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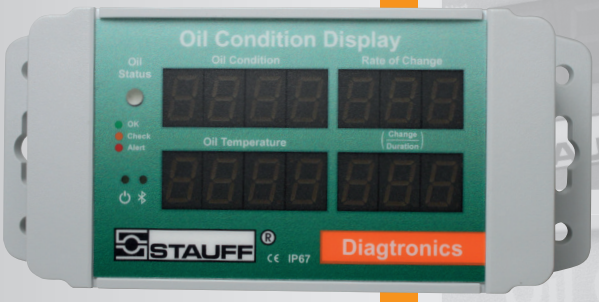

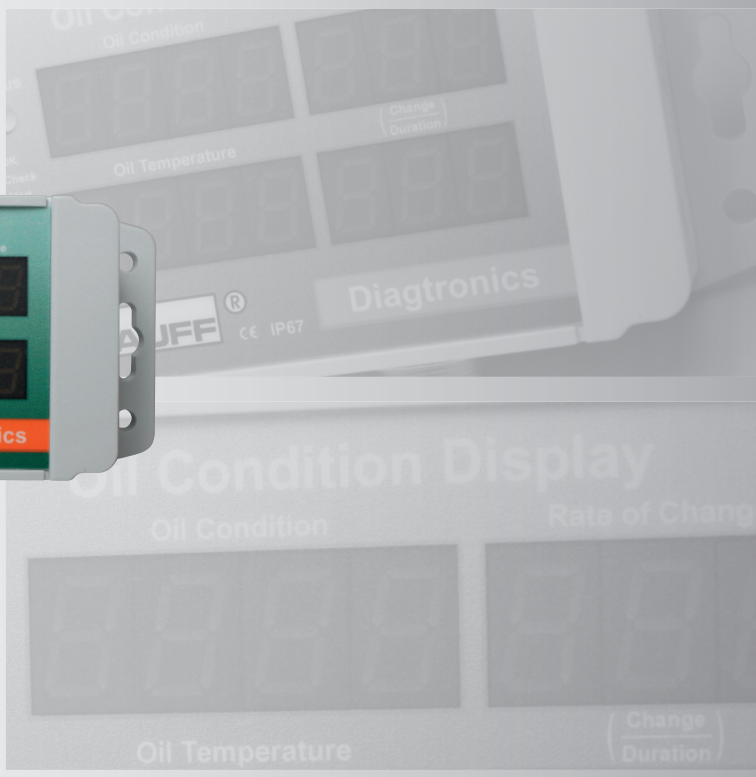

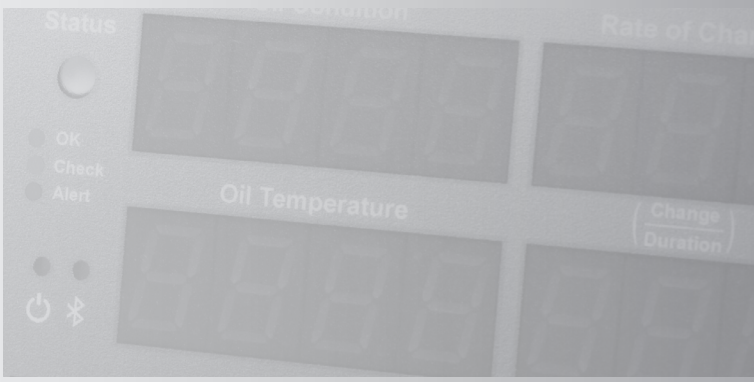

OCS I-Display

Manual

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1. Explanation of Symbols and Notes

The following designations and symbols for dangers are used in this manual:

This symbol denotes safety precautions, the non-observance of which can endanger persons.

This symbol marks an important note for the proper use of the off-line unit. The non observance of these notes can lead to damage to the off-line unit.

This symbol is followed by user tips and other useful information. They help you to obtain optimum function from all sections of your system.

2. Introduction

The STAUFF Oil Quality Display (OCS I-Displays) is a display unit (see Figure 1) for use with a STAUFF Oil Quality Sensor (OCS).

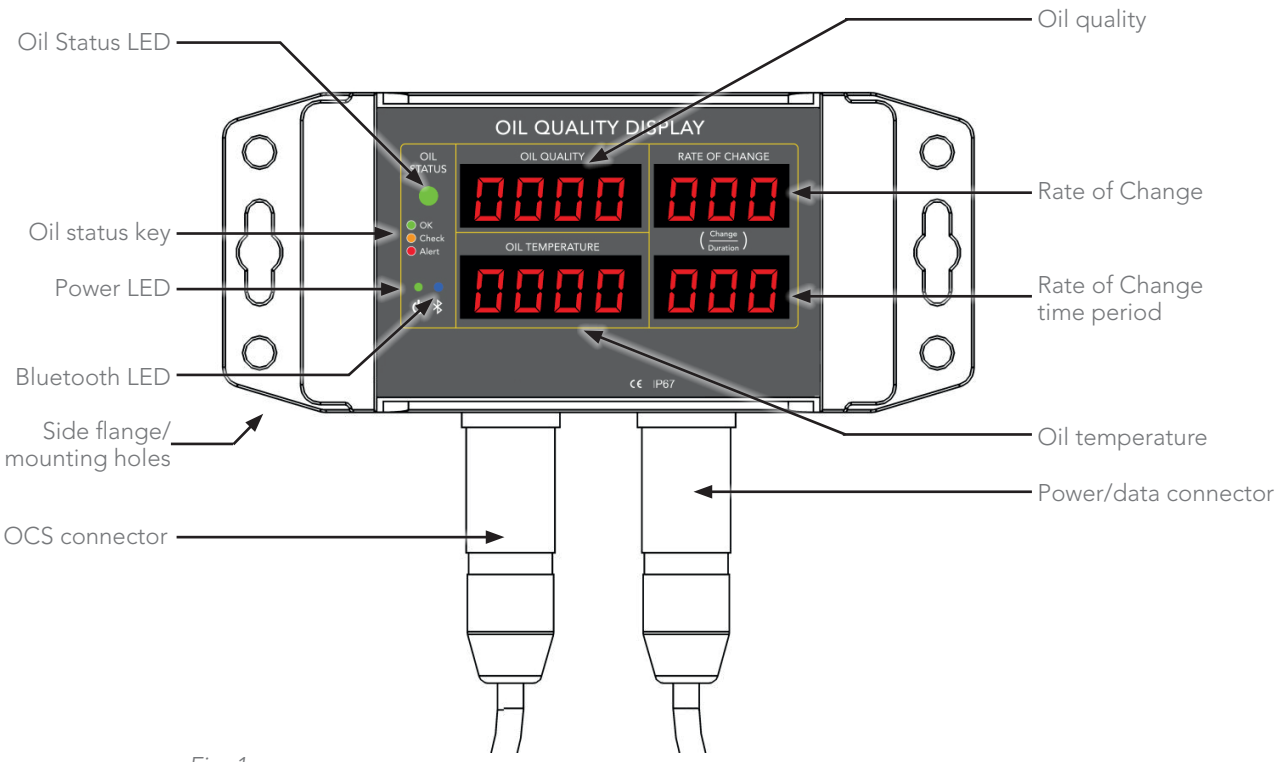


Fig. 1

The OCS I-Displays, in real time:

Quality

Translating the OCS sensor output into a Tan Delta Number (TDN), Oil Quality Index (OQI) value or Loss Factor Percentage (default). In addition to this, a red/amber/green **Oil Status** LED shows the oil quality with the color changes based on your own set threshold values: a green color indicates good oil quality, amber indicates a warning condition and red shows an alarm condition.

Temperature

Configurable to °C or F.

Rate of Change over a programmable period of time (**Duration**)

A 'rate of change' reading allows you to select a time period, for example 1 hour, and then easily monitor the degradation of the oil over that period.

NOTE: The Oil Status LED shows the 'worst' state of all three read-outs. For example, if oil temperature is at a warning threshold and oil quality is at an alarm threshold, the Oil Status LED will be red to show that an alarm condition has been reached. Any read-out exceeding its alarm or warning threshold will also flash.

2.1. Interfaces

The OCS I-Displays has two data interfaces:

- RS485 (proprietary protocol)

Connects the OCS I-Displays to a PC and OCS sensor

- Bluetooth

Connects the OCS I-Displays to a smartphone, tablet or PC equipped with Bluetooth.

Please contact your distributor for details.

2.2. Analog outputs

The dual 4-20 mA outputs from the OCS sensor for oil quality and oil temperature are looped through the OCS I-Displays where they can be used separately to provide analog indication of the oil temperature and quality (see page 15).

2.3. Data logging

The OCS I-Displays has an internal clock and can log real time oil quality readings. With a logging interval of 15 minutes (user-programmable) it has a storage capacity of 800,000 data points – equivalent to continuous operation of about 22.5 years. Stored data can be downloaded via the RS485 or Bluetooth interfaces.

3. Measuring Oil Quality

There are a number of ways to describe oil wear and oil quality. The OCS I-Displays offers three methods:

- Tan Delta Number
- Loss Factor Percentage
- Oil Quality Index

NOTE: We introduced the concept of the Oil Quality Index (OQI) to create a common language for describing overall oil wear and oil quality. It makes it easier to monitor, quantify and trend oil quality and it can be combined with other methods such as ISO cleanliness levels and laboratory test results. However, we recommend that new users adopt the TDN scale as it is more intuitive.

3.1. Tan Delta Number

The STAUFF OCS sensor measures the Loss Factor Percentage of oil (see below). The OCS I-Displays converts this into a Tan Delta Number (TDN) which is a scale running from 1200 (upper limit) to 0 (lower limit). New oil will have a value of about 0900 and the number will fall as the Quality deteriorates. You can set warning and alarm levels anywhere on this scale.

When new, the Clean Point for most oils will generally be between 950 and 850 on the TDN scale. The actual value will depend on a number of factors but most importantly how pure the base stock is and what additive packages have been included. During use, as the oil deteriorates, TDN value will decrease.

Oil wear is not linear, it tends to follow an exponential curve, therefore any initial change in wear and/or contamination will tend to be slow, however, as the wear and/or contamination increases, the rate at which the oil degrades will increase.

The TDN does not start at 1000 for a new, clean oil, as some oils can be improved by using sophisticated on-line or off-line filtration. An oil can also improve on the TDN scale, as well as deteriorate.

3.2. Loss Factor

A clean oil has a Loss Factor Percentage of approximately 0% and then as the oil changes and degrades this Loss Factor Percentage increases. For most applications, oil would be considered to be degraded at a Loss Factor Percentage of 25% and at the “end of life” at a Loss Factor Percentage of 30% or above.

3.3. Oil Quality Index

The OQI measurement scale (-2 to +21) offers a 'traffic light' view of oil quality. There is a green section (1-13), an amber section (14-17) and a red section (18-20) to mark OK, Warning and Alarm thresholds respectively. The OQI scale is linear within the safe, green level but the amount of change reduces by half for the warning, amber level and alarm, red level. Unlike the TDN scale, the green, amber and red sections cannot be adjusted.

4. What's in the Box?

When unpacking your OCS I-Displays unit, please ensure that all the following items are present. If any of the items are missing, please contact your distributor.

- OCS I-Displays unit
- Quick start guide
- Test Certificate

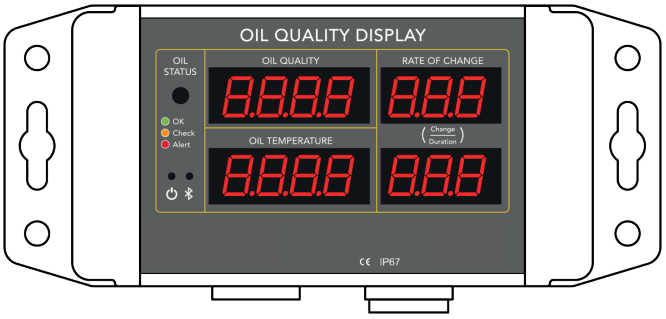
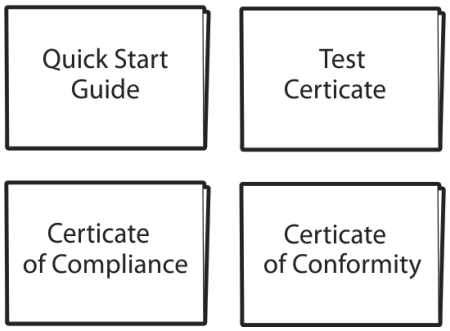


Fig. 2



5. Configuration

Before installation, configure the OCS I-Displays to your specifications using the STAUFF OCS Software. This is a software application, supplied on the USB memory stick, which must be installed on a PC or laptop.

OCS Software allows you to adjust the following OCS I-Displays parameters:

- Warning & Alarm Levels: the points at which the Status LED changes from Green to Amber to Red.
- Temperature (the displayed units: °C/°F).
- Data logging Interval.
- Rate of Change Period: the duration used to indicate the rate at which the oil quality has changed.
- Date/time
- Download and clear data log

NOTE: OCS Software can also be used to adjust OCS parameters such as the oil profile and the communication protocol. This must be done before installing a sensor. For more information, refer to the documentation supplied with your OCS sensor.

5.1. Set Up

To install the software:

1. Connect the PC or laptop to the OCS I-Displays unit using the configuration cable.

NOTE: The OCS I-Displays executes a power on self-test to determine whether the connected power supply has enough current to drive the LED display. The OCS I-Displays measures the supply voltage with all the LED segments off, then monitors the incoming voltage while it illuminates all the display LED segments one by one. If the incoming power supply either drops 5V from the original value, or drops below 5V, it will boot up in low power mode. When in low power mode, the display does not show any sensor values. Low power mode is denoted by a single 'L' in the oil quality window. Functionality is not affected by low power mode.

2. Connect the memory stick to a USB port on your PC or laptop. Allow the PC/laptop to automatically update drivers, if needed.
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.

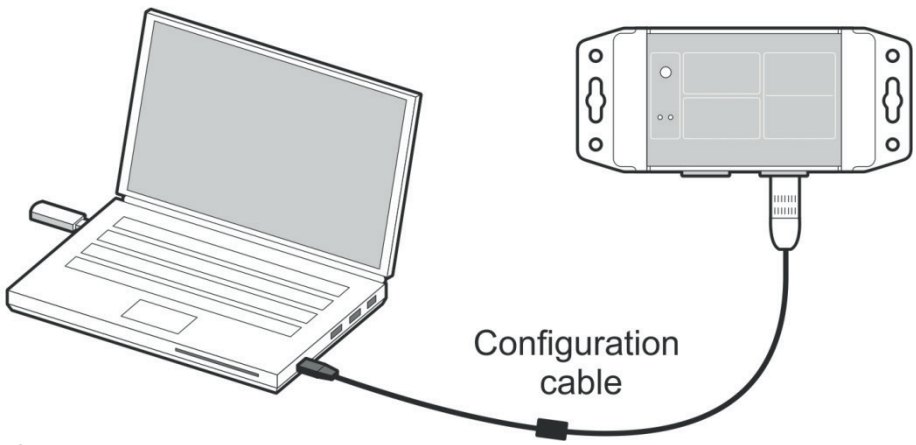


Fig. 3

6. When installation is complete, OCS Software is displayed (see Figure 4).
7. Attach the OCS I-Displays to the female connector on the configuration cable.
   It may take up to a minute for the software to identify the OCS I-Displays.

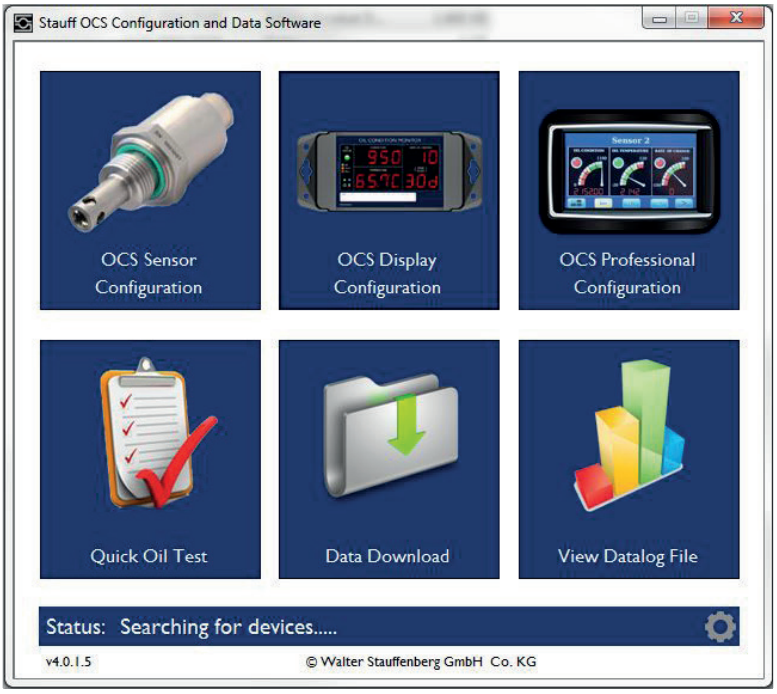


Fig. 4

8. Click on the OCS I-Display Smart Configuration button
9. The Oil Quality Display Configuration screen is then displayed.

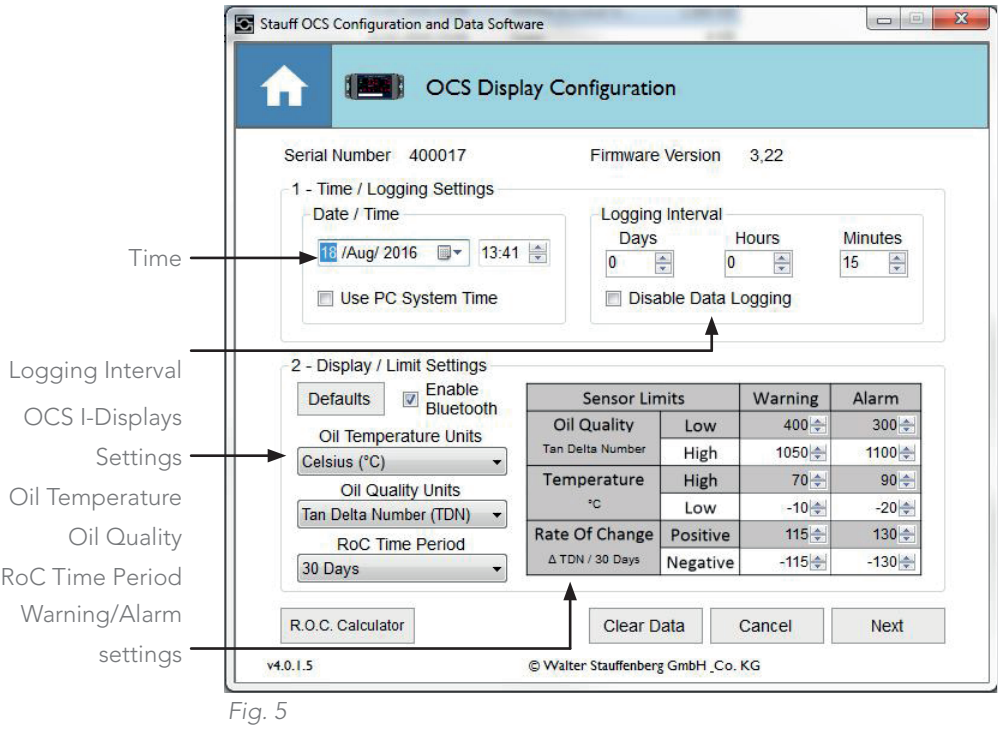


Fig. 5

10. Edit the configuration settings as required. The following section provides guidance; if you require further help, please contact your distributor.
11. When you have finished editing, click on the Next button.
12. Review the changes you have made on the Final Confirmation screen. Click on the Write button to complete the update.

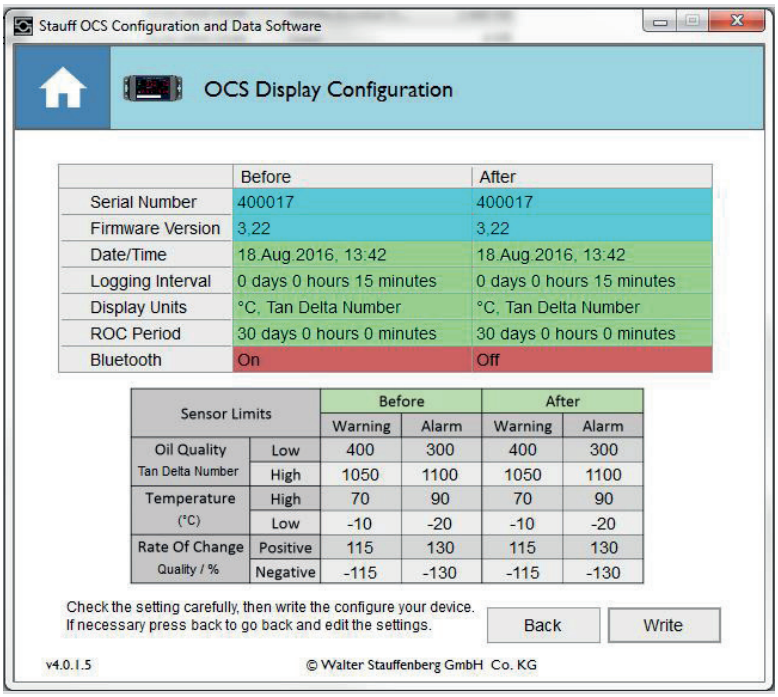


Fig. 6

5.2. Configuration Options

This section describes the various options presented on the Oil Quality Display Configuration screen. For further information about the Oil Quality modes, chapter 3.

DATE/TIME

Set the time for the display. This is used to time-stamp log files. You can set the time manually or take the setting from the connected PC/laptop.

LOGGING INTERVAL

Determines how regularly the sensor takes a data log. You can choose from 5 minutes to 1 hour. An appropriate interval will depend on the application and oil life.

OIL TEMPERATURE

Choose the units for the displayed temperature: °C or °F

OIL QUALITY

Choose from the following three options to measure oil quality:

- Tan Delta Number
- Loss Factor
- Oil Quality Index

For further information about these Oil Quality modes, see chapter 3.

ROC TIME PERIOD

The rate of change calculator can allows you to enter some basic details about your oil and calculate a suitable time period and corresponding warning and alarm levels. Enter the expected life span of the oil - we take 5% of the number of hours or days the oil will last and automatically find the nearest RoC period to select, out of the following options:

- 1 day
- 7 days
- 30 days
- 60 days
- 90 days

Then, our software will calculate the increasing and decreasing rate of change alarm levels and set them automatically.
If you analyse your data and finds the alarm levels need slight adjustment this can be done manually.

NOTE: This reading is only relevant when the system is undisturbed. For example, after an oil change, a positive quality change will be taken into account for the next Rate of Change period. Events such as cleaning may also cause large changes in the Rate of Change reading.

WARNING & ALARM LEVELS

These determine when the Oil Status LED illuminates green, amber or red. You can set upper and lower limits for Oil Quality, Temperature and Rate of Change. These warning/alarms are optional and you can set the levels according to your specifications. The following table shows some typical settings for a range of applications:

APPLICATION	WARNING (LOW)	ALARM (LOW)
For diesel engines, compressors, gear boxes and transformers	583 TDN	500 TDN
For hydraulics and gas engines	791 TDN	750 TDN

When a parameter, for example temperature, goes into a warning or alarm value, the corresponding section of the display will flash. The Oil Status LED will always display the status of the most severely affected parameter, for example if Oil Quality is in 'Warning' and Oil Temperature is in 'Alarm' then the Oil Status LED will illuminate red for 'Alarm'.

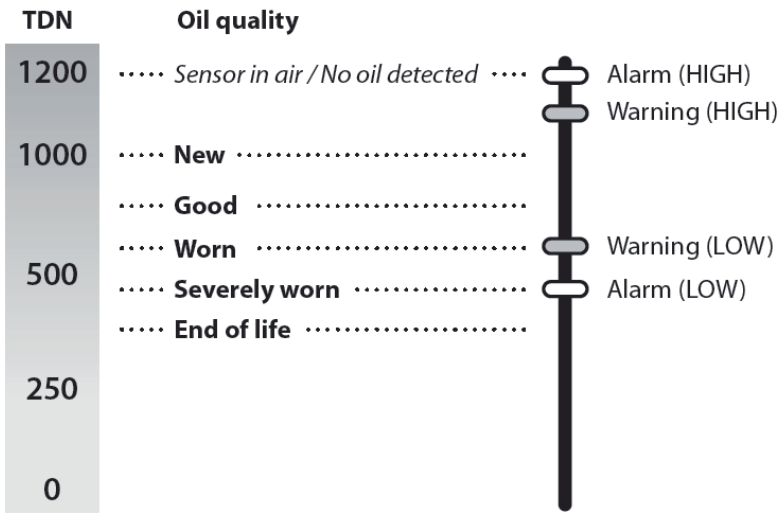


Fig. 7

NOTE: If the OCS software displays "No sensor or Com port found", shut down the software, unplug and then reconnect the USB cable and then re-start software

6. Installation

6.1. Mounting

The OCS I-Displays has a flange on either side with four mounting holes to allow it to be fixed to any suitable flat surface (see Figure 8). Once your OCS I-Displays is correctly configured, you need to mount it near the sensor using the flanges on the sides.

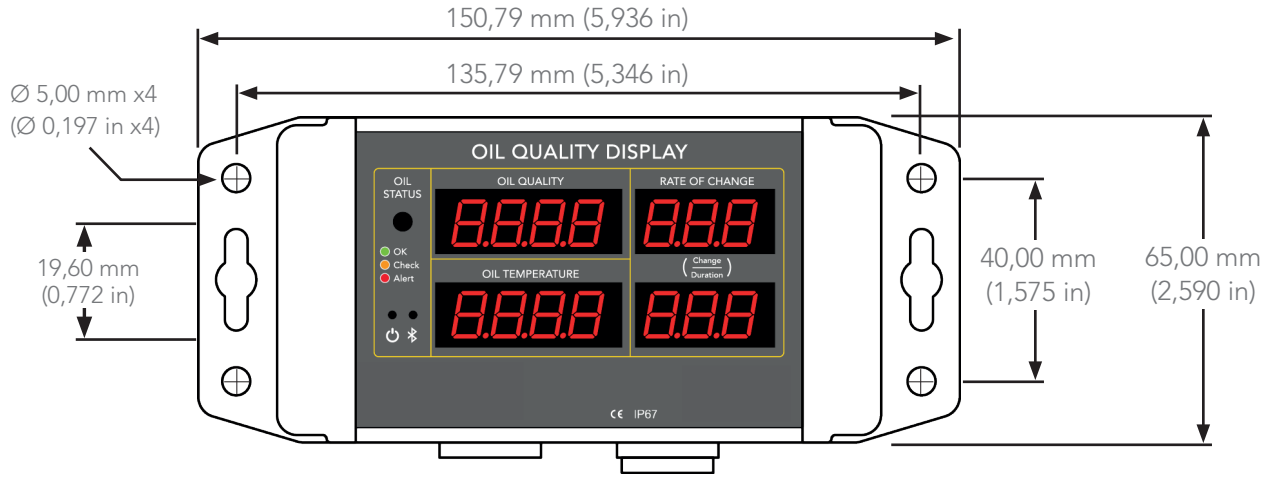


Fig. 8

Please ensure that the following environmental specifications are not exceeded by the proposed location.

Protection Rating:	IP67
Enclosure Type:	Rugged, polycarbonate machined housing with mounting flanges
Temperature (Operating)	-30° C to +65° C
Temperature (Storage)	-30° C to +70°C
Pressure (Ambient)	1 bar +/- 150 mbar
Chemical Exposure (Splash)	Water, Mineral and Synthetic Oils

6.2. Connection

CONNECTING THE OIL QUALITY SENSOR

Connect the Oil Quality Sensor (OCS) to the left-hand connector. We recommend using a STAUFF Female to Male cable. Align and slot in the 6-pin connector and then tighten the connector screw-cap. Please refer to the OCS manual for further information about OCS setup and calibration.

NOTE: This socket can also be used to connect an OCS I-Displays unit to a PC by RS485 or to other devices for remote monitoring purposes (see page 8).

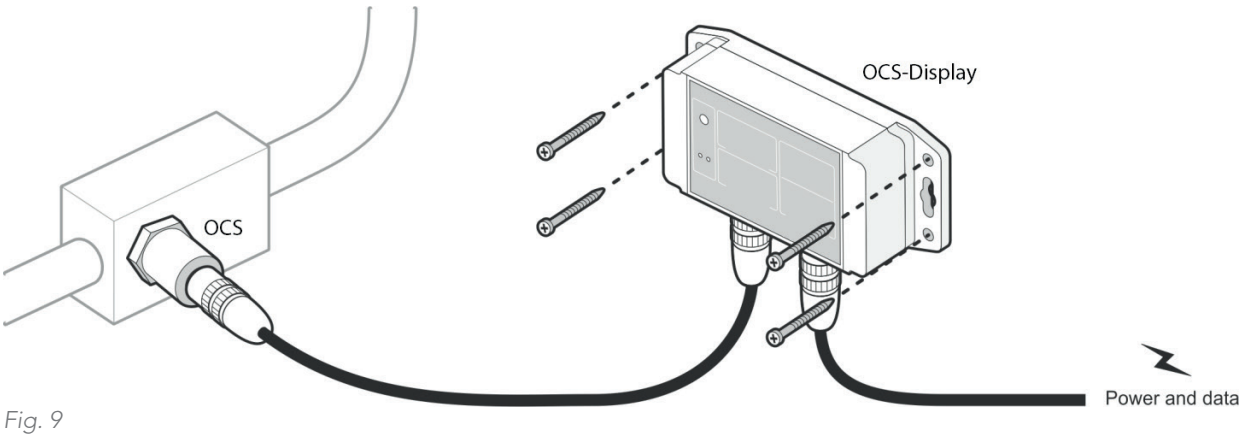


Fig. 9

CONNECTING THE POWER SUPPLY

Connect a suitable power supply (9-30 Vdc, at least 100 mA) to pins 3&4 on the right-hand connector (see Figure 10).

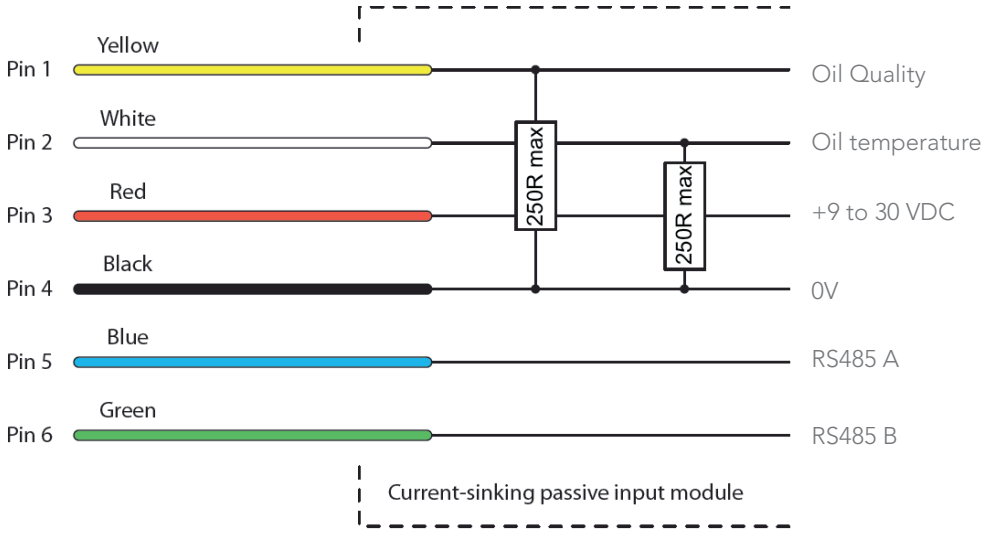


Fig. 10

NOTE: The OCS I-Displays executes a power on self-test to determine whether the connected power supply has enough current to drive the LED display. The Smart measures the supply voltage with all the LED segments off, then monitors the incoming voltage whilst it illuminates all the display LED segments one by one. If the incoming power supply either drops 5 V from the original value, or drops below 5 V, it will boot up in low power mode. When in low power mode, the display does not show any sensor values. Low power mode is denoted by a single 'L' in the oil quality window. Functionality is not affected by low power mode.

DATA OUTPUTS

Analog outputs measuring oil quality and oil temperature are looped through the OCS I-Displays from the OCS sensor. You can use these outputs to provide analog indication of the oil temperature and quality on other, third party, data acquisition and control systems.

USING THE OIL QUALITY ANALOG OUTPUT

Oil quality is output as a Loss Factor Percentage and is linearly scaled from -20% (4 mA) to 60% (20 mA). Loss Factor Percentage can easily be converted to the OQI scale using the table on page 22. A clean oil should provide an output of about 8 mA. For most applications, we recommend setting a warning alert for a value of 13 mA and an alarm notification for values over 14 mA. Any value below 4 mA indicates a fault.

USING THE OIL TEMPERATURE OUTPUT

The analog output on pin 1 provides a linearly scaled measure of Oil Temperature in ° C between -30° C (4 mA) and +130° C (20 mA) – see chapter 9.2.

7. Operation

SWITCHING ON

Ensure that you have configured the unit as described in chapter 5 and connected it correctly as described in chapter 6.

1. Switch on the power supply. The green power LED is illuminated.
2. The OCS I-Displays commences an initial self-test period lasting approximately one minute.
3. On completing its self-test, real time readings are shown on the OCS I-Displays display.

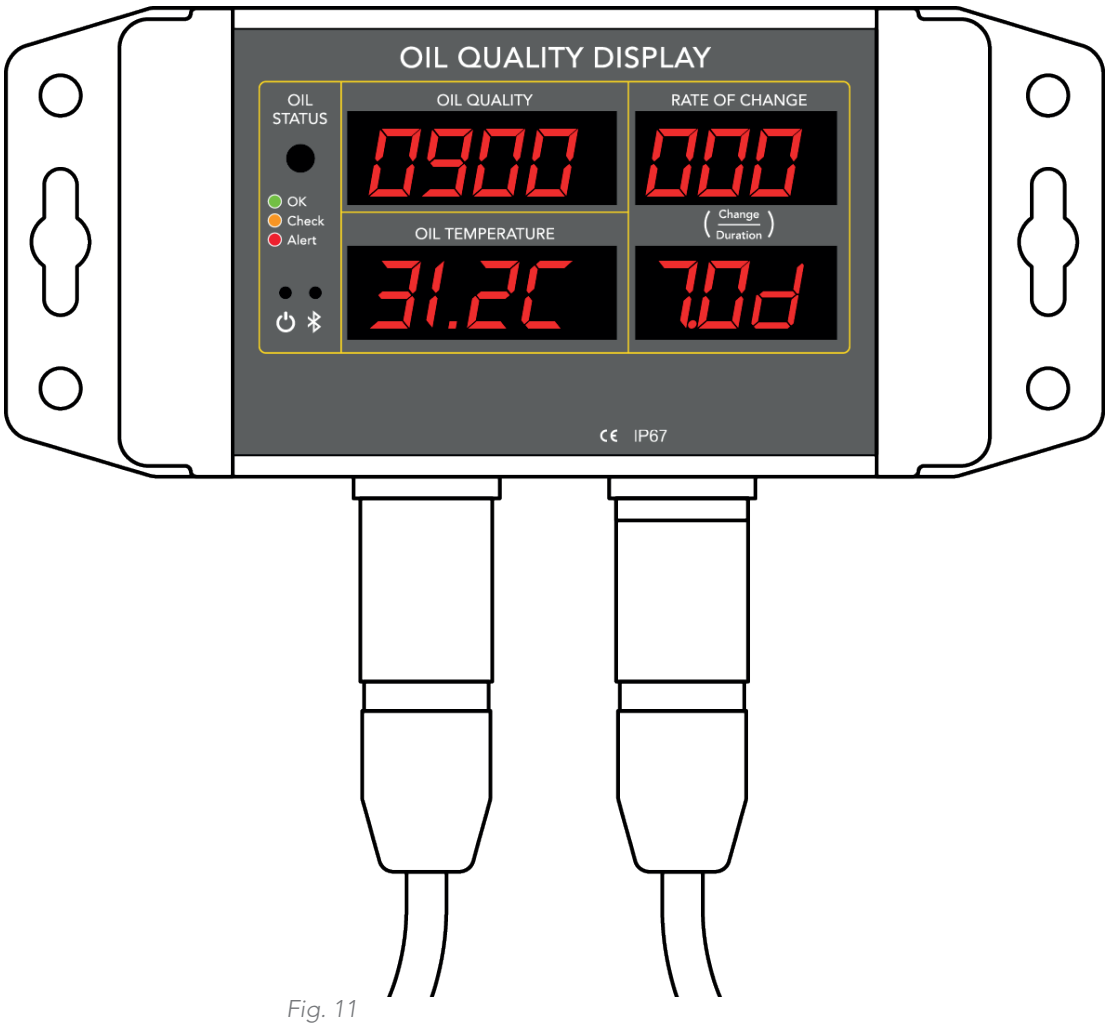


Fig. 11

NOTE: If the OCS I-Displays displays an E1 error message in the Oil Quality display, check the connection to the OCS sensor.

DATA DOWNLOAD

In order to download the data from the OCS I-Displays, connect to a laptop using the configuration cable and launch OCS Software. From the Home Screen, select the 'Data Download' button, this will instantly start downloading data, beginning with the most recent log files. As shown in Figure 12, the data being downloaded is visible behind the status window, you can see the dates of the log files and stop the download when necessary.

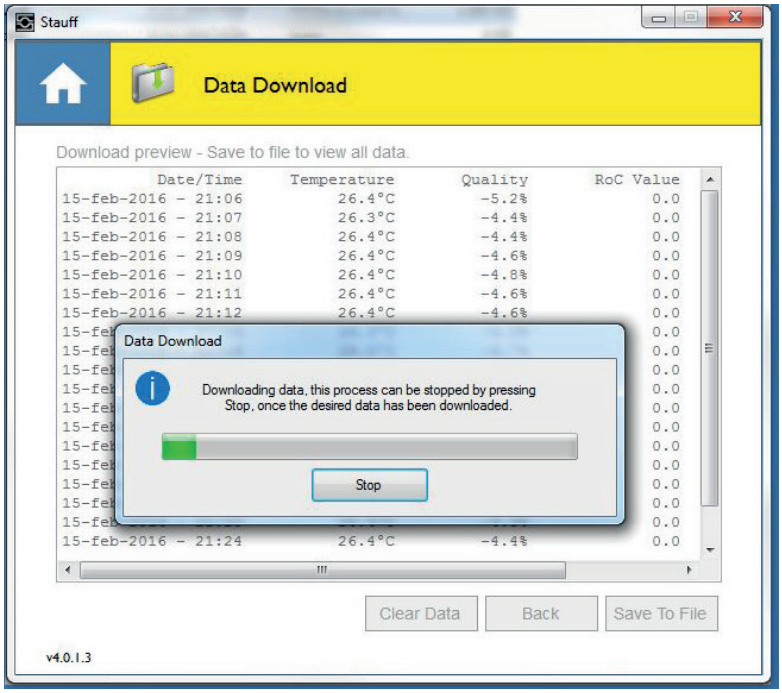


Fig. 12

8. Product Specification

ENVIRONMENTAL SPECIFICATIONS

Protection Rating	IP67
Enclosure Type	Rugged, polycarbonate machined housing with mounting flanges
Temperature (Operating)	-30° C to +65° C
Temperature (Storage)	-30° C to +70° C
Pressure (Ambient)	1 bar +/- 150 mbar
Chemical Exposure (Splash)	Water, Mineral and Synthetic Oils

CONNECTIVITY

General	Two industrial 6 pin connectors, IP67
Power supply input	Two wire, universal 9 to 30 VDC
Analog Interface	Dual 4-20 mA outputs, single wire each plus ground
Serial Interface	Single RS485 interface, two wire

FUNCTIONALITY

- EMC Filtering and fuse protection on input power.
- Power distribution with individual fusing and EMC filtering on power output to one sensor.
- Logged data download facility via RS485 to PC
- Continuous data-logging of oil quality, oil temperature, sensor internal temperature and rate of change.
- Real time display of oil quality, oil temperature and rate of change on 7-segment LEDs.
- Simultaneous interface to either proprietary software via RS485.
- Baud rates from 9600 (default) to 1 Mbaud.
- Bluetooth bit rate from 20 kbit/s to 1 Mbit/s over air.
- Flash upgradable firmware without return to manufacturer.
- Individual real time clock with battery backup of 10 years.
- Auto power on when connected to power supply.
- Auto reboot at internal error condition.
- Internal fault-detection capability.
- Real time oil quality readings from sensor every 1 sec.
- User defined parameters configurable from software via RS485.

STANDARDS AND APPROVALS

CE marked:

- IEC 60529:1989/AMD2:2013 IP67 Dust and Water Ingress.
- IEC 60068-2-30:2005 Cyclic Humidity.
- IEC 60068-2-6:2007 Sine Vibration.
- IEC 60068-2-27:2008 Mechanical Shock.
- EN 61000-6-4:2007 Generic Emissions Standard for Industrial Environments.
- EN 61000-6-2:2007 Generic Immunity Standard for Industrial Environments.
- EN 300 328 v1.8.1. Transferable Electromagnetic Compatibility for Wideband Data Transmission Equipment operating in the 2.4GHz ISM Band and using Wideband Modulation Techniques.

DISPLAY

Real time data is displayed on 14 digits of red color 7-segment LEDs. The display is readable in day-light at 120,000 Lux direct sunlight at 3 m / 10 feet. Internal fault or no readings from sensor after 5 continuous requests are displayed as FAULT condition flashing once every second until error condition solved.

Oil quality	4 digits in 3 user selectable scales: oil quality index (-2 to +21), oil quality loss factor (-20 to +60) and Dielectric Loss Number (0 to 1200).
Oil temperature	3 digits with user selectable scale in Celsius (default) or Fahrenheit indicated on 1 digit (° C or F).
Oil quality rate of change	3 digits.
Oil quality rate of change period of time	3 digits.
Oil status	Display oil quality comparison to user-programmable warning and alarm levels on a multicolor super-bright LED. Green color shows good oil quality, Amber color shows warning level, and Red color shows alarm level.
Power	Green LED turns on when power is present.

DATA LOGGING

Storage Capacity	800,000 records
Logging Interval	5 minute to 1 hour
Battery Backup	10 years
Real time Clock	Yes
Data download	Via RS485 and Bluetooth

PHYSICAL CHARACTERISTICS

Enclosure material	Polycarbonate
Dimensions	120mm x 66mm x 42mm (L x W x H)
Weight	225g
Color	Grey with Black Top
Top	Polyester Autotex XE V207 200 um, UV stable
Mounting	Integrated Flanges
Usage	For indoor and outdoor use

POWER

Input voltage	9-30 VDC
Input current	0.55 A typical, 1.8 A maximum
Average power consumption	2W
Battery capacity	CR1632 coin cell with 3V / 120mAh capacity

COMPATIBILITY

- STAUFF Oil Quality Sensor
- STAUFF Oil Quality Software
- STAUFF Smartphone Application
- STAUFF Accessories

ERROR CODES

E1/E2	Sensor not connected
E3	Real Time Clock communication error
E5	Internal communication error

9. Appendix

9.1. Oil Quality Conversion Chart

Oil quality is output as a Loss Factor Percentage and the output is linearly scaled between -20% (4mA) and +60% (20mA). The Loss Factor Percentage can easily be converted to the OQI scale using the following table.

4-20MA	LOSS FACTOR	TDN	ALARM SETTING
<4			
4 mA	-20.0 %	1200 TDN	
	-19.0 %	1200 TDN	
	-18.0 %	1200 TDN	
	-17.0 %	1200 TDN	
	-16.0 %	1200 TDN	
5 mA	-15.0 %	1200 TDN	
	-14.0 %	1180 TDN	
	-13.0 %	1160 TDN	
	-12.0 %	1140 TDN	High Alarm
	-11.0 %	1120 TDN	
6 mA	-10.0 %	1100 TDN	
	-09.0 %	1080 TDN	
	-08.0 %	1060 TDN	High Warning
	-07.0 %	1040 TDN	
	-06.0 %	1020 TDN	
7 mA	-05.0 %	1000 TDN	
	-04.0 %	0980 TDN	
	-03.0 %	0960 TDN	
	-02.0 %	0940 TDN	
	-01.0 %	0920 TDN	
8 mA	000.0 %	0900 TDN	
	001.0 %	0880 TDN	
	002.0 %	0860 TDN	
	003.0 %	0840 TDN	
	004.0 %	0820 TDN	
9 mA	005.0 %	0800 TDN	
	006.0 %	0780 TDN	
	007.0 %	0760 TDN	
	008.0 %	0740 TDN	
	009.0 %	0720 TDN	
10 mA	010.0 %	0700 TDN	
	011.0 %	0680 TDN	
	012.0 %	0660 TDN	
	013.0 %	0640 TDN	
	014.0 %	0620 TDN	
11 mA	015.0 %	0600 TDN	
	016.0 %	0580 TDN	
	017.0 %	0560 TDN	
	018.0 %	0540 TDN	
	019.0 %	0520 TDN	

4-20MA	LOSS FACTOR	TDN	ALARM SETTING
12 mA	020.0 %	0500 TDN	
	021.0 %	0480 TDN	
	022.0 %	0460 TDN	
	023.0 %	0440 TDN	
	024.0 %	0420 TDN	Low Warning
13 mA	025.0 %	0400 TDN	
	026.0 %	0380 TDN	
	027.0 %	0360 TDN	
	028.0 %	0340 TDN	
	029.0 %	0320 TDN	Low Alarm
14 mA	030.0 %	0300 TDN	
	031.0 %	0280 TDN	
	032.0 %	0260 TDN	
	033.0 %	0240 TDN	
	034.0 %	0220 TDN	
15 mA	035.0 %	0200 TDN	
	036.0 %	0180 TDN	
	037.0 %	0160 TDN	
	038.0 %	0140 TDN	
	039.0 %	0120 TDN	
16 mA	040.0 %	0100 TDN	
	041.0 %	0080 TDN	
	042.0 %	0060 TDN	
	043.0 %	0040 TDN	
	044.0 %	0020 TDN	
17 mA	045.0 %	0000 TDN	
	046.0 %	0000 TDN	
	047.0 %	0000 TDN	
	048.0 %	0000 TDN	
	049.0 %	0000 TDN	
18 mA	050.0 %	0000 TDN	
	051.0 %	0000 TDN	
	052.0 %	0000 TDN	
	053.0 %	0000 TDN	
	054.0 %	0000 TDN	
19 mA	055.0 %	0000 TDN	
	056.0 %	0000 TDN	
	057.0 %	0000 TDN	
	058.0 %	0000 TDN	
	059.0 %	0000 TDN	
20 mA	060.0 %	0000 TDN	

NUMBER RANGES	UPPER	LOWER	GRANULARITY
Loss Factor	060.0 %	-20.0 %	0.1
TDN	1200 TDN	0000 TDN	10

NUMBER FORMAT

Loss Factor = Always 4 characters (including -) to 1 decimal place

TDN = Always 4 digits

CONVERSION

4-20mA to Loss Factor = (mA - 4) * 5 - 20

4-20mA to TDN = (mA -17) * -100

9.2. Oil Temperature Analog Output

The table below shows how the oil temperature output (4-20mA) converts to temperature.

OCS OUTPUT 4.20MA VALUE		TEMPERATURE CONVERSION °C		°F	
MIN	MAX	MIN	MAX	MIN	MAX
20		130		266	
19.5	19.99	125	129	257	264.2
19	19.49	120	124	248	255.2
18.5	18.99	115	119	239	246.2
18	18.49	110	114	230	237.2
17.5	17.99	105	109	221	228.2
17	17.49	100	104	212	219.2
16.5	16.99	95	99	203	210.2
16	16.49	90	94	194	201.2
15.5	15.99	85	89	185	192.2
15	15.49	80	84	176	183.2
14.5	14.99	75	79	167	174.2
14	14.49	70	74	158	165.2
13.5	13.99	65	69	149	156.2
13	13.49	60	64	140	147.2
12.5	12.99	55	59	131	138.2
12	12.49	50	54	122	129.2
11.5	11.99	45	49	113	120.2
11	11.49	40	44	104	111.2
10.5	10.99	35	39	95	102.2
10	10.49	30	34	86	93.2
9.5	9.99	25	29	77	84.2
9	9.49	20	24	68	75.2
8.5	8.99	15	19	59	66.2
8	8.49	10	14	50	57.2
7.5	7.99	5	9	41	48.2
7	7.49	0	4	32	39.2
6.5	6.99	-5	-1	23	30.2
6	6.49	-10	-6	14	21.2
5.5	5.99	-15	-11	5	12.2
5	5.49	-20	-16	-4	3.2
4.5	4.99	-25	-21	-13	-5.8
4	4.49	-30	-26	-22	-14.8
<4		Fault			

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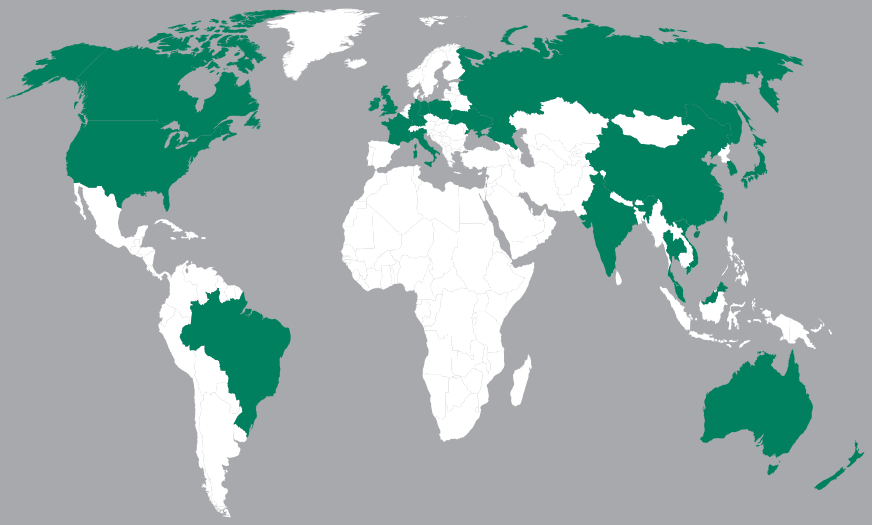

GERMANY / DEUTSCHLAND

Walter Stauffenberg GmbH & Co. KG
Im Ehrenfeld 4 ▪ 58791 Werdohl
Tel.: +49 23 92 916 0
Fax: +49 23 92 916 160
sales@stauff.com

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