Temposonics®

Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors

R-Series Models RP and RH
Ethernet POWERLINK

MTS SENSORS

Data Sheet Part Number
Reference: 551191

R-Series
Powerlink

Model RP Profile-style position sensor
Stroke length: 25 mm to 5080 mm (1 in. to 200 in.)

Model RH Rod-style position sensor
Stroke length: 25 mm to 7620 mm (1 in. to 300 in.)

FEATURES

- Linear, Absolute Measurement
- LEDs For Sensor Diagnostics
- Superior Accuracy, Resolution Down to 1 µm
- Non-Contact Sensing Technology
- Non-Linearity Less Than 0.01%
- Repeatability Within 0.001%
- Direct POWERLINK Interface, Position + Velocity
- 200 µs Position / Velocity Update Time, Regardless of Overall Stroke Length

BENEFITS

- Rugged Industrial Sensor
- Position + Velocity Measurements for Up to 4 Magnets
- Use Switch Settings or Software for Node Addressing

APPLICATIONS

- Continuous Operation In Harsh Industrial Conditions
- High Pressure Conditions
- For Accurate, High-Speed, Simultaneous Multi-Position and Velocity Measurements

TYPICAL INDUSTRIES

- Factory Automation
- Fluid Power
- Plastic Injection and Blow Molding
- Material Handling and Packaging

ISO 9001 CERTIFIED CE

Product overview

R-Series model RH and RP sensors are extremely robust and are ideal for continuous operation under harsh industrial conditions.

MTS 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 captive sliding magnets which utilize slide bearings of special material that reduce friction, and help mitigate dirt build up.

The sensor 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.

Product specifications

Parameters	Specifications
OUTPUT	
Measured output variables:	Position + velocity, up to 4 magnets simultaneously
Resolution:	**Position:** 1 µm **Velocity:** 0.25 mm/s up to 1200 mm, 0.125 mm/s up to 2400 mm, 0.0625 mm/s up to 4800 mm, 0.03125 mm/s up to 7600 mm stroke length
Update times:	200 µs min. (high speed update feature is active when the controller's loop time is less than the sensor's measurement cycle time)
Non-linearity:	< ± 0.01% full stroke (minimum ± 40 µm)
Repeatability:	< ± 0.001% full stroke (minimum ± 2.5 µm)
Hysteresis:	< 4 µm
Outputs:	**Interface:** Ethernet POWERLINK V2 (Ethernet POWERLINK Standardization Group)
Stroke length:	**Range (Profile style):** 25 mm to 5080 mm (1 in. to 200 in.) **Range (Rod style):** 25 mm to 7620 mm (1 in. to 300 in.) **Range (Flexible style):** 255 mm to 10,060 mm (10 in. to 396 in.) *(Contact Factory for longer stroke lengths.)*
ELECTRONICS	
Operating voltage:	**+24 Vdc nominal:** -15% or +20% **Polarity protection:** up to -30 Vdc **Over voltage protection:** up to 36 Vdc **Current drain:** 90 mA typical **Dielectric withstand voltage:** 500 Vdc (DC ground to machine ground)

Parameters	Specifications
ENVIRONMENTAL	
Operating conditions:	**Operating temperature:** -40 °C (-40 °F) to +75 °C (+167 °F) **Relative humidity:** 90% no condensation **Temperature coefficient:** < 15 ppm/ °C
EMC test:	**Emissions:** IEC/EN 50081-1 **Immunity:** IEC/EN 50082-2 IEC/EN 61000-4-2/3/4/6, level 3/4 criterium A, CE qualified
Shock rating:	100 g (single hit)/IEC standard 68-2-27 (survivability)
Vibration rating:	15 g / 10 to 2000 Hz / IEC standard 68-2-6
Wiring	
Connection type:	D57 option: One female 4-pin (M12-DF) plus one 4-pin male (M8) connector
PROFILE STYLE SENSOR (MODEL RP)	
Electronic head:	Aluminum housing with diagnostic LED display (LEDs located beside connectors)
Sealing:	IP 65
Sensor extrusion:	Aluminum (Temposonics profile style)
Mounting:	Any orientation. Adjustable mounting feet or T-slot nut (M5 threads) in bottom groove
Magnet types:	Captive-sliding magnet or open-ring magnet
ROD STYLE SENSOR (MODEL RH)	
Electronic head:	Aluminum housing with diagnostic LED display (LEDs located beside connectors)
Sealing:	IP 67
Sensor rod:	304L stainless steel
Operating pressure:	350 bar static, 690 bar peak (5000 psi static, 10,000 psi peak)
Mounting:	Any orientation. Threaded flange M18 x 1.5 or 3/4 - 16 UNF-3A
Typical mounting torque:	45 N-m (33 ft. - lbs.)
Magnet types:	Ring magnet, open-ring magnet, or magnet float

Enhanced monitoring and diagnostics

SENSOR STATUS AND DIAGNOSTIC DISPLAY

Integrated diagnostic LEDs (green/red), located beside the sensor connectors *(see 'Figure 1')*, provide basic visual monitoring for normal sensor operation and troubleshooting. Diagnostic display LEDs indicate four modes described in *'Table 1'*.

Figure 1. R-Series sensor Integrated diagnostic LEDs

Status LED (Green)	Operation status/mode
OFF	Initializing or not active
ON	Normal function
Flashing	Various flashing codes show different operational status
Error LED (Red)	
OFF	Normal function
ON	Collision error or loss of start cycle
Ethernet Link LED (Green)	
ON	Successful connection
Ethernet Activity LED (Green)	
Flashing	Data transfer

Table 1. Diagnostic display indicator modes

Ethernet POWERLINK V2 interface

R-Series linear-position sensors fulfill the requirements of the Ethernet POWERLINK Standardization Group (EPSG). Ethernet POWERLINK V2 is an open protocol based on the Ethernet-standard according to IEEE 802.3. It is an extension to the Ethernet protocol which allows real-time data communication. Within the Ethernet POWERLINK protocol a CANopen based communication protocol for user data is specified. POWERLINK is the only Ethernet protocol that meets hard real-time requirements using a software-only concept. No special POWERLINK hardware is needed. POWERLINK cycle times as fast as 200 µs are possible.

Operation mode and output

The POWERLINK V2 output (option '**L101**') provides position and velocity measurements for up to 4 magnets. The data telegram for each magnet contains:

- Position (32 bits)
- Velocity (32 bits)
- Long status information (16 bits)

Multi-magnet measurement

When using multiple magnets, the minimum allowed distance between magnets is 76 mm (3 in.) to maintain proper sensor output *(see 'Figure 2')*. The high-speed update feature is not available for POWERLINK sensors when using multiple magnets. Update times are based on the sensor's measurement cycle time and are dependent on the sensor's overall stroke length

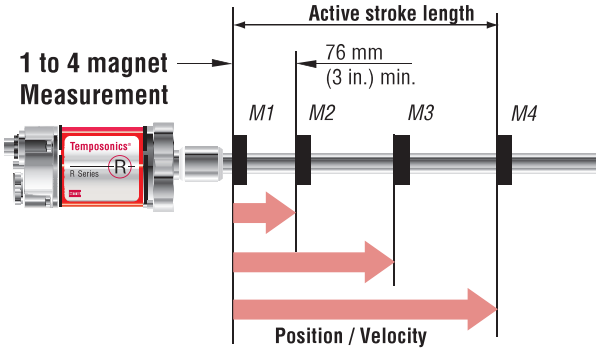


Figure 2. Single to multi-magnet output diagram

Bus connections and IP node addressing

Temposonics R-Series linear-position sensors are easily integrated into the POWERLINK network. The sensor has a single M12 style connector for a star topology network connection. Also, a separate M8 style connector provides for input power to the sensor.
The sensor's IP node address can be entered via the software, or manually by using DIP switches integrated in the sensor head. The DIP switch settings allow up to 239 different addresses. A protective cap seals the access to the DIP switches.

Address	Switch setting
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
-	-
-	-
-	-

Software Interface

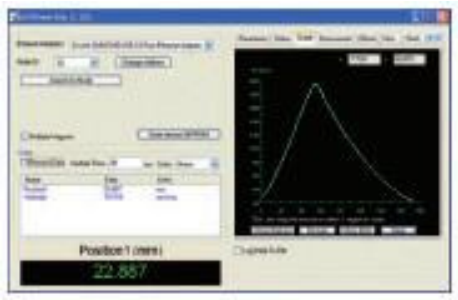


Figure 3. Software Addressing

Model RP Profile-Style Sensor
Dimension References

Model RP profile-style sensor dimension references

MODEL RP, PROFILE-STYLE SENSOR WITH CAPTIVE-SLIDING MAGNET

Drawing is for reference only, contact applications engineering for tolerance specific information.

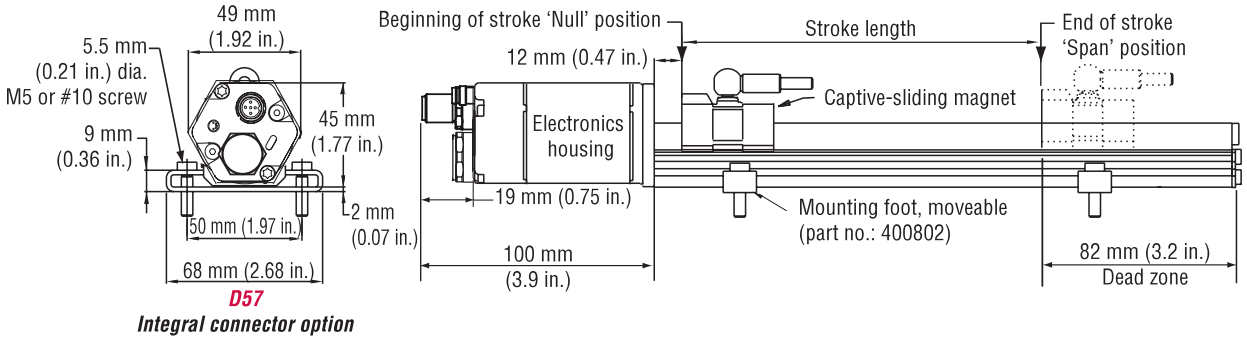


Figure 4. R-Series Model RP Profile-style sensor dimension reference (Shown with the ***D57*** connector option)

MODEL RP, PROFILE-STYLE SENSOR WITH OPEN-RING MAGNET

Drawing is for reference only, contact applications engineering for tolerance specific information.

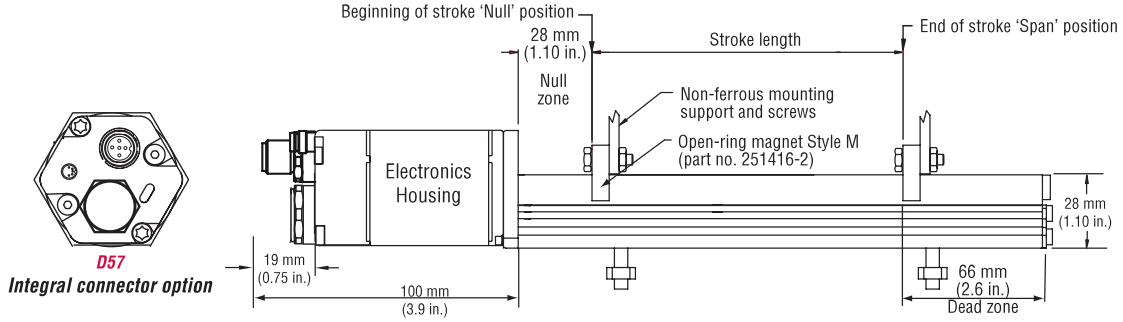


Figure 5. R-Series Model RP Profile-style sensor dimension reference (Shown with the ***D57*** connector option)

Standard magnet selections, mounting and installation (Model RP)

Temposonics model RP profile-style sensors offer two basic mounting methods; side grooves for use with mounting feet or a bottom groove that accepts special T-Slot nuts. Both the mounting feet and T-Slot nuts can be positioned along the sensor extrusion to best secure the sensor for each particular application.

Refer to the Accessories section of this catalog for magnet selections and detailed mounting and installation information.

Model RH rod-style sensor dimension reference

The Temposonics R-Series rod-style sensor (Model RH) offers modular construction, flexible mounting configurations, and easy installation. The Model RH sensor is designed for mounting in applications where high pressure conditions exist (5000 psi continuous, 10,000 psi spike), such as inside hydraulic cylinders. The Model RH sensor *(see 'Figure 6')* may also be mounted externally in many applications.

Stroke-dependent Dead Zones:	
Stroke length:	**Dead zone:**
25 mm (1 in.) - 5000 mm (197 in.)	63.5 mm (2.5 in.)
5005 mm (197 in.) - 7620 mm (300 in.)	66 mm (2.6 in.)

MODEL RH, ROD-STYLE SENSOR WITH RING MAGNET (MAGNET ORDERED SEPARATELY)

Drawing is for reference only, contact applications engineering for tolerance specific information.

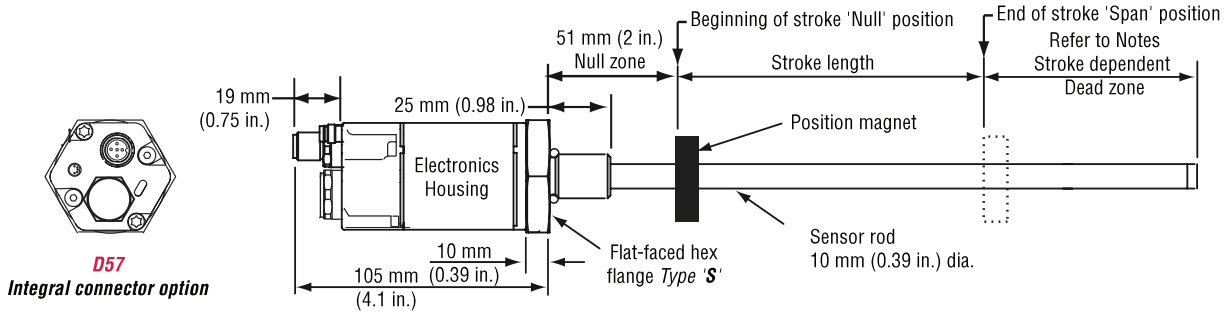


Figure 6. Model RH Rod-style sensor dimension reference (shown with ***D57*** integral connector options)

MODEL RH, ROD-STYLE SENSOR WITH RING MAGNET (MAGNET ORDERED SEPARATELY)

Drawing is for reference only, contact applications engineering for tolerance specific information.

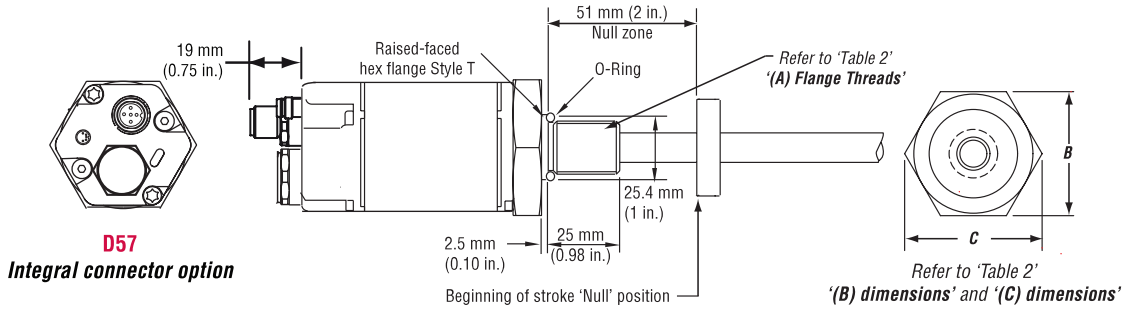


Figure 7. Model RH Rod-style sensor dimension reference (Shown with the ***D57*** Integral cable connection type option)

Housing style Flange type	Description	(A) Flange threads	(B) Dimensions	(C) Dimensions
T	US customary threads with raised-face flange	3/4" - 16 UNF-3A	1.75 in.	2 in.
S	US customary threads with flat-faced flange	3/4" - 16 UNF-3A	1.75 in.	2 in.
M	Metric threads with flat-faced flange	M18 x 1.5	46 mm	53 mm

Table 2. Model RH Rod-style sensor housing style and flange type references

Standard magnets, mounting and installation (Model RH)

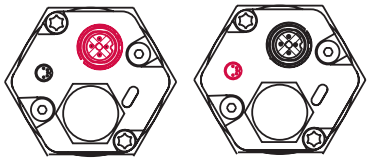
Magnets must be ordered separately with model RH position sensors (unless otherwise specified in the data sheet). The standard ring magnet (part number 201542-2) is suitable for most applications

Refer to the Accessories section of this catalog for magnet, cable connector selections and detailed mounting and installation information.

Connections and wiring

(D57) BUS CONNECTOR OPTION PINOUTS / FUNCTIONS

D7 connector option for star topology network connections. A separate cable is used for the supply voltage.



D57
Female
4-pin Bus In

D57
Male, 4-pin
Input voltage

BUS CONNECTIONS

Female, 4-pin (M12-DF) integral connector pin-outs as viewed from the end of the sensor

Pin number	Cable color	Function
1	Yellow	Tx+
2	White	Rx+
3	Orange	Tx-
4	Blue	Rx-

INPUT VOLTAGE

Male, 4-pin (M8) integral connector pin-out as viewed from the end of the sensor

Pin number	Cable color	Supply voltage
1	Brown	+24 Vdc (-15/+20%)
2	White	No connection
3	Blue	DC ground (for supply)
4	Black	No connection

Models RP and RH Sensors
Ordering Information

R								D	5	7	1	L	1	0	1			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

SENSOR MODEL = R — 1-2

RP = Profile style

RH = Hydraulic rod style

RF = Flexible style

(For more information about the model RF, refer to Industrial Product Catalog, part no.: 551075)

HOUSING STYLE = — 3

Model RP profile-style sensor (includes one magnet):

S = Captive-sliding magnet with ball joint at top (part no. 252182)

V = Captive-sliding magnet with ball joint at front (part no. 252184)

M = Open-ring magnet (part no. 251416-2)

Model RH rod-style sensor (magnet(s) must be ordered separately):

T = US customary threads, raised-faced flange and pressure tube, standard

U = Same as option "T", except uses fluoroelastomer seals for the electronics housing

B = Sensor cartridge only (no flange or pressure tube, stroke length < 1830 mm (72 in.))

S = US customary threads, flat-faced flange and pressure tube, standard

H = Same as option "S", except uses fluoroelastomer seals for the electronics housing

M = Metric threads, flat-faced flange and pressure tube, standard

V = Same as option "M", except uses fluoroelastomer seals for the electronics housing

Model RF Flexible housing style sensor (magnet(s) must be ordered separately):

S = US customary threads, flat-faced flange

M = Metric threads, flat-faced flange

STROKE LENGTH = — 4-8

_ _ _ _ M = Millimeters *(Encode in 5 mm increments)*

_ _ _ . _ U = Inches and tenths *(Encode in 0.1 in. increments)*

Stroke Length Notes:

1. Profile-style sensor (model RP) stroke range = 25 mm (1 in.) - 5080 mm. (200 in.)
2. Rod-style sensor (model RH) stroke range = 25 mm (1 in.) - 7620 mm (300 in.)
3. Flexible housing style sensor (model RF) stroke range = 255 mm (10 in.) - 10,060 mm (396 in.). Contact factory for longer stroke lengths.

CONNECTION TYPE = D 5 7 — 9-11

Integral connector:

D57 = One 4-pin female (M12-DF), plus one 4-pin male (M8)

INPUT VOLTAGE = 1 — 12

1 = +24 Vdc (+20% - 15%)

OUTPUT = L 1 0 1 — 13-16

L101 = POWERLINK V2, position and velocity, maximum 4 magnets

NUMBER OF MAGNETS = Z — 17-19

For multi-position measurement only (Order additional magnets separately).

Z _ _ = Number of magnets for output **L101** (range 02 to 04)