Operation Manual

G-Series Ⅴ Analog
Magnetostrictive Linear Position Sensors

Temposonics® G-Serie V Analog
Operation Manual

Table of contents

1. Introduction

1.1 Purpose and use of this manual

The content of this technical documentation and of its appendices is intended to provide information on mounting, installation and com-

> Before starting the operation of Temposonics® position sensors, read this documentation thoroughly and follow the safety information. Keep this manual for future reference!

missioning by qualified automation personnel [1] or instructed service technicians who are familiar with the project planning and dealing with Temposonics® sensors.

1.2 Used symbols and warnings

Warnings are intended for your personal safety and for avoidance of damage to the described product or connected devices. In this documentation, safety information and warnings to avoid danger that might affect the life and health of operating or service personnel or cause material damage are highlighted by the pictogram defined below.

Symbol	Meaning
NOTICE	This symbol is used to point to situations that may lead to material damage, but not to personal injury.

2. Safety instructions

2.1 Intended use

This product may be used only for the applications defined under item 1 and only in conjunction with the third-party devices and components recommended or approved by Temposonics. As a prerequisite of proper and safe operation the product requires correct transport, storage, mounting and commissioning and must be operated with utmost care.

1. The sensor systems of all Temposonics® series are intended exclusively for measurement tasks encountered in industrial, commercial and laboratory applications. The sensors are considered as system accessories and must be connected to suitable evaluation electronics, e.g. a PLC, IPC, indicator or other electronic control unit.
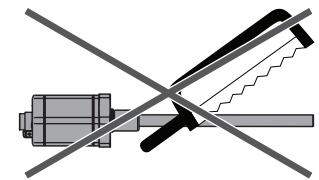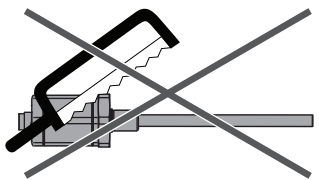
2.2 Foreseeable misuse

Foreseeable misuse	Consequence
Wrong sensor connection	The sensor will not work properly or can be damaged
Operate the sensor out of the operating temperature range	No signal output – the sensor can be damaged
Power supply is out of the defined range	Signal output is wrong/ no signal output/ the sensor will be damaged
Position measurement is influenced by an external magnetic field	Signal output is wrong
Cables are damaged	Short circuit – the sensor can be damaged/sensor does not respond
Spacers are missing/ installed in a wrong order	Error in position measurement
Wrong connection of ground/shield	Signal output is disturbed – the electronics can be damaged
Use of a magnet that is not specified by Temposonics	Error in position measurement
Sensor is exposed to overvoltage/ electrostatic discharge (e.g., welding work, electrostatically supported coating, etc.)	The sensor can be damaged

Do not alter the sensor afterwards.
➔ The sensor might be damaged.

Do not step on the sensor.
➔ The sensor might be damaged.

1/ The term "qualified technical personnel" characterizes persons who:
- are familiar with the safety concepts of automation technology applicable to the particular project
- are competent in the field of electromagnetic compatibility (EMC)
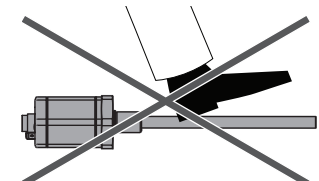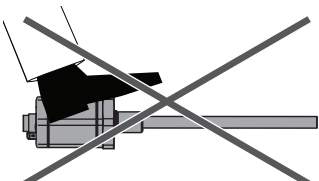
- have received adequate training for commissioning and service operations
- are familiar with the operation of the device and know the information required for correct operation provided in the product documentation

2.3 Installation, commissioning and operation

The position sensors must be used only in technically safe condition. To maintain this condition and to ensure safe operation, installation, connection and service, work may be performed only by qualified technical personnel. If danger of injury to persons or of damage to operating equipment is caused by sensor failure or malfunction, additional safety measures such as plausibility checks, limit switches, EMERGENCY STOP systems, protective devices etc. are required. In the event of trouble, shut down the sensor and protect it against accidental operation.

Safety instructions for commissioning
To maintain the sensor's operability, it is mandatory to follow the instructions given below.
1. Protect the sensors against mechanical damage during installation and operation.
2. Do not open or dismantle the sensors.
3. Connect the sensors very carefully and pay attention to the polarity of connections and power supply.
4. Use only approved power supplies.
5. Ensure the sensor is operating within the defined limits for supply voltage, environmental conditions, etc..
6. Check the function of the sensors regularly and provide documentation of the checks.
7. Before applying power, ensure that nobody's safety is jeopardized by starting machines.

2.4 Safety instructions for use in explosion-hazardous areas

The sensors are not suitable for operation in explosion-hazardous areas.

2.5 Warranty

Temposonics grants a warranty period [2] for the position sensors and supplied accessories relating to material defects and faults that occur despite correct use in accordance with the intended application. The Temposonics obligation is limited to repair or replacement of any defective part of the unit. No warranty can be provided for defects that are due to improper use or above average stress of the product as well as for wear parts. Under no circumstances will Temposonics accept liability in the event of offense against the warranty rules, no matter if these have been assured or expected, even in case of fault or negligence of the company.
Temposonics explicitly excludes any further warranties. Neither the company's representatives, agents, dealers nor employees are authorized to increase or change the scope of warranty.

2.6 Return

For diagnostic purposes, the sensor can be returned to Temposonics or a repair facility explicitly authorized by Temposonics. Any shipment cost is the responsibility of the sender [2]. For a corresponding form, see chapter 9 on page 34.

NOTICE
When returning sensors, place protective caps on male and female connectors of the sensor. For pigtail cables, place the cable ends in a static shielding bag for electrostatic discharge (ESD) protection. Fill the outer packaging around the sensor completely to prevent damage during transport.

2/ See also applicable Temposonics terms of sales and delivery on:
www.temposonics.com

3. Identification

3.1 Order code of Temposonics® GP5

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

a	Sensor model
G P 5	Profile

b	Design
K	Block magnet K (part no. 251 298-2)
L	Block magnet L (part no. 403 448)
M	U-magnet OD33 (part no. 251 416-2)
O	No position magnet
S	Magnet slider joint at top (part no. 252 182)
V	Magnet slider joint at front (part no. 252 184)

c	Mechanical options
A	Standard
V	Fluorelastomer seals for the sensor electronics housing

d	Stroke length
X X X X M	0025…6350 mm

Standard stroke length (mm)	Ordering steps
25… 500 mm	25 mm
500…2500 mm	50 mm
2500…5000 mm	100 mm
5000…6350 mm	250 mm

X X X . X U	001.0…250.0 in.

Standard stroke length (in.)	Ordering steps
1… 20 in.	1.0 in.
20…100 in.	2.0 in.
100…200 in.	4.0 in.
200…250 in.	10.0 in.

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

e	Number of magnets
0 1	01 Position (1 magnet)

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

h	Output
A	Current
V	Voltage

i	Output range
0	0…10 VDC or 4…20 mA
1	10…0 VDC or 20…4 mA
2	0…20 mA
3	20…0 mA

HINWEIS
• For GP5, the magnet selected in **b** "Design" is included in the scope of delivery.

3.2 Order code of Temposonics® GH5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
G	H	5								0	1				1		
a			b	c	d					e		f			g	h	i

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 bars), stroke length: 25...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	
0	1	01 Position (1 magnet)

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/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/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/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

h	Output
A	Current
V	Voltage

i	Output range
0	0…10 VDC or 4…20 mA
1	10…0 VDC or 20…4 mA
2	0…20 mA
3	20…0 mA

3.3 Nameplate

Order code ——— GP5MA0300M01D601A0

Analog output ——— 4...20mA

Serial number & ——— S/N: 70000000   01JAN2025
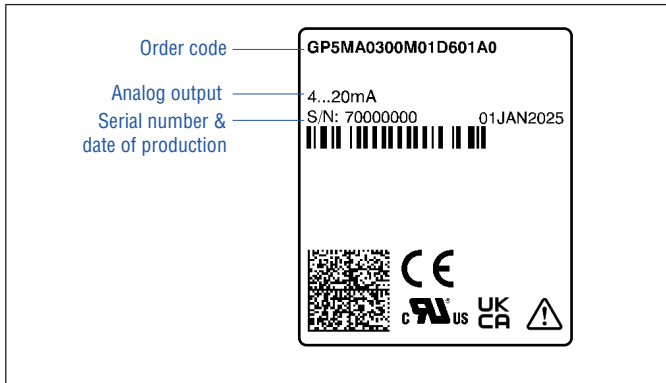date of production

Fig. 1: Example of nameplate of G-Series Ⅴ GH5 sensor with Analog output

3.4 Approvals

- CE declaration
- UKCA declaration
- UL certified

3.5 Scope of delivery

GP5 (profile sensor):
- Sensor
- Position magnet (not for GP5 with design »O«)
- 2 mounting clamps up to 1250 mm (50 in.) stroke length +
  1 mounting clamp for each 500 mm (20 in.) additional stroke length

GH5 (rod sensor):
- GH5-B: Base unit (without flange & rod assembly),
  3 × socket screws M4×59
- GH5-M/S/T: Sensor, O-ring

4. Product description

4.1 Functionality and system design

Product designation
• Position sensor Temposonics® G-Series V

Sensor model
• Temposonics® G-Series V GP5 (profile sensor)
• Temposonics® G-Series V GH5 (rod sensor)

Stroke length
• Temposonics® G-Serie V GP5: 25… 6350 mm (1…250 in.)
• Temposonics® G-Serie V GH5: 25… 7620 mm (1…300 in.)

Output signal
• Analog

Application
The Temposonics® position sensors are used for measurement and conversion of the length (position) variable in the fields of automated systems and mechanical engineering.

Principle of operation and system construction
The absolute, linear position sensors provided by Temposonics rely on the company's proprietary Temposonics® 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 end 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.
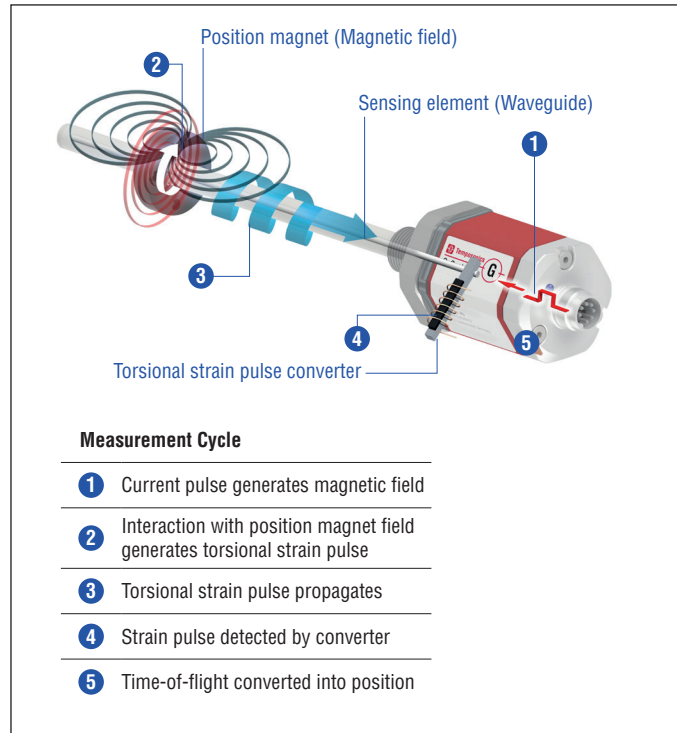

Measurement Cycle	
1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

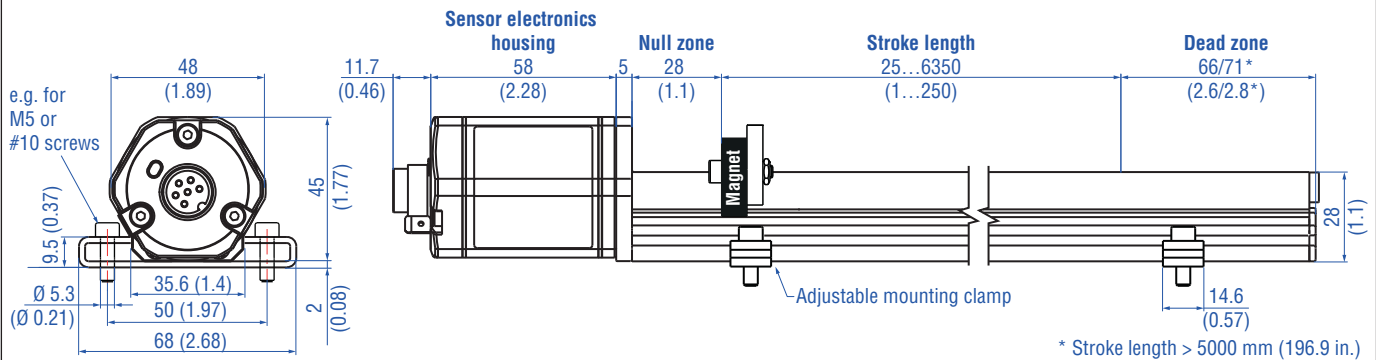*Fig. 2: Time-of-flight based magnetostrictive position sensing principle*

Modular mechanical and electronic construction
• The sensor profile or rod protects the inner sensor element.
• The sensor electronics housing, a rugged aluminum construction, contains the complete electronic interface with active signal conditioning.
• The external position magnet is a permanent magnet. Mounted on the mobile machine part, it travels along the sensor profile or rod and triggers the measurement through the sensor profile/rod wall.
• The sensor can be connected directly to a control system. Its electronics generates a strictly position-proportional signal output between start and end position.
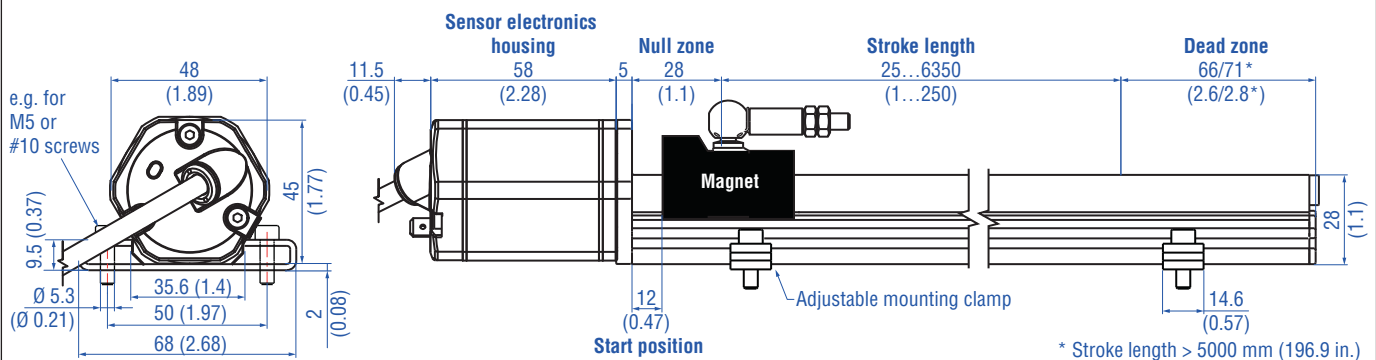
4.2 Installation and design of Temposonics® GP5

GP5-M, example: Connection type D60 (connector outlet)

GP5-G/S, example: Connection type EXX/GXX/LXX (angled cable outlet)

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

Fig. 3: Temposonics® GP5 with U-magnet/magnet slider

Installation of GP5

The position sensor can be installed in any position. Normally, the sensor is firmly installed and the position magnet is fastened to the mobile machine part. Thus it can travel along the sensor profile. The sensor is fitted on a flat machine surface using the mounting clamps (Fig. 4). A length-dependent number of these clamps are delivered with the sensor and must be distributed over the profile at regular distances. For fastening use M5×20 screws to DIN 6912 that should be tightened with a fastening torque of 5 Nm.
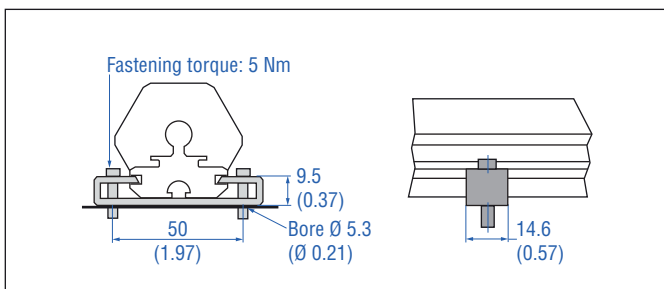

Fig. 4: Mounting clamps (part no. 400 802) with cylinder screw M5×20

Alternative:

If only limited space is available, the profile sensor can be mounted also via the T-rail in the profile bottom using a T-slot nut M5 (part no. 401 602) or a sliding block (Fig. 5).
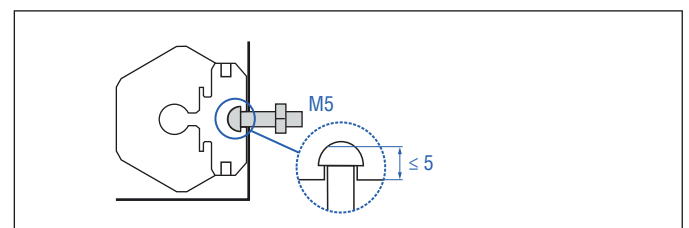

Fig. 5: T-slot nut M5 (part no. 401 602)

NOTICE

Take care to mount the sensor in an axially parallel position to avoid damage to magnet and sensor.
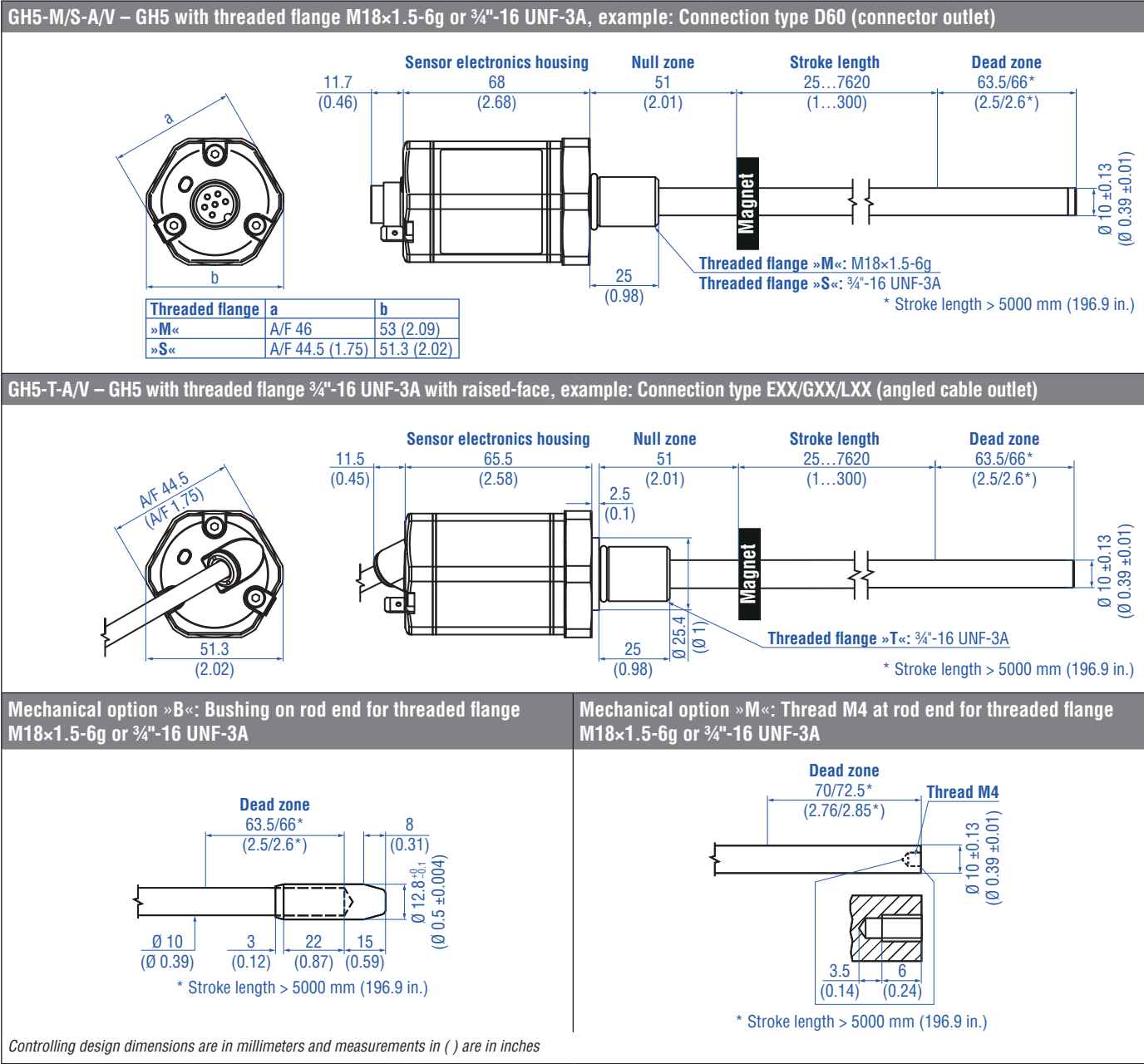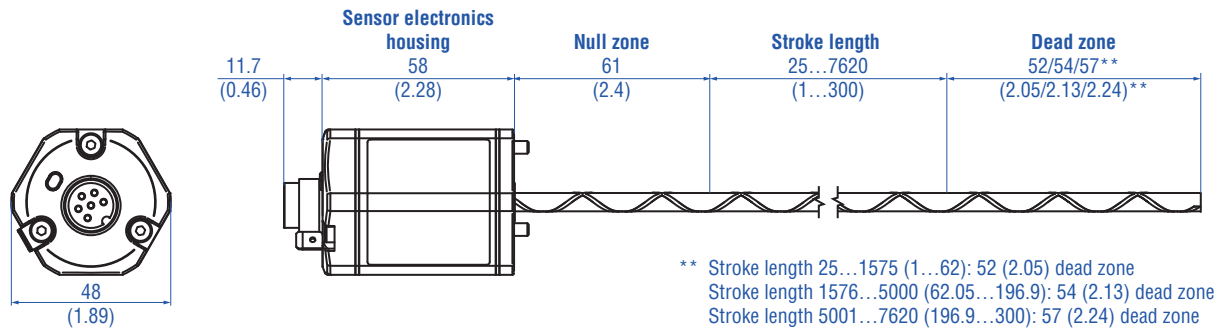
4.3 Installation and design of Temposonics® GH5

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	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

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

Fig. 6: Temposonics® GH5 with ring magnet, part 1

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

GH5-B-A/V – GH5 base unit (only for replacement), example: Connection type D60 (connector outlet)

Sensor electronics housing	Null zone	Stroke length	Dead zone

11.7 (0.46) | 58 (2.28) | 61 (2.4) | 25…7620 (1…300) | 52/54/57** (2.05/2.13/2.24)**

48 (1.89)

** Stroke length 25…1575 (1…62): 52 (2.05) dead zone
Stroke length 1576…5000 (62.05…196.9): 54 (2.13) dead zone
Stroke length 5001…7620 (196.9…300): 57 (2.24) dead zone

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

Fig. 7: Temposonics® GH5 with ring magnet, part 2

Installation of GH5 with threaded flange

Fix the sensor rod via threaded flange M18×1.5-6g, M22×1.5-6g or ¾"-16 UNF-3A. Note the fastening torque shown in Fig. 8. Lightly oil the thread before tightening.
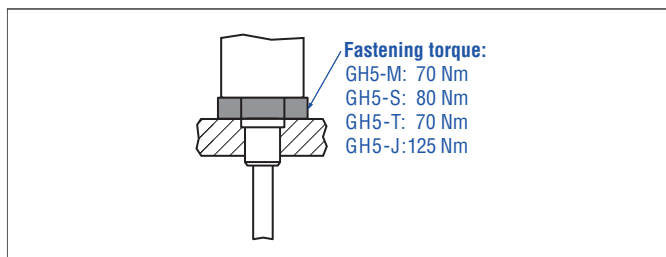

Fastening torque:
GH5-M: 70 Nm
GH5-S: 80 Nm
GH5-T: 70 Nm
GH5-J: 125 Nm

Fig. 8: Mounting example of threaded flange

Installation of a rod-style sensor in a fluid cylinder

The rod-style version has been developed for direct stroke measurement in a fluid cylinder. Mount the sensor via threaded flange or a hex nut.

• Mounted on the face of the piston, the position magnet travels over the rod without touching it and indicates the exact position through the rod wall – independent of the hydraulic fluid.

• The pressure resistant sensor rod is installed into a bore in the piston rod.

• The base unit is mounted by means of three screws. It is the only part that needs to be replaced if servicing is required, i.e. the hydraulic circuit remains closed. For more information see page 15.
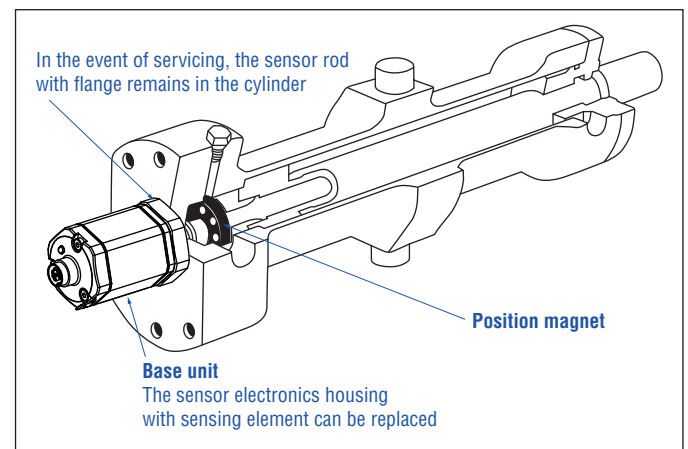

In the event of servicing, the sensor rod with flange remains in the cylinder

Position magnet

Base unit
The sensor electronics housing with sensing element can be replaced

Fig. 9: Sensor in cylinder

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

Hydraulics sealing

There are two ways to seal the flange contact surface (Fig. 10):

1. A sealing by using an O-ring (e.g. 22.4 × 2.65 mm (0.88 × 0.1 in.), 25.07 × 2.62 mm (0.99 × 0.1 in.)) in a cylinder end cap groove.
2. A sealing by using an O-ring in the flange undercut.
   For threaded flange (¾"-16 UNF-3A):
   O-ring 16.4 × 2.2 mm (0.65 × 0.09 in.) (part no. 560 315)
   For threaded flange (M18×1.5-6g):
   O-ring 15.3 × 2.2 mm (0.60 × 0.09 in.) (part no. 401 133)
   For threaded flange (M22×1.5-6g):
   O-ring 19.3 × 2.2 mm (0.76 × 0.09 in.) (part no. 561 337)

In the case of threaded flanges M18×1.5-6g or M22×1.5-6g, provide a screw hole based on ISO 6149-1 (Fig. 10). See ISO 6149-1 for further information.
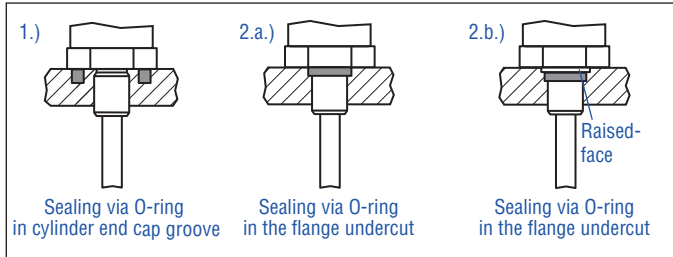

Fig. 10: Possibilities of sealing for threaded flange standard 1. + 2.a. (GH5-J/M/S) and for threaded flange with raised-face 2.b. (GH5-T)

- Seat the flange contact surface completely on the cylinder mounting surface.
- The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
- The position magnet should not grind on the sensor rod.
- The piston rod drilling
  (GH5-M/S/T-A/F/M/V with rod Ø 10 mm: ≥ Ø 13 mm (≥ Ø 0.51 in.);
  GH5-M/S/T-B with rod Ø 10 mm: ≥ Ø 16 mm (≥ Ø 0.63 in.);
  GH5-J-A/V with rod Ø 12.7 mm: ≥ Ø 16 mm (≥ Ø 0.63 in.))
  depends on the pressure and piston speed.
- Adhere to the information relating to operating pressure.
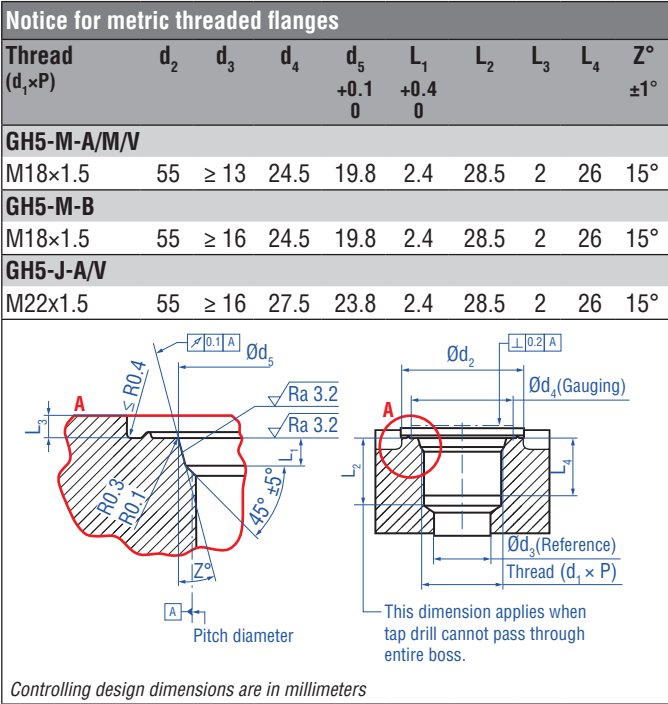- Protect the sensor rod against wear.

Notice for metric threaded flanges									
Thread (d$_1$×P)	d$_2$	d$_3$	d$_4$	d$_5$ +0.1 0	L$_1$ +0.4 0	L$_2$	L$_3$	L$_4$	Z° ±1°
GH5-M-A/M/V									
M18×1.5	55	≥ 13	24.5	19.8	2.4	28.5	2	26	15°
GH5-M-B									
M18×1.5	55	≥ 16	24.5	19.8	2.4	28.5	2	26	15°
GH5-J-A/V									
M22x1.5	55	≥ 16	27.5	23.8	2.4	28.5	2	26	15°

Controlling design dimensions are in millimeters

Fig. 11: Notice for metric threaded flange M18×1.5-6g/M22×1.5-6g based on DIN ISO 6149-1

4.4 Magnet installation

Typical use of magnets

Magnet	Typical sensors	Benefits
Ring magnets	**Rod model** (GH5)	• Rotationally symmetrical magnetic field
U-magnets	**Profile & rod models** (GP5, GH5)	• Height tolerances can be compensated, because the magnet can be lifted off
Block magnets	**Profile & rod models** (GP5, GH5)	• Height tolerances can be compensated, because the magnet can be lifted off
Magnet sliders	**Profile models** (GP5)	• The magnet is guided by the profile • The distance between the magnet and the waveguide is strictly defined • Easy coupling via the ball joint

Fig. 12: Typical use of magnets

Mounting ring magnets, U-magnets & block magnets
Install the magnet using non-magnetic material for mounting device, screws, spacers etc.. The magnet must not grind on the sensor rod/ profile. Alignment errors are compensated via the air gap.

- Permissible surface pressure: Max. 40 N/mm^2 (only for ring magnets and U-magnets)
- Fastening torque for M4 screws: 1 Nm; use washers, if necessary
- Minimum distance between position magnet and any magnetic material has to be 15 mm (0.6 in.) (Fig. 1515).
- If no other option exists and magnetic material is used, observe the specified dimensions (Fig. 15).

NOTICE
- Mount ring magnets and U-magnets concentrically.
- Mount block magnets centrically over the sensor rod or the sensor profile. The maximum permissible air gap must not be exceeded (Fig. 13/Fig. 14).
- Take care to mount the primary sensor axis in parallel to the magnet path in order to avoid damage to the carriage, magnet and sensor rod/profile.
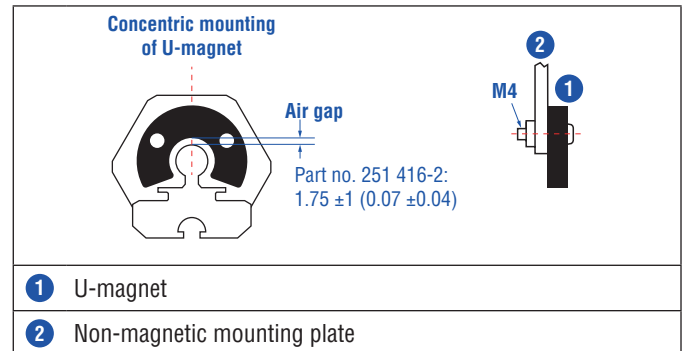

1	U-magnet
2	Non-magnetic mounting plate

Fig. 13: Mounting of U-magnet (part no. 251 416-2)

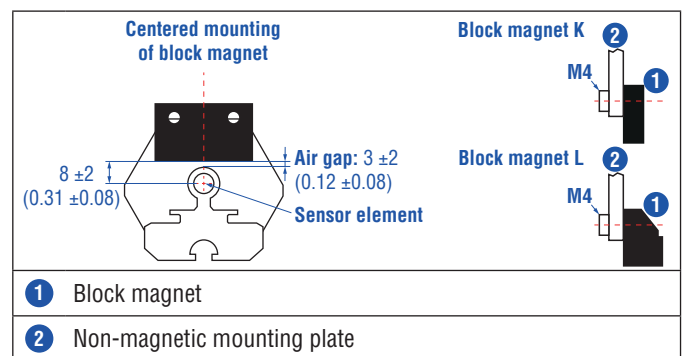|	
1	Block magnet
2	Non-magnetic mounting plate

Fig. 14: Mounting of block magnet K (part no. 251 298-2) and block magnet L (part no. 403 448)

Magnet mounting with magnetic material
When using magnetic material the dimensions of Fig. 15 must be observed.

A. If the position magnet aligns with the drilled piston rod
B. If the position magnet is set further into the drilled piston rod, install another non-magnetic spacer (e.g. part no. 400 633) above the magnet.
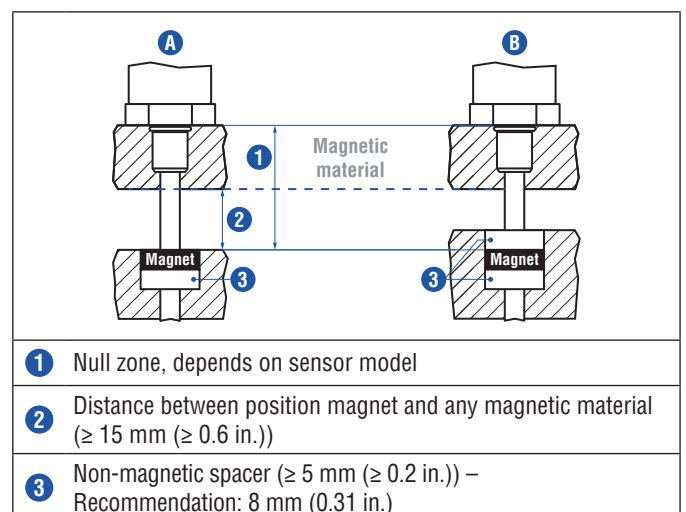

1	Null zone, depends on sensor model
2	Distance between position magnet and any magnetic material (≥ 15 mm (≥ 0.6 in.))
3	Non-magnetic spacer (≥ 5 mm (≥ 0.2 in.)) – Recommendation: 8 mm (0.31 in.)

Fig. 15: Installation with magnetic material

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

Rod sensors with stroke lengths ≥ 1 meter (3.3 ft.)

Support horizontally installed sensors with a stroke length of 1 meter (3.3 ft.) and more mechanically at the rod end. Without using a support, the sensor rod bends over and the rod and the position magnet may be damaged. A false measurement result is also possible. Longer rod require evenly distributed mechanical support over the entire length (e.g. part no. 561 481). Use an U-magnet (Fig. 16) for measurement.
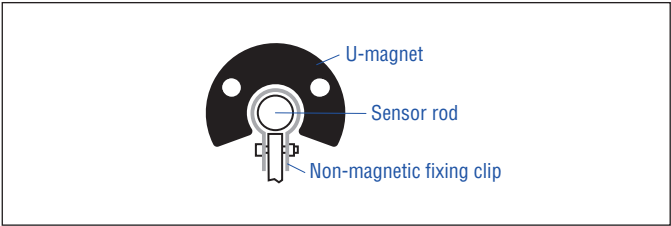

Fig. 16: Example of sensor support (part no. 561 481)

Start- and end positions of the position magnets

Consider the start and end positions of the position magnets during the installation. To ensure that the entire stroke length is electrically usable, the position magnet must be mechanically mounted as follows.
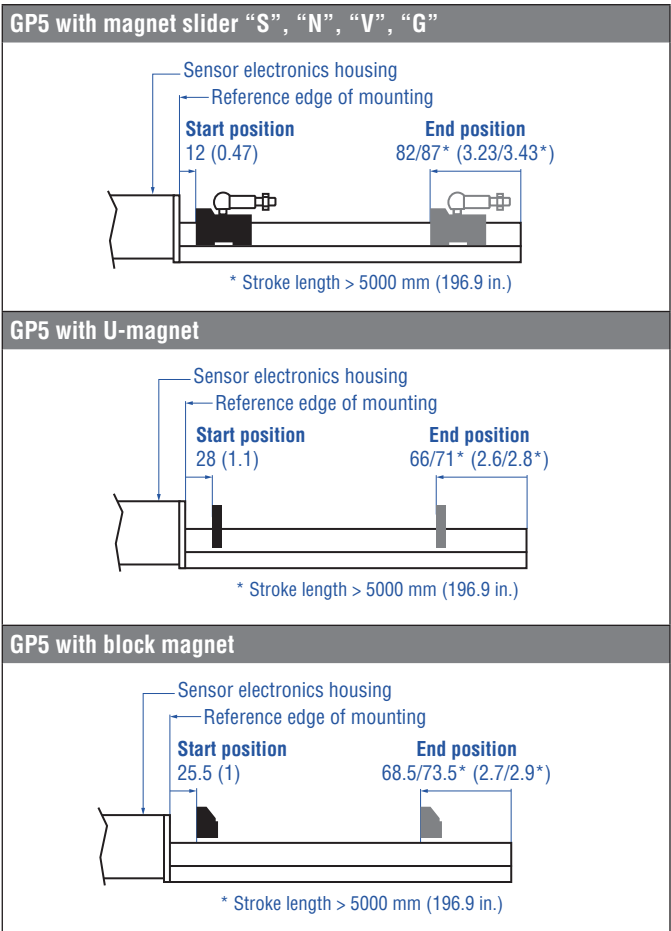
GP5 with magnet slider "S", "N", "V", "G"

Sensor electronics housing
Reference edge of mounting

Start position
12 (0.47)

End position
82/87* (3.23/3.43*)

* Stroke length > 5000 mm (196.9 in.)

GP5 with U-magnet

Sensor electronics housing
Reference edge of mounting

Start position
28 (1.1)

End position
66/71* (2.6/2.8*)

* Stroke length > 5000 mm (196.9 in.)

GP5 with block magnet

Sensor electronics housing
Reference edge of mounting

Start position
25.5 (1)

End position
68.5/73.5* (2.7/2.9*)

* Stroke length > 5000 mm (196.9 in.)

Fig. 17: Start- and end positions of magnets for GP5

GH5 with ring magnet/U-magnet

Sensor electronics housing
Reference edge of mounting

Start position
51 (2.01)

End position
63.5/66* (2.5/2.6*)

* Stroke length > 5000 mm (196.9 in.)

GH5 with block magnet

Sensor electronics housing
Reference edge of mounting

Start position
48.5 (1.91)

End position
66/68.5* (2.6/2.7*)

* Stroke length > 5000 mm (196.9 in.)

Fig. 18: Start- and end positions of magnets for GH5

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

4.5 Replacement of base unit on the GH5 model

The base unit of the sensor model GH5 (GH5-B) is replaceable as shown in Fig. 19 and Fig. 20 for the sensor designs »M«, »S« and »T«. The sensor can be replaced without interrupting the hydraulic circuit.

Base unit

Tube with inner sensor element

Sensor electronics housing

1. Loosen the screws.

3 × socket head screw M4×59 (A/F 2.5)

2. Pull out the base unit.

Fig. 19: Replacement of the base unit (e.g. GH5 sensor), part 1

3. Insert the new base unit.
Install the ground lug on a screw.
Tighten the screws.

Fastening torque 1.4 Nm

Fig. 20: Replacement of the base unit (e.g. GH5 sensor), part 2

NOTICE

- When replacing the base unit, make sure that no humidity enters the sensor tube. This may damage the sensor.
- Secure the base unit screws, e.g. using Loctite 243, before re-installing.
- If the G-Series V replaces a predecessor model of the G-Series, the plastic tube in the sensor rod must be removed.
- Make sure the O-ring is correctly fitted between the flange and the base unit.
- The O-ring is secured with an adhesive strip. Remove the adhesive strip before tightening before reinstalling the base unit (see illustration "Remove adhesive strips").
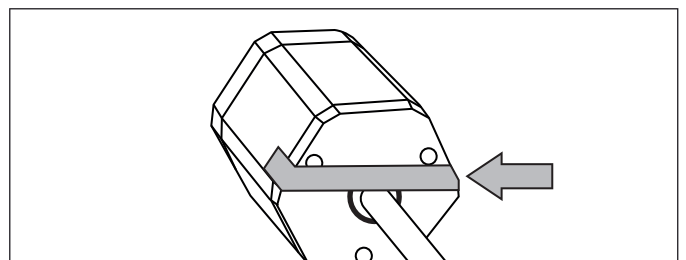
Fig. 21: Remove adhesive strips

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

4.6 Electrical connection

Placement of installation and cabling have decisive influence on the sensor's electromagnetic compatibility (EMC). Hence correct installation of this active electronic system and the EMC of the entire system must be ensured by using suitable metal connectors, shielded cables and grounding. Overvoltages or faulty connections can damage its electronics despite protection against wrong polarity.

> **NOTICE**
> 1. Do not mount the sensors in the area of strong magnetic or electric noise fields.
> 2. Never connect/disconnect the sensor when voltage is applied.

Instructions for connection
- Use low-resistant twisted pair and shielded cables. Connect the shield to ground externally via the control system equipment.
- Keep control and signal cables separate from power cables and sufficiently far away from motor cables, frequency inverters, valve lines, relays, etc..
- Use only connectors with metal housing and connect the shielding to the connector housing.
- Keep the connection surface at both shielding ends as large as possible. Connect the cable clamps to function as a ground.
- Keep all non-shielded leads as short as possible.
- Keep the earth connection as short as possible with a large cross section. Avoid ground loops.
- With potential differences between machine and electronics earth connections, no compensating currents are allowed to flow across the cable shielding.
  Recommendation:
  Install potential compensating leads with large cross section, or use cables with separate double shielding, and connect only one end of the shield.
- Use only stabilized power supplies in compliance with the specified electrical ratings.

Grounding of profile and rod sensors
Connect the sensor electronics housing to machine ground.
Ground G-Serie V via ground lug as shown in Fig. 22. The sensor design can also be grounded via the thread.
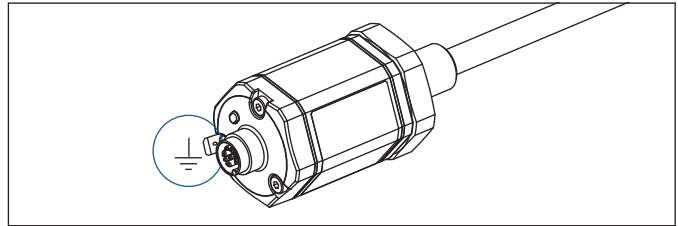

Fig. 22: Grounding via ground lug on the example of GH5 sensor

Connector wiring

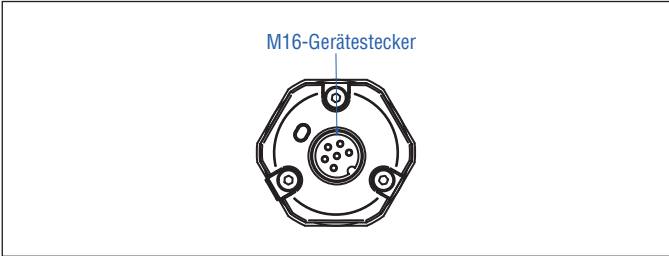Connect the sensor directly to the control system, indicator or other evaluating systems as follows:

Fig. 23: Location of connection (example M16 connector outlet)

D60		
Signal + power supply		
M16 male connector	**Pin**	**Function**
	1	Position
	2	Signal Ground
	3	Do not connect
	4	Do not connect
	5	+24 VDC (−15/+20 %)
View on sensor	6	DC Ground (0 V)

Fig. 24: Connector wiring D60

EXX/GXX/LXX		
Signal + power supply		
Cable	**Color**	**Function**
	GY	Position
	PK	Signal Ground
	YE	Do not connect
	GN	Do not connect
	BN	+12...30 VDC (±20 %)
	WH	DC Ground (0 V)

Fig. 25: Connector wiring cable outlet

4.7 Frequently ordered accessories for Temposonics® GP5 – Additional options available in our Accessories Catalog 551 444

Position magnets

Magnet slider S, joint at top Part no. 252 182	Magnet slider V, joint at front Part no. 252 184	Magnet slider N longer ball-joint arm Part no. 252 183	Magnet slider G, backlash free Part no. 253 421
Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: –40…+85 °C (–40…+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: –40…+85 °C (–40…+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: –40…+85 °C (–40…+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 25 g Operating temperature: –40…+85 °C (–40…+185 °F)

Position magnets / Mounting accessories

U-magnet OD33 Part no. 251 416-2	Block magnet L Part no. 403 448	Mounting clamp Part no. 400 802	T-nut Part no. 401 602
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)	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.	Material: Stainless steel (AISI 304)	Fastening torque for M5 screw: 4.5 Nm

4.8 Frequently ordered accessories for Temposonics® GH5 – Additional options available in our Accessories Catalog ⬜ 551 444

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 | Magnet spacer | O-rings

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
Part no. 400 633

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

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
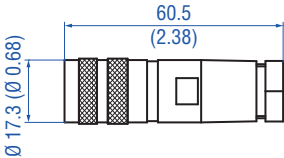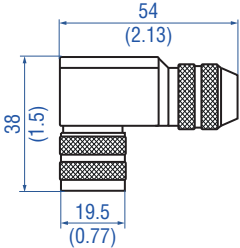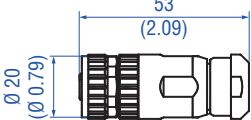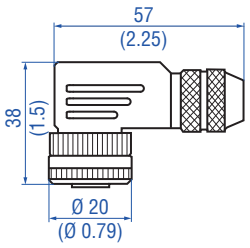Operating temperature:
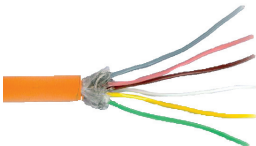–40…+204 °C (–40…+400 °F)

O-ring | Mounting accessories

O-ring for threaded flange
M22×1.5-6g
Part no. 561 337

Material: FPM
Durometer: 75 Shore A
Operating temperature:
–20…+200 °C (–6…+392 °F)

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

4.9 Frequently ordered accessories for Analog output – Additional options available in our Accessories Catalog ⬚ 551 444

Cable connectors*

60.5 (2.38) / Ø 17.3 (Ø 0.68)	54 (2.13) / 38 (1.5) / 19.5 (0.77)	53 (2.09) / Ø 20 (Ø 0.79)	57 (2.25) / 38 (1.5) / Ø 20 (Ø 0.79)
M16 female connector (6 pin), straight **Part no. 370 423**	**M16 female connector (6 pin), angled** **Part no. 370 460**	**M12 A-coded female connector (4 pin/5 pin), straight** **Part no. 370 677**	**M12 A-coded female connector (5 pin), angled** **Part no. 370 678**
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	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	Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 4…8 mm (0.16…0.31 in.) Wire: Max. 1.5 mm² (16 AWG) Operating temperature: –30…+85 °C (–22…+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm	Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 5…8 mm (0.2…0.31 in.) Wire: Max 0.75 mm² (18 AWG) Operating temperature: –25…+85 °C (–13…+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.4 Nm

Cables

PVC cable **Part no. 530 032**	**PUR cable** **Part no. 530 052**	**FEP cable** **Part no. 530 112**	**FEP cable** **Part no. 530 157**
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)	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 × 0.19 mm² Bending radius: 5 × D (fixed installation) Operating temperature: –20…+80 °C (–4…+176 °F)	Material: FEP jacket; black Features: Twisted pair, shielded, flexible, high thermal resistance, mostly oil & acid resistant Cable Ø: 7.6 mm (0.3 in.) Cross section: 4 × 2 × 0.25 mm² Bending radius: 8 – 10 × D (fixed installation) Operating temperature: –100…+180 °C (–148…+356 °F)	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

Programming tools	Extension cabels M16		
TempoLink® kit for Temposonics® G-Series V **Part no. TL-1-0-AS00 (for D60 and cable outlet)**	**PVC cable with M16 female connector (6 pin), straight – pigtail**	**PUR cable with M16 female connector (6 pin), straight – pigtail**	**FEP cable with M16 female connector (6 pin), straight – pigtail**
• 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	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 (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 (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).

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

5. Commissioning

5.1 Getting started

The analog sensor can be directly connected to a controller. Its electronics generates a position signal output proportional to the start and the end of the active measuring range. In this case, the sensor is set at the factory according to the order code, so that the desired output signal corresponds exactly to the selected stroke length, e.g.:
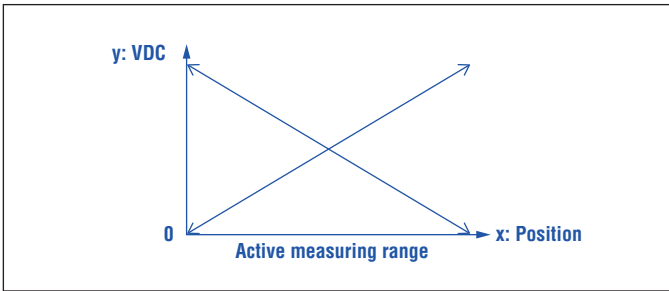
Output 0…10 V = 0…100 % of the stroke length

Fig. 26: Analog interface

HINWEIS

Observe during commissioning
1. Before initial switch-on, check carefully if the sensor has been connected correctly.
2. Position the magnet in the measuring range of the sensor during first commissioning and after replacement of the magnet.
3. Ensure that the sensor control system cannot react in an uncontrolled way when switching on.
4. Ensure that the sensor is ready and in operation mode after switching on. The status LED lights up permanently green.
5. Check the pre-set span start and end values of the measuring range (see Chapter 4.4) and correct them via the TempoLink® smart assistant, if necessary.

5.2 LED status

The LED on the sensor visualizes the current sensor status. In normal function the LED is continuously green. In other cases the color of the LED changes in the time slot of 0.5 seconds as shown in Fig. 26.

G-Series Ⅴ Analog LED status

Time slot 1	Time slot 2	Information
GN	GN	Normal function
GN	Off	Command Mode
RD + GN	Off	Power Supply Error
RD + GN	RD + GN	Magnet Status Error
RD	RD	Internal error
1 × time slot = 0.5 seconds		

Fig. 27: LED status

Fig. 27 describes error conditions that are output via the LEDs and troubleshooting.

Error Condition	Description	Troubleshooting
Power Supply Error	Power supply of the sensor is out of the allowable range	Set the power supply for the sensor to the allowable range
Magnet Status Error	Sensors does not recognize magnet	Ensure that the position magnet is positioned correctly
Internal Error	Internal error of the sensor	Contact Temposonics

Fig. 28: Error conditions and troubleshooting

5.3 Adjustment of sensor settings on-site

Temposonics® G-Series V Analog sensors are factory set according to the order code. These the default sensor settings fit for many applications. To adjust sensor settings in the field, you can use the TempoLink® smart assistant.

5.3.1 Customization of the G-Series V via the TempoLink® smart assistant

The TempoLink® smart assistant can be connected to all G-Series V sensors. Use the adapter cable for connection of the TempoLink® smart assistant to the G-Series V. If the sensor is connected to a control system, disconnect the sensor from that control system before connecting the TempoLink® smart assistant to the sensor. Connect the barrel connector of the adapter cable to the connection point labeled "OUTPUT SENSOR" on the TempoLink® smart assistant (Fig. 28).
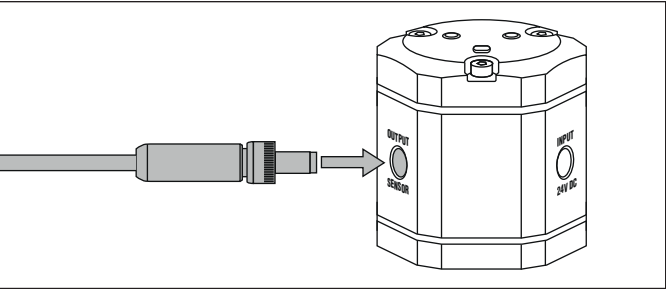

Fig. 29: Connection of adapter cable to TempoLink® smart assistant

NOTICE
• When disconnecting the power supply of the sensor, possibly error messages occur at the connected control system.
• Do not exceed the maximum cable length between TempoLink® smart assistant and G-Series V sensor of 30 m (99 ft.).

1. Connection to a sensor with connector outlet
   Connect a cable with pig-tails to the sensor. (see page 20) Connect the pig-tails to the terminal clamps of the adapter cable AS00.
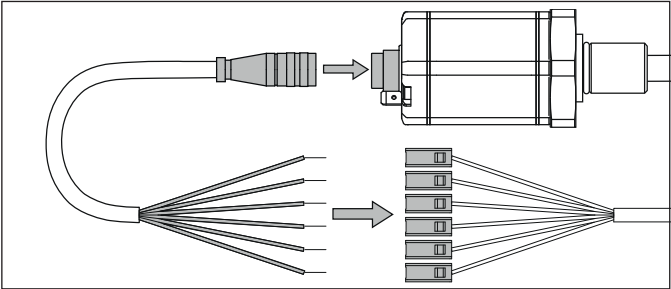

Fig. 30: Connection of adapter cable to G-Series V sensor with connector outlet

2. Connection to a sensor with connector outlet
   Connect the pig-tails of the sensor cable to the terminal clamps of the adapter cable according to the connector wiring in Fig. 31.

Color sensor cable	Color adapter cable	Function
⬤ GY	⬤ GY	–
⬤ PK	⬤ PK	–
⬤ YE	⬤ YE	–
⬤ GN	⬤ GN	–
⬤ BN	⬤ BN	+ 24 VDC
⬤ WH	⬤ WH	DC Ground (0 V)

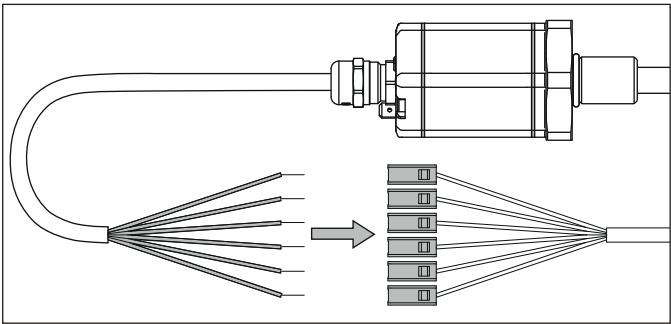*Fig. 31: Connection of adapter cable to sensor cable*

Fig. 32: Connection of adapter cable to G-Series V sensor with cable outlet

5.3.2 Connection of TempoLink® smart assistant to power supply

Connect the barrel connector of the power supply to the connection point labeled "INPUT 24 VDC" on the TempoLink® smart assistant (Fig. 33).
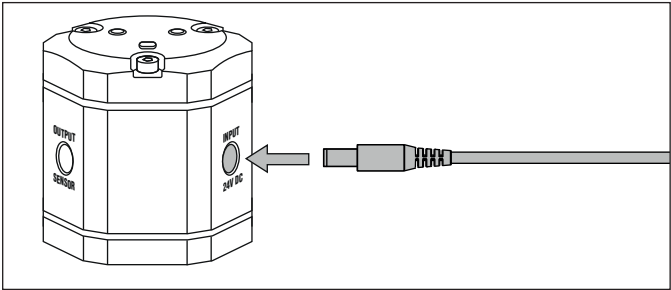

Fig. 33: Connection of power supply to the TempoLink® smart assistant

There are two ways to connect the TempoLink® smart assistant to a power supply:

1. **Connection via the plug-in power supply with plug adapters**
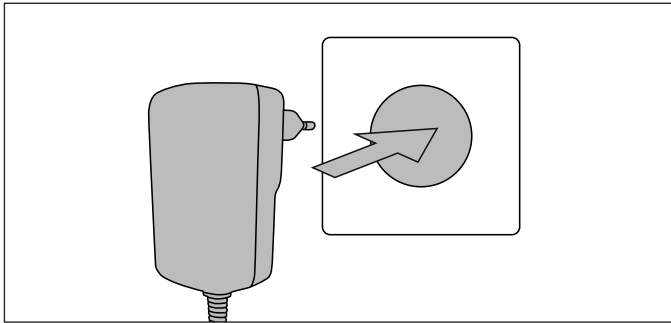   Attach the plug attachment suitable for your country to the plug. Insert the plug into the outlet (Fig. 34).

Fig. 34: Connection of the plug-in power supply to the outlet

2. **Connection via the cable with barrel connector and pig-tail**
   Connect the cable to a power supply according to the connector wiring in Fig. 35 (Fig. 36)

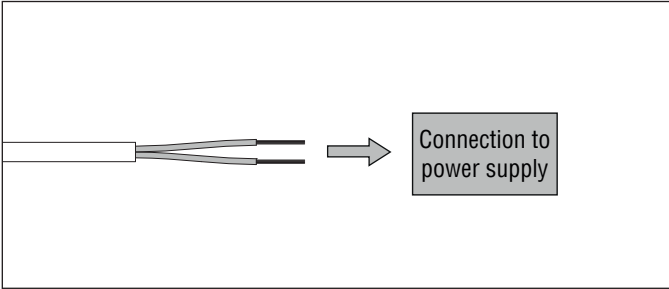| Cable	Function
🔴 RD	+24 VDC
⚫ BK	DC Ground (0 V)

Fig. 35: Connector wiring cable

Fig. 36: Connection of cable with barrel connector and pig-tails

5.3.3 Connection of TempoLink® smart assistant to smartphone, tablet or computer

Connect to a smartphone, tablet or computer to display the graphical user interface of the TempoLink® smart assistant.

Connecting a Wi-Fi enabled device to the integrated Wi-Fi access point [3]
Activate Wi-Fi on the device and choose the network "TempoLink_xxxx" (xxxx indicates the last four digits of the serial number). The access to the Wi-Fi network is password protected. The default password is the serial number printed on the label on the bottom of the TempoLink® smart assistant.
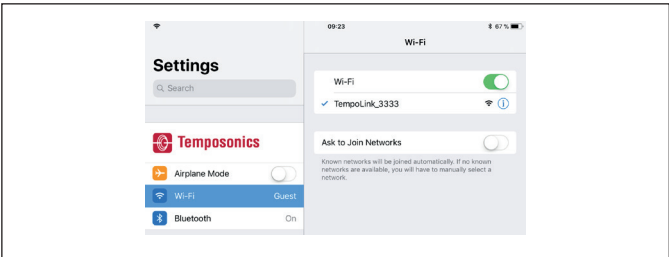

Fig. 37: Choose the network "TempoLink_xxxx" in the Wi-Fi settings of the Wi-Fi-enabled device

NOTICE

If you are using a mobile device, ensure cellular data is off. Depending on your operation system, message can appear, that there is no internet access. TempoLink® smart assistant does not need internet access. Connecting to the user interface may take longer if Wi-Fi and cellular data are active.

Connecting a computer via USB connection

The TempoLink® smart assistant can also be connected via USB. If the computer is Wi-Fi enabled deactivate Wi-Fi on the computer before setting up the USB connection.

1. Connect the USB cable with the micro USB connector to the port labeled "USB" on the TempoLink® smart assistant (Fig. 38).
2. Next, connect the USB type-A connector to a free USB port of the computer. The USB connection simulates a network card. In the folder "network connections" on the computer the connection is shown as "IP-over-USB" or "Remote NDIS".
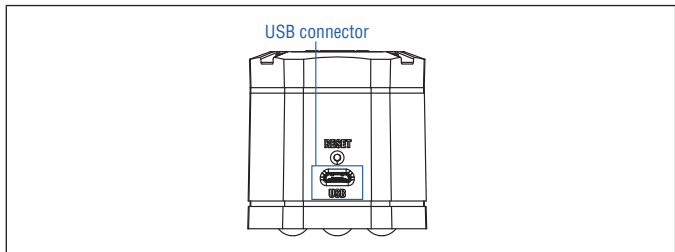

Fig. 38: USB port on the TempoLink® smart assistant

NOTICE

- Only one device can be connected to the TempoLink® smart assistant at a time in order to display the graphical user interface.
- Disable all Wi-Fi and LAN connections before connecting TempoLink® smart assistant via USB. Connecting to the user interface may take longer if Wi-Fi and LAN connections are active.

5.3.4 Establishing a connection via browser

After the connection via Wi-Fi or USB is established, open the browser on your mobile device or computer and go to the website-URL: **http://tempolink.local** It is recommended to use the browser Mozilla Firefox, Google Chrome, Microsoft Edge or Apple Safari.

NOTICE

If the website does not load, it may be helpful to press CTRL + F5 after opening the website http://tempolink.local to delete cached text and images from previous visits to this website.

Fig. 39: Main menu of the graphical user interface

Connection status		
Green	**Information**	
●	ON	Connection to sensor is established
Red	**Information**	
●	ON	Connection to sensor is not established
Blue	**Information**	
●	ON	Sensor in "Command Mode" (adjustment)
Turquoise	**Information**	
●	ON	Sensor in "Trimming Mode" (adjustment of setpoints)

Fig. 40: Connection status

5.3.5 Graphical user interface

Click the menu symbol ≡ in the top left to get to the main menu of the graphical user interface (GUI) (Fig. 41).
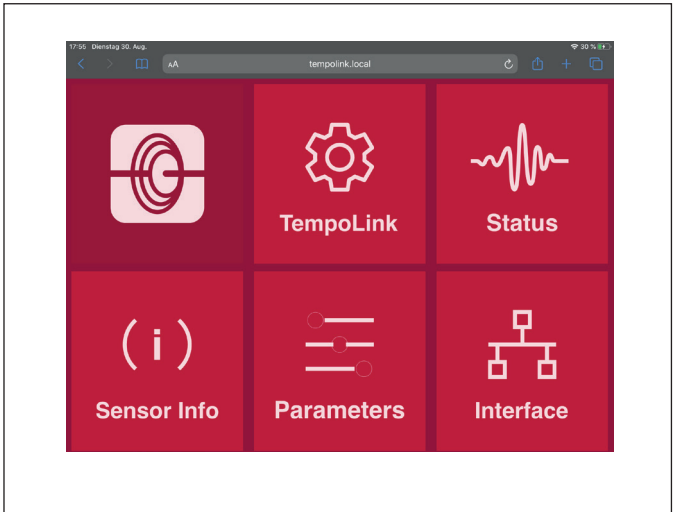

Fig. 41: The main menue of the graphical user interface

HINWEIS

Read the TempoLink® smart assistant operation manual (document part number: 551986) for more information.

3/ The integrated Wi-Fi access point does not provide internet access.

Menu item TempoLink

Includes information about the TempoLink® smart assistant

Menu item Status

Includes information about the sensor status.

- **Status Flags:** Display of the complete status word in hexadecimal format.

- **Storage:** Displays the current status of the internal memory.
  - **OK:** Reading the memory is working properly.
  - **Error:** Error reading the memory. Restart the sensor. If the error is not resolved, contact Temposonics.

- **Operation Mode:** Displays the current operating state of the sensor.
  - **Measure:** Normal operating mode.
  - **Config:** Sensor in Command Mode (change mode).

- **Magnet Detection:** Displays the current status of magnet detection.
  - **OK:** A magnet is detected on the sensor.
  - **Magnet Missing:** No magnet is detected on the sensor.

- **Temperature:** Displays the current status of the temperature inside the sensor electronics housing.
  - **OK:** The temperature inside the sensor electronics housing is within the specified range.
  - **Too high:** The temperature inside the sensor electronics housing is above the specified maximum value.
  - **Too low:** The temperature inside the sensor electronics housing is below the specified minimum value.

- **Input Voltage:** Displays the current status of the sensor's operating voltage.
  - **OK:** The operating voltage is within the specified range.
  - **Too high:** The operating voltage is above the specified maximum value.
  - **Too low:** The operating voltage is below the specified minimum value

- **Communication:** Displays the current communication status with the TempoLink® amart assistant:
  - **OK:** The connection is established and communication is working properly.
  - **Error:** The connection to the TempoLink® smart assistant is not working properly. Check the cable connection between the sensor and the TempoLink® smart assistant.
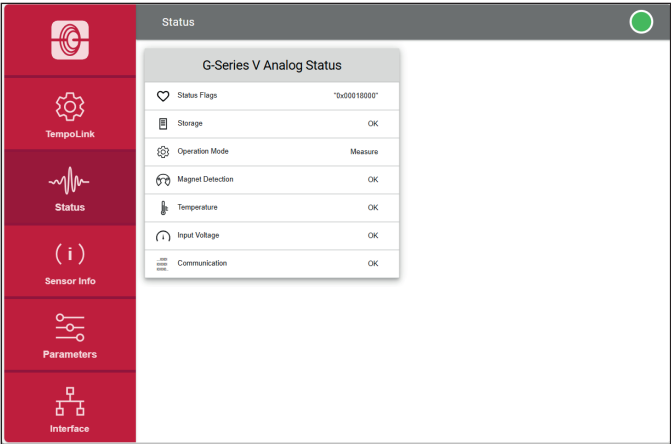

Fig. 42: Sensor status

Menu item Sensor Info

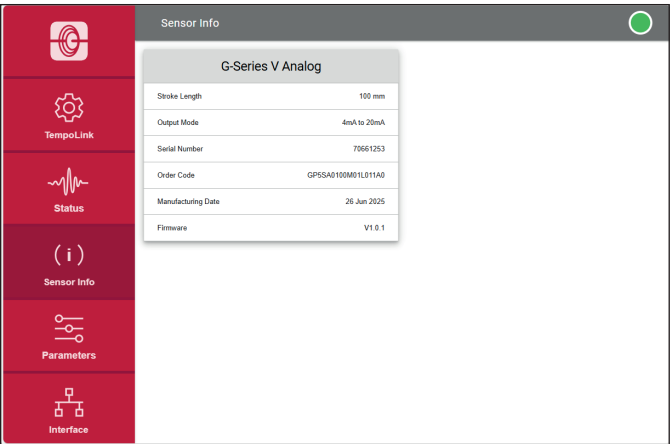Includes information about the connected sensor.

Fig. 43: Sensor info

Menu item Parameters

Offers the option to download or upload a file containing the sensor settings and to reset the sensor to factory settings.
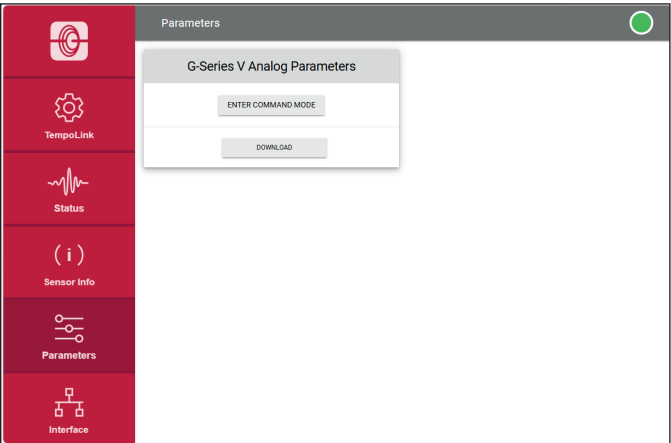

Fig. 44: Sensor parameters

Via the DOWNLOAD button you can save the settings of the sensor in a cek file on your computer (Fig. 45). The file is saved in the location according to your browser settings.
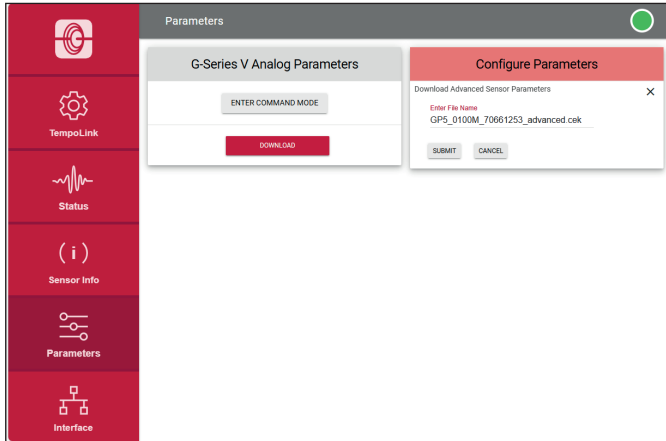

Fig. 45: Download a cek file with the settings of the sensor

To upload a cek file to the connected sensor, start "Command Mode". Click the ENTER COMMAND MODE button and the "Enter Command Mode" window opens. After reading the information, enter the word COMMAND and confirm by clicking the OK button (Fig. 46). After starting "Command Mode," the color of the connection indicator in the top right corner changes from green to blue. In addition the sensor's status LED flashes green.
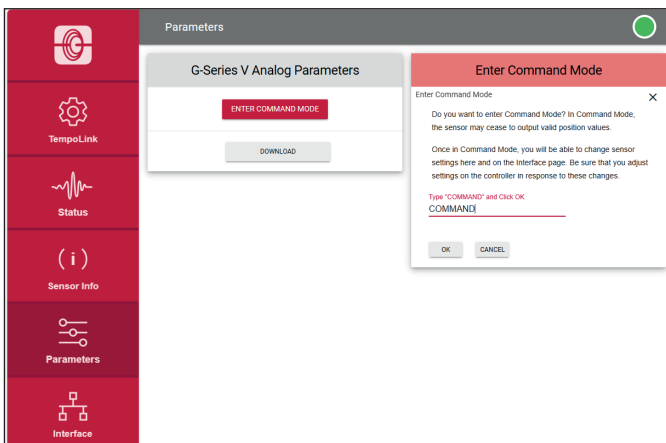

Fig. 46: Enter Command Mode

To upload a cek file to the connected sensor, click the UPLOAD button. A new window will open (Fig. 47). Click the CHOOSE FILE button and navigate to the location of the cek file you want to upload. The selected file is displayed in the "File Selected" field. Click the SUBMIT button to upload the cek file to the connected sensor.

> **NOTE**
>
> The cek file of a G-Series Ⅴ sensor is only valid for that G-Series Ⅴ sensor. Transferring the cek file of a G-Series Ⅴ sensor to another G-Series Ⅴ sensor may result in incorrect measurements for that sensor.
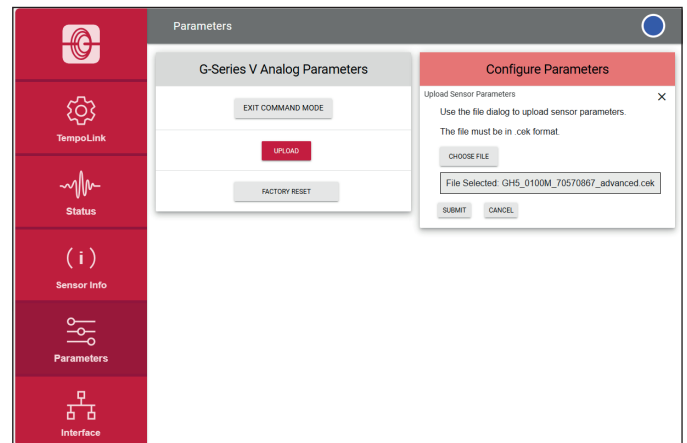

Fig. 47: Uploading a cek file to the connected G-Series Ⅴ sensor

If you want to reset the sensor to factory settings, click the FACTORY RESET button. The "Configure Parameters" window opens. Enter the word RESET and confirm by clicking the SUBMIT button to reset the sensor to factory settings (Fig. 48).
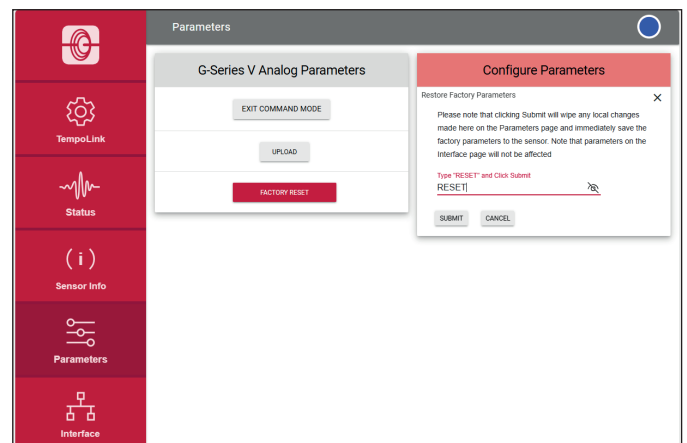

Fig. 48: Reset sensor to factory settings

After uploading the cek file or resetting the sensor to factory settings, click the EXIT COMMAND MODE button. The window for exiting the "Command Mode" opens (Fig. 49). Click the SAVE AND EXIT button to exit Command Mode and transfer the changes to the sensor. If you click the EXIT WITHOUT SAVING button, the changes you made will not be transferred to the sensor. In both cases, the sensor returns to function mode and outputs the current position value. The connection icon on the top right will turn to green. The sensor's status LED also lights up green.
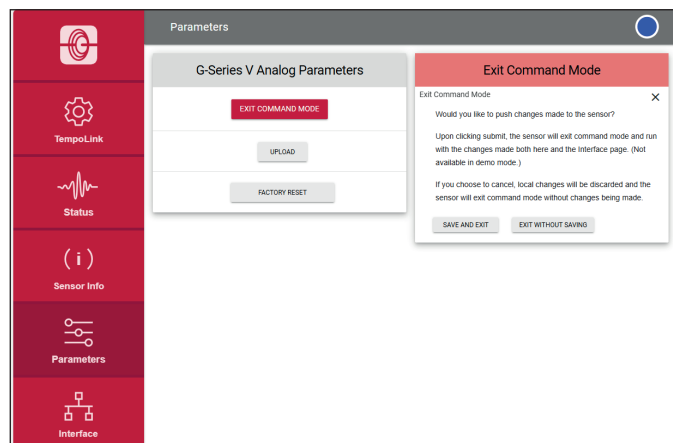
Fig. 49: Exit Command Mode

Fig. 51: Connecting a G-Series Ⅴ sensor to a TempoLink® smart assistant and a multimeter for adjusting set points and output ranges

Menu item Interface

Offers the option to adjust the position of the setpoints and the output range of the sensor (Fig. 50).
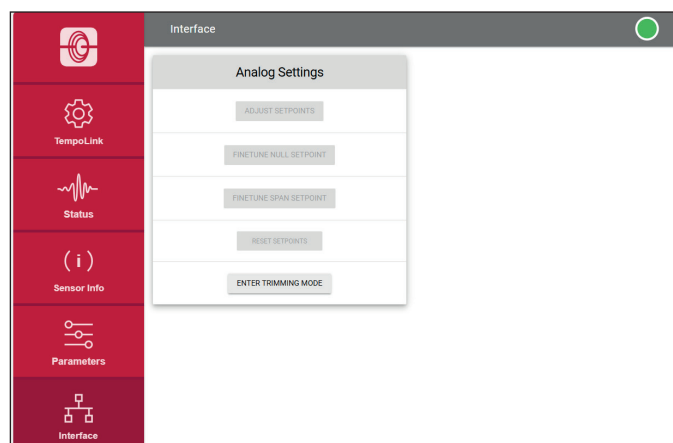

Fig. 50: Settings for the G Series Ⅴ Analog

To change the position of the setpoints or the sensor's output range, connect the pink wire (Signal Ground) and the grey wire (Position (Magnet 1)) to a multimeter. If you are using a sensor with connector outlet (connection type D60), use the TempoLink® smart assistant adapter cable AS00 as described in Section 5.3.1. Connect the sensor to the TempoLink® smart assistant and to a multimeter is shown in Fig. 51.

To change the sensor settings, enter the "Trimming Mode". When you click the ENTER TRIMMING MODE button and a new window will open. After reading the information, enter the word TRIM and confirm by clicking the SUBMIT button (Fig. 52). After starting "Trimming Mode" the color of the connection icon in the top right corner changes from green to turquoise.

Fig. 52: Enter Trimming Mode

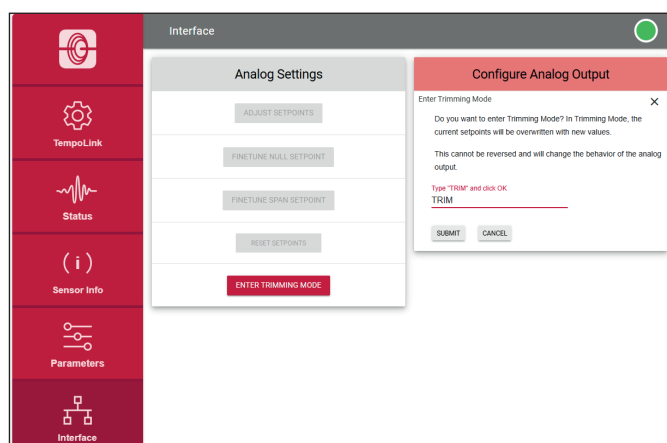To move the position of the setpoints or to change the output current or voltage value at the start or end of the measuring range, click the ADJUST SETPONITS button (Fig. 53).

- Move position of the setpoints
  - Change null position
    Move the position magnet on the rod or profile to the desired start of the measuring range. Read the displayed position value on the multimeter. In the example, the multi-meter shows 4.213 mA. Enter this value in the MEASURED NULL OUTPUT field.
  - Change end position
    Move the position magnet on the rod or profile to the desired end of the measuring range. Read the displayed position value on the multimeter. In the example, the multimeter shows 20.412 mA. Enter this value in the MEASURED SPAN OUTPUT field.

  Confirm your entries by clicking the SUBMIT button. If you do not want to change the values, close the window by clicking the CANCEL button.

- Change output values at null and end position
  To adjust the output current or voltage value at the null and end position, it is not necessary to move the magnet to set point 1 or set point 2. Enter the desired output value at the start position in the "Desired Null Output" field. Enter the desired output value at the end position in the "Desired Span Output" field.
  Confirm your entries by clicking the SUBMIT button. If you do not want to change the values, close the window by clicking the CANCEL button.
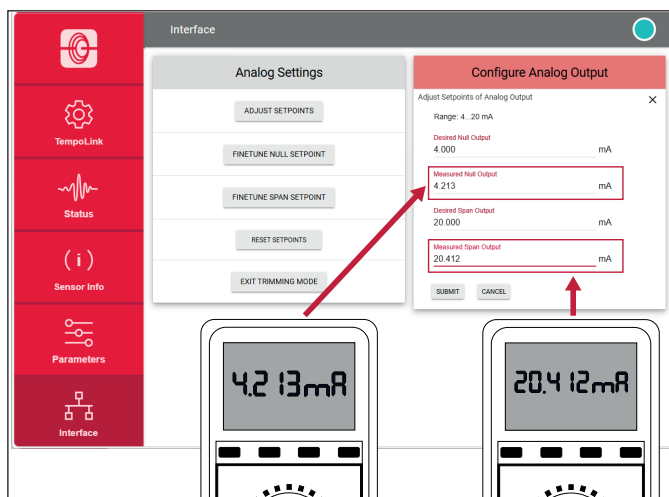
The new values may differ from the desired values. To align the new values with the desired values, you can perform a fine adjustment using FINETUNE (Fig. 54)

- FINETUNE NULL SETPOINT
  - Adjust null position: Move the position magnet to the desired start of the measuring range as described in the ADJUST SETPOINTS step.
  - Adjust the output value at the null position: Move the position magnet to the null position.

  If the value displayed on the multimeter is greater than the desired value, press the "-" button to bring the value closer to the desired value. If the value displayed on the multimeter is less than the desired value, press the "+" button to bring the value closer to the desired value.

- FINETUNE SPAN SETPOINT
  - Adjust the end position: Move the position magnet to the desired end position as described in the ADJUST SETPOINTS step.
  - Adjust the output value at the end position: Move the position magnet to the end position.

  If the value displayed on the multimeter is greater than the desi-red value, press the "-" button to bring the value closer to the de-sired value. If the value displayed on the multimeter is less than the desired value, press the "+" button to bring the value closer to the desired value. Then check the value at the beginning of the measuring range or the value at the end of the measuring range by repeating the FINEADJUST NULL SETPOINT and FINEADJUST SPAN SETPOINT steps. Close both windows using the cross × in the top right.
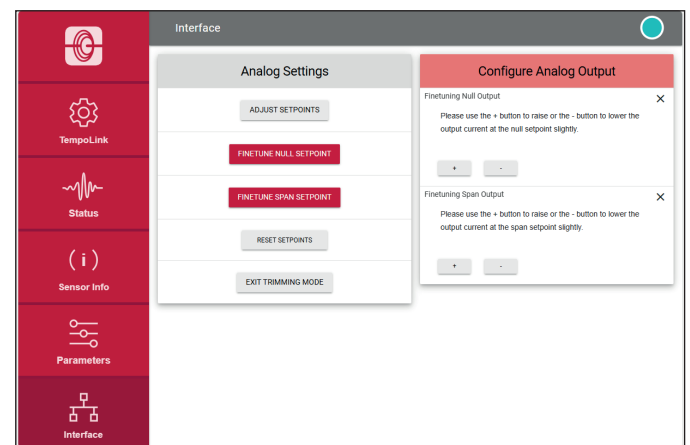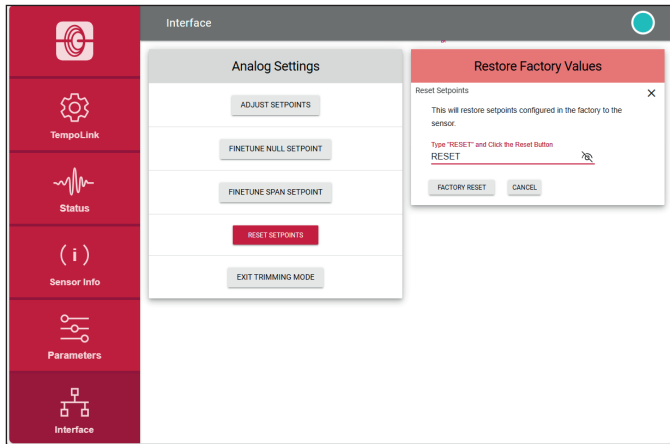

Fig. 53: Reading and entering the values for adjusting the set points

Fig. 54: Fine adjustment of the value at the start and end of the measuring range

To reset the adjusted position, current, or voltage values at both
setpoints to the factory settings, click the RESET SETPOINTS button
(Fig. 55). The "Restore Factory Values" window opens. Enter the word
RESET and confirm by clicking the FACTORY RESET button so that the
values at the start and end of the measuring range are reset to the fac-
tory settings.

Fig. 55: Resetting the values at the start and end of the measuring range

After adjusting the values at the start or end of the measuring range
or resetting these values to factory, click the EXIT TRIM MODE button.
The sensor returns to normal function and outputs the current posi-
tion value. The connection icon on the top right will turn to green.

6. Maintenance and troubleshooting

6.1 Error conditions, troubleshooting

See chapter „5.2 LED status" on page 22.

6.2 Maintenance

The sensor is maintenance-free.

6.3 Repair

Repairs of the sensor may be performed only by Temposonics or
a repair facility explicitly authorized by Temposonics. For return see
chapter "2.6 Return" on page 4.

6.4 List of spare parts

No spare parts are available for this sensor.

6.5 Transport and storage

The conditions of transport and storage of the sensor match the
operating conditions mentioned in this document.

7. Removal from service/dismantling

The product contains electronic components and must be disposed
of in accordance with the local regulations.

8. Technical data

8.1 Technical data Temposonics® GP5

Output	
Analog	Voltage: 0…10 /10…0 VDC (min. controller load > 5 kΩ) Current: 4(0)…20/20…4(0) mA (min./max. load 0/500 Ω)
Measured output variables	Position for one position magnet
Measurement parameters	
Null/Span adjustment	100 % of electrical stroke
Resolution	Infinite
Update time	(see sub-table below)
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) & IP69 for cable outlet
Shock test	100 g/11 ms, IEC standard 60068-2-27
Vibration test	20 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 GP5 sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011
Magnet movement velocity	Magnet slider: Max. 10 m/s; U-magnet: Any; block magnet: Any
Design/Material	
Sensor electronics housing	Aluminum (painted), zinc die cast
Sensor profile	Aluminum
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…6350 mm (1…250 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings on page 9
Electrical connection	
Connection type	1 × M16 male connectors (6 pin)or cable outlet
Operating voltage	+24 VDC (−15/+20 %); the GP5 sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Power consumption	75 mA maximum
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to −30 VDC
Overvoltage protection	Up to 36 VDC

Update time sub-table:

Stroke length	≤ 500 mm	≤ 1100 mm	≤ 3000 mm	≤ 6250 mm	≤ 6350 mm
Update time	500 µs	1 ms	2 ms	4 ms	5 ms

4/ With position magnet # 251 416-2

8.2 Technical data Temposonics® GH5

Output	
Analog	Voltage: 0…10 /10…0 VDC (min. controller load > 5 kΩ) Current: 4(0)…20/20…4(0) mA (min./max. load 0/500 Ω)
Measured output variables	Position or liquid level for one position magnet or float

Measurement parameters						
Null/Span adjustment	100 % of electrical stroke					
Resolution	Infinite					
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) & IP69 for cable outlet
Shock test	100 g/11 ms, IEC standard 60068-2-27
Vibration test	20 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
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.)

Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings on

Electrical connection	
Connection type	1 × M16 male connector (6 pin) or cable outlet
Operating voltage	+24 VDC (–15/+20 %); the GH5 sensors must be power supplied via an external Class 2 power source in accordance with the UL approval
Power consumption	50 mA typical (75 mA maximum)
Dielectric strength	500 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

5/ With position magnet # 251 416-2

9. Appendix – Safety declaration

Dear Customer,
If you return one or several sensors for checking or repair, we need you to sign a safety declaration. The purpose of this declaration is to ensure that the returned items do not contain residues of harmful substances and/or that people handling these items will not be in danger.

Temposonics order code: _____   Sensor model(s): _____

Serial number(s): _____   Stroke length(s): _____

The sensor has been in contact with the following materials:

```
                                                                        
                                                                        
                                                                        
                                                                        
```

Do not specify chemical formulas.
Please include safety data sheets of the substances, if applicable.

In the event of suspected penetration of substances into the sensor, consult Temposonics to determine measures to be taken before shipment.

Short description of malfunction:

```
                                                                        
                                                                        
                                                                        
                                                                        
```

Corporate information

Contact partner

Company:_____   Phone: _____

Address: _____   Fax: _____

_____   Email: _____

We hereby certify that the measuring equipment has been cleaned and neutralized.
Equipment handling is safe. Personnel exposure to health risks during transport and repair is excluded.

_____   _____

Stamp   Signature   Date

10. Glossary

A

Analog output
For a sensor with analog output, the measured value is output as an analog voltage signal or current signal.

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