



Pressure | Temperature | Level | Force

# Measurement technology for mobile working machines



Smart in sensing



## About us

As a family-run business acting globally, with over 9,300 highly qualified employees, the WIKA group of companies is a worldwide leader in pressure and temperature measurement. The company also sets the standard in the measurement of level, force and flow, and in calibration technology.

Founded in 1946, WIKA is today a strong and reliable partner for all the requirements of industrial measurement technology, thanks to a broad portfolio of high-precision instruments and comprehensive services.

With manufacturing locations around the globe, WIKA ensures flexibility and the highest delivery performance. Every year, over 50 million quality products, both standard and customer-specific solutions, are delivered in batches of 1 to over 10,000 units.

With numerous wholly owned subsidiaries and partners, WIKA competently and reliably supports its customers worldwide. Our experienced engineers and sales experts are your dependable contacts locally.

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## High-performing. Robust. Reliable.

Advanced measurement technology provides the basis for complex control systems in modern mobile working machines. Just like the machine itself, the measurement technology must also be robust and reliable to endure extreme operating conditions and high performance demands.

WIKA's portfolio of measurement technology for pressure, temperature, level and force is tailored for use in mobile working machines – high-performing, robust and reliable.

As a true partner, WIKA provides support throughout the entire product lifecycle: WIKA offers expert consultation with product selection, professional project management in development and implementation as well as reliable quality assurance; and supply chain efficiency.



# The right partner counts

## Secured competitive advantages

Highest customer expectations, rapid technological progress, a highly dynamic economic environment and intensifying global competition – market conditions for manufacturers of mobile working machines are challenging.

Leading manufacturers secure their competitive advantages through a superior procurement strategy. To do so, they seek best-in-class suppliers and develop sole source relationships for key components, including measurement instruments.

Measurement technology directly impacts the functional properties of machines and requires careful consideration and selection. Beyond meeting technical and quality requirements, the right partner must provide reliable delivery, long-term security of supply, and competitive terms and conditions. The right partner must also support customer-specific solutions and offer innovations.



### Part of your business

WIKA places customer benefit at the very top. As a privately owned, global company, WIKA is positioned to create value-add for its customers in all dimensions with independent, flexible decision-making.

On the one hand, measuring products from WIKA support machine manufacturers in generating of functional value for their customers. The target parameters are the performance, the robustness and the reliability of the mobile working machine.

On the other hand, as a supplier, WIKA can add value to the process landscape of its customers: WIKA understands that reliability is a product of processes which are consistently aligned to the customer's needs.

This is ensured by the WIKA management system, which combines the principles of lean management with the Kaizen philosophy and Six Sigma methodology.

This makes WIKA a high-performing and reliable partner for manufacturers and equipment suppliers of mobile working machines.

# Performance counts



## Working with high performance

Productivity, fuel efficiency, low emissions and operational safety - these are the factors on which owners measure the performance of their mobile working machines. It does not matter what type of application is involved. Ultimately, the mobile working machine has to carry out motion tasks – powerfully, precisely, quickly, effectively and safely.

In order to meet the high requirements of their customers, manufacturers of mobile working machines rely on the precisely synchronized control of main and auxiliary functions up to the point of full automation as well as on power management systems regulated on the current power demand of the entire work process.

This can only be achieved economically using complex control systems which rely to a high degree on effective sensors.

For the sensor system itself, the main requirement is therefore obvious – it must accurately and safely reflect the operating state of the working machine at any time.

After all, a mobile working machine is only as high-performing as the measurement technology installed.



### Performance is in the detail

WIKA understands measuring performance as the optimal combination of the best technologies with state-of-the-art production processes, all aligned to the customer application.

This is why WIKA produces measurement technology with a unique, in-house production depth and thus retains complete control over all value-add processes – from the first line of product development to the delivery of the finished product.

Together with a zero-defect strategy in the manufacturing processes, WIKA is able to develop and manufacture measuring performance at the exact point, instead of categorising

these into different performance classes at the end of the production process.

The basis is always given by the requirements of known machine manufacturers around the world as well as the expertise from more than 70 years in the development and manufacture of high-quality measurement technology. As a result, WIKA products have the optimal measuring performance – in accuracy, precision and dynamics.



# Robustness counts

## Working under extreme conditions

Shock and vibration, mud and dust, humidity and dryness, cold and heat and also a fluctuating electromagnetic environment – mobile working machines the world over are exposed to extreme operating conditions.

Nonetheless, mobile working machines are expected to perform unaffected and provide highest productivity, efficiently and safely. Machine owners cannot afford unpredictable machine reactions, a drop in machine performance or even a failure of the machine due to external operating conditions.

To ensure a proper function of mobile working machines a robust design of the control systems and the corresponding measurement technology is essential.

After all, mobile working machines are only as robust as the measurement technology installed.



### Robustness is in the detail

WIKA meets the harsh operating conditions of mobile working machines with exceptionally robust products that integrate technological expertise, high-quality materials and manufacturing processes.

It is precisely the details that make up the robustness of WIKA products. In particular, extensive real-world product testing is an integral part of the development and quality assurance processes. The test procedures realistically reproduce future operating conditions and often far exceed internationally recognized standards.

Hence, WIKA products feature high resistance to pulsation, shock, vibration and temperature extremes, as well as high weather protection and outstanding EMC characteristics. The resilience against moisture, dust, dirt and aggressive media are also a given.

# Reliability counts



## Working with great endurance

Total cost of ownership – the most powerful machine can only be operated economically if it is reliably operable over its entire service life at a consistently high level.

Mobile working machines are used in remote areas all over the world and often around the clock to maximize return on investment. Thus, the owners expect the highest machine availability. Also, any drop in machine performance over its service life is unacceptable.

Particularly disruptions due to electronic deviations are extremely critical – they are hard to diagnose and correct. Therefore, control systems in mobile working machines and the corresponding measurement technology must deliver consistent, error-free performance.

After all, mobile working machines are only as reliable as the measurement technology installed.



### Reliability is in the detail

As a matter of principle, WIKA designs its measurement technology to perform reliably over the machine's full service life. The details in design, material component selection and production processes all contribute to product quality and durability.

For products that will be exposed to high mechanical loads with dynamic load cycles, WIKA uses the autofrettage manufacturing technique to meet requirements for long-term stability during operation.

Based on extensive finite element method calculations, specific overload ranges are determined and for individual metal components, the yield point is exceeded to determine the optimal alloy microstructure and stress-strain curve.

As a result, WIKA products provide maximum long-term stability and problem-free operation – even in overload conditions with high stress cycles.

# Electronic pressure sensors

## Working under pressure

In mobile working machines, the central functions are driven through hydraulic, pneumatic and hydropneumatic systems. What is common to all these systems is the pressure measurement is the decisive factor for describing their loaded state.

For mobile working machines, this means with the interaction of all these systems – only those who master the pressure measurement also master productivity, energy efficiency and operational safety.

With the increasing electrification of modern mobile working machines, electronic pressure sensors are used in almost all relevant systems:

- Electronically controlled working hydraulics
- Electro-hydraulic travel drive control
- Electronically controlled CVT
- Live load determination and load torque monitoring
- Flow and level measurement
- Tyre pressure and chassis control systems
- Monitoring of output processes
- Redundant safety circuits

## OEM pressure sensor

# MH-4



The MH-4 is the state-of-the-art pressure sensor for mobile working machines. It combines mature WIKA thin-film technology and the latest generation of WIKA electronics in an extremely compact design. Both its measuring performance and also its robustness are impressive. For the MH-4, a broad portfolio of output signals, electrical and process connections and also the possibility of customer-specific labelling are standard features. The MH-4 is the most economical solution for the realisation of mobile hydraulics systems in medium to high quantities.

- Measuring ranges: 0 ... 40 bar to 0 ... 1,000 bar
- Reference accuracy:  $\leq \pm 1\%$  FS
- Non-linearity:  $\leq \pm 0.25\%$  FS BFSL
- Shock/vibration resistance: -100 / 40 g
- Medium temperature: -40 ... +125 °C
- Ingress protection: IP67 to IP69K
- Options: Signal limiting, diagnostic function

OEM pressure sensor

# MH-3



The MH-3 is the standard pressure sensor for mobile working machines and has been designed for use in small to medium quantities. It has been based on WIKA thin-film technology in a particularly slender design. With its outstanding reliability, the MH-3 has proven its worth worldwide.

- Measuring ranges: 0 ... 40 bar to 0 ... 600 bar
- Reference accuracy:  $\leq \pm 1\%$  FS
- Non-linearity:  $\leq \pm 0.4\%$  FS BFSL
- Shock/vibration resistance: -500 / 20 g
- Medium temperature: -40 ... +125 °C
- Ingress protection: IP67 to IP69K
- Options: Signal clamping, diagnostic function

CAN pressure sensor

# MHC-1



The MHC-1 combines the characteristics that all pressure sensors of the MH product line feature with a CAN signal interface. This is controlled by the SAE J1939 or CANopen® communications protocols. The MHC-1 ensures optimal sensor connection in CAN systems with simple installation and individual CAN configuration.

- Measuring ranges: 0 ... 40 bar to 0 ... 600 bar
- Reference accuracy:  $\leq \pm 1\%$  FS
- Non-linearity:  $\leq \pm 0.2\%$  FS BFSL
- Shock/vibration resistance: 500 / 20 g
- Medium temperature: -40 ... +125 °C
- Ingress protection: IP69K
- Options: Y-connector

Pressure sensors for all requirements



Apart from the pressure sensors of the MH product line, the WIKA portfolio offers specific pressure sensors for special measuring requirements. These are used in mobile working machines wherever specific requirements are imposed.

- A-10: Pressure sensors for general industrial applications
- S-20: Pressure sensors for applications with more stringent requirements
- IS-3: Pressure sensors for applications in hazardous areas
- P-30: Precision pressure sensors
- S-11: Pressure sensors for viscous, adhesive and particle-laden media

# Mechanical pressure switches

## Simple switching

In mobile working machines, for simple switching functions, mechanical pressure switches are used.

They withstand high electrical switching power and can thus be built into a load circuit without an interposing relay.

Therefore, for mechanical pressure switches, neither an additional voltage supply nor a signal input for control electronics is necessary. Mechanical pressure switches can also be used for redundant safety circuits.

With mechanical pressure switches, warning and shut-off functions (direct and independent of the actual control electronics) are generated in mobile working machines:

- Steering systems
- Braking systems
- Hydraulic travel drives
- Load monitoring
- Filter monitoring
- Process monitoring
- Lubrication systems

## OEM compact pressure switch

# PSM01

The PSM01 is the economical solution for implementing switching functions in mobile working machines. It is a high-quality, snap-action switch with self-cleaning contacts and can be delivered as a normally closed, normally open or change-over switch. Its switch point can be individually and easily set via an adjustment screw. The compact design of the PSM01 also enables mounting in hard-to-access locations, particularly with a socket wrench.



- Setting ranges: 0.2 ... 2 bar to 40 ... 400 bar
- Switching power: 4 A at 12 V; 2 A at 24 V
- Switching frequency: max. 100/min
- Shock/vibration resistance: 30 / 10 g
- Medium temperature: -40 ... +120 °C
- Ingress protection: up to IP67

OEM compact pressure switch with settable switch hysteresis

# PSM02



In addition to the features of the PSM01, the PSM02 offers the possibility to individually set the switch hysteresis, and thus also the reset point, alongside the switch point.

- Setting ranges: 0.2 ... 2 bar to 40 ... 400 bar
- Switching power: 4 A at 12 V; 2 A at 24 V
- Switching frequency: max. 100/min
- Shock/vibration resistance: 30 / 10 g
- Medium temperature: -40 ... +120 °C
- Ingress protection: to IP67



# Electronic temperature measurement

## Thermally sound

For mobile working machines, on the one hand, high power density and energy efficiency are required, on the other hand, strict emission regulations must be adhered to.

As a consequence, electronic temperature management systems, controlled to the instantaneous cooling demand, are used in modern mobile working machines. These ensure that all systems are always working in the optimal temperature range in order to achieve the highest-possible productivity for the working machine.

In addition, the temperature of the respective systems always reveals information about their operating state. Only a thermally sound working machine is effective. Accordingly, electronic measurement technology is used in mobile working machines, especially in systems that serve the immediate operating functions and therefore must be monitored:

- Hydraulic oil
- Transmission oil
- Engine oil
- Cooling fluids
- Process/output fluids

## OEM compact thermometer

# TF35



The TF35 is a resistance thermometer with all the characteristics required for up-to-date temperature management of a mobile working machine. It is a screw-in instrument with an electrical plug connection, manufactured in a particularly compact and robust design. Alongside a large number of different resistance measuring elements, there is, of course, a wide portfolio of thermowells and process and electrical connections for the TF35.

- Measuring elements: Pt100, Pt1000, Ni1000, NTC or KTY
- Temperature range: -50 ... +250 °C
- Operating pressure: to 600 bar
- Shock/vibration resistance: 500 / 10 g
- Ingress protection: to IP67

OEM compact thermometer with connection cable

# TF37



The TF37 offers the technological features of the TF35 for use in mobile working machines. For ever-tighter space requirements at the measuring point, the TF37 is thus designed with a connection cable.

- Measuring elements: Pt100, Pt1000, Ni1000, NTC or KTY
- Temperature range: -50 ... +250 °C
- Operating pressure: to 50 bar
- Shock/vibration resistance: 500 / 10 g
- Ingress protection: to IP67

OEM compact thermometer with transmitter

# TR33



The TR33 can be used as a combination of a Pt1000 measuring element with a transmitter, wherever a standard measuring signal is required by the control electronics.

- Measuring elements: Pt1000
- Temperature range: -30 ... +250 °C
- Output signal: 4 ... 20 mA, 1 ... 5 V, 0 ... 10 V, etc.
- Operating pressure: to 270 bar
- Shock/vibration resistance: 50 / 20 g
- Ingress protection: IP67

OEM temperature switch

# TFS35



The TFS35 is a bimetal temperature switch and can be designed as a normally closed or normally open contact. Due to its high transmissive electrical switching power, it can be installed into a load circuit without an interposing relay. This means that neither an additional voltage supply nor a signal input on control electronics is necessary.

- Switching temperature: 50 ... 200 °C
- Switching power: 12 V at 3 A; 24 V at 24 V
- Shock/vibration resistance: 30 / 10 g
- Operating pressure: to 100 bar
- Ingress protection: to IP65

# Electronic force measurement

## Working with force

In many mobile working systems, it does not make sense to determine the load condition via pressure sensors, either because the system in question is not driven hydraulically or because its kinematics do not allow the indirect load determination from the pressure of the driving working hydraulics to be sufficiently accurate.

Particularly for mobile working machines with their high installed power and the high power density, the transition between optimum utilisation of the efficiency on the one hand and unwanted or potentially hazardous operating conditions on the other hand is often only a thin line.

As a result, force measuring systems are used wherever load conditions cannot be detected optimally by pressure measurement or a measurement is required directly in the power train:

- Load torque monitoring
- Live load determination
- Cable force determination
- Forces in tie bars
- Torque determination

## OEM tension link

# F7301



The F7301 is a tension link for static and dynamic tensile force measurement directly in the flow of forces. It is made from high-strength fine-grain structural steel or stainless steel. State-of-the-art welded-in thin-film elements provide the force measurement. As an OEM product, the F7301 is designed and manufactured specifically to customer requirements. Therefore, a multiplicity of product execution can be provided in terms of nominal load, geometry and signal output.

- Measuring ranges: 0 ... 5 kn to 0 ... 10,000 kn
- Non-linearity:  $\leq \pm 0,25\%$  FS BFSL
- Vibration resistance: 20 g
- Nominal temperature: -40 ... +80 °C
- Ingress protection: to IP69K
- Options: CANopen®, Safety version, ATEX/IECEX

OEM load pin

# F5301



The F5301 has been designed for the static and dynamic measurement of bearing forces in pin bearings. The load pins are made from high-strength stainless steel, the force measurement is made via welded-on thin-film sensors. As an OEM product, the F5301 is designed and manufactured in accordance with customer-specific requirements. For optimal connection to the system, there are a multitude of signal outputs available.

- Measuring ranges: 0 ... 1 kN to 0 ... 300 kN
- Non-linearity:  $\leq \pm 1\%$  FS BFSL
- Vibration resistance: 20 g
- Nominal temperature: -20 ... +80 °C
- Ingress protection: to IP69K
- Options: CANopen®, safety version, ATEX/IECEX

Universal load-measuring shackle

# F5302



The F5302 is a load-measuring shackle for static and dynamic tensile force measurement. The force transducer is a high-strength stainless steel load pin with welded-on thin-film sensor elements. The dimensions and handling of the F5302 shackle correspond to those of standard shackles. Thus a universal application, even in existing systems, is guaranteed.

- Measuring ranges: 0 ... 7.5 t to 0 ... 15 t
- Non-linearity:  $\leq \pm 1\%$  FS BFSL
- Vibration resistance: 20 g
- Nominal temperature: -20 ... +80 °C
- Ingress protection: IP67

Force transducers for all measuring requirements

For use in mobile working machines, WIKA offers a portfolio of force measurement technology for almost all measuring requirements. The right product can also be provided for highly specific customer requirements:

- F1211: Compression load cell for general industrial applications
- F1222: Miniature compression force transducer
- F3831: Shear beam to 10 t
- F9302: Strain transducer



# Electronic level measurement

## The correct level counts

In mobile working machines, operating fluids and auxiliary fluids are as functionally relevant as fluids that are deployed in the operating process. Without these, the working machine is not operable or the operating process cannot be carried out. Therefore, the knowledge of the level of these fluids is essential in the operation of a mobile working machine.

With a reliable level monitoring, the operating cycles and interruptions for filling can be planned based on consumption. In addition, when the output of fluids is part of the operating process, the productivity of the working machine can be determined online with continuous level measurement. Correspondingly, in mobile working machines, levels are monitored in order to ensure the highest degree of productivity and machine availability:

- Process/output fluids
- Fuels
- SCR fluids
- Cooling fluids
- Hydraulic oil
- Auxiliary fluids

## Vertical level sensor

# RLT



The RLT is a wear-free magnetic float transducer based on a measuring resistance chain for vertical installation in medium to large vessels. For the RLT there are various measuring lengths and measuring resolutions available, its float can be produced in different geometries and materials.

- Guide tube length: 150 ... 1,500 mm
- Resolution: to +/- 3 mm
- Medium density:  $\geq 750 \text{ kg/m}^3$
- Medium temperature: -30 ... +150 °C
- Operating pressure: to 40 bar
- Output signal: 3-wire potentiometer or 4 ... 20 mA
- Ingress protection: to IP67

## Vertical magnetic float switch

## RLS



The RLS is a contact-free magnetic float switch for vertical mounting in medium to large vessels. It can be produced as normally closed, normally open or change-over contact with up to four switch points at individual heights. For the float, there are various geometries and materials available.

- Guide tube length: 60 ... 1,500 mm
- Switching accuracy: to +/- 3 mm
- Medium density:  $\geq 800 \text{ kg/m}^3$
- Medium temperature:  $-30 \dots +150 \text{ }^\circ\text{C}$
- Operating pressure: to 40 bar
- Ingress protection: to IP67

## Horizontal magnetic float switch

## HLS-M



The HLS-M is a maintenance-free magnetic float switch with compact dimensions for lateral mounting in small to medium-sized vessels. It can be used as a normally closed or a normally open contact. The HLS-M can be made of stainless steel or plastic and is suitable for vessel mounting from the inside or outside.

- Medium density:  $\geq 800 \text{ kg/m}^3$
- Medium temperature:  $-40 \dots +120 \text{ }^\circ\text{C}$
- Operating pressure: to 1 bar
- Ingress protection: IP65

## Optoelectronic switch

## OLS-C



The OLS-C, as an optoelectronic level switch, features no moving parts. The OLS-C is manufactured to be particularly robust and compact and suitable for horizontal and also vertical mounting in vessels. It is available as normally closed and normally open contact in various insertion lengths. For controlling the level directly on the vessel, the OLS-C is fitted with an LED display.

- Insertion length: to 1,500 mm
- Switching accuracy:  $\leq \pm 0.5 \text{ mm}$
- Medium temperature:  $-40 \dots +150 \text{ }^\circ\text{C}$
- Operating pressure: to 25 bar
- Ingress protection: to IP65

# Mechanical indicators

## Traditional indication

Even in the most-modern, electronically controlled mobile working machines, traditional mechanical indicators have their place. Especially in large working machines with many decentrally arranged systems, measured values can be read directly at the measuring point.

Mechanical indicators have clear advantages: On the one hand, analogue indicators can be intuitively read by the operator and, on the other hand, they are independent of the on-board electronics due to their purely mechanical functional principles.

Thus, even in the event of a failure of the electronic systems or during maintenance, the state of the working system can be checked reliably. With respect to the risk potential of systems which are under pressure and temperature, this is an increase in safety. In mobile working machines, mechanical indicators are primarily used in systems for the monitoring of fluids:

- Hydraulic oil
- Transmission oil
- Engine oil
- Cooling fluids
- Process fluids
- Lubricants

## Standard pressure gauge

# 113.53

The model 113.53 Bourdon tube pressure gauge is produced with a stainless steel case. With its liquid filling it is suitable for use on measuring points with high dynamic pressure loads and strong vibrations.

- Nominal sizes: 40, 80, 100
- Scale ranges: 0 ... 1 bar to 0 ... 1,000 bar
- Medium temperature: to 60 °C
- Ambient temperature: to -40 ... +60 °C
- Ingress protection: IP65



Pressure gauge for high temperatures

# 213.53



The model 213.53 Bourdon tube pressure gauge in a stainless steel case is suitable for the pressure indication at increased media temperatures. The liquid filling ensures a high degree of indication accuracy with dynamic pressure spikes and vibrations.

- Nominal sizes: 50, 63, 100
- Scale ranges: 0 ... 0.6 bar to 0 ... 1,000 bar
- Medium temperature: to 150 °C
- Ambient temperature: -40 ... +60 °C
- Ingress protection: IP67

Heavy-duty pressure gauge

# 213.40



The model 213.40 Bourdon tube pressure gauge is fitted with a forged brass case. It is, therefore, extremely robust against mechanical loads. With its liquid filling it is suitable for use on measuring points with high dynamic pressure loads and vibrations.

- Nominal sizes: 63, 80, 100
- Scale ranges: 0 ... 0.6 bar to 0 ... 1,000 bar
- Medium temperature: to 100 °C
- Ambient temperature: -40 ... +60 °C
- Ingress protection: IP65

Robust bimetal thermometer

# 54



Model 54 is a stem thermometer for use on measuring points with more stringent requirements. The liquid filling ensures indication accuracy with dynamic pressure spikes and vibrations.

- Nominal sizes: 63, 80, 100
- Stem lengths: 63 ... 1,000 mm
- Scale ranges: to 250 °C
- Operating pressure: to 25 bar static
- Ambient temperature: -20 ... +60 °C
- Ingress protection: IP65

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