1 Read before use

This manual contains instructions on installation and information on sensor models GYSE-A, GYSE-Q and GYSE-S in the GY series.

This document may be changed without notice. The manual and the datasheet are both useful references. The latest versions of these documents are always available on our website.

1.1 Warranty

The product has a warranty period of 12 months after delivery. However the following cases are not warranted:

- By other use than what is recommended for this product.
- If the product has been modified.
- Due to natural disaster, etc.

1.2 Symbols

Please pay special attention to sections marked with the following symbols.


General attention


Danger of electric shock


Danger of fire


Forbidden

1.3 Attention on safety

Please use this document as a reference when designing for and using the product. The guidelines help to ensure safety and function of this product.


Design the application so that the entire system is safe even if this sensor breaks down and the output becomes irregular.


Design so that the entire system is safe even if the sensor is subjected to abnormalities such as disturbance in power supply, noises, the vibrations, impacts, etc.


Avoid touching terminals and wires since that may cause electric shock or damage to the product.

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

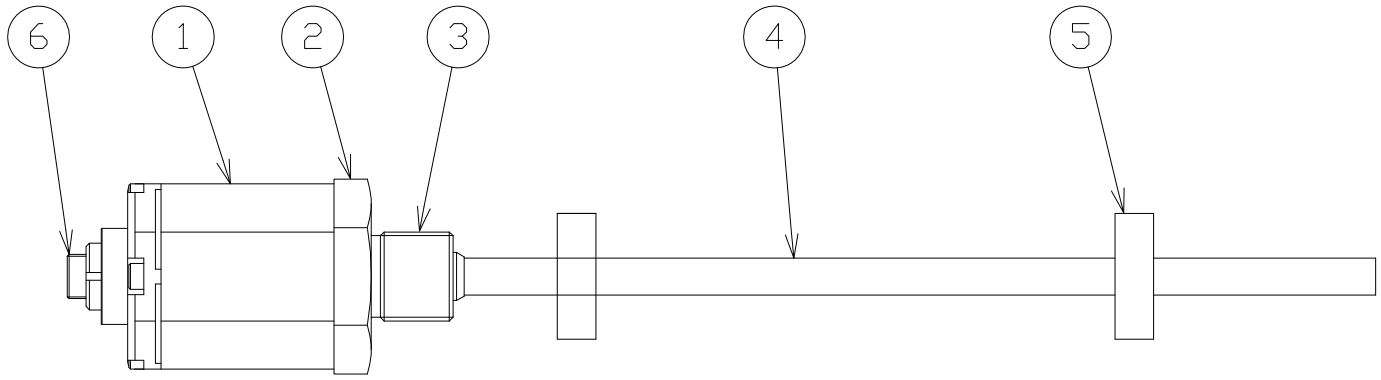
2 Outline

2.1 Outline of function

- **Non-Contact linear sensor**
  The Model GY series employing the Wiedemann effect is an industrial linear displacement sensor. The position of a movable magnet is measured by detecting a mechanical wave propagating in a special magnetostrictive wire from the position of a magnet. The time between an applied electrical current and the mechanical pulse is proportional to the distance to the magnet. There is no mechanical wear since there is no physical contact between the moving parts.
- **Absolute measurement**
  The sensor uses the magnetostrictive phenomena and will sense the position of the magnet immediately after the device is powered.
- **Highly accurate output**
- GYSE-A sensor models use high performance electronics to generate a analog voltage or current output signal.
- GYSE-Q sensor models use high performance electronics to generate an incremental quadrature encoder pulse (A/B)
  GYSE-S sensor models use SSI (Synchronous Serial Interface) output to give out the magnets position.
- **Magnet dropout warning**
  If the magnet drops out of place, it will be detected by the sensor.

2.2 Each part name

1. Sensor head
2. Hex flange
3. Mounting screw
4. Rod
5. Detecting magnet
6. Connector



REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

3 Installation

3.1 Attention in installation

Probe part

Please do not beat, bend or in any way damage the probe
Please do not disassemble the probe.
If the sensor has a premounted cable, don't try to remove it by force since it can cause damage.
Avoid dropping the magnet on the floor because it can be damaged by the fall.

Sensor cable

Please do not damage or pull the cable strongly.
Please fasten the cable, for example, to the nearby machine to make sure it doesn't get pulled out of place and takes damage.
The minimum bend radius of the cable is 20mm.
While installing the sensor, rotate the cable along with the sensor to avoid the cable from getting twisted.
Do not install the cable near other power cables.
Turn off the power before performing installation or detachment.

3.2 Installation in cylinder

The pressure of the cylinder is sealed between the mounting screw and the hex flange. A suitable o-ring should be installed in the slot on the hex flange. If the cylinder is made of ferromagnetic material the magnet zero point must be at least 20 mm from the metal, see Figure 1. The sensor can't be mounted in magnetized materials.

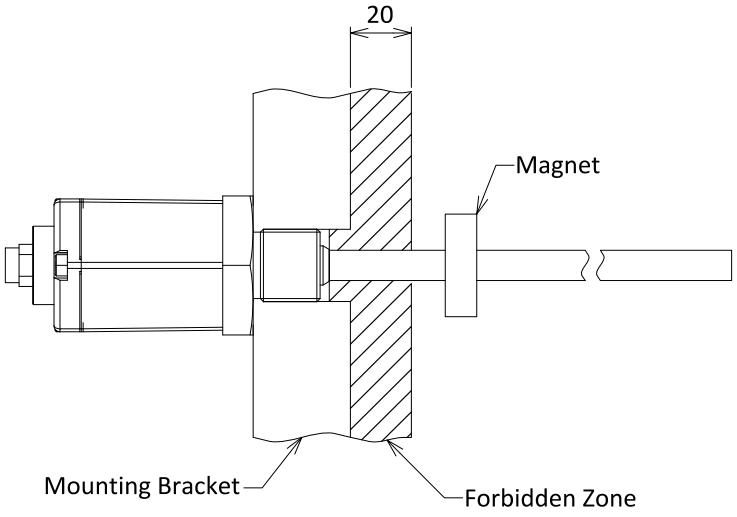


Figure 1. Forbidden magnet zone if ferromagnetic metal is used for installation.

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

The thread for mounting the sensor should be designed according to Figure 2 and Figure 3. Use the hex nut when screwing the sensor in place.

Thread / D	B (mm)	C (mm)
M18x1.5	22.46±0.16	≥24
M24x1.0	28.56±0.16	≥24

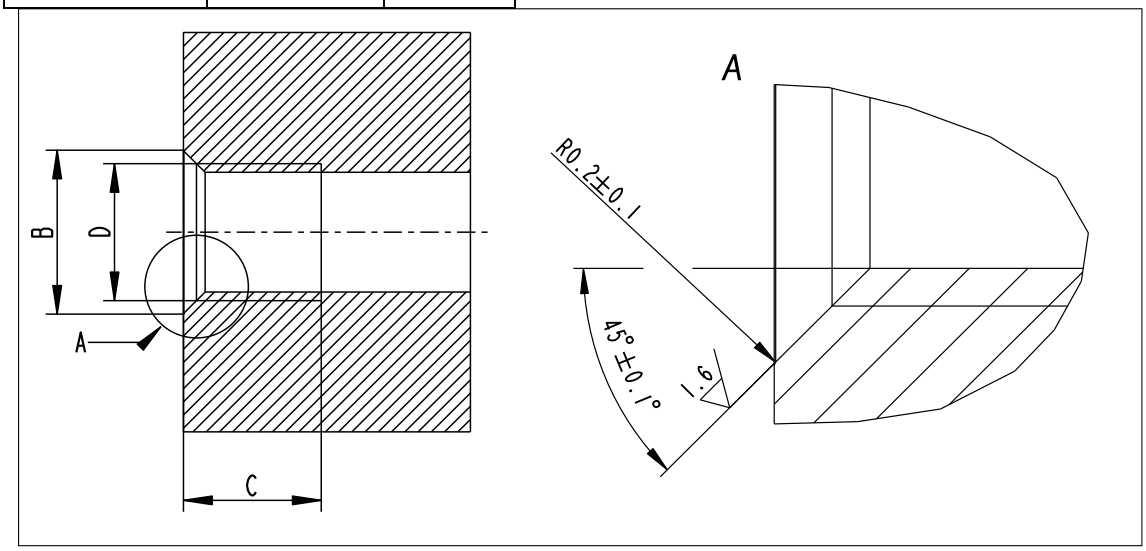


Figure 2. Dimensions for thread M18 and M24.

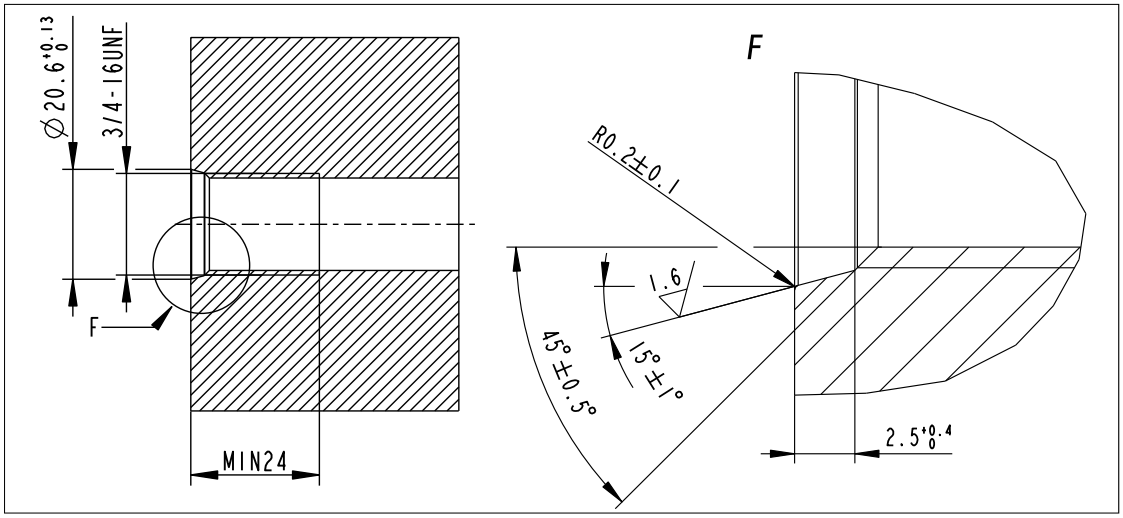


Figure 3. Dimensions for thread 3/4-16UNF.

Table 1. Recommended mounting torque.

Thread	Torque
M18x1.5	67 Nm
M20x1.0	69 Nm
M24x1.0	98 Nm
3/4-16UNF	64 Nm

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

3.3 Installation with mounting brackets or outside cylinder

Metal fittings are recommended to be of nonmagnetic material (stainless steel, aluminum, and brass, etc.). Ferromagnetic fittings are also possible to use but then the magnet must not enter the shaded area according to Figure 4. There is also the possibility to thread the sensor in a metal plate according to Figure 1. Magnetized fittings can't be used. If the sensor is long there may be need to add a rod support to the end of the sensor.

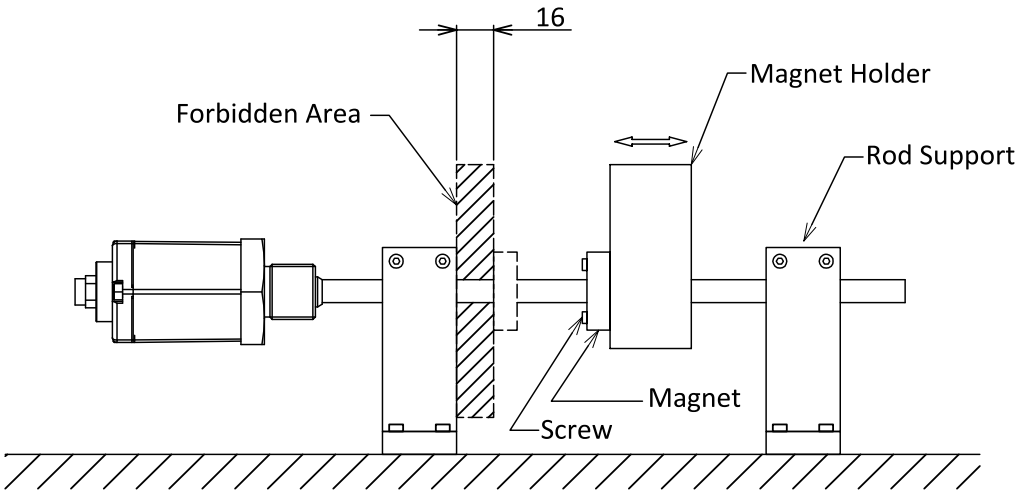


Figure 4. Installation of sensor using support rod.

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

3.4 Exchange sensor element

The sensor element can easily be exchanged by loosening two bolts on sensor head.

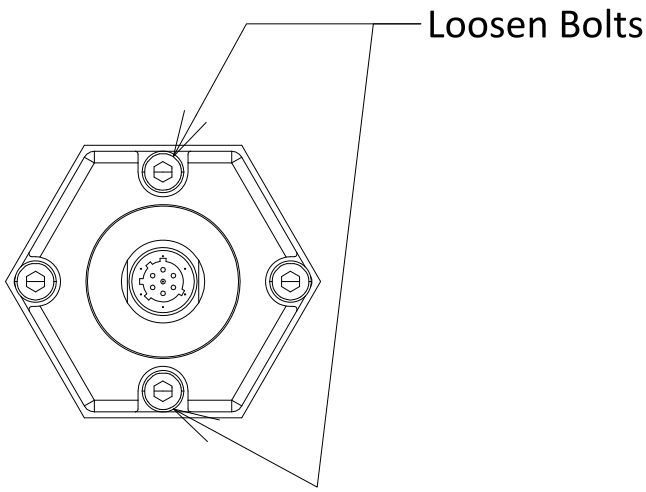


Figure 5. Postion of bolts for sensor element replacement.

Pull out the sensor head and replace it with a new sensor element.

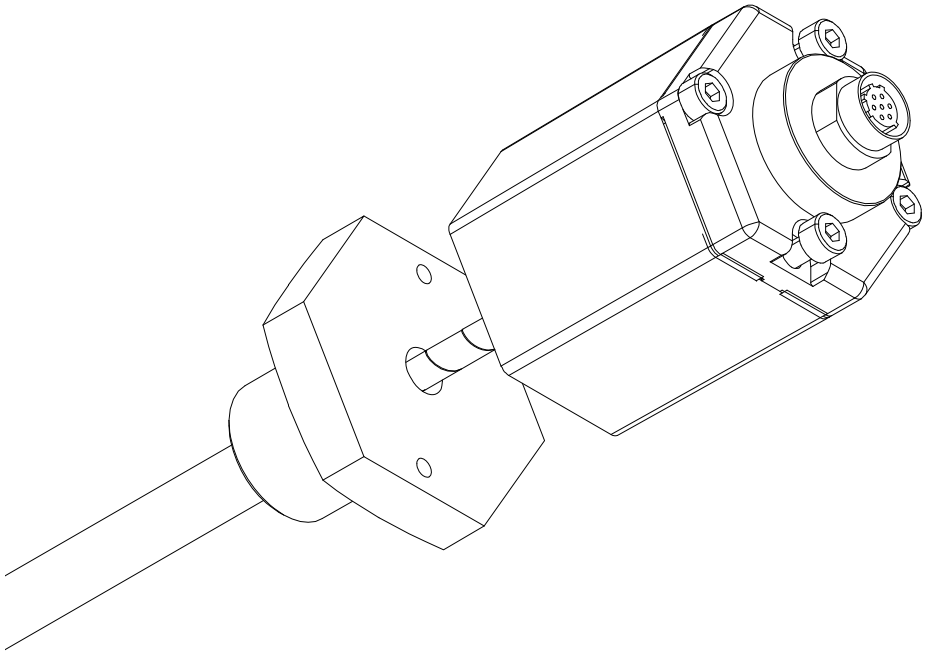


Figure 6.Sensor element removal

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

4 Wiring

4.1 Attention in wiring

Do not set up the cable near other power cables.
Do installation/detaching work after turning off the power supply.

4.2 Wiring method

This probe gives of the position very accurately so the signal can be interfered by a number of factors. To minimize interference, note the following aspects.

- The wiring length should as short as possible.
- The power supply cable, the electric power cable, the sensor cable, and the analog output cable should be separated.
- Install surge absorbers on inductive products such as relays and electromagnetic switches.

4.3 Sensor cable

There are two models of sensor cable; the pigtail type and the connector type. On the pigtail type, you can't detach the sensor cable from the sensor but that is possible with the connector type.

Specification of sensor cable for each model (also see Figure 14):

		Function		
Connector pin	Cable color	GYSE-A	GYSE-Q	GYSE-S
1	Red	V_{supply} +24 VDC	V_{supply} +24 VDC	V_{supply} +24 VDC
2	White	0 V	0 V	0 V
3	Blue	Analog Output1	A+	DATA+
4	Green	Common1	A-	DATA-
5	Brown	Analog Output2	B+	CLK+
6	Black	Common2	B-	CLK-
7	Yellow	Alarm	Alarm	Alarm
Shield is connected to sensor housing and should be grounded of good EMC-properties				

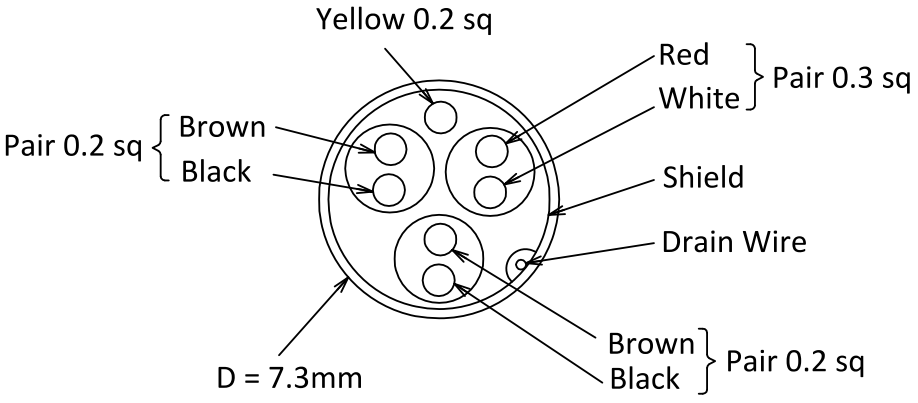


Figure 7. Structure of the cable.

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

4.4 Connection of power supply

This product is rated for 24V(±2V) and rated current is 80mA. Supply a stabile DC power to the red line (24V) and white line (0V).

4.5 Connection of output

4.5.1 GYSE-A

In output terminal 1 and 2, voltage/current output proportional to position/speed of the detection magnet is obtained.

4.5.2 GYSE-Q

Connect quadrature pulse output according to Figure 8.

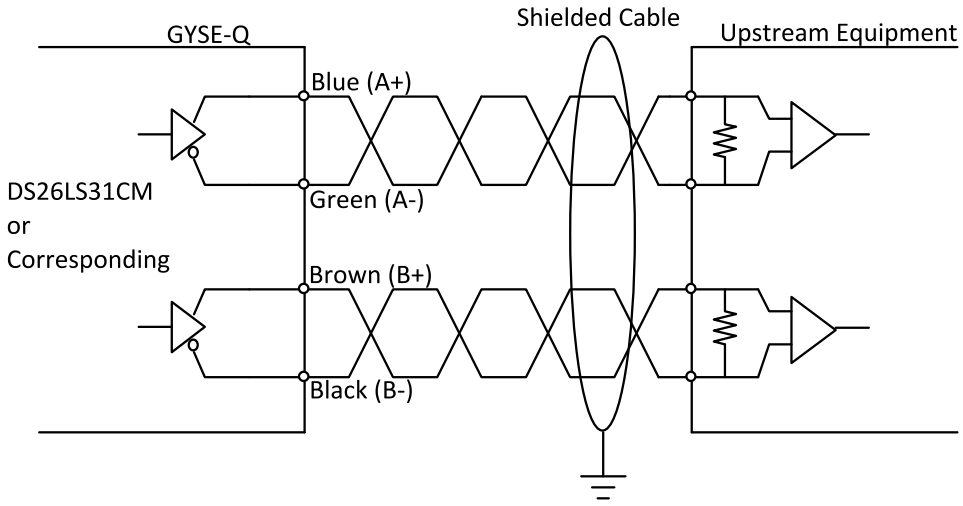


Figure 8. Wiring for quadrature pulse output.

4.5.3 GYSE-S

Connect SSI output with the equipment for SSI according to Figure 9.

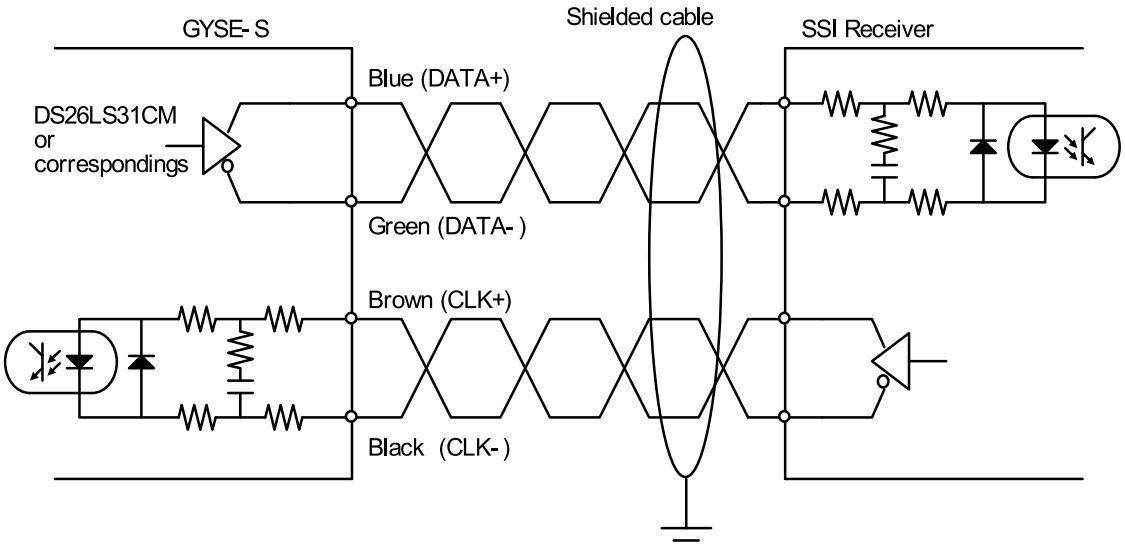


Figure 9. Wiring for SSI output.

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

4.6 Connection of alarm output

The warning signal (open drain) of magnet dropout is obtained from the yellow line. The output circuit of the warning signal is illustrated in Figure 10.

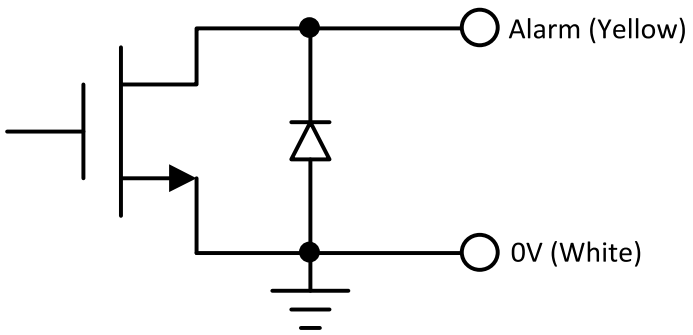


Figure 10. Warning output circuit.

The maximum acceptable voltage	50V
The maximum current	100mA
Static drain-source on-state resistance	Less than 20Ω

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

5 Output specification

5.1 GYSE-Q

5.1.1 Data form

The pseudo quadrature pulse output is provided. The output is RS-422 differential level, and Z phase is not output.

5.1.2 Timing

The sequence of pulses that corresponds to the amount of the movement at each sampling period (T1) is generated as shown in Figure 11. Please note that the sequence of the pulses does not become a continuous pulse like the rotary encoder because of pseudo calculations depending on the information of the magnets location. Pulse frequency (1/T2) is fixed to 250 kHz. The LE signal is activated (negative logic) when no pulse is present so that it can be used as a counter latch signal.

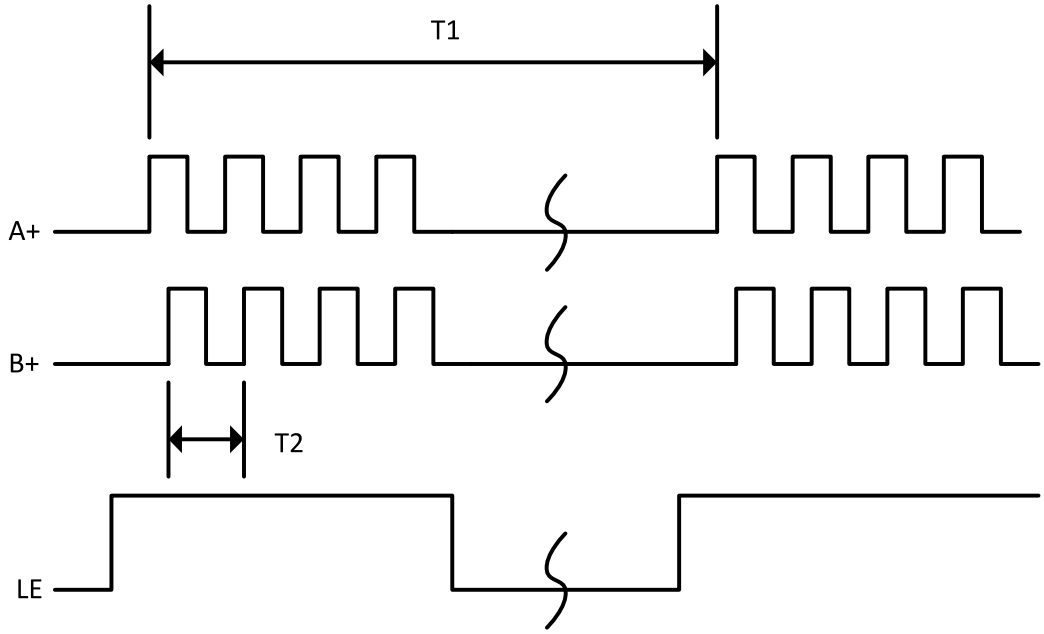


Figure 11. Incremental output time chart

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

5.2 GYSE-S

GYSE-S sensor model has SSI (Synchronous Serial Interface).

24bit data that shows the position or the speed is sent using clock (CLK+/CLK-) and data (DATA+/DATA-) signals.

5.2.1 Data form

The data is composed of 24 bits, which can be selected from the binary or the gray code. Consult this when ordering.

5.2.2 Timing chart

See Figure 12. On rising edge the first clock, the latest data is sent to the internal shift resister and MSB is sent to the DATA line at the same time.

Data is sent to LSB at the time of each rising edge of the clock.

After LSB is sent, DATA + becomes L.

The sequence is ended when a new clock is not supplied within 20µs or less, and DATA + becomes H.

When a new clock is supplied within 20µs or less, the same data is sequentially sent from MSB again.

An internal shift register is reset when 20µs passes from last rising edge of the clock even if the number of clocks doesn't come up to 25.

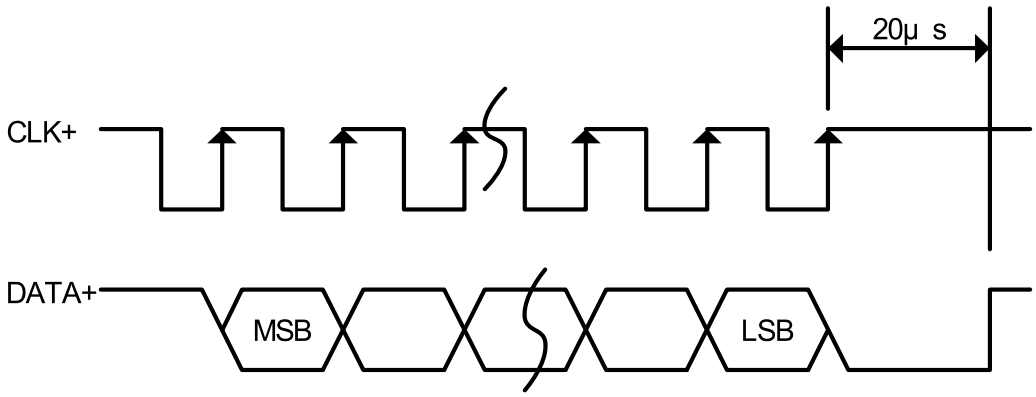


Figure 12. SSI communication timing chart.

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

Limitations of cable length

Because the delay of the signal is generated by the cables impedance, the maximum transmission distance is limited by the clock frequency so the cable length must be within the range shown in Figure 13.

The supply clock frequency to this controller corresponds to an arbitrary frequency from 100 kHz to 750 kHz.

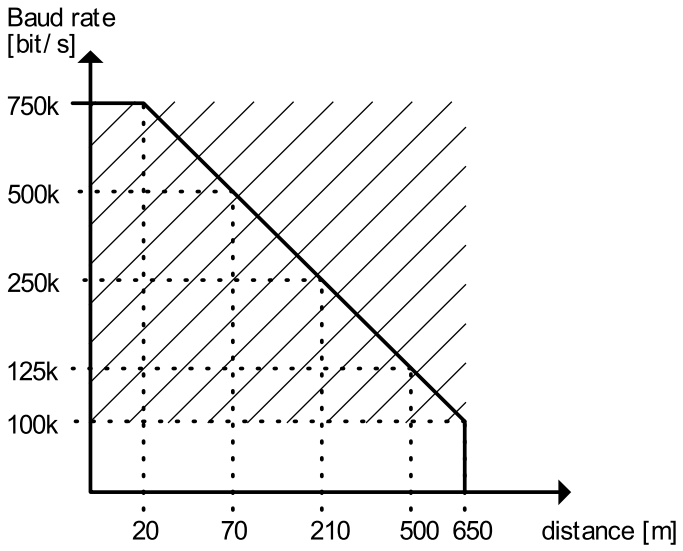


Figure 13. Relation between transmission distance and clock frequency.

5.2.3 Synchronization

This sensor can use SSI to measure the magnets position or speed in two different ways;

- **Internal synchronization(standard).** Measuring with internal timer at constant cycle (sampling rate), and read SSI data on arbitrary timing.
- **External synchronization**. Method for measurement with the first falling edge of clock from the outside. The output data becomes the second last data. The measurement timing can be synchronized when two or more sensors are used. However, when the cycle of the measurement is shorter than that of the measurement time required, an accurate measurement cannot be performed. Please follow the following expression at the shortest measurement cycle. $T_{min}[ms] = \frac{stroke + deadzone\ [mm]}{2700} + 0.7$

⚠ When using external synchronization, the measurement stops when the clock stops.
⚠ When the clock is stopped using external synchronization, magnet error is not detected.

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

6 Models

Here is a description of the product name and its properties which is describe by symbols as listed below.

GYSE-A/Q/S-[①]-[②][③]-[④]-[⑤] [⑥] -[⑦]

6.1 Shared Properties

① Stroke length (mm)

50 – 7500 (mm)

② Mounting screw

Symbol	Screw size
M	M24×P1.0(Standard)
N	M18×P1.5
U	3/4-16UNF-A3

③ Rod size

Symbol	Rod Size
Blank	Φ10 (Standard)
8	Φ8
14	Φ13.8

④ Connection type

Symbol	Specification
CN	Connector (Standard)
G*	Integral cable *Cable length(m), 1.5m standard, MAX 400m

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

6.2 GYSE-A Models

⑤**Positional output (OUT 1)**

Symbol	Magnet position
AD	0 - 10 (V) (standard)
AR	10 - 0 (V)
BD	4 - 20 (mA)
BR	20 - 4 (mA)
CD** or CR**	- - (V) - **(V)
VZ/F	Specified voltage
IZ/F	Specified current

*Z: zero point (root) output

F: Full-scale point (tip) output

⑥ **Option: Analog output (OUT 2)**

Select from ④ in case of positional output

At the speed output

Symbol	
VA [ ]*	±10 (V)
WB [ ]*	4 - 20 (mA)

*[ ] is the rating of velocity (1.00-999mm/sec). Ordered in three significant digits, decimals are written as “R”.

6.3 GYSE-Q Models

⑤ **Resolution**

Symbol	Resolution
D2	0,1 mm
D3	0,05 mm
D4	0,01 mm (Standard)
D5	0,005 mm
D7	0,002 mm
D8	0,001 mm
Symbol	Resolution

⑥ **Direction of Output**

Symbol	Specification
D	Output increases when the magnet moves towards the tip
R	Output decreases when the magnet moves towards the tip

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

6.4 GYSE-S Models

⑤ **Resolution**

Symbol	Resolution	Symbol	Resolution
D2	0.1mm	D5	0.005mm
D3	0.05mm	D7	0.002mm
D4	0.01mm(Standard)	D8	0.001mm

⑥ **Direction of output**

Symbol	Specification
D	Output increases when the magnet moves towards the tip
R	Output decreases when the magnet moves towards the tip

⑦ **Output Code**

Symbol	Specification
B	Binary output
G	Gray-code output

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

7 Specification

7.1 General specification

Item	Specification
Model	GYSE-A, GYSE-Q & GYSE-S
Power supply	DC24V (± 2V) 80mA
Operating temperature range	-20 - 80C˚
Storage temperature range	-40 - 80C˚
Operating humidity range	10 - 90% RH (no condensation)
Atmosphere	No causticity/combustible gas/firedamp
Cooling method	Natural air-cooling
Sealing	IP67 (connector type) IP68 (cable grand type)

7.2 Performance specification

GYSE-A	
Item	Specification
Voltage output	0-10V or 10-0V 16 bit resolution load current Max 5mA Load resistance Min 2kΩ
Current output	4-20mA or 20-4mA 16bit resolution load resistance Max 500Ω
Temperature coefficient	20 ppm/ C˚
Linearity	Less than 0.02% FS (±50µm minimum)
Repeatability	Less than 0.001% FS (±3µm minimum)
EMC test	500Vpp, 1us, 25 - 100Hz, by noise simulator

GYSE-Q & GYSE-S	
Item	Specification
Resolution	0.1/0.05/0.01/0.005/0.002/0.001 [mm]
Stroke (mm) < 1000 1000 – 2500 >2500	Sampling rate (Hz) 1000 500 250
Temperature coefficient	15 ppm/ C˚
Linearity	Less than 0.02% FS (±50 µm minimum)
Repeatability	Less than 0.001% FS (±3 µm minimum)
EMC test	500 Vpp, 1us, 25 - 100Hz, by noise simulator

REGAL COMPONENTS AB
Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se

7.3 External Size

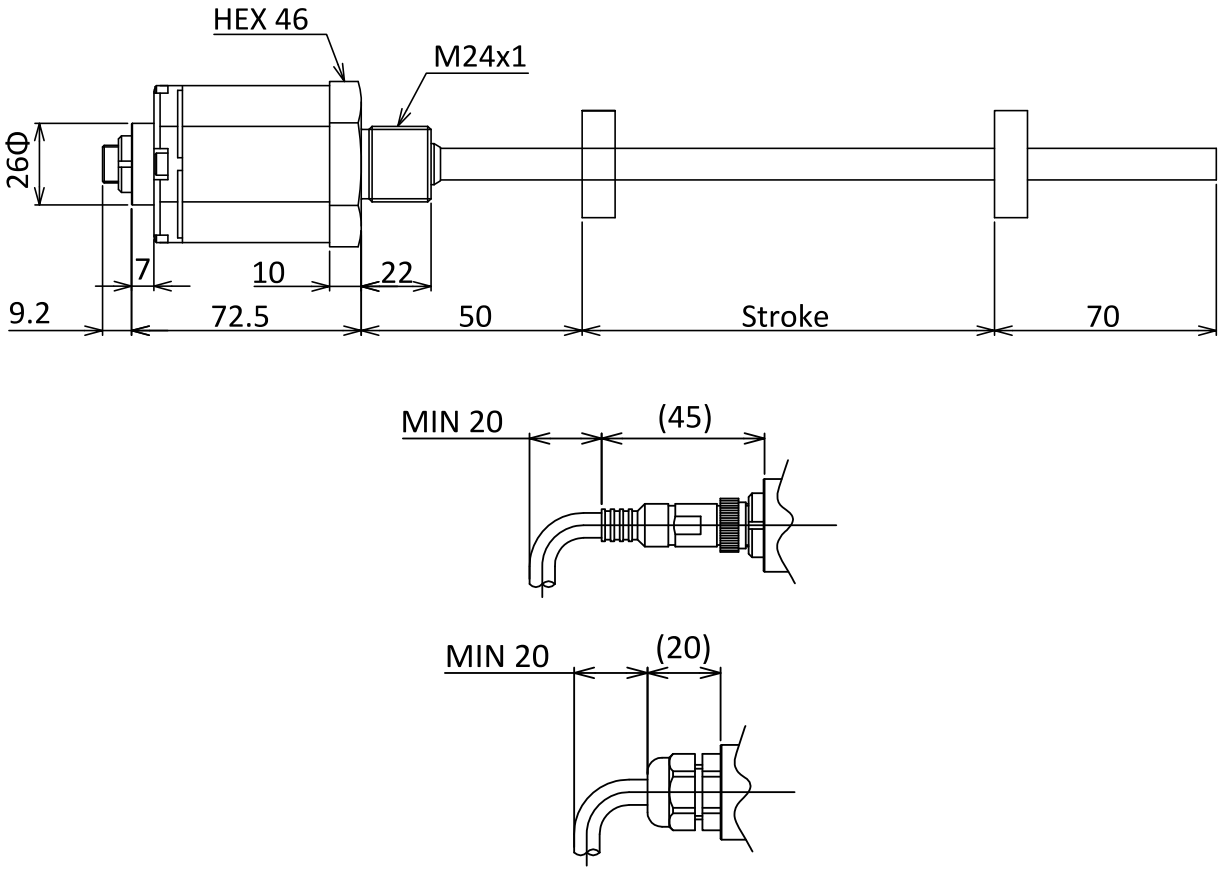


Figure 14. External dimensions

REGAL COMPONENTS AB

Lefflersgatan 1, SE-754 50 Uppsala, SWEDEN +46 (0)18-65 70 00 +46 (0)18-10 74 78 info@regal.se www.regal.se