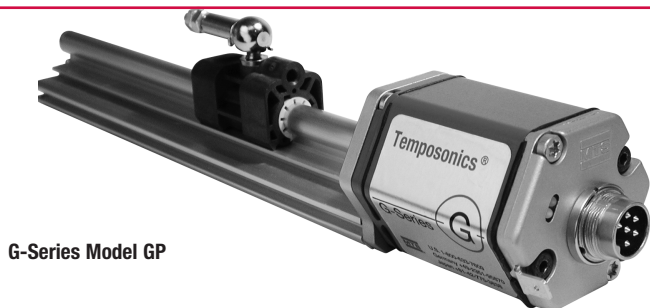


## G-Series Models GP and GH Sensors Analog and Digital-Pulse Outputs



G-Series Model GP



G-Series Model GH

- Advanced sensor communication via serial RS-422, RS-485 or Infrared interfaces
- Enhanced diagnostics and programming capability using serial communications and visual LEDs
- Designed for backwards compatibility with legacy Temposonics products

MTS Sensors, the inventors of magnetostrictive position sensing and makers of Temposonics sensors, is proud to introduce our new G-Series linear position sensors utilizing our next generation technology platform. G-Series position sensors feature a microprocessor-based design with enhanced diagnostics and programmability to maximize backwards compatibility.

Backwards compatibility is one of the primary benefits of the new G-Series position sensor. G-Series position sensors provide the same functionality as Tempo II and L-Series sensors making them an ideal direct replacement for these products.

In addition to providing advanced programming and diagnostic capabilities in a rugged package, G-Series position sensors also include the following features:

- Electronics housing small enough to allow for drop in replacements of legacy Temposonics products.
- Standard 24 Vdc and extended input power supply options for compatibility with older controller interfaces.
- Fully adjustable voltage and current outputs within:
  - 10 to +10 Vdc or +10 to -10 Vdc
  - 0 to 20 mA or 20 to 0 mA
- Up to 15 magnet positions simultaneously using the Start/Stop output option.
- Integral connector replacement options including:
  - Hanging (inline) connectors
  - Adapter cables
  - Field-installed connector kits

Parameters	Specification
<b>Measured variable:</b>	Displacement
<b>Resolution:</b>	Analog: Infinite Digital: $1 \div [\text{gradient} \times \text{crystal freq. (MHz)} \times \text{circulation}]$
<b>Non-linearity:</b>	$\pm 0.02\%$ or $\pm 0.05 \text{ mm}$ ( $\pm 0.002 \text{ in.}$ ), whichever is greater
<b>Repeatability:</b>	$\pm 0.001\%$ of full stroke or $\pm 0.0001 \text{ in.}$ ( $\pm 0.0025 \text{ mm}$ ), whichever is greater.
<b>Outputs:</b>	Analog: Voltage or current Digital: Start/Stop or PWM

Parameters	Specifications
<b>Stroke length:</b>	Rod-style sensor: Analog: 50 mm (2 in.) to 2540 mm (100 in.)* Digital: 50 mm (2 in.) to 7620 mm (300 in.) Profile-style sensor: Analog: 50 mm (2 in.) to 2540 mm (100 in.)* Digital: 50 mm (2 in.) to 5080 mm (200 in.)
<b>Operating voltage:</b>	+24 Vdc nominal: 20.4 - 28.8 Vdc standard +9 to +28.8 Vdc optional
<b>Operating temperature:</b>	-40 °C (-40 °F) to 80 °C (176 °F), 85 °C (185 °F **) max.
<b>EMC test:</b>	Emissions IEC/EN 61000-6-3, Immunity IEC/EN 61000-6-2, IEC/EN 61000-4-2/3/4/5/6/8, 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>Adjustability:</b>	Field adjustable Null and Span (for analog sensors only)
<b>Update time:</b>	Analog: < 1 ms (typical) Digital (external interrogate): Minimum = (2.5 + null + stroke) x 10.0 $\mu\text{s/in.}$ x (number of recirculations)

### PROFILE STYLE (MODEL GP) 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 M5 nut in base channel
<b>Magnet type:</b>	Captive-sliding magnet or open-ring magnet

### ROD STYLE (MODEL GH) SENSOR

<b>Electronic head:</b>	Aluminum housing Diagnostic display (LED's located beside connector/cable exit)
<b>Sealing:</b>	IP 67
<b>Sensor rod:</b>	304L Stainless steel
<b>Operating pressure:</b>	350 bar static, 690 bar spike (5000 psi static, 10,000 psi spike)
<b>Mounting:</b>	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

\* Stroke lengths longer than 2540 mm (100 in.) for analog output are available on a custom basis.

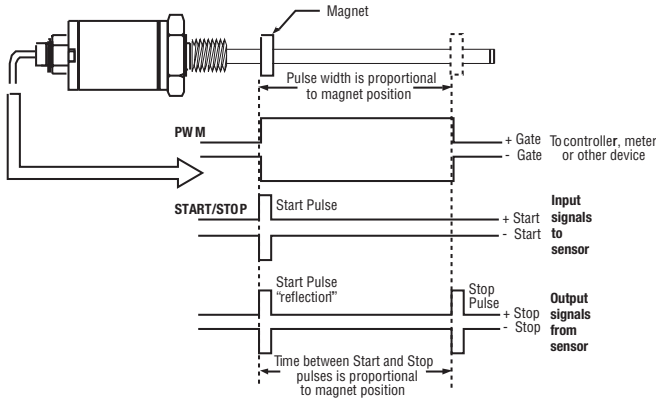
\*\* Consult factory for high temperature applications.

The above specifications for analog output sensors are based on the assumption that output ripple is averaged by the measuring device as with any typical analog device.

## OUTPUTS

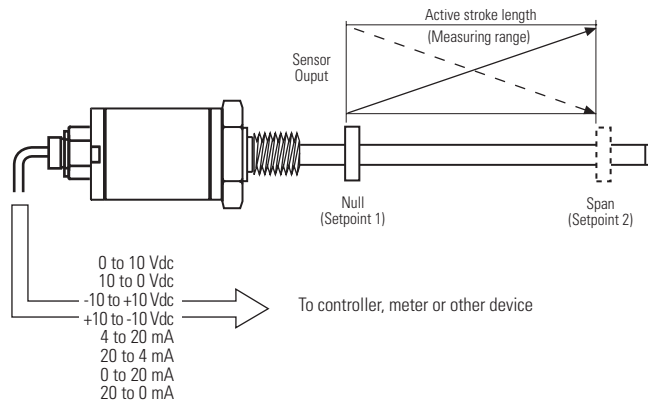
### Digital-pulse outputs

Temposonics G-Series position sensors provide direct Start/Stop and PWM signals. Standard resolution is 0.004 in. with digital-pulse outputs (when using a 28 MHz counter). Higher resolutions are possible with increased circulations or with the use of higher resolution counters.



### Analog output

Temposonics G-Series position sensors with analog output provide direct signals, including voltage (0 to 10 Vdc or -10 to +10 Vdc, forward or reverse acting) and current (4 to 20 mA, or 0 to 20 mA, forward or reverse acting). Both voltage and current outputs allow full adjustments of null and span setpoints (minimum 2 in. between setpoints). Since the outputs are direct, no signal-conditioning electronics are needed when interfacing with controllers or meters.



## ADVANCED COMMUNICATION AND PROGRAMMABILITY

Temposonics G-Series sensors are preconfigured at the factory by model code designation. For many applications no adjustments are required for normal sensor installation and operation. If, however, sensor parameter changes are desired while in the field, the G-Series sensor is easily programmed.

Using external communication for monitoring and programming, there is no need to open the sensor's electronics housing. This can simplify installation and commissioning, saving valuable time. Keeping the sensor electronics isolated ensures that seal integrity and the highest product reliability are maintained.

The platform technology inside the G-Series position sensor enables:

- Built-in serial interfaces for robust hard-wired serial communication, (RS-422 for digital-pulse outputs and RS-485 for analog outputs).
- Remote programmability for operational modes and sensor parameters.
- Enhanced monitoring and diagnostic capabilities (see below).

Programmable modes and sensor parameters for G-Series position sensors include:

### For Digital-Pulse outputs

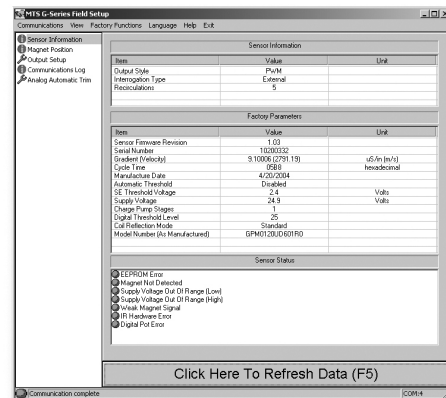
- Start/Stop or PWM output mode
- Internal or external interrogation mode for PWM mode
- Number of recirculations (1 to 20) for PWM mode

### For Analog outputs

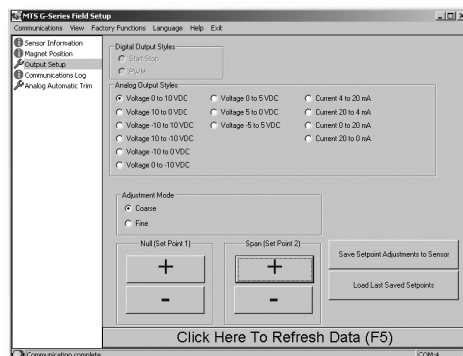
- Voltage or Current output mode
- Voltage or Current output range
- Full adjustment for Null and Span setpoints

### G-Series PC configuration and diagnostics software user interface

G-Series sensor information window



G-Series output setup



## ENHANCED MONITORING AND DIAGNOSTICS

The G-Series simple visual user interface helps resolve the majority of customer installation and troubleshooting issues. Integrated LEDs indicate (refer to LED indicator table):

- Normal operating conditions
- Error conditions, power and sensor/control interface issues
- Programming modes (IR or hard wired)

Hard-wired G-Series serial communication enables diagnostic feedback at a convenient remote location. Access to internal sensor conditions minimizes troubleshooting efforts and enables the development of more sophisticated controller diagnostic routines. All of these features will simplify sensor installation and maximize operational productivity.

**G-Series LED indicator table**

Green	Red	Description
OFF	OFF	No power to sensor
OFF	ON	Self-diagnostic error
OFF	FLASHING	IR programming mode
<b>ON</b>	<b>OFF</b>	<b>Normal sensor function</b>
ON	ON	Magnet not detected
ON	FLASHING	Missing (external) interrogation
FLASHING	OFF	Serial programming mode
FLASHING	ON	Magnet signal weak
FLASHING	FLASHING	Power out of range (high or low)

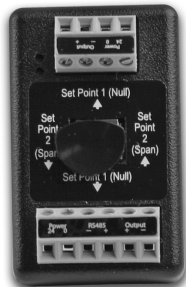
**G-Series electronics housing with built-in LEDs**



**G-Series IR Setpoint Programmer  
(for Analog output sensors)  
Part no. 380078**



**G-Series Analog Handheld  
Programmer  
Part no. 253294**



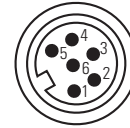
## SENSOR CONNECTIONS AND WIRING

### Sensor integral connector (D60 Male), standard

#### Pinout/wire color code (integral or extension cable)

Pin no.	Wire color	Function	Function
		Digital-pulse outputs	Analog outputs
1	Gray	(-) Gate for PWM (-) Stop for Start/Stop or Programming (RS-422 TX-)	0 to 10, -10 to +10 Vdc or 4 to 20 mA, 0 to 20 mA or reverse acting: 10 to 0, 10 to -10 Vdc or 20 to 4 mA, 20 to 0 mA
2	Pink	(+) Gate for PWM (+) Stop for Start/Stop or Programming for (RS-422 TX+)	Return for pin 1
3	Yellow	(+) Interrogation for PWM (+) Start for Start/Stop or Programming (RS-422 RX+)	Programming (RS-485+)
4	Green	(-) Interrogation for PWM (-) Start for Start/Stop or Programming (RS-422 RX-)	Programming (RS-485-)
5	Red or Brown	Supply voltage (+Vdc)	Supply voltage (+Vdc)
6	White	DC Ground (for supply)	DC Ground (for supply)

#### Integral 6-pin male D6 connector as viewed from end of sensor



#### Notes:

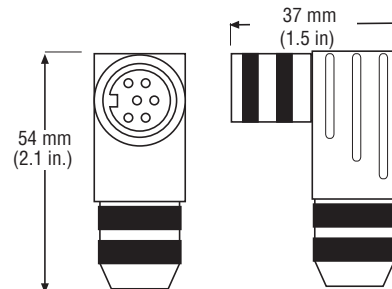
1. A grounding lug on the end of the sensor is provided for convenient connection to earth ground.
2. Appropriate grounding of cable shield is required at the controller end.

#### Cable connectors (field-installed 6-pin D6 female) mates with sensor's integral connector

##### 6-pin D6 Straight-exit connector Part no. 560700



##### D6 90° connector Part no. 560778

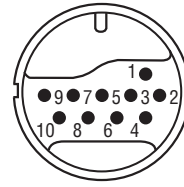


**Retrofit connections**

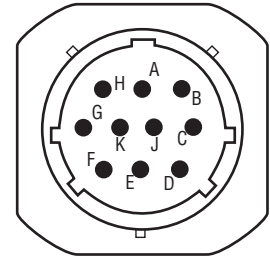
A variety of retrofit/replacement connection options are available to provide direct backwards compatibility for your application

**Analog output connections (voltage or current)**

In-line connector RB_ pin no.	In-line connector FM_ pin no.	Function (Note 1)
4	D	0 to 10, -10 to +10 Vdc, or 4 to 20 mA, 0 to 20 mA or reverse acting (note 2): 10 to 0, +10 to -10 Vdc, or 20 to 4 mA, 20 to 0 mA
3	C	Return for pin 1
7	G	Programming (RS-485 +)
8	H	Programming (RS-485 -)
5	E	Supply voltage (+Vdc)
1	A	DC ground (for supply)
2	B	No connection
6	F	No connection
9	J	No connection
10	K	No connection



In-line RB connector  
Option RB \_



MS connector  
In-line: Option FM \_  
Integral: Option MSO  
(digital-pulse output only)

**Notes:**

1. The format used to show the voltage and current output range is: [Value at Null (Setpoint 1)] to [Value at Span (Setpoint 2)]. Not all of the available outputs ranges for voltage are shown.
2. If the G-Series sensor is replacing a L-Series sensor where the reverse acting outputs are being used then the wire connections must be changed at the controller. Refer to G-Series Cross Reference, part no. 550967 for details.

**Note:**

When using PWM output with internal interrogation both of the interrogation input signals are not used, and can be left unconnected or connected to ground.

**Digital pulse output connections (Start/Stop or PWM)**

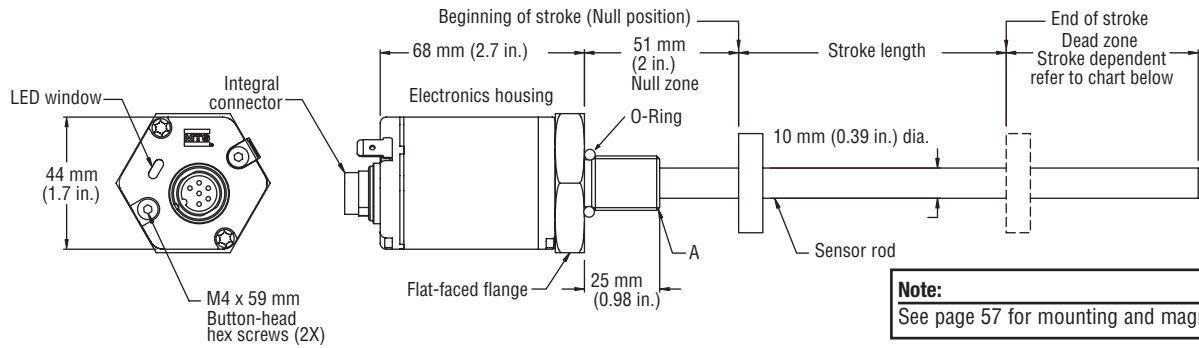
In-line connector RB_ pin no.	In-line connector FM_ pin no.	Integral connector MSO_ pin no.	Function
3	C	C	(-) Gate for PWM (-) Stop for Start/Stop, or Programming (RS-422 TX -)
4 (and 8)	D	D	(+) Gate for PWM (+) Stop for Start/Stop, or Programming (RS-422 TX +)
9	G	G	(+) Interrogation for PWM (see note) (+) Start for Start/Stop, or Programming (RS-422 RX +)
10	H	H	(-) Interrogation for PWM (see note) (-) Start for Start/Stop, or Programming (RS-422 RX -)
5	E	E	Supply voltage (+Vdc)
1	A	A	DC ground (for supply)
2	B	B	No connection
6	F	F	No connection
7	J	J	No connection
---	K	K	No connection

**Square wave neuter output**

The G-Series sensor can provide a square wave neuter output for backwards compatibility to replace Temposonics I, Temposonics II, and L-Series sensors that produced a neuter output signal. The neuter output option was used for connection to the Analog Output Module (AOM), Digital Interface Box (DIB), and to some custom interface/controllers. Reference the "G-Series Cross Reference", part no. 550967, for neuter output connection information, including adapter cables and field-installed connections.

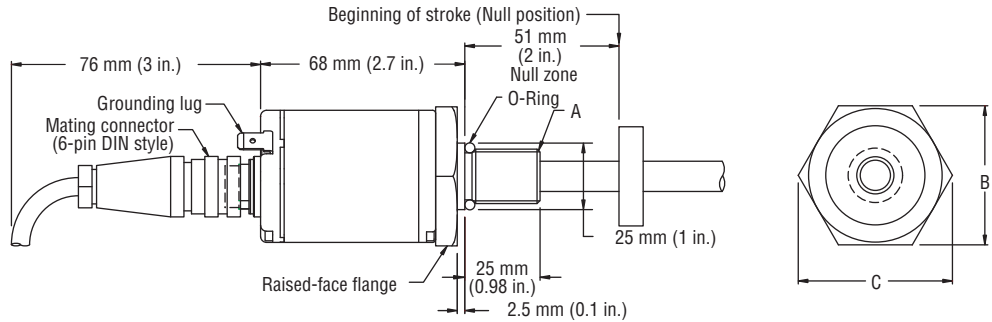
## MODEL GH ROD-STYLE SENSOR

The G-Series rod-style (model GH) 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 GH sensor may also be mounted externally in many applications.



**Note:**  
See page 57 for mounting and magnet details.

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.)



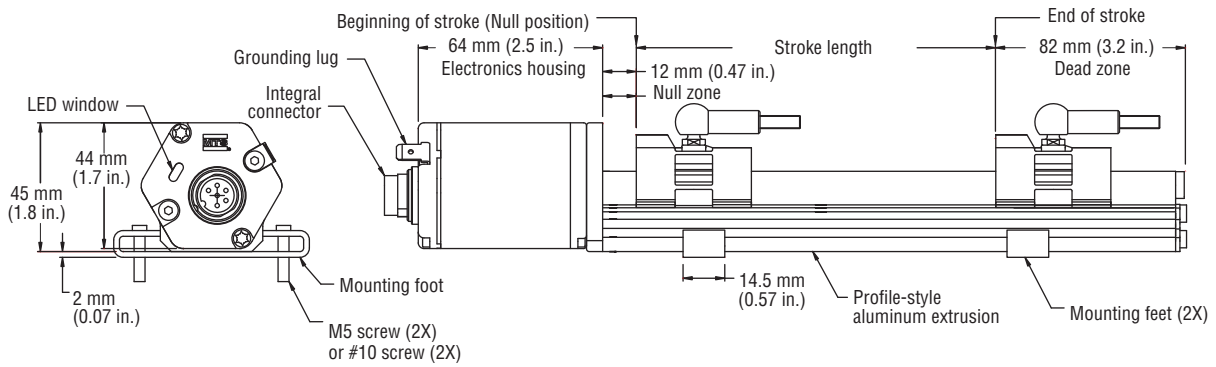
Housing style Flange type	Description	A Flange threads	B Dimensions	C Dimensions
T	US customary threads with raised-face flange	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2 in.)
S	US customary threads with flat-faced flange	3/4"-16 UNF-3A	44.5 mm (1.75 in.)	51 mm (2 in.)
M	Metric threads with flat-faced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

G-Series - Analog/Digital-Pulse

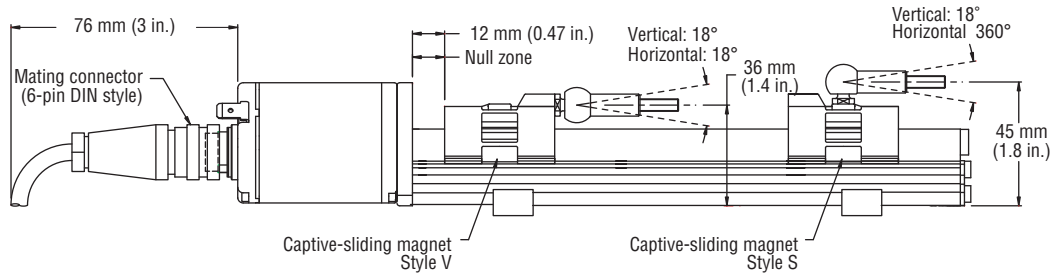
## MODEL GP PROFILE-STYLE SENSOR

The G-series profile-style (model GP) sensor offers modular construction, flexible mounting configurations, two magnet configurations to choose from, and easy installation. Magnet configuration choices for the profile housing are the captive-sliding magnet or open-ring magnet, shown below.

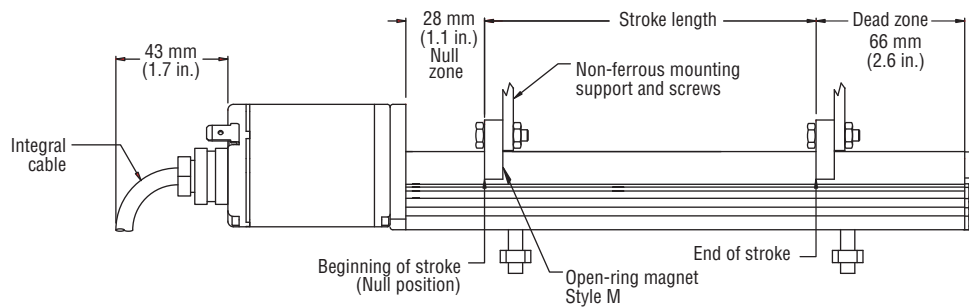
### Captive-sliding magnet



**Note:**  
See page 58 for installed magnet dimensions.



### Open-ring magnet



**Note:**  
See page 58 for installed magnet dimensions.

## HOW TO ORDER

2 or 3 digit code depending on output selected

G														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

### SENSOR MODEL

- GH** = Hydraulic rod-style  
**GP** = Profile style

### HOUSING STYLE

Model GP profile-style sensor (magnet included):

- S** = Captive-sliding magnet with joint at top (part no. 252182)  
**V** = Captive-sliding magnet with joint at front (part no. 252184)  
**M** = Open-ring magnet (part no. 251416-2)

Model GH rod-style sensor only (magnet must be ordered separately):

- T** = US customary threads, raised-faced flange and pressure tube, standard  
**S** = US customary threads, flat-faced flange and pressure tube, standard  
**U** = Same as option "T", except uses fluoroelastomer seals for electronics housing  
**H** = Same as option "S", except uses fluoroelastomer seals for electronics housing  
**M** = Metric threads, flat-faced flange and pressure tube, standard  
**V** = Same as option "M", except uses fluoroelastomer seals for electronics housing  
**B** = Sensor cartridge only, no flange and pressure tube stroke length < 1830 mm (72 in.)

### STROKE LENGTH

- **M** = Millimeters (Encode in 5 mm increments)  
 ----- **U** = Inches and tenths (Encode in 0.1 in. increments)

### CONNECTION TYPE

Integral connector:

- D60** = 6-pin DIN (M16), male, standard  
**MS0** = 10-pin MS style, male (digital-pulse output only)

Integral cables:

- R** \_\_\_ = Integral cable, PVC jacket, pigtail termination.  
**F** \_\_\_ = Integral cable, black polyurethane jacket with pigtail termination (see Note 1 on page 52)

Cable length:

- \_\_\_ = 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

Integral cables with in-line connectors:

- RB1** = 1 ft. integral cable, PVC jacket, with male in-line RB connector (see Note 2 on page 52)  
**RB2** = 5 ft. integral cable, PVC jacket, with male in-line RB connector (see Note 2 on page 52)  
**FM1** = 1 ft. integral cable, PUR jacket, with male in-line 10-pin MS connector (see Notes 1 and 3, page 52)  
**FM2** = 5 ft. integral cable, PUR jacket, with male in-line 10-pin MS connector (see Notes 1 and 3, page 52)  
**FD1** = 1 ft. integral cable, PUR jacket, with male in-line 6-pin DIN (M16) connector (see Note 1 on page 52)  
**FD2** = 5 ft. integral cable, PUR jacket, with male in-line 6-pin DIN (M16) connector (see Note 1 on page 52)

### INPUT VOLTAGE

- 1** = +24 Vdc (+20%, -15%), standard  
**2** = +9 to +28.8 Vdc (see Note 4 on page 52)

- A** = Same as option "1" except includes the High Vibration-Resistant (HVR) option, model GH only, Stroke length: 50 mm (2 in.) to 2000 mm (78.7 in.) (see Note 8 on page 52)  
**B** = Same as option "2" except includes the High Vibration-Resistant (HVR) option, model GH only, Stroke length: 50 mm (2 in.) to 2000 mm (78.7 in.) (see Note 8 on page 52)

### OUTPUT (Selections are continued on page 52)

#### Retrofit documents:

1. Refer to G-Series Cross Reference part numbers 550967 and 550956 for information about backwards compatible replacement options, including integral cables with in-line connectors, adapter cables, and field-installed connector kits. Contact the factory for special offers.
2. Refer to the G-Series User's Manual, part no. 550966 for initial setup information.
3. Refer to G-Series installation drawings, part no's. 550953 and 550955 for installation information.

#### Stroke length notes:

1. GH Voltage or Current = 50 mm (2 in.) to 2540 mm (100 in.) (see Note 6 on page 52).
2. GH Digital Pulse = 50 mm (2 in.) to 7620 mm (300 in.)
3. GP Voltage or Current = 50 mm (2 in.) to 2540 mm (100 in.) (see Note 6 on page 52).
4. GP Digital Pulse = 50 mm (2 in.) to 5080 mm (200 in.)

#### Cable length notes:

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

#### L-Series retrofit notes:

1. For stroke lengths < or = to 1525 mm (60 in.), either +15 volts or +24 volts could be used for L-Series. Therefore, choose the appropriate G-Series option based on the power supply used. Choose option "2" if not certain.
2. For stroke lengths > 1525 mm (60 in.), choose G-Series option "1".

13	14	15

**OUTPUT (2 or 3 digit code depending on output selected)**

Voltage (format below is: "Voltage [value at Null (Setpoint 1)] to [value at Span (Setpoint 2)]"):

- V0** = 0 Vdc to +10 Vdc
- V1** = +10 Vdc to 0 Vdc
- V2** = -10 Vdc to +10 Vdc
- V3** = +10 Vdc to -10 Vdc
- V4** = 0 Vdc to +5 Vdc
- V5** = +5 Vdc to -5 Vdc
- V6** = -10 Vdc to 0 Vdc
- V7** = 0 Vdc to -10 Vdc
- V8** = -5 Vdc to +5 Vdc
- V9** = +5 Vdc to 0 Vdc

Current (format below is: "Current [value at Null (Setpoint 1)] to [value at Span (Setpoint 2)]"):

- A0** = 4 mA to 20 mA
- A1** = 20 mA to 4 mA
- A2** = 0 mA to 20 mA
- A3** = 20 mA to 0 mA

Digital pulse

- RO X** = Start/Stop. If more than one magnet, the X denotes the number of magnets in hexadecimal (2 to F).
- RF X** = Start/Stop with Closed-Error Signal Utility, (see Note 7). If more than one magnet, the X denotes the number of magnets in hexadecimal (2 to F).
- DI X** = PWM, internal interrogation, the X denotes the number of circulations in hexadecimal (1 to F), and G = 16 to K = 20 circulations.
- FI X** = PWM, internal interrogation with Closed Error Signal Utility (See Note 7).The X denotes the number of circulations in hexadecimal (1 to F), and G = 16 to K = 20 circulations.
- DE X** = PWM, external interrogation, the X denotes the number of circulations in hexadecimal (1 to F), and G = 16 to K = 20 circulations.
- FE X** = PWM, external interrogation with Closed Error Signal Utility (See Note 7).The X denotes the number of circulations in hexadecimal (1 to F), and G = 16 to K = 20 circulations.
- NO X** = Start/Stop output wired for square wave neuter, (" + Stop" used for neuter output pulse). If more than one magnet, the X denotes the number of magnets in hexadecimal (2 to F), (see Note 5).

- Notes:**
- Polyurethane jacketed cable for use where higher resistance to moisture, oil, and other environmental conditions are required.
  - Wired for analog, digital-pulse, or neuter, depending on output selected. For Temposonics II and model LH replacements/retrofits only. Refer to G-Series Cross Reference part numbers 550967 and 550956 for more information.
  - Wired for analog and digital-pulse depending on output selected. Use for model LH replacements or retrofits. Refer to the G-Series Cross Reference document, part number 550956 for more information.
  - Selected when retrofitting sensors with +/- 15 Vdc input voltages.
  - For Temposonics I, Temposonics II, and model LH neutered output sensor retrofits only. Refer to the G-Series Cross Reference documents, part numbers 550956 and 550967 for more information.
  - Stroke lengths longer than 2540 mm (100 in.) for analog outputs are available on a custom basis.
  - When shock and vibration events exceed the sensor specification rating, the Closed Error Signal Utility (option "F") will provide either PWM or Start/Stop outputs, which are backwards compatible to interface cards/controllers designed for the legacy Temposonics II and L-Series sensor models. For more information about the Closed Error Signal Utility (option "F"), refer to Application Note, part number 550983.
  - The High Vibration-Resistant (HVR) option provides the model GH 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.

**Table C:**

<b>Decimal:</b>	1	2	3	4	5	6	7	
<b>Hexadecimal:</b>	1	2	3	4	5	6	7	
<b>Decimal:</b>	8	9	10	11	12	13	14	15
<b>Hexadecimal:</b>	8	9	A	B	C	D	E	F