OEWM
INSTALLATION & COMMISSIONING

Parker

Contents

About this manual

The purpose of this installation manual is to promote safe, proper and optimal installation and commissioning of the Online Ferrous Wear Meter (OFWM) system. The manual also helps to identify, avoid and prevent hazardous situations and related consequences.

This document is intended for qualified installation personnel only.

This manual covers pre-installation, installation and commissioning work for the OFWM system. It is recommended to fully read this manual before starting any work to ensure all required component parts and any additional resource are available for installation and commissioning.

The manual is arranged in order of work to be completed. This manual is to be used in conjunction with the other manuals listed below, together they form the complete manual set for the installation, commissioning and use of the OFWM.

Prior to any engine modification or installation work is undertaken, a proper survey should be conducted as all installations are different. To assist in this, a survey form is available for download. This will help ensure all key aspects are considered

Read and understand the manual carefully. Follow the given instructions. Follow the instructions in local laws and regulations and any orders given by local authorities.

Refer to further manuals and software to support installation and commissioning:

EMA-K32649 OFWM User Manual

EMA-K32676 OFWM Software Manual

EMA-K32677 OFWM Installation Manual

SW-K32679 OFWM PC Software

To access resources scan the QR code or go to:

https://ph.parker.com/gb/en/product-list/on-line-ferrous-wear-meter-ofwm

1. Safety

1.1 General Safety

This equipment is only to be operated by persons trained in the use and handling of electrical and pressurised hydraulic and pneumatic systems. Local laws and regulations for installation, operation and servicing of pressurised hydraulic systems must be adhered to. Prior to operating the unit, hoses should be inspected for damage. If any damage is found, consult with Parker accordingly.

1.2 Safety symbols used in this manual

WARNING indicates a potentially hazardous situation that can cause property damage.

CAUTION indicates a hazard with a low level of risk that can cause minor or moderate injury.

ELECTRICAL HAZARD indicates a situation where a person can receive injuries from open electric sources

1.3 Warnings and precautions

WARNING

If the equipment is used in a manner, or for a specific purpose other than that described in this manual, then any safety protection may be impaired.

WARNING

Pressurised systems.

The OFWM system is designed to be connected to pressurised systems including pneumatic lines and hydraulic systems. A responsible body, the end user or system integrator, is responsible for ensuring the safety of associated systems, hoses or pipework containing fluids. This includes isolation for maintenance to the sensor(s).

WARNING

The OFWM system must be installed and operated by qualified persons only.

WARNING

The OFWM system must be powered on at all times. Even if the engine is off, power and air supply must be connected for both software and sensors to operate. If power or air supply is interrupted, the system must be reconnected as soon as possible. Failure to reconnect could result in sensor blockages.

1.3.1 Personal protective equipment

Always wear personal protective equipment (PPE). Follow the instructions in local laws and regulations and any orders given by local authorities.

Ensure Personal Protective Equipment (PPE) is always used when installing, operating and maintaining the OFWM system.

1.4 Improper use

The OFWM system is not suitable for use in explosive or hazardous atmospheres.

Do not attempt to open or dismantle the casing of the sensor.

1.5 Exclusion of liability

Parker has worked hard to ensure the accuracy of the information contained in this document. Despite these efforts, the possibility of errors cannot be eliminated. Therefore, we cannot accept liability for any errors that may exist, nor for any damage or loss that may result from these errors.

Please note that technical specifications may be updated or changed without prior notice.

2. Overview

The Online Ferrous Wear Meter (OFWM) is a key tool for maximising uptime and reducing operating costs on large two-stroke engines.

Cylinder condition must be monitored, but visual inspection is only possible with the engine shut down. Therefore, monitoring cylinder lubrication oil (CLO) on the underside of the piston while the engine is running provides critical insight into cylinder condition. This process is known as scavenge drain analysis (SDA).

OFWM offers an accurate method to detect, quantify, and trend ferromagnetic material (magnetic iron) suspended in CLO that has been in contact with the piston and liner. With continuous feedback, abrasive and adhesive wear can be monitored in line with OEM guidelines, helping reduce total cost of ownership by:

- Optimising the CLO feed rate
- Wear control
- Optimising overhaul intervals.

The flexibility of OFWM means that the sensors can be installed to all cylinders, selected cylinders or the main drain line — though the speed of response to a wear issue is reduced respectively due to the oil flow path and dilution effects. With minimal disruption, installation can be done during port calls and requires minimal drain-line modification together with daisy-chained cabling and a compressed air line.

Optional software can be installed on a standalone PC to trend and log data and generate alerts. Alternatively, the sensor outputs can be integrated directly into the engine's supervisory monitoring system.

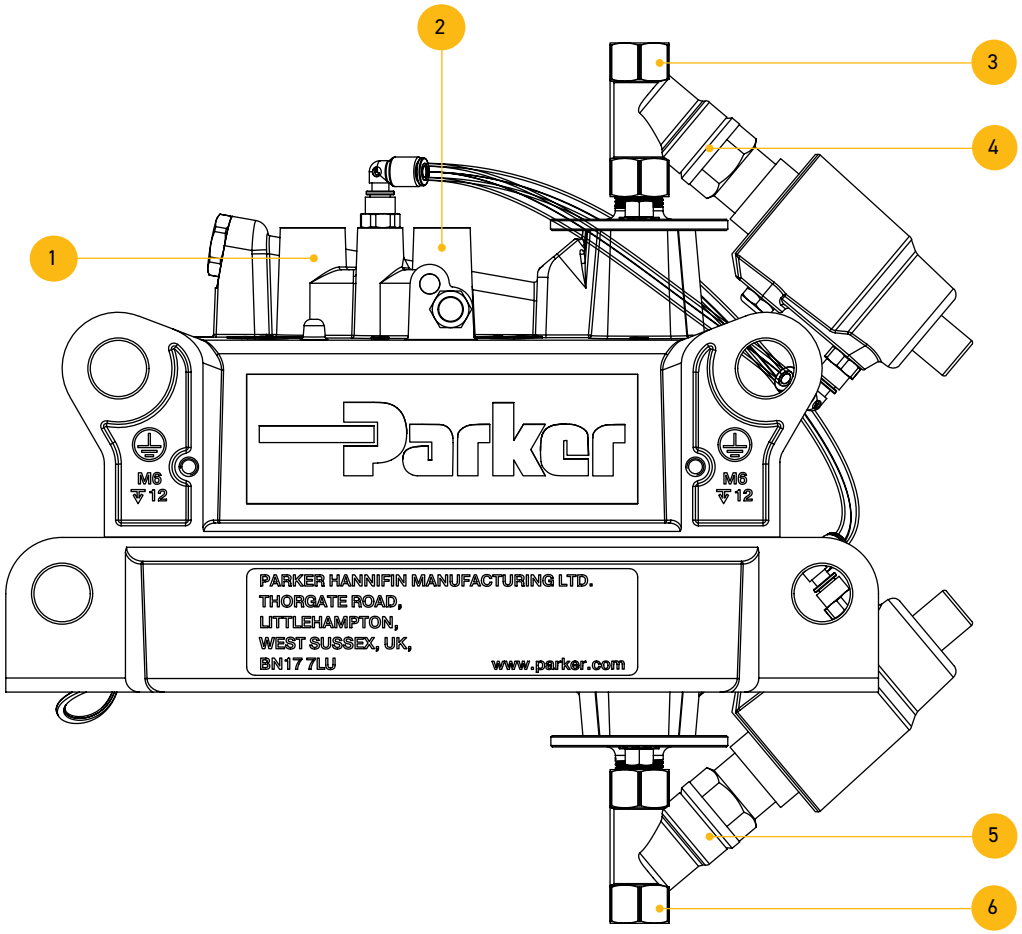
3. General description

3.1 Main components

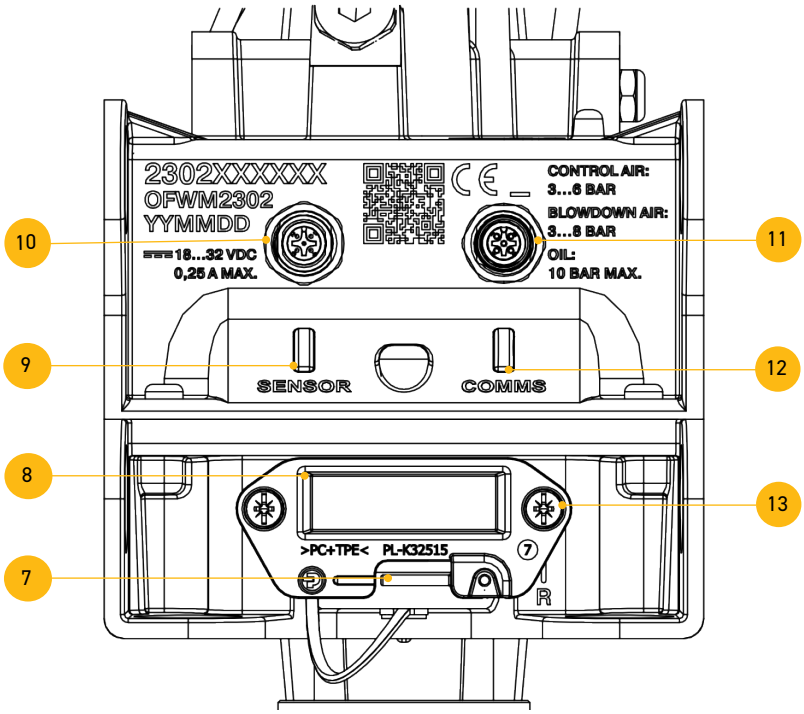
The sensor box contains:

- Sensor
- Vibration mounts

The sensor has the following components:



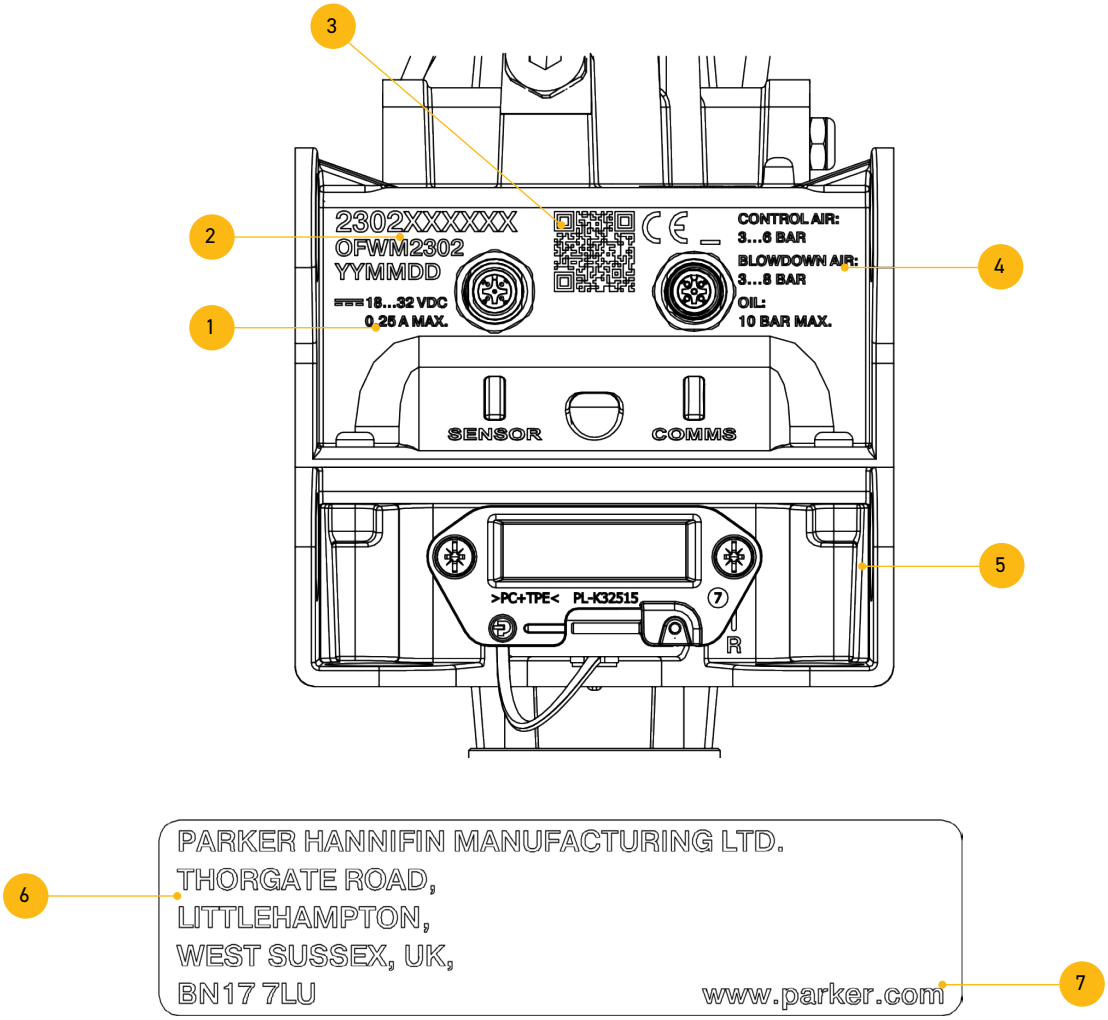
KEY			
1.	Blowdown air	4.	Upper angle seat valve
2.	Control air	5.	Lower angle seat valve
3.	Oil in	6.	Oil out



KEY

7. Probe for the reset button and DIP switch actuation — rotate probe to operate
8. DIP switch cover
9. Sensor status indicator
10. Power and communications input
11. Power and communications output
12. Communications status indicator
13. Reset button — remove DIP switch cover to access

3.3 Product markings

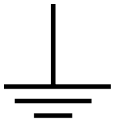


KEY

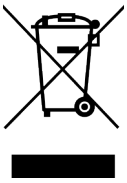
1. Power requirements
2. Product serial number, model and manufacturing date
3. QR-code to product web page
4. Air and oil pressure requirements
5. Location of type plate
6. Name and address of manufacturer
7. Manufacturer web page

3.4 Symbols on the product

Refer to the instruction manual



Earth ground



Follow local laws and regulations when discarding the product.
See OFWM User manual section Decommissioning.

CE certified product

Port #2 — Lower angle seat valve

Port #4 — Upper angle seat valve

3.5 Contents of the delivery

The sensor box contains:

- Sensor
- Anti-vibration mounts

3.6 Handling and storage

- Storage temperature: 0 — 55 °C
- relative humidity 65%

Keep the product in its original packaging to prevent dust ingress. Store the packed sensor box only in locations where it will not be exposed to excessive vibrations.

4. Technical specification

4.1 Measurement performance

Unit of measurement	Fe ppm (mg/kg)
Sensor resolution	1 ppm
Minimum measurement	20 ppm
Maximum measurement	20,000 ppm
Calibration reference values	Fe powder/epoxy (mg/kg)
Sample volume	12 ml

4.2 Physical

Maximum number of sensors	14
Electrical and communications	CAN Input: M12 circular socket – Male – A-coding CAN Output: M12 circular socket – Female – A-coding
Power and communications cable	Bus system - CANopen Cores - 4 core (2 twisted pairs) with shield and drain wire Current - 4A nominal Characteristic impedance at 1 MHz - 120 Ω
Interface — oil in/out	G3/8
Interface — pneumatic	Air in, flow control: G1/4 Blowdown: G3/8
Mounting fasteners	M8
Earthing points	M6 x 12 mm

4.3 Operating environment

Environmental temperature	10 °C — 55 °C Keep the product in its original packaging to prevent dust ingress. Store the packed sensor box only in locations where it will not be exposed to excessive vibrations.
Handling & Storage	Storage: 0 — 55 °C Keep the product in its original packaging to prevent dust ingress. Store the packed sensor box only in locations where it will not be exposed to excessive vibrations.
Oil temperature	10 °C to 65 °C
Oil viscosity	250 cst at 40 °C
Sensor ingress protection	IP 65
Minimum pressure delta; blowdown — oil pressure	Δ 3 barg*
Maximum safe operating pressure	10 barg**
Blowdown pressure	3 to 8 barg*
Control air pressure	3 to 6 bar

*Minimum pressure delta must be maintained during sensor operation. The blowdown pressure must exceed scavenge pressure by at least 3 barg to ensure reliable and complete sample purging.

** This is the sensor's safe static pressure limitation.

4.4 Materials

Enclosure	Aluminium Alloy
Material wetted flow path	Polyphenylene Sulphide (PPS) NBR Seals PTFE Stainless Steel Zinc Plated Mild Steel

4.5 Electrical

Sensor supply voltage	18—32 V DC
Sensor current	0.25 A
Communication physical layer	CAN bus V2.0b
Supported baud rate	50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1000 kbit/s
Communication protocol	CANopen

5. Principle of Operation

The OFWM is an automated sensor that continuously measures ferrous (iron) particles in lubricating oil. Results are reported in parts per million (ppm) by weight (mg of iron/kg of oil). Up to 14 sensors can be daisy-chained on a single system.

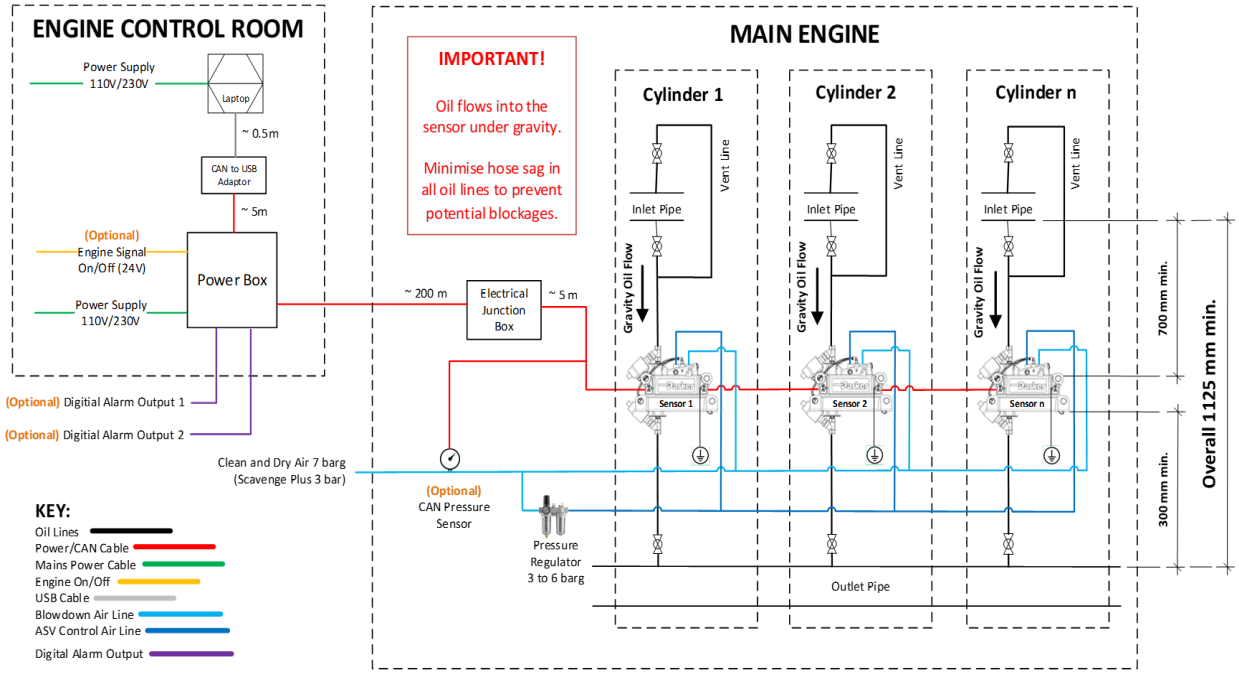
Each sensor receives oil by gravity into a sample tube. A level sensor inside the OFWM confirms when the required volume is reached, and the sensor then records a measurement. Compressed air is subsequently used to purge the tube (blowdown), after which a second measurement is taken. The difference between the “full” and “empty” readings is used to calculate the ppm concentration.

Only one sensor draws from the air supply at a time for the blowdown to ensure sufficient air volume for tube clearing. Measurement data and configuration parameters are communicated via CANopen for data logging and system setup. Data logging and configuration can be done using Parker's OFWM software or by third-party software that supports the CANopen protocol.

5.1 System schematic

There are alternative ways to configure standalone systems or integration into the ship’s supervisory management systems.

The following is an example of a typical standalone system schematic.



6. Material supply

6.1 What is supplied

The following equipment is supplied with the Online FWM sensor:

- Anti-vibration mounts - 4 pieces

6.2 What is not supplied

Since each installation is unique, the level of additional equipment varies. Below is a general list of required material. In addition to the list below, suitable hosing and fittings will be required for connecting the hydraulic and pneumatic lines.

Item	Description
Y piece for oil inlet	3/8 BSPT Y Piece M/F/F
Peak PCAN-USB Adapter (only required if system is configured as standalone using Parker OFWM software, refer to the software manual)	IPEH-002022
Phoenix Contact SUBCON-PLUS-CAN/PG 9 Way (only required if system is configured as standalone)	2708119
Main Trunk Cable	1 x 2 x 15 AWG & 1 x 2 x 18 AWG DeviceNet ™ / Can Bus Shielded Cable
Final Sensor Termination Resistor	M12 CAN Bus Termination Resistor 120 Ω
Sensor daisy chaining cables	Male/Female 5 way M12 A code DeviceNet ™ / CAN Bus Shielded Cable

7. Transportation and Storage

7.1 Transportation

When transporting the OFWM sensor, ensure that:

- The sensor has no residual oil or air pressure
- The sensor is cleaned according to the user manual.

7.2 Storage

When storing the sensor, ensure that:

- The sensor has no residual oil or air pressure
- The sensor is cleaned according to the user manual.

8. Pre-Installation

The Online FWM system requires pre-installation work, including pipework modifications, fabrication and mounting of sensor brackets, and installation of cable runs and air lines, before the sensors can be fitted. A suitable pre-installation survey should be completed in advance to minimise issues.

Refer to the system schematic in section 5.1 System schematic for an overview.

WARNING

Ensure air and oil supplies are isolated or shut off before installation.

ELECTRICAL HAZARD

Ensure the system is electrically isolated and de-energised before carrying out any electrical installation work.

8.1. Prepare pipework

Pipe modifications and unit mounting should consider the installation location and the fittings required to connect to the sensor. Use straight or 45° fittings wherever possible; 90° fittings on oil lines increase the risk of blockage and should be avoided. The recommended weld boss size is ½" BSP.

Fitting and bracket locations should be arranged to minimise hose lengths. Refer to Figure 2 for the recommended dimensional clearance between the sensor and the oil inlets and outlet weld bosses.

WARNING

If the application dimensions between the inlet and outlet weld bosses, fall outside of the recommended clearance of ~1125mm (Figure 2), then a separate common drainpipe must be installed (Figure 1b)

Figure 1a

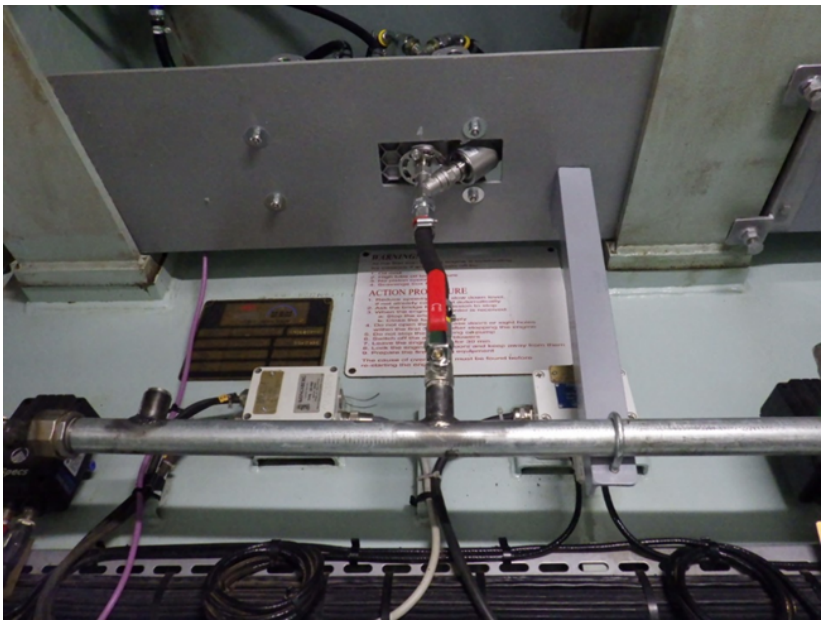


Figure 1b

WARNING

Isolation valves, ball valves, must be fitted to all weld bosses to ensure the sensor installation can be isolated from the main engine.

WARNING

Do not use 90° fittings, as they increase the risk of system blockages.

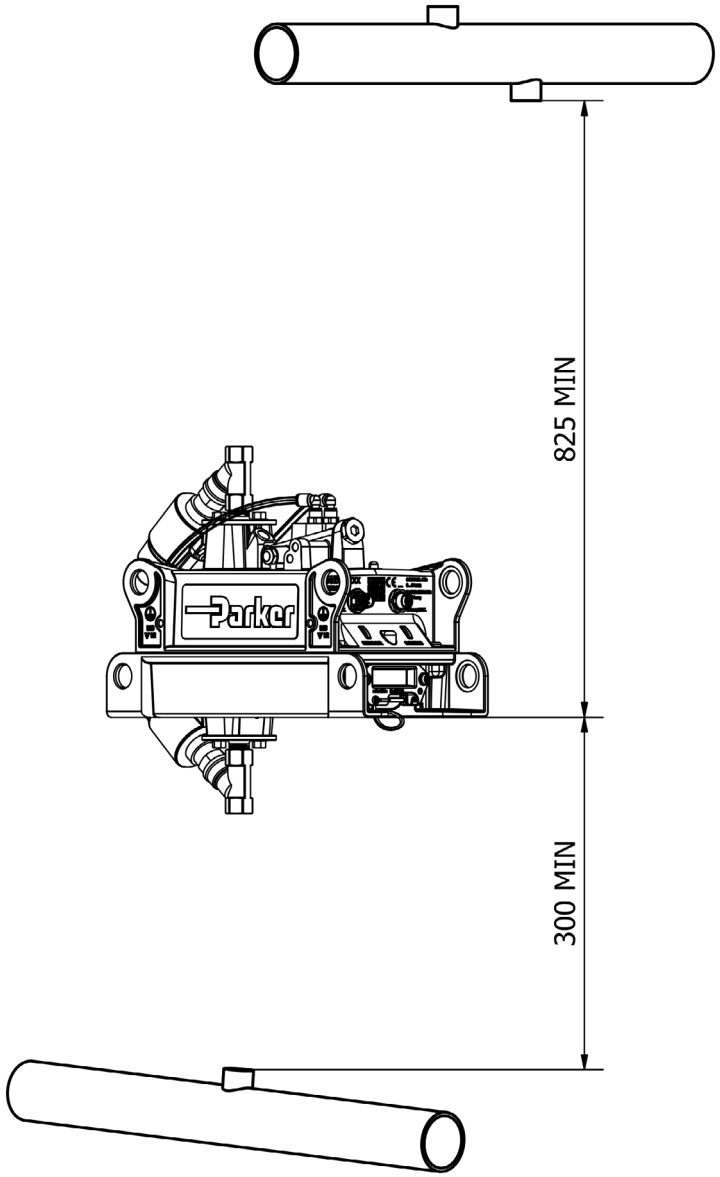


Figure 2

The oil inlet weld boss must be installed on the underside of a horizontal section of the cylinder lubrication pipe outlet.

WARNING

The oil supply to the sensor is gravity-fed; therefore, any restriction to flow will significantly affect sensor performance. Refer to Figure 3 below to ensure the hose installation does not impede the gravity feed of oil into the sensor.

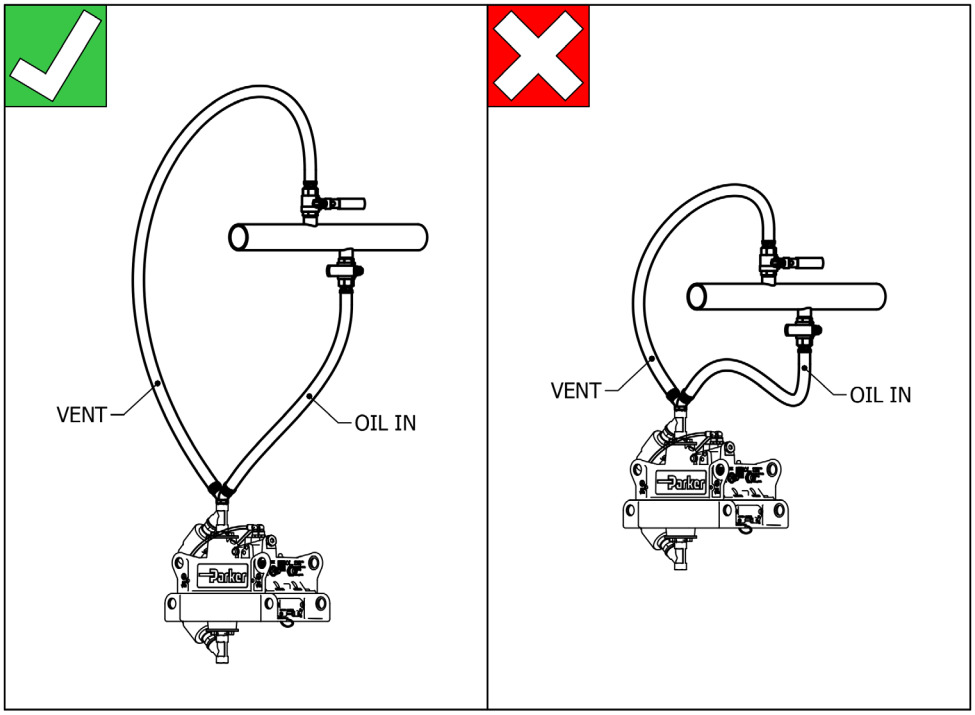


Figure 3

WARNING

The oil inlet weld boss must be sub-flush with the pipe bore to prevent particulate build-up. The drilled hole into the pipe should be between Ø9 mm and Ø13 mm, refer to Figure 4 below.

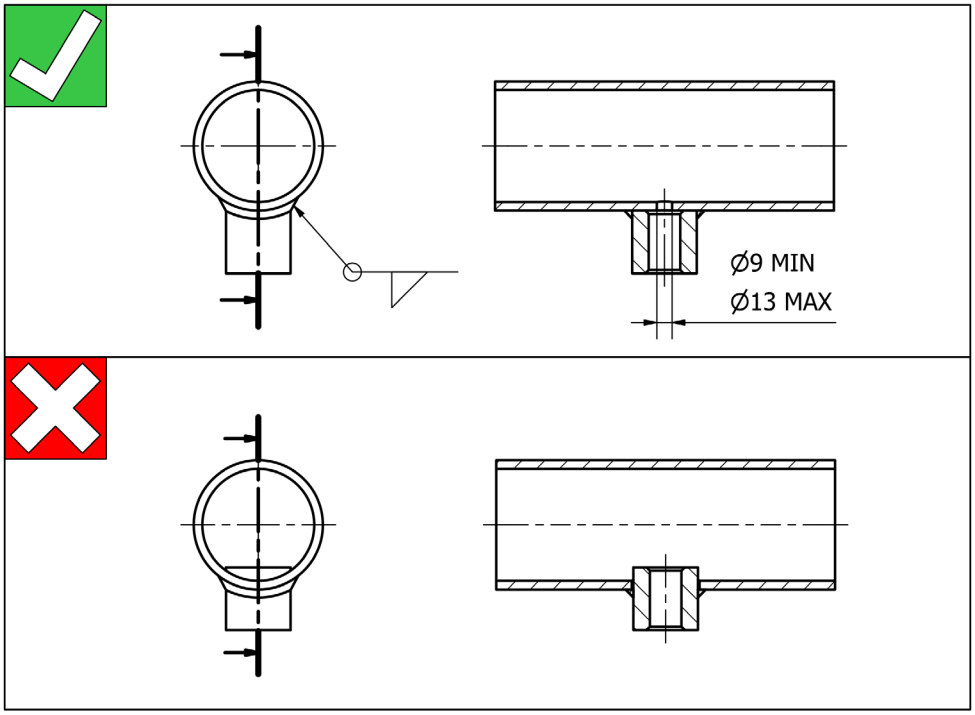


Figure 4

The vent line must be installed downstream of the oil inlet so it does not affect sensor measurements. Where space allows, install it on the top of a horizontal pipe section, refer to Figure 3.

If there is insufficient space to fit the vent boss on the top of a horizontal section, it may be installed on a vertical section at a 45° upward angle to prevent oil ingress, refer to Figure 5.

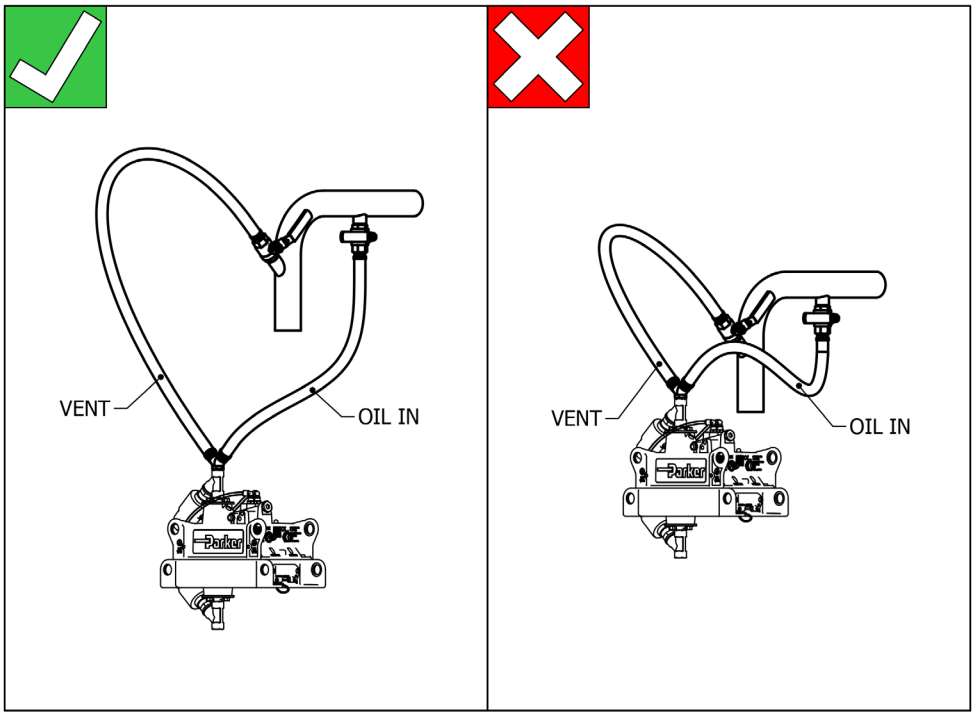


Figure 5

The oil outlet weld boss should be installed as close to the sensor as practicable, with approximately 300 mm of vertical separation between the lower face of the sensor and the oil outlet weld boss to minimise hose length and prevent oil restriction. See Figures 2 and Figure 6.

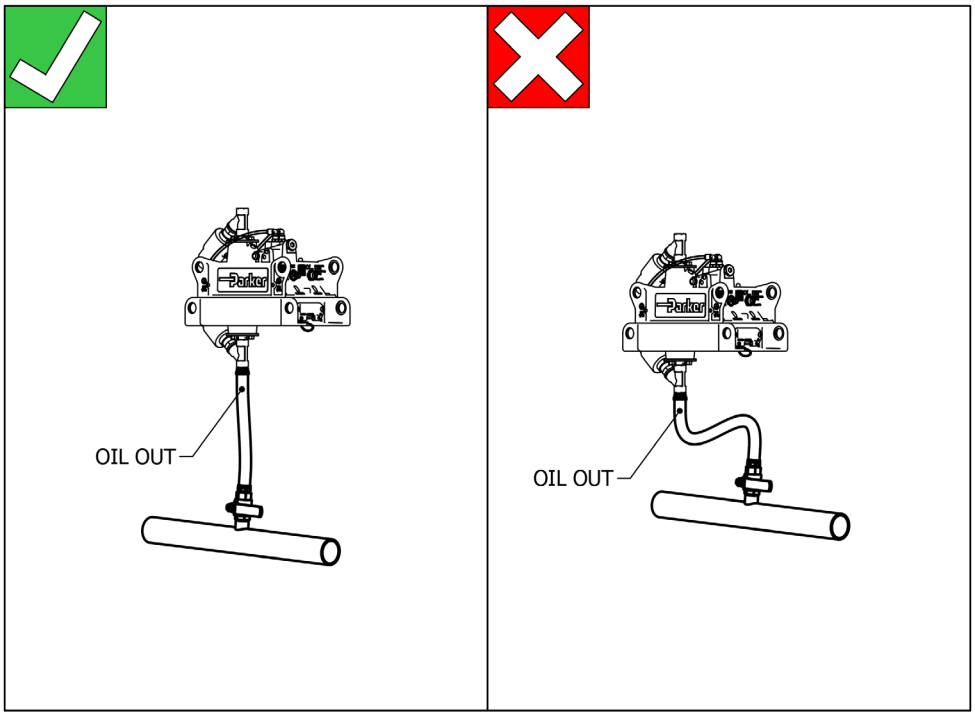


Figure 6

WARNING

To minimise potential issues and blockages, ensure there are no restrictions in the outlet pipework (refer to Figure 6).

If the oil outlet weld boss is located on a vertical pipe section, weld the boss onto the pipe at a 45° upward angle. Refer to Figure 7 below.

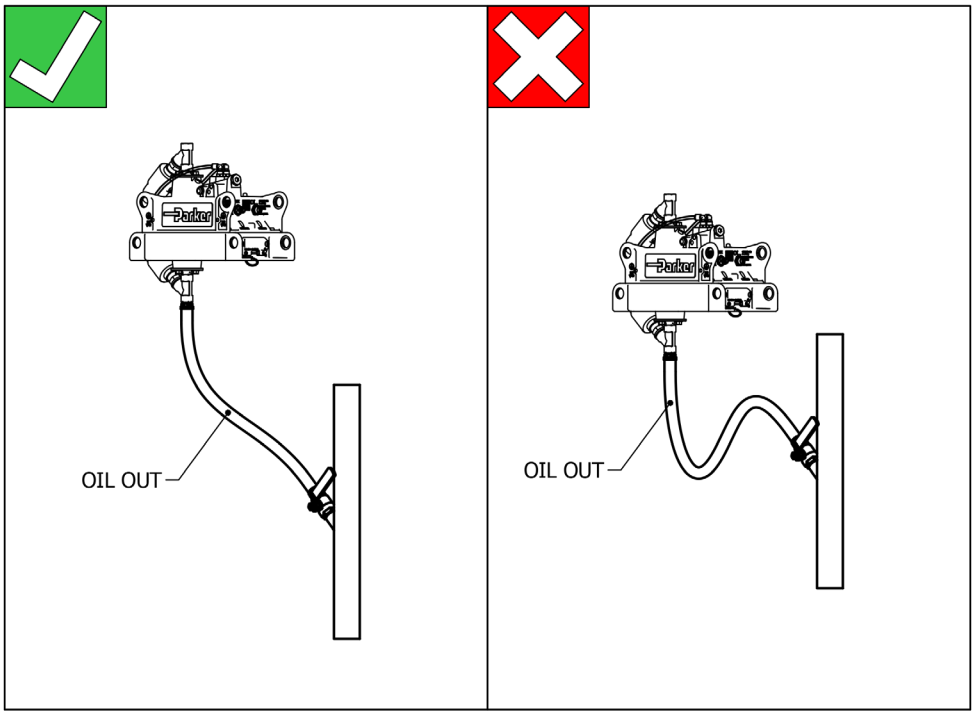
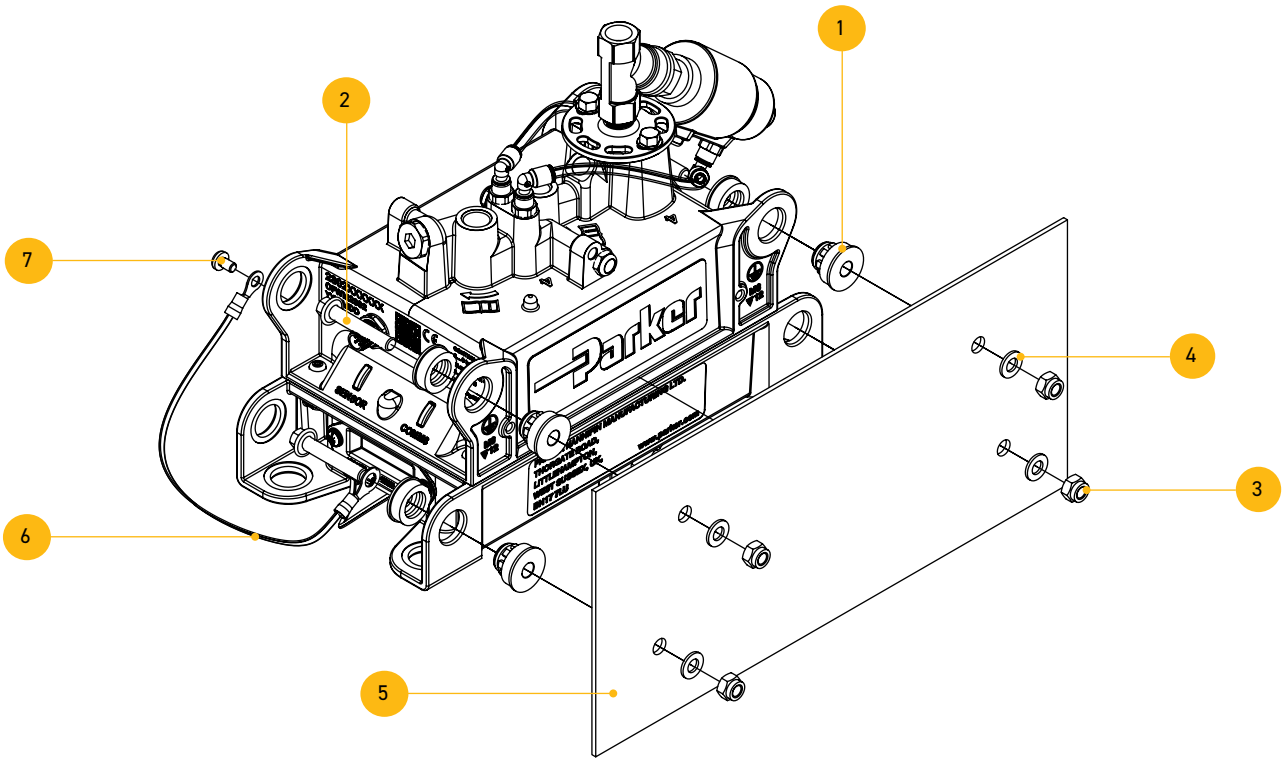


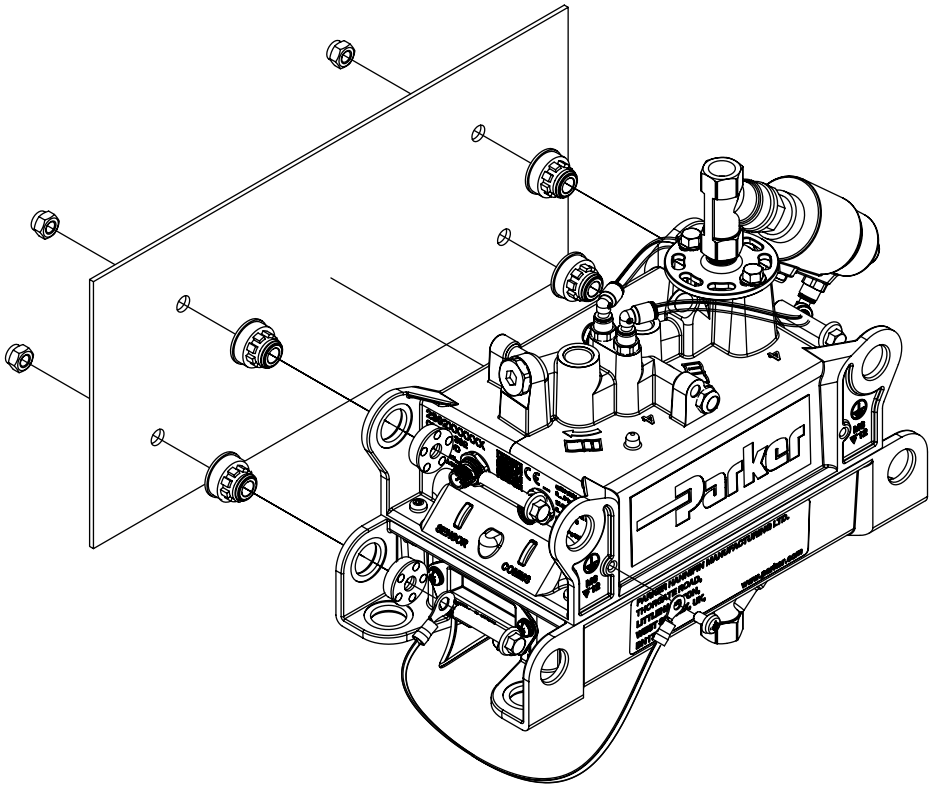
Figure 7

8.2 Fabricate Mounting Bracket

Manufacture a suitable bracket to hold the OFWM in all operating conditions. Consider clearance for piping and cables etc. Make sure that there is sufficient clearance to safely install and maintain the sensor. Consideration may need to be given to create access panels in deck plates if mounting below. The anti-vibration mounts supplied with the sensor fit M8 flange head bolts. See Drawings below showing possible mounting orientations. A General Arrangement drawing and mounting template drawings can be found in Appendix 12.1.



KEY	
1. Vibration Mounts	5. Deckplate / Mounting Plate
2. Flange Bolt (M8)	6. Earth Strap
3. Self Locking Nut (M8)	7. Earth Strap Screw (M6 x 12 mm)
4. Washer	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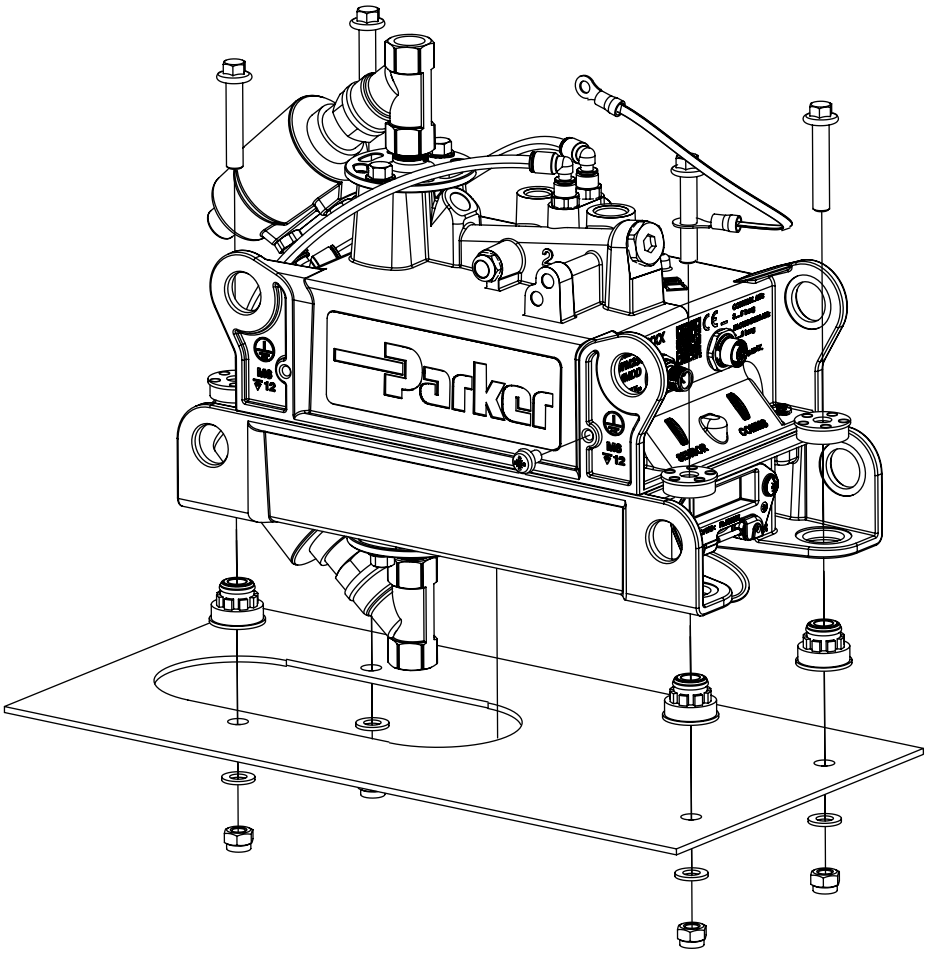
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8.3 Preparing and Installing the Sensor Compressed Air Supply

WARNING

The compressed air supply to the sensors must conform to ISO 8573-1:2010 [7:4:4], as contamination or moisture will affect sensor performance and may lead to functional issues over time. Please follow the guidelines below to ensure these recommendations are implemented.

With reference to section 5.1 System Schematic, the system requires two different air pressure supplies to ensure correct sensor operation: the control air line and the sensor blowdown air line, as specified below. Both are typically supplied from the engine control air, which must be supplied clean and dry as per 'Engine Control Air' spec. below.

Compressed air type	Pressure/Flow	Specification
Engine Control Air	7-8 bar (300 l/min minimum free air delivery)	Compressed air to ISO 8573-1:2010 [7:4:4] • Particles – Class 7: allows a relatively high particle level (ISO defines this class by particle count up to 5 µm; commonly specified as up to 500,000 particles/m³ for ≤5 µm). • Water – Class 4: pressure dew point (PDP) ≤ +3°C (typical of a refrigerated dryer). • Oil – Class 4: total oil (aerosol + vapor + liquid) ≤ 5 mg/m³.
Control Input	4-6 bar	G1/4
Blowdown Air Input	Minimum: Scavenge Pressure + 3 bar Maximum: 8 bar	G3/8

1. Install appropriate pressure regulation and air preparation equipment (filtration and water removal), along with any required airline/cable support brackets, along the engine in accordance with local requirements.

WARNING

Sensor airline bracketry should be routed below the sensors to minimise the risk of condensation entering the sensors.

2. Run the main airline to the regulator install location, this should have a minimum diameter of ½ BSP. The air regulator/s should be mounted in a location where vibrations are low. Vibrations may cause premature failure to internal components. It is recommended that flexible hoses be run to and from the regulators.

3. As a minimum, a single regulator should be installed, this must be used to control the air to the control circuit of the sensor. The air to the blowdown circuit can remain unregulated as long as it is below 8 bar and meets the air specification. It is recommended to fit a regulator to both lines for complete control. A means of isolation should be fitted to all lines such that the system can be shut off in an emergency or for maintenance. A pressure transducer (part #) should be installed prior to the regulators but after isolation as the sensors need a constant/uninterrupted air supply for operation.
   Ensure regulators are in the vented/no pressure state prior to final commissioning.

WARNING

Ensure regulators are in the vented/no pressure state prior to final commissioning. Isolation valves should be installed on all air lines so the system can be shut off for emergency situations or maintenance.

4. Run 2 x air manifold lines along the engine with connection points. For the control air it is recommended that a 3/8" (9.7 mm ID) hose is run with teeing off to sensors in ¼" (6.4 mm ID)hose minimum. For the blowdown it is recommended that a ½" (12.7 mm ID) hose is run with teeing off to each sensor in 3/8" (9.7 mm ID) minimum.

WARNING

Provide a means of draining condensate from each manifold at its lowest point; alternatively, install regulators with automatic drains.

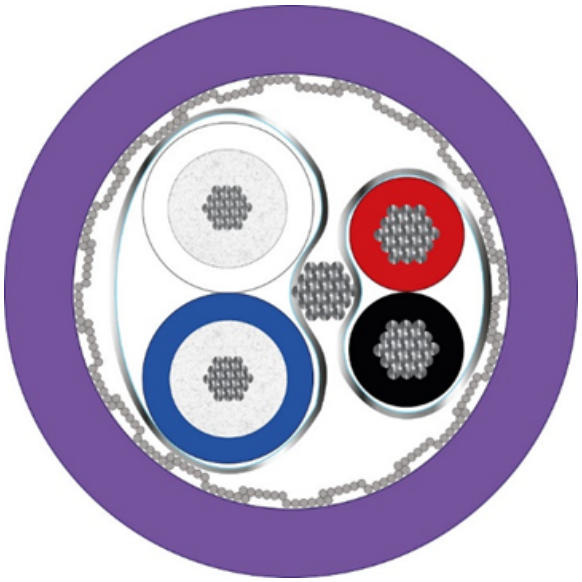
8.4 Running the Main Trunk Cable

CAUTION

All cables must be shielded and approved for shipboard use. Follow local regulations.

The main trunk cable is used to send power and communications from the engine control room to the engine room terminal box location. Enough slack at each end should be allowed to ensure proper terminal box placements. It is recommended that the engine terminal box location is at one end of the engine to enable easy daisy chaining of sensors.
The recommended main power/communications cable used from the engine control room to the engine junction box ~20 m to 100 m:

Cable Specification	Manufacturers
1 x 2 x 15 AWG & 1 x 2 x 18 AWG DeviceNet / CAN Bus	Various



Example DeviceNet Cable

Cores	Utilisation
1 x 2 x 15 AWG (Power Pair)	Red – 24 V DC & Black – 0 V
1 x 2 x 18 AWG (Data Pair)	Blue – CAN L & White – CAN H
Drain Wire	Shielding/Ground

Ideally, route the cable separately from high-voltage conductors (>120 VAC) to reduce the risk of EMI. Where shielded cable runs parallel to power cabling, maintain a minimum separation of 50 mm. If the cable must cross a power cable, cross at 90°. Avoid routing near high-voltage sources such as motors, transformers, and fluorescent ballasts, and do not install high-voltage and communications cables in the same conduit.

The CAN bus uses a linear topology with 120 Ω termination resistors at both ends of the trunk. Sensor nodes connect along the bus in a daisy-chain arrangement; any spurs/stubs off the main trunk should be kept as short as possible.

The maximum allowable total length of the combined communications/power cable depends on the CAN baud rate (see table below). If the network includes many stubs, reduce the total cable length accordingly.

CANbus Baud Rate (kbits/s)	Maximum Total Cable Run Length (m)
1000	25
800	50
500	100
250	250
125	500
50	1000

9. Installation

CAUTION

Before proceeding, ensure that all tasks in section 8 Pre-Installation are completed.

WARNING

Ensure that there is no electrical current in the system when doing electrical installations. Do not connect power until instructed.

Ensure air and oil supplies are isolated or turned off when installing.

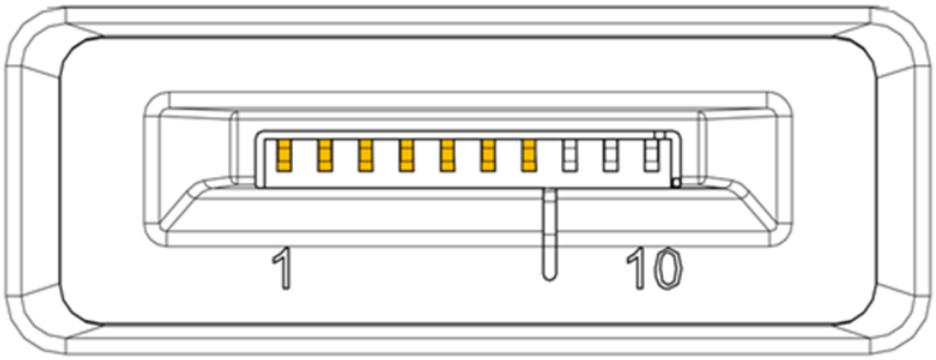
9.1 Unpack the equipment

Unpack all equipment and check that all parts specified in section 3.5 Contents of the delivery have been delivered. If there are any missing or damaged parts, contact your Parker representative. Before proceeding, ensure that you have all non-supplied equipment necessary for installation. Sections 9.2 -9.4 should be done whilst the sensor is easily accessible and not mounted.

9.2 Set the CAN node IDs

Remove the dipswitch cover from the sensor by removing the 2 screw, see section 3.1 Main components.

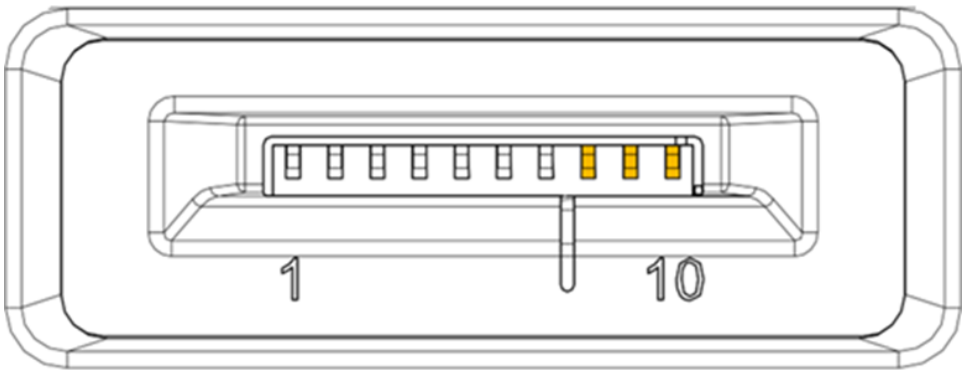
The individual unit CAN Node IDs must be set using the first 7 dip switches. The sensor is supplied with all the dip switches in the off/up position. Parker recommends setting the unit id to the cylinder number to allow easier identification. The first 14 node IDs are shown below, the full table can be found in Appendix 12.2.



NodeID	SW1–(1)	SW2–(2)	SW3–(4)	SW4–(8)	SW5–(16)	SW6–(32)	SW7–(64)
1	DOWN	UP	UP	UP	UP	UP	UP
2	UP	DOWN	UP	UP	UP	UP	UP
3	DOWN	DOWN	UP	UP	UP	UP	UP
4	UP	UP	DOWN	UP	UP	UP	UP
5	DOWN	UP	DOWN	UP	UP	UP	UP
6	UP	DOWN	DOWN	UP	UP	UP	UP
7	DOWN	DOWN	DOWN	UP	UP	UP	UP
8	UP	UP	UP	DOWN	UP	UP	UP
9	DOWN	UP	UP	DOWN	UP	UP	UP
10	UP	DOWN	UP	DOWN	UP	UP	UP
11	DOWN	DOWN	UP	DOWN	UP	UP	UP
12	UP	UP	DOWN	DOWN	UP	UP	UP
13	DOWN	UP	DOWN	DOWN	UP	UP	UP
14	UP	DOWN	DOWN	DOWN	UP	UP	UP

9.3 Set the CANbaud rate

It is recommended that the OFWM sensors are installed on their own CANbus network. It is recommended that CAN baud rate is set to 125 kbit. If the sensors cannot be installed on their own network, the baud rate should match that of the existing CANbus network. Re-install the dipswitch cover and tighten the screws to no more than 1Nm.



SW8	SW9	SW10	Baud Rate	Max Bus Length
UP	UP	UP	OFF / Reserved	N/A
DOWN	UP	UP	50 kbit/s	1000 m
UP	DOWN	UP	125 kbit/s*	500 m
DOWN	DOWN	UP	250 kbit/s	250 m
UP	UP	DOWN	500 kbit/s	100 m
DOWN	UP	DOWN	800 kbit/s	50 m
UP	DOWN	DOWN	1000 kbit/s	25 m
DOWN	DOWN	DOWN	OFF / Reserved	N/A

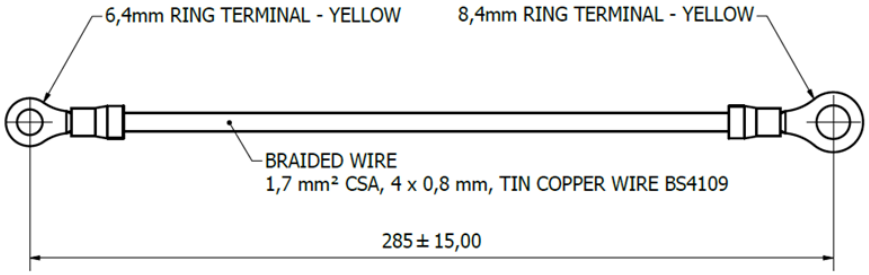
* Recommended run speed

9.4 Install Fittings

Install all the required oil and air fittings to the unit ensuring a Y piece is installed into the upper angle seat valve first.

9.5 Earthing strap

To ensure earth continuity between the OFWM housing and mounting structure, make up an earthing strap. An example is given below:



9.6 Install the sensor onto the mounting bracket

1. Attach the anti-vibration mounts onto the selected mounting holes by pushing a male and female part together through the hole as per the mounting images in section 8.2 Fabricate Mounting Bracket.
2. Install the grounding strap between the unit (M6) and underneath the M8 bolthead. It is recommended that the strap is installed at the dipswitch end for improved access.
3. Set the sensor on the mounting bracket.
4. Fasten the sensor with M8 flange head hexagon bolts ensuring the ring terminal of the grounding strap is in place. Fasten the bolts through the anti-vibration mounts and tighten to 20Nm using washers and nylon nuts as appropriate.

9.7 Connect Oil and Air to the Sensor

Make up the drop hoses for the oil feed, oil vent, oil return, control air, blowdown air and connect to the sensor and the respective points. Ensure all points are isolated/pressure free before making the connections. Oil hoses to and from the bosses/isolation valves should be ½ BSP and only reduced at the fitting into the sensor. Ensure all oil line hoses use straight or 45 degree fittings.

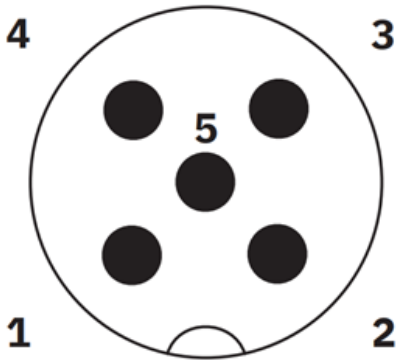
9.8 Install the Engine Terminal Box

Install the Engine Terminal box, connect the main trunk cable with appropriate cable glands and appropriately sized terminals. See picture as example

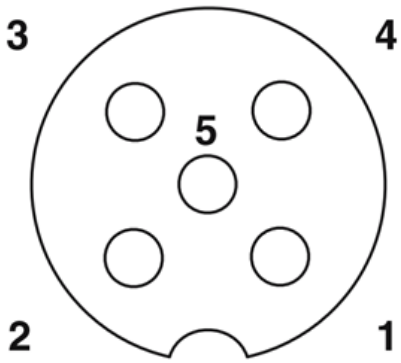
9.9 Daisy Chain Sensors

Recommended Cable Type	Part number	Length (m)	Manufacturer
Phoenix Contact Straight Female 5 way M12 to Straight Male 5 way M12 Bus Cable, Typical lengths available 2 m, 5 m and 10 m	1507573	10	Phoenix contact
	1507560	5	
	1507557	2	
Phoenix Contact M12 5 Pole Termination Resistor	1507816	N/A	Phoenix contact

1. Install the cable between the engine junction box and the first sensor. This is typically achieved by removing the female plug from the cable and hardwiring into the junction box, leaving the male plug to go into the first sensor. The pin out information is given below.
2. Daisy chain the remaining sensors together with the appropriate length cables.
3. Fit an M12 terminating dongle (120 Ω resistor) to the last sensor in the chain.



Pin out – Male Connector



Pin out - Female Socket

Pin	Description
1	Shielding/Ground
2	Red – 24V DC
3	Black – 0V
4	White – CAN H
5	Blue – CAN L

9.10 Make Power Connections

WARNING

Online FWM is classified as permanently connected equipment and requires an external isolating switch or circuit breaker a suitable fuse should also be installed prior to the sensors. These items must be clearly identifiable, labelled and positioned in a readily accessible location.

Supply the required power to the engine room via the main trunk cable previously installed (See section 8.4 Run Main Trunk Cable). Ensure engine room terminals are already isolated in the engine room terminal box before undertaking this work.

Various options of supplying the required power are possible, it is up to the end user/integrator to determine the best method based upon how the system is going to be integrated in terms of power source and data acquisition.

An example of a standalone power/communications setup is available in Appendix 12.3.

The Online FWM system requires the following power input:

Voltage input	24 V DC (18-32 V DC)
Current consumption	0.25 A per sensor @ 24 V DC

9.11 Make Communications Connections

It is the end user/system integrators choice on how the data from the OFWM is captured and used.

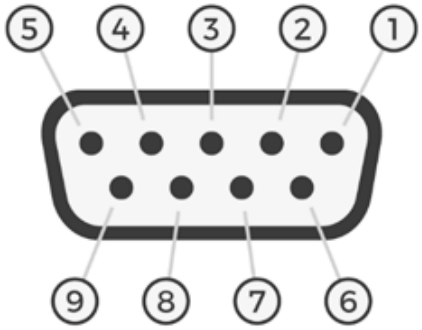
A basic setup can use a PC in conjunction with the Parker OFWM software. This will allow for basic configuration and data capture. This method of setup will require a PEAK PCAN-USB adapter to be plugged into the PC. The CAN wires from the main trunk cable should be connected to a 9-pin D-sub female plug with a 120-ohm terminator which can then be plugged into the adapter. Note that plugs with built-in 120-ohm terminators are available.

Depending on the situation and where power is being sourced from it may be prudent to run the main trunk cable into a terminal box in the engine control room and splitting the power and communications components out for neatness and simplicity. A daisy chain type cable can then be modified and wired from the junction box to the D Plug.

If the Parker OFWM software is not going to be used to communicate with the sensors other options for communications/data acquisition can be used such as an HMI/SCADA system but it is for the end user/system integrator to create and configure this. Further information on the Sensor protocol and CANopen object dictionary can be found in the OFWM Protocol Manual. An EDS file is also available for download from the website.

Item	Part Number
Peak PCAN-USB Adapter (only required if system is configured as standalone)	IPEH-002022
Phoenix Contact SUBCON-PLUS-CAN/PG 9 Way (only required if system is configured as standalone)	2708119

Female D-Sub Pin Out	Description
2	Blue – CAN L
3	Black- CAN GND
7	White – CAN H



Female D Sub

9.12 Install PC/Load Software

If required, install a PC / laptop at the desired location. Ensure the PC is securely mounted and that connections to and from PC are secure and not easy to pull out. Install the Parker OFWM software application, the drivers for the PCAN-USB adapter will also be installed at the same time. Refer to the software manual for more information.

Connect the PCAN-USB adapter to the PC USB port and to the CAN bus using the 9-pin D-sub female plug with a 120-ohm terminator.

10. Commissioning

Overview

This procedure defines the required sequence for first-time power-up and commissioning. Follow the steps in order and complete the checks at each stage before proceeding.

1. Apply supply power

1. Apply power to the system.
2. On power-up, verify the sensor LEDs run through an initial colour cycle.
3. After a short delay, confirm the LEDs indicate:
    - Sensor LED: Green blip every 4 seconds (sensor Stop Mode)
    - Comms LED: Green flashing (CANopen pre-operational)
        - If a single red flash is also present, the sensor is the only device on the CAN bus.

If the LEDs indicate any other state, refer to Appendix 12.4 and the Troubleshooting section.

2. Place sensor(s) in "Run" Mode

Select the method that matches your system configuration:

A: Using the Parker OFWM software:

1. Launch the software
2. As per the software manual, discover the sensors.
3. Set the sensor(s) to Run mode.
4. Confirm the sensor(s) are communicating with the software.

B: Using a 3rd party application/HMI:

1. Send the appropriate command to place the sensor(s) in Run mode.

Confirm the LEDs indicate Run Mode:

- Sensor LED: Green blip off every 2 seconds (sensor Run mode).
- Comms LED: Solid green (CANopen operational).

If the LEDs indicate any other state, refer to Appendix 12.4 and the troubleshooting section.

3. Turn On the Air Supply

1. Turn on the air supply.
2. Increase pressure gradually using the local regulators:
    - Control: 4–6 bar
    - Blowdown (minimum): Max Scavenge Pressure + 3 bar
    - Blowdown (maximum): 8 bar.
3. Check for any air leaks.
4. Confirm the angle seat valves are in the following positions:
    - Top valve: Open (red indicator out)
    - Bottom valve: Closed (red indicator in).

4. Power Cycle and Restart the System

1. Power cycle the system.
2. Confirm the sensor LED power-up sequence:
    - The sensor briefly illuminates each possible colour for the Sensor Status indicator and the Communications Status indicator, followed by a 1 second period with both indicators off.

After powering on, confirm the system operates in the following sequence:

1. The top and bottom valves close.
2. The sensor pressurises with compressed air. (Sensor LED turns blue)
3. The sensor blasts air downward.
4. The bottom valve closes and the top valve opens.
5. The system is ready to accept oil.

5. Open the Oil Line Valves

Open the oil line valves in the following order:

1. Oil Return Valve.
2. Oil Vent Valve (set handle to approximately 45°).
3. Oil In Valve.
4. Wait for oil/measure-timing for this is variable.

If the engine is not operational during commissioning:

- Ensure the Oil In isolator is closed. Unmount Oil In hose.
- Pour 15–20 ml of oil into the Oil In hose to trigger the unit, wait 10 seconds. (Sensor LED turns blue when blow down air is activated)
- Check the measure has been captured by the data acquisition system. For clean oil, this will typically be <20PPM.
- Check for oil leaks at the earliest opportunity.

If all the items above are satisfactory, the system is ready to be run. If not, please refer to the trouble shooting section for further guidance. Settings/Thresholds/trigger points can be set via the Parker software or 3rd party setup. Please refer to the software manual or Protocol manual for further guidance.

11. Troubleshooting

Note: The data logging software referred in this troubleshooting section may refer to the Parker OFWM software or third-party equivalent.

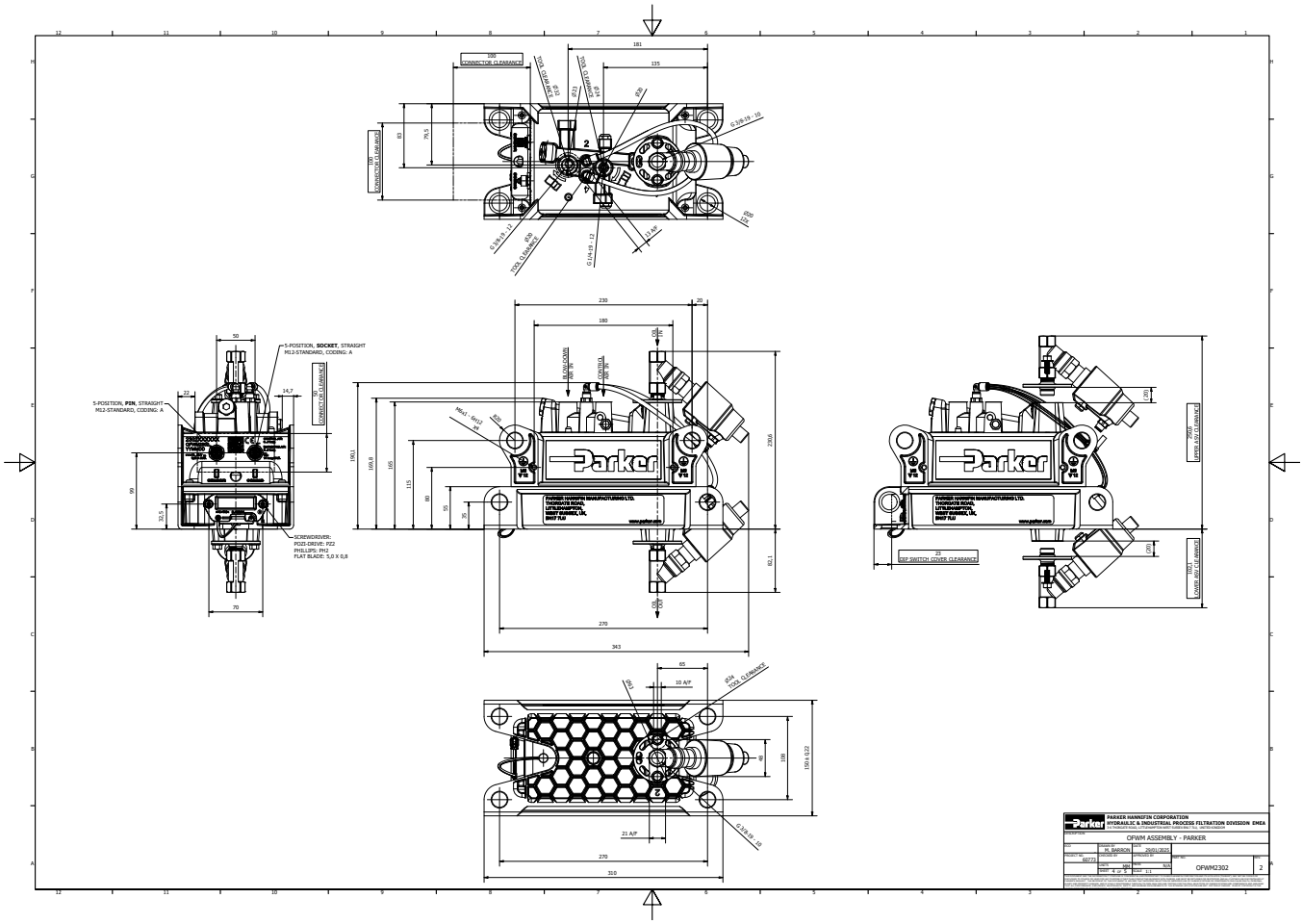
Further troubleshooting can be found in the User Manual and Software Manual.

Problem	Possible reason		Suggested solution
Sensor status LEDs off.	Sensor has no power.		Check cables are connected. Check power supply and fuses. Check sensor supply voltage is in the range 18 – 32 Vdc.
Intermittent communications.	Loose wiring.		Check communication wiring.
	Electrically noisy environment.		Move communication cables away from power cables, electrical switching equipment, etc.
			Use daisy-chain cables with screw securing collars that are isolated from the shield of the cable to avoid earth loops.
Sensor not detected by data logging soft-ware.	Sensor has no power.		See above.
	CAN-USB adapter problem (if using Parker OFWM software)		Disconnect adapter from the PC and reconnect. Make sure drivers are installed on the PC, see the Software manual.
	The sensor communications error status LED shows red blinking. See the Status indicator section.	Sensor node ID and baud rate not configured.	Change DIP switches on the sensor to configure a unique node ID and to configure the correct baud rate for the CAN bus. See the Installation manual.
	The sensor communications error status LED shows a single red flash. See the Status indicator section.	Communications cable disconnected from the PC.	Reconnect the cable.
		Mismatched baud rate.	Make sure the baud rate matches that of the software.
		Short circuited communications cable.	Check cables for short circuit.
		Missing CAN terminator resistors from communications cable.	Make sure 120-ohm terminator resistors are connected to each end of the CAN communica-tions cable.
	The sensor communications error run LED shows blinking green. See the Status indicator section.	Not connected to the PC.	Make sure the CAN-USB adapter is connected to the PC.
Sensor does not report new measurement to data logging software.	Sensor node ID and baud rate not configured.		Change DIP switches on the sensor to configure a unique node ID and to configure the correct baud rate for the CAN bus. See the Installation manual.

	Sensor not in Run mode.		Put the sensor in Run mode.
	Sensor is not filling	No system oil flow.	Manually check of oil flow.
		Blocked upper angle seat valve.	See the User Manual section Maintenance.
		Blockage in the system.	See the User Manual section Maintenance.
		Isolation valves closed.	Open the isolation valves.
		No system air.	Make sure system air pressure and air flow is correct. Examine pneumatic hoses and fittings.
		Oil misting	If you are unable to sample oil, refer to the Installation manual for potential solutions, for example, pipework baffles.
		Faulty angle seat valve.	Make sure the red indicator is positioned correctly. When the red indicator is visible, the valve is open. Replace the angle seat valve, see the User manual section Maintenance.
		Vessel listing.	Check listing angle and orientation (port/ starboard).
Data logging software reporting block alarm. (Sensor status LED changed to red. See the Status indicator section).	No blowdown function.		Check system air pressure is correct and examine pneumatic hoses and fittings. Check sensor supply voltage is in the range 18 – 32 Vdc. Blocked lower angle seat valve. See the User Manual Maintenance section. Blockage in system. See the User Manual section Maintenance.
Fatal error detected by data logging software. (Both LEDs 'railroading'. See the Status indicator section.)	A software or hardware fault.		The sensor will attempt to restart by itself. If not, attempt to restart the sensor from the software (if using Parker OFWM software see the Software manual) or by pressing and releasing the sensor reset button (see the section Using the reset button). If the sensor fails to restart, note down the fatal code from the Parker OFWM software, if possible, and export all the data ensuring the event log is included and report to your Parker distributer.
Firmware not installed (Both LEDs solid red. See the Status indicator section)	Firmware not installed.		Firmware needs to be installed. Contact your Parker distributer.
Sensor triggers ship alarm	System power supply.		Make sure the system power supply is isolated.
	Communication cable 0 V signal ground connected to earth.		Isolate the 0 V ground from earth.

12. Appendices

12.1 General Arrangement Drawing



12.2 CAN node ID Configuration

NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
1	DOWN	UP	UP	UP	UP	UP	UP
2	UP	DOWN	UP	UP	UP	UP	UP
3	DOWN	DOWN	UP	UP	UP	UP	UP
4	UP	UP	DOWN	UP	UP	UP	UP
5	DOWN	UP	DOWN	UP	UP	UP	UP
6	UP	DOWN	DOWN	UP	UP	UP	UP
7	DOWN	DOWN	DOWN	UP	UP	UP	UP
8	UP	UP	UP	DOWN	UP	UP	UP
9	DOWN	UP	UP	DOWN	UP	UP	UP
10	UP	DOWN	UP	DOWN	UP	UP	UP
11	DOWN	DOWN	UP	DOWN	UP	UP	UP
12	UP	UP	DOWN	DOWN	UP	UP	UP
13	DOWN	UP	DOWN	DOWN	UP	UP	UP
14	UP	DOWN	DOWN	DOWN	UP	UP	UP
15	DOWN	DOWN	DOWN	DOWN	UP	UP	UP
16	UP	UP	UP	UP	DOWN	UP	UP
17	DOWN	UP	UP	UP	DOWN	UP	UP
18	UP	DOWN	UP	UP	DOWN	UP	UP
19	DOWN	DOWN	UP	UP	DOWN	UP	UP
20	UP	UP	DOWN	UP	DOWN	UP	UP
21	DOWN	UP	DOWN	UP	DOWN	UP	UP
22	UP	DOWN	DOWN	UP	DOWN	UP	UP
23	DOWN	DOWN	DOWN	UP	DOWN	UP	UP

NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
24	UP	UP	UP	DOWN	DOWN	UP	UP
25	DOWN	UP	UP	DOWN	DOWN	UP	UP
26	UP	DOWN	UP	DOWN	DOWN	UP	UP
27	DOWN	DOWN	UP	DOWN	DOWN	UP	UP
28	UP	UP	DOWN	DOWN	DOWN	UP	UP
29	DOWN	UP	DOWN	DOWN	DOWN	UP	UP
30	UP	DOWN	DOWN	DOWN	DOWN	UP	UP
31	DOWN	DOWN	DOWN	DOWN	DOWN	UP	UP
32	UP	UP	UP	UP	UP	DOWN	UP
33	DOWN	UP	UP	UP	UP	DOWN	UP
34	UP	DOWN	UP	UP	UP	DOWN	UP
35	DOWN	DOWN	UP	UP	UP	DOWN	UP
36	UP	UP	DOWN	UP	UP	DOWN	UP
37	DOWN	UP	DOWN	UP	UP	DOWN	UP
38	UP	DOWN	DOWN	UP	UP	DOWN	UP
39	DOWN	DOWN	DOWN	UP	UP	DOWN	UP
40	UP	UP	UP	DOWN	UP	DOWN	UP
41	DOWN	UP	UP	DOWN	UP	DOWN	UP
42	UP	DOWN	UP	DOWN	UP	DOWN	UP
43	DOWN	DOWN	UP	DOWN	UP	DOWN	UP
44	UP	UP	DOWN	DOWN	UP	DOWN	UP
45	DOWN	UP	DOWN	DOWN	UP	DOWN	UP
46	UP	DOWN	DOWN	DOWN	UP	DOWN	UP
47	DOWN	DOWN	DOWN	DOWN	UP	DOWN	UP

NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
48	UP	UP	UP	UP	DOWN	DOWN	UP
49	DOWN	UP	UP	UP	DOWN	DOWN	UP
50	UP	DOWN	UP	UP	DOWN	DOWN	UP
51	DOWN	DOWN	UP	UP	DOWN	DOWN	UP
52	UP	UP	DOWN	UP	DOWN	DOWN	UP
53	DOWN	UP	DOWN	UP	DOWN	DOWN	UP
54	UP	DOWN	DOWN	UP	DOWN	DOWN	UP
55	DOWN	DOWN	DOWN	UP	DOWN	DOWN	UP
56	UP	UP	UP	DOWN	DOWN	DOWN	UP
57	DOWN	UP	UP	DOWN	DOWN	DOWN	UP
58	UP	DOWN	UP	DOWN	DOWN	DOWN	UP
59	DOWN	DOWN	UP	DOWN	DOWN	DOWN	UP
60	UP	UP	DOWN	DOWN	DOWN	DOWN	UP
61	DOWN	UP	DOWN	DOWN	DOWN	DOWN	UP
62	UP	DOWN	DOWN	DOWN	DOWN	DOWN	UP
63	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	UP
64	UP	UP	UP	UP	UP	UP	DOWN
65	DOWN	UP	UP	UP	UP	UP	DOWN
66	UP	DOWN	UP	UP	UP	UP	DOWN
67	DOWN	DOWN	UP	UP	UP	UP	DOWN
68	UP	UP	DOWN	UP	UP	UP	DOWN
69	DOWN	UP	DOWN	UP	UP	UP	DOWN
70	UP	DOWN	DOWN	UP	UP	UP	DOWN
71	DOWN	DOWN	DOWN	UP	UP	UP	DOWN

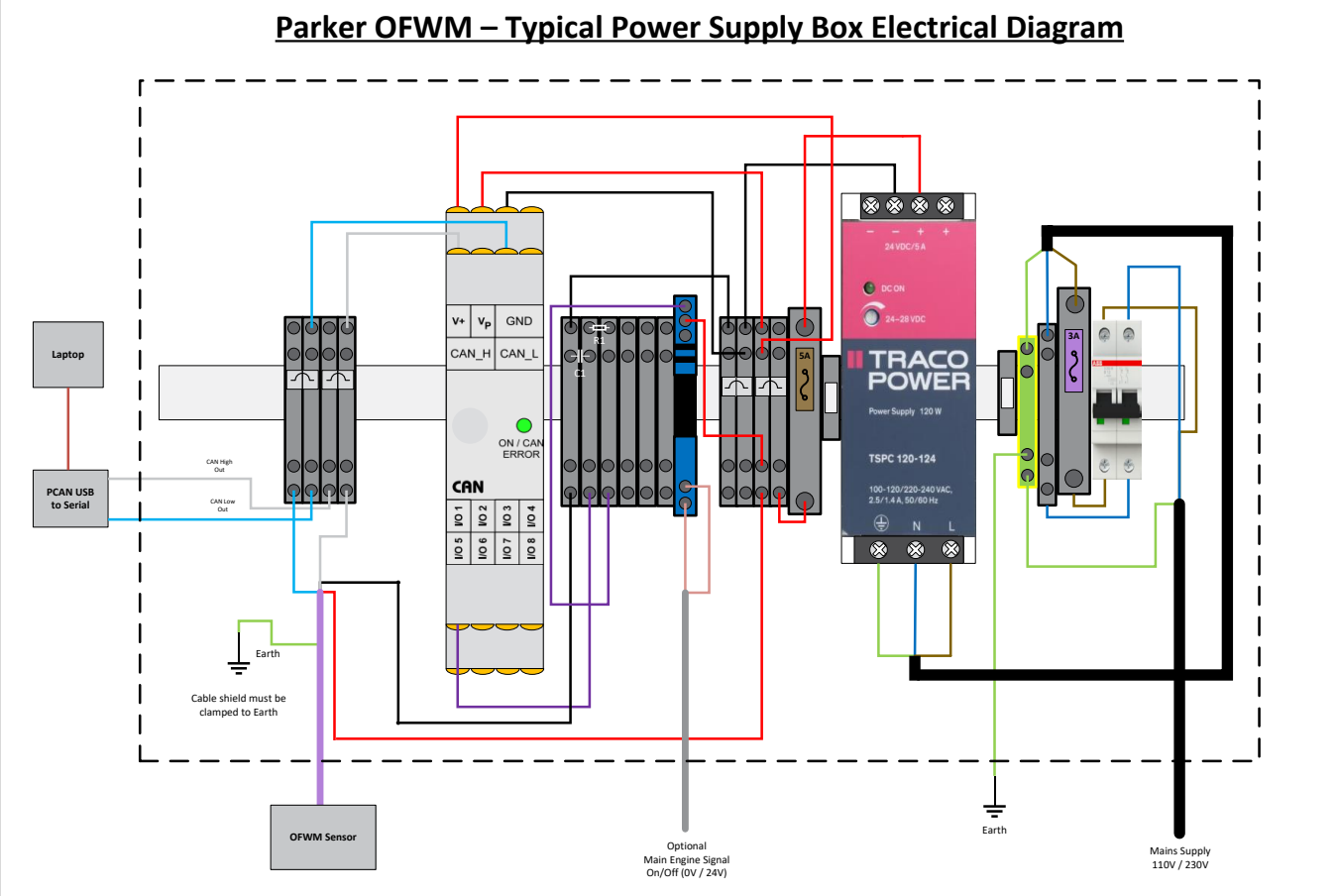
NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
72	UP	UP	UP	DOWN	UP	UP	DOWN
73	DOWN	UP	UP	DOWN	UP	UP	DOWN
74	UP	DOWN	UP	DOWN	UP	UP	DOWN
75	DOWN	DOWN	UP	DOWN	UP	UP	DOWN
76	UP	UP	DOWN	DOWN	UP	UP	DOWN
77	DOWN	UP	DOWN	DOWN	UP	UP	DOWN
78	UP	DOWN	DOWN	DOWN	UP	UP	DOWN
79	DOWN	DOWN	DOWN	DOWN	UP	UP	DOWN
80	UP	UP	UP	UP	DOWN	UP	DOWN
81	DOWN	UP	UP	UP	DOWN	UP	DOWN
82	UP	DOWN	UP	UP	DOWN	UP	DOWN
83	DOWN	DOWN	UP	UP	DOWN	UP	DOWN
84	UP	UP	DOWN	UP	DOWN	UP	DOWN
85	DOWN	UP	DOWN	UP	DOWN	UP	DOWN
86	UP	DOWN	DOWN	UP	DOWN	UP	DOWN
87	DOWN	DOWN	DOWN	UP	DOWN	UP	DOWN
88	UP	UP	UP	DOWN	DOWN	UP	DOWN
89	DOWN	UP	UP	DOWN	DOWN	UP	DOWN
90	UP	DOWN	UP	DOWN	DOWN	UP	DOWN
91	DOWN	DOWN	UP	DOWN	DOWN	UP	DOWN
92	UP	UP	DOWN	DOWN	DOWN	UP	DOWN
93	DOWN	UP	DOWN	DOWN	DOWN	UP	DOWN
94	UP	DOWN	DOWN	DOWN	DOWN	UP	DOWN
95	DOWN	DOWN	DOWN	DOWN	DOWN	UP	DOWN

NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
96	UP	UP	UP	UP	UP	DOWN	DOWN
97	DOWN	UP	UP	UP	UP	DOWN	DOWN
98	UP	DOWN	UP	UP	UP	DOWN	DOWN
99	DOWN	DOWN	UP	UP	UP	DOWN	DOWN
100	UP	UP	DOWN	UP	UP	DOWN	DOWN
101	DOWN	UP	DOWN	UP	UP	DOWN	DOWN
102	UP	DOWN	DOWN	UP	UP	DOWN	DOWN
103	DOWN	DOWN	DOWN	UP	UP	DOWN	DOWN
104	UP	UP	UP	DOWN	UP	DOWN	DOWN
105	DOWN	UP	UP	DOWN	UP	DOWN	DOWN
106	UP	DOWN	UP	DOWN	UP	DOWN	DOWN
107	DOWN	DOWN	UP	DOWN	UP	DOWN	DOWN
108	UP	UP	DOWN	DOWN	UP	DOWN	DOWN
109	DOWN	UP	DOWN	DOWN	UP	DOWN	DOWN
110	UP	DOWN	DOWN	DOWN	UP	DOWN	DOWN
111	DOWN	DOWN	DOWN	DOWN	UP	DOWN	DOWN
112	UP	UP	UP	UP	DOWN	DOWN	DOWN
113	DOWN	UP	UP	UP	DOWN	DOWN	DOWN
114	UP	DOWN	UP	UP	DOWN	DOWN	DOWN
115	DOWN	DOWN	UP	UP	DOWN	DOWN	DOWN
116	UP	UP	DOWN	UP	DOWN	DOWN	DOWN
117	DOWN	UP	DOWN	UP	DOWN	DOWN	DOWN
118	UP	DOWN	DOWN	UP	DOWN	DOWN	DOWN
119	DOWN	DOWN	DOWN	UP	DOWN	DOWN	DOWN

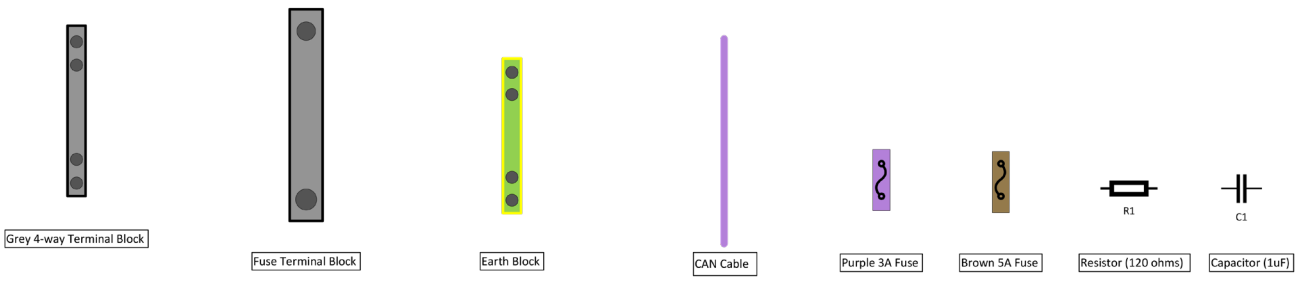
NodeID	SW1-(1)	SW2-(2)	SW3-(4)	SW4-(8)	SW5-(16)	SW6-(32)	SW7-(64)
120	UP	UP	UP	DOWN	DOWN	DOWN	DOWN
121	DOWN	UP	UP	DOWN	DOWN	DOWN	DOWN
122	UP	DOWN	UP	DOWN	DOWN	DOWN	DOWN
123	DOWN	DOWN	UP	DOWN	DOWN	DOWN	DOWN
124	UP	UP	DOWN	DOWN	DOWN	DOWN	DOWN
125	DOWN	UP	DOWN	DOWN	DOWN	DOWN	DOWN
126	UP	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN
127*	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	DOWN

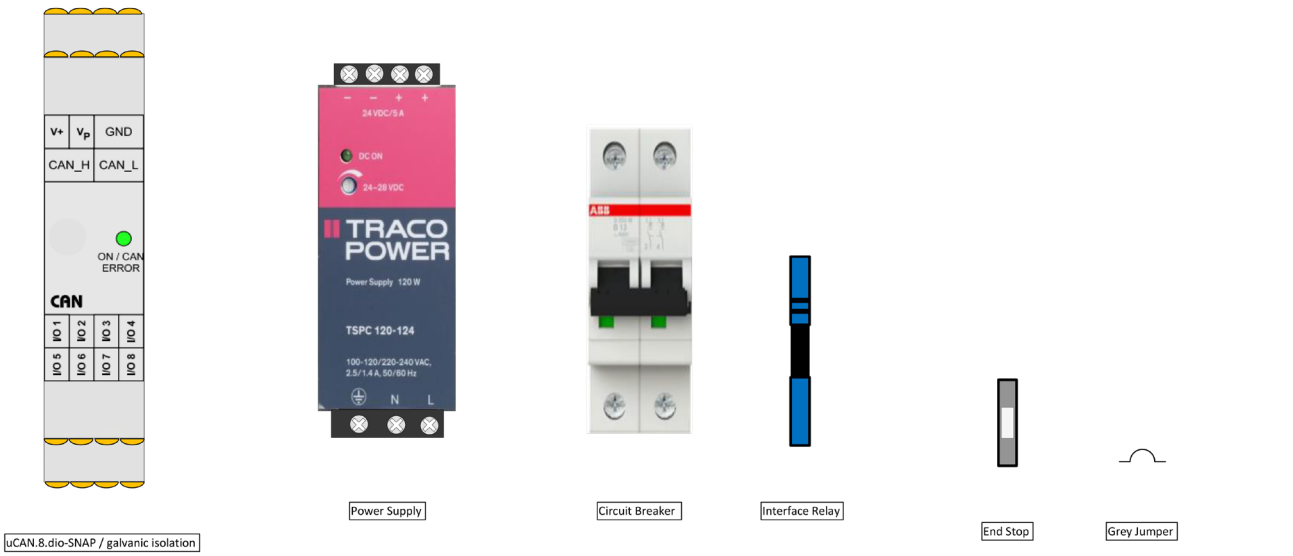
* Node 127 should not be addressed to a sensor if the Parker software is being used. If the Parker software is not being used Node 127 can be addressed.

12.3 Example Power Box Configuration



Components





12.4 Interpreting the LED

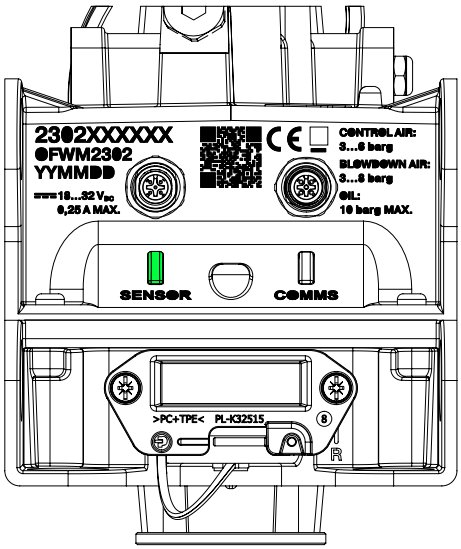
The sensor has two tri-coloured LED indicators, the sensor status indicator on the left-hand side and the communications status indicator on the right-hand side.

With the sensor configured and operating normally, the sensor status LED will be green with a blip off every 2 seconds to indicate Run mode and the communications status LED will be solid green to indicate CAN operational.

The sensor status LED will change to blue for a few seconds during an air blowdown.

Red on either LED indicates the sensor requires attention or a fault has occurred.

12.4.1 Sensor status LED



Stop Mode
Blips on once every four seconds

Run Mode
Blips off once every two seconds
Turns blue during air blowdown
Turns red to indicate a blocked tube or balance fail

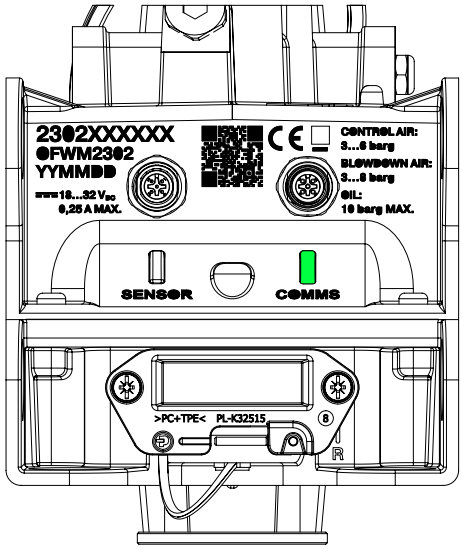
Configuration Mode
Double flash every 2 seconds
Turns blue during air blowdown
Turns red to indicate a blocked tube or balance fail

Bootloader Mode
Triple flash every 2 seconds
Changes to flicker when updating the firmware

Factory Mode
Quadruple flash every 2 seconds
Turns red to indicate a blocked tube or balance fail

12.4.2 Communications status LED

The Run (green) and the Error (red) status are interleaved on the single communications status LED.

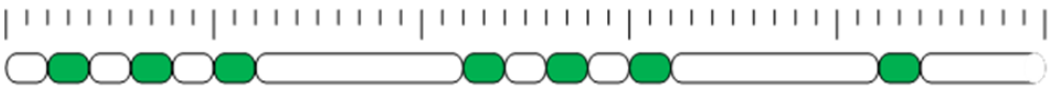


Run status

Pre-Operational State
Blinking (200 ms)

Operational State
Solid on

Firmware Updating
Triple flashes followed by a one second pause



Error Status

Invalid Configuration
Blinking (200 ms)

Bus Off
Solid on

Warning
Single flash (200 ms) flash followed by a one second pause

Sensor status and communications status LEDs together

Power up sequence
CAN and Status LEDs alternate colour

Fatal error detected
Railroad flash (500 ms) alternating between the CAN and Status LEDs

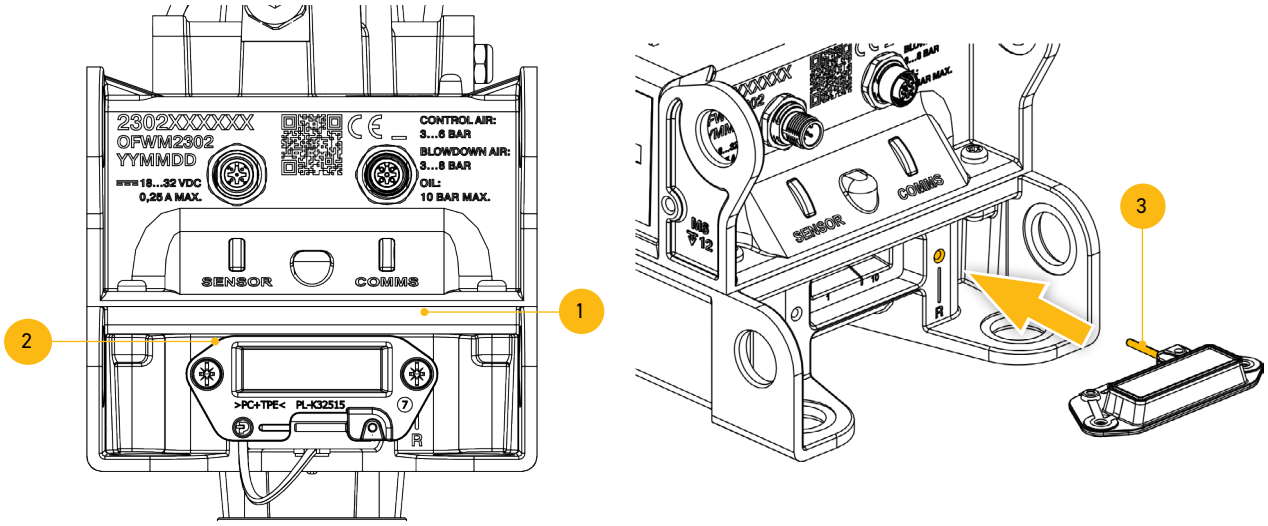
Fatal error detected at startup
Railroad flash (250 ms) alternating red and blue between the CAN and Status LEDs

Firmware no installed
CAN and Status LEDs solid on

12.5 Using the reset button

To access the button:

1. Remove the two screws (1) on the plastic cover at the end of the sensor.
2. Remove the plastic cover (2) from the front of the sensor.
3. Fold and use the yellow probe (3) on the plastic cover to push the button as required.
4. Set the plastic cover back on the sensor.
5. Fasten the plastic cover with the two screws.



12.5.1 Reset the sensor back to factory defaults

1. Push and hold the reset button for 5 seconds.

Result: Both LEDs will flash green five times to indicate the sensor has returned to factory settings, including the CANopen communication configuration.

12.5.2 Retry after blockage indication

If a blockage indication is shown when in Run mode, the reset button can be used to attempt to restart measurements. However, normally this restart is done from the software via the user interface.

1. Push and release the reset button.

Result: The sensor attempts to restart measurements.

12.5.3 Retry after fatal error indication

If a fatal error indication is shown, the reset button can be used to attempt to restart the sensor. However, normally the restart is done from the software via the user interface.

1. Push and release the reset button.

Result: The sensor attempts to restart the sensor.

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