

Temposonics®

Magnetostrictive Linear-Position Sensors

R-Series Model RP and RH Sensors
Synchronous Serial Interface (SSI) Output

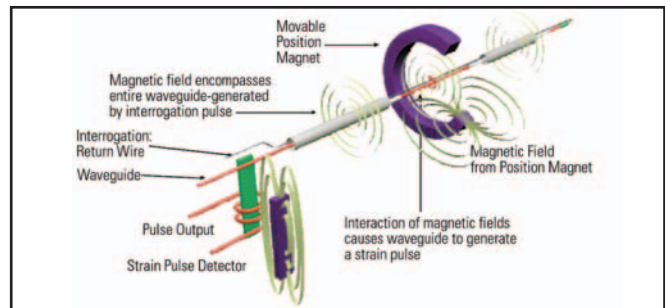
MTS
SENSORS

550989 C

Product Specification



- Rugged industrial sensor
- Linear, absolute measurement
- LEDs for sensor diagnostics
- Non-contact sensing technology
- Superior accuracy: Resolution up to 1 μm
- Non-linearity less than 0.01%
- Repeatability within 0.001%
- Direct 24/25/26 Bit SSI output, gray/binary
- Synchronous measurement for real-time sensing



The benefits of magnetostrictive sensing

Temposonics linear sensors use the time-based magnetostrictive position sensing principle developed by MTS. Within the sensing element, a sonic strain pulse is induced in a specially designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable permanent magnet that passes along the outside of the sensor. The other field comes from an “interrogation” current pulse applied along the waveguide. The resulting strain pulse travels at ultrasonic speed along the waveguide and is detected at the head of the

sensing element. The position of the magnet is determined with high precision and speed by accurately measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse with a high speed counter. Using the elapsed time to determine position of the permanent magnet provides an absolute position reading that never needs recalibration or re-homing after a power loss. Non-contact sensing eliminates wear, and guarantees the best durability and output repeatability.



All specifications are subject to change. Please contact MTS for specifications that are critical to your needs.

R-Series Model RP and RH sensor parameters

R-Series linear-position sensors

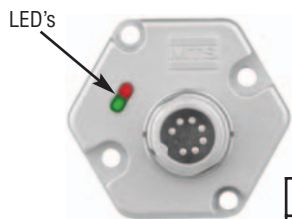
- R-Series model RH and RP sensors are extremely robust and are ideal for continuous operation under harsh industrial conditions.
- Two standard sensor housings are available. The rod housing is capable of withstanding high pressures such as those found in hydraulic cylinders. The profile extrusion housing provides convenient mounting options and sliding magnets.
- 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.

Parameters	Specification																				
Measured variable:	Displacement, displacement difference between 2 magnets, velocity																				
Resolution:	Displacement: 1 µm, 2 µm, 5 µm, 10 µm, 20 µm, 50 µm, 100 µm.																				
Update time:	Measuring length: <table border="1"> <tr> <td>300</td> <td>750</td> <td>1000</td> <td>2000</td> <td>5000</td> </tr> <tr> <td>mm</td> <td></td> <td></td> <td></td> <td></td> </tr> </table> Measurements/sec. <table border="1"> <tr> <td>3.7</td> <td>3.0</td> <td>2.3</td> <td>1.2</td> <td>0.5</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	300	750	1000	2000	5000	mm					3.7	3.0	2.3	1.2	0.5					
300	750	1000	2000	5000																	
mm																					
3.7	3.0	2.3	1.2	0.5																	
Non-linearity:	< ± 0.01% F.S. (minimum ± 40 µm)																				
Repeatability:	< ± 0.001% F.S. (minimum ± 2.5 µm) Hysteresis: < 4 µm typical 2 µm																				
Outputs:	Interface: Synchronous Serial Interface (SSI) or Differential signal in SSI standard. Data format: Binary or gray, optional parity and errorbit Data length: 8 to 32 bit Data speed: 70 kBd to 1 MBd, depending on cable length:																				
	<table border="1"> <tr> <td>Length:</td> <td><3</td> <td><50</td> <td><100</td> <td><200</td> <td><400</td> </tr> <tr> <td>Baud rate:</td> <td>1.0 MBd</td> <td><400 kBd</td> <td><300 kBd</td> <td><200 kBd</td> <td><100 kBd</td> </tr> </table>	Length:	<3	<50	<100	<200	<400	Baud rate:	1.0 MBd	<400 kBd	<300 kBd	<200 kBd	<100 kBd								
Length:	<3	<50	<100	<200	<400																
Baud rate:	1.0 MBd	<400 kBd	<300 kBd	<200 kBd	<100 kBd																
Measuring range:	Profile style: 50 - 5080 mm (2 - 200 in.) Rod style: 50 - 7620 mm (2 - 300 in.)																				
Operating voltage:	+24 Vdc nominal (-15 or +20%) Polarity protection: up to -30 Vdc Overvoltage protection: up to 36 Vdc Current drain: 100 mA typical Dielectric withstand voltage: 500 V (DC ground to machine ground)																				
Operating conditions:	Temperature: - 40 to +75 °C Relative humidity: 90% no condensation Temperature coefficient: < 15 ppm / °C For two magnet differential output: Min. 75 mm distance between magnets. Magnet speed: Any																				
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/10-2000 Hz/IEC standard 68-2-6																				
Connection type:	7-pin male D70 connector or integral cable																				
PROFILE STYLE (RP MODEL)																					
Electronic head:	Aluminum housing Diagnostic display (LED's beside connector/cable exit)																				
Sealing:	IP 65																				
Sensor extrusion:	Aluminum (Temposonics profile style)																				
Mounting:	Adjustable mounting feet or T-slot nut (M5 threads) in base channel																				
Magnet type:	Captive-sliding magnet or floating (open ring) magnet																				
ROD STYLE (RH MODEL)																					
Electronic head:	Aluminum housing Diagnostic display (LED's beside connector/cable exit)																				
Sealing:	IP 67 or IP 68 for integral cable model																				
Sensor rod:	304L Stainless steel																				
Operating pressure:	350 bar, 690 bar peak, (5,000 psi, 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 type:	Ring magnet, floating (open ring) magnet, or magnet float																				

Enhanced monitoring and diagnostics

Sensor status and diagnostic display

Integrated LEDs (green/red) provide basic visual feedback for normal sensor operation and troubleshooting.



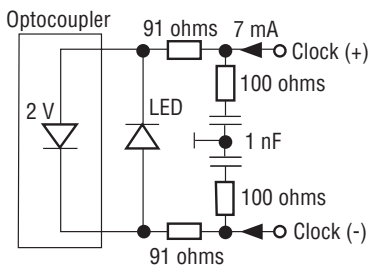
Green	Red	Description
ON	OFF	Normal function
ON	ON	Magnet not detected
ON	Flashing	Sensor not synchronous*
Flashing	ON	Programming mode

*for synchronous operation mode only.

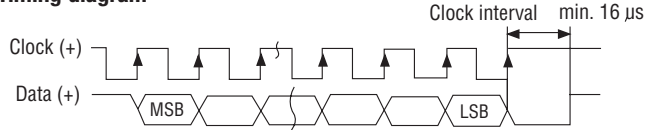
SSI (Synchronous Serial Interface)

The sensors fulfill all requirements of the SSI standard for absolute encoders. Its displacement value is encoded in a 24/25/26 code format and transmitted at high speed in SSI standard format to the control device. The main feature of SSI is the synchronized data transfer. Synchronization in a closed-loop control system is made simple. A clock pulse train from a controller is used to gate out sensor data: one bit of position data is transmitted to the controller per one clock pulse received by the sensor. The absolute position data is continually updated by the sensor and converted by the shift-register into serial information.

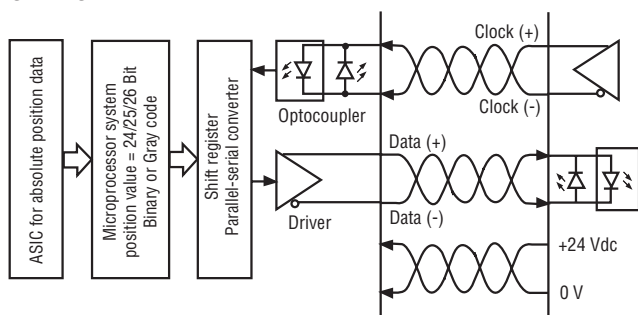
Sensor input



Timing diagram



Logic diagram



Advanced communication and programmability

Sensor field programming

Temposonics R-Series sensors are preconfigured at the factory by model code designation. If needed, MTS offers a programming kit for modifying the sensor parameters. There is no need to open the sensor's electronics housing.

R-Series SSI PC programming kit

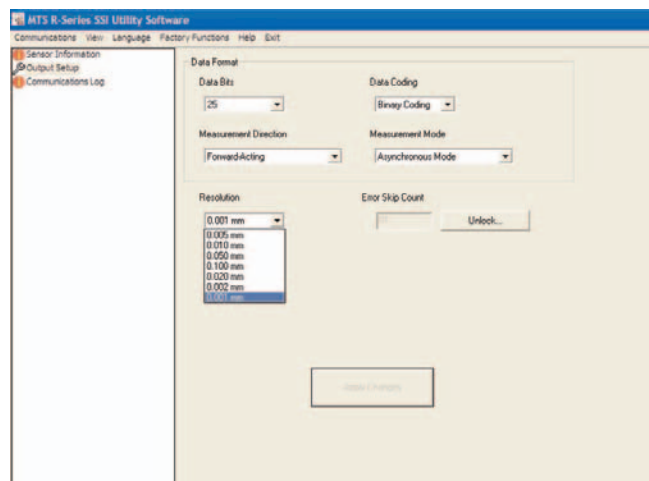
This programming kit includes a wall adapter style power supply, serial converter box, two connection cables (wired for RS-422 protocol), and the software CD-ROM. The SSI parameters that are field programmable are as follows:

- Data length
- Data format
- Resolution
- Measuring direction
- Synchronous / asynchronous measurement
- Offset, start of the measurement range
- Alarm value (Magnet outside stroke range)
- Measurement filter
- Differential measurement: Distance between two magnets
- Speed measurement instead of position



Programming Kit, Part No. 253310
(Serial converter, Power supply, Cable, Software)

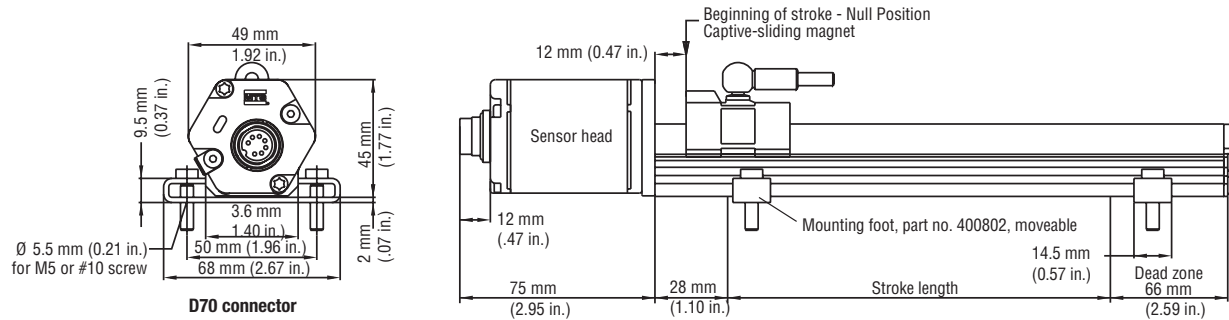
Windows sensor programming example



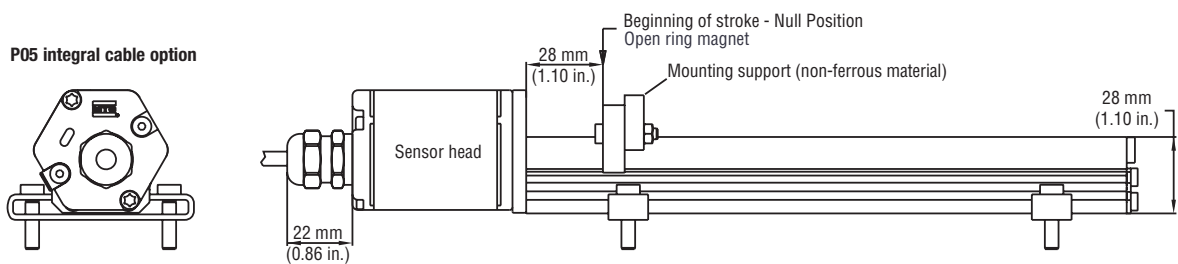
Model RP profile-style sensor

The Temposonics model RP sensor offers modular construction, flexible mounting configurations and easy installation.

Captive-sliding magnet



Floating magnet (open ring)



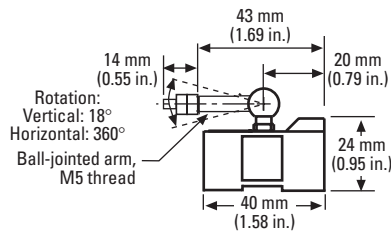
Selection of position magnets (included with sensor)

A choice of two magnet mounting configurations are available with the profile-style sensor; the captive-sliding magnet or the floating (open ring) magnet.

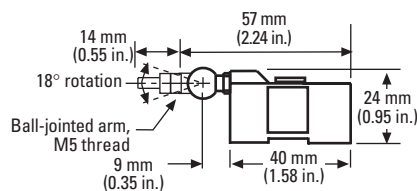
Captive-sliding magnets utilize slide bearings of special material that reduce friction, and if required, help mitigate dirt build up. The slide bearings are designed to operate dry, requiring no external lubrication or maintenance.

The floating magnet (open ring) mounts on the moving machine part and travels just above the sensor's profile extrusion. The open ring magnet (style M) requires a minimum distance away from ferrous metals to allow proper sensor output. It must be mounted using non-ferrous screws and a non-ferrous support bracket, or utilize a non-ferrous spacer of at least 5 mm (0.2 in.) thickness.

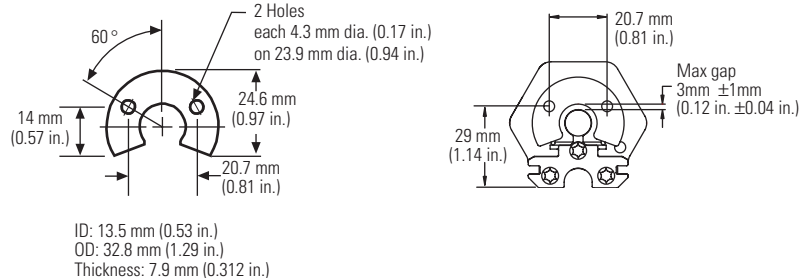
Captive-sliding magnet, style S part no. 252182



Captive-sliding magnet, style V part no. 252184

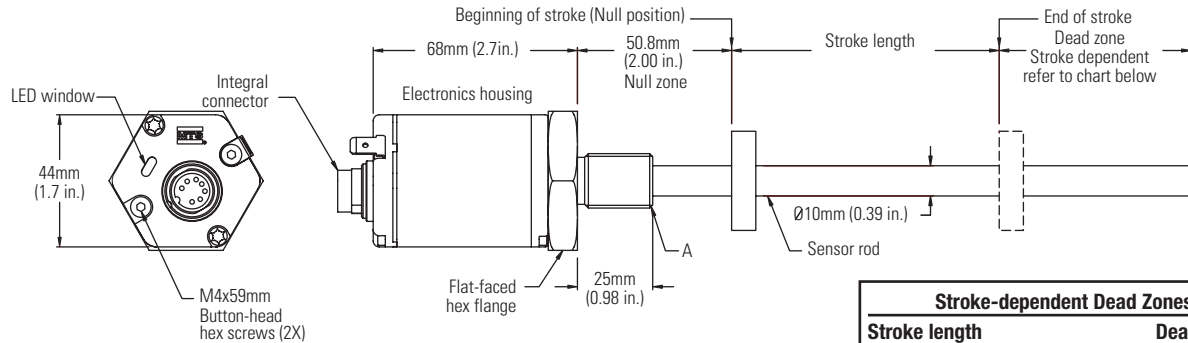


Floating (open ring) magnet, style M part no. 251416-2

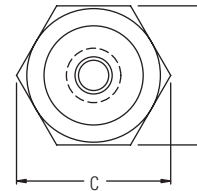
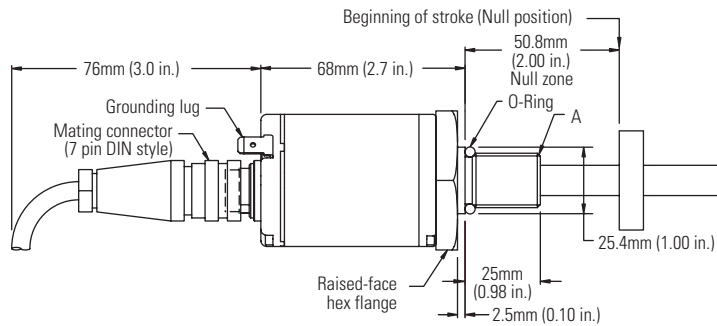


Model RH rod-style sensor

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



Stroke-dependent Dead Zones	
Stroke length	Dead zone
50 - 5000 mm (2 - 197 in.)	63.5 mm (2.5 in.)
5005 - 7620 mm (197.1 - 300 in.)	66 mm (2.6 in.)

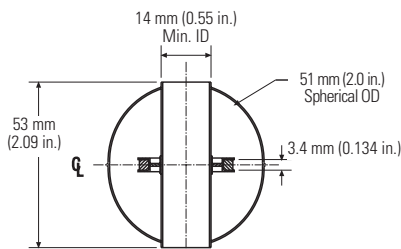


Housing style Flange type	Description	A Flange threads	B Dimensions	C Dimensions
T	US customary threads with raised-face hex	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2.0 in.)
S	US customary threads with flat-faced hex	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2.0 in.)
M	Metric threads with flat-faced hex	M18 x 1.5	46 mm (1.81 in.)	53 mm (2.1 in.)

Selection of position magnets (must order separately)

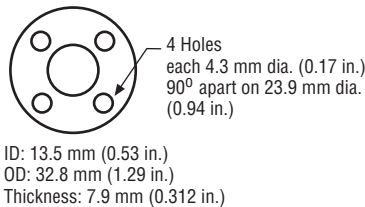
Magnets must be ordered separately with model RH position sensors. The standard ring magnet (part number 201542-2) is suitable for most applications.

Magnet Float (Level Sensing Application)
Part No. 251447

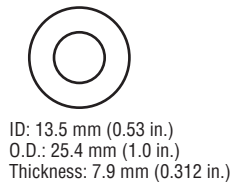


Specific Gravity: 0.70 max.
Pressure: 870 psi max.
(Float for use with rod-style sensors in hydraulic fluid or fresh water applications only)

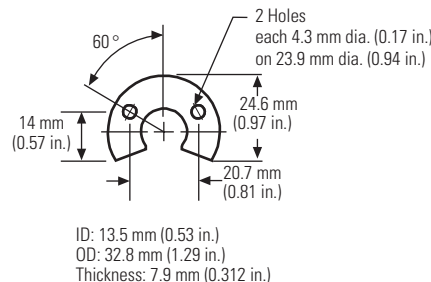
Standard-ring magnet part no. 201542-2



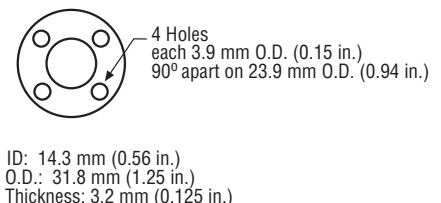
Ring magnet part no. 400533



Floating magnet (open ring), style M part no. 251416-2



Magnet spacer (non-ferrous spacer for use with standard ring magnet) part no. 400633

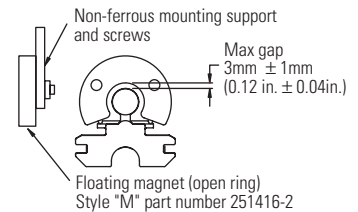
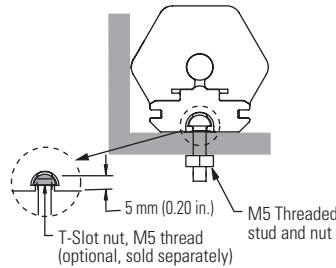
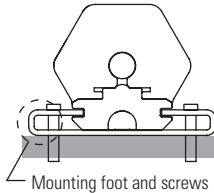


Mounting, wiring and magnets

Profile-style sensor mounting

Flexible installation in any position

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.

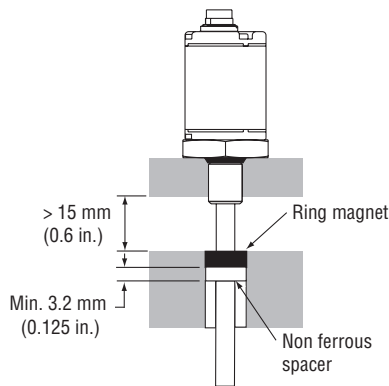


Note:

Temposonics Model RP sensors include two mounting feet (part no. 400802) for sensors up to 1250 mm (50 in.) One additional mounting foot is included for every additional 500 mm (20 in.)

Rod-style sensor mounting

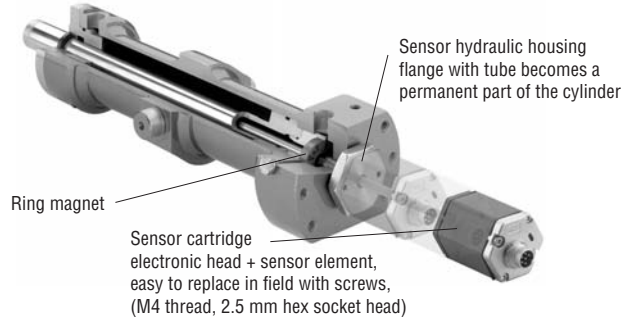
The position magnet requires minimum distances away from ferrous metals to allow proper sensor output. The minimum distance from the front of the magnet to the cylinder end cap is 15 mm (0.6 in.). The minimum distance from the back of the magnet to the piston head is provided by the non-ferrous spacer, i.e. 3.2 mm (0.125 in.).



Cylinder installation

When used for direct stroke measurement in fluid cylinders, the sensor's high pressure, stainless steel rod installs into a bore in the piston head/rod assembly as illustrated. This method guarantees a long-life and trouble-free operation.

The sensor cartridge can be removed from the flange and rod housing while still installed in the cylinder. This procedure allows quick and easy sensor cartridge replacement, without the loss of hydraulic pressure.



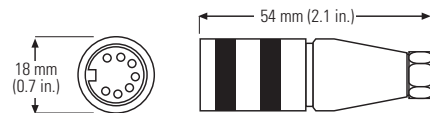
Sensor connections

Wiring	Pin	Cable	Function
6	1	grey	Data (-)
7	2	pink	Data (+)
1	3	yellow	Clock (+)
4	4	green	Clock (-)
2	5	brown	+24 Vdc
3	6	white	0 V (GND)
5	7	n.c.	

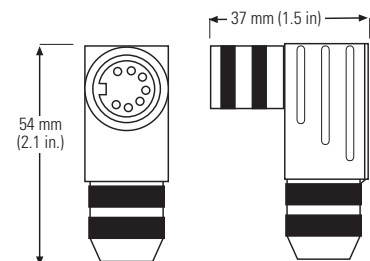
Male connector pin-out as viewed from the end of the sensor.

Cable connector (recommended, order separately)

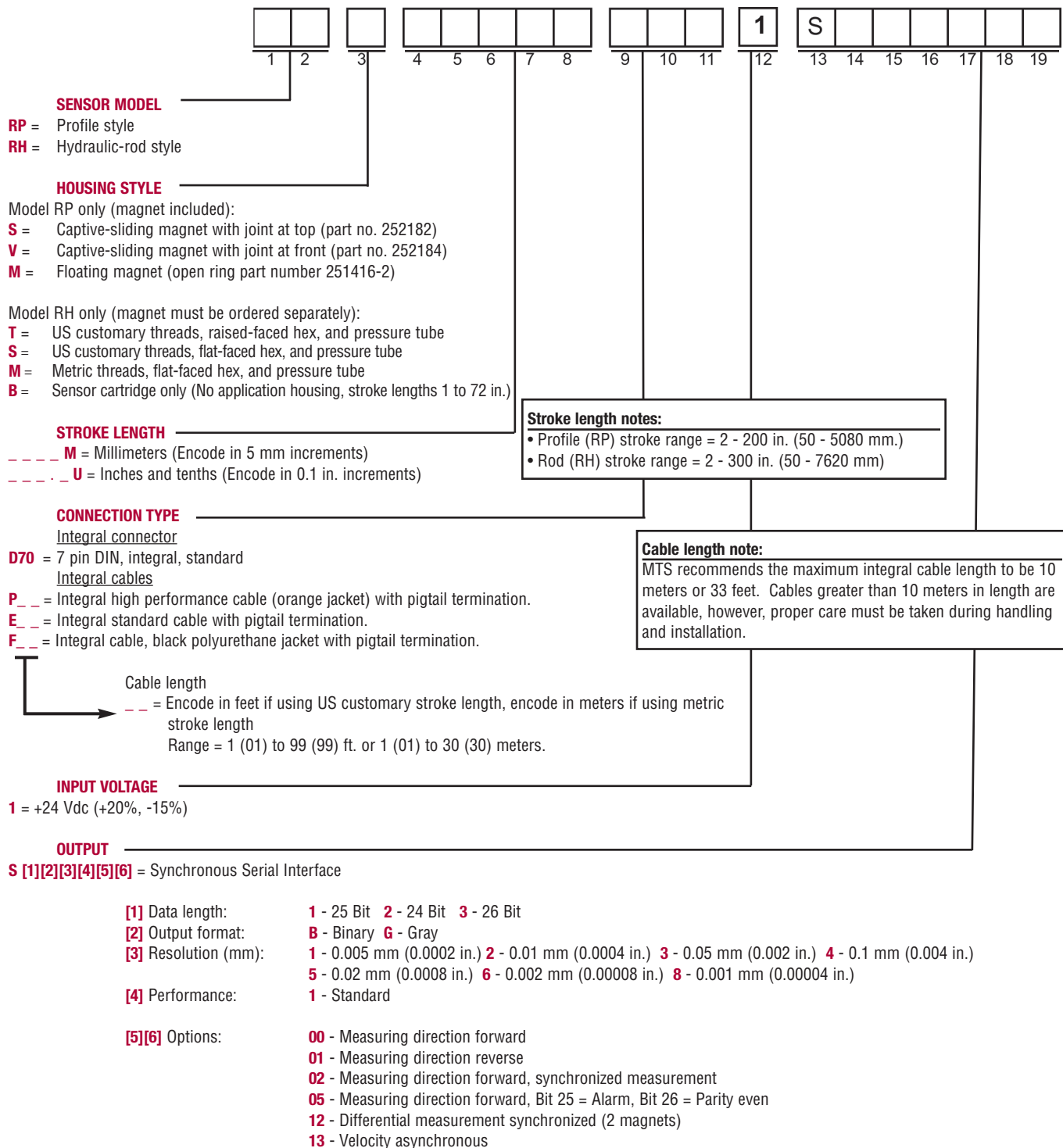
D7 straight-exit connector part no. 560701



D7 90° connector part no. 560779



How to order



How to order (continued)

Accessories

Description	Function/Notes	Part no.
Mounting feet, standard (spares)	Model RP sensors come with mounting feet (see page 6).	400802
Base channel T-slot nut	Nut for mounting model RP sensors. Requires M5 screw (see page 6).	401602
Hex jam nut	3/4 - 16 UNF nylon insert locknut for use with model RH sensors with style "T" or "S" housing	500015
O-Ring (spare)	For use with model RH sensors with style "T" or "S" housing	560315
O-Ring (spare)	For use with model RH sensors with style "M" housing	401133
Joint-rod Sleeve (1 in.)	For use with model RP sensors with "S" or "V" style magnets	401603
Ball-jointed arm, straight	For use with model RP sensors with "S" or "V" style magnets	401913

Magnets and float options

Description	Function/Notes	Part no.
Small open ring (model RP spare)	Magnet style M, "floating" magnet used with model RH and RP sensors.	251416-2
Small ring magnet	Standard magnet for model RH sensors.	201542-2
Magnet float	For use with RH sensors used to measure liquid level	251447
Captive-sliding magnet (spare)	Style S captive-sliding magnet with joint at top. Comes with RP sensors.	252182
Captive-sliding magnet (spare)	Style V captive-sliding magnet with joint at front. Comes with RP sensors.	252184
Magnet spacer	For use with standard ring magnet, part no. 201542-2.	400633
Collar	Provides end of stroke "stops" for magnet float, part number 251447	560777
Magnet mounting screws	Used to mount the standard ring magnet, part no. 201542-2. (4 screws required)	560357

Field-installed connectors

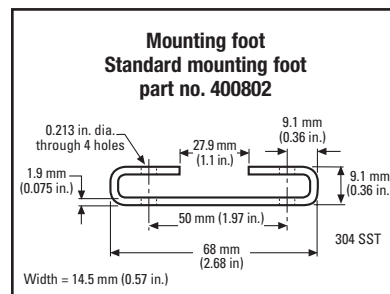
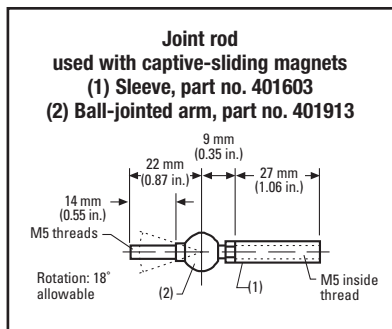
Description	Function/Notes	Part no.
7-pin DIN connector, 90°	Female, 90° exit, mates to D70 connection type (see page 6)	560779
7-Pin DIN connector, straight	Female, straight exit, mates to D70 connection type (see page 6)	560701

Cables

Description	Function/Notes	Part no.
PUR cable	High performance shielding, orange polyurethane jacket	530029
PVC cable	Standard cable, gray PVC jacket	530026
PUR cable	Black polyurethane jacket for higher resistance to moisture and oil	530045

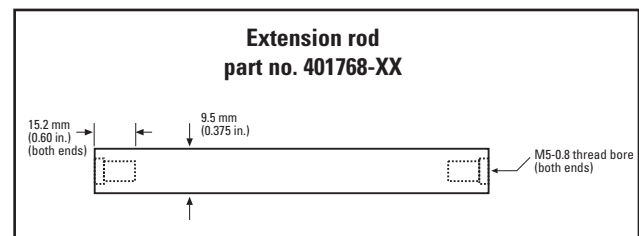
Programming tools

Description	Function/Notes	Part no.
R-Series SSI PC programming kit	Includes serial converter, power supply (100-240V 24 Vdc), connection cable and software	253310



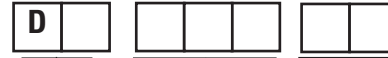
Optional extension rods (for use with captive-sliding magnets)

Extension rod lengths	Part no.	Extension rod lengths	Part no.
60.3 mm (2.375 in.)	401768-2	390.5 mm (15.375 in.)	401768-15
85.7 mm (3.375 in.)	401768-3	466.7 mm (18.375 in.)	401768-18
111.1 mm (4.375 in.)	401768-4	517.5 mm (20.375 in.)	401768-20
161.9 mm (6.375 in.)	401768-6	542.9 mm (21.375 in.)	401768-21
187.3 mm (7.375 in.)	401768-7	619.1 mm (24.375 in.)	401768-24
212.7 mm (8.375 in.)	401768-8	771.5 mm (30.375 in.)	401768-30
238.1 mm (9.375 in.)	401768-9	923.9 mm (36.375 in.)	401768-36
263.5 mm (10.375 in.)	401768-10	1076.3 mm (42.375 in.)	401768-42
314.3 mm (12.375 in.)	401768-12	1228.7 mm (48.375 in.)	401768-48
365.1 mm (14.375 in.)	401768-14	1533.5 mm (60.375 in.)	401768-60



How to order (continued)

Extension cable with connectors for the D7, (D70), connection type



SENSOR CONNECTION TYPE

- D7** = Female connector, (straight exit), and (part no. 530029) cable, (high performance shielding, orange polyurethane jacket)
- DR** = Female connector, (90° exit), and (part no. 530029) cable, (high performance shielding, orange polyurethane jacket)
- DS** = Female connector, (straight exit), and standard (part no. 530026) cable, (PVC jacket)
- DT** = Female connector, (90° exit), and standard (part no. 530026) cable, (PVC jacket)
- DU** = Female connector, (straight exit), and (part no. 530045) cable, (black polyurethane jacket)
- DV** = Female connector, (90° exit), and (part no. 530045) cable, (black polyurethane jacket)

CABLE LENGTHS

For standard length cables up to 100 ft

- 005** = 5 ft. **050** = 50 ft.
- 015** = 15 ft. **100** = 100 ft.
- 025** = 25 ft.

For custom length cables over 100 ft

--- = Cable length (maximum cable length is dependent on the baud rate, refer to cable length limitations table, or consult MTS Applications Engineering)

CABLE TERMINATION

- P0** = Pigtail connection, (no connector).

CABLE LENGTH LIMITATIONS

(BASED ON PUBLISHED BUS AND SERIAL COMMUNICATIONS STANDARDS)

Apply good industry practices for long cable runs - keep cable away from high power AC lines and all motor drive cables.

R-Series Sensor Models	Baud Rate	Maximum Cable or Bus Length	
R-Series SSI	1.5 MBd	10 ft.	(3 m)
	400 kBd	160 ft.	(50 m)
	300 kBd	320 ft.	(100 m)
	200 kBd	650 ft.	(200 m)
	100 kBd	1300 ft.	(400 m)



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Part Number: 04-06 550989 Revision C
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