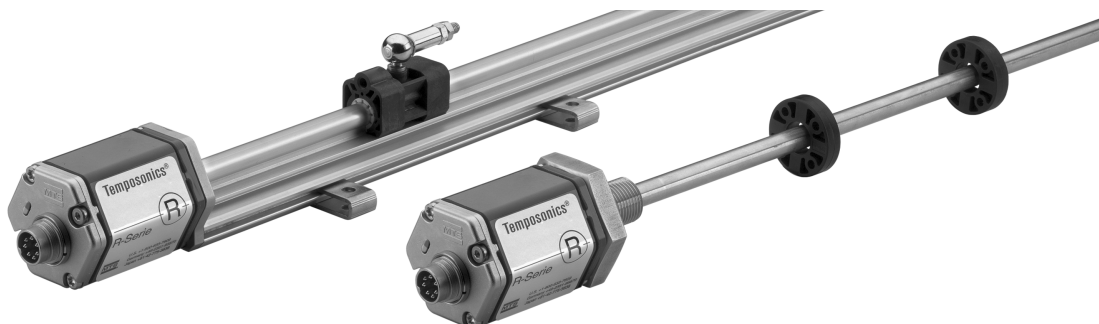


## R-Series Models RP and RH Sensors Synchronous Serial Interface (SSI) Output



- Rugged industrial sensor
- Linear, absolute measurement
- LEDs for sensor diagnostics
- Non-contact sensing technology
- Superior accuracy: Resolution down to 1  $\mu$ m
- 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

### 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 active signal conditioning and a complete integrated electronics interface. Double shielding is used to ensure EMI protection for unsurpassed reliability and operating safety.

Parameters	Specifications
<b>Measured variables:</b>	Displacement, displacement difference between 2 magnets, velocity
<b>Resolution:</b>	Displacement: 1 $\mu$ m, 2 $\mu$ m, 5 $\mu$ m, 10 $\mu$ m, 20 $\mu$ m, 50 $\mu$ m, 100 $\mu$ m.
<b>Update time:</b>	Measuring length: 300 750 1000 2000 5000 mm Measurements/sec. 3.7 3.0 2.3 1.2 0.5 kHz
<b>Non-linearity:</b>	< $\pm$ 0.01% F.S. (minimum $\pm$ 40 $\mu$ m)
<b>Repeatability:</b>	< $\pm$ 0.001% F.S. (minimum $\pm$ 2.5 $\mu$ m) Hysteresis: < 4 $\mu$ m typical 2 $\mu$ m
<b>Outputs:</b>	Interface: Synchronous Serial Interface (SSI) or Differential signal in SSI standard. Data format: Binary or gray, optional parity and error bit Data length: 8 to 32 bit Data speed: 70 kBd to 1 MBd, depending on cable length: Length: <3 <50 <100 <200 <400 m Baud rate: 1.0 MBd <400 kBd <300 kBd <200 kBd <100 kBd

Parameters	Specifications (continued)
<b>Stroke length:</b>	Profile-style sensor: 50 mm (2 in.) to 5080 mm (200 in.) Rod-style sensor: 50 mm (2 in.) to 7620 mm (300 in.)
<b>Operating voltage:</b>	+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 Vdc (DC ground to machine ground)
<b>Operating conditions:</b>	Temperature: -40 $^{\circ}$ C (-40 $^{\circ}$ F) to 75 $^{\circ}$ C (167 $^{\circ}$ F) Relative humidity: 90% no condensation Temperature coefficient: < 15 ppm / $^{\circ}$ C For two magnet differential outputs: 75 mm (3 in.) min. distance between magnets. Magnet speed: Any
<b>EMC test:</b>	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
<b>Shock rating:</b>	100 g (single hit)/IEC standard 68-2-27 (survivability)
<b>Vibration rating:</b>	15 g (30 g with HVR option)/ 10-2000 Hz/IEC standard 68-2-6
<b>Connection type:</b>	7-pin D70 male connector or integral cable

### PROFILE STYLE (MODEL RP) SENSOR

<b>Electronic head:</b>	Aluminum housing Diagnostic display (LED's located beside connector/cable exit)
<b>Sealing:</b>	IP 65
<b>Sensor extrusion:</b>	Aluminum
<b>Mounting:</b>	Adjustable mounting feet or T-slot nut (M5 threads) in base channel
<b>Magnet type:</b>	Captive-sliding magnet or open-ring magnet

### ROD STYLE (MODEL RH) SENSOR

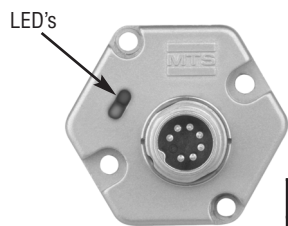
<b>Electronic head:</b>	Aluminum housing Diagnostic display (LED's located beside connector/cable exit)
<b>Sealing:</b>	IP 67 or IP 68 for integral cable model
<b>Sensor rod:</b>	304L Stainless steel
<b>Operating pressure:</b>	350 bar, 690 bar peak, (5,000 psi, 10,000 psi peak)
<b>Mounting:</b>	Any orientation. Threaded flange M18 x 1.5 or 3/4-16 UNF-3A
<b>Typical mounting torque:</b>	45 N-m (33 ft. - lbs.)
<b>Magnet type:</b>	Ring magnet, 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.



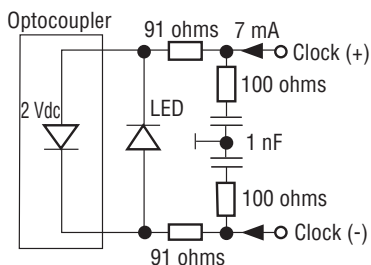
Green	Red	Description
ON	OFF	Normal function
ON	ON	Magnet not detected
ON	Flashing	Sensor not synchronous*
Flashing	ON	Programming mode

\*for synchronous operation mode only.

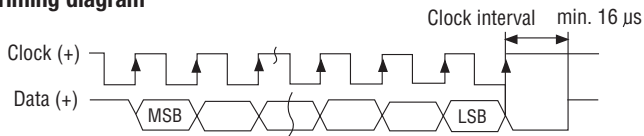
### Synchronous Serial Interface (SSI)

The sensors fulfill all requirements of the SSI standard for an absolute encoder. The displacement value is encoded in a 24/25/26 code format and is transmitted at high speed in SSI standard format to the control device. The main feature of the SSI interface 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.

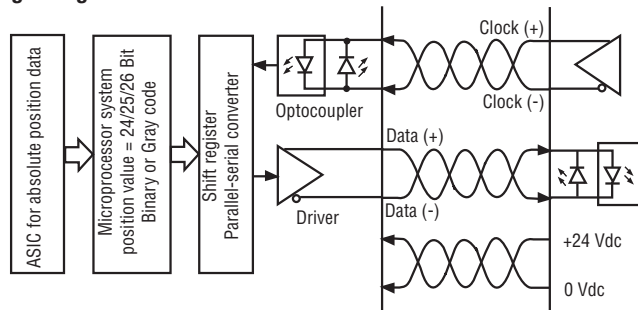
### Sensor input



### Timing diagram



### Logic diagram



## ADVANCED COMMUNICATION AND PROGRAMMABILITY

### Sensor field programming

R-Series Models RP and RH 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

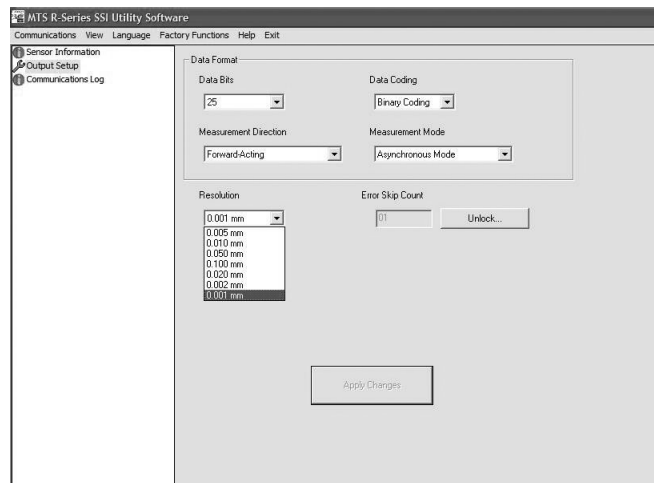
This programming kit includes a wall adapter style power supply, serial converter box, two connection cables (wired for RS-422 protocol), and the software CD-ROM. The SSI parameters that are field programmable are as follows:

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



**Programming Kit, part no. 253310**  
(Serial converter, Power supply, Cable, Software)

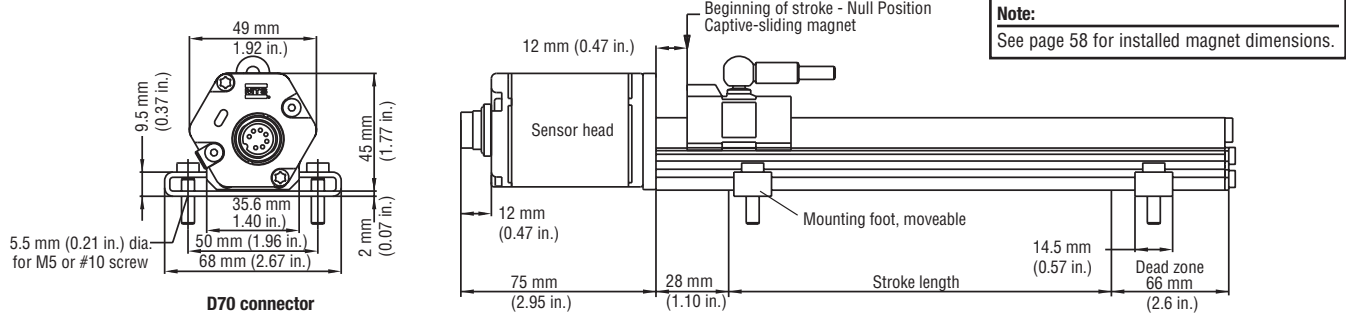
### MTS R-Series utility software user interface



## MODEL RP PROFILE-STYLE SENSOR

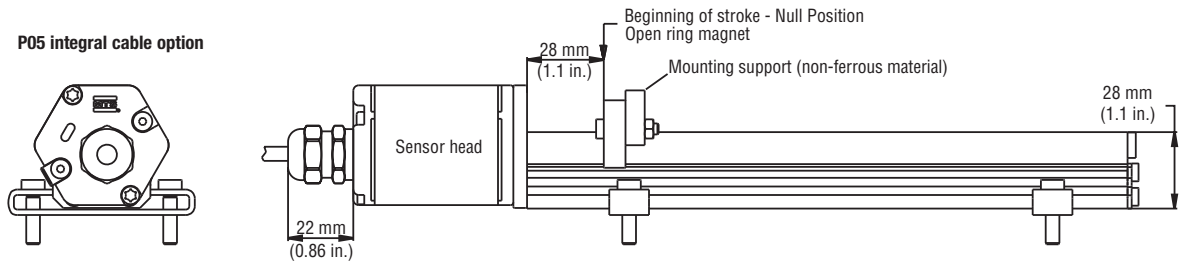
The profile-style (model RP) sensor offers modular construction, flexible mounting configurations and easy installation.

### Captive-sliding magnet



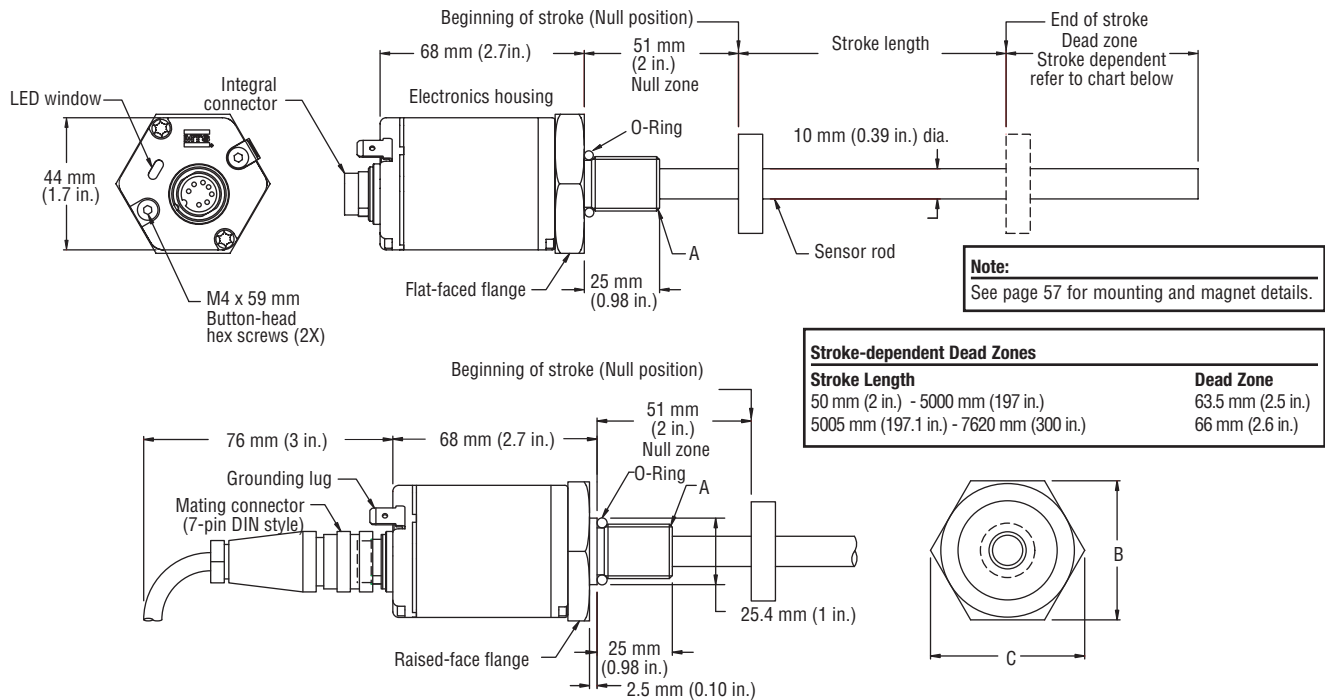
### Open-ring magnet

#### P05 integral cable option



## MODEL RH ROD-STYLE SENSOR

The rod-style (Model RH) sensor 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

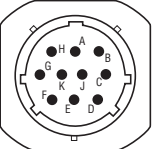
Stroke Length	Dead Zone
50 mm (2 in.) - 5000 mm (197 in.)	63.5 mm (2.5 in.)
5005 mm (197.1 in.) - 7620 mm (300 in.)	66 mm (2.6 in.)

Housing style Flange type	Description	A Flange threads	B Dimensions	C Dimensions
T	US customary threads with raised-face flange	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2 in.)
S	US customary threads with flat-faced flange	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2 in.)
M	Metric threads with flat-faced flange	M18 x 1.5	46 mm (1.81 in.)	53 mm (2.1 in.)

## CONNECTIONS AND WIRING

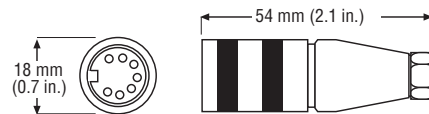
### Sensor connections

Wiring	Pin No.	Cable Color	Function
 <p>Integral D70 connector as viewed from end of sensor</p>	1	Gray	Data (-)
	2	Pink	Data (+)
	3	Yellow	Clock (+)
	4	Green	Clock (-)
	5	Brown	+24 Vdc
	6	White	0 Vdc (GND)
	7	n.c.	-

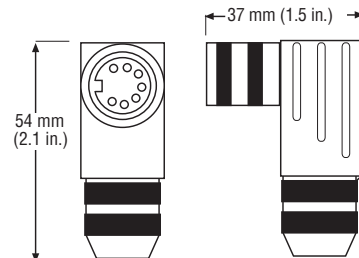
Wiring	Pin No.	Wire Color	Function
 <p>Integral MS0 connector as viewed from end of sensor (see Notes 1 &amp; 2)</p>	A	White	DC Ground (for supply)
	B	n.c.	-
	C	Gray	Data (-)
	D	Pink	Data (+)
	E	Red	24 Vdc (-15/+20)
	F	n.c.	-
	G	Yellow	Clock (+)
	H	Green	Clock (-)
	I	n.c.	-
	J	n.c.	-
	K	n.c.	-

### Cable connector (recommended, order separately)

7-pin D7 straight-exit connector  
part no. 560701



7-pin D7 90° connector  
part no. 560779



#### Notes:

1. The MS0 connector option does not provide the sensor status and diagnostics LED's (as shown on page 14), for sensor status.
2. MS style cable connector, part no. 370013, (field installed) mates with the Integral MS0 connector.

## HOW TO ORDER

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19																																							
												<b>1</b>	<b>S</b>																																													
<p><b>SENSOR MODEL</b></p> <p><b>RP</b> = Profile style  <b>RH</b> = Hydraulic rod-style  <b>RF</b> = Flexible style</p> <p><b>HOUSING STYLE</b></p> <p>Model RP profile-style sensor (magnet included):  <b>S</b> = Captive-sliding magnet with joint at top (part no. 252182)  <b>V</b> = Captive-sliding magnet with joint at front (part no. 252184)  <b>M</b> = Open-ring magnet (part no. 251416-2)</p> <p>Model RH rod-style sensor only (magnet must be ordered separately):  <b>T</b> = US customary threads, raised-faced flange and pressure tube, standard  <b>S</b> = US customary threads, flat-faced flange and pressure tube, standard  <b>U</b> = Same as option "T", except uses fluoroelastomer seals for electronics housing  <b>H</b> = Same as option "S", except uses fluoroelastomer seals for electronics housing  <b>M</b> = Metric threads, flat-faced flange and pressure tube, standard  <b>V</b> = Same as option "M", except uses fluoroelastomer seals for electronics housing  <b>B</b> = Sensor cartridge only, no flange and pressure tube, stroke length &lt; 1830 mm (72 in.)</p> <p>Model RF flex sensor only, (reference page 41 for flex housing style):  magnet must be ordered separately:  <b>S</b> = US customary threads, flat-faced flange  <b>M</b> = Metric threads, flat-faced flange</p>																																																										
<p><b>STROKE LENGTH</b></p> <p>--- <b>M</b> = Millimeters (Encode in 5 mm increments)  --- <b>U</b> = Inches and tenths (Encode in 0.1 in. increments)</p>																			<p><b>Stroke length notes:</b></p> <p>1. Profile-style sensor (model RP) stroke length = 50 mm (2 in.) - 5080 mm (200 in.)  2. Rod-style sensor (model RH) stroke length = 50 mm (2 in.) - 7620 mm (300 in.)</p>																																							
<p><b>CONNECTION TYPE</b></p> <p>Integral connector:  <b>D70</b> = 7-pin DIN (M16), male, standard  <b>MS0</b> = 10-pin MS style, male</p> <p>Integral cables:  <b>P</b> = Integral high-performance cable (orange jacket) with pigtail termination  <b>E</b> = Integral standard cable, with pigtail termination  <b>F</b> = Integral cable, black polyurethane jacket with pigtail termination</p>																			<p><b>Cable length note:</b></p> <p>MTS recommends the maximum integral cable length to be 10 meters (33 ft.). Cables greater than 10 meters (33 ft.) in length are available, however, proper care must be taken during handling and installation.</p>																																							
<p><b>Cable length:</b></p> <p>--- = 1 (01) to 30 (30) meters or 1 (01) to 99 (99) ft.  Encode in meters if using metric stroke length,  encode in feet if using US customary stroke length</p>																																																										
<p><b>INPUT VOLTAGE</b></p> <p><b>1</b> = +24 Vdc (+20%, -15%)  <b>A</b> = Same as option "1", except includes the High Vibration-Resistant (HVR) option  Model RH sensor only, stroke length = 50 mm (2 in.) - 2000 mm (78.7 in.) see note</p>																			<p><b>Note:</b></p> <p>The High Vibration-Resistant (HVR) option provides the model RH rod-style sensors with increased resistance to shock and vibration for use in heavy duty machinery. Refer to "G-Series and R-Series Sensors for High Shock and Vibration Applications", part no. 551073 for more information.</p>																																							
<p><b>OUTPUT</b></p> <p><b>S</b> = SSI output (fill in the six blanks with the following codes):  a b c d e f</p>																																																										
<table style="width: 100%; border: none;"> <tr> <td style="width: 20%;"><b>a) Data length</b></td> <td style="width: 20%;"><b>b) Output Format</b></td> <td style="width: 20%;"><b>c) Resolution</b></td> <td style="width: 20%;"><b>d) Performance</b></td> <td style="width: 20%;"><b>e, f) Scale Orientation</b></td> </tr> <tr> <td><b>1</b> = 25 bits</td> <td><b>B</b> = Binary</td> <td><b>1</b> = 0.005 mm (0.0002 in.)</td> <td><b>1</b> = Standard</td> <td><b>00</b> = Forward-acting measurement</td> </tr> <tr> <td><b>2</b> = 24 bits</td> <td><b>G</b> = Grey code</td> <td><b>2</b> = 0.01 mm (0.0004 in.)</td> <td><b>2</b> = Skip filter (2 times)</td> <td><b>01</b> = Reverse-acting measurement</td> </tr> <tr> <td><b>3</b> = 26 bits</td> <td></td> <td><b>3</b> = 0.05 mm (0.002 in.)</td> <td><b>4</b> = Skip filter (4 times)</td> <td><b>02</b> = Forward-acting, synchronized measurement</td> </tr> <tr> <td></td> <td></td> <td><b>4</b> = 0.1 mm (0.004 in.)</td> <td><b>8</b> = Skip filter ( 8 times)</td> <td><b>05</b> = Forward-acting measurement, Bit 25 = Alarm, Bit 26 = Parity even</td> </tr> <tr> <td></td> <td></td> <td><b>5</b> = 0.02 mm (0.0008 in.)</td> <td></td> <td><b>12</b> = Differential measurement, synchronized (2 magnets)</td> </tr> <tr> <td></td> <td></td> <td><b>6</b> = 0.002 mm (0.00008 in.)</td> <td></td> <td><b>13</b> = Velocity, asynchronous</td> </tr> <tr> <td></td> <td></td> <td><b>8</b> = 0.001 mm (0.00004 in.)</td> <td></td> <td></td> </tr> </table>																			<b>a) Data length</b>	<b>b) Output Format</b>	<b>c) Resolution</b>	<b>d) Performance</b>	<b>e, f) Scale Orientation</b>	<b>1</b> = 25 bits	<b>B</b> = Binary	<b>1</b> = 0.005 mm (0.0002 in.)	<b>1</b> = Standard	<b>00</b> = Forward-acting measurement	<b>2</b> = 24 bits	<b>G</b> = Grey code	<b>2</b> = 0.01 mm (0.0004 in.)	<b>2</b> = Skip filter (2 times)	<b>01</b> = Reverse-acting measurement	<b>3</b> = 26 bits		<b>3</b> = 0.05 mm (0.002 in.)	<b>4</b> = Skip filter (4 times)	<b>02</b> = Forward-acting, synchronized measurement			<b>4</b> = 0.1 mm (0.004 in.)	<b>8</b> = Skip filter ( 8 times)	<b>05</b> = Forward-acting measurement, Bit 25 = Alarm, Bit 26 = Parity even			<b>5</b> = 0.02 mm (0.0008 in.)		<b>12</b> = Differential measurement, synchronized (2 magnets)			<b>6</b> = 0.002 mm (0.00008 in.)		<b>13</b> = Velocity, asynchronous			<b>8</b> = 0.001 mm (0.00004 in.)		
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