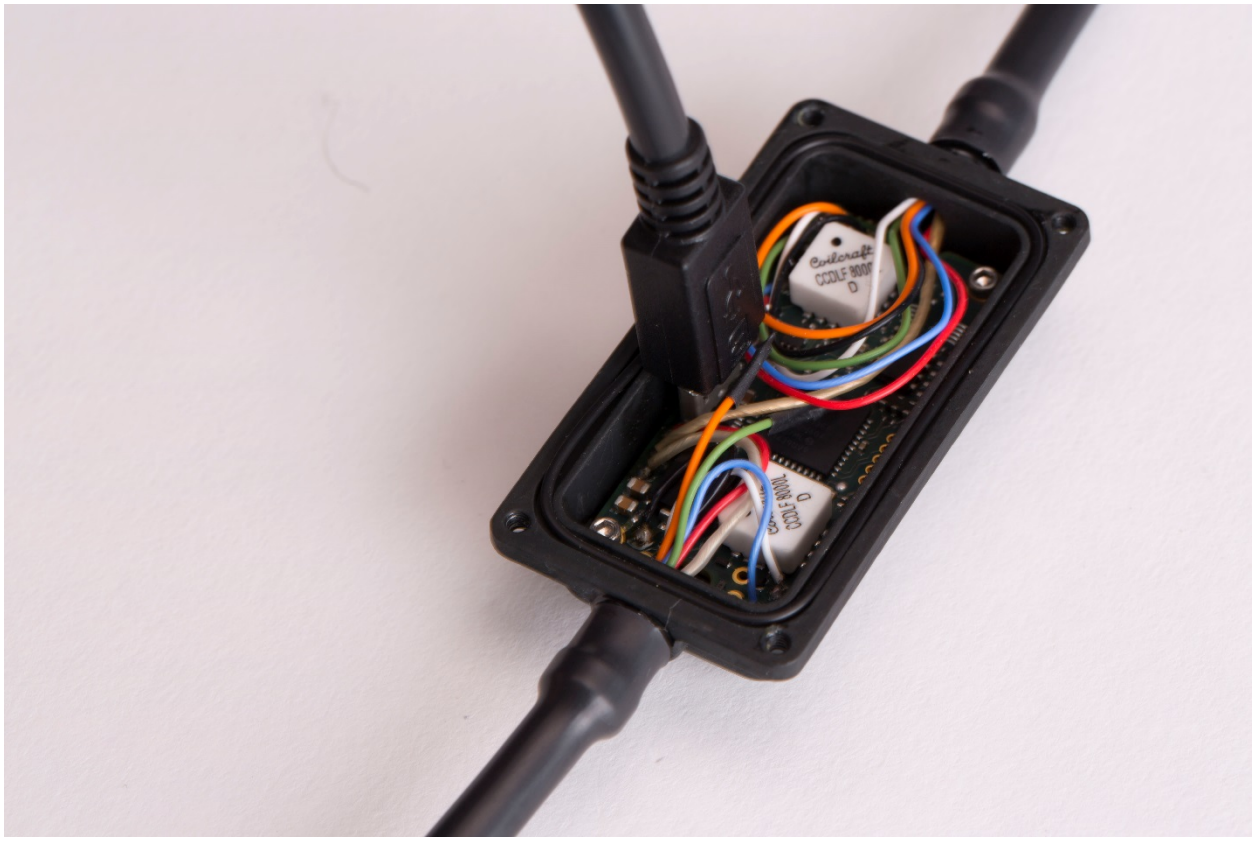
2.2.1 Industrial Unit

Remove the lid by undoing the 4 off lid retaining screws and allowing the enclosure to open. Note – the lid is retained by a metallic banding strap for protection. The micro USB connector is located on the underside of the lid as shown below:



2.2.2 Standard Unit

Take out the 4 off lid screws (Tx6) and remove the lid to expose the sensor electronics. The micro USB connector is located on the PCB as shown below:



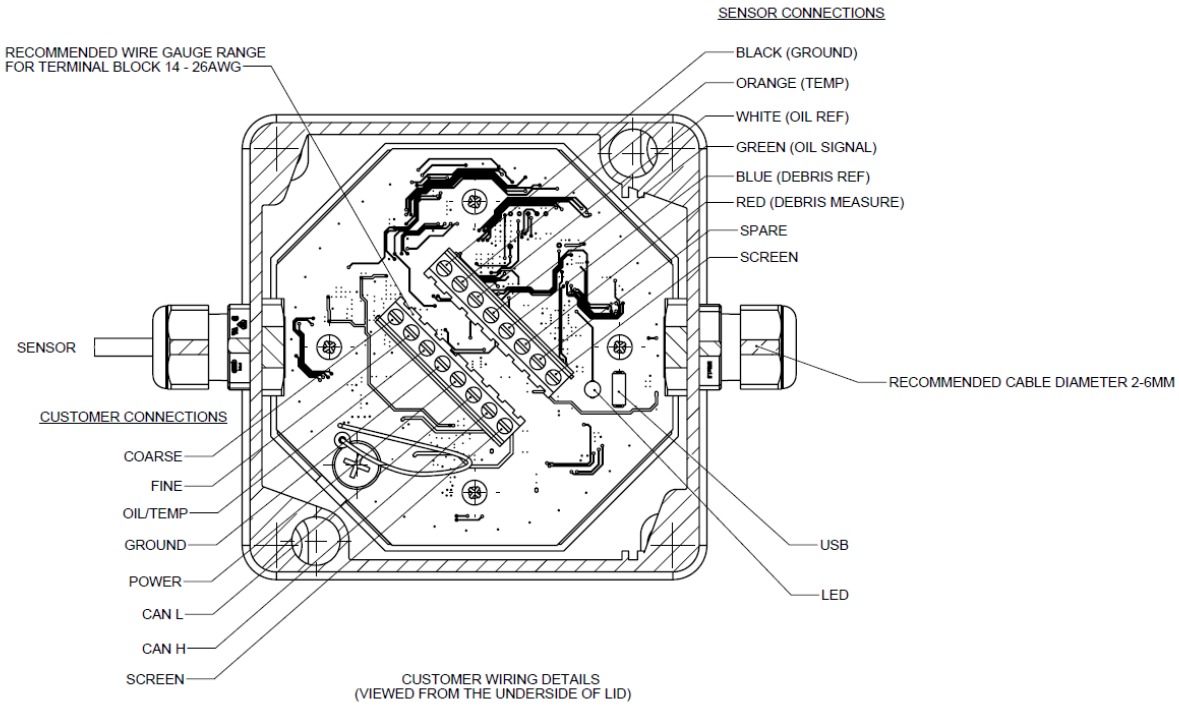
2.3 Electrical Connections

2.3.1 Power supply

See section 5 Specifications, for the applicable power supply ranges appropriate to your model variant.

Note: for voltage devices the analogue output is limited by the supply voltage provided to power the sensor and a minimum 0.7 V power supply headroom above the desired analogue output is recommended for stable sensor output.

2.3.2 Industrial Unit



Fit wires with the bootlace ferrules provided prior to termination into the terminal block.

2.3.3 Standard

2.3.3.1 Analogue 4-20mA & 0-10V

	Wire Colour	Designation
	White	Fine
	Green	Course
	Orange	Oil/Temp
	Black	Power Gnd (V-)
	Red	Power (V+)
	Blue	(Not Connected)
	Clear	Screen

2.3.3.2 Digital CAN J1939

	Wire Colour	Designation
	White	Can H
	Blue	Can L
	Orange	(Not Connected)
	Green	(Not Connected)
	Red	Power (V+)
	Black	Power Gnd (V-)
	Clear	Screen

2.4 Install FTDI drivers

Once connected, your computer may automatically recognise the Oil Condition Monitoring Sensor; if not you may be prompted to search for FTDI driver software, in which case allow your Windows® software to automatically search Windows® Updates for the drivers. Note: an internet connection is required to obtain driver updates.

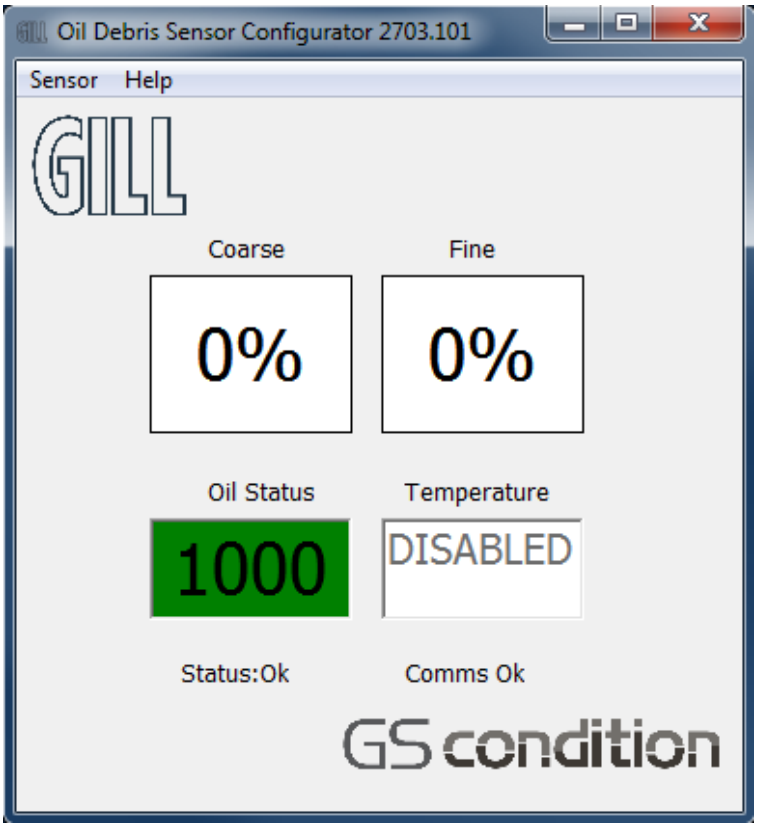
For manual installation of the FTDI driver software, follow the steps below:

FTDI drivers can be downloaded at http://www.ftdichip.com/drivers/vcp.htm

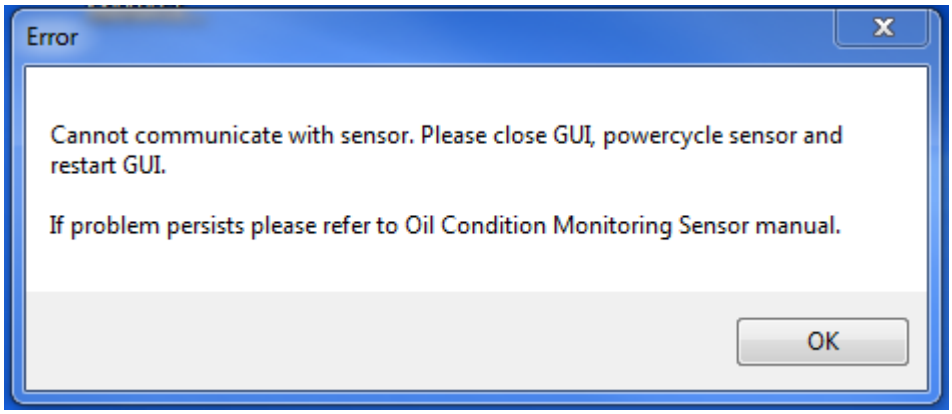
Open Control Panel>Device Manager and select the unidentified USB serial port from the list and click the right hand mouse button to select 'Properties' from the drop down menu. Select the Driver tab > Update driver select > Browse my computer for driver software and select the folder location of the FTDI driver that you downloaded. Select the folder and click Next to update the driver. The FTDI driver should now be installed.

2.5 Launch the Oil Condition Monitoring Sensor Configurator Software

Launch the Oil Condition Monitoring Sensor configurator software application by double clicking the Gill Oil Condition Monitoring Sensor Configurator Icon located on your desktop, start menu or your program file location selected during installation. The following home screen should appear:



If there is a fault with the connection between the PC and the Oil Condition Monitoring Sensor, then you will see the following message:



Check the cable is correctly inserted at both ends and that the sensor is powered. It is also possible that the installation of the device drivers has not yet been completed. Re-starting usually clears the problem. If not, then check that sufficient power is being supplied to the sensor.

2.6 Bench system test

It is recommended that the Oil Condition Monitoring Sensor is functionally tested on the bench prior to installation. From the start screen shown on the previous page, select the Sensor menu and then select Restore Factory Defaults. There are 3 possible pre-set debris conditions available within the software which can be selected appropriate to your system; Small, Medium and Large. These set the coarse and fine scales according to the size/quantity of debris (see values in the table below).

Parameter	*Sensitivity Scale*		
	Small	*Medium*	*Large*
100% FSD Course	1 x 3mm Chrome steel ball bearing	1 x 5mm Chrome steel ball bearing	4 x 5mm Chrome steel ball bearing
100% FSD Fine	0.1g iron powder	0.25g iron powder	0.5g iron powder

Note that the factory default sensitivity is always set to Small. Note also that, once the sensor probe is installed on the equipment, there is the option of customizing the settings to suit the application (see Section 3.1) in which case these sensitivity settings no longer apply.

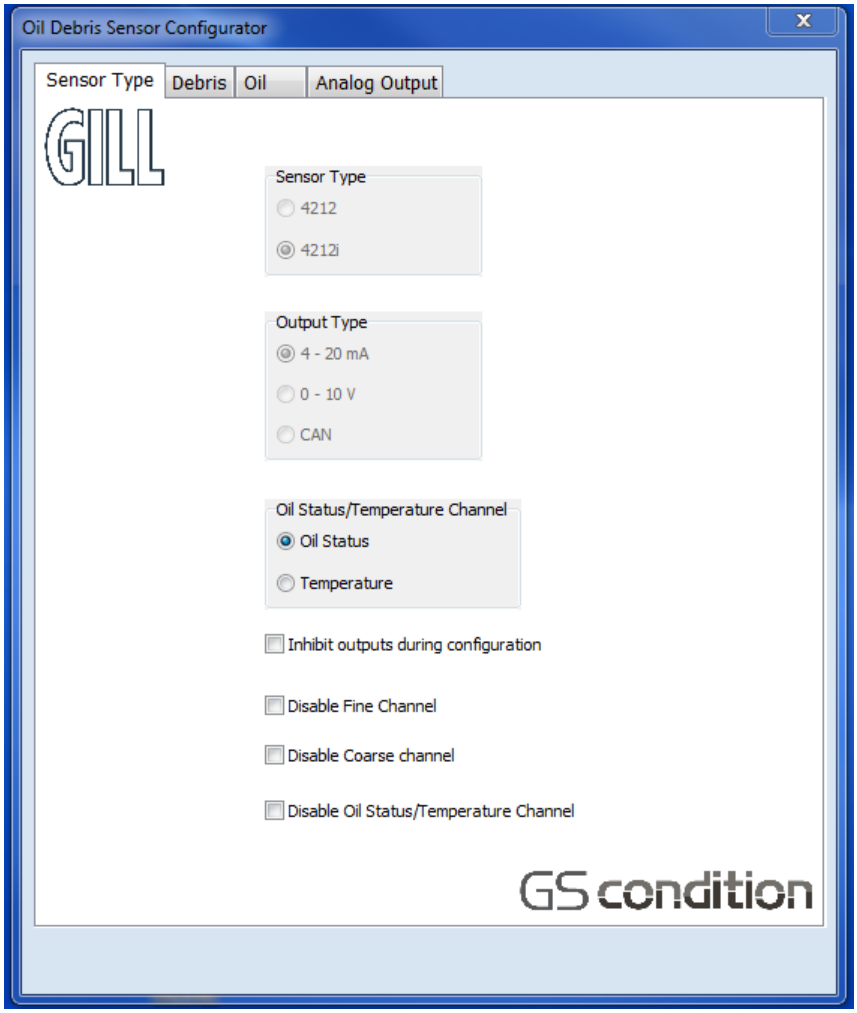
Gill can provide a debris test strip with measured amounts of fine and coarse debris impregnated in epoxy to assist with bench testing. If you have collected samples from a previously failed system then this debris can be placed on the end of the sensor to scale the sensitivity to your specific system requirements.

Debris Strip (Part No. 4212-00-063)

3.0 Operating Instructions

3.1 Configuring the Sensor

Select the Sensor>Configure option from the top pull down menu. Note that on the Industrial version of the product, the green LEDs will turn to blue whilst configuring the sensor.



3.1.1 Sensor Type

The Sensor type is factory configured and is displayed for reference purposes only. The button references either the Industrial version (4212i) or the Standard version (4212).

3.1.2 Sensor Output

The Sensor output type is factory configured and is displayed for reference purposes only. The button references either 4-20mA, 0-10V or CAN output types.

3.1.3 Oil Status/Temperature Channel

Select the required third channel output option by clicking the Oil status or Temperature button. On setting the 3rd channel status, the configuration tabs are automatically adjusted to display the selected channel options.

The 3rd channel status is set to oil status by default.

Note: the home screen now reflects the options selected. Unused features shall be disabled in this window.

3.2 Inhibit Outputs during Configuration

Select the inhibit outputs during configuration to fix the analogue outputs to a known state. This may be used to disable external alarm conditions during configuration and maintenance of the Oil Condition Monitoring Sensor i.e. when an external PLC controller alarm status may be triggered while setting the Full Scale Deflection (FSD) level. The analogue output levels can be set by the user within the Analog Output tab>Inhibit level. On disabling the Inhibit outputs during configuration feature, the inhibit level is disabled from the Analog Output tab.

The inhibit outputs during configuration option is switched on by default and is set to 0.25 V for the voltage output versions and 2 mA for the 4-20 mA output versions.

3.2.1 Disable Fine Channel

Select the disable fine channel option to make the fine channel inoperable. On disabling the fine channel option, setting of the fine channel is disabled from the Debris tab.

The disable fine channel option is switched off by default, meaning the fine channel is enabled.

Note: the home screen now reflects the options selected. Unused features shall be disabled in this window.

3.2.2 Disable Coarse Channel

Select the disable coarse channel option to make the coarse channel inoperable. On disabling the coarse channel option, setting of the coarse channel is disabled from the Debris tab.

The disable coarse channel option is switched off by default, meaning the coarse channel is enabled.

Note: the home screen now reflects the options selected. Unused features shall be disabled in this window.

3.2.3 Disable Oil Status/Temperature Channel

Select the disable fine channel option to make the oil status/temperature channel inoperable.

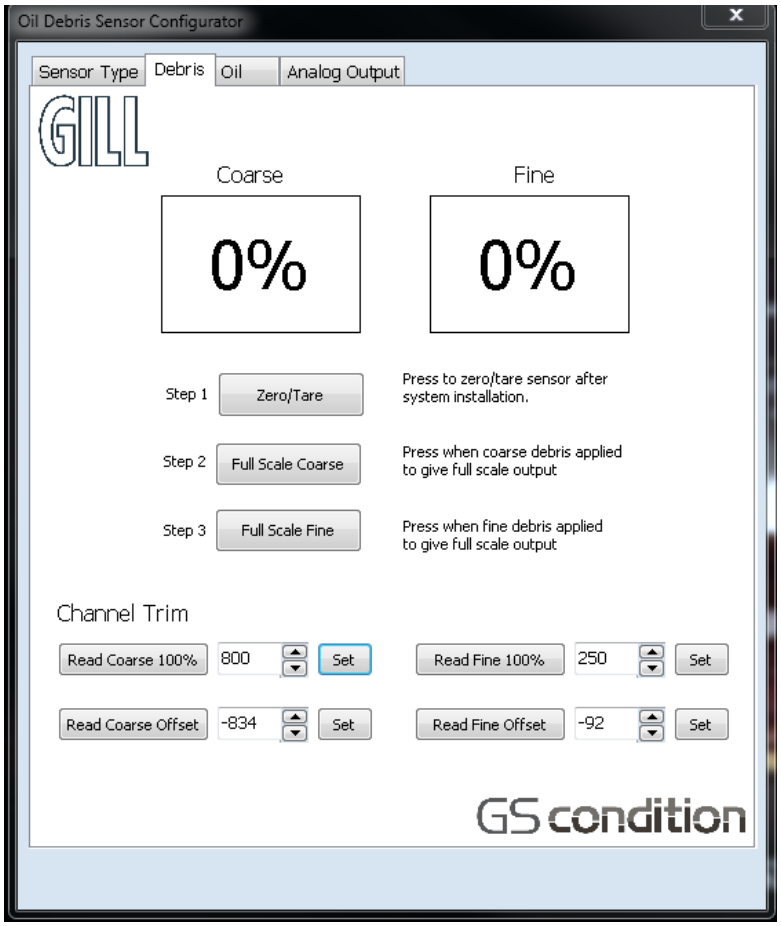
The disable Oil Status/Temperature channel option is switched off by default, meaning the channel is enabled in it's out of the box condition.

Note: the home screen now reflects the options selected. Unused features shall be disabled in this window.

3.3 Debris Calibration

Select the Sensor pull down menu and then the Configure setting.

Select the Debris tab from this new window.



3.3.1 Zero/Tare

The zero/tare function must be used if during installation the sensor develops an offset due to surrounding metalwork. This shall become evident if the sensor output is greater than the zero level specified by the user (>0%) without debris present following installation into the gearbox.

It is recommended that the zero/tare function is used at the start and end of every configuration.

On this screen you will see three buttons labelled **Zero / Full Scale Coarse / Full Scale Fine.**

Press the Zero button to reset the probe.

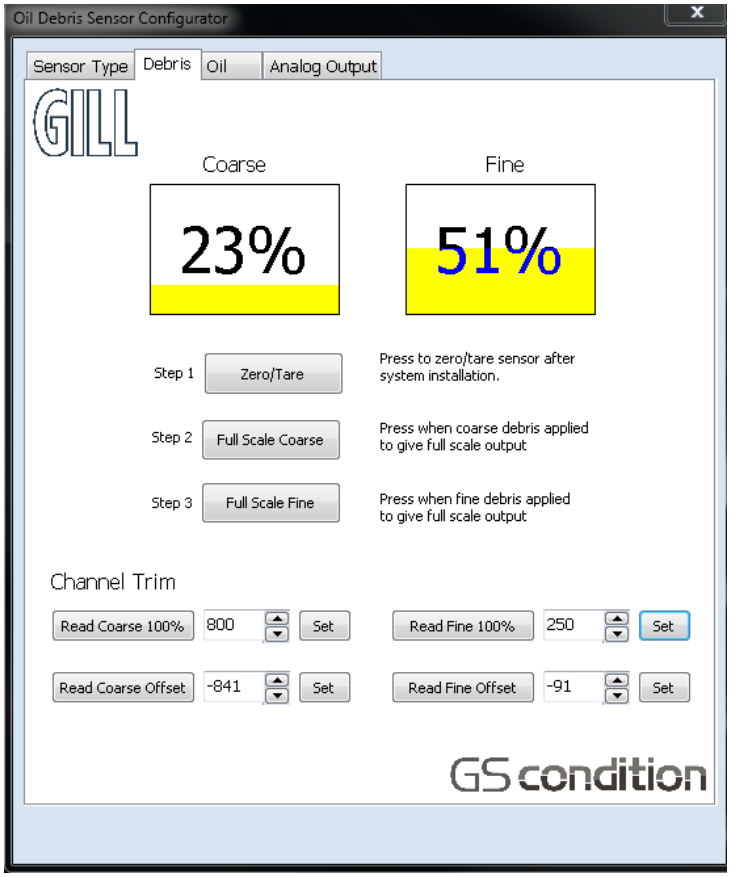
3.3.2 Full Scale Coarse

The full scale coarse operation will gauge the output of the sensor to the desired level with the maximum amount of coarse debris applied to the sensor (100% Full Scale Deflection).

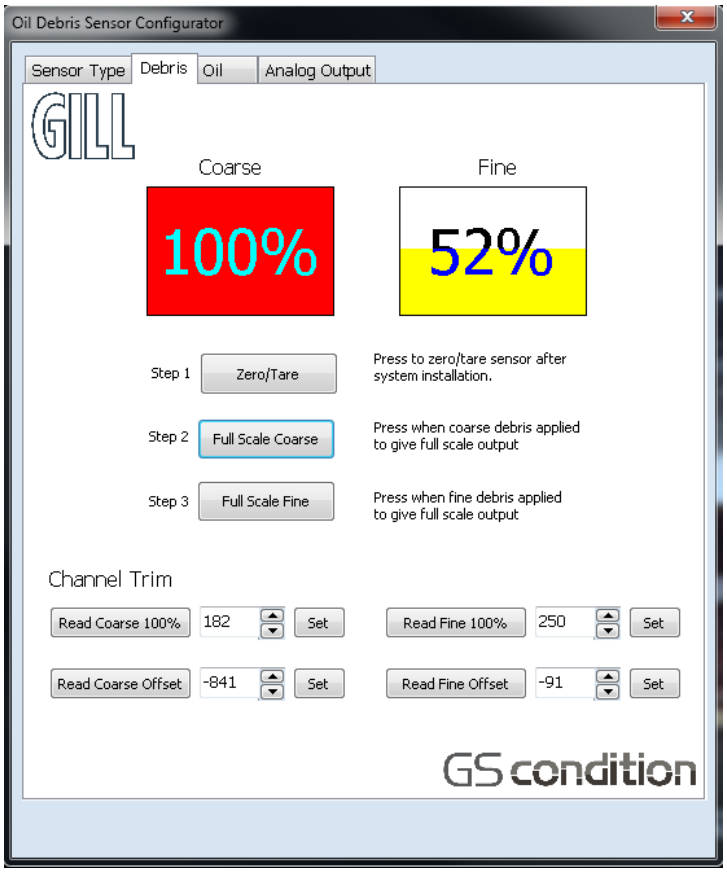
Note: see Section 7 for the saturation point of coarse debris.

Add some coarse debris to the probe (This should represent what you would constitute to a 100% failure). For this demonstration five 2mm balls were used. The debris strip may also be used as reference.

A coarse value will now be displayed in the window.



Press the Full Scale Coarse Button and this will set this quantity of debris as 100%.



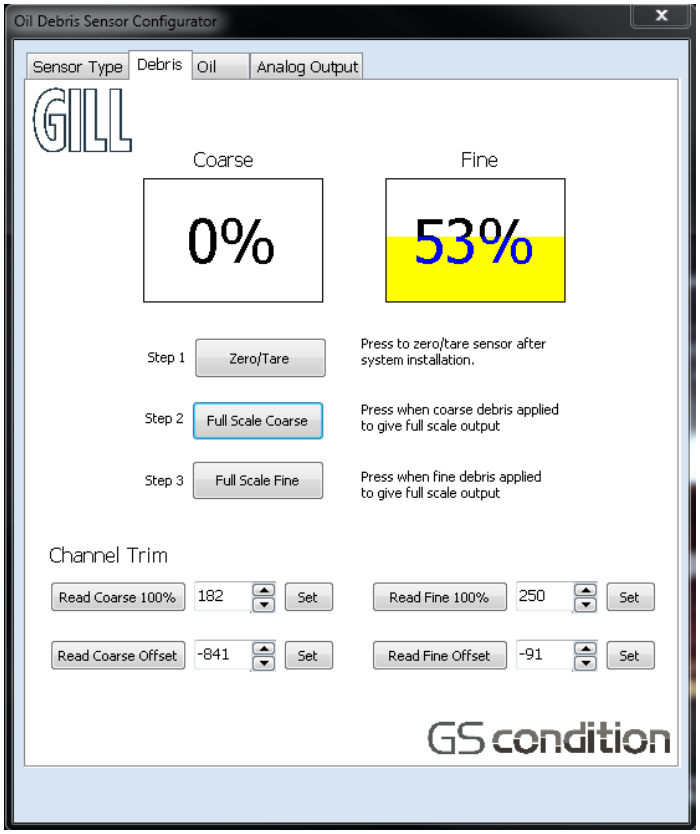
3.3.3 Full Scale Fine

The full scale fine operation will gauge the output of the sensor to the desired level with the maximum amount of fine debris applied to the sensor (100% Full Scale Deflection).

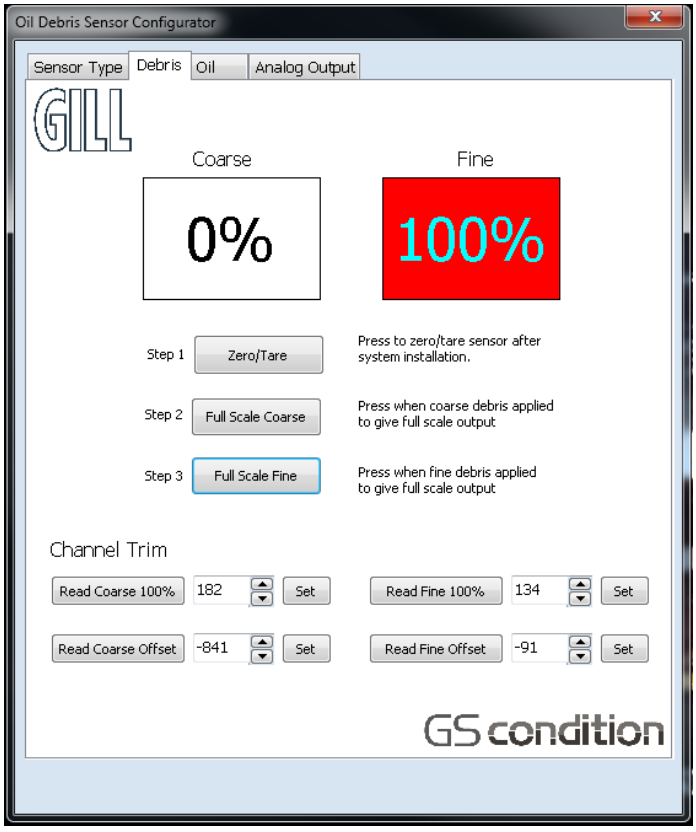
Note: see Section 7 for the saturation point of fine debris.

Add some fine debris to the probe (again this should represent what you would constitute to a 100% failure).

A fine value will now be displayed in the window.



Press the Full Scale Fine Button and this will set this quantity of debris as 100%.



The probe is now calibrated and ready to fit to your equipment.

3.3.4 Channel Trim

The channel trim function allows adjustments to the zero and full scale deflection of the fine and coarse channels. The up/down arrows can be used to bias the zero and full scale within the graphics window.

When the desired values are selected press the set button to write the value to the sensor.

Please note:

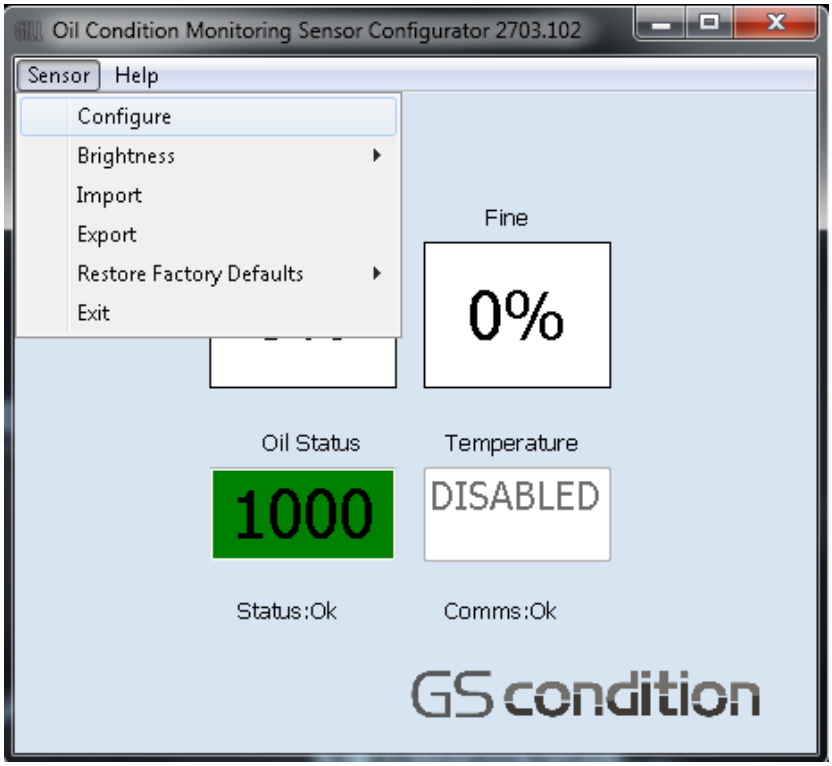
1. Do not enter negative values for coarse and fine 100% as these would make the sensor operate in reverse, i.e. the less debris collected the greater the percentage displayed.
2. If the value is too great then the setting is too insensitive and the percentage level displayed will be zero. Conversely, if the value is too low then the setting is too sensitive and the percentage level will be 100%, even if no debris is present.
3. It is advisable to set both channels to 250 in the first instance.

3.4 Oil Calibration

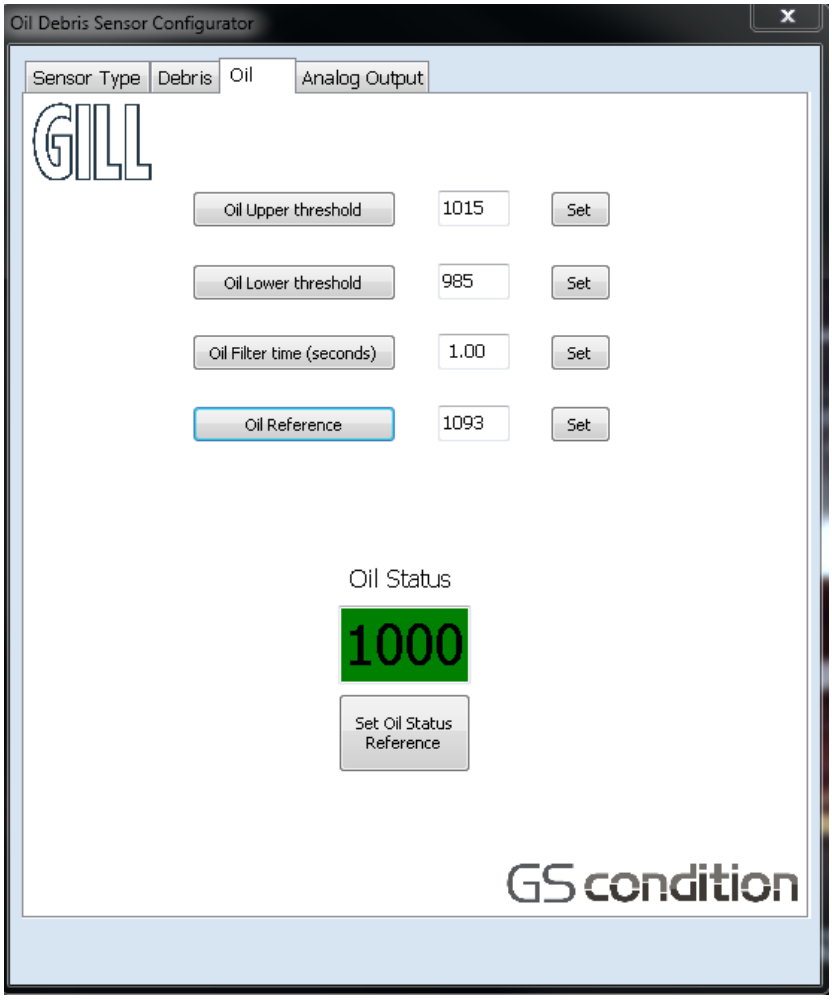
The Oil Condition Monitoring Sensor measures the dielectric property of the liquid surrounding the sensor element. This is used to provide information about dielectric changes such as a no-oil condition (air) or water in oil condition. Note that this is only a bulk indication. The sensor will not detect water content below 10% Note also that the oil status output does not report a linear response, i.e. zero or full scale output only.

When an alarm threshold is reached, the sensor output is triggered to full scale. Normal oil status remains at zero.

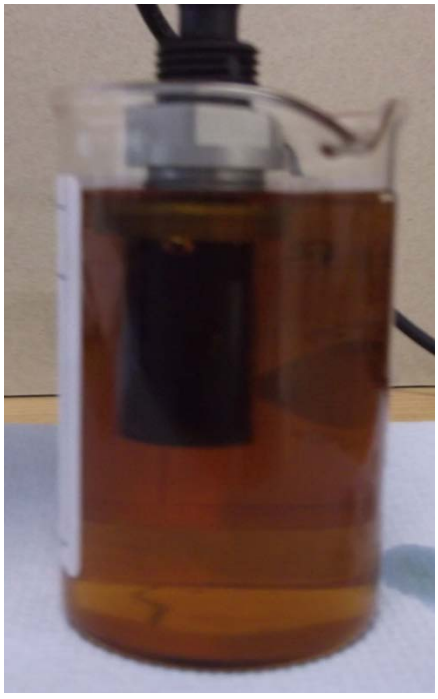
Select the Sensor pull down menu and then the Configure setting.

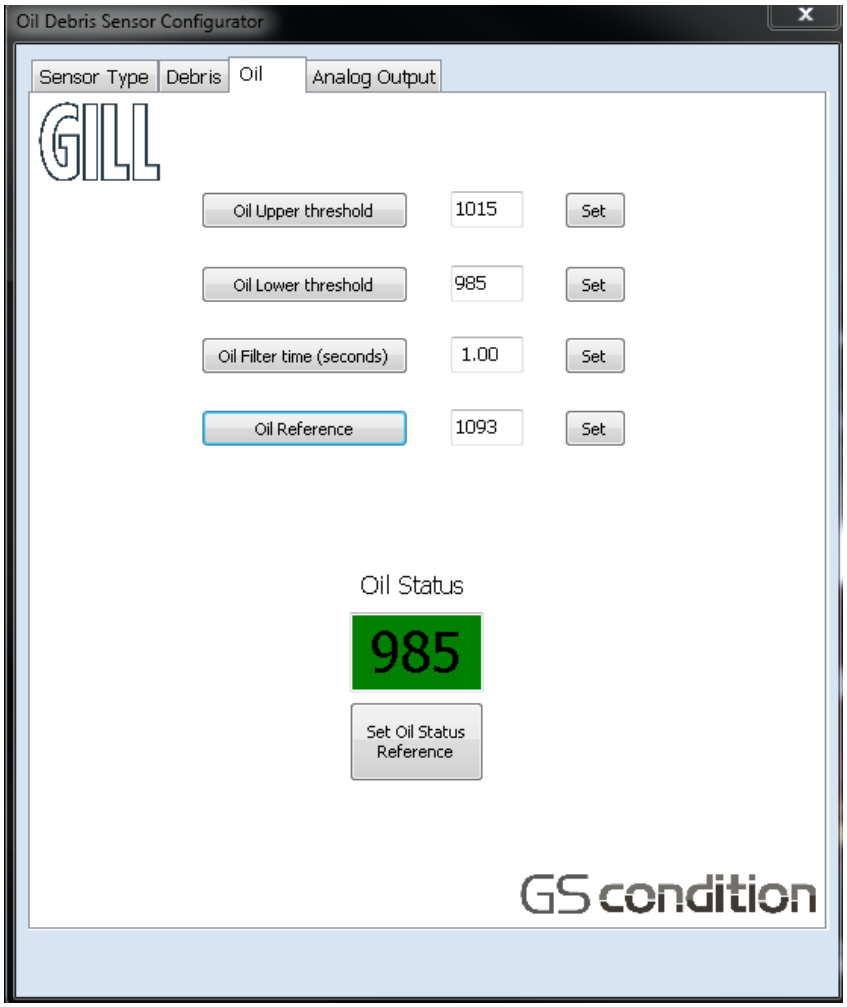


Select the oil tab from this new window.

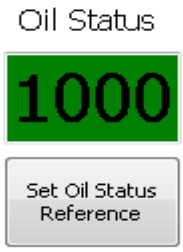


Fully immerse the sensor element in the selected reference oil (fresh oil) to set the oil status reference value. The value should be normalised to 1000 once set.

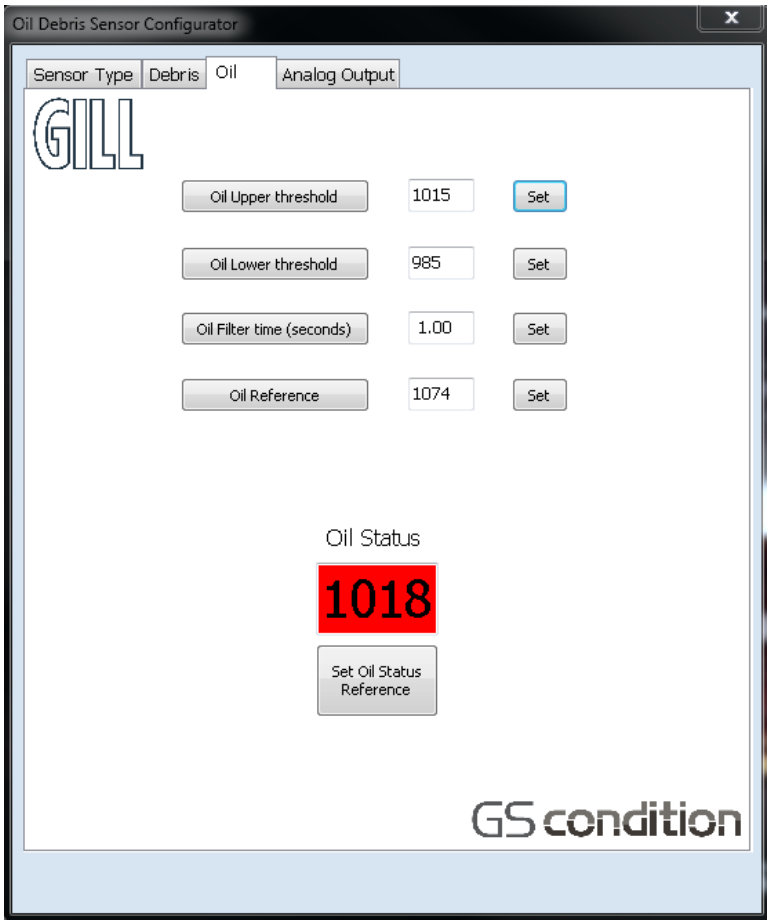




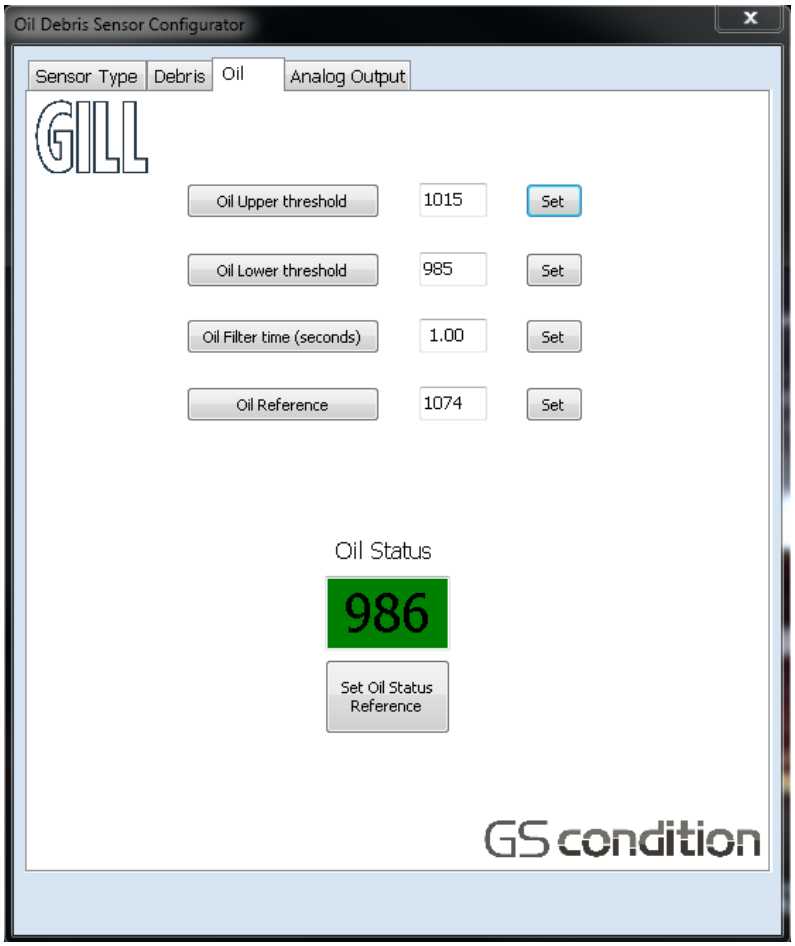
Press the Set Oil Status Reference button and this will return the value to 1000.



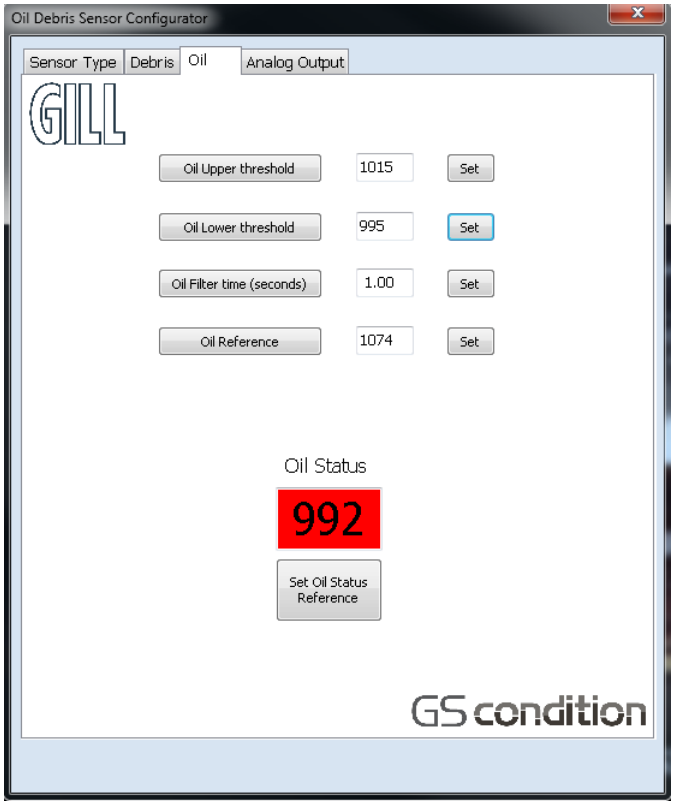
Now remove the probe from the oil and set the Oil Upper Threshold if needed. If the oil status is not shown in red lower the threshold value just below the oil status value and press the set button.



Fully immerse the sensor element in an oil and water mix to set the Oil Lower Threshold. It should contain at least 10% water.



If the Oil Status is not shown in red, increase the value of the Oil Lower Threshold value just above the Oil Status value and press set.



The probe is now calibrated and ready to fit to your equipment.

3.4.1 Set Oil Status Reference

Fully immerse the sensor element in the selected reference oil (fresh oil) to set the oil status reference value. The oil status window displays the reference value in real time. The value should be normalised to 1000 once set.

Note: when the lower or upper alarm thresholds are reached the window changes status from green to red.

3.4.2 Oil Upper Threshold

The upper oil threshold is used to set the no-oil condition of the sensor.

To set the oil upper threshold, remove the sensor element from the oil and note the new oil status reference number with the sensor element positioned in free air. Enter the desired value into the oil upper threshold dialogue box and press the set button to apply the new value.

Note: the value should be set between the reference oil (1000) and the reference air value (>1000).

3.4.3 Oil Lower Threshold

The lower oil threshold is used to set the end of life oil or water in oil condition of the sensor.

To set the oil lower threshold, place the sensor element in the end of life oil sample or water in oil sample and note the new oil status reference number. Enter the desired value into the oil lower threshold dialogue box and press the set button to apply the new value.

Note: the value should be set between the reference oil (1000) and the reference end of life oil or water in oil sample value (<1000).

3.4.4 Oil Filter Time (seconds)

The oil filter time function is normally set to a 1 second sample period. The sample period may be extended to prevent false alarms in splash systems where the sensor element is not fully in contact with the oil.

3.4.5 Oil Reference

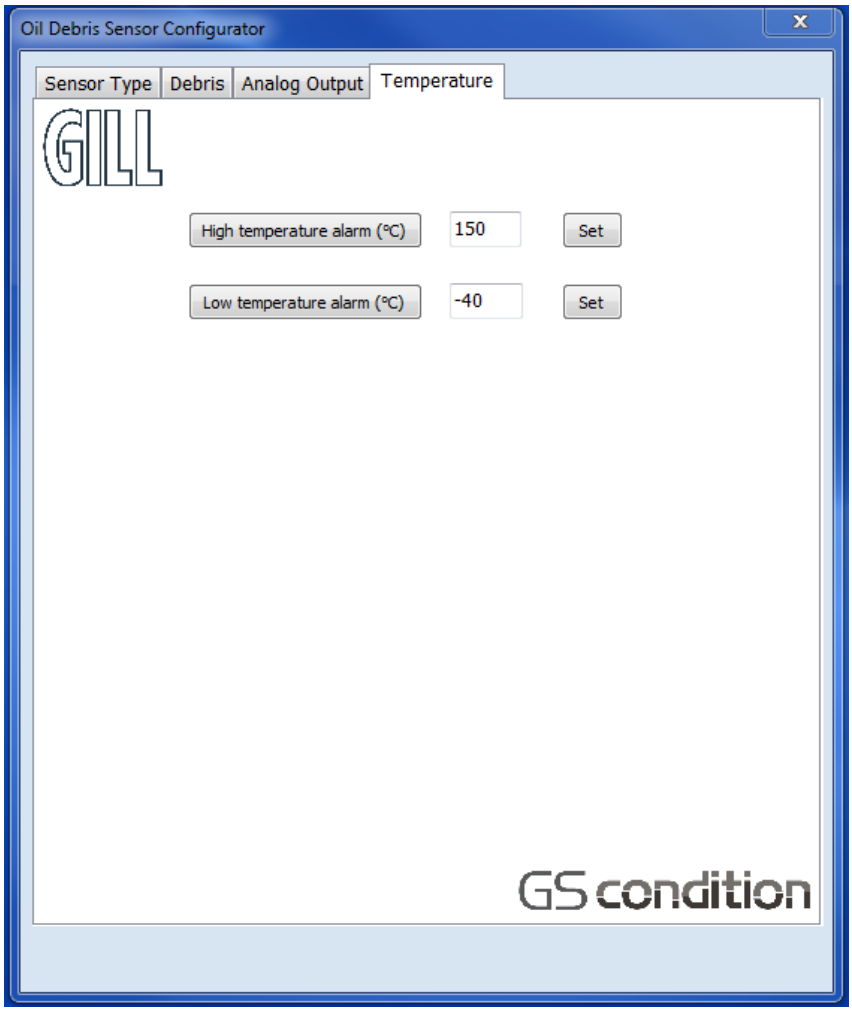
The raw value for oil reference is displayed in the oil reference dialogue box. This can be manually adjusted to set the oil status reference. See the appendix for guideline oil status reference values for different oil types.

3.5 Temperature

The temperature sensor measures the oil temperature at the sensing probe. An alarm threshold can be set to identify low and high temperature thresholds.

Input the desired temperature values into the dialogue box and press the set button to write the value to the sensor. When an alarm threshold is reached, the sensor output is triggered to full scale. The normal temperature output remains at zero.

Note: the temperature output does not report a linear response i.e. zero or full scale output only



3.6 Analog Output

For analogue output sensors, the following values can be set by the user:

3.6.1 Error Level

The sensor output level at an error state may be set by the user to identify a sensor failure. Input the desired error level value into the dialogue box and press the set button to write the value to the sensor.

Note: the error level is applied to all three output channels

3.6.2 Zero level

The sensor output level may be set by the user to identify 0% FSD. Input the desired zero level (0%) value into the dialogue box and press the set button to write the value to the sensor.

Note: the zero level is applied to all three output channels

3.6.3 Full Scale Level

The sensor output level may be set by the user to identify 100% FSD. Input the desired full scale (100%) level value into the dialogue box and press the set button to write the value to the sensor.

Note: the full scale level is applied to all three output channels

3.6.4 Inhibit Level

The sensor inhibit level may be set by the user to set the sensor output during maintenance and cleaning operations to a known state. Input the desired inhibit level value into the dialogue box and press the set button to write the value to the sensor.

Note: the inhibit level is applied to all three output channels

3.7 CAN

Note: for alternative CAN configurations consult Gill with your custom requirements

For CAN output sensors, the following values are displayed:

3.7.1 Function Instance

The function instance works in combination with the function field. A J1939 network may accommodate several ECUs (Controller Applications) with the same function. The 5 bit long function instance assigns a number to each instance of the function, where 0 is assigned to the first instance.

The function instance is factory set to 0000. Input the desired value into the dialogue box and press the set button to write the value to the sensor.

3.7.2 ECU Instance

A J1939 network may accommodate several ECUs (controller applications) with the same function. The 3 bit long ECU instance assigns a number to each instance of the ECU, where 0 is assigned to the first instance.

The ECU instance is factory set to 0000. Input the desired value into the dialogue box and press the set button to write the value to the sensor.

3.7.3 Industry Group

Industry group codes are associated with particular industries. The 3 bit code is assigned by the SAE and definition can be found in the J1939 standard.

The Industry group is factory set to 0000.

3.7.4 Vehicle System Instance

A J1939 network may accommodate several ECUs of the same vehicle system. The 4 bit long vehicle system instance assigns a number to each instance of the vehicle system (0 to 15).

The vehicle system instance is factory set to 0000.

3.7.5 Vehicle System

This 7 bit field is defined and assigned by the SAE. Definitions of the vehicle system are found in the J1939 standard.

The vehicle system instance is factory set to 0000.

3.7.6 Function

The function field is defined and assigned by the SAE. The range of the field is from 0 to 255. The function code does not depend on any other field in cases where it is less than 128 (0 to 127).

The function is factory set to 00ff.

3.7.7 Manufacturer Code

The 11 bit Manufacturer code is assigned by the SAE and it indicates which manufacturer produced this particular equipment.

The manufacturer code is factory set to 07ff.

3.7.8 Identity Number

The identity number is assigned by the manufacturer and should be used to guarantee unique names within a product line.

The identity number is factory set to 0000.

3.7.9 NAME

The 64 bit name is used to uniquely identify each equipment in a network. The NAME field contains 10 entries of which five are assigned by the SAE. The remaining five fields are derived from the network characteristics or are manufacturer specific.

The NAME field is also used during the claim process when two or more equipment's are attempting to claim the same address. In such a case the equipment with a name of higher priority (=lower numeric value) will claim the address.

3.8 PGN/ID

Note: for alternative CAN configurations consult Gill with your custom requirements

For CAN output sensors, the following values are displayed:

3.8.1 Priority

There are 8 priority levels which represent the equipment priority during the arbitration process. In compliance with the CAN standard a value of 0 has the highest priority and a value of 8 has the lowest priority.

The priority number is factory set to 0006.

3.8.2 Data Page

The data page bit works as a page selector for the protocol data unit.

The data page is factory set to 0001.

3.8.3 PDU Format

The protocol data unit defines the function of the PDU specific. A value of 240 to 255 is a destination address broadcast message. A value between 0 – 239 is a group extension peer-to-peer message.

The PDU format is factory set to 00ff.

3.8.4 PDU Specific

PDU specific means that its content is interpreted according to the information in the PDU format. A value 240 to 255 is a destination address broadcast message. A value between 0 – 239 is a group extension peer-to-peer message.

The PDU specific is factory set to 0000.

The last 8 bits of the message identifier contains the address of the transmitting equipment. There is a total of 253 addresses available and every address must be unique within the network.

Input the desired value into the dialogue box and press the set button to write the value to the sensor.

3.8.5 PGN

The parameter group number (PGN) uniquely identifies the parameter group that is being transmitted in the message. The structure of the PGN permits a total of up to 8672 different parameter groups to be defined.

The PGN is compiled from the assignment of each parameter.

3.8.6 CAN ID

The CAN ID is displayed in this window.

3.9 LED Brightness (Industrial Unit Only)

To make adjustments to the LED brightness:

Select the Sensor>Brightness option from the top pull down menu and select the desired LED brightness.

3.10 Exporting a Configuration File

When your Oil Condition Monitoring Sensor is fully configured it is recommended that the configuration is saved for future reference. The configuration file contains all of the user configurable information. Follow the steps below to import and export a configuration file.

Select the Sensor>Export option from the top pull down menu.

Enter the file name and save the file (*.dsc) to a suitable location on your PC.

3.11 Importing a Configuration File

To setup your sensor with a pre-saved configuration file use the following steps to import the pre-configured settings:

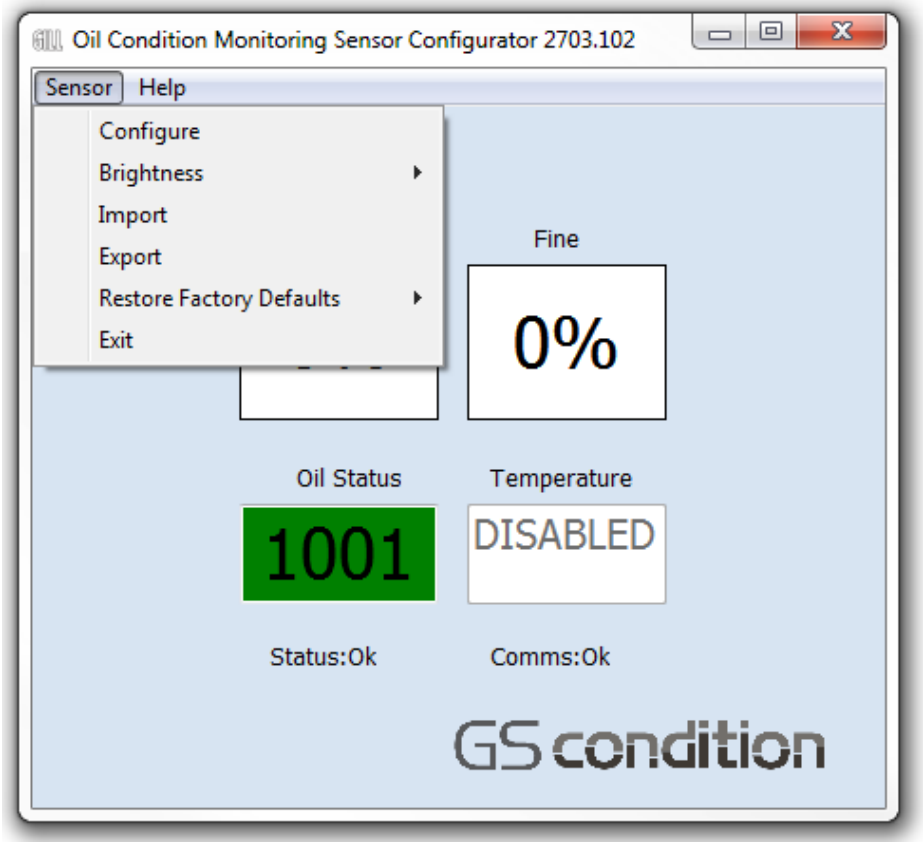
Select the Sensor>Import option from the top pull down menu.
Navigate and select the required configuration file (*.dsc) and press the open button. The new configuration file will be automatically loaded.

3.12 Restore Factory Defaults

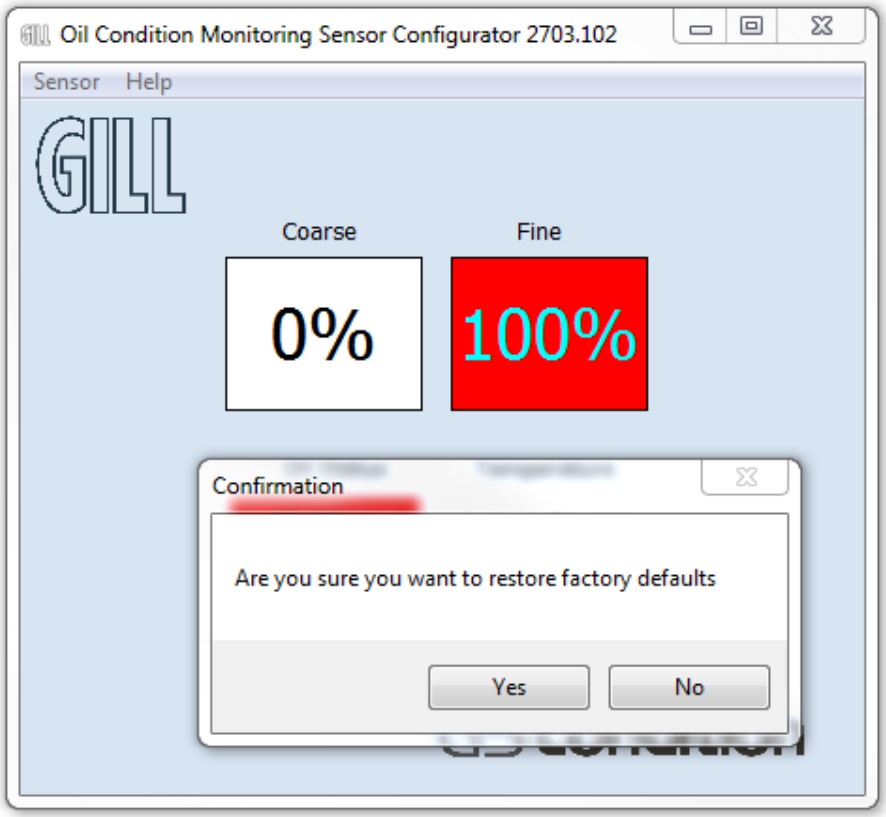
The following factory defaults are loaded into the Oil Condition Monitoring Sensor and can be restored at any time during sensor configuration. The sensor is shipped with the measurement scale set to small. The default configuration settings are defined below:

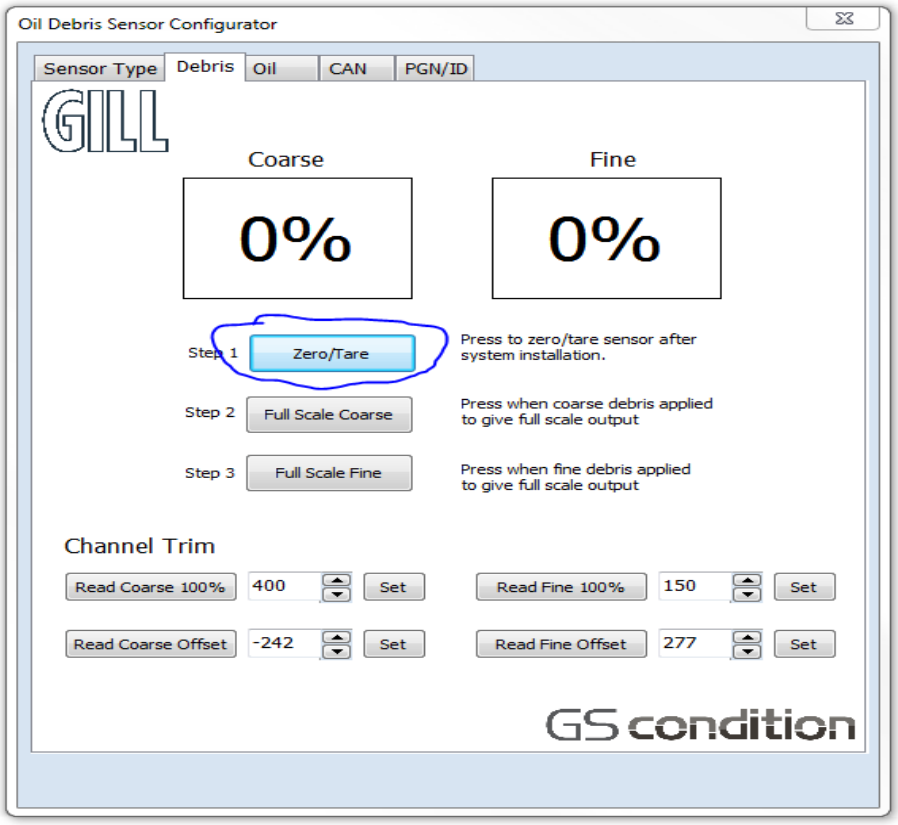
Parameter	*Sensitivity Scale*
	Small
Oil Status / Temperature	Oil Status
Inhibit Outputs During Configuration	Switched Off
Disable Fine Channel	Switched Off
Disable Coarse Channel	Switched Off

Parameter		*Sensitivity Scale*
		Small
Disable Oil Status / Temperature Channel		Switched Off
100% FSD Course		1 x 3mm Chrome steel ball bearing
2.12100% FSD Fine		0.1g iron powder
Oil Status	Reference Oil Type	Mineral Oil
	Oil Upper Threshold	1010
	Oil Lower Threshold	985
	Oil Filter Time	1 second
Temperature Status	High Temperature Alarm	+150 °C
	Low Temperature Alarm	-40 °C
LED Brightness (Industrial only)		Maximum
0-10V Outputs	Error Level	0.0V
	0% FSD	2V
	100% FSD	10V
	Inhibit	1V
4-20 mA Outputs	Error Level	0 mA
	0% FSD	4 mA
	100% FSD	20 mA
	Inhibit	2 mA
Can Outputs (J1939)	Function instance	User Configured
	ECU Instance	User Configured
	Industry Group	0000
	Vehicle System Instance	0000
	Vehicle System	0000
	Function	00ff
	Manufacturer Code	07ff
	Identity Number	0000
	NAME	User Configured
PGN/ID	Priority	0006
	Data Page	0001
	PDU Format	00ff
	PDU Specific	0000
	Address	User Configured
	PGN	User Configured
	CAN ID	User Configured

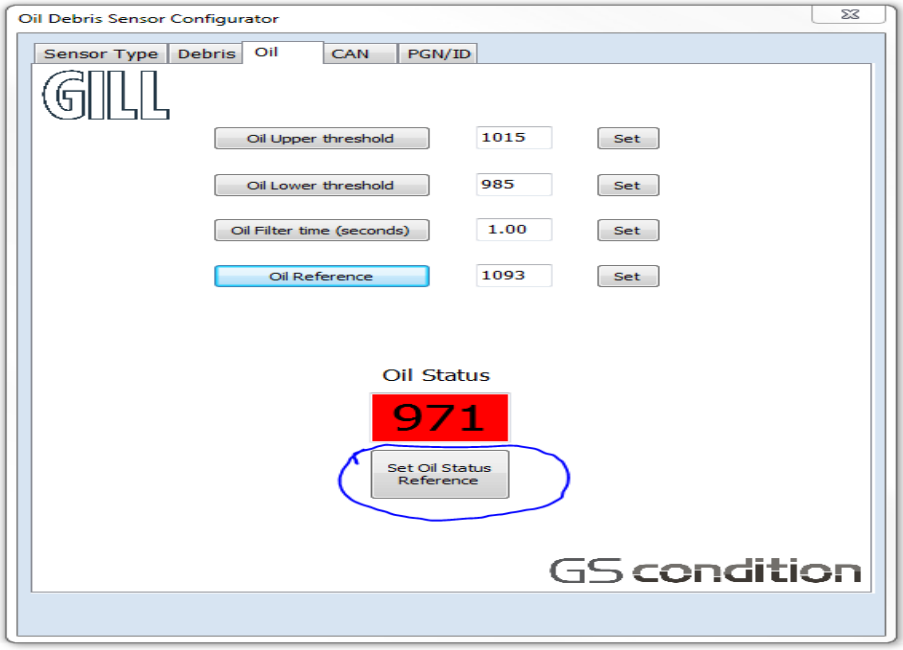


Select 'Restore Factory Defaults' then 'Small' then 'Yes'. On the next screen select 'zero/tare'.





Note: it is recommended that the zero/tare and oil status reference is always re-set after the factory defaults are loaded.



Select 'Set Oil Status Reference' and the oil status window will return to green.

4.0 Installation

4.1 Cable length

Each Standard Oil Condition Monitoring Sensor is supplied with 3000mm of cable between the sensor head and the electronics enclosure. This length should be altered by the user and any excess cable should be carefully coiled and secured to avoid damage. For volume or regular requirements please contact the Gill sales team for custom lengths. The 1000mm of flying lead after the electronics enclosure may be shortened appropriate to application.

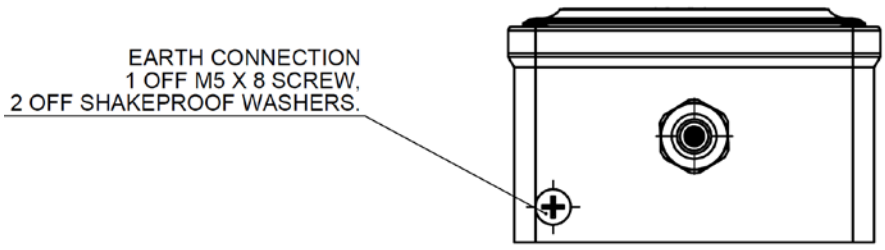
The Industrial units also come with 3000mm of cable, between the sensor and electronics enclosure, though this may be shortened and re-attached to the screw terminal connections. Bootlace ferrules are supplied for crimping to the cable ends prior to terminating in the terminal block.

It is recommended that cable length is kept to a minimum to prevent large voltage drops over the length of the cable which may affect the operation of the sensor. Care should also be taken when using the J1939 CAN variants to ensure the electrical characteristics of the CAN bus are not compromised.

4.2 Grounding

The Oil Condition Monitoring Sensor complies with International EMC standards. In order to maintain compliance with these standards it is essential that the electrical installation is connected to ground correctly. Electrical installation standards and practices vary for different countries and installation companies. It is the responsibility of the electrical installation design authority to determine the applicable standards / practices and ensure compliance with them. When designing electrical installations for the Oil Condition Monitoring Sensor it is recommended that the design authority considers the recommendations about grounding schemes are described in Section 7.5

The following local safety earth is provided for grounding the Industrial unit enclosure if local regulations require local earthing of the metallic enclosure:



4.3 Sensor Location

It is recommended that the sensor is located directly in the flow of oil. Flow restriction may be required to eliminate ferrous particle loss within high flow oil systems.

It is recommended that the sensor is fitted in the oil system before any particle filtration devices to ensure maximum ferrous particle capture.

To collect and indicate particles which have settled, the sensor may be located at the bottom of an oil pump or reservoir.

For oil contamination applications, the optimum sensor position is at the bottom of the sump for non-miscible oils or for miscible oils the sensor may be mounted in any position providing the 12mm oil sensor region remains in permanent contact with the oil.

For oil loss indication the sensor may be mounted in any orientation. The no oil condition is achieved when the 12mm oil sensor region is no longer in contact with oil.

4.4 Sensor Mounting

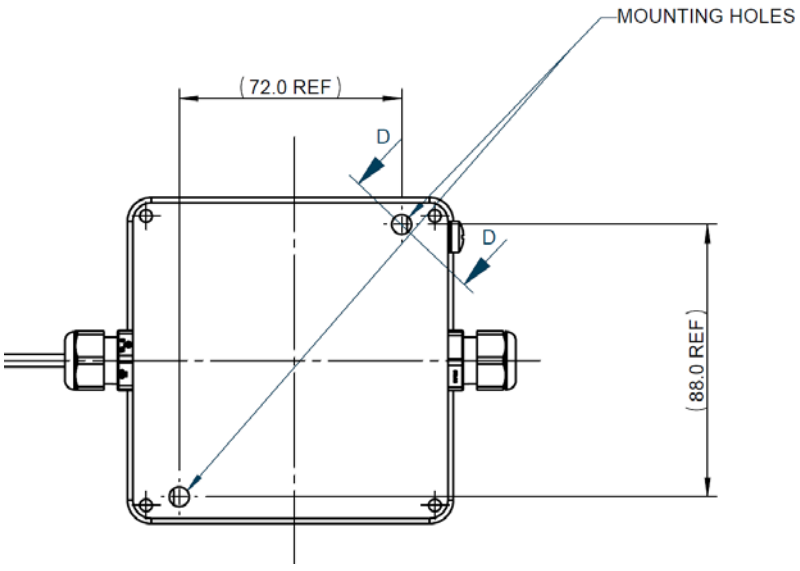
The following are the spanner sizes and tightening torques applicable for each mounting thread option:

Thread Size	Spanner A/F	Torque ±10%	Thread Size	Spanner A/F	Torque ±10%
M22 x 1.5	22.0	50 Nm	M42 x 2.0	60.0	100 Nm
M24 x 2.0	22.0	50 Nm	1 1/2" BSPP	60.0	100 Nm
3/4" x 16 UNF	22.0	50 Nm	1" BSPP	60.0	100 Nm
1/2" BSPP	22.0	50 Nm	1 1/8" 12 UNF	60.0	100 Nm
M20 x 1.5	22.0	50 Nm	1 5/16" 12 UNF	60.0	100 Nm
M25 x 1.5	22.0	50 Nm			
M26 x 1.5	22.0	50 Nm			
M27 x 2.0	22.0	50 Nm			
M30 x 1.5	22.0	50 Nm			
3/4" BSPP	22.0	50 Nm			
1" 14 UNF	22.0	50 Nm			
1" 18 UNF	22.0	50 Nm			

Note: it is recommended that the surface finish is ≤0.8µ Ra to ensure adequate sealing

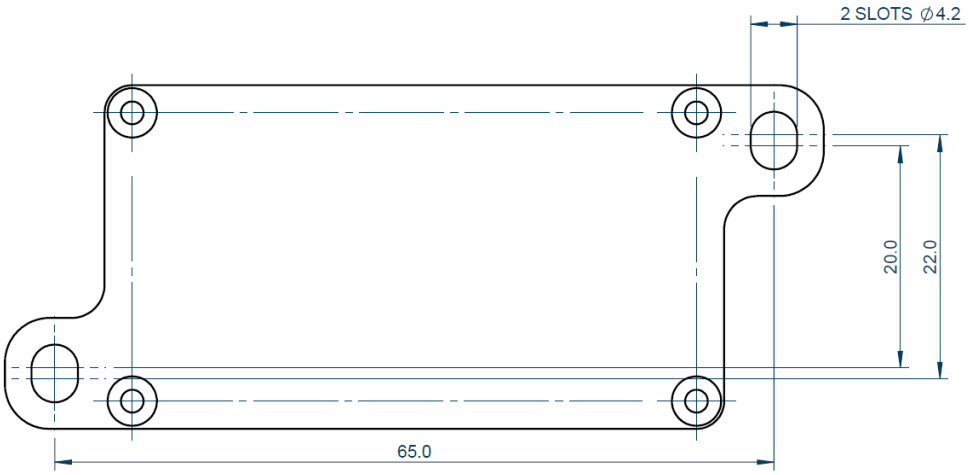
4.5 Industrial Unit Electronics Mounting

Two diameter 6.4mm mounting holes are provided for fixing the Industrial Junction Box to a fixed surface. The mounting holes are accessed by removal of the lid. The fixings (not provided) shall be suitable for supporting the weight of the enclosure. The following figure shows the mounting dimensions:



4.6 Standard Unit Electronics Mounting

Two 4.2mm diameter mounting slots are provided for fixing the electronics enclosure to a fixed surface. The fixings must be suitable for supporting the weight of the enclosure. The following figure shows the mounting dimensions:



4.7 Cable strain relief and Protection

4.7.1 Strain relief: Industrial Unit

Cable strain relief is provided at the sensor and in-line electronics cable entries. Care should be taken not to stress the cable at the cable entry. The minimum recommended cable bend radius is 20mm.

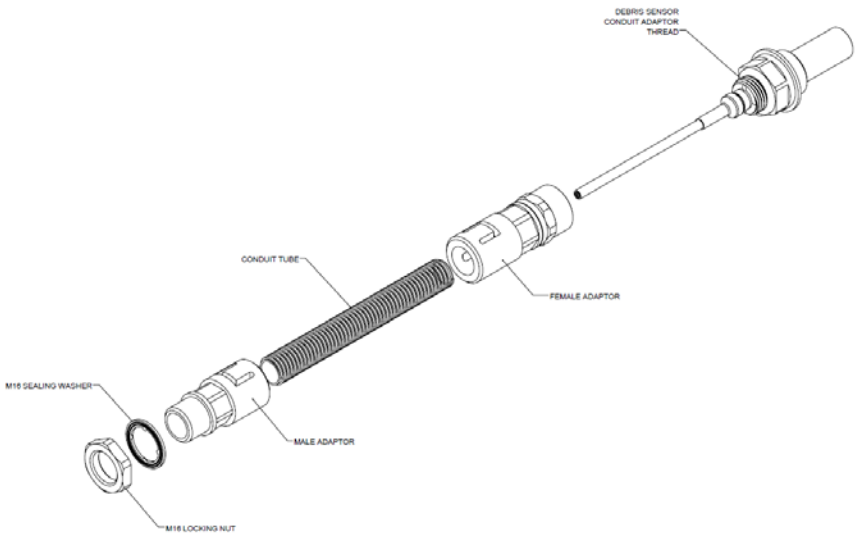
Cable strain relief is provided at the junction box cable entries. These are suitable for cable diameters of between 2-6mm.

During installation please ensure that the cable glands are fully tightened to retail the strain relief and ingress protection rating of the cable gland. The minimum recommended cable bend radius is 20mm.

4.7.2 Cable Protection: Industrial Unit

An optional conduit kit (Gill part No. 4212-10-051-X) is offered for additional cable protection of the Industrial Oil Condition Monitoring Sensor. For installation, follow the following guidelines:

1. Remove your Oil Condition Monitoring Sensor from the industrial electronics enclosure, disconnecting the wiring from the termination block.
2. Remove the M16 cable gland from the industrial junction box by unscrewing the M16 back nut.
3. Install the female adaptor onto the back of the sensor head, using an appropriate thread sealer to maintain the ingress protection of the junction box.
4. Cut the conduit tube to the required length, feed the sensor head cable through the conduit tube and clip into the back of the female adaptor by firmly pushing the tube into the aperture.
5. Feed the cable through the male adaptor and clip into the back of the adaptor by firmly pushing the tube into the aperture.
6. Install the sensor into the gearbox, engine or pump housing ensuring that the sealing washer is used.
7. Fit the male adaptor into the junction box by securely fastening the back nut ensuring that the sealing washer is used.



4.7.3 Strain Relief: Standard Unit

Cable strain relief is provided at the sensor and in-line electronics cable entries. Care should be taken not to stress the cable at the cable entries. The minimum recommended bend radius is 20mm.

5. Specifications

5.1 Industrial Unit: 4 – 20 mA output

Model Number: 4212-PK-045Sensor Connections*	
SHIELD	Silver/clear wire
DEBRIS MEASURE	RED
DEBRIS REF	BLUE
OIL SIGNAL	GREEN
OIL REF	WHITE
TEMP	ORANGE
PROBE GND	BLACK
Wire	26 AWG PTFE 3G210 screened with DR25 jacket

* Connect the wires from the probe to the respective terminals in the electronics box, see section 7.4

Electrical (Box)		Connections and outputs (Box)		
Supply voltage	+9 V to +26 V DC	SHIELD		
Over-voltage protection	> 32 V DC	CAN H	Not connected	
Power consumption	< 5.6 Watts	CAN L	Not connected	
Reverse polarity protection	> -32 V	Power DC +ve	+9 to +26 V DC	
Resolution	10-bit	Power DC –ve (ground)	0 V DC	
Report update rate	10 Hz	OIL/TEMP	0 to 20 mA	
Configuration interface	Micro USB	FINE	0 to 20 mA	
		COARSE	0 to 20 mA	
		Error indication	All outputs ,	0 – 20 mA
		Output inhibit*	All outputs ,	0 – 20 mA
		Multicolour light ring**	All outputs	
		Wire range***	35 to 13 AWG (solid) 35 to 15 AWG (stranded)	
		Armour	Additional option	

* The output inhibit is the voltage output when configuring the sensor.

** For the function of the multicolour light ring see section below.

*** Bootlace ferrules are provided protect the wires from damage by the screw terminals.

		
Green – OK	Amber – increases with debris collection	Red (Flashing) – Maximum debris condition breached

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	105.5 mm (w) x 105.5 mm (l) x 66 mm (h)
Mounting	Threaded	Mounting	2 off M6 socket-cap screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.7 kg in total		

5.2 Industrial Unit: Voltage output

Model Number: 4212-PK-046

Sensor Connections*	
SHIELD	Silver/clear wire
DEBRIS MEASURE	RED
DEBRIS REF	BLUE
OIL SIGNAL	GREEN
OIL REF	WHITE
TEMP	ORANGE
PROBE GND	BLACK
Wire	26 AWG PTFE 3G210 screened with DR25 jacket

* Connect the wires from the probe to the respective terminals in the electronics box see section 7.4

Electrical (Box)	
Supply voltage*	+5 V to +26 V DC
Over-voltage protection	> 32 V DC
Power consumption	< 2.8 Watts
Reverse polarity protection	> -32 V
Resolution	10-bit
Report update rate	10 Hz
Configuration interface	Micro USB

Connections and outputs (Box)		
SHIELD		
CAN H	Not connected	
CAN L	Not connected	
Power DC +ve	+5 to +26 V DC	
Power DC –ve (ground)	0 V DC	
OIL/TEMP	0 – 10 V	
FINE	0 – 10 V	
COARSE	0 – 10 V	
Error indication	All outputs ,	0 – 10 V
Output inhibit**	All outputs ,	0 – 10 V
Multicolour light ring***	All outputs	
Wire range****	35 to 13 AWG (solid) 35 to 15 AWG (stranded)	
Armour	Additional option	

* The supply voltage must be greater than the configured output voltage; for a 5 V output the supply must be greater than 5 V.

** The output inhibit is the voltage output when configuring the sensor

*** For the function of the multicolour light ring see section below.

**** Bootlace ferrules are provided to fit the connector.

		
Green – OK	Amber – increases with debris collection	Red (Flashing) – Maximum debris condition breached

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	105.5 mm (w) x 105.5 mm (l) x 66 mm (h)
Mounting	Threaded	Mounting	2 off M6 socket-cap screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.7 kg in total		

5.3 Industrial Unit: J1939 CAN output

Model Number: 4212-PK-047

Sensor Connections*	
SHIELD	Silver/clear wire
DEBRIS MEASURE	RED
DEBRIS REF	BLUE
OIL SIGNAL	GREEN
OIL REF	WHITE
TEMP	ORANGE
PROBE GND	BLACK
Wire	26 AWG PTFE 3G210 screened with DR25 jacket

* Connect the wires from the probe to the respective terminals in the electronics box see section 7.4

Electrical (Box)	
Supply voltage*	+5 V to +26 V DC
Over-voltage protection	> 32 V DC
Power consumption	< 2.8 Watts
Reverse polarity protection	> -32 V
Resolution	7-bit
Report update rate	1 Hz
Configuration interface	Micro USB

Connections and outputs (Box)	
SHIELD	
CAN H	CAN H (not terminated)
CAN L	CAN L (not terminated)
Power DC +ve	+5 to +26 V DC
Power DC –ve (ground)	0 V DC
OIL/TEMP	No connection
FINE	No connection
COARSE	No connection
Multicolour light ring*	All outputs
Wire range**	35 to 13 AWG (solid) 35 to 15 AWG (stranded)
Armour	Additional option

* For the function of the multicolour light ring see section below.

** Bootlace ferrules are provided to fit the connector.

		
Green – OK	Amber – increases with debris collection	Red (Flashing) – Maximum debris condition breached

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	105.5 mm (w) x 105.5 mm (l) x 66 mm (h)
Mounting	Threaded	Mounting	2 off M6 socket-cap screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.7 kg in total		

CAN digital Output			
Standard	J1939	Byte 0	Coarse measurement 0 to 100%, no scaling
Approval	Compatible	Byte 1	Fine measurement 0 to 100%, no scaling
Data Length	8 bytes	Byte 2	8 x Status bits*
PGN	130816	Byte 3	(Mux) Multiplex of next 5 bytes**
Report rate	1 Hz	Byte 4	}
Can bit rate	250 kb/s	Byte 5	} Meaning depends on value of Byte 3**
		Byte 6	}
		Byte 7	}

* Status bits are: b0 – temperature alarm, b1 – oil dielectric too high
b2 – oil dielectric too low, b3 – fine debris error,
b4 – coarse debris error b5 – dielectric error,
b6 – internal temperature error, b7 – external temperature error.

** Byte 3 values 0x00 to 0x08: bytes 4 to 7 are manufacturer specific
Byte 3 value 0x09: bytes 6 and 7 are probe temperature as 0.0625 °C / bit
Byte 3 value 0x0A: bytes 6 and 7 are electronics temperature as 0.0625 °C / bit

5.4 Standard Unit: 4 – 20 mA output

Model Number: 4212-PK-048

Electrical		Connections and outputs		
Supply voltage	+9 V to +32 V DC	Red wire		Power DC +ve
Over-voltage protection	> 32 V DC	Black wire		Power DC –ve (ground)
Power consumption	< 2.6 Watts	White wire ,	4 - 20 mA	Fine debris
Reverse polarity protection	> -32 V	Green wire ,	4 - 20 mA	Coarse debris
Resolution	10-bit	Orange wire ,	4 - 20 mA	Oil or temperature
Report update rate	10 Hz	Blue wire Blue wire		Blue wire
Configuration interface	Micro USB	Silver/clear wire		Screen
		All outputs ,	4 - 20 mA	Error indication
		All outputs ,	4 - 20 mA	Output inhibit*
Wire	26 AWG PTFE 3G210 screened with DR25 jacket			

* The output inhibit is the current output when configuring the sensor

Note – All 4-20mA channels can be configured between 0mA and 20mA with the Gill Oil Condition Monitoring Sensor user interface.

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	55 mm (w) x 30 mm (l) x 12 mm (h)
Mounting	Threaded	Mounting	2 off M4 screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.21 kg in total		

5.5 Standard Unit: Voltage output

Model Number: 4212-PK-049

Electrical		Connections and outputs		
Supply voltage*	+5 V to +32 V DC	Red wire		Power DC +ve
Over-voltage protection	> 32 V DC	Black wire		Power DC –ve (ground)
Power consumption	< 0.7 Watts	White wire ,	0 – 10 V	Fine debris
Reverse polarity protection	> -32 V	Green wire ,	0 – 10 V	Coarse debris
Resolution	10-bit	Orange wire ,	0 – 10 V	Oil or temperature
Report update rate	10 Hz	Blue wire Blue wire		Blue wire
Configuration interface	Micro USB	Silver/clear wire		Screen
		All outputs ,	0 – 10 V	Error indication
		All outputs ,	0 – 10 V	Output inhibit**
Wire	26 AWG PTFE 3G210 screened with DR25 jacket			

* The supply voltage must be greater than the configured output voltage; for a 5 V output the supply must be greater than 5 V.

** The output inhibit is the voltage output when configuring the sensor

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	55 mm (w) x 30 mm (l) x 12 mm (h)
Mounting	Threaded	Mounting	2 off M4 screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.21 kg in total		

5.6 Standard Unit: J1939 CAN output

Model Number: 4212-PK-050

Electrical		Connections and outputs	
Supply voltage	+5 V to +32 V DC	Red wire	Power DC +ve
Over-voltage protection	> 32 V DC	Black wire	Power DC –ve (ground)
Power consumption	< 0.7 Watts	White wire	CAN high (not terminated)
Reverse polarity protection	> -32 V	Green wire	Not connected
Resolution	7-bit	Orange wire	Not connected
Report update rate	1 Hz	Blue wire	CAN low (not terminated)
Configuration interface	Micro USB	Silver/clear wire	Screen
Wire	26 AWG PTFE 3G210 screened with DR25 jacket		

Mechanical			
Sensor		**Box**	
Size	57 mm x ø24.5mm	Size	55 mm (w) x 30 mm (l) x 12 mm (h)
Mounting	Threaded	Mounting	2 off M4 screws (not supplied)
Materials	Al. alloy, FEP, PEI	Materials	Al. alloy, st/steel, polyester
Weight	0.21 kg in total		

CAN digital Output			
Standard	J1939	Byte 0	Coarse measurement 0 to 100%, no scaling
Approval	Compatible	Byte 1	Fine measurement 0 to 100%, no scaling
Data Length	8 bytes	Byte 2	8 x Status bits*
PGN	130816	Byte 3	(Mux) Multiplex of next 5 bytes**
Report rate	1 Hz	Byte 4	}
Can bit rate	250 kb/s	Byte 5	} Meaning depends on value of Byte 3**
		Byte 6	}
		Byte 7	}

* Status bits are: b0 – temperature alarm, b1 – oil dielectric too high
b2 – oil dielectric too low, b3 – fine debris error,
b4 – coarse debris error b5 – dielectric error,
b6 – internal temperature error, b7 – external temperature error.

** Byte 3 values 0x00 to 0x08: bytes 4 to 7 are manufacturer specific
Byte 3 value 0x09: bytes 6 and 7 are probe temperature as 0.0625 °C / bit
Byte 3 value 0x0A: bytes 6 and 7 are electronics temperature as 0.0625 °C / bit

5.7 Environmental

	Sensor Head	Standard	Industrial
Operational Temperature	-40°C to +150°C EN60068-2-1, ISO16750-4	-40°C to +125°C EN60068-2-1, ISO16750-4	-40°C to +85°C EN60068-2-1, ISO16750-4
Protection	IP68 / IP69k to EN60529		IP65 to EN60529
Humidity	95% RH +55 °C EN60945, EN60068-2-30 Test Db, ISO16750-4		
Thermal Shock	EN60945 EN60068-2-14 Test Na, ISO16750-4		
EMC	EN 50498 & Automotive E-marking to UN ECE Reg10		--
	EN60945 (Marine) EN61000-6-3, EN61000-6-1 (Light industrial) EN61000-6-4, EN61000-6-2 (Heavy industrial) EN61326-2-1 (Measurement and control) EN13309 (Construction machinery) ISO 13766 (Earth moving machinery) ISO 14982 (Agricultural & Forest machinery)		
Vibration	EN60945 (Marine)	3 axis, 2 to 13Hz, +/-1mm 13.2Hz to 100Hz constant acceleration of 0.7g	
	EN60068-2-6(Industrial)	3 Axis, 10 to 55 Hz 0.75mm or 10g	
	Motorsport/Automotive	3 Axis, Random 5 - 2000 Hz, up to 36g	
	EN60068-2-27(Shock)	3 Axis, 25g, 6ms, 1000 cycles	
Chemical compatibility	Fuels	Diesel, Gasoline	
	Oils	Hydraulic, Gear, Motor, Vegetable, Synthetic ester, Polyalphaolefin, Polyglycol	
	Coolants	Ethylene Glycol, water	
	Fluids	Salt water	
Differential pressure	10 bar		
Cable pull	50 N all 3 axis		
General handling	1 m drop all 3 sides (in packaging)		

6. Maintenance

6.1 Cleaning

The Oil Condition Monitoring Sensor reports the amount of ferrous material attached to the sensor in real time. It is recommended that the sensor is investigated once the full scale output is reached.

The user can decide whether to remove the debris at this time or to re-install and increase the full scale alarm level.

It is recommended that the sensor is cleaned with a non-abrasive cloth prior to installation, removing any traces of used oil or metallic debris.

Note: Abrasive cleaners or solvents must not be used to clean the Oil Condition Monitoring Sensor

6.2 Servicing

There are no serviceable parts on your Oil Condition Monitoring Sensor; however it is recommended that the following periodic checks are made:

- Periodically check your Oil Condition Monitoring Sensor for oil leaks. If any oil leaks are observed, replace the hydrogenated nitrile (HNBR) bonded sealing washer and securely tighten the sensor into the gearbox or engine housing.
- It is recommended that your Oil Condition Monitoring Sensor zero/span/oil reference is checked periodically to ensure that your sensor is fully functioning using the Gill Oil Conditioning Monitoring Sensor configurator.
- Lid screws are fully fastened to prevent ingress into the electronics housing.
- Cable glands (industrial version only) are fully fastened prevent ingress into the electronics housing.

6.3 Corrosion

All of the Oil Condition Monitoring Sensor components are treated for protection against corrosion.

6.4 Sealing

A hydrogenated nitrile (HNBR) bonded sealing washer, is provided for sealing the sensor to the oil enclosure. It is recommended that the sealing washer is periodically checked for leaks and a new washer fitted if necessary.

6.5 Fault-finding

6.5.1 Troubleshooting

Q. I can't access the Debris set menu
A. Both the fine and coarse channels are disabled from the sensor type menu.

Q. I can't set the fine channel;
A. The fine channel is disabled from the sensor type menu.

Q. I can't set the coarse channel
A. The coarse channel is disabled from the sensor type menu.

Q. I can't access the Oil status/temperature channel
A. The Oil status/temperature channel is disabled from the sensor type menu.

Q. I can't set the inhibit level;
A. The inhibit outputs during configuration function is disabled from the sensor type menu.

Q. The sensor output is greater than the zero level specified by the user (>0%) without debris present.
A. Check there is no debris present on the sensor and repeat the zero / tare step with the sensor installed in the application. *Note: adjacent metalwork can cause a sensor offset and needs to be zero'd out after installation.*

Q. The status LED's do not light up
A. Turn up the brightness level.

6.5.2 Status (error) codes

To aid troubleshooting, the following status codes are shown in the Gill Configurator start up window:

Code	*Status*	*Description*
OK	Normal Operation	Normal Operation
01	Temperature alarm	Temperature over/below threshold
02	Oil status high	Oil status above threshold
04	Oil status low	Oil status below threshold
08	Fine error	Fine channel error
10	Coarse error	Coarse channel error
20	Oil status error	Oil status channel error
40	Internal temperature error	Processing electronics temperature out of range
80	External temperature error	Probe temperature out of range

6.5.3 Communications (error) codes

If a communication error occurs a communications fail error message will be displayed in the Gill Configurator start-up window. Please check power and communication connections and restart the Gill Configurator.

6.5.4 Returning a Faulty Sensor

Should a fault arise during the use of your Oil Condition Monitoring Sensor which is within the warranty period, or if you require a repair to your sensor please contact Gill Sensors & Controls for a Return Material Authorization number (RMA).

Please ensure any return units are cleaned prior to shipment.

7. Appendices

7.1 Maximum Range Coarse Debris

The following maximum range numbers are provided as a guideline only and these numbers should be confirmed with actual coarse debris samples.

Course Debris Particle Size	*Material Type*	*Maximum No. Off*
2mm	Chrome Steel Ball Bearing	>20
3mm	Chrome Steel Ball Bearing	20
4mm	Chrome Steel Ball Bearing	12
5mm	Chrome Steel Ball Bearing	10

Note: Results may vary with more debris layers, different materials and positional variation.

7.2 Maximum Range Fine Debris

The following maximum range numbers are provided as a guideline only and these numbers should be confirmed with actual fine debris samples.

Fine Debris Particle Size	*Material Type*	*Maximum Mass*
1-6 µm	Iron Powder	0.41g
60 µm	Iron Powder	0.44g
125-300 µm	Iron Powder	0.43g
450 µm	Iron Fillings	0.48g
420-850 µm	Iron Fillings	0.35g

Note: Results may vary with different materials and positional variation.

7.3 Interaction between Coarse and Fine Channels

The coarse channel is not affected by the presence of fine debris particles.

The fine channel is affected by the presence of course debris particles and both alarm levels are likely to be triggered during a coarse alarm event.

7.4 Guideline Oil Reference Number

The following oil reference numbers are provided as a guideline only and these numbers should be confirmed with actual oil samples.

Reference Media	*Alarm State*	*Raw Oil Reference number*
Air	Green	1000 - 1015
Water	Red	860
Oil	Green	990

7.5 Grounding Schemes and Recommendations

The Oil Condition Monitoring Sensor complies with International EMC standards. In order to maintain compliance with these standards it is essential that the electrical installation is engineered correctly. Electrical installation standards and practices vary for different countries and installation companies. It is the responsibility of the electrical installation design authority to determine the applicable standards / practices and ensure compliance with them. When designing electrical installations for the Oil Condition Monitoring Sensor it is recommended that the design authority considers the following:-

For the industrial version, a safety earth connection can be made by a wire connected to the unit's external earthing point.

When deciding how to earth the unit, consideration should be given to the recommendations below.

a. Ideally, the cases of both the units and the sensor should not be connected to electrically noisy (dirty) metalwork or conductors. Preferably, they should both be connected to a low noise instrument (clean) earth.

b. For the Industrial Junction box, the field cable's screen should be connected to the sensor screen via the terminations provided within the junction box, providing a single, continuous earth screen connected to a low noise instrument (clean) earth. This connection must not be allowed to complete an earth loop or connect instrument earth to safety earth.

c. If armoured cable is being used it is necessary to prevent safety (dirty) earth from becoming connected to instrument (clean) earth via the earth connections inside the junction box. This is most easily achieved by the use of insulating cable glands for the field cable entry.

d. If it is not practical to isolate the unit's case from safety (dirty) earth. The junction box should be earthed in a manner that complies with local regulations.

e. Any earth / ground bonding arrangement employed should ensure that the maximum peak voltage between the unit's case earth and any field cable conductor is less than 150 V. This includes conditions where transient surge voltages are generated by lightning or the switching of heavy electrical plant. Surge voltages in excess of 150 V can cause permanent damage to the unit's RFI filters and such damage is not covered by warranty

f. In general, correctly engineered star earthing arrangements minimise earth current crosstalk and noise, improving the reliability and performance of instrumentation.

g. Low noise instrument (clean) earth should only be connected to safety earth (usually dirty) at a single point on a site / installation. This connection should be made in such a manner that it does not introduce noise onto the instrument earth.

h. The entire length of the field cabling connected to a unit should be screened/shielded. This screen/shield should be connected to a low noise instrument (clean) earth at a single end. (The screen/shield can be connected to the unit's earth in the junction box, provided that this is isolated from all other earths/grounds.)

i. For installations where the field cable conductors run through conduit or armour connected to safety (dirty) earth, the conduit or armour should not be considered as a sufficient screen/shield. A separate cable screen/shield, connected to a low noise instrument earth should be employed.

j. The screens/shields of field cabling should not be connected in a manner that creates earth loops or that will result in the screens/shields carrying large currents from heavy plant or equipment.

k. The use of a single, screened/shielded cable for each field device ensures good screening/shielding and reduces crosstalk. Cabling arrangements that use a single cable to connect a number of field devices compromise screening and increase the potential for crosstalk. Such arrangements should only

be employed if the electrical installation design authority is confident that this will not adversely affect the reliability or performance of the system.

l. The 0V rail of a control card / control system is often connected directly to one side of the 4-20 mA input's current sensing resistor. In such instances, any electrical noise on the 0 V rail can be considered to be directly connected to the 4-20 mA input. In order to reduce the likelihood of such noise adversely affecting the performance of the Oil Condition Monitoring Sensor system it is desirable to keep noise on the 0V rail to a minimum. Safety earth/ground frequently carries a high level of electrical noise and it is therefore advisable not to connect the 0 V rail to safety earth/ground. If the 0 V rail cannot be isolated from earth it is advisable to either connect it to a low noise instrument (clean) earth or through a path that presents a high impedance to noise on the earth.

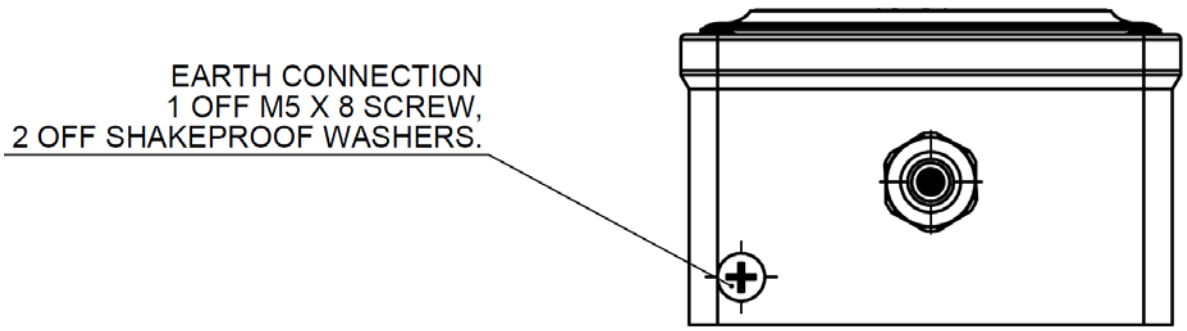
m. Oil Condition Sensor is designed to operate correctly with supply voltages down to 5 V. The reported output voltages (voltage version) or currents (4-20 mA version) are limited by the power supply. The power supply voltage should be at least 0.7 V greater than the maximum output voltage, either directly (voltage version) or when measured across the 4-20 mA sense resistor (4-20 mA version).

n. The maximum current drawn by the industrial unit is 150 mA, this includes 3 x 20 mA when the outputs are at maximum in the 4-20mA version. The maximum current drawn by the standard unit is 75 mA, again when the outputs are at maximum in the 4-20mA version. Voltage and CAN output versions will draw at least 30 mA less than these values. The field cabling conductors should have sufficient cross sectional area to ensure that when a unit is drawing these currents that the voltage reaching the units it does not fall below the required working voltage. Round loop cable resistances greater than those necessary to ensure that units always receive working voltages may result in unreliable operation.

o. Ideally, the power supply reaching units should be free from large transients, fluctuations or high frequency noise. Transients or fluctuations which take the supply voltage outside of the specified range may result in units switching off and re-booting.

p. In order to reduce the likelihood of radio frequency interference affecting the operation of units it is recommended that neither units nor their cabling are installed in close proximity to the antennae of high powered radio, radar or satellite communication equipment.

The following local safety earth is provided for grounding the industrial enclosure if local regulations require local earthing of the metallic enclosure:



7.6 Oil Conditioning Monitor Sensor parts

Your Oil Condition Monitoring Sensor consists of the following parts:

Standard Unit

- Oil Condition Monitoring Sensor prewired with In-Line electronics unit
- USB cable assembly for setup configuration, Gill Part Number 020-05880

Industrial Unit

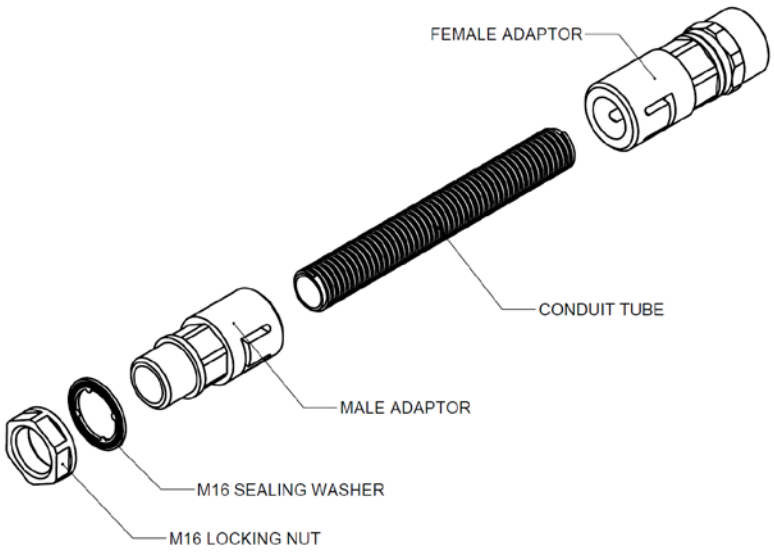
- Oil Condition Monitoring Sensor
- Junction Box electronics unit with local visual display
- USB cable assembly for setup configuration, Gill Part Number 020-05880
- Crimp type Bootlace ferrules.

7.8 Packaging

The packaging has been designed to protect the Oil Condition Monitoring Sensor during transportation. Carefully unpack the equipment, observing any instructions that may be printed on or contained in the packaging, and check the contents for transit damage. Dispose of the packaging according to local regulations.

7.9 Accessories

An optional conduit kit (Gill part No. 4212-10-051-X) is offered for additional cable protection of the industrial variant of the Oil Condition Monitoring Sensor. The X suffix is the length of the conduit tube in meters. The conduit kit consists of the following components:



7.10 Product variants

Part No.	Variant
4212-PK-045	Industrial 4-20mA output
4212-PK-046	Industrial 0-10V output
4212-PK-047	Industrial CAN output

Part No.	Variant
4212-PK-048	Standard 4-20mA output
4212-PK-049	Standard 0-10V output
4212-PK-050	Standard CAN output

7.11 Sensor De-commissioning

7.11.1 Uninstall the Oil Condition Monitoring Sensor Configurator App

Launch the Oil Condition Monitoring Sensor configurator uninstall software application from your program file location selected during installation.

Alternatively, open Control Panel>Programs and Features and select the Oil Condition Monitoring Sensor Configurator from the list and select the Uninstall option to remove your Oil Condition Monitoring Sensor configurator software from your PC.

7.13 EC Declaration

Gill Sensors & Controls

EU Declaration of Conformity

In accordance with the following CE Directives:

CE **2014/30/EU (Electromagnetic Compatibility – EMC)**
2011/65/EU (Restriction of Hazardous Substances – RoHS)

We, Gill Sensors & Controls Ltd., declare under our sole responsibility that the products:

GS Condition Monitoring Sensor:

4-20mA Output variant	**4212-PK-048**
Voltage Output variant	**4212-PK-049**
CAN Output variant	**4212-PK-050**

GS Industrial Condition Monitoring Sensor:

4-20mA Output variant	**4212-PK-045**
Voltage Output variant	**4212-PK-046**
CAN Output variant	**4212-PK-047**

Manufactured by: Gill Sensors & Controls Ltd.
Unit 600 Ampress Park
Lymington,
Hampshire. UK
SO41 8LW

To which this declaration relates, are in conformity with the protection requirements of Council Directive 2014/30/EU on the aproximation of the laws relating to electromagnetic compatibility. This Declaration of Conformity is based upon compliance of the product with the following harmonised standards:

Marine	EN60945:2002
Vehicle Components	EN50498 as per UN ECE Reg 10
High. Industrial	EN61000-6-3:2007 + A1:2011
	EN61000-6-1
Heavy Industrial	EN61000-6-2:2005
	EN61000-6-4
Measurement Contro	EN61326-2-1:2013
Construction Machinery	EN13309:2010

Gill Sensors & Controls Limited certifies that the 4212 Condition Monitoring Sensor is compliant with the European Union's Restriction on the Use of Hazardous Substances in Electrical and Electronic Equipment ("RoHS 2") Directive 2011/65/EC by absence of hazardous materials specified herein.

Restriction of Hazardous Substances EN 50581:2012

Signed by:

Print Name: *C Wright– Director of Group Operations*

Date of issue: 15/06/2017
Place of issue: Gill Sensors & Controls Ltd. Unit 600 Ampress Park, Lymington, Hampshire. UK SO41 8LW

Change Note: 558 Doc no: 5002-249 ... 4

Important Notices:

1. Gill Sensors & Controls Limited can take no responsibility for installation and/or use of its equipment if this is not done in accordance with the appropriate issue and/or amendment of the manual.
2. The user of this manual should ensure that it is appropriate in all details to the exact equipment to be installed and/or operated. If in doubt, the user should contact Gill Sensors & Controls Limited for advice.
3. If further details are required which do not appear in this manual, contact Gill Sensors & Controls Limited or one of their agents.
4. Install and use the Oil Condition Monitoring Sensor in accordance with the local regulations.
5. Gill Sensors & Controls Limited reserve the right to change or revise the information supplied in this document without notice and without obligation to notify any person or organisation of such revision or change.

Help Us to Help You:

Every effort has been made to ensure the accuracy in the contents of our documents, however, Gill Sensors & Controls Limited can assume no responsibility for any errors or omissions in our documents or their consequences. Gill Sensors & Controls Limited would greatly appreciate being informed of any errors or omissions that may be found in the contents of any of our documents.

Gill Sensors & Controls Limited
Unit 600, Ampress Park, Lymington,
Hampshire, SO41 8LW, UK
Tel: +44 1590 613900, Fax: +44 1590 613901
Email: info@gillsc.com Website: www.gillsc.com