TANDELTA
Oil Condition Monitoring

User Guide

OQSx-G2 (Standard Sensor)

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DEFINITIONS


WARNING: Risk of injury or death.

CAUTION: Risk of damage to objects


IMPORTANT: Important information

TABLE OF ACRONYMS

MOT - Mobile Oil Tester Kit	TBN - Total Base Number	LHS - Left Hand Side
FSH - Full Spectrum Holistics	UKCA - UK Conformity Assessed	PDO - Process Data Object
OQS - Oil Quality Sensor	FAQ's - Frequently Asked Questions	ENC - Electronic Navigational Charts
TDN - Tan Delta Number	BS - British Standard	Ts&Cs - Terms and Conditions
TAN - Total Acid Number	RHS - Right Hand Side	

COPYRIGHT NOTICE

DISCLAIMER

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain. Always ensure the correct configuration, installation, and connection of the sensor in accordance with these instructions prior to any use.

The information contained within this manual affects your legal rights, responsibilities, and safety. Failure to read and follow any instructions and warnings contained within this document may result in a serious injury to yourself or others, damage to your Tan Delta Systems product(s), or damage to other objects.

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AMENDMENT RECORD SHEET

Version Number	Amendment(s)	Issued by	Date
1	New document	S Rickards	29 November 2024

CONTENTS

1 PRODUCT INFORMATION - OQSx-G2 OIL QUALITY SENSOR

Fig. 1-1 OQSx-G2 Sensor

IMPORTANT:

If you purchase a Tan Delta OQSx-G2 Oil Quality Sensor on its own, it **will not** be supplied with a Configuration Cable (**Cable J**).

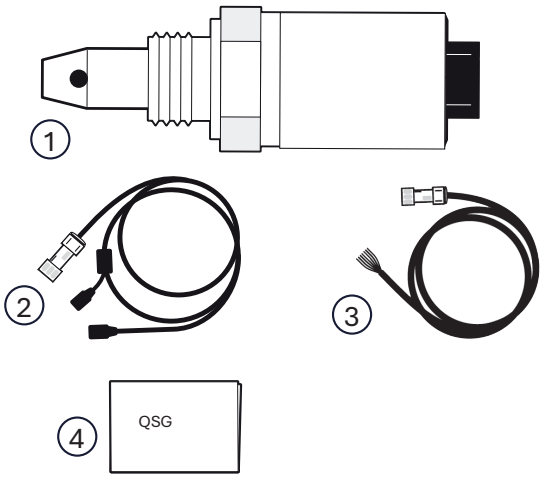
Cable J is needed to configure the sensor to your specifications using the Tan Delta Configuration and Data Management Software (**CADS**).

Cable J is included, along with an OQSx-G2 Sensor, in the Tan Delta **SENSE-1**, **SENSE-2** and **SENSE-3** kits. This User Guide covers the basic kit, SENSE-1, but the sensor configuration and installation is identical for SENSE-2 and SENSE-3.

1.1 Kit Content

Check that your kit contains the following items:

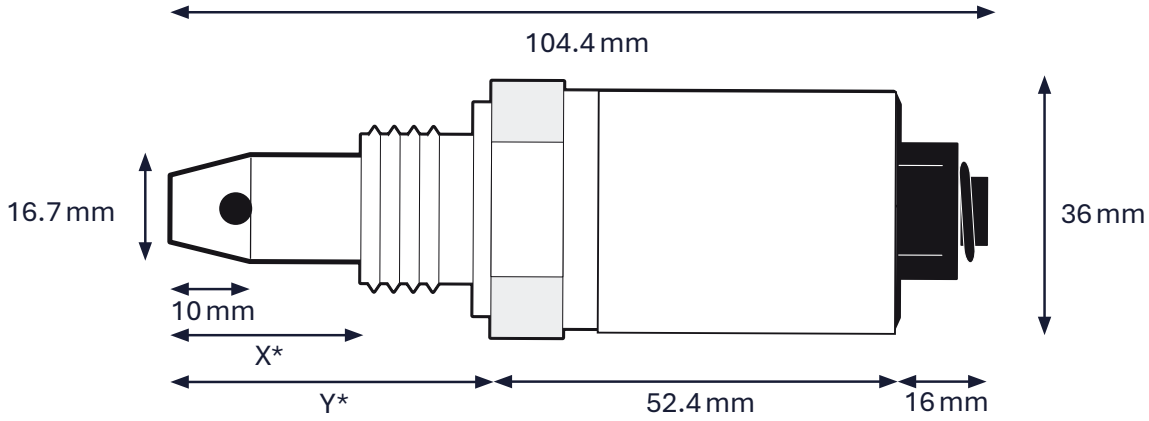
What's in the box Product Code: SENSE-1-BS1	
Item	Description
1	Gen II Oil Quality Sensor (OQSx-G2)
2	Configuration Cable J
3	Cable SB## - for installation of the sensor into third-party telematics systems
4	Quick Start Guide



1.2 Dimensions

Approximate dimensions that may change. Illustrations not to scale.

1.2.1 Standard-Body Sensor



**X and Y dependent on thread dimensions - see table below*

1.2.2 Long-Nosed Sensor

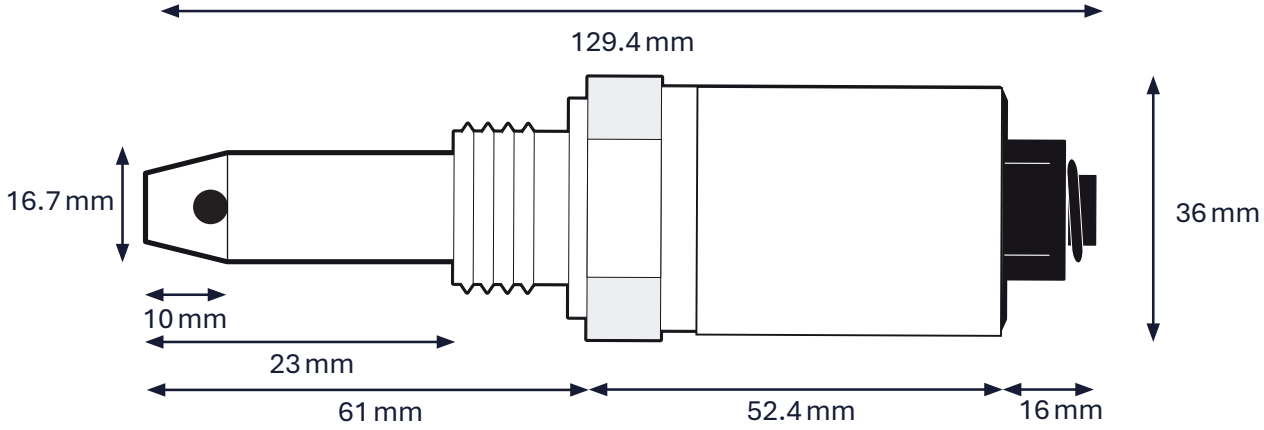


Fig. 1-1 Probe Dimensions

Thread Dimensions			
Item	Product Code	Description	Thread Length
1	OQSx-G2-NP1	Body 1/2 in NPT	Nose diameter 16.7 mm Insertion Length 36 mm
2	OQSx-G2-BS1	Body 1/2 in BSPP Flat Faced	Nose diameter 16.7 mm Insertion Length 36 mm
3	OQSx-G2-UN1	Body 7/8 UNF	Nose diameter 16.7 mm Insertion Length 36 mm
4	OQSx-G2-M18	Body M18 Fine	Nose diameter 16.3 mm Insertion Length 36 mm
5	OQSx-G2-BS2	Body 1/2 in BSPP Long-Nosed Sensor	Nose diameter 16.7 mm Insertion Length 61 mm Long

2 OQSx-G2 SENSOR TECHNICAL SPECIFICATION

Environmental Specifications	
Operating Temperature	-40 °C (-40 °F) to +120 °C (+248 °F)
Calibrated Temperature	-20 °C (-4 °F) to +120 °C (+248 °F)
Fluid Temperature	-40 °C (-40 °F) to +120 °C (+248 °F)
Fluid Pressure	up to 70 bar (1015 psi)
Storage Temperature	-55 °C (-67 °F) to +150 °C (+302 °F)
Physical Characteristics	
Material	Stainless Steel AISI304
Dimensions	102 mm x 36 mm (L x W)
Weight	180 g
Connection	32 mm AF Hex Collar
Torque	25 Nm
Available Threads	
Thread	**Seal**
1/2 in BSPP	Dowty Type
1/2 in NPT	n/a
7/8 in UNF	‘O’ Ring
M18	Dowty Type
Connections	
Connector	6 pin Bulgin 4000 series
Electrical	
Supply	+9 - 30 V DC
Consumption	0.4 W Average
Data Output/Input	
Digital Output	RS485, CANbus
Protocols Supported	Modbus RTU, CANopen and J1939 on CANbus
Analog Output	4 - 20 mA
Oil Quality Detection Parameters	
Frequency	Every 2 seconds
Output	Tan Delta Number (TDN), Oil Temperature (C or F)
Elements	All wear and contamination
Accuracy	+/- 0.5%

Range and Accuracy	
Sensor oil quality normal operating range	- 10 % to + 30 % loss factor
Sensor oil quality accuracy/repeatability	+/- 3 % loss factor
Sensor temperature normalisation accuracy	Pre V 2.4 +/- 3 % loss factor Post V 2.4 +/- 1.5 % loss factor
Sensor oil temperature normal operating range	-20 °C to + 120 °C
Sensor oil temperature accuracy	+/- 3% of full range (+/- 4.2 °C)
Sensor internal temperature operating range	-20 °C to +120 °C
Sensor internal temperature accuracy	+/- 3% of full range (+/- 4.2 °C)
Sensor 4-20 mA accuracy	+/- 1% of full range (+/- 0.2 mA)*
Standards and Certification	
Water & Dust	IP68 when connected
Shock & Vibration	BS EN 60068-2-30 (Test Db - Cyc. Hum.) BS EN 60068-2-6 (Test Fc - Sine Vib.) BS EN 60068-2-27 (Test Ea -Mech. Shock)
EMC	EN 61000-6-4:2007 (Generic Emissions Standard for Industrial Environments) EN 61000-6-2:2005 (Generic Immunity Standard for Industrial Environments)
Conformity	CE Marked RoHS Compliant

3 OQSx-G2 SENSOR CONFIGURATION

IMPORTANT:

You must configure the sensor to your specifications using the Tan Delta **Configuration and Data Management Software (CADS)**.

Install **CADS** by going to our website and clicking the link to download:
www.tandeltasystems.com/support/

NOTE:

The CADS application **must** be installed on a windows PC or laptop.

CADS **does not** operate on Mac devices or Chromebook devices.

3.1 Set Up

NOTE:

You will Administrator privileges on your computer to Install the CADS application.

Also, when CADS has installed, we recommend that you connect the Configuration cable to the PC whilst Administrator privileges are still granted, so it will recognise the cable and install any drivers that are needed.

3.1.1 Install the CADS application onto a PC / Laptop

1) Install CADS by accessing www.tandeltasystems.com/support/
2) Follow the link and download.
3) When prompted, select **Open folder** to view files.
4) Launch the **setup.exe** file and follow the instructions in the setup wizard.
5) When prompted, click on **Install**.
   When installation is complete, **CADS** is displayed.
   It may take up to a minute for the software to identify the OQSx-G2.
6) Allow the PC/laptop to automatically update drivers, if needed.

3.1.2 Start the software

Start the CADS application and wait for the home screen to load.

NOTE:

If sensors are configured to Modbus/CANbus, you **must** open the software first, and then connect the Sensor.

3.1.3 Connect the OQSx-G2

1) Once the home screen has loaded, select **Configure Oil Quality Sensor** from the options on the home screen.
2) Connect the OQSx-G2 to your computer using the configuration cable (**Cable J**) as shown in Fig. 3-1.

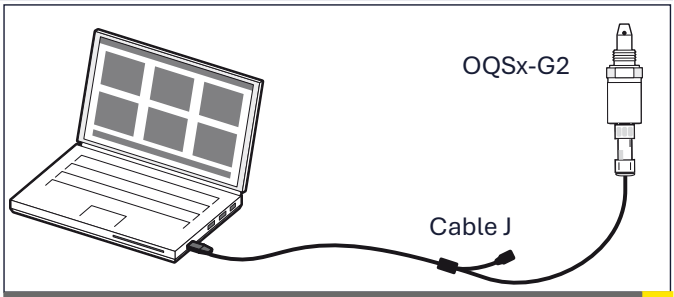


Fig. 3-1 Setting up a sensor for configuration

(Standard sensor shown)

3.1.4 Select your Sensor

CADS will display a list of all connected devices, identified by serial number, as shown in Fig. 3-2.

1) Select the required device.

2) Click the arrow in the top right corner to proceed

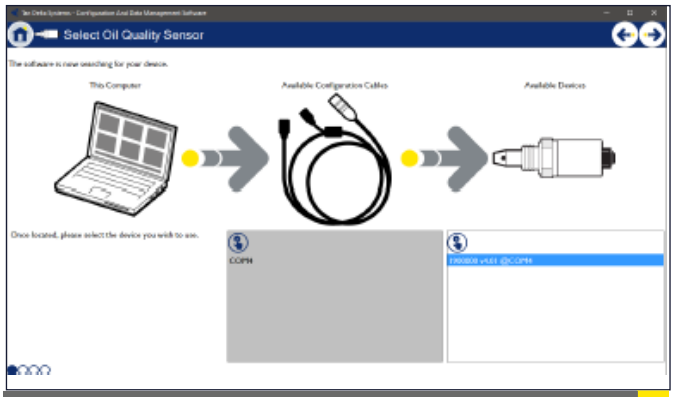


Fig. 3-2 CADS Sensor selection screen

3.1.5 Communication Settings

The CADS application lists the options for the device to which you are connecting the sensor, as shown in Fig. 3-3. SENSE-3 Gateway Devices are supplied configured for Modbus, and therefore require Custom Communications Settings.

Earlier versions of the Gateway were not configured for Modbus. If you have a query, contact Tan Delta Support www.tandeltasystems.com/support/

- **Custom Communications Settings** – Allows you to select custom **Node ID** and **Bit Rate** for RS485, CANbus, J1939, Modbus RTU.

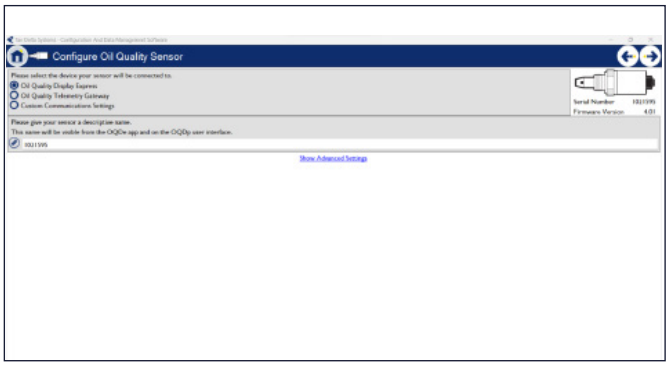


Fig. 3-3 Communication options

3.1.6 Oil Configuration

This page allows you to select any oil from our database.

The boxes at the top of each column allow you to either search or filter the database with the drop-down menu or type directly into the box.

If the oil you require is not in the database, please contact support@tandeltasystems.com for help.

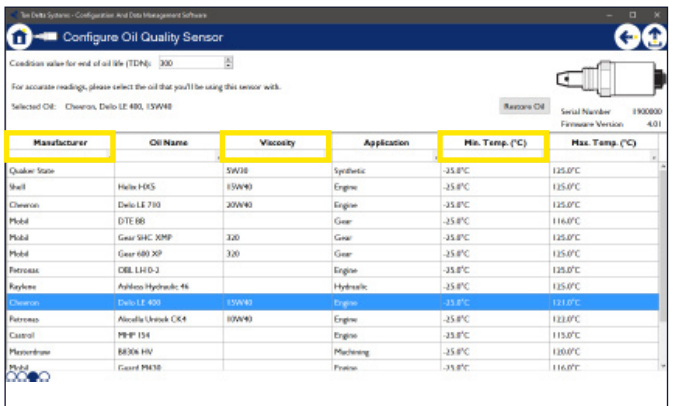


Fig. 3-5 Oil Selection

4 OQSx-G2 SENSOR INSTALLATION

4.1 Precautions

Read these instructions before installing the oil quality sensor.

The sensor is robust, however it can be damaged by mistreatment.

The following must be noted:

- Install the sensor into the equipment **before** making electrical/wiring connections.
- Make sure that the fittings being used correspond with the sensor thread size
- Tighten to no more than 20 Nm with a 32 mm spanner.
  Do not over tighten.
- Do not attempt to screw or tighten the sensor using the body. Always use the “Hex” head with the correct size spanner (32 mm).
- Refer to Fig. 4-1. To prevent vibration having any adverse effects to the cable/ sensor connectors, the cable must either be mounted on the same plane as the sensor, or have a loop fitted to absorb vibration.
- Do not twist the cable relative to the sensor head.
- Keep away from sharp edges which may cut into the cable.
- Do not bend the cable excessively, minimum bend radius = 50 mm (2 inches).
- Where possible, keep the cable away from sources of heat, (such as an engine block), and electrical interfaces.
- Oil pressure must not exceed 70 bar.

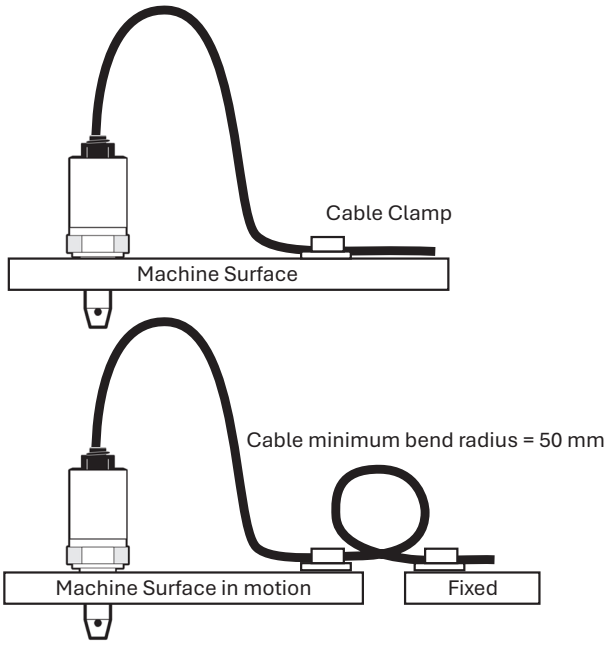


Fig. 4-1 Cable Fitting

4.2 Choosing the Sensor Mounting Location

The performance of the sensor will be enhanced through careful consideration of the mounting location.

Refer to Fig. 4-2.

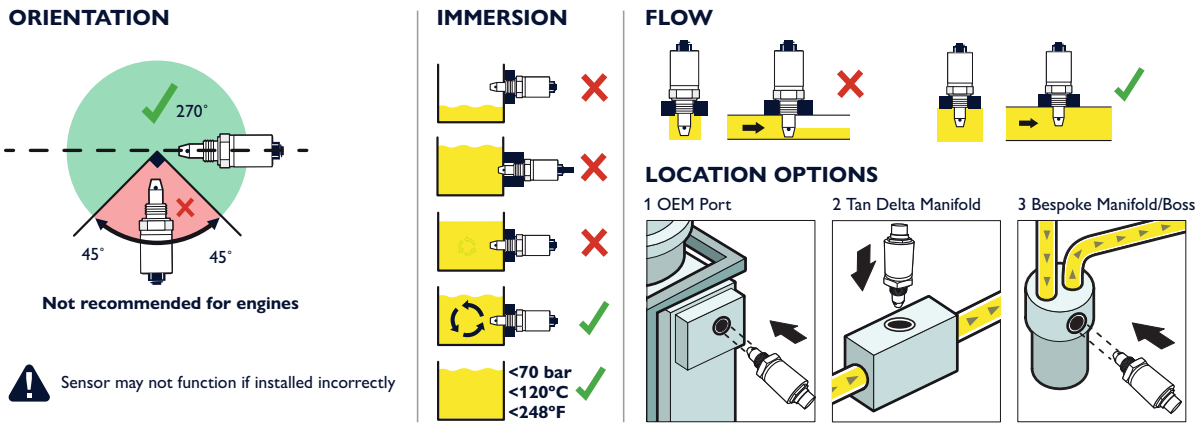


Fig. 4-2 Choosing a mounting location for the Sensor

The following guidelines must be followed.

- The Sensor must, if possible, be mounted in a horizontal position.
- Whenever possible, the sensor **should not** be mounted in the bottom of a sump, as the sensor head may become restricted which will prevent correct operation.
- Dynamic oil flow is necessary: do not mount in places where the oil is likely to stagnate or be static; The oil in the sensor needs to be representative of the whole system.
- The sensor nose must remain immersed in the oil at all times.
- When the oil quality sensor is mounted in a pipeline, make sure that the sensor will not restrict flow.
- For maximum performance when mounting the oil quality sensor in a lubrication system, make sure that the sensor is located prior to the oil filters, oil coolers etc. This ensures that the oil is representative of the whole system.

4.3 Fitting Method

- Use a 32 mm Torque-adjustable spanner for installation.
- Decide on an appropriate location for the sensor head installation.
- Drain the lubricant sufficiently to allow the sensor to be fitted.
- Install the sensor head into the selected location/position. Torque to 20 Nm, being careful not to over-tighten.
- Route the cable, fixing it with cable ties at appropriate intervals.
- Avoid sharp edges and hot surfaces.
- Connect the sensor to the chosen interface.

4.4 Electrical Connection

4.4.1 Power Supply

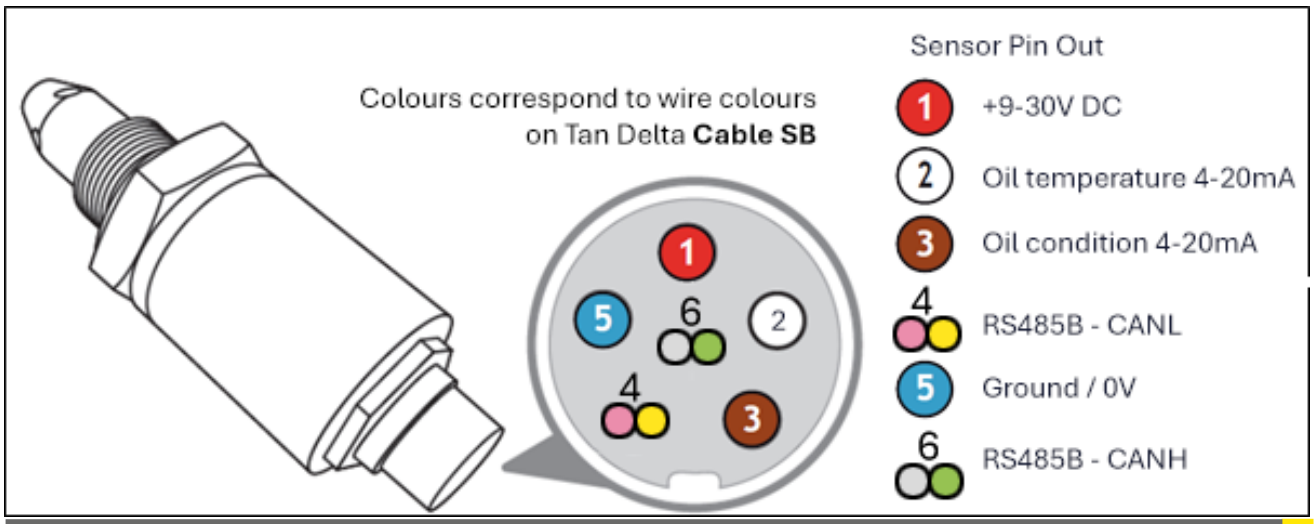


Fig. 4-3 OQSx-G2 cable connector pin out & Tan Delta cable schedule

4.4.2 Connecting the sensor to your system

If the sensor is not used as part of either a SENSE-2 or SENSE-3 kit, we recommend using a Tan Delta OQSx-G2 to Bare Ends cable (**Cable SB** – various lengths available). Refer to Fig. 4-3 for the bare end wire connection details.

Align and slot in the 6-pin connector and then tighten the connector screw-cap.

NOTE:

To prevent possible damage, it is recommended that any unused cable ends are insulated.

4.4.3 Data Output

You can use the output from Pins 2 and 3 to provide an analog indication of the oil temperature and condition on other, third party, data acquisition and control systems.

Oil condition is output on Pin 3 and is linearly scaled from 4 mA to 20 mA.

This can easily be converted to the TDN using the table in “8.1 Appendix 1” on page 16.

A clean oil should provide an output of about 8 mA.

For some common applications, illustrative the warning and alarm values are shown in Fig. 4-4.

Any value below 4 mA or above 20 mA indicates a fault.

	Engine (e.g. Diesel)	Gas Engine	Hydraulic	Compressor	Transmission
High Alarm	**5.6 mA (1140 TDN)**	**5.6 mA (1140 TDN)**	**6.4 mA (1060 TDN)**	**7.7 mA (1050 TDN)**	**6 mA (1100 TDN)**
High Warning	6.4 mA (1160 TDN)	6.4 mA (1160 TDN)	7 mA (1000 TDN)	7 mA (1000 TDN)	7 mA (1000 TDN)
Condition OK					
Low Warning	13 mA (400 TDN)	9.4 mA (760 TDN)	9.4 mA (760 TDN)	10.5 mA (650 TDN)	10 mA (700 TDN)
Low Alarm	**14 mA (300 TDN)**	**10.4 mA (660 TDN)**	**10.4 mA (660 TDN)**	**11 mA (600 TDN)**	**12 mA (500 TDN)**

Fig. 4-4 Generic Warnings / Alarms (Inc 4 - 20 mA)

4.4.4 Using the Oil Temperature analog output

The analog output on pin 2 provides a linearly scaled measure of Oil Temperature in °C as follows:

- 4 mA = -30°C
- 20 mA = +130°C

Refer to Appendix 2.

5 SENSOR CLEANING & MAINTENANCE

CAUTION:

For accurate results during testing, it is vitally important to do any test using a clean sensor.

Any oil residue from a previous test **MUST** be removed.

To clean the sensor:

1) Clean any excess oil from the end of the sensor with absorbent paper.
2) Remove the remaining oil by spraying Loctite 7063 cleaner into each of the four holes at the end of the sensor, and all over the outside of the tip.
3) Give a general exterior wash on both sides as shown in Fig. 5-1.
4) Give a longer blast into the centre hole (2 seconds).
5) Give the sensor a sharp shake to dislodge any solvent remaining around the electrode.
6) Leave to dry for at least 1 minute.

Fig. 5-1 Cleaning the Sensor

*Loctite 7063 Solvent Cleaner Recommended

Other low residue cleaners may also be suitable, please refer to your distributor for more information. See Section 5.1.

NOTE:

The sensor does not require cleaning once it has been installed, unless the application is relatively high in particulate contamination.

5.1 Cleaning Procedure – Using Odourless Kerosene

1) Unplug and remove the sensor then use absorbent paper to wipe off the excess oil from the sensor tip and thread.
2) Attach a bottle adaptor to a sample bottle and pour in approximately 15ml of kerosene.
3) Screw in the sensor and shake vigorously for 2 minutes to ensure the kerosene washes up around the tip of the sensor.
4) Remove the sensor from the adaptor and shake rigorously over the absorbent paper to dislodge any excess kerosene.
5) Leave to dry for a few minutes.

6 OQSX-G2 SENSOR - SUPPORT

Issue	Possible cause	Checks	What to do if the check fails...
No Output from the sensor Analog Outputs	Power Issue?	Make sure that the power supply is 9-30V DC	Make sure sensor earth connection is properly made.
			Contact Tan Delta Support
No Output from the sensor Digital Outputs	Power Issue?	Make sure that the power supply is 9-30 V DC	Make sure sensor earth connection is properly made.
			Contact Tan Delta Support
	Communication issue	Check communication with CADS using Cable J	Connect in the correct order: CADS looking for sensor > Connect Cable J (ID COM port) > Connect Sensor
			Contact Tan Delta Support
	Cable Issue	Check cable connections are correct	Check the cable for damage
			Disconnect the sensor and receiving device / system, check the cable for continuity
			Check the cable for shorts across wire cores
			Contact Tan Delta Support
Sensor analog output implausible	Connection / integration issue	Is the receiving device / system current sensing?	Install a resistor in parallel to the receiver device (not to exceed 250 R)
Sensor output implausible	Oil condition high (above 1200 TDN)	Sensor nose is in air	Immerse sensor nose in oil continually
			Check that the correct oil profile is being used
	Oil Condition extremely high (above 1500 TDN)	Contact Tan Delta Support	
	Oil Condition low (Below 300 TDN)	Oil likely to be very worn or contaminated	Change Oil
	Oil condition extremely low (Below 0 TDN)	Oil likely to be highly contaminated	Change Oil
	Oil condition extremely low (Below -1000 TDN)	Has sensor got an oil profile loaded?	Configure sensor with an oil profile
			Sensor possibly in water or contaminated with metallic particles. Clean sensor and investigate source of contamination
			Contact Tan Delta Support
Sensor output unstable (Noisy or unreadable)	Incorrect oil profile being used	Check oil profile is correct	Contact Tan Delta Support
	Air / cavitation	Install sensor where it will be continually immersed in oil with no air bubbles	Contact Tan Delta Support
	Heavy contamination	Replace Oil & investigate the source of the contamination	Contact Tan Delta Support

7 SOFTWARE USER AGREEMENT

IMPORTANT:

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8 APPENDIX 1

Oil Condition Conversion Chart

The table below gives illustrative and guideline figures only.
For further advice on setting your alarms, contact our support team
www.tandeltasystems.com/support/

Number Format
TDN = Always 4 digits
Conversion
4 - 20 mA to TDN = (mA -17) * -100

4 - 20 mA	TDN	Alarm Setting
<4		
4 mA	1200	
5 mA	1200	High Alarm
6 mA	1100	High Warning
7 mA	1000	
8 mA	0900	
9 mA	0800	
10 mA	0700	
11 mA	0600	
12 mA	0500	
13 mA	0400	Low Warning
14 mA	0200	Low Alarm
15 mA	0200	
16 mA	0100	
17 mA	0000	
18 mA	0000	
19 mA	0000	
20 mA	0000	

9 APPENDIX 2

Oil Temperature Analog Output

The table below shows how the Oil Temperature output (4 - 20 mA) converts to temperature.
The conversion from mA to °C and °F are as follows:

Output	Pin	Calculation	Unit	Low	High
Oil Temperature	2	°C = (mA * 10) – 70	°C	4 mA = - 30°C	20 mA = 130°C
		°F = (mA * 18) – 94	°F	4 mA = -22°F	20 mA = 266°F

OQSxG2 Output 4-20 mA value	Temperature Conversion	
	°C	°F
20	130	266
19.5	125	257
19	120	248
18.5	115	239
18	110	230
17.5	105	221
17	100	212
16.5	95	203
16	90	194
15.5	85	185
15	80	176
14.5	75	167
14	70	158
13.5	65	149
13	60	140
12.5	55	131
12	50	122
11.5	45	113
11	40	104
10.5	35	95
10	30	86
9.5	25	77
9	20	68
8.5	15	59
8	10	50
7.5	5	41
7	0	32
6.5	-5	23
6	-10	14
5.5	-15	5
5	-20	-4
4.5	-25	-13
4	-30	-22
<4	Fault	

TANDELTA
Oil Condition Monitoring

Tan Delta Systems Plc

1 Carrera Court
Church Road
Dinnington
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