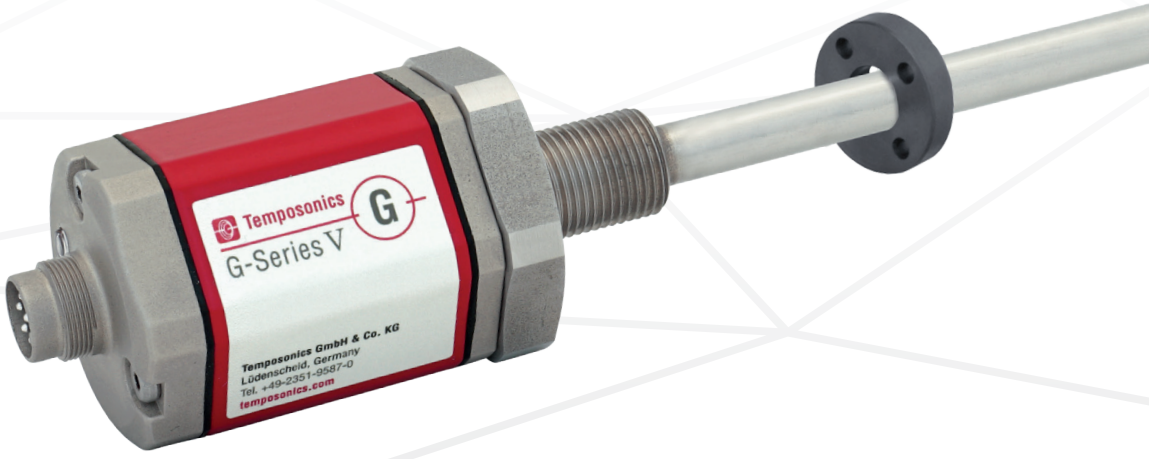
Temposonics
AN AMPHENOL COMPANY

Data Sheet

G-Series V GH5 Digital

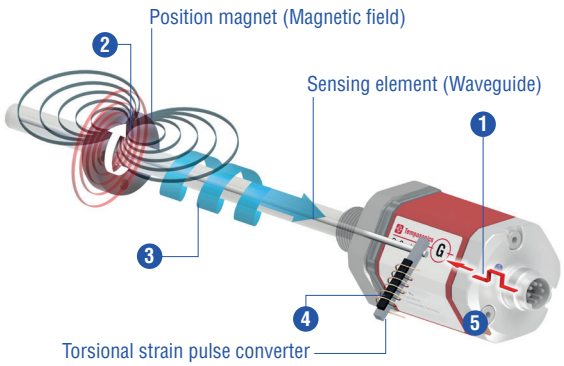
Magnetostrictive Linear Position Sensors

- Digital-pulse output models: PWM or Start/Stop
- LED for visualization of the sensor status
- Field adjustments and diagnostics using the TempoLink® smart assistant



MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Temposonics rely on the company's proprietary magnetostrictive technology, which can determine position with a high level of precision and robustness. Each Temposonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide. A short current pulse is applied to the waveguide. This creates a momentary radial magnetic field and torsional strain on the waveguide. The momentary interaction of the magnetic fields releases a torsional strain pulse that propagates the length of the waveguide. When the ultrasonic wave reaches the beginning of the waveguide it is converted into an electrical signal. Since the speed of the ultrasonic wave in the waveguide is precisely known, the time required to receive the return signal can be converted into a linear position measurement with both high accuracy and repeatability.



Measurement Cycle

1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

Fig. 1: Time-of-flight based magnetostrictive position sensing principle

G-SERIES V GH5 Digital

The Temposonics® G-Series V brings balanced sensor performance to meet the many demands of your application. The main advantages of the rod version GH5 with digital output PWM and Start/Stop are:

15 positions simultaneously
The G-Series V Digital can detect and report the position of up to 15 magnets simultaneously (controller dependent).

LED for sensor status
The LED in the housing cover visualizes the sensor status. This allows you to see the current status of the sensor at a glance.

Switching output
You can switch the digital output of the sensor from Start/Stop to Pulse Width Modulation (PWM) and vice versa on site.

All settings under control with the smart assistant for the G-Series V

The TempoLink® smart assistant supports you in setup and diagnostics of the G-Series V. Among other things, you can adjust the parameters of the sensor to your application on site or read out information about the current status of the sensor.
For more information of this assistant please see the data sheet:
• TempoLink® smart assistant
(Document part number: 552070)

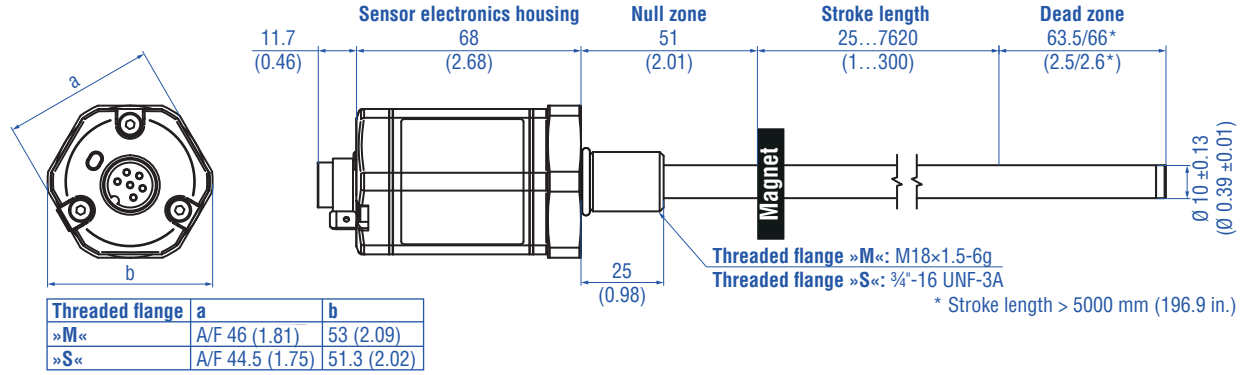
TECHNICAL DATA

Output						
Digital pulse outputs	Start/Stop and Pulse Width Modulation (PWM)					
Measured output variables	Position or liquid level					
Measurement parameters						
Null/Span adjustment	100 % of electrical stroke					
Resolution	0.1, 0.01 and 0.005 mm (controller dependent)					
Update time	Stroke length	≤ 500 mm	≤ 1100 mm	≤ 3000 mm	≤ 6250 mm	≤ 7620 mm
	Update time	500 µs	1 ms	2 ms	4 ms	5 ms
Linearity deviation [1]	< ±0.02 % F.S. (minimum ±50 µm)					
Repeatability	< ±0.002% % F.S. (minimum ±5 µm)					
Hysteresis	< 4 µm typical					
Temperature coefficient	< 30 ppm/K typical					
Operating conditions						
Operating temperature	–40…+80 °C (–40…+176 °F)					
Humidity	90 % relative humidity, no condensation					
Ingress protection	IP67 (connectors correctly fitted)/IP68 (3 m/3 d) and IP69 for cable outlet					
Shock test	100 g/11 ms, IEC standard 60068-2-27					
Vibration test	30 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)/ GH5-J: 15 g/10…2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)					
EMC test	Electromagnetic emission according to EN 61000-6-3 Electromagnetic immunity according to EN 61000-6-2 The GH5 sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011.					
Operating pressure	450 bar (6,527 psi)/700 bar (10,153 psi) peak (at 10 × 1 min) for sensor rod/GH5-J: 800 bar (11,603 psi)					
Magnet movement velocity	Any					
Design/Material						
Sensor electronics housing	Aluminum (painted), zinc die cast					
Sensor flange	Stainless steel 1.4305 (AISI 303)					
Sensor rod	Stainless steel 1.4306 (AISI 304L)					
RoHS compliance	The used materials are compliant with the requirements of EU Directive 2011/65/EU and EU Regulation 2015/863 as well as UKSI 2022 No. 622 with amendments					
Stroke length	25…7620 mm (1…300 in.)/GH5-J: 25...5900 mm (1…232 in.)					
Mechanical mounting						
Mounting position	Any					
Mounting instruction	Please consult the technical drawings on page 4					
Electrical connection						
Connection type	1 × M16 male connector (6 pin) or cable outlet					
Operating voltage	Standard: +24 VDC (–15/+20 %)/option: +9 VDC...+28.8 VDC; The GH5 sensors must be power supplied via an external Class 2 power source in accordance with the UL approval					
Power consumption	2.5 W typical (3.5 W maximum)					
Dielectric strength	500 VDC (DC ground to machine ground)					
Polarity protection	Up to –30 VDC					
Overvoltage protection	Up to 36 VDC					

1/ With position magnet # 251 416-2

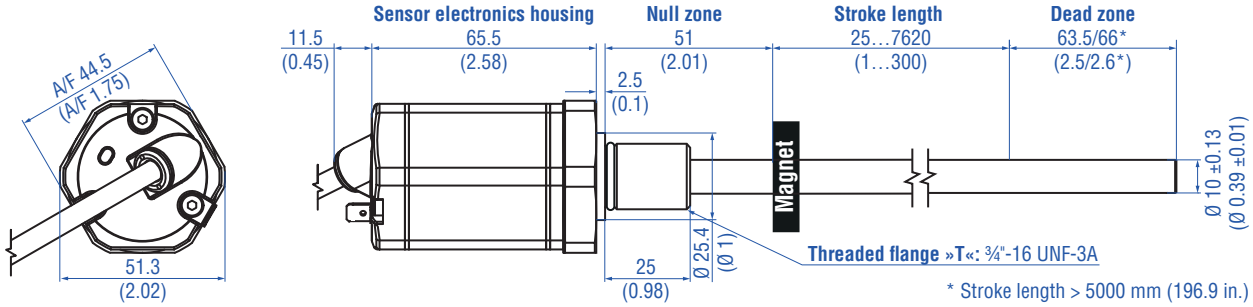
TECHNICAL DRAWING

GH5-M/S-A/V – GH5 with threaded flange M18×1.5-6g or ¾"-16 UNF-3A, example: Connection type D60 (connector outlet)

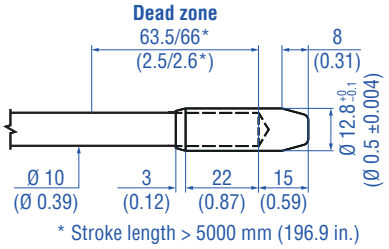


Threaded flange	a	b
»M«	A/F 46 (1.81)	53 (2.09)
»S«	A/F 44.5 (1.75)	51.3 (2.02)

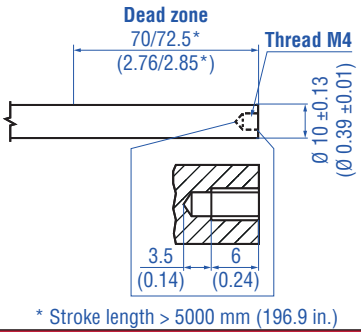
GH5-T-A/V– GH5 with threaded flange ¾"-16 UNF-3A with raised-face, example: Connection type EXX/GXX/LXX (angled cable outlet)



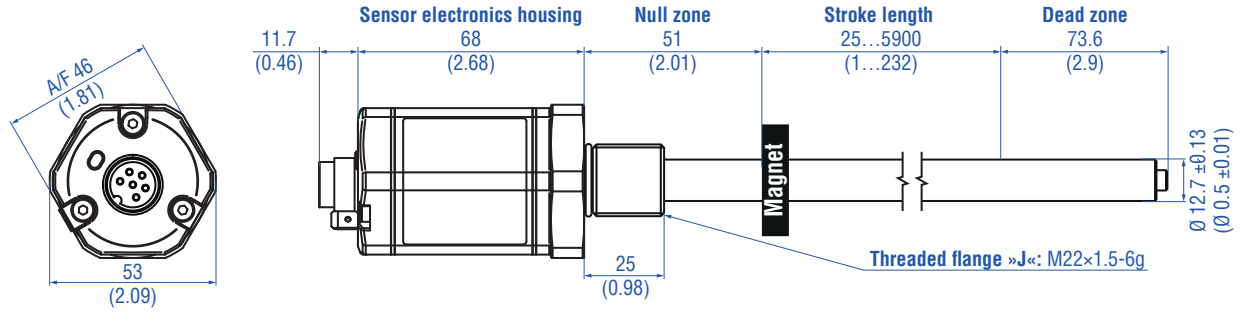
Mechanical option »B«: Bushing on rod end for threaded flange M18×1.5-6g or ¾"-16 UNF-3A



Mechanical option »M«: Thread M4 at rod end for threaded flange M18×1.5-6g or ¾"-16 UNF-3A



GH5-J-A/V – GH5 with threaded flange M22×1.5-6g and Ø 12.7 mm rod, example: Connection type D60 (connector outlet)



Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 2: Temposonics® GH5 with ring magnet

CONNECTOR WIRING

D60

Signal + power supply

M16 male connector	Pin	Function
 View on sensor	1	Gate (–) for PWM Stop (–) for Start/Stop
	2	Gate (+) for PWM Stop (+) for Start/Stop
	3	Interrogation (+) for PWM Start (+) for Start/Stop
	4	Interrogation (–) for PWM Start (–) for Start/Stop
	5	+24 VDC (–15/+20 %)
	6	DC Ground (0 V)

Fig. 3: Connector wiring D60

EXX/GXX/LXX

Signal + power supply

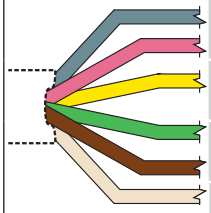
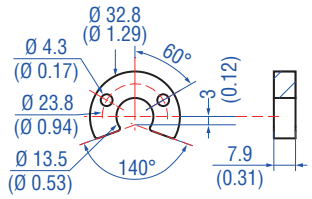
Cable	Color	Function
	GY	Gate (–) for PWM Stop (–) for Start/Stop
	PK	Gate (+) for PWM Stop (+) for Start/Stop
	YE	Interrogation (+) for PWM Start (+) for Start/Stop
	GN	Interrogation (–) for PWM Start (–) for Start/Stop
	BN	+24 VDC (–15/+20 %)
	WH	DC Ground (0 V)

Fig. 4: Connector wiring cable outlet

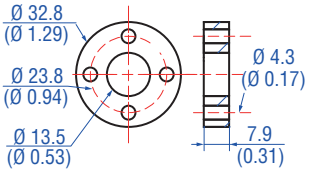
FREQUENTLY ORDERED ACCESSORIES – Additional options available in our Accessories Catalog 551444

Position magnets



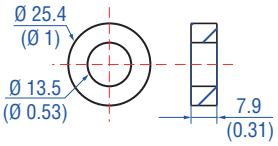
U-magnet OD33
Part no. 251 416-2

Material: PA ferrite GF20
Weight: Approx. 11 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+120 °C (–40…+248 °F)



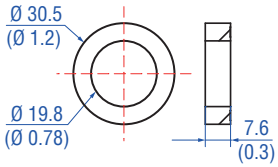
Ring magnet OD33
Part no. 201 542-2

Material: PA ferrite GF20
Weight: Approx. 14 g
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40...+120 °C (–40...+248 °F)



Ring magnet OD25.4
Part no. 400 533

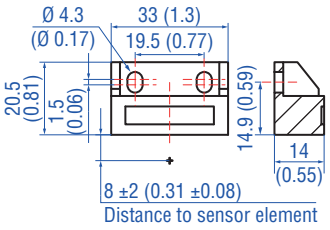
Material: PA ferrite
Weight: Approx. 10 g
Surface pressure: Max. 40 N/mm²
Operating temperature:
–40…+120 °C (–40…+248 °F)



Ring magnet
Part no. 402 316

Material: PA ferrite coated
Weight: Approx. 13 g
Surface pressure: Max. 20 N/mm²
Operating temperature:
–40…+100 °C (–40…+212 °F)

Position magnet

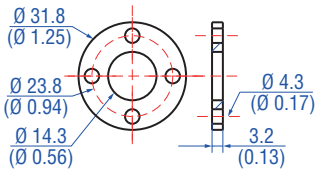


Block magnet L
Part no. 403 448

Material: Plastic carrier with neodymium magnet
Weight: Approx. 20 g
Fastening torque for M4 screws: 1 Nm
Operating temperature:
–40…+75 °C (–40…+167 °F)

This magnet may influence the sensor performance specifications for some applications.

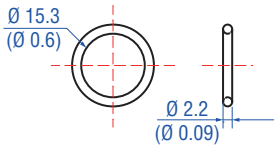
Magnet spacer



Magnet spacer
Part no. 400 633

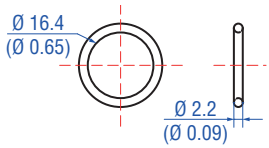
Material: Aluminum
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm

O-rings



O-ring for threaded flange
M18×1.5-6g
Part no. 401 133

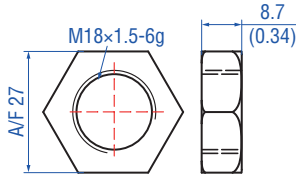
Material: Fluoroelastomer
Durometer: 75 ±5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)



O-ring for threaded flange
¾"-16 UNF-3A
Part no. 560 315

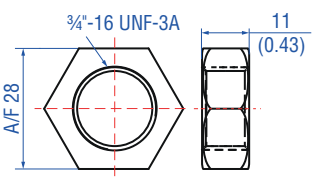
Material: Fluoroelastomer
Durometer: 75 ±5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)

Mounting accessories



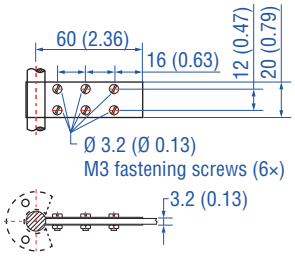
Hex jam nut M18×1.5-6g
Part no. 500 018

Material: Steel, zinc plated



Hex jam nut ¾"-16 UNF-3A
Part no. 500 015

Material: Steel, zinc plated

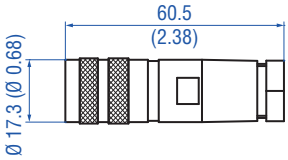


Fixing clip
Part no. 561 481

Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet
Material: Brass, non-magnetic

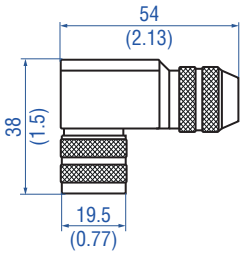
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Cable connectors*



M16 female connector (6 pin), straight
Part no. 370 423

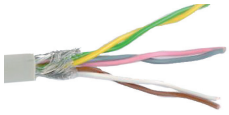
Material: Zinc nickel plated
Termination: Solder
Cable Ø: 6…8 mm (0.24…0.31 in.)
Operating temperature:
–40…+100 °C (–40…+212 °F)
Ingress protection: IP65/IP67
(correctly fitted)
Fastening torque: 0.6 Nm



M16 female connector (6 pin), angled
Part no. 370 460

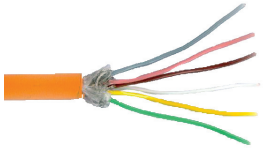
Material: Zinc nickel plated
Termination: Solder
Cable Ø: 6…8 mm (0.24…0.31 in.)
Wire: 0.75 mm² (20 AWG)
Operating temperature:
–40…+95 °C (–40…+203 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm

Cables



PVC cable
Part no. 530 032

Material: PVC jacket; gray
Features: Twisted pair, shielded, flexible
Cable Ø: 6 mm (0.23 in.)
Cross section: 3 × 2 × 0.14 mm²
Bending radius: 10 × D
(fixed installation)
Operating temperature:
–40…+105 °C (–40…+221 °F)



PUR cable
Part no. 530 052

Material: PUR jacket; orange
Features: Twisted pair, shielded, highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant
Cable Ø: 6.4 mm (0.25 in.)
Cross section: 3 × 2 × 0.25 mm²
Bending radius: 5 × D
(fixed installation)
Operating temperature:
–20…+80 °C (–4…+176 °F)

Cable

FEP cable
Part no. 530 157

Material: FEP jacket; black
Features: Twisted pair, shielded
Cable Ø: 6.7 mm (0.26 in.)
Cross section: 3 × 2 × 0.14 mm²
Operating temperature: –40…+180 °C
(–40…+356 °F)

*/ Follow the manufacturer's mounting instructions
Color of connectors and cable jacket may change. Color codes for the individual wires and technical properties remain unchanged.
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Extension cables M16

PVC cable with M16 female connector (6 pin), straight – pigtail

PVC cable (part no. 530 032) with M16 female connector, straight (part no. 370 423)

Order code:
K2-A-370423-xxxxyy-530032-0
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)

PUR cable with M16 female connector (6 pin), straight – pigtail

PUR cable (part no. 530 052) with M16 female connector, straight (part no. 370 423)

Order code:
K2-A-370423-xxxxyy-530052-0
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)

FEP cable with M16 female connector (6 pin), straight – pigtail

FEP cable (part no. 530 112) with M16 female connector, straight (part no. 370 423)

Order code:
K2-A-370423-xxxxyy-530112-0
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)

Notice for extension cables M16

Standard cable lengths

Meters	Feet	Code
1.5	5.0	0150
2.0	6.6	0200
4.6	15.0	0460
5.0	16.4	0500
7.6	25.0	0760
10.0	32.8	1000
15.2	50.0	1520

For additional extension cables reference the accessories catalog for industrial sensors (document part no.: 551444).

Programming tools

TempoLink® kit for Temposonics® G-Series V
Part no. TL-1-0-AD60 (for D60)
Part no. TL-1-0-AS00 (for cable outlet)

- Connect wirelessly via Wi-Fi enabled device or via USB with the diagnostic tool
- Simple connectivity to the sensor via 24 VDC power line (permissible cable length: 30 m)
- User friendly interface for mobile devices and desktop computers
- See data sheet “TempoLink® smart assistant” (document part no.: 552070) for further information

Color of connectors and cable jacket may change. Color codes for the individual wires and technical properties remain unchanged.
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
G	H	5																
a			b	c	d					e		f			g	h		

19 optional

a	Sensor model
G H 5	Rod

b	Design
B	Base unit (only for replacement)
J	Threaded flange M22×1.5-6g (rod Ø 12.7 mm, 800 bar), max. stroke length 5900 mm
M	Threaded flange M18×1.5-6g (standard)
S	Threaded flange ¾"-16 UNF-3A (standard)
T	Threaded flange ¾"-16 UNF-3A (with raised-face)

c	Mechanical options
A	Standard
B	Bushing on rod end (only for design »M«, »S« & »T«)
M	Thread M4 at rod end (only for design »M«, »S« & »T«)
V	Fluorelastomer seals for the sensor electronics housing

d	Stroke length
X X X X M	0025…7620 mm

Standard stroke length (mm)	Ordering steps
25… 500 mm	5 mm
500… 750 mm	10 mm
750…1000 mm	25 mm
1000…2500 mm	50 mm
2500…5000 mm	100 mm
5000…7620 mm	250 mm

X X X X U	001.0…300.0 in.

Standard stroke length (in.)	Ordering steps
1… 20 in.	0.2 in.
20… 30 in.	0.4 in.
30… 40 in.	1.0 in.
40…100 in.	2.0 in.
100…200 in.	4.0 in.
200…300 in.	10.0 in.

Non-standard stroke lengths are available;
must be encoded in 5 mm/0.1 in. increments.

e	Number of magnets
X X	01...15 positions (1...15 magnets) (multi-position measurement* only for outputs »R0« & »RF«)

*Number of magnets ≥ 2 magnets

f	Connection type
Connector	
D 6 0	M16 male connector (6 pin)
Angled cable outlet	
E X X	XX m/ft. PVC cable (part no. 530 032) E01…E30 (1…30 m)/E03...E99 (3...99 ft.) See “Frequently ordered accessories” for cable specifications
G X X	XX m/ft. FEP cable (part no. 530 157) G01…G30 (1…30 m)/G03...G99 (3...99 ft.) See “Frequently ordered accessories” for cable specifications
L X X	XX m/ft. PUR cable (part no. 530 052) L01…L30 (1…30 m)/L03...L99 (3...99 ft.) See “Frequently ordered accessories” for cable specifications
Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length.	

g	System
1	Standard
2	Operating voltage: +9...+28.8 VDC

h See next page

Continue to the next page

h			Output
R	O		Start/Stop
R	F		Start/Stop with closed error signal utility
D	I	X	PWM, internal interrogation X denotes the number of circulations (see table 1)
F	I	X	PWM, internal interrogation with closed error signal utility X denotes the number of circulations (see table 1)
D	E	X	PWM, external interrogation X denotes the number of circulations (see table 1)
F	E	X	PWM, external interrogation and closed error signal utility X denotes the number of circulations (see table 1)

»X« for output »DIX«, »FIX«, »DEX« and »FEX«										
Number of circulations	1	2	3	4	5	6	7	8	9	10
»X« in order code	1	2	3	4	5	6	7	8	9	A
Number of circulations	11	12	13	14	15	16	17	18	19	20
»X« in order code	B	C	D	E	F	G	H	I	J	K

Table 1: Number of circulations

NOTICE

- Specify the number of magnets for your application and order magnets separately.
- The number of magnets is limited by the stroke length. The minimum allowed distance between magnets (i.e. of one to the front face of the next one) is 75 mm (3 in.).
- Use magnets of the same type for multi-position measurement.

DELIVERY

GH5-B:

- Base unit (without flange & rod assembly)
- 3 × socket screws M4×59

GH5-J/M/S/T:

- Sensor
- O-ring

Accessories have to be ordered separately.

Manuals, Software & 3D Models available at:
www.temposonics.com

GLOSSARY

C

Closed Error Signal Utility
At very high shock or vibration events, the magnet may no longer be detected properly. For these error events the Closed Error Signal Utility will produce an output signal waveform that corresponds to a value of just over the 100 % full stroke position. Therefore, the Closed Error Signal Utility should only be used with certain Allen Bradley and Digitron Electronics interface cards that are designed to process this sensor output appropriately. Contact Applications Engineering for more information.

E

External Interrogation
For a sensor that is configured for external interrogation, a signal is required from the controller or interface module to initiate every measurement cycle.

I

Internal Interrogation
For a sensor that is configured for internal interrogation, no signal is needed from the controller as the sensor itself initiates the next measurement cycle upon the completion of the current cycle.

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