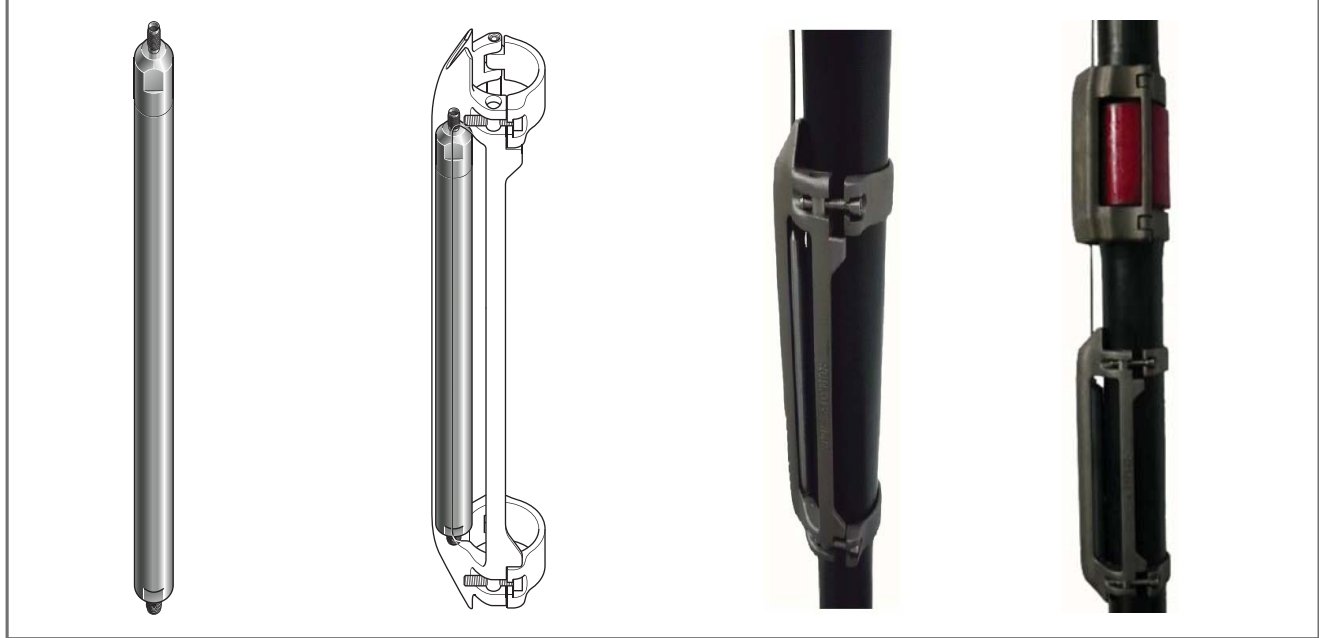


ROD PUMP MONITORING  
WELLMONITOR™ RP GAUGE SYSTEMS



### WellMonitor™ RP Gauge Systems.

WellMonitor™ RP gauge systems enable rod pump operators to protect their reciprocating rod pump system from pump off, premature failure and optimise well production. Simplicity, reliability and sophistication are combined into one package providing the benchmark in rod pump monitoring.

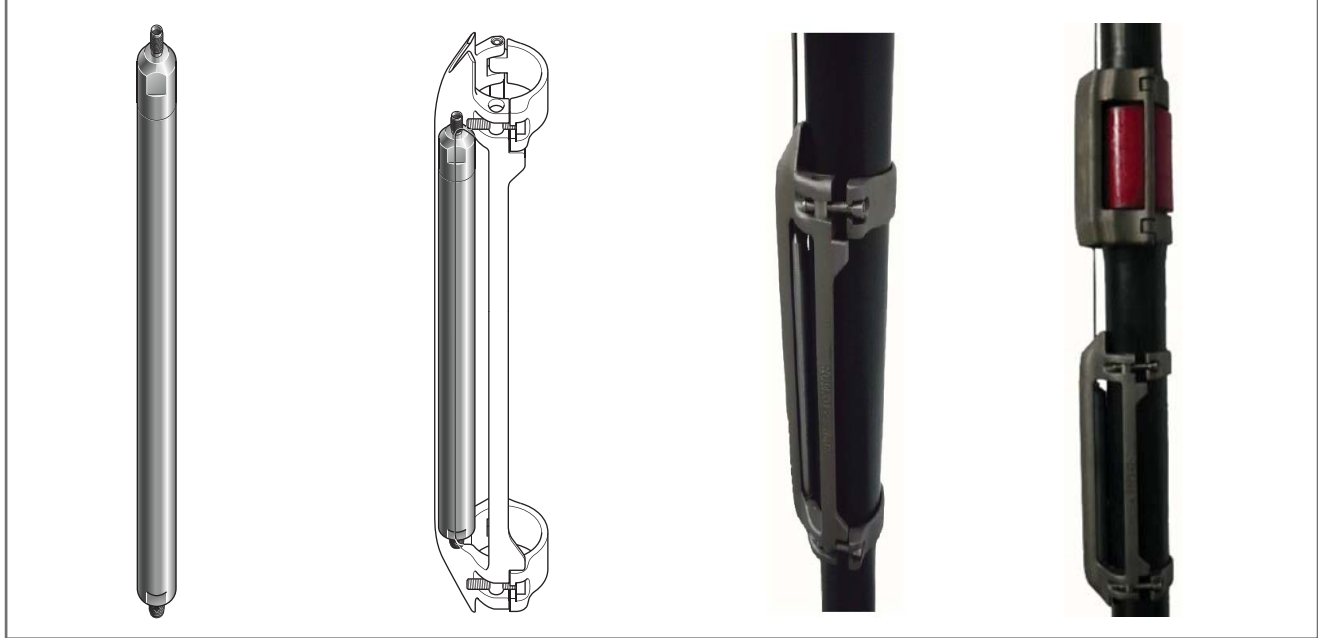
- The gauge systems are compatible with any brand, size and type of Rod Pump systems.
- Gauge Carriers are available to connect to any size and type of tubing string.
- The gauge systems are available in 150C, 125C and 120C temperature ratings, provide a wide range of downhole parameters and offer excellent value across their range of downhole applications.
- The gauge interface card can be set up in minutes to match an existing SCADA Modbus map.
- The gauge systems are designed and supported by experts with more than 100 years of permanent gauge design and TEC wire telemetry experience.
- Modern electronic components are carefully screened and incorporated into a gauge that is designed for long term reliability and reduced lifetime ownership costs.
- Comprehensive technical support is available 24/7.

The gauge systems provide the following parameters:

The **RP-D** gauge system is a dual pressure gauge system that provides **Pi** (pump intake pressure), **Ti** (pump intake temperature), **Pd** (pump discharge pressure), **Td** (pump discharge temperature), **Vx, Vy** and **Vz** (tri-axis vibration), **Vpk** (Peak Vibration) and gauge diagnostic data.

The **RP** gauge system is a single pressure gauge system that provides **Pi** (pump intake pressure), **Ti** (pump intake temperature), **Vx, Vy** and **Vz** (tri-axis vibration), **Vpk** (Peak Vibration) and gauge diagnostic data.

The **RP-L** gauge system is a single pressure gauge system that monitors **Pi** (pump intake pressure). This gauge system is typically used as a pump off control especially in CBM and other cost sensitive applications.



### System overview.

WellMonitor™ RP is the optimum monitoring solution for reciprocating rod pump applications, providing accurate pressure, temperature and tri-axis vibration measurements at surface through a high speed digital communication system. Multiple gauges can be run on a single instrument cable and an optional analogue telemetry system can provide back-up pressure readings in critical applications. Reservoir monitoring and rod pump protection are combined into one high value solution.

The WellMonitor™ RP system consists of three main items – the gauge, the surface interface package and the TEC wire.

The gauge is designed to perform reliably in the high vibration environment of rod pump monitoring applications and the gauge cable head and connection can be pressure tested prior to deployment in the well. It is installed just above the rod pump on the side of the tubing using the gauge carrier assembly where it has access to the different parameters that it measures and transmits to the surface.

The gauge is powered by the surface interface package through the TEC wire, either bare or polypropylene encapsulated, installed on the side of the tubing and it sends the data to the surface interface package via the same cable.

The surface interface package is available in a number of different options that are designed to meet the operator’s individual requirements. The base option is a Surface Interface Card (SIC) which is normally installed inside the switchboard or VSD enclosure and is normally DIN rail mounted. The SIC provides an isolated 4 to 20 mA analogue output, an isolated RS 485 Modbus output and one relay control. The SIC has an inbuilt data logger suitable for logging all monitored parameters on a 2 GB Micro SD card.

The Integrated Surface Module (ISM) contains the SIC and an OLED data display, packaged in an IP65 polycarbonate box that can be mounted on the outside of the switchboard or VSD cabinet. The package can also be provided in a powder coated metal cabinet on request.

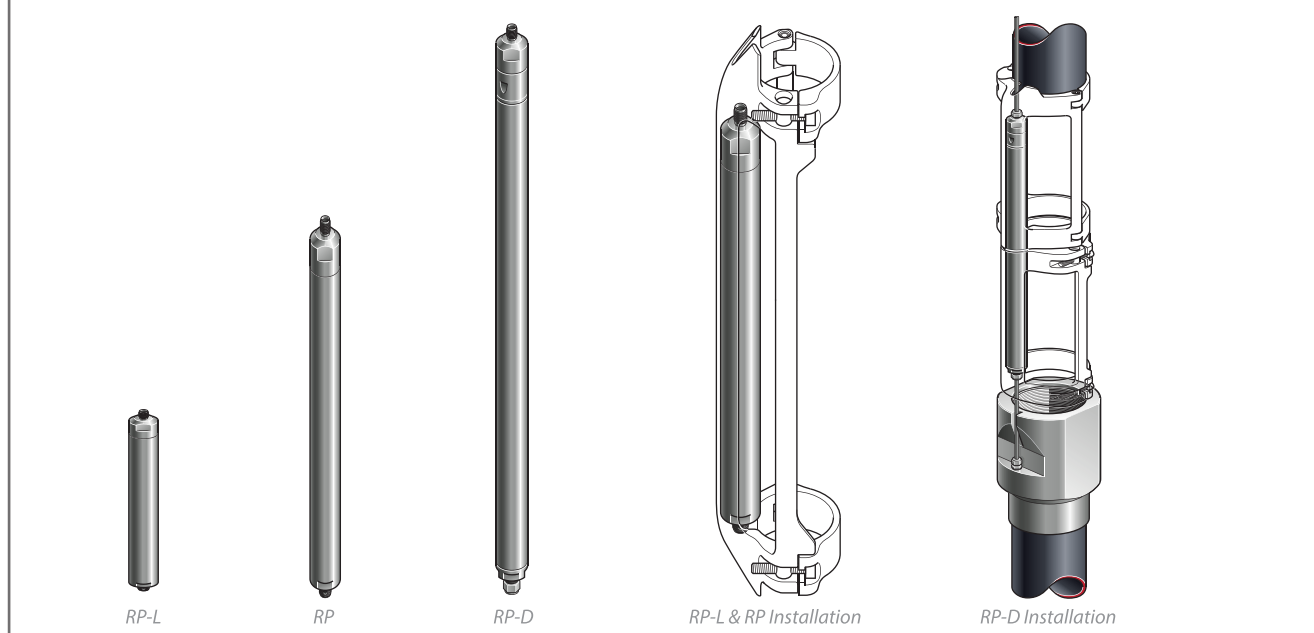
The WellMonitor™ RP gauges have a single body stainless steel construction and is designed and manufactured to withstand the vibrations, shocks and corrosive environment that are seen in the Rod Pump operating environment. The electronics in the gauge are isolated from the extreme vibration and the well temperature using intelligent mounting design and insulation techniques, making this a very reliable Rod Pump downhole monitoring gauge.

#### Parameters monitored

Gauge model	Parameters							
	Pi.	Ti.	Vx.	Vy.	Vz.	Vpk.	Pd.	Td.
RP-D 150	✓	✓	✓	✓	✓	✓	✓	✓
RP-D 125	✓	✓	✓	✓	✓	✓	✓	✓
RP 150	✓	✓	✓	✓	✓	✓		
RP 125	✓	✓	✓	✓	✓	✓		
RP-L 120	✓							

#### Maximum continuous operating temperature ratings.

Gauge model.	Rating.
WellMonitor RP-D 150	150 C.
WellMonitor RP-D 125	125 C.
WellMonitor RP 150	150 C.
WellMonitor RP 125	125 C.
WellMonitor RP-L120	120 C.



### WellMonitor™ RP-D Gauge System.

The WellMonitor™ **RP-D** gauge system provides all of the parameters that are needed for real time protection and optimization of rod pump installations in high and moderate temperature oil wells.

Standard parameters available are **Pi** (pump intake pressure), **Ti** (pump intake temperature), **Vx, Vy** and **Vz** (tri-axis vibration), **Vpk** (peak vibration), **Pd** (pump discharge pressure) and **Td** (pump discharge temperature).

The dual pressure gauge system enables monitoring of annulus (pump intake) pressure, pump discharge pressure, temperatures and vibrations. The gauge is installed in a special carrier on to the tubing, close to the ported sub that forms a part of the tubing string. The ported sub is connected to the gauge discharge pressure port using 1/4" control line. This ensures that the pressure inside the tubing is seen at the discharge pressure sensor.

### WellMonitor™ RP Gauge System.

The WellMonitor™ **RP** gauge system provides the basic parameters that are needed for real time protection and optimization of RP installations in high and moderate temperature oil wells.

Standard parameters available are **Pi** (pump intake pressure), **Ti** (pump intake temperature), **Vx, Vy** and **Vz** (tri-axis vibration), and **Vpk** (peak vibration).

This is a single pressure gauge system that enables monitoring of annulus (pump intake) pressure, temperature and vibrations. The gauge is installed in a special carrier on to the tubing, just above the pump. Multiple gauges of this type may be connected on a single TEC wire to monitor pressure and temperature at different zones in a single well. This type of multi-gauge system is called a multi-drop system and is used in high profile oil wells.

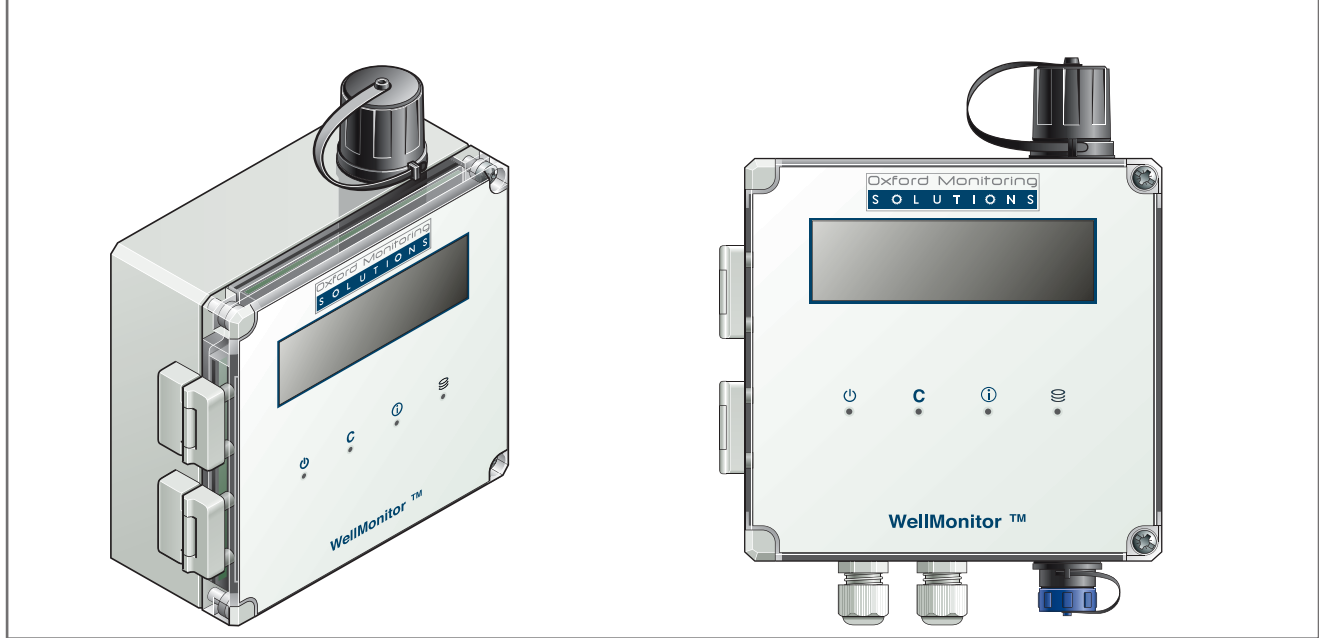
### WellMonitor™ RP-L Gauge System.

The WellMonitor™ **RP-L** gauge system provides one single pressure for real time protection and optimization of RP installations in low temperature oil and water wells including wells that require de-watering like coal bed methane (CBM) and shale gas.

The only parameter available from this gauge is **Pi** (pump intake pressure).

This is a single pressure gauge system that enables monitoring of annulus (pump intake) pressure. The gauge is installed in a special carrier on to the tubing, just above the pump.

Parameters	Rating	Accuracy	Resolution	Data rate
Intake temperature	150 C	+/- 1% FS	0.1%	1 Sec
Intake pressure	5800 psi	+/- 0.2% FS	0.1 psi	1 Sec
Discharge pressure	5800 psi	+/- 0.2% FS	0.1 psi	2 Sec
Vibration	10g	+/- 1% FS	0.01 g	1 Sec



### WellMonitor™ Integrated Surface Module.

The WellMonitor™ RP Integrated Surface Module (ISM) combines a high resolution OLED display with one removable 2 Gb Micro SD card logger and a Surface Interface Card (SIC) in an outdoor mountable IP 66 rated enclosure. The module is normally positioned on the outside of the customer’s variable frequency drive or switchboard enclosure.

The ISM provides power for up to two single or one dual pressure WellMonitor™ RP gauges, two relay controllers for alarms and trips and a 10 bit 4 to 20 mA analogue output.

The OLED display provides better visibility in bright sunlight than a LCD display. It can be programmed to power down at a timed interval in order to extend the life of the display in harsh environments, reduce the display’s energy consumption or hide the displayed data from public view. The display is reactivated using a magnet.

The Micro SD card records any of the gauge parameters that are set up to be displayed. It stores over one year of high frequency gauge and VSD data which can be read from the memory card by Microsoft Excel or other compatible spreadsheet software. An optional second Micro SD card can be installed in the ISM, providing redundant data storage and allowing continued data storage when one of the two Micro SD cards is removed.

The ISM has a programmable RS 485 Modbus RTU master port, one RS 485 Modbus slave port, one isolated analogue output port and one engineer’s port. The ISM can be optionally programmed to poll any Modbus RTU slave device, displaying the data on the OLED display and passing the data on to the data logger to be permanently recorded. In this way, time stamped downhole gauge data and VSD data can be stored on the memory card where it is available for downloading into standard spreadsheet software for viewing and graphing. The unit is programmed via PC software and all settings are stored in a PC setup file which allows the operator to clone the settings in order to set up multiple ISM modules. All data captured by the ISM is also made available on its slave port for either remote SCADA or local use.

Specifications	
Enclosure	IP66 / NEMA 4 Polycarbonate enclosure.
Power supply	24 VDC (+/- 10%).
Power consumption	150 mA typical.
Connection Orientation	Bottom entry.
Communications	Programmable Modbus RTU master and slave.
Analogue output	10 bit, 4-20 mA.
Display type	OLED.
Data storage	2 GB, FAT 16 disk format, CSV file.
Operating temperature	-30 to +80C.
Dimensions and weight	13.5 x 12.0 x 6.0 cms; 0.6 Kg.



### WellMonitor™ Surface Interface Card.

The WellMonitor™ RP surface equipment is compact, modular and easy to configure for varying customer requirements. The simplest configuration requires one small DIN rail mounted Surface Interface Card (SIC) to be installed inside the customer's variable frequency drive or switchboard enclosure.

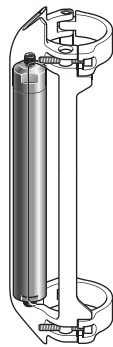
This board sends power to the gauge, decodes the signal from the gauge, provides a digital RS 485 Modbus output and carries an optional removable memory logging module with real time clock. The SIC also provides power for up to two single or one dual pressure WellMonitor RP gauge, two relay controllers for alarms and trips and a 10 bit 4 to 20 mA analogue output. Additional analog outputs can be obtained by installing an Expansion Module (IOX) with the SIC.

The SIC also has 2 relay drivers that will provide alarm and trip signals. If one or more analogue outputs of any of the down-hole parameters are required, then one or more DIN rail mounted analogue boards are connected to the interface board on the DIN rail. An optional Display and Logger Module (DLM) that plugs into the Modbus RS 485 port is also available. The modules are also available as an Integrated Surface Module (ISM) that is mounted inside a NEMA 4 (IP65) enclosure that can be located outside the customer's variable frequency drive or switchboard.

The Micro SD card records any of the gauge parameters that are set up to be displayed. It stores over one year of high frequency gauge and VSD data which can be read from the memory card by Microsoft Excel or other compatible spreadsheet software. All data captured by the SIC is also made available on its slave port for either remote SCADA or local use.

The WellMonitor™ RP Surface Interface Card is also able to power and process the signal from the WellMonitor™ RP Light pressure gauge.

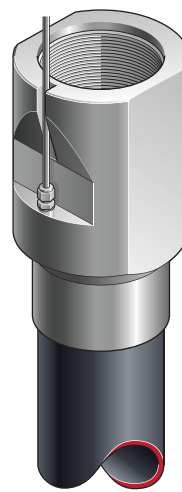
Specifications	
Enclosure	DIN rail mountable modules
Power supply	24 VDC (+/- 10%).
Power consumption	100 mA typical.
Data storage	2 GB, FAT 16 disk format, CSV file.
Communications	Programmable Modbus RS 485 RTU
Analogue output	10 bit, 4-20 mA.
Relay drivers	2 ea. per card (Alarm & Trip)
Operating temperature	-30 to +80C.
Dimensions and weight	11.0 x 10.0 x 2.5 cms; 0.2 Kg.



RP-L & RP Gauge Carrier



RP-D Gauge Carrier



Ported Collar



Tubing Encapsulated Cable (TEC)

## Accessories.

### Gauge Carriers.

A Clamp-On Gauge Carrier (COGC) is used to clamp the gauge firmly to the side of the tubing and protects it from damage during installation and retrieval. The COGC is secured using upper and lower clamps which incorporate retained socket head cap screws. The COGC is normally made of cast carbon steel with tempered steel socket head cap screws however they are also optionally available in stainless steel metallurgy.

### Ported Collar.

A Ported Collar is used when tubing or pump discharge pressure is being monitored. The Ported Collar is supplied with upper and lower female threads that match to the production tubing thread size and type. Ported Collars are available in both carbon and stainless steel metallurgy. The Ported Collar incorporates a hole that connects from its inside diameter to an outside port which is in turn connected to the downhole pressure gauge using a length of ¼" stainless steel control line.

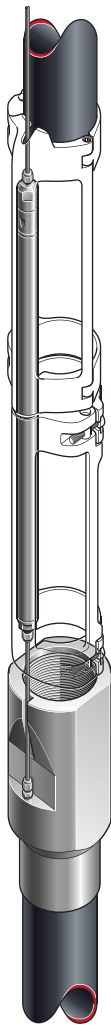
### Tubing Encapsulated Gauge Cable (TEC).

Single conductor tubing encapsulated instrument cable is a reliable solution for down-hole monitoring applications up to 150C. The tin coated copper conductor cable is protected from corrosive well bore environments by the stainless steel outer tube which provides excellent mechanical protection and an impermeable barrier to well fluids.

Tubing encapsulated gauge cable is also available with an outer protective elastomeric jacket. The jacket is either round or square profile and it provides increased resistance to damage due to compression in deviated or horizontal wells.

Physical Characteristics:	
Working / Collapse Pressure	10,000 / 20,000 psi
Cable weight, Kg/Km (Lbs/1000Ft)	113 Kgs (79 Lbs)
Temperature rating	150 C (302 F)
Electrical Characteristics:	
DC Resistance at 20°C - Center conductor	21.06 Ohms/Km (6.42 Ohms/1000Ft)
DC Resistance at 20°C - Tube (nominal)	62.0 Ohms/Km (18.9 Ohms/1000Ft)
Voltage rating	1000 VDC
Capacitance - Center conductor to tube	92 pf/m / 28 pf/Ft
Insulation resistance at 20°C - Conductor to tube	2900 MOhms/Km (9515 MOhms/1000Ft)





Oxford Monitoring Solutions  
Plot 8, Oakfield Industrial Estate, Eynsham  
OX29 4TH, Oxfordshire, England  
[www.oxmos.com](http://www.oxmos.com)