

Temposonics®

Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors



R-Series Models RP and RH Profibus-DP Output Data Sheet

Data Sheet Part Number
Reference: 550990



Model RP Profile-style position sensor

Model RH Rod-style position sensor

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 Profibus-DP Output (Position +Velocity)
- Standard and Multi-magnet position measurements (up to 20 positions per sensor)

BENEFITS

- Rugged Industrial Sensor
- Fulfills All Requirements of Profibus-DP (EN 50170) Protocol
- Profibus-DP Provides Powerful Functions for Diagnostics and Configuration
- Linearity Correction Options

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



R-Series Models RP/RH Sensors with Profibus-DP Output

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.

Temposonics R-Series models RP and RH linear-position sensors fulfill all requirements of Profibus-DP (EN 50170) protocol. They also provide absolute position data to Profibus control units by using a serial, bit synchronous, RS-485 format at a baud rate up to 12 Mbps maximum.

In addition to data transmission, Profibus-DP provides powerful functionality for diagnostics and configuration, which is loaded into the bus using the GSD electronic device data sheet file. The downloadable .gsd file for Temposonics Profibus model sensors is available at <http://www.mtssensors.com>.

Product specifications

Parameters	Specifications
OUTPUT	
Measured output variables:	Position, up to 20 magnet positions simultaneously Position + Velocity, up to 5 magnets simultaneously
Resolution:	1 µm, other values are selectable when using the .gsd file
Update times:	0.5 ms at 500 mm, 1 ms at 2000 mm, 2 ms at 4500 mm, 3.1 ms at 7600 mm stroke length. For each additional magnet add 0.05 ms,. Add 0.03 ms for approximate values for velocity measurements.
Non-linearity:	< ± 0.01% full stroke (minimum ± 50 µm) (<i>Linearity Correction Option (LCO) available</i>)
Repeatability:	< ± 0.001% full stroke (minimum ± 2.5 µm)
Hysteresis:	< 4 µm
Outputs:	Interface: Profibus-DP system ISO 74498 Data format: Profibus-DP (EN 50 170)
Data transmission rates:	12 MBd 1.5 MBd 500 kBd 187.5 kBd ≤93.75 kBd
Cable length, m:	<100 <200 <400 <1000 <1200
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.) (<i>Contact Factory for longer stroke lengths.</i>)
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 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
WIRING	
Connection type:	D63 option: Two 6-pin (M16) connectors one male and one female D53 option: Two 5-pin (M12) connectors one male and one female. plus one 4-pin connector (M8) male
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 M18x1.5 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 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

Green	Red	Operation status/mode
ON	OFF	Normal function (operation mode)
ON	ON	Magnet not detected or wrong quantity of magnets
Flashing	OFF	Waiting for master parameters
Flashing	ON	Programming mode

Table 1. Diagnostic display indicator modes

Profibus-DP output parameters

R-Series sensors with Profibus-DP output are compliant with Profibus DP slave class 2 and have the following features:

Selectable outputs:

- Absolute position measurement
- Velocity measurement
- Sensor Status
- Error detection (e.g. magnet status)

Selectable parameters:

- Offset / preset for each magnet
- Measuring direction; forward and reverse acting
- Intel® and Motorola® data format transfers

OPERATION MODES

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

Standard measurement (P102 output code):

- Position (using one magnet)

Multi-magnet measurement (P101 output code):

- Position (using up to 20 magnets simultaneously)

Multi-magnet measurement (P103 output code):

- Position + velocity (using up to 5 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')

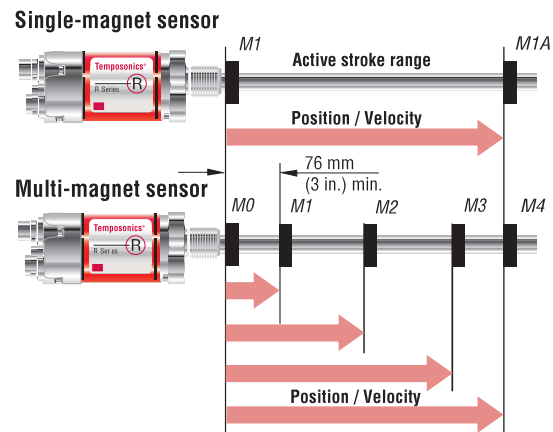


Figure 2. Single and multi-magnet output diagram

Profibus-DP communication and functionality

DATA EXCHANGE

For multi-magnet measurement, 1 status byte and 3 bytes of position data for each position are transmitted. The status byte contains an error bit and the position number for the following measurement value. Dependent on sensor parameters, sensor data can be transferred in different data formats, (e.g. Intel® or Motorola®)

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.

Models RP and RH Programming Accessory

Model RP Profile-Style Sensor Dimension References

Profibus-DP Node and Field Address programmer

The *Profibus-DP Handheld Address Programmer* (see 'Figure 3') is offered as an accessory used to setup the *Slave Address* via the Profibus-DP interface. Addressing is usually performed by the Profibus-DP SetSlaveAddress command. If the master system or controller does not support this service, connecting the Profibus-DP Handheld Address Programmer to the sensor will bypass the service and allow direct setup.

The *Profibus-DP Handheld Address Programmer* part no.: 280640, comes with a 24 Vdc wall adapter power supply and three programming cables; one cable for Profibus sensors with the D63 connection type and two cables for Profibus sensors with D53 connection types.



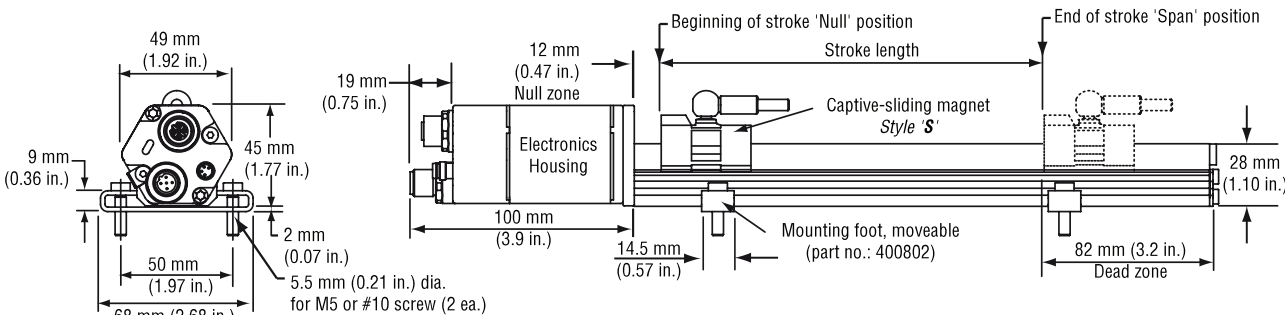
Figure 3. R-Series Profibus-DP Handheld Address Programmer, kit part no.: 280640

Programming accessory	Function	Part number
Profibus handheld address programming kit	Displays the current Profibus node address for the sensor and provides new address programming capability from 01 to 7E hex.	280640
Profibus master simulator	Check sensor operation using Bihl + Wiedemann, Model 1131	401727
Master simulator cable	For sensors with the D63 connection type	401726
Master simulator cables	For sensors with the D53 connection type	252383
Profibus noise filter box	Junction box with noise filter for connecting 24 Vdc input power on to the bus when using the hybrid Profibus cable, (D63 connection type).	252916

Model RP profile-style sensor dimension references

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

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

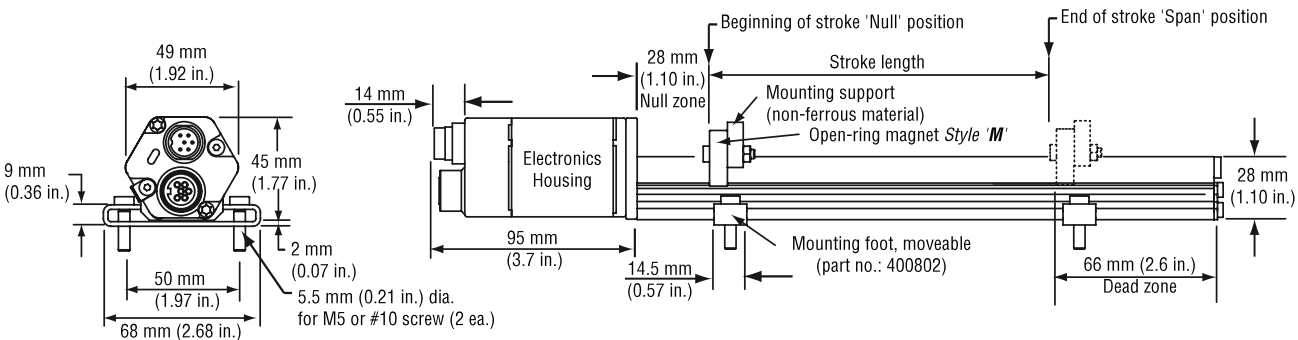


D53 Connector option

Figure 4. R-Series Model RP Profile-style sensor dimension reference (Shown with the **D53** connector option)

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

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



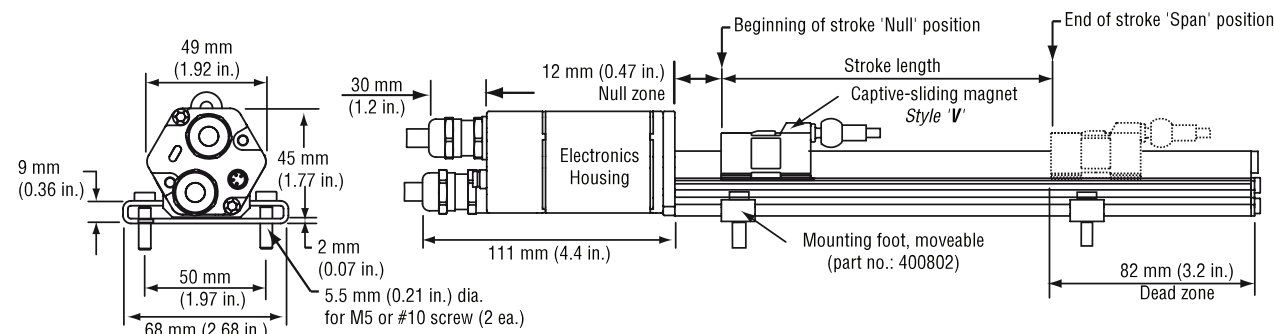
D63 Connector option

Figure 5. R-Series Model RP Profile-style sensor dimension reference (Shown with the **D63** connector option)

Model RP Profile-Style Sensor Dimensions Model RH Rod-Style Sensor Dimensions

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

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



A05 Integral cable option

Figure 6. R-Series Model RP Profile-style sensor dimension reference (Shown with the **A05** integral cable 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 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.

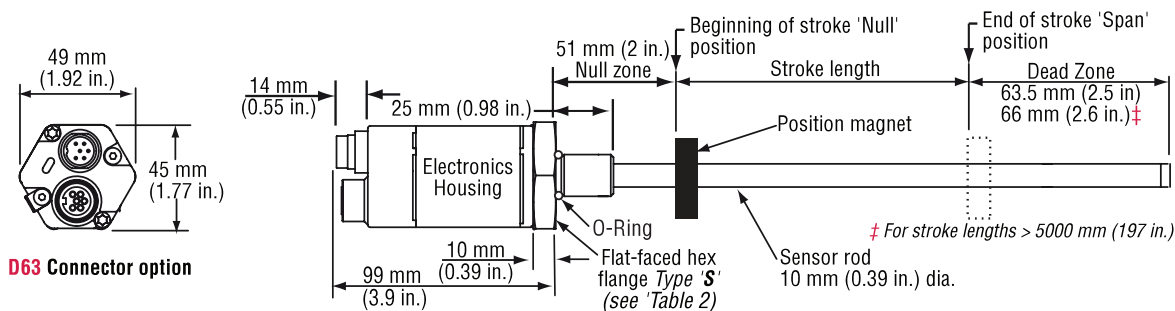


Figure 7. Model RH Rod-style sensor dimension reference (shown with **D63** connector option)

R-Series
Profibus

Model RH Rod-Style Sensor Dimension References

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

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

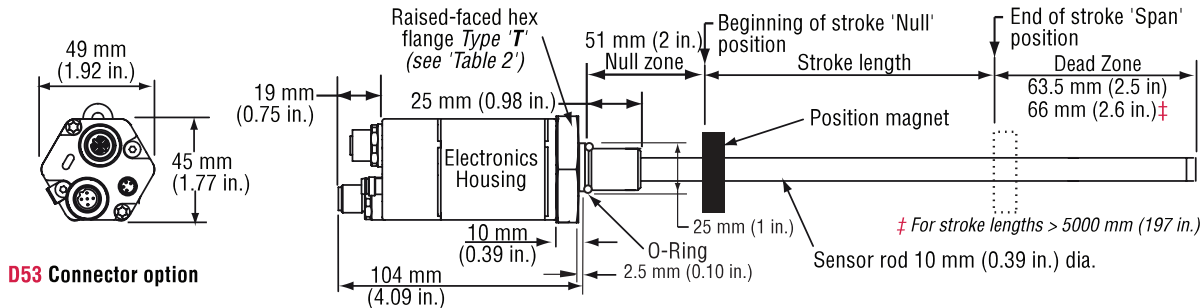


Figure 8. Model RH Rod-style sensor dimension reference (shown with **D53** connector option)

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

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

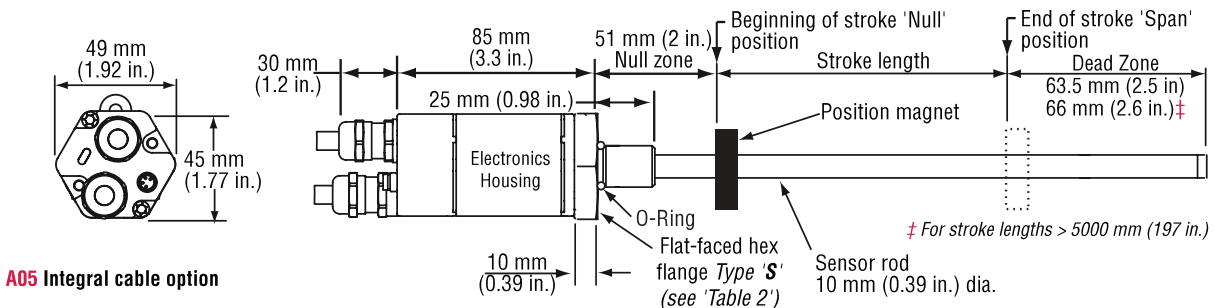


Figure 9. Model RH Rod-style sensor dimension reference (Shown with the **A05** Integral cable connection type option)

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

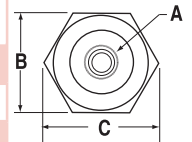



Table 2. Model RH Rod-style sensor housing style and flange type references

Standard magnets, mounting and instalation (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

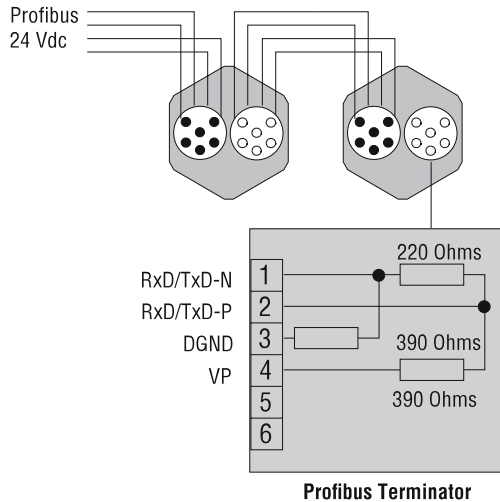
 Refer to the Accessories section of this catalog for magnet, cable connector selections and detailed mounting and installation information.

Connections and wiring options

BUS / INPUT VOLTAGE CONNECTION OPTIONS (DAISY-CHAIN TOPOLOGIES)

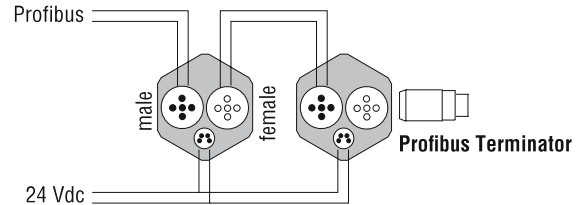
(D63) CONNECTOR OPTION

The shielded hybrid cable (5 wires; two bus, two power supply and 1 machine ground, part no.: 530040) is used for both bus and supply voltage (D63) connections. This provides convenient daisy-chain connections for applications with multiple Profibus-DP sensors.



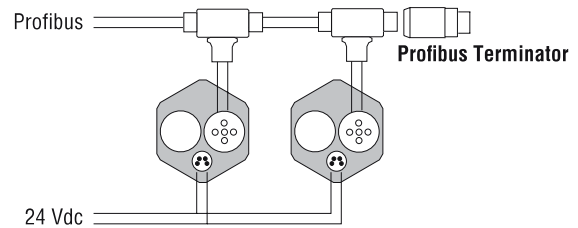
(D53) CONNECTOR OPTION

For (D53) connection types, a separate 4-pin connector and cable is used for the supply voltage.



(D53) CONNECTOR OPTION WITH THE 'T' CONNECTOR

A 'T' connector is used with the separate bus cable to enable the bus to remain active when a sensor is disconnected.



Connections and wiring (D63)

BUS CONNECTOR OPTION PINOUTS/FUNCTIONS

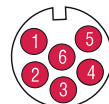


D63 Male, 6-pin outlet

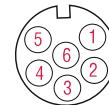


D63 Female, 6-pin outlet

MALE/FEMALE, 6-PIN (D63) INTEGRAL CONNECTOR OPTION FOR SHIELDED HYBRID CABLE FOR BUS AND INPUT VOLTAGE



Male, 6-pin (M16) integral connector pin-out as viewed from the end of the sensor



Female, 6-pin (M16) integral connector pin-out as viewed from the end of the sensor

Pin number	Cable wire color	Function
1	Green	RxD/TxD-N (Bus)
2	Red	RxD/TxD-P (Bus)
3	N/A	DGnd (Bus termination) <i>female connector only</i>
4	N/A	VP (Bus termination) <i>female connector only</i>
5	Black	+24 Vdc (-15/+20%)
6	Blue	DC ground (for supply)
N/A	Yellow/ Green	Shielding, machine ground

Models RP and RH Sensors
Connection and Wiring Options

Connections and wiring (D53)

BUS CONNECTOR OPTION PINOUTS/FUNCTIONS



D53
Male, 4-pin
Input voltage

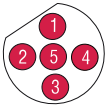


D53
Male
5-pin outlet

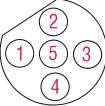


D53
Female
5-pin outlet

MALE/FEMALE, 5-PIN (D53) INTEGRAL CONNECTOR OPTION



Male, 5-pin (M12) integral connector pin-out as viewed from the end of the sensor



Female, 5-pin (M12) integral connector pin-out as viewed from the end of the sensor

Pin number	Cable wire color	Function
1	N/A	VP+5 (Bus termination) <i>female connector only</i>
2	Green	RxD/TxD-N (Bus)
3	N/A.	DGnd (Bus termination) <i>female connector only</i>
4	Red	RxxD / TxD-P (Bus)
5	Shield	Shield

INPUT VOLTAGE INTEGRAL CONNECTOR OPTION



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

Pin number	Wire color	Function
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										1	P							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

SENSOR MODEL

RP = Profile style

RH = Hydraulic rod style

RF = Flexible style

(For more information about the model RF option, refer to Specification part no.: 551081 or 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 < 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 TYPES

Integral connector:

D63 = Two 6-pin DIN (M16), male/female, standard

D53 = Two 5-pin DIN (M12), male/female plus one 4-pin (M8) male

Integral cable:

A — — = Integral cable, Hybrid Profibus 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 - 19) Continued on next page

R-Series
Profibus

Models RP and RH Sensors

How to Order

PRODUCT SPECIFICATION / DATA SHEET

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

OUTPUT (13 - 16) _____ =

P			
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13-16

P _____ = Profibus-DP protocol - Enter the 3 digit output code (1-3) defined by the following selections

[1] [2] [3]

[1] [2] [3] Protocol

101 = Multi-magnet (multi-position measurement) max. 20 positions

102 = Single magnet measurement (standard)

103 = Position, velocity (max. 5 positions and 5 velocities)

202L = Multi-magnet, up to 20 magnets with Linearity Correction Option (LCO)

NUMBER OF MAGNETS (17- 19) FOR MULTI-POSITION MEASUREMENT ONLY Z + Enter a 2 digit code _____ =

Z		
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17-19

Z _____ = If output **P101** or **P202L** is entered, enter a number between (02 - 20).
 [1] [2] If output **P103** is entered, enter a number between (02 - 05)
 (For multi-position measurements, additional magnets are ordered separately.)