ecs

INDUSTRIAL SENSOR GUIDE

DELTA MOTION

Temposonics
AN AMPHENOL COMPANY

LEINE LINDE

SATEC

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ecs FOR INDUSTRY

Established in 1983, we are proud to be a family-owned New Zealand company, spanning two generations. From humble beginnings designing and manufacturing automated machinery, we've grown to support key industries such as dairy production and construction, with innovative, purpose-built solutions.

Our relationships with our suppliers such as LAPP in Germany was initiated through our own demand for high quality products for our production.

Over the last 40 years ECS has evolved from a manufacturing company to a market leading supplier of electrical and automation products. We are now the exclusive distributors in New Zealand for world leading manufacturers such as LAPP, Wieland Electric, Wago, MOXA Networking and ABB LV Switchgear.

At ECS we strive to offer the best customer service in the industry. When you phone us you will go straight through to our sales team who are made up of trained electricians and automation engineers. We are not just order takers; we are able to guide you through our products so you can select the right product to suit your requirements.

In 2012 we moved into a purpose built 2500m2 warehouse, specifically designed to suit our requirements. Located in Hamilton where we stock 5000 different parts and over 1 million metres of cable, in our 5000m2 warehouse, we are committed to holding the right products for you.

Over the course of 2015 we more than doubled the size of our warehouse giving us the ability to hold greater stock quantities and much larger cable sizes.

With our well established logistics network, we are able to deliver products to customers from Kaitaia to Invercargill in just one working day. Linking with our supplier's warehouses around the world, if customers are working overseas we are able to drop-ship directly to site anywhere in the world while handling all the paperwork back here in New Zealand.

ECS is an expanding and adapting company; we are consistently adding new products to our line-up based on customers' requirements. We strive to offer you a complete package for all your electrical and automation requirements.

OUR WORLD LEADING BRAND PARTNERS

LAPP
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MOXA
wieland
WAGO
icotek
PCE
RITTAL
LS is
Allied Telesis
Cambium Networks
DELTA MOTION
TOSIBOX
Temposonics
LEINE LINDE
SATEC
SCHLEGEL
Vecow
PEPPERL+FUCHS
MARLEY
EKD SYSTEMS
cimco WERKZEUGFABRIK
STÄUBLI
Noark

ECS is an ever expanding company; we are consistently adapting and adding new products to our line-up based on customer requirements.

We strive to offer all of our customers a complete package for all their electrical and automation requirements. We are distributors of world leading manufacturers such as LAPP, Wieland Electric, MOXA Networking, ABB and much more.

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Buy online freight-free for orders over $100, real time stock & price check, order Tracking and Account Management plus more.

6,000,000+ mtrs of Cable

From Power & Control to Ethernet & Fibre, we've got the variety, quantity and the quality your industry demands.

1,000+ Customers

We supply to a diverse range of engineers, technicians, installers and OEM's in the Electrical & Automation industry.

5,000m^2 Warehousing

To keep up with demand we doubled the size of our warehouse providing stockholding for now and the future.

TEMPOSONICS
INDUSTRIAL & MOBILE
ABSOLUTE POSITION
SENSORS

Temposonics
AN AMPHENOL COMPANY

AN AMPHENOL COMPANY

Temposonics (formerly MTS Sensors) is recognised as an industry leader in sensing technologies and solutions. These sensors and transmitters permit high-precision and dynamic position and/or speed measurement in state-of-the-art automation and safety-relevant systems.

With a versatile and ever-increasing product portfolio and a focus on superior regional support, Temposonics cooperates closely with customers, to optimise performance and reduce downtimes.

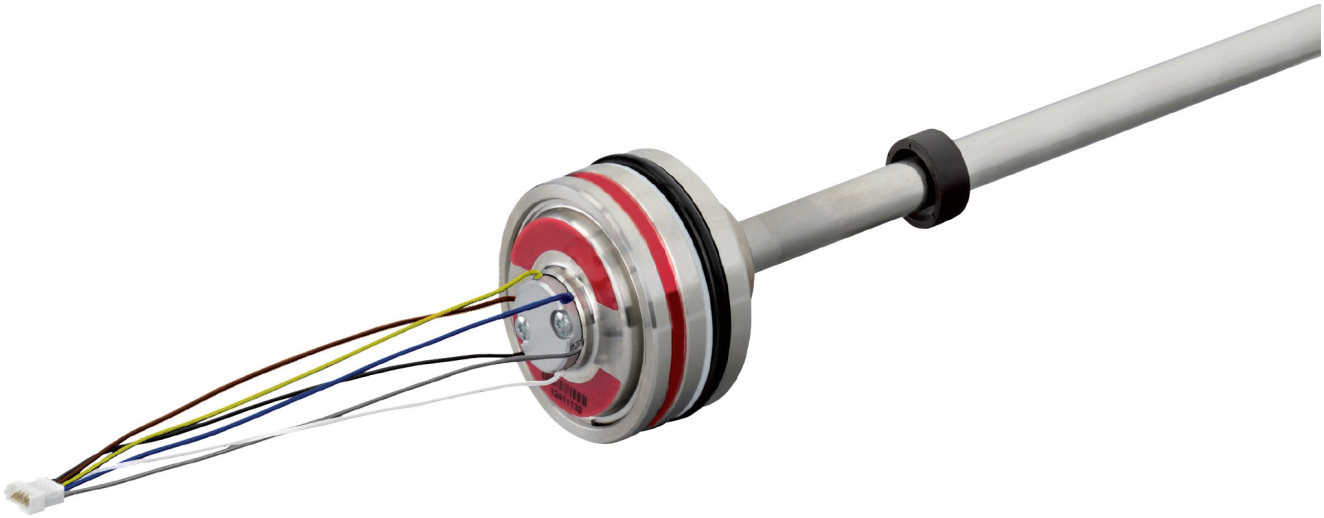
Outstanding quality associated with practical know-how ensures that customers achieve utmost productivity and success. Continuous research, development and production of sensor systems constantly enable new solutions for measuring tasks in the industrial, mobile hydraulics as well as process technology fields to be created.

Since April 2021, the company Temposonics is part of Amphenol Corporation (NYSE: APH). Amphenol is one of the largest manufacturers of interconnect products in the world. The company designs, manufactures and markets electrical, electronic and fibre optic connectors, coaxial and flat-ribbon cable, and interconnect systems.

As sensor solutions manufacturer, Temposonics matches the portfolio of the group of companies that are all part of Amphenol, enabling customers to benefit from an extended, complementary product selection.

Amphenol Corporation is one of the world's largest designers, manufacturers and marketers of electrical, electronic and fibre optic connectors and interconnect systems, antennas, sensors and sensor-based products and coaxial and high-speed specialty cable.

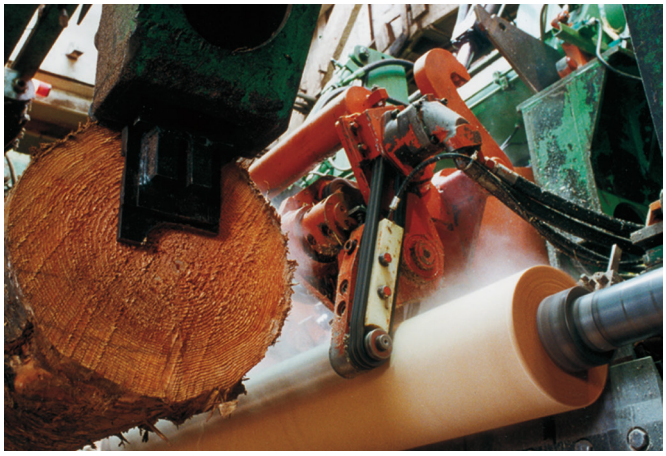
E-SERIES EE ANALOG



EE SENSOR

Robust, non-contact and wear free, the Temposonics® linear position sensors provide best durability and accurate position measurement solutions in harsh industrial environments. The position measurement accuracy is tightly controlled by the quality of the waveguide which is manufactured by Temposonics.

The Temposonics® E-Series EE position sensor is designed for the installation into a hydraulic cylinder. Because of his compact design the EE sensor is the perfect solution for small cylinders with limited space for the integration in a measuring system. The increased operating temperature capability allows the sensor to be used in a wide range of industrial applications.



E-SERIES ER ANALOG

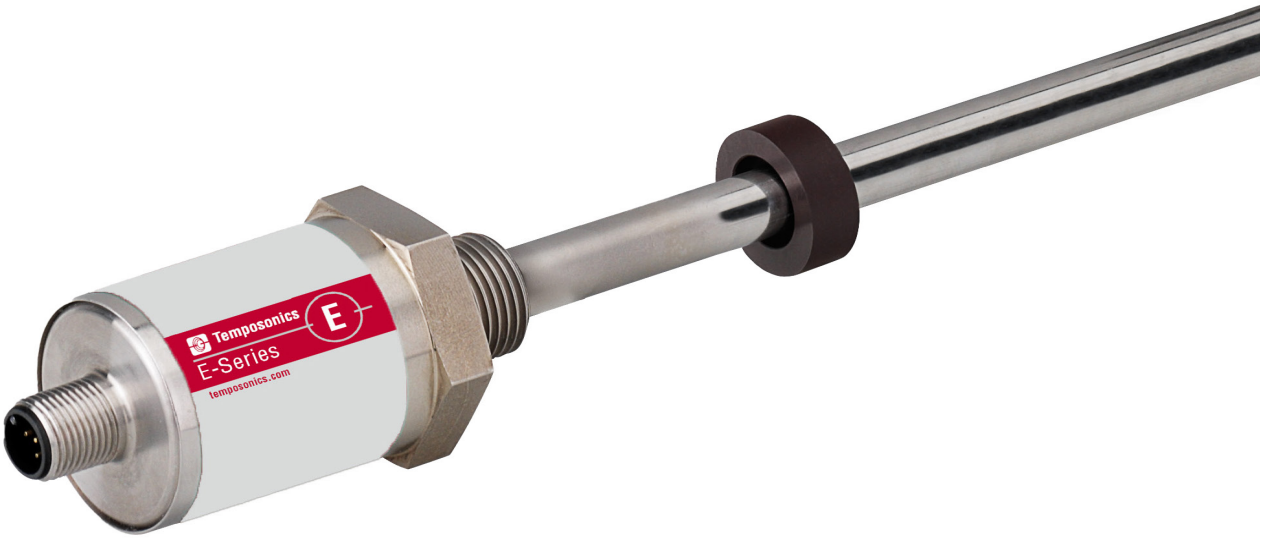
ER SENSOR

Robust, non-contact and wear free, the Temposonics® linear position sensors provide the best durability and precise position measurement feedback in harsh industrial environments. Measurement accuracy is tightly controlled by the quality of the waveguide manufactured exclusively by Temposonics.

The Temposonics® ER has an aluminium rod-and-cylinder design where the rod can extend and retract from the sensor housing to measure linear position. Inside, a magnet is secured to the end of the rod and remains protected within the sensor electronics housing.

Accessory rod ends are available for attaching the rod to the machine's moving part. The rod-and-cylinder sensor design can be installed in any orientation, and provides a convenient and versatile position feedback solution. Typical fields of applications are printing and paper industry, machine tools and plastics industry as well as control systems.

E-SERIES EH ANALOG

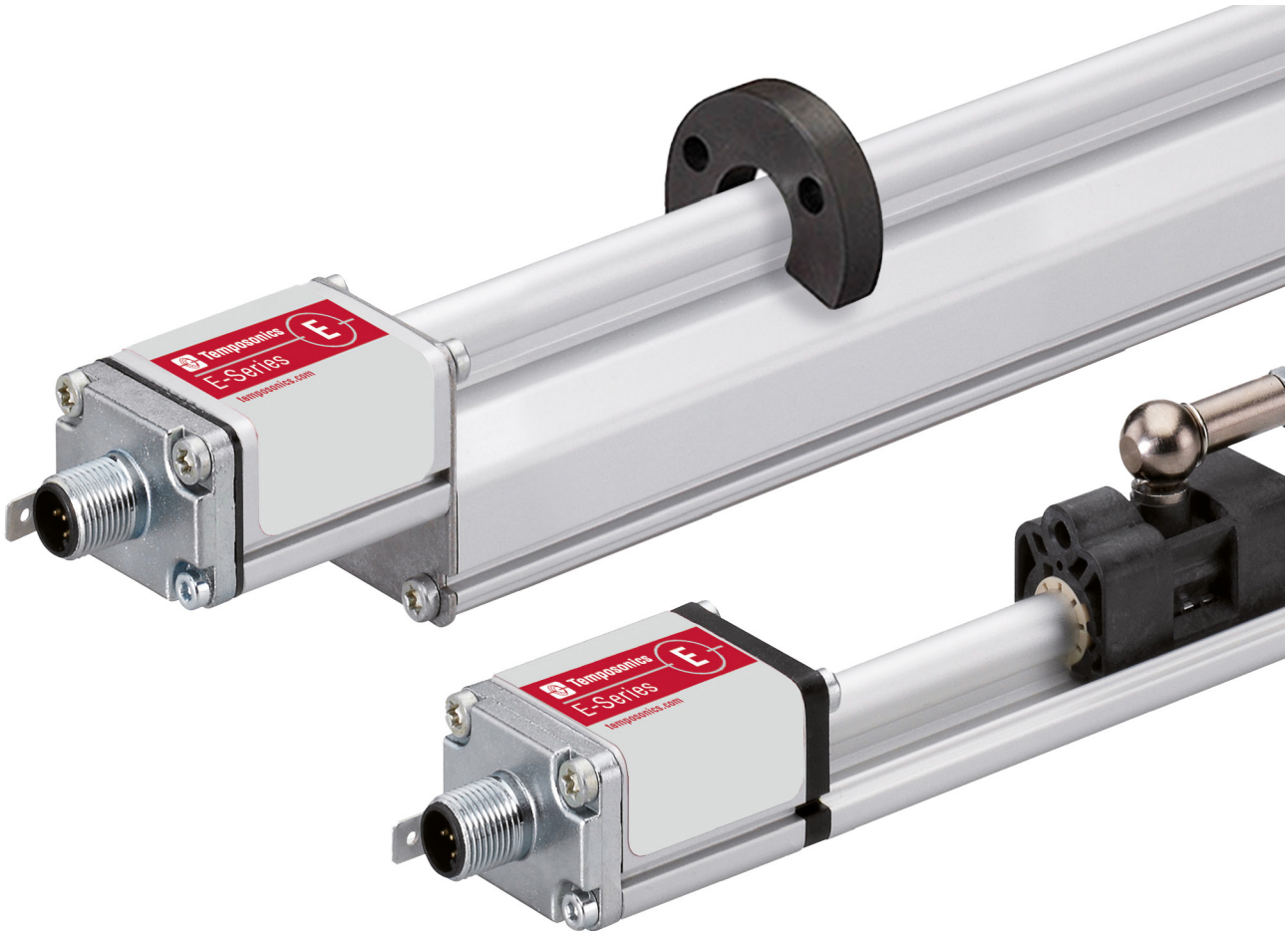


EH SENSOR

Robust, non-contact and wear free, the Temposonics linear position sensors provide the best durability and precise position measurement feedback in harsh industrial environments. Measurement accuracy is tightly controlled by the quality of the waveguide manufactured exclusively by Temposonics.

Temposonics® EH is a compact rod-style sensor and the ideal solution for direct stroke measurement in small hydraulic cylinders. The position magnet mounted on the piston head of the hydraulic cylinder travels over the sensor rod with the built-in waveguide to provide a precise, non-contact position measurement. The EH is ideal for a variety of applications including: fluid power, food industry, plastic industry, glass and ceramics, energy sector, machine tools and testing machines.

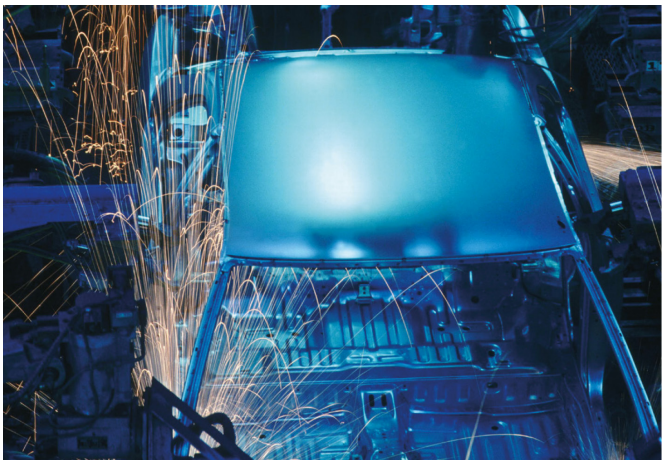
E-SERIES EP ANALOG



EP SENSOR

Robust, non-contact and wear free, the Temposonics linear position sensors provide the best durability and precise position measurement feedback in harsh industrial environments. Measurement accuracy is tightly controlled by the quality of the waveguide manufactured exclusively by Temposonics.

The compact Temposonics® EP as well as the ultra low Temposonics® EL are profile sensors suitable for standard applications and in particularly for applications with limited installation space. The evaluation electronics is accommodated in an aluminium sensor housing. Typical fields of applications are plastics industry, metal forming and woodworking as well as factory automation.



G-SERIES GH/GP ANALOG OR DIGITAL OUTPUTS

G-SERIES GH/GP ANALOG

G-Series sensors feature a microprocessor-based design with enhanced diagnostics and programmability offering the flexibility to fit a wide range ovf applications. The sensor's head contains the active signal conditioning and a complete integrated electronics interface. Double shielding is used to ensure EMI protection for unsurpassed reliability and operating safety. G-Series model GH and GP sensors are extremely robust and are ideal for continuous operation under harsh industrial conditions. Backward compatibility with upgraded performance is one of the primary benefits of choosing a G-Series sensor. The G-Series sensor provides the same functionality as our legacy Temposonics I, II and L-Series sensor products which make it an ideal direct replacement. Temposonics offers two standard sensor housings, rod and profile extrusion. The rod housing is capable of withstanding high pressures such as those found in hydraulic cylinders. The profile extrusion housing provides convenient mounting options and captivesliding magnets which utilize slide bearings of special material that reduce friction, and help mitigate dirt build up.

FEATURES

- Linear, Absolute Measurement
- Non-Contact Sensing Technology
- LEDs For Enhanced Sensor Diagnostics
- Programmability, Analog Output Models:
- Voltage or Current, Fully Adjustable Outputs Within: -10 to +10 Vdc or 0 to 20 mA
- Programmability, Digital-Pulse Output Models: PWM or Start/Stop
- Simultaneous Multi-Magnet Measurements Using Start/Stop
- Linearity Deviation Less Than 0.02%
- Repeatability Within 0.001%
- Designed for Backward Compatibility with Legacy Temposonics Products
- Standard 24 Vdc and extended input power supply options for compatibility with older controller interfaces
- Integral connector replacement options including: Hanging (in-line) connectors, Adapter cables, Field-installed connector kits

BENEFITS

- Rugged Industrial Sensor, Backward Compatible with Tempo I, Tempo II and L-Series Legacy Products
- Compact electronics housing for applications with limited space
- Offers Supply Options for Compatibility with Older Controller Interfaces

APPLICATION

- Continuous Operation In Harsh Industrial Conditions
- High Pressure Conditions

TYPICAL INDUSTRIES

- Fluid Power
- Lumber and Woodworking
- Stamping and Diecasting
- Metalworking, Presses and Assembly Tools
- Material Handling and Packaging

R-SERIES MODEL RF

R-SERIES MODEL RF

MTS offers the Model RF Flexible housing as an option with our R-Series family of extremely robust, highly accurate, linear-position sensors. Constructing a R-Series sensor with the RF flexible housing results in a flexible style sensor that offers trouble-free performance in applications that require very long stroke lengths and linear measurements on an arc. The Model RF flexible sensors are available in all R-Series sensor outputs including Analog, serial, digital, and bus interfaces. Standard stroke lengths for the sensor are up to 10 meters (396 in.) and for special applications, longer lengths are available by consulting the factory. Flexible sensors incorporate the Temposonics SE (Sensing Element) technology that is the same building block all MTS sensor models use. The SE is housed in a fluoroelastomer coated stainless steel housing that is flexible and can be bent in an arc to an 8 inch minimum bend radius. Most operating parameters are identical to their rigid cousins. Model RF sensors are recommended for long-length applications because they are simply coiled inside a 40-inch diameter box for shipping, which simplifies logistics and handling. The model RF sensor can easily bend around corners or obstacles and provides a simple solution for applications where installation space is too confined, or has limited access, making installation or replacement too difficult and costly for a standard rigid type sensor.

FEATURES

- Linear, absolute Measurement along an arc
- LeDs For Sensor Diagnostics
- Non-Contact Sensing Technology
- Linearity Deviation Less Than 0.02%
- Repeatability Within 0.001%
- Flexible Housing is Optional For MTS R-Series Sensors With The Following Full Range of Outputs: Voltage, Current, SSI, CaNbus, DeviceNet, Profibus, EtherCaT® and EtherNet/IP
- Measuring Stroke Range: 255 mm (10 in.) to 10,060 mm (396 in. (Contact factory for longer stroke lengths)

BENEFITS

- Rugged Industrial Sensor
- Multi-Magnet Position Measurement: up to 20 Positions
- 100% Field adjustable Null and Span Setpoints
- Cost effective, Convenient Shipping for Long Measuring Lengths

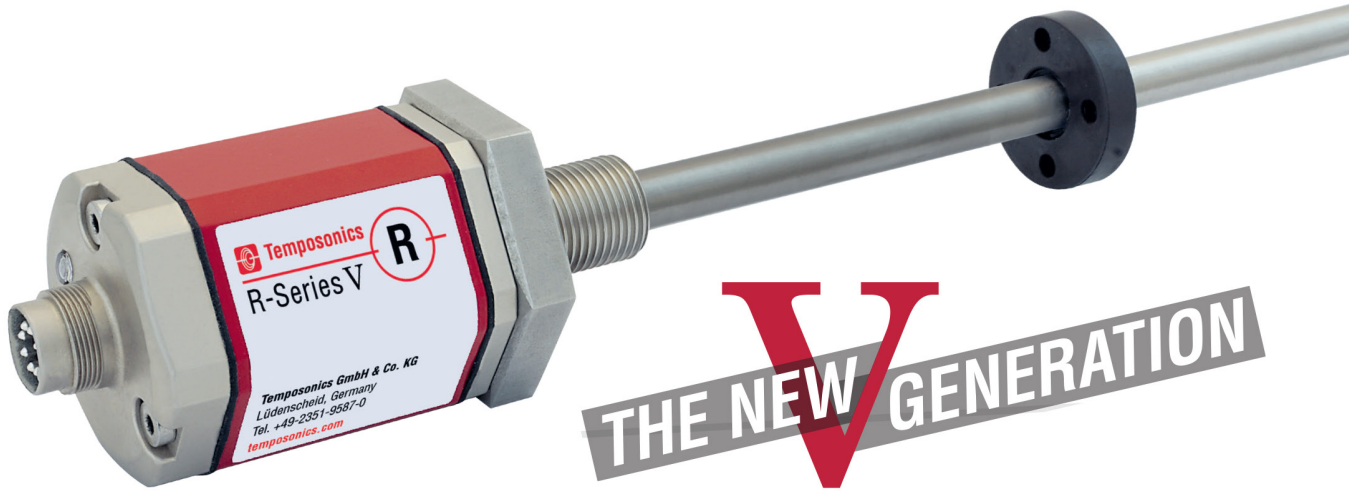
APPLICATION

- Hydraulic Cylinder applications with Limited Sensor Installation Space
- Accurate Position Measurement along an arc
- Very Long Measurement Lengths

TYPICAL INDUSTRIES

- Fluid Power
- Steel Mills using Long Cylinders
- Material Handling and Packaging
- Woodworking, Metalworking and assembly Tools
- Converting Machines

R-SERIES V RH5 SSI



MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Temposonics rely on the company's proprietary magnetostrictive technology, which can determine position with a high level of precision and robustness. Each Temposonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide.

A short current pulse is applied to the waveguide. This creates a momentary radial magnetic field and torsional strain on the waveguide. The momentary interaction of the magnetic fields releases a torsional strain pulse that propagates the length of the waveguide. When the ultrasonic wave reaches the beginning of the waveguide it is converted into an electrical signal. Since the speed of the ultrasonic wave in the waveguide is precisely known, the time required to receive the return signal can be converted into a linear position measurement with both high accuracy and repeatability.

R-SERIES V RH5 SSI

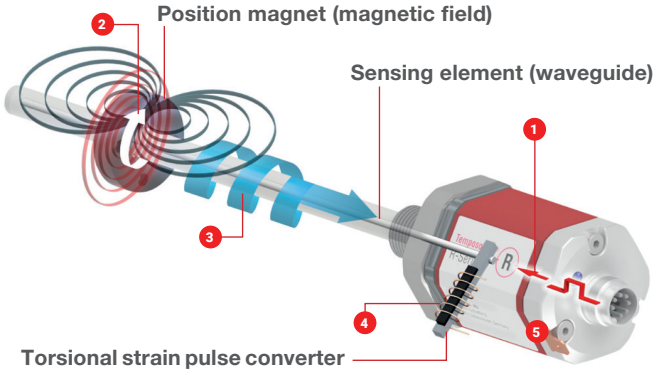
The Temposonics® R-Series V brings very powerful sensor performance to meet the many demands of your application. The main advantages of the rod version RH5 with SSI output (Synchronous Serial Interface) are:

High shock and vibration resistance
The R-Series V is the long term solution for harsh environments that have high levels of shock and vibration.

Internal resolution 0.1 µm
The sensor is characterized by a very stable position signal with a minimum resolution of 0.1 µm.

Synchronous measurement
The sensor offers one asynchronous mode as well as three different synchronous modes to match the measurement to the data request cycle of the controller.

MEASUREMENT CYCLE



1. Current pulse generates magnetic field.
2. Interaction with position magnet field generates torsional strain pulse.
3. Torsional strain pulse propagates.
4. Strain pulse detected by converter.
5. Time-of-flight converted into position.

Extrapolation
The sensor supports linear extrapolation. This allows a cycle time of 100 µs or the readout of the data with up to 10 kHz for any stroke length of the sensor.

Internal linearisation
The sensor is available with internal linearisation which offers improved linearity for overall higher accuracy of the position measurement value.

In addition the R-Series V SSI scores with the following features:

Differential measurement between 2 positions
The R-Series V SSI can measure and output the distance between 2 position magnets.

R-Series V SSI
The interface of the R-Series V SSI corresponds to the SSI industry standard for absolute encoders. You can select the configuration of the SSI signal that fits best to your application and also adjust it on site with the sensor assistants.

TEMPOLINK SMART INTERFACE FOR R SERIES 5

THE ACCESSORY FOR THE R-SERIES V

The TempoLink® smart assistant is an accessory for the R-Series V sensors family. It supports the setup of the sensor in the application as well as providing additional status information for sensor diagnostics.

THE POSSIBILITIES

Via the TempoLink® smart assistant, sensor parameters can be adjusted and status information can be read from the sensor.

THE KIT

The TempoLink® kit contains the TempoLink® smart assistant and the hardware required to connect it to the R-Series V sensor.

THE DISPLAY

The graphical user interface is displayed on your smartphone, tablet, or computer. Simply connect your Wi-Fi enabled device to the integrated Wi-Fi access point, or alternatively via USB, and go to the TempoLink® smart assistant URL via your browser.

THE UPDATE

We are continuously developing the firmware of the TempoLink® smart assistant to enable new functions and improve the operation. You can update your TempoLink® smart assistant yourself and always stay up to date.

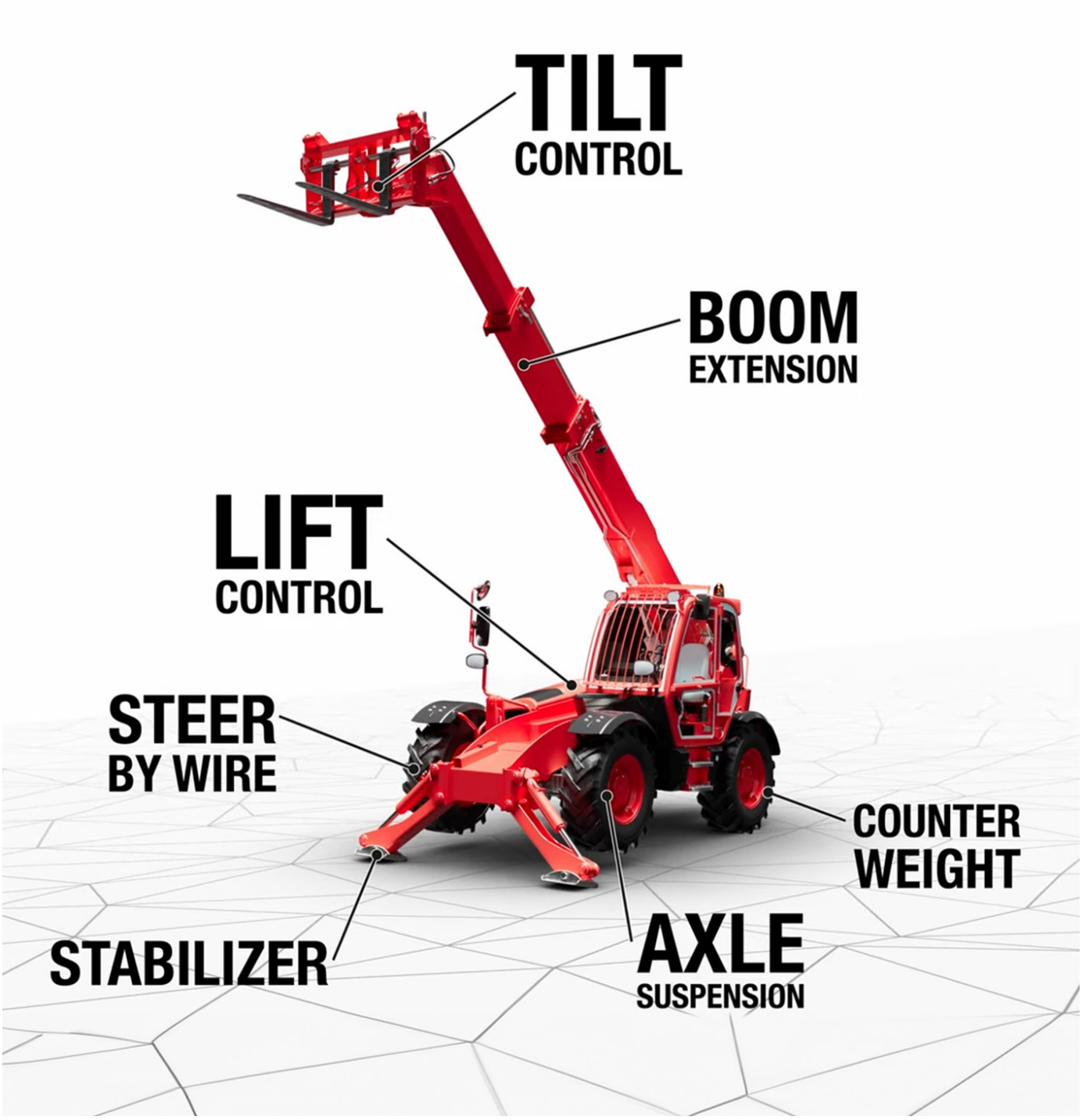
THE EXPANSION

The adapter cables for connecting the R-Series V sensor to the TempoLink® smart assistant can be ordered separately to allow other R-Series V connection types to be used with your kit. So you can flexibly expand your kit.

THE SENSORS

The TempoLink® smart assistant can be connected to all R-Series V sensors for adjusting sensor settings and reading additional information.

MOBILE HYDRAULICS POSITION SENSORS



TEMPOSONICS LINEAR MAGNETOSTRICTIVE POSITION SENSORS FOR MOBILE HYDRAULICS APPLICATIONS FEATURE ALL RELEVANT OUTPUTS, DESIGNS, AND LENGTHS TO GUARANTEE SUPERIOR CONTROL AND RELIABILITY OF POSITION AND VELOCITY MEASUREMENT FOR NEARLY ALL MACHINES!

- Developed for linear position measurement in mobile hydraulics machinery
- The position sensors are available with a stroke length from 50 mm to 5000 mm
- Designed for cylinder integration or external mounting
- High robustness against shock and vibration provide more safety, comfort and machine availability

MH SERIES, ANALOG, CANBUS OR PWM OUTPUT

MH SENSOR

Temposonics® Sensors can be used in versatile mobile machines without any restriction and replace contact-based linear sensors like potentiometers. Highly dynamic systems are controlled safely by means of Temposonics® sensors, thus enhancing the productivity, availability and quality of the working process of the machine. Insensitive to vibration, shock, dust and weathering influence and electro-magnetic disturbances. Temposonics® MH sensors are successfully used in front axle and articulated frame steering cylinders, hydraulic jacks an in steering systems for hydraulic units on agricultural and construction machinery.

DESIGNED FOR THE MOBILE WORLD

MH sensors are designed for mobile machines and intended for IN cylinder use. They are validated in the field by worldwide OEM's and replace linear potentiometers and inductive sensors.

MH-SERIES MS ANALOG OR DIGITAL

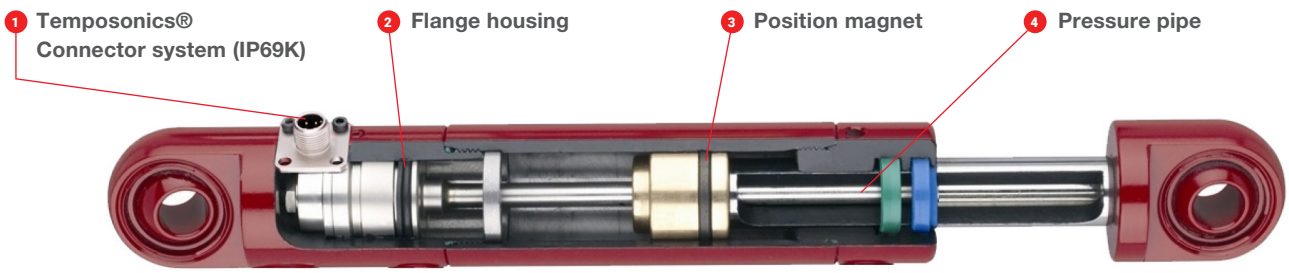
PRODUCT DESCRIPTION AND TECHNOLOGY

Temposonics® Sensors can be used in versatile mobile machines without any restriction and replace contact-based linear sensors like potentiometers. Highly dynamic systems are controlled safely by means of Temposonics® sensors, thus enhancing the productivity, availability and quality of the working process of the machine. Insensitive to vibration, shocks, dust and weathering influence and electro-magnetic disturbances. Temposonics® MH Series sensors are successfully used in front axle and articulated frame steering cylinders, hydraulic jacks and in steering systems for hydraulic units on agricultural and construction machinery.

SIMPLE MECHANICS

The extremely robust sensor consists of the following main parts:

1. The innovative connector system which is easy to install in a few seconds, any soldering or crimping needless, dust-and waterproof up to IP69K.
2. The flange housing with built-in electronics and signal converter.
3. The position magnet as only moving part, which is assembled into the piston bottom. This permanent magnet travels wear-free and contactless along the pressure pipe and measures the actual position
4. The pressure pipe placed within the drilled piston rod contains the protected magnetostrictive sensing element.

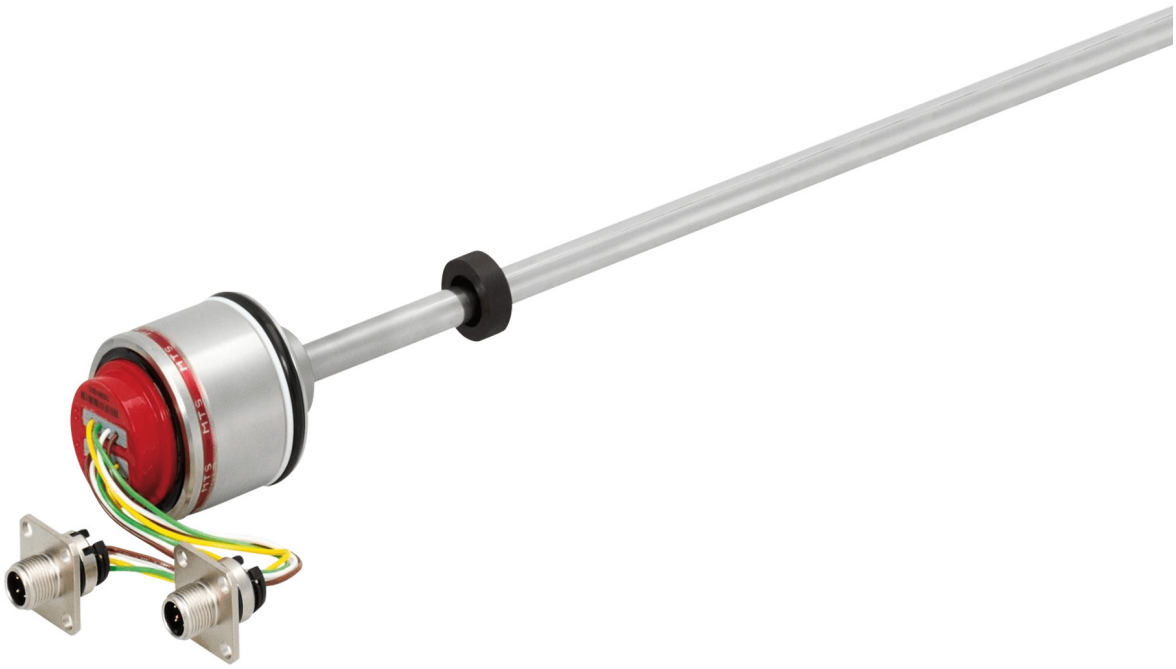


MH-SERIES MXR ANALOG

MXR ANALOG

The MH-Series Model MXR sensor is available in two versions. The MXRC and the MXRS. Although the two versions are similar in both appearance and performance, there are unique features distinguishing the two sensors from one another. The MXRC is available in four discrete stroke lengths up to 250 mm, while the MXRS is available in stroke lengths up to 600 mm (50 mm ordering increments). The MXRC works with a 5 VDC operating voltage, and provides a voltage output that is ratiometric to the operating voltage. The MXRS can work with an operating voltage of either 12/24 VDC nominal (8…32VDC), and has multiple analog output options available.

MH-SERIES MT
ANALOG REDUNDANT

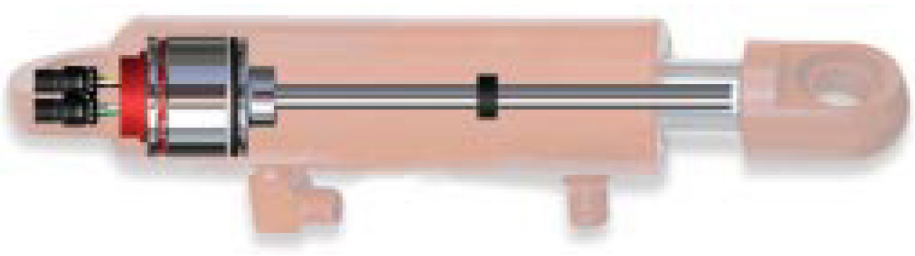


REDUNDANT SENSOR FOR MOBILE HYDRAULICS

- Redundant Sensor System
- Linear, Absolute Position Sensors
- Non-Contact Sensor Technology with Highest Durability
- Superior Accuracy: Linearity Tolerance < 0.04 % F.S.
- Hysteresis ± 0.1 mm
- Direct Analog Displacement Output: Current or Voltage
- Power Supply: 12/24 VDC nominal (8…32VDC)
- Shock Rating 100 g (single hit) / IEC 68-2-27
- Vibration Rating 15 g / 10-2000 Hz / IEC 68-2-6

DESIGNED FOR THE MOBILE WORLD

MH-Series sensors were designed with the “mobile” world in mind, and have been validated in the field by customers worldwide. They are available with a redundant output for safety sensitive applications. Performance is second to none; high accuracy, position output. Ruggedness is “designed in”; 100 g shock rating. Cable and wire options are sized for direct connection to proven connectors. The model MT sensor can be fully sealed and embedded in a cylinder to ensure a long operating life.



M-SERIES ANALOG AND PWM TEST KIT

DESIGNED FOR THE MOBILE WORLD

The M-Series analog/PWM Tester supports M-Series sensors with analog, 0-20 mA and 0-10 Vdc, scaled Pulse Width Modulated (PWM), and PWM time of flight (tOF) sensor outputs. With its rechargeable battery, the M-Series Tester can provide power directly to the sensor thus isolating the sensor from the rest of the vehicle.

This is useful in situations where a vehicle harness could be mis-wired or there could be an error in the software that makes the sensor appear to be malfunctioning. By isolating the sensor the operator can quickly determine if the sensor is functioning or not. This eliminates time wasted on replacing a functioning sensor.

Whether in the factory or in the field the M-Series Analog/PWM Tester can be quickly attached to the sensor under test by using one of three cables included in the kit. Two test cable comes with a M12 plug, that mates with MTS' M12 integrated connector system, and colour coded banana plugs that mate with the terminals of the tester. The third cable is a simple pigtail cable with colour coded banana plugs that allows the cable to be customized to other connector systems that may be in use.

FEATURES

- Easy connection to MTS' M12 integrated connector system
- Easy to use push-button controls
- Supports voltage (0-10 Vdc) and current (0-20 mA) outputs
- Tolerances 5 Vdc ± 10 mV, 20 mA ± 0,02 mA
- Supports scaled PWM and time of flight (TOF) PWM outputs
- Compact construction for use in field applications
- Provides both +5 Vdc and +12 Vdc sensor power supply
- Rechargeable battery that provides up to 8 hours of operation per charge
- Battery level monitoring
- Automatic detection of PWM sensor frequency
- Carrying case

BENEFITS

- Isolates sensor from vehicle system to independently determine functionality of the sensor.
- Designed for use in both factory and in-field applications.

DELTA MOTION
ELECTRO-HYDRAULIC
MOTION CONTROLLERS

DELTA

CONNECT. CONTROL. OPTIMIZE.

Delta Computer Systems, Inc., also doing business as Delta Motion, is a manufacturer of industrial control products, with a focus on high-performance motion controllers for servo hydraulic and servo electric applications. Look to Delta Motion for highly capable products, responsive support, and lasting value.

Delta Motion's RMCTools software and RMC Motion Controllers provide an unmatched combination of performance and ease-of-use. This allows our customers to achieve optimal results in less time. RMCTools software is free to download and the system does not require ongoing activation or subscription fees.

Delta's extensive RMCTools Online Help is backed by a variety of training options and responsive, knowledgeable technical support. (Telephone and email support is provided at no cost).

Our practice of not obsoleting products as long as there is demand ensures future availability. The ease-of-use allows our customers to take ownership of their control systems, and there are no subscription fees or charges for software upgrades.

Delta Motion is an independent, employee-owned company. Our focus on financial stability and attracting and retaining talented people backs up our goal of supporting customers for as long as they need support.

The new RMC200 Lite, featuring up to 18 axes, is introduced along with the enhanced RMC200 Standard which now handles up to 50 axes - 2020 Delta celebrates 40 years in business and introduces a refreshed logo - 2022.

RMC70 SERIES

ONE AND TWO AXIS MOTION CONTROLLERS

The RMC70 Base module includes a CPU, communications, and one or two motion axes. Up to four Expansion modules can be added (e.g. analog inputs and DI/O).

The RMC70 Series motion controllers offer a valuable combination of performance and ease of use for one- and two-axis systems.

With powerful control modes–including dualloop position-pressure algorithms–and multiple feedback types, the RMC70 Series provides optimum control to a wide range of hydraulic, electric, and pneumatic position and position–pressure/force applications.

Communications with popular PLCs and HMIs is efficient, with support for numerous protocols, easy-to-use address mapping features, and mirroring of PLC addressing.

Time-critical sequences can be offloaded from the PLC into the RMC70's flexible User Programs. A full set of motion parameters, including acceleration and velocity feed forwards and separate directional gains, delivers smooth, precise motion to boost through put, improve quality, and extend machine life.

Command-based programming speeds development and reduces long-term software maintenance. Advanced graphing and diagnostic capabilities can be used to troubleshoot the entire motion system.

RMCTools software with informative help is downloadable from deltamotion.com

FEATURES

Setup and Programming

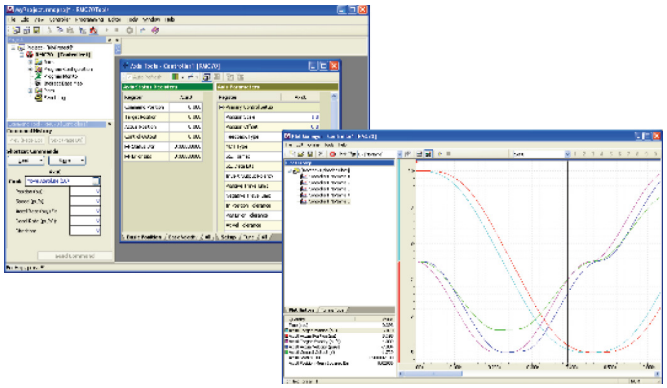
- Command-based—minimal program development and maintenance.
- Flexible User Programs—advanced step sequencer with usernamed variables and mathematical expressions.
- Extensive, context-sensitive online help.

Control Algorithms

- Position, velocity, pressure, force, position–pressure, position force, velocity–pressure, velocity–force, active damping.
- Full parameter set supports high-performance motion control.

Tuning and Diagnostics

- Powerful motion graphing and event logging for optimizing the entire motion system
- Event Log shows real-time activity



RMC70 CONTROL FEATURES

The RMC70 provides an extensive set of motion commands and programming capability for quick and easy yet flexible motion control for virtually every motion application.

CONTROL MODES

Closed Loop Control
Full PID loop control with velocity, acceleration, and jerk feed forwards for precise synchronized motion. Directional gain factors support fluid power control.

Position Control
- Point-to-Point moves
- S-curves
- Speed at Position
- Gearing
- Cyclic Sinusoidal Motion
- Splines, Cams
- Rotary motion (incremental and absolute)

Velocity Control
- Velocity control with position feedback
- Velocity control with velocity feedback

Pressure and Force Control
- Pressure sensor, load cell, or differential force
- Linear or S-curve Ramps
- Gearing
- Cyclic Sinusoidal Profile
- Splines, Cams

Position-Pressure and Position-Force Control
- Transition seamlessly between position control and pressure or force control.
- Pressure or Force Limit – limit the pressure or force during a position or velocity move.

Active Damping
For high-performance control of pneumatics and difficult systems.

Open Loop Control
Seamless transition from open loop to closed loop. Ramp Control Output between two values, or ramp based on position for hard-to-control systems.

Quick Move
Move in open loop and stop in closed loop for fast, smooth motion with accurate stops.

Valve Linearization
For valves with a sharp knee or “kink” in the flow versus command signal diagram.

Custom Feedback
Control using any calculated value as feedback.
- Sum, difference, average, etc.
- Switch feedback on-the-fly
- Redundant feedback
- Feedback linearization

HIGH-LEVEL PROGRAMMING

User Programs
Programs are easy-to-understand sequences of commands. Run multiple programs simultaneously to handle axis commands and machine control functions.

Program Triggers
Start user programs automatically based on userdefined events such as discrete inputs, error conditions, etc.

Variables
Recipes and other user parameters can be stored for use by user programs.

Mathematical Expressions
Expressions provide flexible programming capability for advanced calculations and machine control sequences.

TROUBLESHOOTING AND MONITORING

Plots
Plot any register in the RMC70, up to 16 registers per plot, sampled down to the control loop resolution.

Event Log
Speeds troubleshooting by recording events such as parameter changes, commands, errors, and communications.

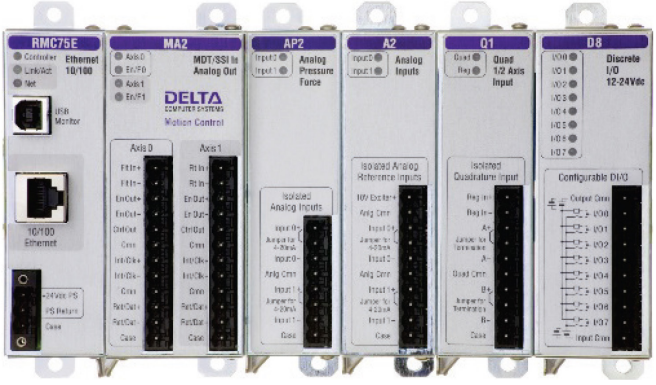
FAULT HANDLING

Closed Loop stops
Ramp speed to zero at a specified rate and hold position.

Open Loop stops
Ramp output voltage to zero at a specified rate.

Multi-axis (group) stops
A fault on one axis halts multiple axes when configured as a group.

AutoStops
The response of axes to each fault type is easily configurable.



RMC70 BASE MODULE: CPU CHOICES

The RMC70 CPU portion of the Base module contains the communications and the central processing unit.

The initial CPU offering is the RMC75 with support for one or two axes of motion, up to four Expansion modules, and Delta Motion's easy-to-use Step Editor for user programs. The RMC75 CPU modules differ only in the communication type. In addition to the power input and primary communications port, each RMC70 CPU module contains a Monitor.

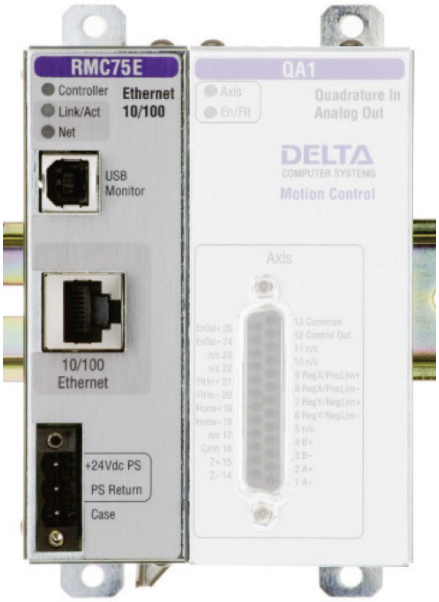
Port intended for communication with RMCTools. On the RMC75E, this is a USB port. The RMC75E can also connect to RMCTools via Ethernet. On the RMC75P and RMC75S CPU modules, the Monitor Port is an RS-232 serial port.

AVAILABLE CPU MODULES

Part Number	Primary Communication	Monitor Port
RMC75E	Ethernet	USB
RMC75P	PROFIBUS-DP	Serial (RS-232)
RMC75S	Serial (RS-232/485)	Serial (RS-232)

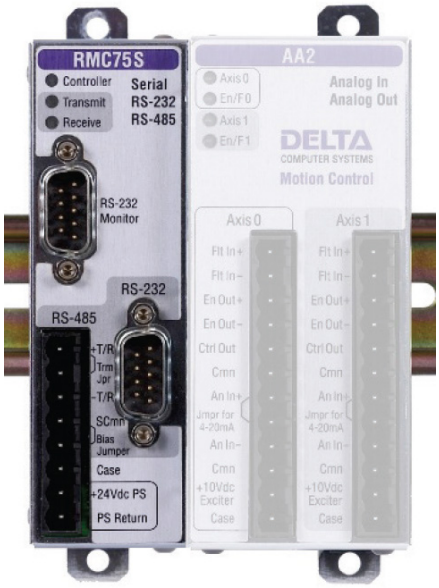
SPECIFICATIONS COMMON TO ALL BASE MODULES

Motion Loop Time	
Control loop time	User-selectable: RMC75E: 0.25 to 4 ms RMC75S/P: 0.5 to 4 ms
Power	
Voltage	+24Vdc ±20%
Current – Base module with 4 Expansion modules	Typ. 200mA @ 24Vdc, max 375mA Typ. 350mA @ 24Vdc, max 500mA
DC-DC converter isolation	500Vac input to the controller
Mechanical	
Mounting	Symmetrical DIN 3 or panel-mount
Dimensions – Base module with 4 Expansion modules	3.22 x 5.0 x 2.75 in (WxHxD) (8.3 x 12.7 x 6.4 cm) up to 9.22 x 5.0 x 2.75 in, width varies (23.4 x 12.7 x 6.4 cm)
Weight – Base module with 4 Expansion modules	Up to 0 lb 12 oz (0.4 kg) Up to 2 lb 0oz (0.9 kg)
Environment	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	40 to +185°F (-40 to +85°C)
Agency compliance	UL, CUL, CE



RMC75E CPU Module

RMC75P CPU Module



RMC75S CPU Module

RMC150 SERIES

TWO TO EIGHT AXIS MOTION CONTROLLERS

The RMC150/151 delivers high-performance motion control to hydraulic, electric servo, and pneumatic industrial applications. With powerful control modes—including dual loop position-pressure algorithms—and connectivity to many transducer types, the RMC provides optimum control for a wide range of motion applications.

The RMC150/151 CPU module comes standard with Ethernet, supporting protocols such as EtherNet/IP, PROFINET, and Modbus/TCP, and is designed to integrate easily with your favourite PLCs, PCs, and HMIs.

Equipped with excellent graphing features and easy-to-use wizards, the RMCTools software handles setup, programming, tuning, and diagnostics for both the RMC150 and RMC70 series controllers.

Flexible Multi-axis Capability

Modules can be "mixed and matched" to support up to 8 control axes for tightly synchronized motion, and additional reference axes up to a total of 16 control, reference, or virtual axes.

INDUSTRIAL APPLICATIONS

- Forest products
- Testing
- Metals
- Energy / Petrochemical
- Automotive
- Aerospace
- Plastics and rubber
- Entertainment
- Mining
- Petrochemical

COMMUNICATIONS

Ethernet (10/100Mbps), built-in on CPU.

- EtherNet/IP
- PROFINET
- Modbus/TCP
- CSP (Allen-Bradley)
- FINS (Omron)
- Procedure Exist (Mitsubishi Q Series)

USB Port For use with the RMCTools software.

PROFIBUS-DP

FEEDBACK TYPES

Magnetostrictive Linear Displacement Transducer (MDT) RS-422 Start/Stop and PWM signals

Synchronous Serial Interface (SSI) Linear and single- or multi-turn rotary

Analog ±10V and 4-20mA

Quadrature Encoder
5V differential only (RS-422)

Resolver
Wide range of frequencies and ratios

RMC150 CONTROL FEATURES

The RMC150 provides an extensive set of motion commands and programming capability for quick and easy yet flexible motion control for virtually every motion application.

CONTROL MODES

Closed Loop Control
Full PID loop control with velocity, acceleration, and jerk feed forwards for precise synchronized motion. Directional gain factors support fluid power control.

Position Control
- Point-to-Point moves
- S-curves
- Speed at Position
- Gearing
- Cyclic Sinusoidal Motion
- Splines, Cams
- Rotary motion (incremental and absolute)

Velocity Control
- Velocity control with position feedback
- Velocity control with velocity feedback

Pressure and Force Control
- Pressure sensor, load cell, or differential force
- Linear or S-curve Ramps
- Gearing
- Cyclic Sinusoidal Profile
- Splines, Cams

Position-Pressure and Position-Force Control
- Transition seamlessly between position control and pressure or force control.
- Pressure or Force Limit – limit the pressure or force during a position or velocity move.

Active Damping
For high-performance control of pneumatics and difficult systems.

Open Loop Control
Seamless transition from open loop to closed loop. Ramp Control Output between two values, or ramp based on position for hard-to-control systems.

Quick Move
Move in open loop and stop in closed loop for fast, smooth motion with accurate stops.

Valve Linearization
For valves with a sharp knee or “kink” in the flow versus command signal diagram.

Custom Feedback
Control using any calculated value as feedback.
- Sum, difference, average, etc.
- Switch feedback on-the-fly
- Redundant feedback
- Feedback linearization

HIGH-LEVEL PROGRAMMING

User Programs
Programs are easy-to-understand sequences of commands. Run multiple programs simultaneously to handle axis commands and machine control functions.

Program Triggers
Start user programs automatically based on userdefined events such as discrete inputs, error conditions, etc.

Variables
Recipes and other user parameters can be stored for use by user programs.

Mathematical Expressions
Expressions provide flexible programming capability for advanced calculations and machine control sequences.

TROUBLESHOOTING AND MONITORING

Plots
Plot any register in the RMC70, up to 16 registers per plot, sampled down to the control loop resolution.

Event Log
Speeds troubleshooting by recording events such as parameter changes, commands, errors, and communications.

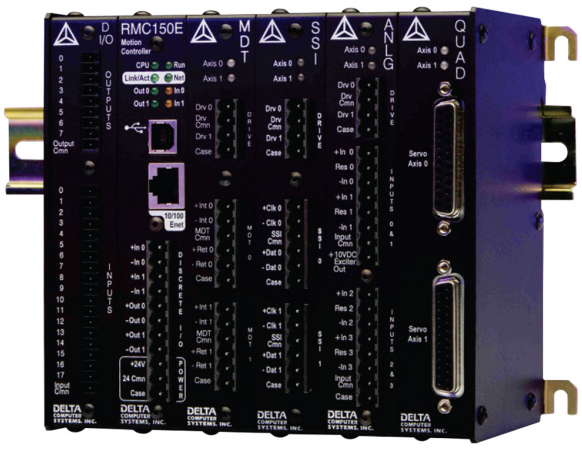
FAULT HANDLING

Closed Loop stops
Ramp speed to zero at a specified rate and hold position.

Open Loop stops
Ramp output voltage to zero at a specified rate.

Multi-axis (group) stops
A fault on one axis halts multiple axes when configured as a group.

AutoStops
The response of axes to each fault type is easily configurable.



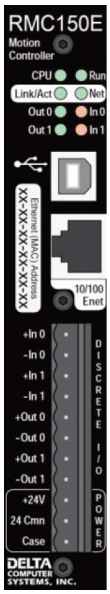
RMC150E OR RMC151E CPU'S

2-8 AXES CONTROLLERS

The RMC150E and RMC151E CPU's are capable of controlling up to 8 control axes plus additional reference axes. These CPU's provide an onboard Ethernet port, a USB port for connection to the RMCTools software, two 24Vdc discrete outputs, and two 12-24Vdc discrete inputs.

RMC150E – 8 Axes: Control 8 axes, built-in Ethernet, USB monitor port, 2 discrete inputs, 2 discrete outputs.

RMC151E – 8 Axes with Dual-Loop: RMC150E with dual-loop. Dual-loop is the ability to control two quantities–such as position and pressure–on the same axis. Notice that controlling only pressure or only force on an axis does not require the RMC151E.



RMC150E/RMC151E CPU SPECIFICATIONS

Motion Control	
Control loop times	250 µs, 500 µs, 1 ms, 2 ms, or 4 ms
USB Monitor Port (for setup, programming, and maintenance only)	
Connector	USB "B" Receptacle
Data Rate	Full-speed (12 Mbps)
Discrete Inputs (2)	
Input type	12-24Vdc inputs; polarity independent
Logic polarity	True "High"
Isolation	500Vac
Input "High" range	7 to 26.4Vdc, 3mA maximum
Input "Low" range	0 to 3.5Vdc, <1mA
Maximum propagation delay	160 µs
Discrete Outputs (2)	
Output type	Solid State Relays (SSR)
Isolation	500Vac
Rated voltage	max ±30V (DC or peak AC voltage)
Maximum current	±75mA (±50mA for Class I Div 2)
Maximum propagation delay	2.0 ms
Logic 1 (True, On)	Low impedance (50Ω maximum)
Logic 0 (False, Off)	High impedance (<1µA leakage current at 250V)
Power	
Voltage	+24Vdc ±15%
Current 3 slots 4 slots 5 slots 6 slots	Typical 290mA, max 375mA Typical 385mA, max 500mA Typical 485mA, max 625mA Typical 585mA, max 750mA
DC-DC converter isolation	500Vac
Mechanical	
Mounting	Symmetrical DIN 3 or panel-mount
Dimensions 3 slots 6 slots	4.12 x 5.95 x 4.75 in (WxHxD) (10.5 x 15.0 x 12.1 cm) width increases by 1.0 in for each slot 7.12 x 5.95 x 4.75 in (WxHxD) (18.1 x 15.0 x 12.1 cm)
Weight 3 slots 6 slots	2 lb (0.9 kg) max 3 lb (1.4 kg) max

Environment	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	UL, CUL. Optional: Class I, Division 2
Ethernet Interface	
Hardware interface	IEEE 802.3 for 100BASE-T (twisted pair)
Data Rate	10/100 Mbps
Duplex	Full/Half-Duplex
Features	Auto-negotiation, Auto-crossover (MDI/MDI-X)
Connector	RJ-45
Cable	CAT5, CAT5e or CAT6, UTP or STP
Ethernet Configuration	
Configuration parameters	IP address, subnet mask, gateway address, enable/disable auto configuration
Configuration methods	BOOTP, DHCP, or static
Ethernet Protocol Support	
Application Protocols (Call Delta Motion for the availability of other protocols)	EtherNet/IP, Modbus/TCP, PROFINET, CSP (DF1 over Ethernet), Omron FINS, Procedure Exist (Mitsubishi Q-series)
Framing protocol	Ethernet II
Internet protocol	IP (includes ICMP, ARP, and Address Collision Detection)
Transport protocols	TCP, UDP

RMC200 SERIES

MOTION CONTROLLERS – STANDARD AND LITE

The RMC200, available in two versions – Standard (up to 50 axes) and Lite (up to 18 axes) – is Delta Motion's highest performance motion control platform for servo-hydraulic and servo-electric industrial applications. User-swappable modules provide flexibility and connectivity to many transducer types. Additionally, EtherCAT communications provides connectivity to drives, valves, sensors, and IO devices.

Powerful control algorithms offer advanced multi-axis synchronized motion, dual-loop control of position and pressure or position and force with bumpless transfer, advanced tuning capabilities specifically for hydraulic motion, and much more. The RMC200's CPU modules come standard with Ethernet, supporting protocols such as EtherNet IP, PROFINET, and Modbus/TCP, and are designed to integrate easily with your favourite PLCs, PCs, and HMIs.

Delta Motion's RMCTools software handles setup, programming, tuning, and diagnostics for the RMC200, as well as the RMC150 and RMC75 controllers. Excellent graphing features and easy-to-use wizards complement its user programs designed specifically for motion sequences.

Flexible Multi-axis Capability

As Delta Motion's largest and most capable motion controller, a variety of base sizes accommodate modules that can be mixed and matched to support up to 50 axes of tightly synchronized motion.

INDUSTRIAL APPLICATIONS

- Forest products
- Testing
- Metals
- Presses
- Energy / Petrochemical
- Automotive
- Aerospace
- Plastics and rubber
- Entertainment
- Mining

COMMUNICATIONS

Ethernet (100 Mbps), built into the CPU. Dual ports (single IP address) supporting star, linear, and ring topologies. Supports the following protocols as a slave only:

- EtherNet/IP
- PROFINET
- Modbus/TCP
- CSP (Allen-Bradley)
- FINS (Omron)
- Procedure Exist (Mitsubishi)
- DMCP

USB Port For use with RMCTools software and RMCLink ActiveX and .Net assembly.

FEEDBACK TYPES

Synchronous Serial Interface (SSI) Linear and single or multi-turn rotary

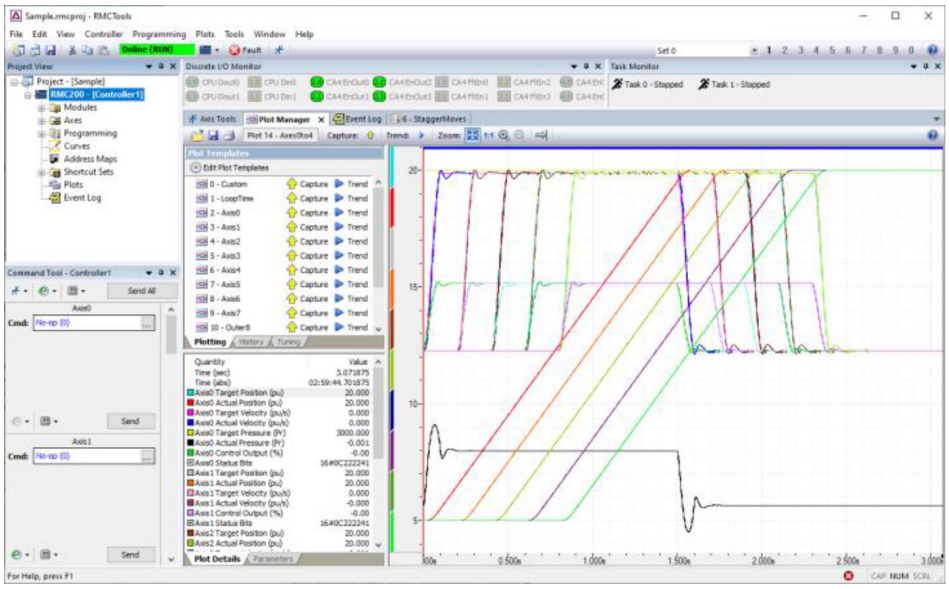
Magnetostrictive Linear Displacement

Transducer (MDT) RS-422 Start/Stop and PWM

Analog
±10V and 4-20mA

Quadrature Encoder

RMCTOOLS SOFTWARE



RMCTOOLS SOFTWARE

RMCTools is a powerful motion control software package for setting up, tuning, troubleshooting, programming, and controlling all features of Delta Motion 's multi-axis RMC200 controllers from a PC. RMCTools also supports the RMC75 and RMC150 controllers.

Delta Motion's intuitive and easy-to-use RMCTools software features flexible User Programs with extensive commands and the ability to embed mathematical expressions. Setup and tuning wizards reduce startup times, and the graphical diagnostics tools speed up troubleshooting of the entire motion system. Extensive context-sensitive help is included in RMCTools.

RMCTools software is free to download and the system does not require ongoing activation or subscription fees.

Supported Operating Systems: Windows® 7/8.1/10/11

COMMUNICATION SOFTWARE

RMCLink ActiveX Control and .NET Assembly
RMCLink enables full monitoring and control of RMC200 motion controllers via Ethernet and USB communications on Windows®-based PCs from custom applications in languages such as Visual Basic, C++, C#, VBScript, VBA (Microsoft Excel®), PHP, Jscript, Python, and MATLAB®.

RMCLink comes with fully-functioning sample projects to help you get up and running quickly. The help includes detailed walkthroughs and numerous code samples.

For non-Windows applications, such as Linux or embedded C, Delta Motion provides sample C code for communicating with the RMC using Delta Motion's simple DMCP protocol.

RMCTOOLS FEATURES

Delta Motion's powerful RMCTools software makes setup, tuning, and troubleshooting motion systems easier than ever.

SETUP

Wizards - Easy-to-use wizards include New Project, New Controller, Scale & Offset, and Tuning.

Full Parameter Set - Monitor all axis status registers and modify parameters.

TUNING AND DIAGNOSTICS

Plots
Plot any item, up to 128 items per plot, sampled down to the control loop resolution. XY plot view supported.

Tuning Wizard
Quickly and accurately tune your axes, using a slider bar to choose from a range of gains appropriate for your system.

Event Log
Speed troubleshooting by recording events such as parameter changes, commands, errors, and communications.

PROGRAMMING

Commands
Issue commands directly from RMCTools. Use Shortcut Commands to quickly issue commands to speed up the tuning process

User Programs
Easily create programs to issue sequences of commands. Supports complex logic with branching and looping.

Program Triggers
Start user programs automatically based on user-defined events such as discrete inputs, error conditions, etc.

Mathematical Expressions
Expressions provide flexible programming capability for advanced calculations and machine control sequences.

RMC200 CONTROL FEATURES

The RMC200 provides an extensive set of motion commands and programming capability for quick and easy yet flexible motion control for virtually every motion application.

CONTROL FEATURES

Closed Loop Control
Full PID loop control with velocity, acceleration, and jerk feed forwards for precise synchronized motion. Directional gain factors support fluid power control.

Position Control
- Point-to-Point moves
- S-curves
- Speed at Position
- Gearing
- Cyclic Sinusoidal Motion
- Splines and Cams
- Rotary motion (incremental and absolute)

Velocity Control
- Velocity control with position or velocity feedback

Pressure and Force Control
- Transition seamlessly between position or velocity control and pressure or force control.
- Pressure or Force Limit – limit the pressure or force during a position or velocity move.

Position-Pressure and Position-Force Control
- Transition seamlessly between position control and pressure or force control.
- Pressure or Force Limit – limit the pressure or force during a position or velocity move.

Synchronized Motion
Many features for various types of synchronized motion:
- Ratioed moves
- Gearing
- Camming
- Tracking with velocity and acceleration limits

Active Damping
For high-performance control of pneumatics and difficult systems.

Higher-Order Control
Includes Double Differential gain and Jerk Feed Forward for systems with a low natural frequency.

Open Loop Control
Seamless transition from open loop to closed loop. Ramp Control Output between two values, or ramp based on position for hard to-control systems.

Quick Move
Move in open loop and stop in closed loop for fast, smooth motion with accurate stops.

HIGH-LEVEL PROGRAMMING

User Programs
Programs are easy-to-understand sequences of commands. Run multiple programs simultaneously to handle axis commands and machine control functions.

Program Triggers
Start user programs automatically based on userdefined events such as discrete inputs, error conditions, etc.

Variables
Recipes and other user parameters can be stored for use by user programs.

Mathematical Expressions
Expressions provide flexible programming capability for advanced calculations and machine control sequences.

TROUBLESHOOTING AND MONITORING

Plots
Plot any item, up to 128 items per plot, sampled down to the control loop resolution. XY plot view supported.

Event Log
Speeds troubleshooting by recording events such as parameter changes, commands, errors, and communications.

FAULT HANDLING

Closed Loop stops
Ramp speed to zero at a specified rate and hold position.

Open Loop stops
Ramp output voltage to zero at a specified rate.

Multi-axis (group) stops
A fault on one axis halts multiple axes when configured as a group.

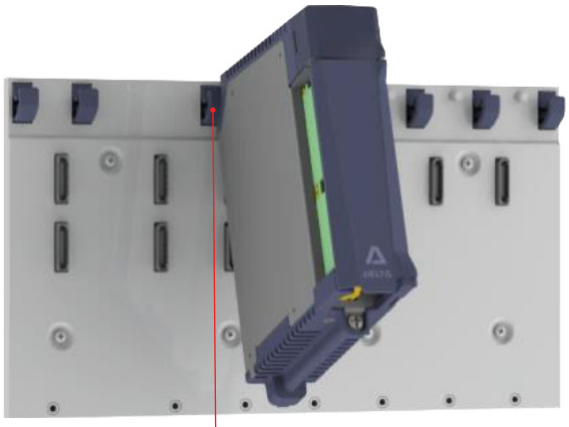
AutoStops
The response of axes to each fault type is easily configurable.

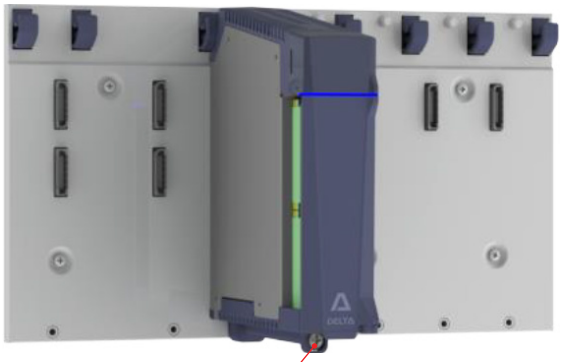
VALVE COMPENSATION

Output Deadband for overlapped spools and Valve Linearization for non-linear flow.

Custom Feedback
- Control using any calculated value as feedback.
- Sum, difference, average, etc.
- Switch feedback on-the-fly
- Redundant feedback
- Feedback linearization

MODULAR DESIGN





MODULES ROCK IN, ROCK OUT

The RMC200 modules are designed to be user-installable and removable. The modules rock in and out, rotating around a pivot point. Modules may be installed and removed without being damaged while the RMC200 is powered. The pivot action ensures the electrical pins engage the base pins in a certain order, preventing damage to the module. Note: this is not hot-swapping in the sense of removing modules while equipment is operating.

MATERIALS AND CONSTRUCTION

An aluminium base and modules composed of 22 gauge nickel-plated steel sheet metal and PC/ABS plastic provide a long-lasting industrial controller. Indicator LEDs on each module aid troubleshooting and doors make for a clean appearance. The top of the modules are angled downward to help ensure space for airflow and to allow the modules to be removed while remaining within the footprint of the base.

MODULE HOLD-DOWN SCREWS

Each module is secured to the base via a captive screw, which extends toward the front of the module for easy screwdriver access.

UNPLUGGABLE TERMINAL BLOCKS

Wiring connections are made via unpluggable terminal blocks to facilitate the removal of modules in the field. Terminal blocks latch into place and the push-in wire capture style facilitates efficient and reliable wiring. A wire hold-down clip and cable tie points help keep wiring organized.

GENERAL RMC200 SPECIFICATIONS

Mechanical		
Mounting Dimensions with mounting tabs		**Panel-mount**
	B5L	7.0 x 7.9 x 5.8 in. (WxHxD) (177 x 200 x 146 mm)
	B7L	9.7 x 7.9 x 5.8 in. (WxHxD) (246 x 200 x 146 mm)
	B5	7.9 x 7.9 x 5.8 in. (WxHxD) (201 x 200 x 146 mm)
	B7	10.7 x 7.9 x 5.8 in. (WxHxD) (270 x 200 x 146 mm)
	B11	16.2 x 7.9 x 5.8 in. (WxHxD) (410 x 200 x 146 mm)
	B15	21.9 x 7.9 x 5.8 in. (WxHxD) (555 x 200 x 146 mm)
Environment		
Operating temperature		-4 to +140ºF (-20 to +60ºC)
Storage temperature		-40 to +185ºF (-40 to +85ºC)
Humidity		5-95%, non-condensing
Agency compliance		CE, UL, CUL
Electrical Isolation		
All isolation on the RMC200 is functional isolation at 500 Vac. This is not safety isolation and is not tested on individual modules		

POWER CONSUMPTION AND DISSIPATION

Power consumption is the power the module draws from the RMC's power supply. Power dissipation is the heat generated by the module. Power dissipation may be more than the power drawn from the power supply due to power received from devices connected to discrete inputs, discrete outputs, encoder inputs, etc.

LEINE LINDE
ROTARY ENCODERS

LEINE LINDE

ROBUST AND RELIABLE PARTNER

Leine Linde is a leading manufacturer of robust encoders, sensors, and system electronics for industrial applications. The products are primarily used for positioning or velocity feedback and are known for their robustness, performance and reliability. Our solutions often become the natural choice for heavy-duty operations located in harsh environments.

At Leine Linde, we maintain a strong global presence across all continents, collaborating closely with our customers and partners through local offices and representatives. Our deep application expertise, customer focus, and cutting-edge technologies deliver exceptional value to original equipment manufacturers and end users around the world. We believe in fostering long-term relationships built on mutual trust, cultivated every day in every interaction.

Leine Linde was founded in 1967 by Per-Olov Leine and Henrik Linde in Stockholm, Sweden. In 2017 we celebrated 50 years of faithful service to our clients.

From two talented engineers with a feel for the technology to a company with market-leading products in a global market. Read about the first 50 years with robust encoders!

Leine Linde's management system is certificated according to ISO 9001 since 1995, and according to ISO 14001 since 2002. The products are certified in accordance with ATEX, EAC Ex, CCC Ex, UL-listing and JPEx. Leine Linde is part of the HEIDENHAIN Group.

INDUSTRIAL 600 SERIES ABSOLUTE POSITION ENCODERS

RESOLUTION UP TO A TOTAL OF 31 BIT MULTITURN

With the 600 series absolute encoder it is possible to get exact positioning since each position within the revolution of the encoder is made up of a unique code, allowing the shaft's exact position to be read directly on start-up. The total resolution for a 31 bit encoder is equivalent to 524 288 unique positions on each individual revolution, multiplied by 4096 distinguishable revolutions.

Sustainable
Market leading vibration and shaft load resistance.

Encapsulation
Ingress protection class IP67 for protection against dust and liquids. Verified for use in salt water environments.

Resolution
High singleturn and multiturn resolution versions of the encoder available.

Connection
- M23 or M12 connectors
- Cable glands or premounted cable

STAINLESS STEEL FOR INCREASED ROBUSTNESS

As an option, the 600 series has variants that comply to ATEX for usage within the zone 2/22. The inductive 600 series in stainless steel has a high resistance to corrosion and is therefore suitable in demanding environments such as those common within marine and offshore applications or where aggressive liquids are used.

Shaft and flange
- Hollow shaft, either blind or through-going for fixing with a stator coupling. Shaft dimensions: Ø8 mm, Ø10 mm and Ø12 mm for blind hollow shaft, Ø12mm for through-going hollow shaft.
- Solid shaft, either round or face for fixing with a flange of either synchro or clamping type. Shaft dimensions: Ø6 mm, Ø10 mm and Ø12 mm.

Material
- Anodized aluminium or
- Stainless steel A4, AISI 316L/EN 1.4404

INTERFACES

PROFIBUS

The 600 series supports the encoder profiles 3.062 (DVP0) and 3.162 version 4.1 (DVP2) which contains functions such as preset, scaling and code sequence. The encoder profile DVP2 also adds isochronous data exchange and slave-to-slave functions.

PROFINET

PROFINET can in general be described as Ethernet-based PROFIBUS DP communication and contains functions such as preset, scaling, code sequence, slave-to-slave and isochronous data exchange.

CANOPEN

The 600 series CANopen encoder supports encoder profile DS-406 version 3.2 and is certified by the CIA (CAN In Automation) organization. Apart from the standard encoder functionality such as positioning, scaling and presetting commands, the encoder supports speed and acceleration read out as well as PDO mapping and LSS service.

DEVICENET

The 600 series also features support for DeviceNet protocol and the encoder functionality has been tested in compliance with the ODVA conformance test. The DeviceNet encoder supports profile revision 2 with the supported functionalities code sequence, preset, velocity and scaling.

SSI

Synchronous Serial Interface is a digital point-to-point interface. It provides uni-directional communication at speeds up to 1.0 MHz by the use of only four wires.

ETHERNET/IP

EtherNet/IP is an Industrial Ethernet network that combines standard Ethernet technologies with Common Industrial Protocol, CIP. The EtherNet/IP encoders support the device profile 0x22 with available features such as preset, velocity, speed and acceleration limits, code sequence and scaling.

DRIVE-CLIQ

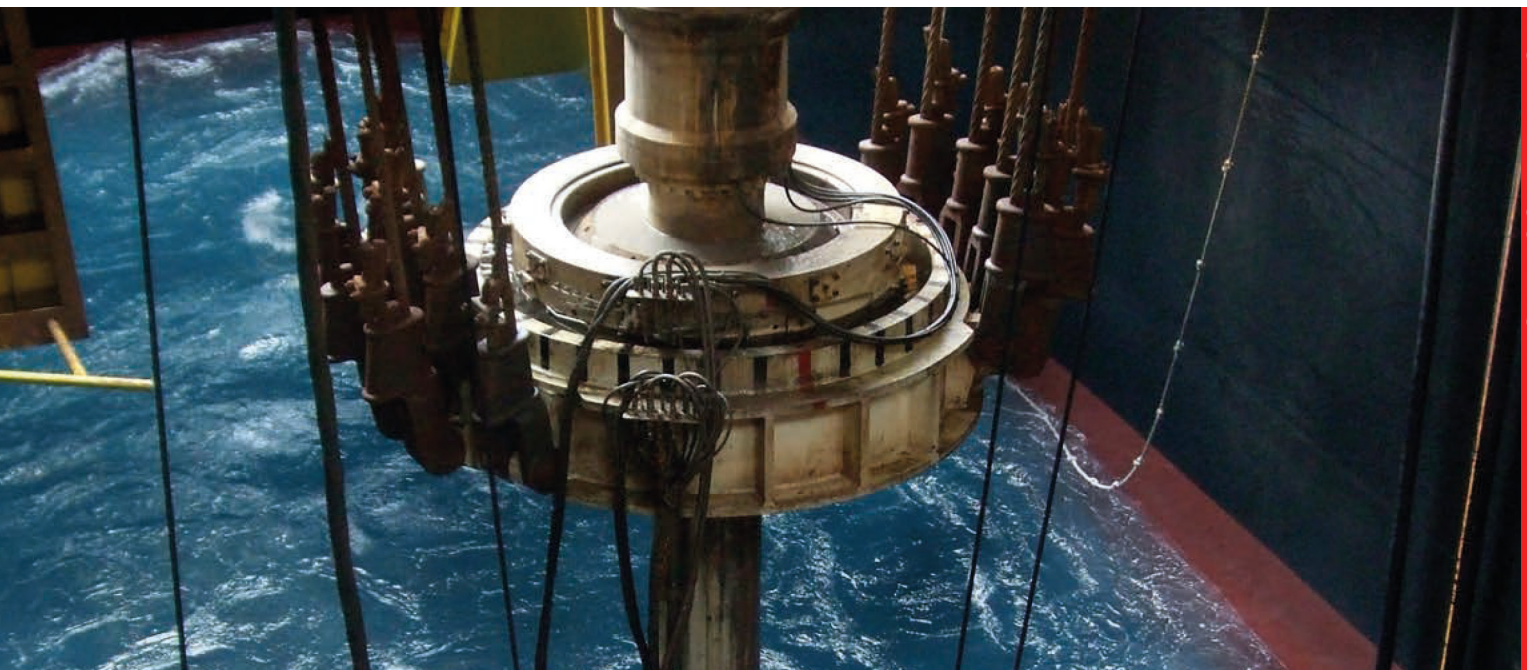
DRIVE-CLiQ is an Ethernet-based protocol from Siemens. With a speed of 100 Mbit/s and a cycle time of 31.25 µs, DRIVE-CLiQ has the performance required for the most demanding applications. Components with DRIVE-CLiQ are automatically configured with each other since every component has an electronic label. The encoders are supplied with specially adapted connectors, with power supply and data in the same connector.

ETHERCAT

With no underlying subsystems EtherCAT has a fast Industrial Ethernet technology and is therefore suitable in applications where cycle time down to 31,25 µs is required. The encoder interface supports CANopen over EtherCAT according to CiA 301 and the device profile CiA 406. With objects for position value, speed, and acceleration, the encoder provides a wide usability for fast EtherCAT control systems.

ENDAT 2.2

The EnDat 2.2 interface is a digital, bidirectional interface for encoders. It is capable of transmitting position values from absolute encoders, as well as reading and updating information stored in the encoder.



COMPACT 700 SERIES ENCODERS FOR DRIVES

ROBUSTNESS IN TIGHT SPACES

The 700 series is designed to fit in tight spaces without compromising on robustness. With its short build length, it is perfect for installations where space is limited.

Compact and robust
The 700 series has large hollow shafts up to 30 mm, which means that it can often be mounted directly on the motor's shaft without an intermediate adapter for shaft reduction. This reduces the total build length and, at the same time, facilitates assembly. Like all Leine Linde products, the sensor is designed for tough challenges. Mechanically, it has a dual set of heavy-duty bearings and a well-encapsulated enclosure. Electronically, it is built for reliability in harsh environments where it is exposed to vibration and electrical interference.

Modularity
Our innovative products and solutions can always be tailored for your specific requirements. We have a wide range of electrical interfaces to choose from, where signals can consist of square waves, sine waves, or even be optical with the help of a gateway for OptoLink transmission. On the mechanical side, there are a multitude of different shaft variants that cover the market's standards for both inch- and millimetre-based dimensions.

DNV's Marine Type Approval
The 700 series is tested and complies with DNV class rules for ships, offshore units, high-speed vessels, and light craft. Thanks to its increased resistance to salt air, salt water, high vibrations, and EMC (Electromagnetic Compatibility), the 700 series is suitable for use in marine equipment, such as engines in ships.

CERTIFIED FOR MARINE APPLICATIONS

DNV (Det Norske Veritas) is the world's leading classification society and a recognised advisor for the maritime industry. DNV has tested Leine Linde's 700 series* and approved their use for ships, offshore units, high-speed vessels, and light craft. For example, the encoders are suitable for use in machinery spaces, control rooms, pump rooms, holds, and more.

Simplified documentation process
The DNV certificate guarantees the reliability and quality of the product, which means you do not need to do any additional testing or evaluation. This simplifies the validation and documentation process from the motor for motor manufacturers to the commissioning for ship manufacturers and operators.

What is DNV Marine Type Approval?
The DNV Marine Type Approval is a well-known accreditation for the maritime business, defining standards for ships and offshore units. The certification ensures that the components comply with several standards, also known as class rules, that state requirements within quality and environmental performance. Among the certification classes are temperature, vibration, humidity, IP protection, and EMC (Electromagnetic Compatibility). The approval process includes a variety of tests within the classes, for example salt spray tests.

Location classes and status for the 700 series:
Temperature: D
Humidity: B
Vibration: B/C
EMC: A
Enclosure C

MODULARITY

RESOLUTION

Incremental pulses per revolution:			
10 ppr	400 ppr	1024 ppr	3072 ppr
50 ppr	500 ppr	1200 ppr	4000 ppr
100 ppr	512 ppr	1250 ppr	4096 ppr
150 ppr	600 ppr	1800 ppr	4800 ppr
200 ppr	720 ppr	2000 ppr	5000 ppr
256 ppr	800 ppr	2048 ppr	6350 ppr
300 ppr	900 ppr	2400 ppr	8192 ppr
360 ppr	1000 ppr	2500 ppr	10000 ppr

SHAFT

Through-going hollow shafts with insulation:	
Ø25 mm	Optional Ø30 mm
Ø20 mm	(without insulation)
Ø16 mm	Ø1 inch
Ø14 mm	Ø5/8 inch
Ø12 mm	Ø3/4 inch

ELECTRONICS

Output interfaces (supply voltage):	
HTL (5-30 Vdc)	RS422 (9-30 Vdc)
HCHTL (9-30 Vdc)	1 Vpp (5 Vdc)
TTL (5 Vdc)	

FLANGE

- Torque bracket (120°)
- Tether arm (with insulation)

CONNECTION

- M23 connector 12 pin (CCW)
- MS connector 10 pin
- MS connector 7 pin
- Cable (free length)

HEAVY DUTY 800 SERIES INCREMENTAL ENCODER

ROBUSTNESS AND RELIABILITY

Are you looking for the most robust, maintenance-free and cost-effective encoder? Then the 800 series is for you – it's the first choice of most engineers!

The product series has a long history of successful operation in applications within heavy industries, such as the steel, paper and wind power industries. These applications place stringent demands on robustness and reliability, and the encoder is designed thereafter. Mechanically it features a dual set of heavy duty bearings and a well-encapsulated enclosure. The electronics are designed to withstand an environment where it is exposed to powerful vibrations, electronic disturbances, and shock.

The 800 series can also be equipped with Leine&Linde's advanced diagnostics system, ADS, for condition-based maintenance. ADS constantly monitors the encoder's key functions and environmental parameters. In case an impending fault is detected a warning signal is immediately generated. This enables service that is only performed as necessary and that can be planned in ample time to avoid unforeseen breakdowns.

QUALITY INTO EVERY DETAIL

QUALITY INTO EVERY DETAIL

Enclosure
Robust cover with ingress protection class IP67 for protection against dust and liquids. Verified for use in salt water environments. Model available with ATEX/IECEx certification for hazardous environments.

Shaft and flange
Robust shaft sealing verified for IP66. O-ring for tight sealing of the hollow shaft to its mating shaft. Hollow shafts for fixing with an axial screw. Shaft dimensions: Ø12 mm, Ø16 mm, Ø17 mm taper. Solid shaft Ø 11 mm with key nut, and B10 Euro flange, for fixing with a shaft coupling. Through-going hollow shaft with dimensions Ø 25 mm or Ø 1 inch.

Bearings
Insulated peek insert to protect the bearings from shaft currents. Model available with ceramic bearings for increased insulation and prolonged lifetime. Heavy duty bearings allow the encoder to be placed in the most demanding environments, where it can be subjected to shock and vibrations daily without losing quality or accuracy.

Shock, vibrations, and temperature resistance
High accuracy code discs and robust electronics verified for powerful shocks, vibrations, and extreme temperatures.

Stable and easy mounting
Torque bracket available in a variety of orientations, for fixing of the torque arm. Separate back cover for connection of cable wires to screw terminals. Ample space for easy handling when connecting the cables. M23 connector or pre-mounted cable with or without flying connector available.

Protected against electronic interference
Short-circuit protection and polarity protection as standard. Overvoltage protection for protection against voltage peaks on the supply, for example due to lightning strokes. Earthing strap to conduct currents away from the encoder cover.

Resolution
Wide range of different pulse rates available from 1 to 10 000 ppr.

Output signals
Square wave signal output with 6 channels for differential transmission and reference pulse for relative position. Available with a big number of output signals according to market standards, like HTL, TTL, RS422, or 1 Vpp, as well as High Current HTL for transmission over long cables. Dual output models are available, with double scanning sensors and two galvanically insulated electronic circuits. The dual output signals can be used in two separate systems for different functions, or for achieving redundant signals.

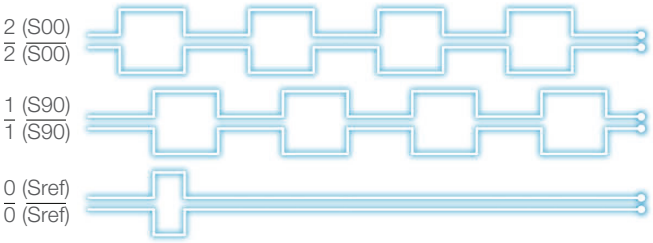
Programmable speed switch
The 800 series can be bought with Overspeed, which is the Leine&Linde speed switch solution with four programmable relays for the settings of your choice.

Data and encoder diagnostics
Leine &Linde's ADS solutions are advanced diagnostic systems, built into the encoder, enabling condition monitoring and predictive maintenance. ADS monitors the encoder functions as well as parameters like vibration and temperature in the motor installation.

Relevant certifications
Models available certified for use in hazardous areas, ATEX/IECEx zone 1/21, or 2/22. Functional safety certified encoders available up to risk level SIL2, PLd, category 3.

ELECTRONICS

SQUARE WAVE SIGNALS



Interface	TTL	RS 422	HTL	HCHTL
Supply	5 Vdc	9-30 Vdc		
Output signal	5 Vdc	5 Vdc		
Suitable for	Low frequencies short cable	High frequencies over long cables	High frequencies over medium-length cables	Medium frequencies over long cables
Max frequency	200 kHz	200 kHz	200 kHz	200 kHz
Max cable length	50 m at 50 kHz	1000 m (TiA/EIA - 422-B)	100 m at 100 kHz	350 m at 100 kHz

DUAL OUTPUTS

Two separate encoders can be combined into one and the same cover. This solution provides added safety in the form of redundancy, the outputs are based on two separate scanning LED:s and electronic circuits. The outputs are galvanically insulated from each other and may be connected to two separate systems for different functions or for redundancy.

Available in model 855 and 865

SINE WAVE SIGNALS

Sine waves are an alternative form of output signal. The Analog signal produces a unique amplitude for each position on the wave, allowing interpolation and very high resolutions. The interface 1 Vpp is often used in safety-critical applications where detection is required of extremely small movements.

Available in model 801, 803, 850, 861 and 862

DIGITAL SPEED OVER PROFIBUS

With this option the encoder has two different connections, one with a standard incremental output and another for communication over PROFIBUS.

The standard incremental pulse output is used for connection to the inverter for direct speed control, while the additional PROFIBUS output can be connected to another system where a reference value of the speed is required. The speed is calculated internally in the encoder and is sent over the fieldbus.

Available in model 850, 861 and 862

OPTOLINK TRANSMISSION INTEGRATED

System for transmission of incremental encoder signals in an optical fibre can be integrated into the encoder. This is suitable for use in environments with high electromagnetic disturbances, transmission of signals over long distances (up to 1,5 km) and where galvanic insulation is required.

Available in model 801, 803 and as a separate Optolink module (CRG Optolink)

MORE THAN JUST AN ENCODER

ADS UPTIME – MORE DATA, MORE CONTROL

ADS Uptime is Leine &Linde's most recent advanced diagnostic system, which enables more control over both the encoder and its immediate environment, such as the motor installation. Forestall problems before they occur. Get detailed data for scanning quality, frequency, time in motion, and vibration in both radial and axial directions. ADS Uptime continuously records and stores data, and gives a warning or an alarm anytime something outside the set specifications occurs. ADS Uptime can be used with an app on a mobile device for wireless service check-up (via Bluetooth) and/or connected via OPC-UA to the systems of your choice.

Available in model 850, 861 and 862.

ADS ONLINE – ENABLES PREDICTIVE MAINTENANCE

ADS Online is an advanced diagnostic system that not only monitors the encoder key functions, but also the ambient environmental parameters, such as supply voltage, vibration, and temperature. ADS Online also records and stores data, and gives a warning or an alarm anytime something outside the set specifications occurs. The encoders can be connected to an Ethernet network to provide access to diagnostics and analysis.

Available in model 801, 803, 850, 861 and 862.

ADS CLASSIC – BUILT-IN CONDITION MONITORING FUNCTIONALITY

ADS Classic is the advanced diagnostic system that continuously monitors the encoder functions. If serious deviations are detected, a warning is transmitted, enabling action to be taken. This system is integrated into the encoder and is used in applications with high demands for reliability, for example, in motors for continuous operation at a paper mill.

Available in model 801, 803, 841, 850, 861 and 862.

OVERSPEED – INTEGRATED PROGRAMMABLE SPEED SWITCH

Overspeed is Leine&Linde's integrated programmable speed monitoring solution. It detects not only overspeed, but also underspeed, direction, and standstill, depending on how the user chooses to program the settings. Up to four relays can be set to react at desirable levels. One and the same encoder covers the speed range 0-6000 rpm and can easily be programmed or reprogrammed via the associated PC-software.

Detailed datasheets with relay settings and other information is available at www.leinelinde.com under Downloads.

Available in model 850, 861, 862, and as a separate Overspeed module.

ATEX/IECEX-CERTIFICATION FOR HAZARDOUS ENVIRONMENTS

Explosive atmospheres demand extraordinary encoder solutions. The model XHI 841 is available for Ex zone 1/21, with Ex db (gas) and Ex tb (dust) protection. Several models from the 800 series are also declared and available for Ex zone 2/22, with Ex ec (gas) and Ex tc (dust) protection.

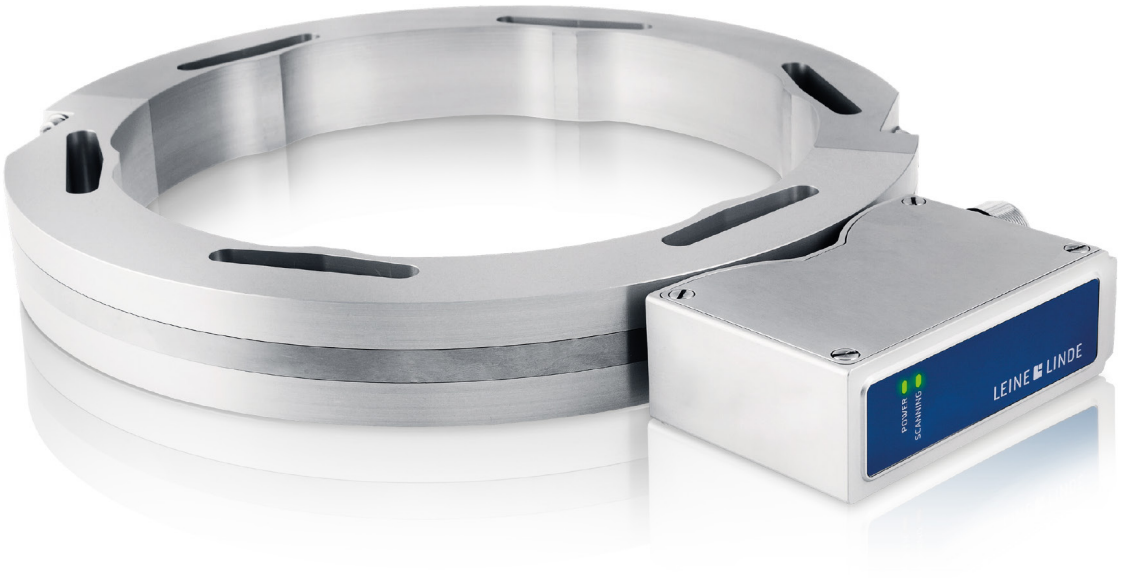
The 841 encoder is certified according to EAC TR CU for distribution within the Customs Union.

Read more in the Oil & gas application brochure from Leine&Linde.

FSI 800 SERIES – FOR SAFE SPEED

FSI is Leine&Linde's certified functional safety product line. The FSI 800 series includes incremental encoders for drives, with hollow shaft and solid shaft. The certifications are made in accordance with EN ISO 13849-1, EN 61800-5-2, IEC 61508 and EN IEC 62061. As a result, the encoders can be used in functional safety applications up to risk level SIL2 and PLd, category 3.

BEARINGLESS 2000 SERIES ENCODERS FOR LARGE SHAFTS



LOW-MAINTENANCE FOR LARGE SHAFTS

Certain motors benefit from having the speed feedback sensor mounted directly on the main shaft. A bearingless sensor, mounted between the other parts in the machinery, takes up less space and requires less maintenance. The Leine Linde 2000 series is designed to meet this demand, also for shaft dimensions around a meter, or larger.

WIDER TOLERANCE FOR RUNOUT

The 2000 series is suitable for heavy duty applications, where motors are exposed to powerful shocks and vibrations, subjected to heavy mechanical forces. The 2000 series accepts an air gap of up to 6 mm between the rotating ring and the fixed scanning unit, which allows for a certain runout of the motor. This is why the Leine Linde ring offers significantly better performance than most ring products found on the market.

COMMISSIONING MADE SIMPLE

Easy access for mounting and service saves commissioning time. The Leine Linde ring can be mounted from two sides of the shaft, as it is segmented into pieces. Fix the ring to the shaft by flange mounting or by the Leine Linde ClampFit solution. With the ClampFit solution, the ring automatically tightens around the mating shaft as the ring segments are screwed together. This enables fixing to a standard cylindrical shaft without any flange expansion prepared and makes retrofitting easy.

VARIOUS INTERFACES

The scanning head unit uses several market standard interfaces for incremental signals. The interface High Current HTL has been specially designed for long distance transmission. This is extra useful in the process industry, where very long cables may be needed to reach out to each encoder in the factory.

ENGINEERED FOR ENDURANCE

ELECTRONICS

6 channel square wave signal for differential transmission and a reference pulse for relative position. Available with different standard incremental interfaces.

Interface	Supply voltage
HCHTL	9-30 Vdc
HTL	9-30 Vdc
RS422	9-30 Vdc
TTL	5 Vdc

Resolution
Resolution can be specified according to the requirements of the application. Resolution is available from 1 to 16383 ppr.

Wide air gap
Between ring and scanning head a gap is allowed in order to permit thermal expansion or runout of the application's mating shaft. Radial tolerance is 0.1-3 mm and axially a ±4 mm offset is allowed.

Extended scanning
Greater runout tolerance, up to 6 mm, is available for shaft sizes over 400 mm.

Extra scanning heads
Available for achieving redundancy and increased connectivity with multiple sources, drives, or controllers.

Protective stainless steel surface
Ensures the magnetic tape is not damaged by exposure to mechanical hits.

MECHANICS

Bearingless
Designed for wear-free operation.

Segmented into pieces
The ring is segmented for easy access and commissioning.

ClampFit design
Simplifies the manner of fixing the ring to any standard cylindrical shaft. When the ring segments are screwed together, the tethers will automatically tighten the ring to the mating shaft with only radial force.

Flange mount design
Axial screw holes in the ring enable fixing to a flange expansion on the application's mating shaft.

Light-weight aluminium
Facilitates handling and transport. Anodized surface for use in salt water environments.

Inner and outer diameter
Flexible to customisations, as the scanning technology is made to compensate for almost any circumference.

Tethers
Eccentricity or thermal expansion of the mating shaft is compensated for by tethers. They ensure that the outer surface of the ring stays within optimal scanning range from the scanning head unit to give the best signal quality.

Magnetical tape
With alternating north and south poles for pulse generation.

SATEC
POWER MONITORING
& ANALYSIS

SATEC

POWER & QUALITY

Founded in 1987, SATEC is a market leader in the field of power quality analysis and power metering. SATEC was one of the first companies to pioneer this field, introducing one of the very first digital power meters, and ever since SATEC has made its priority to lead and innovate.

For over 35 years now, prominent global utilities and industrial leaders have made SATEC their go-to choice, for both off-the-shelf and bespoke solutions, for telemetry and energy management, working together with us on product design. SATEC designs, develops and manufactures in-house its full range of products, hardware and software alike.
Quality is reliability. Reliability mirrors hardware durability and clockwork functionality.

For over 35 years of global growth, development and evolution, SATEC solutions have incorporated the most stringent requirements of utilities and users from all over the globe. Our products have come to comply with harsh environmental requirements, maintaining functionality in temperatures as low as -40C and as high as 70C. Drastic surge protection requirements (12kV) and humidity resistance requirement up to 98% are examples as well.

Our clients have learned to invest in SATEC systems, because our power inputs include galvanic isolation. Because our communication ports will not burn out during thunderstorms and since the communication speed supplied is unmatchable.

EM133 MULTI-FUNCTION POWER METER

MULTI-FUNCTION POWER METER

SATEC EM133 is a multifunction power meter, ideal for a wide range of applications such as revenue metering, industrial power monitoring and for interfacing SCADA in utility substations.

The EM133 can be fitted with a wide range of communication interfaces and I/O extensions, making it a cost-effective combination of a power meter, smart transducer and PLC controller.

MID certified for revenue metering, it is designed for DIN-rail mounting, equipped with built-in communication ports, digital I/Os and anti-tamper enclosures.

HIGHLIGHTS

Accuracy: Class 0.5/0.5S per ANSI / IEC 62053-22
Revenue Meter: anti-tamper design; can bill 3 individual single phase clients; IR interface.

MID CERTIFIED

Communication

- Built-in ports: RS485; IR (optical)
- Optional ports: ETH; Wi-Fi; cellular; Profibus
- Open protocol: Modbus RTU; DNP3.0;
- IEC 60870-5-101/104

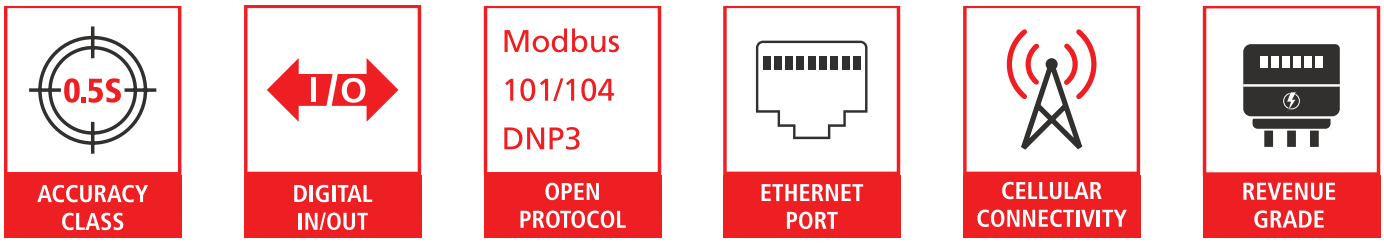
Digital & Analog I/O

- Built-in I/O: 1 RO; 2 DI
- Modular I/O: up to 16 I/O
- Smart Transducer: 4 analog outputs

Broad-range frequency measurement: 25-400 Hz

MODELS

EM133	Standard
EM133-XM	Extended Memory version. Over 40-fold memory capacity than standard model. Features sensor for internal unit temperature.
EM133-MID	MID certified (5A)



MULTIFUNCTIONAL 3-PHASE SMART METER

- True RMS volts, amps, power, power factor, neutral current, angles and unbalance for voltage and current, frequency, symmetrical components and many more.
- Ampere/Volt demand meter.
- 25, 50, 60 and 400 Hz measurements.
- 28 samples per cycle.

BILLING/TOU ENERGY METER

- Accuracy Class 0.5S per IEC 62053-22 / ANSI.
- MID certified EN50470-3 Class B or C (5A).
- Four-quadrant active and reactive energy polyphase static meter.
- Three-phase total and per phase energy measurements; active, reactive and apparent energy counters.
- Time-of-Use, 4 totalisation and tariff energy/ demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day.
- Easy programmable tariff calendar schedule.
- Automatic logging of daily energy and maximum demand profiles (total & TOU).

HARMONIC ANALYSER

- Individual voltage & current harmonic spectrum and harmonic angles up to 40th order harmonic.
- Voltage and current THD, TDD and K-Factor.

REAL-TIME WAVEFORM CAPTURE (VIA PC)

- Real-time “scope mode” waveform monitoring via PAS software.

PROGRAMMABLE LOGICAL CONTROLLER

- Embedded programmable controller.
- 16 control set points; programmable thresholds and delays.
- Relay output control.
- 1-cycle response time.

EVENT AND DATA RECORDING

- Non-volatile memory for timestamped event and data logging: over 90 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 200 events.
- Optional extended memory version: 40 times the capacity of the standard model. Reads and displays additional utility meter pulses as customized labels (water, gas etc.). This version includes a sensor for internal unit temperature and a battery status monitor.
- Event recorder for logging internal diagnostic events and setup changes.
- Two data recorders; programmable data logs on a periodic basis.

VOLTAGE INPUTS

- Direct measurement 0-690V AC.

EVENT AND DATA RECORDING

- Non-volatile memory for timestamped event and data logging: over 90 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 200 events.
- Optional extended memory version: 40 times the capacity of the standard model. Reads and displays additional utility meter pulses as customized labels (water, gas etc.). This version includes a sensor for internal unit temperature and a battery status monitor.
- Event recorder for logging internal diagnostic events and setup changes.
- Two data recorders; programmable data logs on a periodic basis.

DIRECT MEASUREMENT 0-690V AC

- Direct measurement 0-690V AC.

CURRENT INPUT OPTIONS

- 1A or 5A inputs from CT secondary
- 40mA input designed for SATEC HACS CTs (100- 3000A options).
- 63A Direct connection
- RS: unique input for 5A rated split-core HACS
- CTs, ideal for retrofit installation

DIGITAL AND ANALOG I/O

- Built-in: 2 Digital Inputs and 1 form A SSR.
- Available I/O modules.
- **4DIO**: four digital inputs and two relay outputs (as SSR or EM relay). 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses.
- **12DIO**: twelve digital inputs, 4 relay outputs (incl. optional port: ETH or additional RS485).
- **4AO**: four analog outputs (internal power supply); selection of 0-20mA, 4-20mA, 0-1mA, 0-3mA, 0-5mA, ±1mA and ±5mA output; 1 cycle update time.
- **8DI**: eight digital inputs with 1-ms scan time.
- **2AI**: 2 analog inputs (4-20mA. available with T3G-y-2AI cellular module).

DISPLAY

- 2x16 characters LCD display; adjustable update time
- Auto-scroll option; auto-return to a default page

TECHNICAL SPECIFICATIONS

POWER METER

- Voltage, current (including neutral current), power, energy, power factor, frequency, voltage/current unbalance.
- Ampere/Volt demand meter.
- 25, 50, 60 and 400 Hz measurements.
- Sampling frequency: 128 samples per cycle.

REVENUE METER

- Class 0.5/0.5S accuracy per ANSI C12.20 / IEC 62053-22.
- Optional: MID certified, Class B or C (EN50470-3); 5A input is mandatory.
- Four-quadrant import and export (e.g. PV), active and reactive energy poly-phase static meter.
- Three-phase total and per phase energy measurements; active, reactive and apparent energy counters.
- Time-of-Use, 4 totalisation and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day.
- Easily programmable tariff calendar schedule.
- Automatic daily energy and maximum demand profile log for total and tariff registers.
- Sealable, revenue grade anti-tamper design.

HARMONIC ANALYSER

- Voltage and current THD, TDD and K-Factor.
- Voltage and current harmonic spectrum and angles, up to the 40th order harmonic

DATA LOGGER

- Non-volatile memory for timestamped event and data logging: over 90 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 200 events.
- Event recorder for logging internal diagnostic events and setup changes.
- Two data recorders; programmable data logs on a periodic basis.

VARIABLE CURRENT INPUTS

Available options:

- 5A (mandatory for MID)
- 1A
- HACS: special 40mA inputs for SATEC's High Accuracy Current Sensors.
- 63A Direct Measurement
- RS5: Special 5A input for 5A clip-on HACS for retrofit installation on existing MV/HV CT secondary.

VOLTAGE MEASUREMENT INPUT RATING

- **Nominal voltage**: 400/690V AC (L-N/L-L)
- **Operating range**: 15-480/828V AC (L-N/L-L)

I/O

Built-in:

- 2 Digital Inputs
- 1 form A digital output (Solid State Relay)

Modular I/O (available options):

- 4 Digital Inputs + 2 digital outputs (SSR or EM)
- 12 Digital Inputs + 4 Digital Outputs (including additional com port of choice)
- 8 Digital Inputs
- 4 Analog Outputs (for Smart Transducer application)

(see Module tab for detailed spec)

PROGRAMMABLE LOGICAL CONTROLLER

- Embedded programmable controller.
- 16 control set points; programmable thresholds and delays.
- Relay output control (for alarm and protection).
- 1-cycle response time.

REAL TIME CLOCK

- Built-in clock and calendar functions
- 2 year battery backup

COMMUNICATION INTERFACES

Built-in:

- Standard 2-wire RS-485
- IR (optical)

Add-on Com Modules (1 per device):

- Multipurpose RS-232/422/485 port
- ETH 10/100Base-T
- PROFIBUS
- 2G/3G/4G modem
- Wi-Fi module

COMMUNICATION PROTOCOLS

- Modbus RTU/TCP
- ASCII
- DNP 3.0/TCP
- IEC 60870-5-101/104

POWER SUPPLY

Available options:

- Self-powered from measured voltage (120/207 – 277/480V AC, L-N/L-L)
- Auxiliary AC/DC power supply (85-265V AC, 88-290V DC)
- Special versions (12, 24-48V DC)

PLUG-IN MODULES

The EM133 modular configuration enables users to assemble a system that meets their specific needs.

MODULE DIMENSIONS (HxWxD):

- Small form: 2.8×1.8×1.3” / 72×46×34 mm
- Large form: 3.7×3×1.7” / 95×77×45 mm

8 DIGITAL INPUTS

- 8 Dry Contacts, internally wetted @ 24V DC

SECOND COMMUNICATION PORT - SMALL FORM

One of the following:

- Ethernet (TCP/IP)
- PROFIBUS
- RS232/422/485
- 2G/3G/4G
- RF *
- Wi-Fi

* Module & accessories available in certain regions only

4 ANALOG OUTPUTS - SMALL FORM

4 analog outputs selection of ranges upon order:

- ±1mA
- 0-20mA
- 0-1mA
- 4-20mA
- 0-5mA
- ±5mA

6 DIGITAL I/O - SMALL FORM

One of the following:

- 4 Digital Inputs (Dry Contact) + 2 Relay Outputs 250V / 5A AC
- 4 Digital Inputs (Dry Contact) + 2 SSR Outputs 250V / 0.1A AC

16 DIGITAL I/O - LARGE FORM

- 12 Digital Inputs (Dry Contact or 250VDC)
- 4 Relay Outputs 250V/5A AC
- Optional selection of additional ETH, RS-485 or Profibus com port in module

PM130 PLUS MULTI-FUNCTION POWER METER

MULTI-FUNCTION POWER METER

The PM130 PLUS is a compact, multi-function power-meter, designed for metering three-phase AC current or three DC current circuits.

Featuring versatile I/O options, communication ports and protocols, it is suitable for integration in utility substation or industrial SCADA systems.

A bright 7-segment LED display, accompanied by a LED load-bar, enables easy on-site access to power parameters and viewing of load percentage at a glance.

DC METERING

The PM130 allows also Direct Current (DC) metering via shunt, making it a unique meter compatible with DC applications such as renewable energy or data centres.

HIGHLIGHTS

Accuracy: Class 0.5/0.5S per ANSI/IEC 62053-22

Communication:

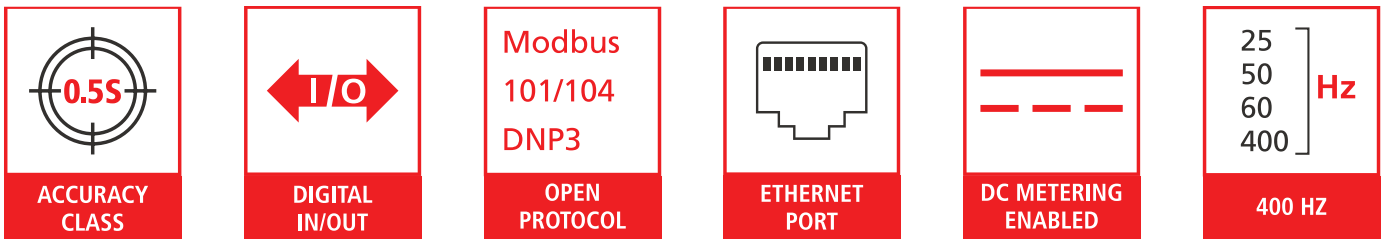
- Built-in port: standard RS-485
- Optional ports: ETH; Profibus
- Open protocol: Modbus RTU, DNP3.0, IEC 60870-5-101/104

Digital and Analog I/O Modules: up to 16 I/O

DC Enabled: metering DC loads via shunt resistors

Broad-range frequency measurement: 25-400 Hz

LED Bar-graph: Displays load as percentage of nominal current



MULTI-FUNCTIONAL 3-PHASE POWER METER

- True RMS volts, amps, power, power factor, neutral current, angles and unbalance for voltage and current, frequency and many more parameters.
- Symmetrical components.
- Ampere/Volt demand meter.
- 25, 50, 60 and 400 Hz measurements @ 3 decimal digit values.
- 128 samples per cycle.

BILLING/TOU ENERGY METER (PM130E & PM130EH)

Accuracy:

- Class 0.5S per IEC 62053-22.
- Class 0.2 per IEC 61557-12.
- Class 0.5 per ANSI C12.20, four-quadrant active and reactive energy polyphase static meter.

Three-phase total and per phase energy measurements; active, reactive and apparent energy counters.

Time-of-Use, 4 totalisation and tariff energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day.

Easy programmable tariff calendar schedule.

Automatic daily energy and maximum demand profile log for total energy and tariff registers.

HARMONIC ANALYSER (PM130EH)

- Individual voltage & current harmonic spectrum and harmonic angles up to 40th order harmonic.
- Voltage and current THD, TDD and K-Factor.

REAL-TIME WAVEFORM CAPTURE (VIA PC)

- Real-time “scope mode” waveform monitoring via PAS software.

PROGRAMMABLE LOGICAL CONTROLLER

- Embedded programmable controller.
- 16 control setpoints; programmable thresholds and delays.
- Relay output control.
- 1-cycle response time.

EVENT AND DATA RECORDING (PM130E & PM130EH)

- Non-volatile memory for timestamped event and data recording: 48 days for 2 daily TOU records, half-hourly writing of 4 parameters and recording over 100 events during the entire period.
- Event recorder for logging internal diagnostic events and setup changes.
- Two data recorders; programmable data logs on a periodic basis; automatic daily energy log and maximum demand profile.

VOLTAGE INPUT OPTIONS

Direct Measurement:

- 0-690V AC
- 0-670V DC*

* extended range up to 1500V DC is possible via SATEC VRM

CURRENT OPTIONS

- 1A or 5A inputs from CT secondary
- 40mA input designed for SATEC HACS CTs (100- 3000A options)
- DC metering: current measurements using Hall Effect Sensors. meter accuracy: 0.5%. System accuracy set by implemented sensor
- RS: unique input for 5A rated HACS CT

DIGITAL AND ANALOG I/O

Available I/O modules:

TOD (TOU+4DI): four digital inputs with 1-ms scan time and battery backup for real time clock; automatic recording of last five digital input change events with timestamps (see the PM130 PLUS Modbus Reference Guide).

DIOR: 4 digital inputs and 2 relay outputs with 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses, selection of solid state or electromechanical relays.

12DIOR: 12 digital inputs, 4 relay outputs (incl. optional ETH port or additional RS485 port).

4AO: four optically isolated analog outputs with an internal power supply; selection of 0-20mA, 4-20mA, 0-1mA, and ±1mA output; 1 cycle update time.

8DI: eight digital inputs with 1-ms scan time.

COMMUNICATION

On-board interface

- Standard 2-wire RS-485

Optional interfaces

- ETH (10/100Base T)
- Multipurpose RS-232/485
- PROFIBUS

Client (Modbus/TCP over ETH)

- TCP notification client for communicating events or periodic reports to remote server
- Expertpower client on subscription basis

Communication protocols

- Modbus RTU
- SATEC ASCII
- DNP 3.0 (Level 2)
- IEC 60870-5-101 (optional)
- IEC 60870-5-104 (optional)

APPLICATIONS

DISPLAY

- Easy to read 3-row (2x4 digits + 1x5 digits) bright LED display
- Adjustable display brightness and update rate
- Auto-scroll option with adjustable page; auto-return to a default page
- LED bar-graph displaying load as percentage of nominal load current (user-definable)

METER SECURITY

- Password security for protecting meter setups and accumulated data from unauthorized changes

UPGRADEABLE FIRMWARE

- Device firmware is easily upgraded through the serial or Ethernet port

SOFTWARE SUPPORT

- SATEC's Power Analysis Software (PAS) for comprehensive configuration and data acquisition is available for download (free): https://www.satec-global.com/products/pas/ Always make sure to update .exe file with latest version on webpage.
- Expertpower web-based energy management platform (subscription)
  Please visit https://www.satec-global.com/products/expertpower
- Any 3rd party software supporting open-protocol

REAL-TIME CLOCK

- Internal clock with 20-second retention time.
- Optional battery backup (TOU+4DI module).

UNIQUE DESIGN

- Pass through CT connection
- Built-in auxiliary terminal for loose CT wires
- Dual panel mounting: 92×92mm square or 4" round cutout

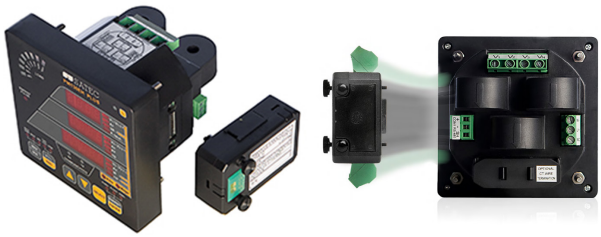
MODELS

PM130P	Basic model offering voltage, current, power and frequency measurements
PM130E	Offers all the features above, as well as energy measurements and data logging (available in certain regions only)
EM133-MID	Offers all the features above, as well as harmonic analysis

All models offer identical communication and control features.

PLUG-IN MODULES

The PM13X modular approach enables users to assemble a system that meets their specific needs.



DIMENSIONS (HxWxD):

- Small form: 2.8×1.8×1.3”/ 72×46×34 mm
- Large form: 3.7×3×1.7” / 95×77×45 mm

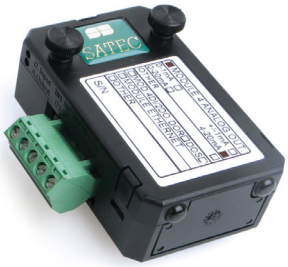
8 DIGITAL INPUTS

- 8 Dry Contacts, internally wetted @ 24V DC

SECOND COMMUNICATION PORT - SMALL FORM

One of the following:

- Ethernet (TCP/IP)
- PROFIBUS
- RS232/422/485
- 2G/3G/4G
- RF *
- Wi-Fi
- * Module & accessories available in certain regions only



4 ANALOG OUTPUTS - SMALL FORM

4 analog outputs selection of ranges upon order:

- ±1mA
- 0-20mA
- 0-1mA
- 4-20mA
- 0-5mA
- ±5mA

6 DIGITAL I/O - SMALL FORM

One of the following:

- 4 Digital Inputs (Dry Contact) + 2 Relay Outputs 250V / 5A AC
- 4 Digital Inputs (Dry Contact) + 2 SSR Outputs 250V / 0.1A AC

16 DIGITAL I/O - LARGE FORM

- 12 Digital Inputs (Dry Contact or 250VDC)
- 4 Relay Outputs 250V/5A AC
- Optional selection of additional ETH, RS-485 or Profibus com port in module

BFM-II MULTI-CIRCUIT POWER AND ENERGY METER

A REVOLUTIONARY APPROACH TO MULTI-CIRCUIT METERING

The Branch Feeder Monitor™ multi-circuit meter is ideal for both new and retrofit projects. It displays and logs parameter readings of energy, power and demand, along with multi-tariff (ToU) capabilities.

The BFM-II monitors up to 18 three-phase circuits, 54 single-phase circuits, or any combination of single, two-phase or three-phase circuits. This flexibility makes the BFM-II perfect for multi-tenant facilities such as residential projects, office buildings and shopping malls.

The BFM's modular design enables it to meet any requirement and to fit easily into existing panel boards or be flush mounted nearby. In effect, the BFM II is a whole metering room crammed into one compact device, significantly reducing costs.

SAFE REMOTE INSTALLATION

The BFM II utilizes High Accuracy Current Sensors (HACS). These SATEC branded CTs act as a primary CT, with a product range of up to 3000A. These CTs feature low-burden milliamp outputs, feeding directly into the meter, making it a "One-CT" system, thus considerably increasing accuracy.

Equipped with an internal electronic switch, providing an automatic protection circuit, these CTs prevent fire hazards regularly associated with disconnected CT outputs, rendering shorting bars unnecessary. Due to the low output burden, it is possible to run wiring to loads up to 200m away, without any compromise to accuracy.

For billing purposes, single or multiple circuits can be defined for each customer. This flexibility allows simple reassignment of circuit groups without wiring changes, and easy changes when tenants move in and out.

THE PERFECT SOLUTION FOR MULTI-CIRCUIT METERING

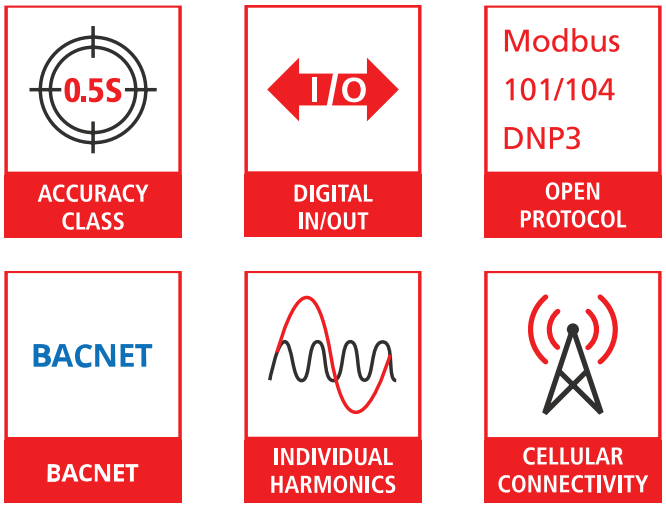
Modular Design:
- Up to 54 current channels
- Up to 72 I/O

Digital Fault Recorder (optional):
- Recording waveforms up to 40 x In

INDIVIDUAL HARMONICS ANALYSIS

Billing Meter:
- Anti-tamper design
- Time-Of Use (ToU) metering

Simultaneously Metering 2 Independent Power Sources



FEATURES

Multifunctional 3-Phase Smart Meter
- True RMS volts, amps, power, power factor, neutral current and frequency, and many more
- Ampere/Volt demand meter
- 50/60 Hz measurements

Waveform & Fault Recorder
Independent product; limited to 12 three-phase current channels.
- Digital Fault Recording with pre / post fault waveform capture on 36 current channels and 4 voltage channels.
- Time-tagged fault events included in fault event report.
- Triggered externally through device digital inputs or internally from embedded fault detector.
- Automatic detection of fault category using the sub-cycle measurements.
- Fault triggers include programmable thresholds and hysteresis, adjustable for specific substation conditions.
- Recording input waveforms and long-duration RMS trends during fault.

Billing/TOU Energy Meter
- Accuracy Class 0.5S/0.5 per IEC 62053-22 / ANSI.
- Four-quadrant active and reactive energy poly-phase static meter.
- Three-phase total and per phase energy measurements; active, reactive and apparent energy counters.
- Time-of-Use, 8 energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day, easily programmable tariff schedule.
- Automatic 120-day daily profile for energy and maximum demand readings (total and tariff registers) for each submeter.
- Easily programmable tariff calendar schedule.
- Automatic logging of daily energy and maximum demand profiles (total & TOU).

Harmonic Analyser
- Individual voltage & current harmonic spectrum and harmonic angles up to 25th order harmonic.
- Voltage and current THD, TDD and K-Factor.

Programmable Logical Controller
- Embedded programmable controller.
- 4 control set points; programmable thresholds and delays.
- Relay output control.
- 1-cycle response time.

Event and Data Recording
- Non-volatile memory for timestamped event and data recording for each channel.
- Event recorder for logging internal diagnostic events and setup changes.
- Two data recorders; 2 separate programmable data logs, on a periodic basis, per channel.

Voltage Inputs
- Direct measurement 0-561V AC.
- Dual Input Voltage: a second set of 3-phase voltage inputs (VIM module) is available for measurement of a parallel power source. Each set of measured currents is ascribed to one of the two voltage sets.

Note: using the VIM module limits the instrument' capacity to 36 current channels.

Current Input Options
The BFM II features unique milliamp inputs. Each current-input module is ordered for individual compatibility with one of the three CT options below. Modules may be mixed and matched within the 18- 54 circuit channels. Each module is specified to host only one of these 3 input options:
- **HACS**: 40mA input designed for SATEC HACS CTs (100-3000A options).
- **RS5**: 40mA input designated for 5A split-core HACS for reading 5A from CT secondary, ideal for retrofit installation.
- **Flex**: for interfacing 3VAC current sensor output.

DIGITAL AND ANALOG I/O

Available I/O modules
- **9DI**: nine digital inputs (dry contact / 24/125/250V DC). 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses.
- **18DI**: eighteen digital inputs (max. 4 per device)
- **4AI**: four analog inputs; selection of 0-20mA, 4-20mA, 0-1mA and ±1mA output; 2 cycle update time
- **9RO**: nine form A relay outputs (max. 2 modules per device)

Software Support
- Includes comprehensive Power Analysis Software (PAS) for configuration and data acquisition.
- SATEC's Expertpower web-based energy management platform (subscription).
- Any 3rd party software supporting open-protocol.

HIGHLIGHTS

Cost-effective:
- Saves drastically on installation costs and space occupied by dozens of legacy meters.

Multi-circuit:
Modular options for multi-load metering.
- Up to 18 three-phase loads
- Up to 54 single-phase loads
- Various combinations of the two

Dual Input Voltage:
- 2 parallel measurements for 2 different 3-phase power sources (VIM module; optional).

Revenue Meter:
- Class 0.5/0.5S accuracy per ANSI C12.20 / IEC 62053-22
- Anti-tamper design

Communication
- Built-in ports: RS485; ETH
- Optional: 3G modem
- BACnet; Modbus RTU; DNP3.0
- IEC 60870-5-101/104

Digital & Analog I/O (modular)
- Digital I/O: up to 72 digital I/O
- Analog: up to 16 inputs

Multi-option Current Inputs
- 40mA for HACS CTs (5 – 3,000A)
- 3V AC inputs for flex clamps (Rogowski coil)

TECHNICAL SPECIFICATIONS

Power Meter
Power: True RMS volts, amps, power, energy, power factor, neutral current and many more.
- Event and parameter data-logging.
- Measurement at 50/60 Hz.
- Sampling frequency: 64 samples per cycle.

Harmonic Analyser
- Voltage and current THD, TDD and K-Factor.
- Voltage and current harmonic spectrum and angles, up to the 25th order harmonic.

Revenue Meter
- Class 0.5S / 0.5 accuracy per IEC 62053-22 / ANSI C12.20 for active energy.
- Anti-tamper design.
- Bills up to 18 individual three-phase clients or 54 single-phase clients or various combinations in between.
- Time-of-Use billing and logging: 8 energy/demand registers x 8 tariffs, 4 seasons x 4 types of days, 8 tariff changes per day, easy programmable tariff schedule.
- Automatic 120-day daily profile for import/export energy and maximum demand readings (total and tariff registers) for each submeter.
- Pulse reading via DI for water and gas meters.

Variable Current Inputs
- HACS: 40mA HACS CT designated inputs (available HACS ratings: 100A-3,000A).
- RS5: inputs for specific split-core HACS CTs rated 5A.
- 3V AC: inputs for Flex Clamps (Rogowski Coil).

Voltage & Power Supply
- Nominal voltage: 120/208 – 277/480V AC (L-N/L-L).
- Operating range: 70-561V AC 50/60 Hz (direct connection, L-L).
- Self-Energized from measured voltage.
- Optional auxiliary power supply: 50-290V AC, 40*-290V DC.
- *Above 60°C – minimum 90V DC

Dual Voltage Inputs
- Voltage Input Module: a set of 3-phase voltage inputs for metering parallel power sources.
- Calibrated at either 50 Hz or 60 Hz.
- Every submeter can be assigned to one of the measured voltages.
- Rating: identical to main voltage inputs (70 – 571V AC, L-L).

Note: When the VIM module is used, the total maximum amount of 3-phase current channels is 12

Modular I/O
- Up to 72 DI
- Up to 18 DO
- 4 Analog input option
- (see Module Page for detailed spec)

Programmable Logical Controller
- Embedded programmable controller.
- 4 control setpoints, programmable thresholds and delays for each submeter.
- Relay output control (for alarm and protection).
- 1 cycle response and update time.

Graphic Display Module (GDM)
- Optional 3.5” 320×240 pixel touch-screen graphic display.

Real Time Clock
- Built-in clock and calendar functions
- Accuracy: < 5 sec/month @ 25°C

COMMUNICATION INTERFACES

Built-in:
- RS485
- Ethernet (10/100Base-T)
- USB (Type A)

Optional:
- 2G/3G modem

Communication Protocols
- Modbus
- ASCII
- BACnet
- DNP3.0
- IEC 60870-5-101/104

Meter Security
- 3 level password security for protecting meter setups and accumulated data from unauthorized changes.
- Anti-tamper design (wiring seal).

Mounting
- DIN-rail

MODULES

BFM-II MODULES

The BFM supports various add-on modules:

- Current inputs
- Additional voltage inputs
- I/O
- Auxiliary power supply
- 2G/3G modem

Please see below for options and rules regarding possible combinations.

2ND VOLTAGE INPUT SET (VIM)

One Voltage Input Module (VIM) per device (optional) calibrated at either 50 Hz or 60 Hz.

Rating:

- Nominal voltage: 120/208 – 277/480V AC (L-N/L-L)
- Operating range: 70-561V AC 50/60 Hz

CURRENT INPUT MODULES (CIM)

Up to 2 CIM modules per instrument
Up to 1 CIM module per instrument when employing VIM module

- 6 current input module – HACS version
- 6 current input module – RS5 version
- 6 current input module – FLEX version
- 18 current input module – HACS version
- 18 current input module – RS5 version
- 18 current input module – FLEX version

AUXILIARY POWER SUPPLY

Rated voltage: 50 – 290V AC, 40*- 290V DC
* Above 60°C – min. 90 VDC

I/O

Up to 4 DI/AI modules per BFM
Up to 2 RO modules per BFM

- **9DI**: nine digital inputs (dry contact / 24/125/250V DC). 1-cycle update time; unlatched, latched, pulse and KYZ operation; energy pulses
- **18DI**: eighteen digital inputs
- **4AI**: four analog inputs, selection of: 0-20mA, 4-20mA, 0-1mA and ±1mA output; 1 cycle update time
- **9RO**: nine form-A relays

2G/3G CELLULAR MODEM

Includes 2nd RS-422/485 communication port

PMU PRO

PHASOR MEASUREMENT UNIT

A Phasor Measurement Unit, or PMU for short, is the essential building block in the platform called Wide Area Monitoring System (WAMS).

These systems were developed to provide an overall real-time health check of nation-wide transmission grids, predicting and helping to prevent power failures, analysing those which did take place.

By interfacing Global Positioning System (GPS) receivers or clocks, or using Precision Time Protocol (PTP) the PMU reaches micro-second precision. This enables it to provide razor-sharp resolution snapshots of the angles formed by the measured parameters.

Providing the highest performance, and incomparably cost-effective, the PMU PRO is a true game-changer, especially in the field of Distribution System Operators (DSO). It communicates with 3rd party Phasor Data Concentrators (PDC), an important WAMS component in itself, enabling versatility.

A WAMS REVOLUTION

The PMU PRO is a true game changer in the field of Wide Area Monitoring Systems. This is true especially for Distribution, where WAMS is still in its infancy, and is heavily budget-dependent. This is where the PMU is a cost-effective novelty.

HIGHLIGHTS

Full IEEE C37.118.1 / IEC 60255-118-1:2018 compliance for both:

- M-Class
- P-Class

Dual Protocol

- IEC 61850-9-2
- IEEE C37.118.2

Versatile micro-second resolution time-sync:

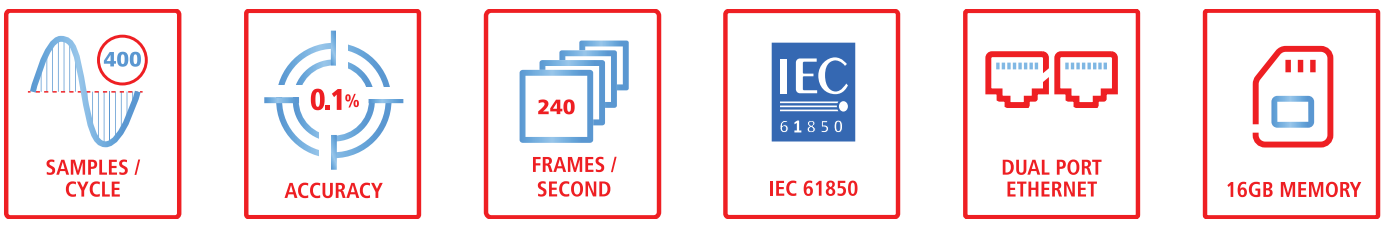
- PTP
- IRIG-B
- Up to 240 frames/sec
- Super-compact design
- Expected Steady State Total Vector Error (TVE) at nominal frequency < 0.05%

M-CLASS (METERING CLASS)

Advanced filtering rejects harmonic components and other oscillations, leading to high accuracy.

P-CLASS (PROTECTION CLASS)

Involves less filtering, increasing streaming speed and enabling responsive control.



PLUG-IN MODULES

8 DI

8 optically isolated digital inputs, available as:

- 24V dry contact
- 24/48/125/250V AC/DC wet input
- Programmable de-bounce time from 1 ms to 1 sec
- 1ms sampling rate
- 1pps time synchronization

4 DO

4 optically isolated digital outputs, available as:

- Electro-Mechanical relay, 250V / 5A AC
- Solid-State Relay, 250V / 0.1A AC

COMBO: 4 DI + 2 RO

Available per above specifications

- (DI: @ 24V DC only)

4 ANALOG OUTPUTS

Universal (configurable) isolated analog outputs

- (±1 mA; 0-1 mA; 0-20 mA; 4-20 mA)

AUXILIARY POWER SUPPLY

- 88-264V AC
- 90-290V DC

DC AUXILIARY POWER SUPPLY

- 24V DC (9-36V DC)

TECHNICAL SPECIFICATIONS

PHASOR MEASUREMENT UNIT

- IEEE C37.118.1-2011, IEEE C37.118.1a-2014 and IEC/IEEE 60255-118-1:2018 P-Class and M-class performance compliance.
- IEEE C37.118.1 compliant three-phase voltage, current, and positive and negative sequence phasor measurements synchronized to a common UTC time reference.
- IEEE C37.118.1 synchronous frequency and Rate of Change of Frequency (ROCOF) measurements.
- Clock synchronization to a UTC time reference using an IRIG-B timecode source or an IEEE 1588 PTPv2 master clock source.
- IEEE C37.118.2 commanded client-server UDP and TCP data transmission and spontaneous UDP data transmission over IP protocol
- IEEE C37.118.2 reporting rates from 1 to 200/240 frames/s.

Streaming of phasor data over Ethernet using the IEC 61850-9-2 multicast sampled value (SV) service with IEEE C37.118.2 compliant mapping of synchrophasor data upon IEC 61850-9-2 and IEC 61850-90-5 guidelines.

- Expected steady-state total vector error (TVE) at nominal frequency: < 0.05%.
- Streaming rate: 1 to 200 or 240frames/s @ 50 or 60Hz, respectively

IEEE C37.118.2

- Synchrophasor data frames transmit a time stamped set of measurements that include phasor estimates, frequency deviation from the nominal power line frequency or actual frequency, and the rate of change of frequency. In addition, the data frame can be expanded to contain analog data (total active, reactive and apparent power, and power factor) and digital input status information.
- Phasor components can include three voltage and three current phasors, positive sequence voltage and current phasors, negative sequence voltage and current phasors, or all of them in one frame.
- Complex phasor values can be sent in a rectangular coordinates format (real and imaginary) or in polar coordinates (magnitude and angle). Phasor and frequency data can be represented in 32-bit IEEE floating-point format or as 16-bit scaled integer numbers. When using the integer format, the data conversion factors are provided in IEEE C37.118.2 configuration frames.
- Client-server UDP and TCP data transmission; spontaneous UDP data transmission over IP protocol.
- Optional IEEE C37.118.2 frame extensions with analog data (total active, reactive and apparent power and power factor) and digital status data (up to 32 inputs).
- The PMU PRO supports CFG-1, CFG-2 and CFG-3 configuration frames.
- In spontaneous UDP data transmission mode, CFG-2 or CFG-3 configuration frames can be sent spontaneously without an explicit user command. When enabled, a configuration frame is sent periodically every 30 seconds.

5 data streaming slots for continuous synchrophasor data streaming via unicast UDP or/and TCP connections

LOGGING, RECORDING & PROGRAMMING

- Programmable controller: up to 32 control setpoints and half-cycle scan time.
- OR, AND, arithmetical functions logic, extensive triggers, programmable thresholds and delays, relay control, event-driven data recording.
- Event recorder for logging internal diagnostic events, power faults and operations of the logic controller and digital I/O.
- Eight data recorders with programmable datasets for data logging on a periodic basis and on any internal or external trigger.
- 32 digital counters for counting internal events and pulses from external sources.
- 16 interval timers with programmable periods from half cycle to 24 hours for periodic recording and triggering timed operations.

VARIABLE CURRENT INPUTS

- 5A
- 1A

VOLTAGE MEASUREMENT INPUTS

- Measurement category: CAT III
- Operating range: up to 277/480 VAC +25%

I/O

Built-in I/O

- 1 AI (±1 mA; 0-1 mA; 0-20 mA; 4-20 mA)
- 1 SSR (100mA/250V AC/DC)
- External power supply 24/48/125/250V DC
- 1 DI Internally wetted @ 24VDC

4 Relay Outputs

Electromechanical (SPST Form A)

Available options:

- 5A/30 VDC
- 5A/250V AC
- 100mA/800V DC

Combo: 4 Digital Inputs + 2 Relay Outputs

Available per above specifications

4 Analog Outputs

Universal (configurable) isolated analog outputs

(±1 mA; 0-1 mA; 0-20 mA; 4-20 mA)

DISPLAY

- High contrast 1.77” TFT colour graphics display with configurable backlight.
- Multi-page displays; time, instrumentation and service data.
- Menu-driven setups.
- Multilanguage support.

COMMUNICATION INTERFACES

Two 10/100Base-T IEEE 1588 Ethernet ports with packet forwarding/ routing capabilities; connecting to Ethernet through one or two different network switches, or daisy chaining multiple devices to a switch using a linear or ring network topology (daisy chaining is not available for PTP-enabled devices); up to 8 simultaneous TCP connections via Modbus TCP, DNP3, IEC 60870-5-104, IEC 61850 (up to 5 client associations, GOOSE and MSV publishers) protocols.

Up to 5 TCP or/and UDP synchrophasor data streams via C37.118.2 protocol.

Full speed USB 2.0 type C port for local configuring and monitoring the device via Modbus RTU protocol.

RS-485 serial communication port; 2400 to 115200 bps; Modbus RTU/ASCII, DNP3 and IEC 60870-5-101 protocols (the port is not operational if the IRIG-B time synchronization source is used).

- Modbus TCP notification client.
- Expertpower client.

REAL-TIME CLOCK & SYNCHRONIZATION

- High-accuracy real-time clock with a lithium backup battery.
- Clock synchronization to a UTC time reference using an IRIG-B timecode source or an IEEE 1588 PTPv2 master clock.
- Daylight saving time shift for local time indication with configurable DST start and end time.

POWER SUPPLY

Built-in:
- 57.7-277V AC / 48-290V DC

Additional options:
- AUX 88-264V AC / 90-290V DC
- AUX 9-36V DC

ENHANCED METER SECURITY

3 levels Password security for protecting meter setups and accumulated data from unauthorized changes.

MOUNTING

- DIN Rail mount

FEATURES

PMU
- 1-us satellite-synchronized clock (IRIG-B/ PTP time-code input)
- IEEE C37.118.2 reporting rates: 1 to 200/240 frames/s

COMMUNICATION

Ports
- 2 × ETH (independent interfaces), USB 2.0 (Type C),

Protocols
- IEC 61850-9-5
- IEEE C37.118.2
- Modbus RTU/TCP, MODBUS Master,
- DNP3 (level 2), IEC 60870-5-101/104
- Up to 10 non-intrusive
- Simultaneous connections per
- Ethernet port

Current Input Options
- 1A or 5A inputs from CT secondary

Voltage Inputs
- Nominal: 400/690V AC (L-N/L-L)
- Operating range: 10-1,000V AC

On-Board Inputs / Outputs
- Built-in I/Os: 1 digital input; 1 SSR output; 1 analog input

Programmable Logical Controller
- 32 control setpoints; programmable operate and release delays
- OR/AND logic, extensive triggers, programmable thresholds and delays
- 8 user-definable data logs

POWER SUPPLY

Built-in:
- 57.7-277V AC @ 50/60 Hz 48-290V DC

Auxiliary (as module):
- 88-264V AC @ 50/60 Hz 125-300V DC

24V DC AUX (as module):
- 24V DC (9-36V DC) Tolerance for all PS: ±15%

DC ACCESSORIES

FOR DIRECT CURRENT MEASUREMENT

Based on the PRO Series meters, SATEC provides a unique comprehensive solution for DC metering. The current sensing technology used by the PRO is that of Hall Effect Sensors. The voltage reading is performed by direct measurement, rated up to 820V DC.

The challenges that arise in this application:

- Hall Effect Sensors require an external power supply
- Many DC systems are rated at 1,500V DC

Please see below the accessories we offer to provide power supply and read voltages higher than 820V DC.

VOLTAGE RATIO MODULE (VRM)

- Accuracy = 0.1%
- 3 Independent voltage inputs
- Wire size: 12 AWG (up to 3.5 mm2)
- DIN-rail installation

HALL EFFECT POWER SUPPLY (HEPS)

Input Ratings

- Voltage: 90-264V AC (50/60Hz)
- Burden: 30 VA

Connector Type

- Terminals: 2 X 7.5mm
- Wire Size: 1.5-0.25mm2

Output

- Voltage: 4 X ± 15V DC +(15 ;0 ;-15)
- Power: 1.5W per each

Environmental

- -40°C to 60°C / -40°F to 140°F

FOR DIRECT CURRENT APPLICATIONS

VRM MODULE

Typical DC power systems are rated at 1,500V DC. Our Voltage Ratio Module serves as an adaptor for voltages up to 1,500V DC.

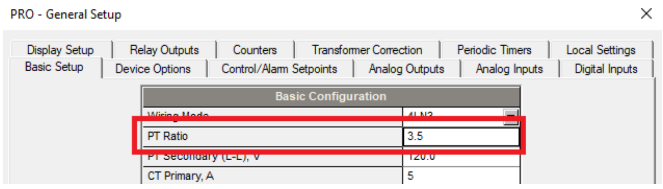
- Accuracy = 0.1%
- 3 independent voltage inputs

SATEC VRM Module is designed for connecting SATEC meters to DC voltage systems above meter rating (800V DC for PM130 PLUS and 800V DC for PRO EM235/PM335) ranging up to 1500V DC.

- Dimensions: 127 x 75 x 52 mm
- Weight: 80 grams
- Installation: DIN-Rail only

ELECTRICAL INSTALLATION

It is recommended that the distance between the SATEC VRM and SATEC meter should not exceed 2 meters, using cabling featuring minimum 600V insulation.



When using SATEC VRM, the correct ratio coefficient must be set with PAS software ("Basic Setup" tab):

- Using the PRO Series meters, enter "ratio" = 3.5
- Using the PM130 PLUS, enter "ratio" = 11 Ratio coefficient = 11

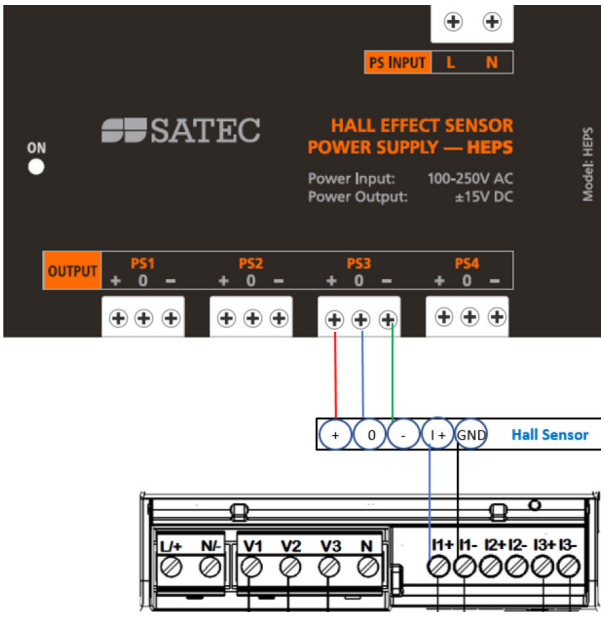
HEPS MODULE

This module provides ±15V DC for powering common Hall Effect Sensors.

ELECTRICAL INSTALLATION

Install the HEPS module on a DIN-rail, close to an appropriate AC power supply. Wire L to phase and N to neutral current.

Each Hall Sensor must be connected to power supply via 3 wires, +, – and 0. When using the HEPS as power supply, wire + to +, – to – and 0 to 0.



HEPS MODULE CHARACTERISTICS

- Power supply: 100-250V AC
- Output: ±15V DC

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