

# Temposonics®

Magnetostrictive, Absolute, Non-contact  
Linear-Position Sensors



## R-Series Models RP and RH CANbus Outputs (CANopen/CANbasic)

Data Sheet Part Number  
Reference: 550991



**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.)

R-Series  
CANbus

### FEATURES

- Linear, Absolute Measurement
- LEDs For Sensor Diagnostics
- Superior Accuracy, Resolution down to 2  $\mu$ m
- Non-Contact Sensing Technology
- Non-Linearity Less Than 0.01%
- Repeatability Within 0.001%
- Direct CAN Output (Position + Velocity)

### BENEFITS

- Rugged Industrial Sensor
- Selectable Bus Termination (CANopen)
- CANopen with Heartbeat Function

### APPLICATIONS

- Continuous Operation In Harsh Industrial Conditions
- High Pressure Conditions
- For Accurate, Multi-Magnet Position Measurement (up to 20 positions per sensor)

### TYPICAL INDUSTRIES

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



## Product Overview and Specifications

### 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
<b>OUTPUT</b>	
Measured output variables:	Position, velocity, optional multi-magnet position measurements (up to 20 magnet positions simultaneously)
Resolution:	<b>CANopen:</b> <b>Position:</b> 5 µm 2 µm <b>CANbasic:</b> <b>Position:</b> 5 µm 2 µm <b>Velocity:</b> 0.5 mm/s 0.2 mm/s <b>Velocity:</b> 1.0 mm/s 0.1 mm/s
Update times::	1.0 ms up to 2400 mm, 2.0 ms up to 4800 mm, 4.0 ms up to 7600 mm stroke length Add 0.5 ms for CANbasic up to 1200 mm
Non-linearity:	< ± 0.01% full stroke (minimum ± 40 µm) (Linearity Correction Option (LCO) available)
Repeatability:	< ± 0.001% full stroke (minimum ± 2.5 µm)
Hysteresis:	< 4 µm
Outputs:	<b>Interface:</b> CAN-Fieldbus system ISO DIS 11898 <b>Data protocol CANopen:</b> CIA standard DS-301 V4.02 encoder profile DS-406 V3.1 <b>CANbasic:</b> CAN 2.0 A
Baud rate, kBit/s:	1000 800 500 250 125 50 20
Cable length, m:	<25 <50 <100 <250 <500 <1000 <2500 <i>Sensors will be supplied with ordered Baud rate which can be changed by the customer.</i>
Stroke length:	<b>Range (Profile style):</b> 25 mm to 5080 mm (1 in. to 200 in.) <b>Range (Rod style):</b> 25 mm to 7620 mm (1 in. to 300 in.) <b>Range (Flexible style):</b> 255 mm to 10,060 mm (10 in. to 396 in.) (Contact Factory for longer stroke lengths.)
<b>ELECTRONICS</b>	
Operating voltage:	<b>+24 Vdc nominal:</b> -15% or +20% <b>Polarity protection:</b> up to -30 Vdc <b>Over voltage protection:</b> up to 36 Vdc <b>Current drain:</b> 100 mA typical <b>Dielectric withstand voltage:</b> 500 Vdc (DC ground to machine ground)

Parameters	Specifications
<b>ENVIRONMENTAL</b>	
Operating conditions:	<b>Operating temperature:</b> -40 °C (-40 °F) to +75 °C (+167 °F) <b>Relative humidity:</b> 90% no condensation <b>Temperature coefficient:</b> < 15 ppm/ °C
EMC test:	<b>Emissions:</b> IEC/EN 50081-1 <b>Immunity:</b> IEC/EN 50082-2 IEC/EN 61000-4-2/3/4/6, level 3/4 criterion 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
<b>WIRING</b>	
Connection type:	Single or dual 6-pin male D60 (M16) connector or two 5-pin Male/Female D54 (M12) connectors with 4-pin male (MS) connector or integral cable
<b>PROFILE STYLE SENSOR (MODEL RP)</b>	
Electronic head:	Aluminum housing with diagnostic LED display (LEDs located beside connector/cable exit)
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
<b>ROD STYLE SENSOR (MODEL RH)</b>	
Electronic head:	Aluminum housing with diagnostic LED display (LEDs located beside connector/cable exit)
Sealing:	IP 67 or IP 68 for integral cable models
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 on top of the sensor housing (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

Green	Red	Operation status/mode
ON	OFF	Normal function (operation mode)
ON	ON	Magnet not detected or wrong quantity of magnets
OFF	ON	Initialization error
Flashing	Flashing	Power out of range (high or low)

Table 1. Diagnostic display indicator modes

### CANbus protocol

Temposonics R-Series models RP and RH linear-position sensors, as slave devices, fulfill all requirements of the CANbus (ISO 11898) protocol. The sensor's electronics convert the position measurements into bus oriented outputs and transfer this data directly to the controller.

The bus interface is appropriate for serial data transfer up to 1 Mbps maximum. Sensor integrated software supports bus profiles CANopen, CANbasic and DeviceNet for a comprehensive customized configuration of the sensor-bus system.

DeviceNet documentation is available from the MTS website at <http://www.mtsensors.com/products/linear-position-sensors/index.html>.

### OPERATION MODES

R-Series sensors with CANbus protocol provide the following single or multi-magnet measurements:

#### Standard measurements:

- CANbasic; Position + velocity (using one magnet)
- CANopen; Position + velocity (using one to four magnets)  
+ sensor internal electronics temperature

#### Multi-magnet measurement:

CANbasic; Positions for each of two to twenty magnets simultaneously.

When using multiple magnets, the minimum allowed distance between magnets is 76 mm (3 in.) to maintain proper sensor output (see 'Figure 2').

#### Single-magnet sensor

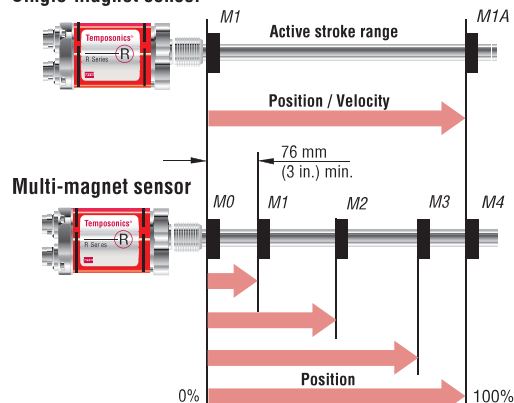


Figure 2. Single and multi-magnet output diagram

### CANopen communication and functionality

CANopen corresponds to encoder profile 'DS-406 V3.1 (CIA standard DS-301 V4.02)'. The CANopen functionality is described below in the following communication objects.

#### Note:

Conformance Test Certificate No. CiA199902-301V30/I-004 is provided by the CANbus user organization CiA (CAN in Automation) for MTS CANopen sensors.

### LINEARITY CORRECTION OPTION (LCO)

The Linearity Correction Option (LCO) provides improved sensor output accuracy. For most stroke lengths linearity accuracy is improved up to a factor of 5 resulting in deviations from actual position of less than +/- 20 microns (0.0008 in.). For stroke lengths over 5000 mm (197 in.), the linearity accuracy is improved up to a factor of 10. Selecting the sensor style and magnet is important (both must be matched together). Contact the factory for assistance when designing for the LCO in your application.

### SERVICE DATA OBJECT (SDO)

The SDO is mainly used for sensor configuration. Selectable parameters are as follows:

- Resolution for position + velocity
- 4 set points
- Preset of the operation range and the null position for four magnets

### PROCESS DATA OBJECT (PDO)

The PDO provides real-time data transfer of sensor measurements in up to 8-byte data blocks. The sensor uses PDO's to relay information about magnet position, velocity, limit status, cam control and operation range for up to four magnets.

#### Data formats:

- 32-bits for position
- 16-bits for velocity
- 8-bits for value limit.

## Advanced communication and programmability (cont)

### Field Programming

#### CANbus outputs

##### PDO TRANSMISSION TYPE

**Asynchronous (cycle time of 1 to 65.535 ms) or synchronous**

- Synchronization Object (SYNC)
- Emergency Object
- Nodeguard Object
- Heartbeat function
- Selectable bus termination
- Monitoring for the sensor internal electronics temperature

#### CANopen communication and functionality

##### CANOPEN CONFIGURATION

A software file is used as an Electronic Data Sheet (EDS) for sensor configuration. The EDS file is available on the R-Series Setup software mini diskette, part number: 551052 that comes with the sensor. To download the latest software go to MTS website at: <http://www.mtssensors.com>.

#### CANbasic (MTS)

*CANbasic (MTS)* allows a simple, flexible adaptation to customized profiles with a short bus access. The CANbasic protocol complies with CAN the 2.0A standard and includes applications data for single-magnet measurement (position, velocity, sensor status and five setpoints).

#### CANbasic (Multi-magnet measurement)

*CANbasic (Multi-magnet measurement)* provides position measurement on a single sensor using a maximum of twenty magnets. Setup and operation are accomplished through the on-site control system.

#### CANopen handheld address programmer

The *CANopen Handheld Address Programmer* (see 'Figure 3') is offered as an accessory used to setup the Node-Address for sensors with the CANopen interface. This setup is usually completed by the bus' LMT/LSS-Service. If the master system or customer controller does not support this service, connecting the CANopen Handheld Address Programmer to the sensor will bypass the service and allow direct setup.



**Figure 3.** R-Series CANopen Handheld Address Programmer (part no. 252382-D62) Installation Instructions (part no.: 551192)

## 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.

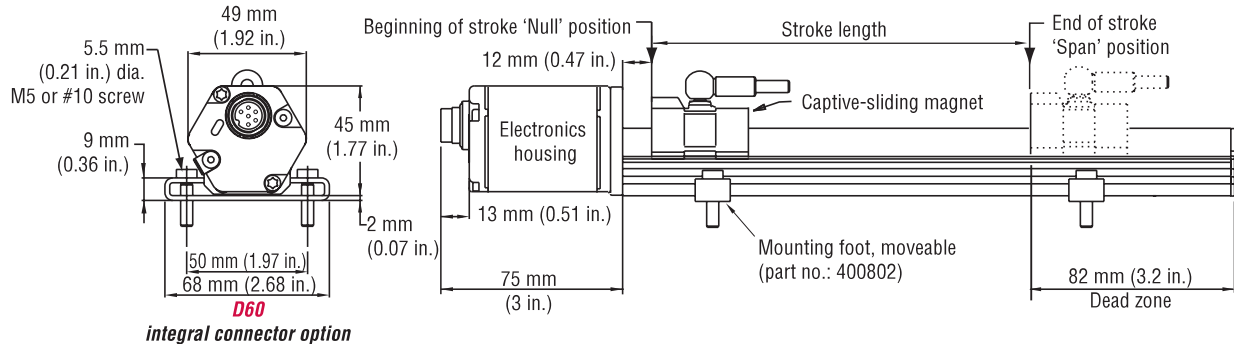


Figure 4. R-Series Model RP Profile-style sensor dimension reference (Shown with the **D60** integral connector option)

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

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

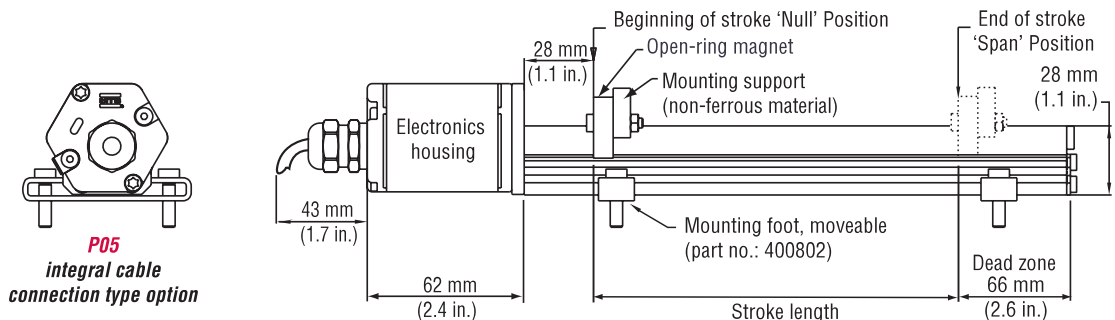


Figure 5. R-Series Model RP Profile-style sensor dimension reference (Shown with the **P05** integral cable option)

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

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

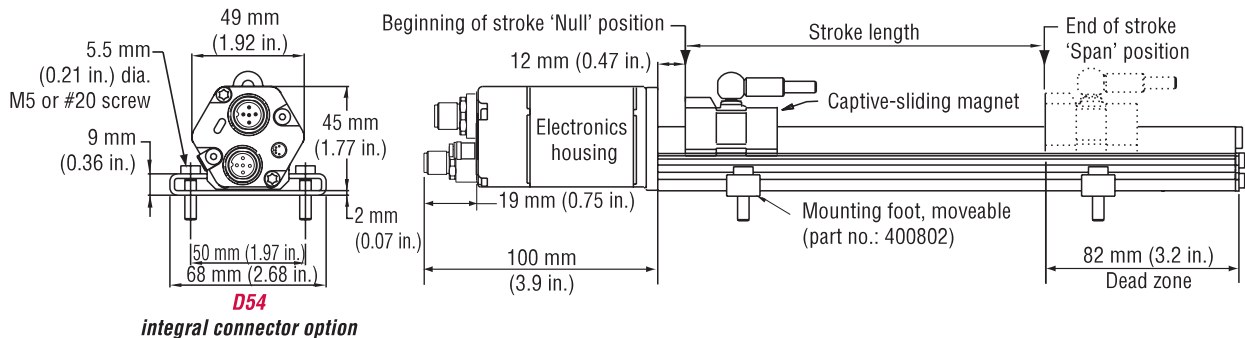


Figure 6. R-Series Model RP Profile-style sensor dimension reference (Shown with the **D54** integral connector option)

## 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 references

#### 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 7') may also be mounted externally in many applications.

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

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

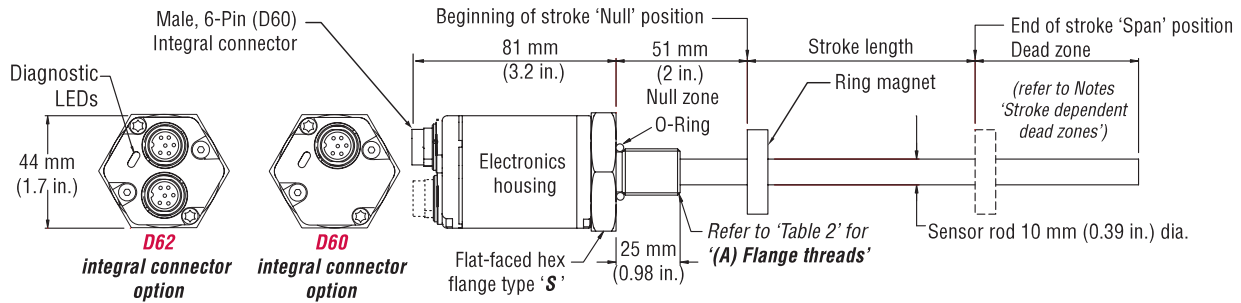


Figure 7. Model RH Rod-style sensor dimension reference (shown with **D60 / D62** integral connector options)

#### MODEL RH, ROD-STYLE SENSOR

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

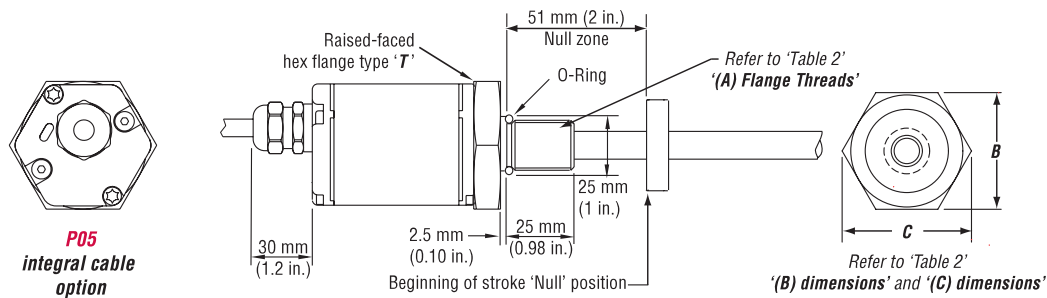


Figure 8. Model RH Rod-style sensor dimension reference (shown with **P05** integral cable option)

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

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

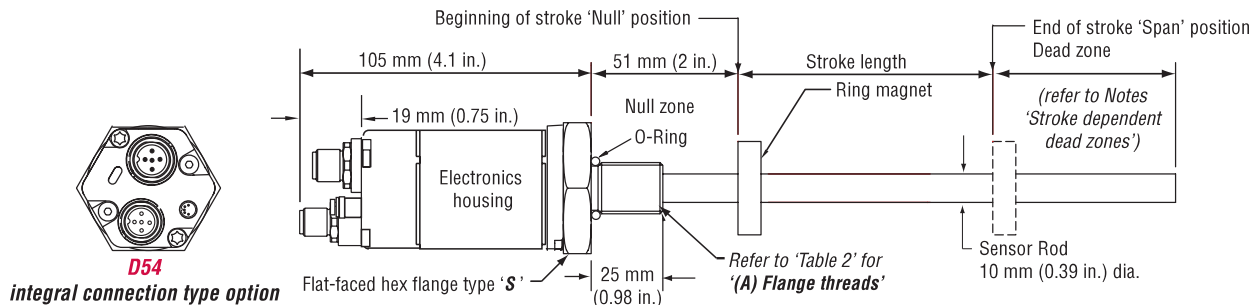


Figure 9. Model RH Rod-style sensor dimension reference (Shown with the **D54** integral cable connection type option)

Housing style Flange type	Description	(A) Flange threads	(B) Dimensions	(C) Dimensions
<b>T</b>	US customary threads with raised-face flange	3/4" - 16 UNF-3A	1.75 in.	2 in.
<b>S</b>	US customary threads with flat-faced flange	3/4" - 16 UNF-3A	1.75 in.	2 in.
<b>M</b>	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, cable connector selections, mounting and instalation (Model RH)

Magnets must be ordered separately with model RH position sensors. The standard ring magnet (part number 201542-2) is suitable for most applications

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

## Connections and wiring

### STANDARD MALE (M16) INTEGRAL CONNECTOR FOR SINGLE (D60) AND DUAL (D62) TYPE CONNECTIONS



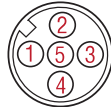
Male, 6-pin (D60) integral connector pin-out as viewed from the end of the sensor

Pin number	Cable Wire color	Function / CANbus outputs
1	Gray	CAN (-)
2	Pink	CAN (+)
3	Yellow	N.C.
4	Green	N.C.
5	Red or Brown	+24 Vdc (-15/+20%)
6	White	DC ground (for supply)

### MALE/FEMALE (M12) INTEGRAL CONNECTORS FOR (D54) TYPE CONNECTIONS



Male, 5-pin (D54) integral connector pin-out as viewed from the end of the sensor



Female, 5-pin (D54) integral connector pin-out as viewed from the end of the sensor

Pin number	Function / CANbus outputs
1	Shield
2	N.C.
3	N.C.
4	CAN (+)
5	(CAN (-)



Input voltage, male, 4-pin (D54) integral connector pin-out as viewed from the end of the sensor

Pin number	Cable Wire color	Function
1	Brown	+24 Vdc (-15/+20%)
2	White	N.C.
3	Blue	DC ground (for supply)
4	Black	N.C.

R-Series  
CANbus



## Models RP and RH Sensors

## Ordering Information

R										1	C										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

## SENSOR MODEL

RP = Profile style

RH = Hydraulic rod style

RF = Flexible style

For more information about the model RF, refer to Specification part no.: 551081 or Industrial Product Catalog, part no.: 551075

## HOUSING STYLE

## 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 and pressure tube, stroke length &lt; 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

— — — — — 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

## Integral connector:

D60 = 6-pin DIN (M16), male, standard

D62 = 6-pin DIN (M16), male, dual

D54 = 5-pin DIN (M12), male/female and 4-pin (M8) male

## Integral cable:

P — — — — — = Integral cable, Orange polyurethane jacket with pigtail termination

## Cable length:

Encode in feet if using US customary stroke length  
Encode in meters if using metric stroke length

— — — — — = 1 (01) to 99 (99) ft. or 1 (01) to 30 (30) meters.

## Cable Length Note:

MTS recommends the maximum integral cable length to be 10 meters (33 ft.). Cables greater than 10 m (33 ft.) in length are available, however, proper care must be taken during handling and installation.

## INPUT VOLTAGE

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

13 - 22 CONTINUED ON PAGE 29



## Models RP and RH Sensors Ordering Information

<b>R</b>												<b>C</b>									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

**OUTPUT (13 - 19)** \_\_\_\_\_ = **C** \_\_\_\_\_ **13-19**

**C** \_\_\_\_\_ = CANbus output - Enter the 6 digit output code (1-6) defined by the following selections  
[1] [2] [3] [4] [5] [6]

[1] [2] [3] Protocol	[4] Baud rate	[5] Resolution	[6] Type
<b>101</b> = CANbasic (MTS)	<b>1</b> = 1000 kBit/s	<b>1</b> = 0.005 mm (0.0002 in.)	<b>1</b> = Standard
<b>207</b> = Multi-position measurement	<b>2</b> = 500 kBit/s	<b>2</b> = 0.002 mm (0.00008 in.)	
<b>304</b> = CANopen	<b>3</b> = 250 kBit/s		
<b>504</b> = CANopen with Linearity Correction Option (LCO)	<b>4</b> = 125 kBit/s		

**NUMBER OF MAGNETS (20- 22) FOR MULTI-POSITION MEASUREMENT ONLY Z** + Enter a 2 digit code \_\_\_\_\_ = **Z** \_\_\_\_\_ **20-22**

**Z** \_\_\_\_\_ = Enter range (02 - 20) 20 magnets maximum

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