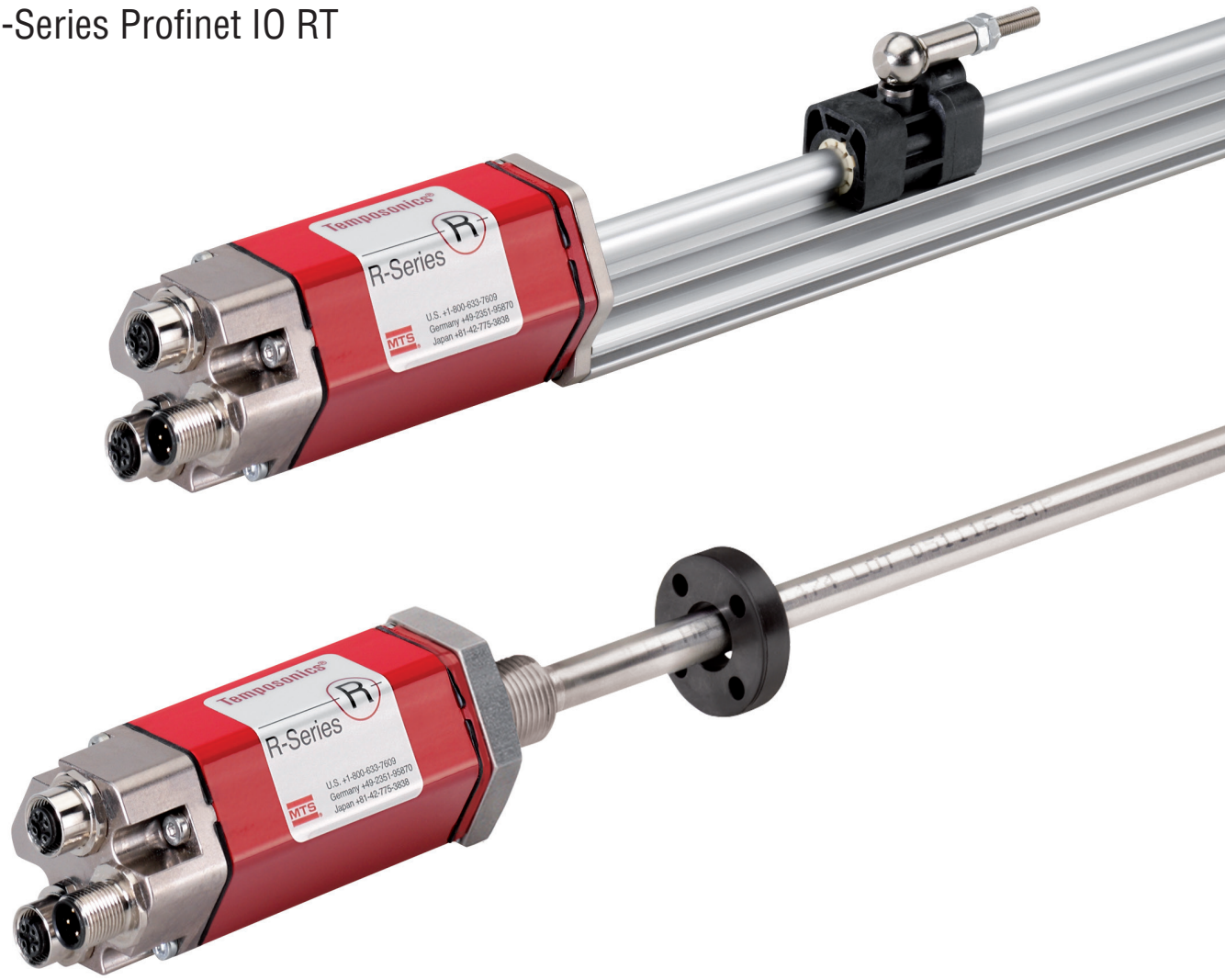
MTS SENSORS

Temposonics®

Absolute, Non-Contact Position Sensors

OPERATION MANUAL

R-Series Profinet IO RT



The Measurable Difference

Table of contents

1. Introduction

1.1 Purpose and use of this manual

Before starting the operation of Temposonics® sensors read this documentation thoroughly and follow the safety information.

The content of this technical documentation and of its various annexes is intended to provide information on mounting, installation and commissioning 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 dangers that might affect the life and health of operating or service personnel or cause material damage are highlighted by the preceding pictogram, which is 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 provided under item 1 and item 2 and only in conjunction with the third-party devices and components recommended or approved by MTS Sensors. As a prerequsite 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. 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.

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 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.

2.2 Installation, commissioning and operation

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.

Installation, operation

To maintain the sensor operability, it is mandatory to follow the instructions given below.

1. Protect the sensor against mechanical damage during installation and operation.
2. Do not open or dismantle the sensor.
3. Connect the sensor very carefully and pay attention to the polarity of connections, power supply as well as to the shape and duration of control pulses.
4. Use only approved power supplies.
5. It is indispensable to ensure that the specified permissible limit values of the sensor for supply voltage, environmental conditions, etc. are met.
6. Check the function of the sensor regularly and provide documentation of the checks.
7. Before system switch-on, ensure that nobody's safety is jeopardized by starting machines.

2.3 Safety instructions for use in explosion-hazardous areas

The sensor is not suitable for operation in explosion-hazarded areas.

2.4 Warranty [2]

MTS grants a warranty period for the Temposonics® position sensors and supplied accessories relating to material defects and faults that occur despite correct use in accordance with the intended application [2]. The MTS obligation is limited to repair or replacement of any defective part of the unit. No warranty can be taken 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 MTS 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.

MTS explicitly excludes any further warranties. Neither the company's representatives, agents, dealers nor employees are authorized to increase or change the scope of warranty.

2.5 Return

For diagnostic purposes, the sensor can be returned to MTS Sensor Technologie GmbH. Any shipment cost will be borne by the sender [2]. For a corresponding form, see chapter 9 (Annex).

2/ see also applicable MTS Sales and supply conditions, e.g. under www.mtssensor.com

3. Identification

3.1 Order structure

Temposonics® order code

R								M	D	5	8	1	U	4			Z		

Specification
RP – Profile
RH – Rod

Design
Profile Temposonics® RP:
S – Magnet slider, joint at top
V – Magnet slider, joint at front
G – Magnet slider, join at top, blackslash free
M – U-magnet, OD33
Rod Temposonics® RH:
M – Flange M18×1.5 (standard)
V – Flange M18×1.5 (Fluorelastomer housing-seal)
D – Flange M18×1.5 with bushing on rod end
R – Flange M18×1.5 with thread M4 at rod end
J – Flange M22×1.5, rod Ø 12.7 mm, 800 bar
S – Flange 3/4" - 16 UNF - 3A

Stroke length
Profile – 0025…5000 mm
Rod – 0025…7600 mm
Standard: see chart
Other length upon request.

Connection type
D58 – 2 × 4 pin M12 d-coded, 1 × 4 pin M12 a-coded

Operating voltage
1 – +24 VDC

Output
U401 – Profinet RT, Encoder Profile, 1 magnet
U402 – Profinet RT, MTS Profile, 1…19 magnets

Magnet number for multi-position measurement [3]
Z02…**Z19 –** 2…19 pcs

Stroke length standard RH	
Stroke	Ordering steps
≤ 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…≤ 7600 mm	250 mm

Stroke length standard RP	
Stroke	Ordering steps
≤ 500 mm	25 mm
500…2500 mm	50 mm
2500…≤ 5000 mm	100 mm

3/ Please specify magnet numbers for your sensing application and order magnets separately.

3.2 Nameplate (example)

Order code (Part no.)	RP X XXXXX XXX X XX
Coding depending on output	XXXXXXXX
Serial no.	FNr. 1320 0376

3.3 Approvals

The sensor conforms to the EU directives and is provided with CE marking.

3.4 Scope of delivery

Profile

Sensor, position magnet, 2 mounting clamps up to 1250 mm + 1 clamp for each 500 mm.

Rod:

Sensor and O-ring

4. Product description and commissioning

4.1 Functionality and system design

Product designation

– Position sensor Temposonics® R-Series

Construction series

– Temposonics® RP (profile-style housing)
– Temposonics® RH (rod-style housing)
– Stroke length 25...7600 mm
– Output signal: Profinet IO RT

Application

The Temposonics® sensor is used for measurement and conversion of the position variable in the field of automated system and mechanical engineering.

Principle of operation and system construction

For position measurement, the absolute, linear Temposonics® position sensors make use of the properties offered by the specially designed magnetostrictive waveguide. Inside the sensor a torsional strain pulse is induced in the waveguide by momentary interaction of two magnetic fields. The interaction between these two magnetic fields produces a strain pulse, which is detected by the electronics at the head of the sensor. One field is produced by a moving position magnet, which travels along the sensor rod with the waveguide inside. The other field is generated by a current pulse applied to the waveguide. The position of the moving magnet is determined precisely by measuring the time elapsed between the application of the current pulse and the arrival of the strain pulse at the sensor head. The result is a reliable position measurement with high accuracy and repeatability.

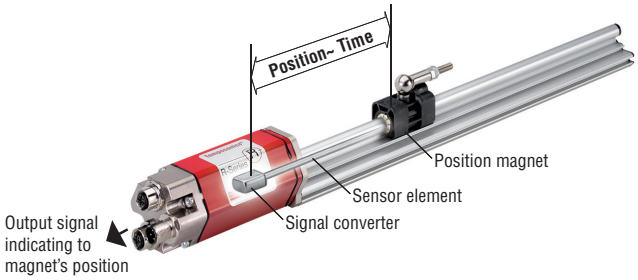


Fig. 1: Principle of operation:
Magnetostrictive runtime measurement = position information

Modular mechanical and electronic construction

– The sensor housing (profile- or rod-style) protects the sensor element.
– The sensor electronics housing, a rugged aluminum construction, contains the complete electronic interface with active signal conditioning. Double shielding ensures high safety of operation and optimum EMC (Electromagnetic compatibility).
– The external position magnet is a permanent magnet. Mounted on the mobile machine part, it travels along the sensor rod or profile- and triggers the measurement through the housing wall. The sensor is connected via a plug.
– The sensor can be connected directly to a control system. Its electronics generates a strictly position-proportional signal output between zero and end position.

4.2 Styles and installation

Temposonics® RP profile style

Purpose: e.g. mounting on machines

The profile-style sensor can be operated with various position magnets:

- Profile-guided magnet carriages are connected to the mobile machine part via a ball coupling to compensate alignment errors.
- A free position magnet on the mobile machine part travels along the measuring rod at a defined distance. Alignment errors can be compensated via the air gap.

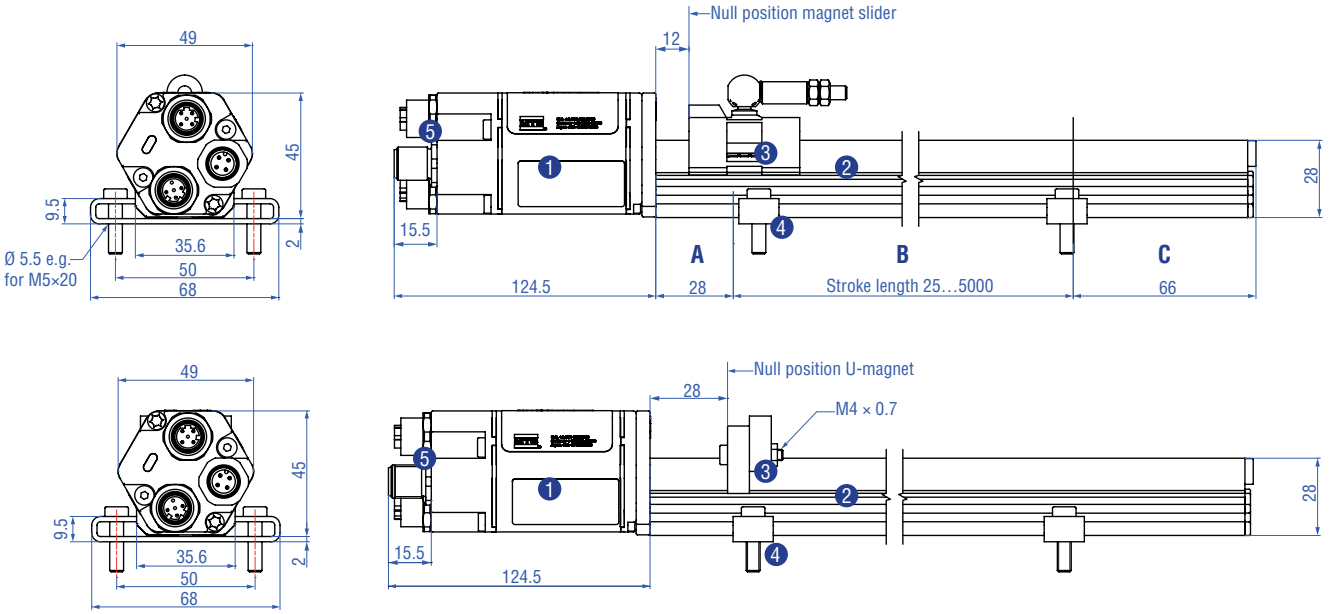


Fig. 2 [4]: Temposonics® RP

A Mounting zone
B Stroke length
C Inactive zone

1. Sensor electronics housing
2. Measuring rod with internal sensing element
3. Position magnet
4. Mounting clamps adjustable
5. Connector

4/ All dimensions in mm.

Temposonics® RH rod style
Purpose: e.g. installation in hydraulic cylinders

The pressure-resistant stainless steel rod is installed in the fluid power system in the cylinder and externally, if space conditions are limited. Position measurement is contactless via ring or U-magnets.

Advantage...
For servicing the complete basic sensor can be easily replaced *without opening* the fluid circuit.

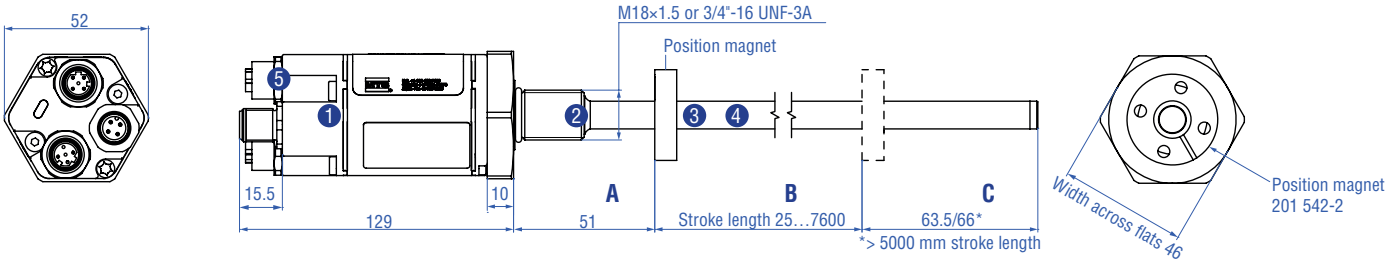


Fig. 3 [5]: Temposonics® RH

A Mounting zone
B Stroke length
C Inactive zone

1. Sensor electronics housing
2. Threaded flange M18 × 1,5 or 3/4"-16UNF-3A
3. Position magnet
4. Measuring rod with internal sensing element, Ø 10
5. Connector

5/ All dimensions in mm.

Active measuring range

The technical data of each sensor is checked as well as documented and the active stroke length (useful electrical stroke) with its start and end position is adjusted during final inspection and testing (see dimension drawing).

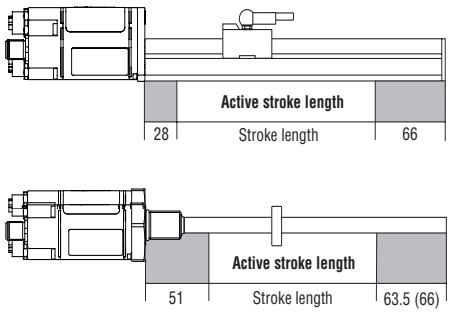


Fig. 4 [6]: Active stroke length

NOTICE On all sensors, the areas left and right of the active stroke length are provided for mounting and damping of the measuring signal. They should not be used for measurement, but the active stroke length can be exceeded without problem.

Mechanical zero

To ensure that the entire measuring range can be used electrically, the position magnet must be mounted mechanically as follows:

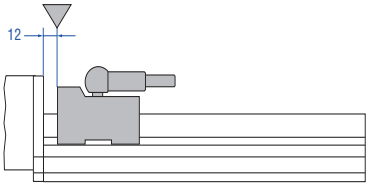


Fig. 5 [6]: Temposonics® profile with magnet slider "S" and "V"

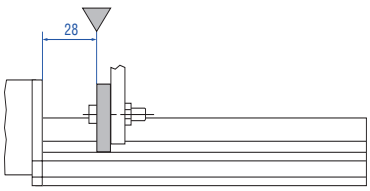


Fig.6 [6]: Temposonics® profile with U-magnet OD33

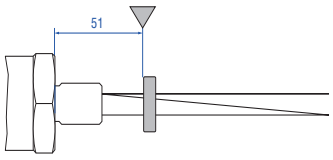


Fig. 7 [6]: Temposonics® rod with ring magnet

Installation of a profile-style sensor

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 measuring rod contactlessly.

The sensor is fitted on a flat machine surface using the mounting clamps (see Fig. 8). A length-dependent number of these clamps are delivered with the sensor and must be distributed over the profile at regular distances.

For fastening, we recommend using M5 × 20 screws to DIN 6912 that shout be tightened with a maximum torque of 5 Nm.

Alternative: If only limited space is available, the profile sensor can be mounted also via the T rail in the profile bottom using an M5 T-slot nut or a sliding block (see Fig. 9).

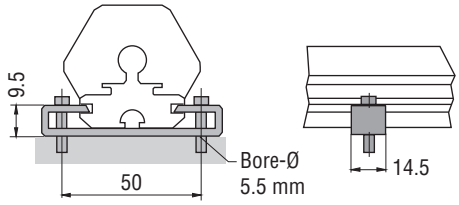


Fig. 8 [6]: Mounting clamps with cylinder screw M5 × 20, fastening torque < 5 Nm

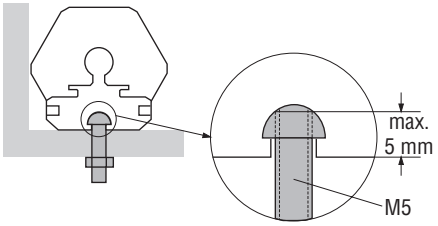


Fig. 9: T-slot nuts M5

NOTICE Don't mount the sensors in the area of strong magnetic or electric noise fields. Take care to mount the sensor in an axially parallel position to avoid damaging the carriage, magnet and measuring rod.

The sensor is isolated from the machine ground. For this reason, earthing via the flat-pin connector on the sensor electronics housing is indispensable (see Fig. 10).

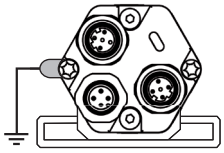


Fig. 10: Grounding profile sensor

6/ All dimensions in mm.

Installation of a rod-style sensor
The rod-style version has been developed for direct stroke measurement in a fluid cylinder.
– Mounted on the bottom of the piston, the ring magnet travels over the rod contactlessly and marks the position exactly through the rod wall - independent of the hydraulic fluid.
– Inside the pressure-resistant sensor housing immerging into the open piston rod, the basic sensor is mounted by means of only two screws. It is the only part that needs replacing if servicing is required, i.e. the hydraulic circuit remains closed.

NOTICE After re-installing, securing the basic sensor screws, e.g. using Loctite 243, is mandatory.

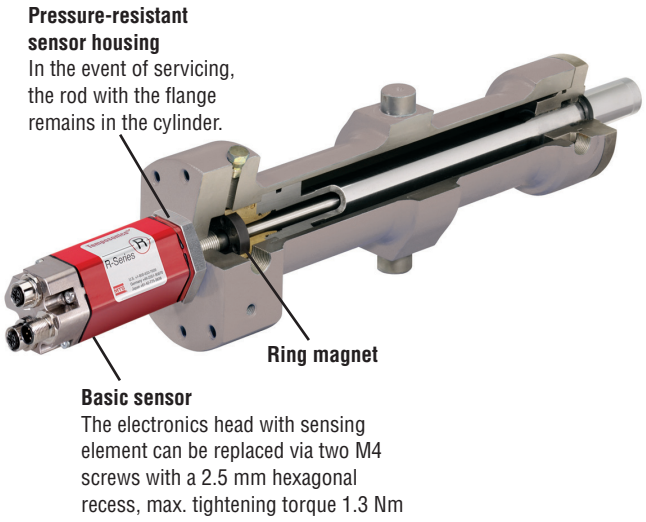


Fig. 11: Sensor in fluid cylinder

– The flange contact surface must be seated completely on the cylinder mounting surface.
– The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
– The position magnet should not rub against the rod.
– The plunger borehole (min. Ø 13 mm) depends on the pressure and piston speed.
– The peak pressure should not be exceeded.
– Protect the sensor rod from wear using suitable constructive measures.

NOTICE For mounting by means of screws, use only a hexagonal flange width across flats 46 mm below the sensor electronics housing (electronics) and avoid exceeding the maximum tightening torque of 50 Nm.

Hydraulics sealing
The sensor is mounted directly in a fluid cylinder via the flange using M18 × 1.5 or 3/4"-16-UNF-3A screws, or fastened with a nut. If possible, non-magnetizable material should be used for the sensor mount. Taking the dimensions (Fig. 12) into account is indispensable.

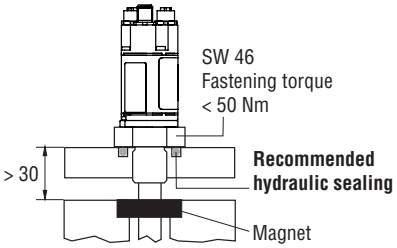


Fig. 12 [7]: Installation with non-magnetizable material

We recommend sealing the flange contact surface using an O-ring (e.g. 22.4 × 2.65) in a cylinder bottom groove. However, sealing via a 15.3 × 2.2 O-ring in the undercut is also possible (Fig. 13.) In this case, a screw hole to ISO 6149-1 must be provided.

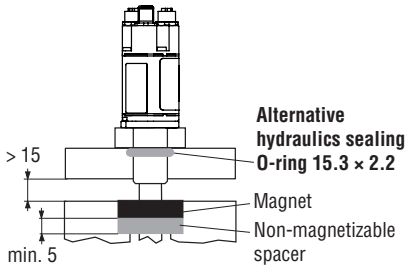


Fig. 13 [7]: Installation with magnetizable material

7/ All dimensions in mm.

Mounting the U-magnet

The U-magnet is removable and can be used for profile- and rod-style sensors. Using a non-magnetizable entrainment device is mandatory. The magnet must not rub against the measuring rod. Alignment errors are compensated via the air gap.

– Max. surface pressure: 40 N/mm²
– Max. tightening torque for M4 screws: 1 Nm; use washer, if necessary

NOTICE A maximum permissible air gap of 3 mm must not be exceeded.

(1) U-magnet
(2) Non-magnetic entrainment device

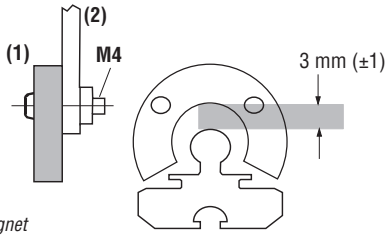


Fig. 14: Entrainment device for U-magnet

Large measuring lengths from 1 meter

Horizontally installed sensors should be supported mechanically at the rod end. Longer rods require evenly distributed mechanical support over the entire length. U-magnets (see Fig. 15) are used for measurement.

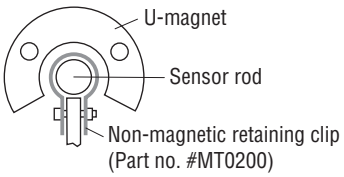


Fig. 15: Example of sensor support

Mounting the ring magnet

Install the magnet using non-magnetizable material for entrainment device, screws, spacers etc.

– Max. permissible surface pressure: 40 N/mm²
– Max. tightening torque for M4 screws: 1 Nm; use washers, if necessary

4.3 Electrical connection

Place of installation and cabling have decisive influence on the sensor 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.

Instruction for connection

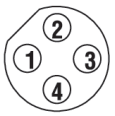
– Use low-resistance twisted pair and shielded cables and connect the shield to earth externally via the controller equipment.
– Control and signal leads should be kept separate from power cables and away from motor cables, frequency inverters, valve cables, switching relays, etc.
– Use only metal connectors and connect the shielding to the connector housing.
– Connect the shields at both cable ends via a large surface and connect the cable clamps to function earth.
– Keep all non-shielded leads as short as possible.
– Keep the earth connections short and with a large cross section and avoid ground loops.
– With potential differences between the earth connection of the machine and the electronics, no compensating current flowing over the shield is allowed. We recommend using an equipotential bonding conductor with large cross-section or a cable with separate dual shielding and connecting the shields only at one end.
– Use only stabilized power supplies and ensure that the specified connecting values are met.

NOTICE

– Never connect the sensor when under voltage!
– Earthing the profile-style sensor via the flat-pin connector on the sensor electronics housing (see Fig. 10) is mandatory.

Pin allocation

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

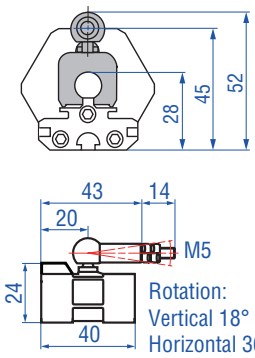
Supply	Pin	Cable	Function
 male	1	BN	+24 VDC (-15/+20 %)
	2	WH	not connected
	3	BU	0 V (GND)
	4	BK	not connected

BUS on/off	Pin	Cable	Function
 female	1	YE	Tx+
	2	WH	Rx+
	3	OG	Tx-
	4	BU	Rx-

Fig. 16: Pin allocation

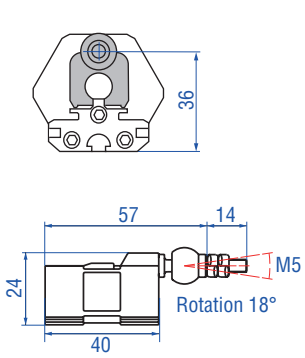
4.4 Accessories

Position magnets for sensor profile [8]



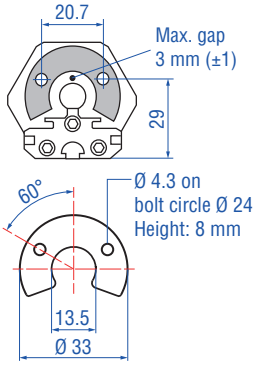
Magnet slider S
Part no. 252 182

GRP, magnet hard ferrite
Joint CuZn39Pb3 nickel-plated
Weight: ca. 30 g
Operating temperature: -40…+75 °C



Magnet slider V
Part no. 252 184

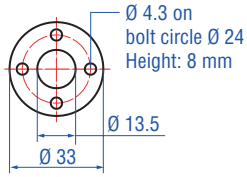
GRP, magnet hard ferrite
Joint CuZn39Pb3 nickel-plated
Weight ca. 30 g
Operating temperature: -40…+75 °C



U-magnet OD33
Part no. 251 416-2

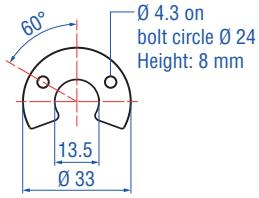
PA-Ferrit-GF20
Weight: ca. 11 g
Operating temperature: -40…+100 °C
Surface pressure max. 40 N/mm²
Fastening torque for M4 screws max.
1 Nm

Position magnets for sensor rod [8]



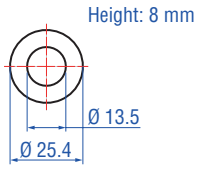
Ring magnet OD33
Part no. 201 542-2

Composite PA-Ferrite-GF20
Weight: ca. 14 g
Operating temperature: -40…+100 °C
Surface pressure max. 40 N/mm²
Fastening torque for M4 screws
max. 1 Nm



U-magnet OD33
Part no. 251 416-2

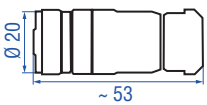
PA-Ferrit-GF20
Weight: ca. 11 g
Operating temperature: -40…+100 °C
Surface pressure max. 40 N/mm²
Fastening torque for M4 screws max.
1 Nm



Ring magnet OD25,4
Part no. 400 533

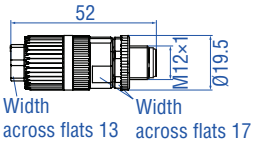
Composite PA-Ferrite
Weight: ca. 10 g
Operating temperature: -40…+100 °C
Surface pressure max. 40 N/mm²

Female connector/ Male connector [8, 9]



5 pin female connector M12 x 1
Part no.: 370 677

Housing: GD-Zn, Ni / IP67
Termination: screw terminals
Contact insert: CuZn
Max. cable: Ø 4…8 mm



4 pin bus cable connector M12-D
Part no.: 370 523

Zinc, nickel-plated
Termination: D-coded with
IDC technology

When connecting the connectors, please follow the manufacturer mounting instructions on the connector packaging.

8/ All dimensions in mm.
9/ max. fastening torque 0.6 Nm

5. Operation

5.1 Getting started

The sensor is factory-set to its order sizes and adjusted, i.e. the required output signal corresponds exactly to the selected measuring length.

Example: Output Profinet IO RT = 0…100 % measuring length

Diagnostic display
(Red/green) LEDs in the sensor electronics lid provide information on the current sensor condition.

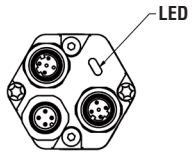


Fig 17: LED-Display

Green	Red	Meaning
ON	OFF	Normal function
ON	ON	No master contact
ON	FLASHING	Parametrization failed
OFF	ON	Warning (inadmissible supply voltage / faulty number of magnets)

NOTICE

1. Before initial switch-on, check carefully if the sensor has been connected correctly.
2. Ensure that the sensor control system cannot be displaced in an uncontrolled way when switching on.
3. If the sensor is operational and in operating mode after switching on, the diagnostics LED is lit permanently (green).
4. Check the preset span start and end values of the measuring range (see section 4.2) and correct them via the customer's control system, if necessary.

5.2 Programming and configuration

Software configuration
These instructions describe the installation and configuration of an MTS Profinet IO RT sensor using a CP1616 PROFINET IRT controller and a Siemens projecting tool (SIMATIC NC Manager, version 5.5).

Installing the software and the network card
Depending on control system type.

The following figures (18 – 54) are taken from the Siemens SIMATIC NCM Manager documentation.

☐ **Step 1: Configuration of the network interface**
☐ Step 2: Configuration of the sensor designation
☐ Step 3: Controller setting and preparation of the network
☐ Step 4: Integration of the Profinet sensor GSDML files
☐ Step 5: Integration and configuration of the sensors
a) with MTS profile
b) with encoder profile 4.1

For communication with the Profinet network, an Ethernet connection with corresponding configuration must be selected.

1. Select “Options” → “Set PG/PC Interface” (Fig. 18):

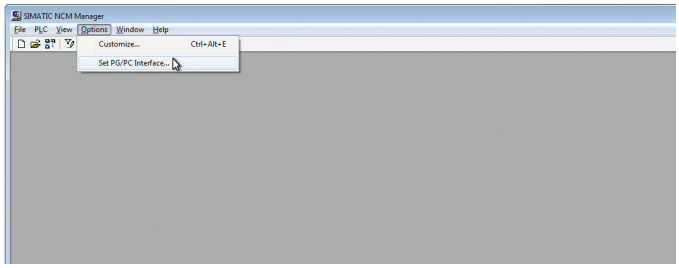


Fig. 18: Set PG/PC Interface (source: Siemens)

2. Select a connection from the list, which is connected with CP1616, and press “OK” to confirm (Fig. 19.).

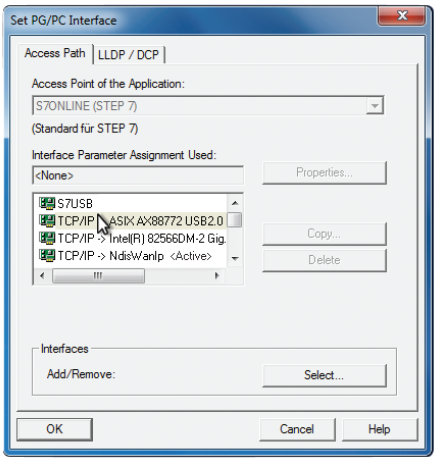


Fig. 19: Set PG/PC Interface (source: Siemens)

Note that the selected interface is configured in the same IP subnet as the CP1616 unit and that the following protocols are activated: QoS package planner, Profinet IO RT protocol V2.0, network monitor drivers, Internet protocol (TCP/IP).

☑ Step 1: Configuration of the network interface
☐ **Step 2: Configuration of the sensor designation**
☐ Step 3: Controller setting and preparation of the network
☐ Step 4: Integration of the Profinet sensor GSDML files
☐ Step 5: Integration and configuration of the sensors
a) with MTS profile
b) with encoder profile 4.1

For clear sensor identification in the network, a sensor designation must be assigned. This is done in the NCM Manager.

1. Select the MTS R series Profinet IO RT sensor as described below (Fig. 20):
– PLC
– Edit Ethernet Node
– Browse (Fig. 21)

Fig. 20: Select the MTS R-Series Profinet sensor (step 1) (source: Siemens)

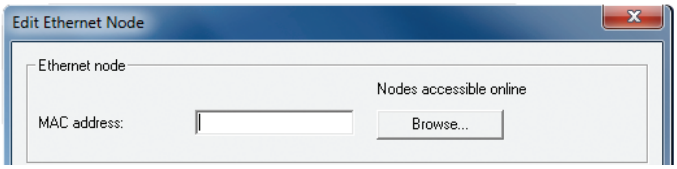


Fig. 21: Select the MTS R-Series Profinet sensor (step 2) (source: Siemens)

2. Select a sensor from the list to which a name must be assigned. A sensor is identified by the type designation “MTS-R-SERIES-PROF-INET” and a “MAC address prefix 00-03-CA”. Press “OK” to confirm your selection.

3. Assign a device name and confirm your entry with “Assign name” (Fig. 22).

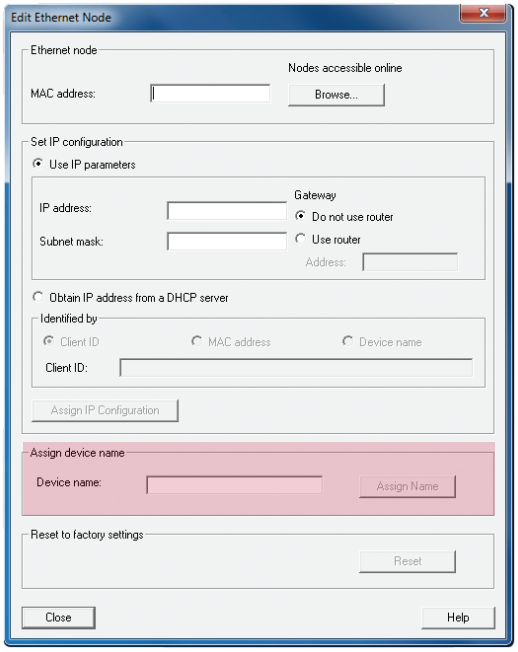


Fig. 22: Select the MTS R-Series Profinet sensor (step 3) (source: Siemens)

☑ Step 1: Configuration of the network interface
☑ Step 2: Configuration of the sensor designation
☐ **Step 3: Controller setting and preparation of the network**
☐ Step 4: Integration of the Profinet sensor GSDML files
☐ Step 5: Integration and configuration of the sensors
a) with MTS profile
b) with encoder profile 4.1

1. Start the SIMATIC NCM Manager to configure the Profinet IO RT network.

2. Create a new project under “File”→“New” (Fig. 23). Subsequently, select the “Name” and the “Path” of the project file (Fig. 24). Press “OK” to confirm your entry.

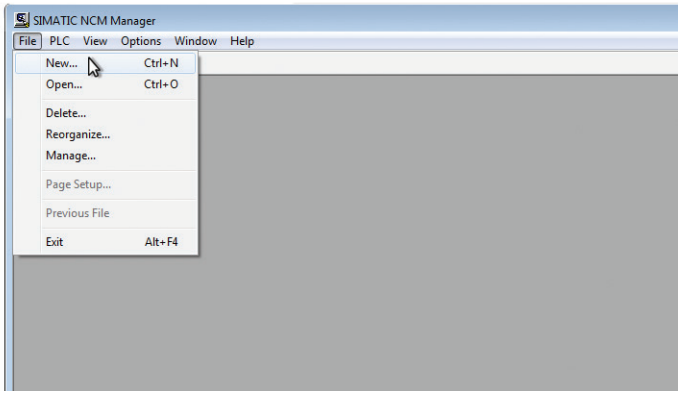


Fig. 23: Create a new project (source: Siemens)

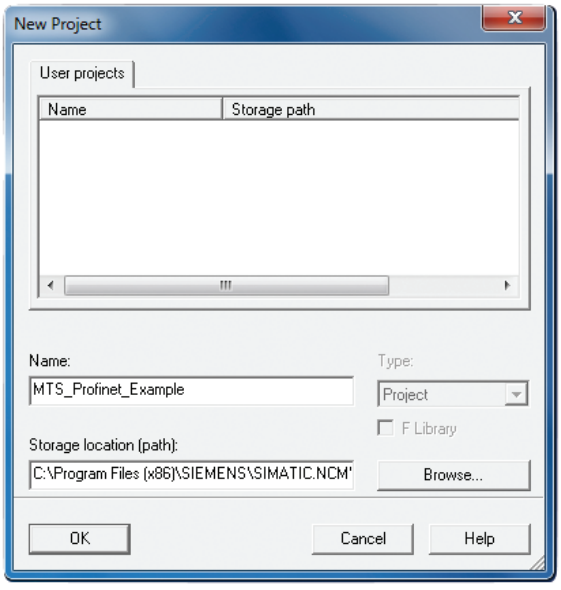


Fig. 24: Assign a project name and a memory location (source: Siemens)

After creating the project, the project overview opens, which will be filled with components when proceeding (Fig. 25).

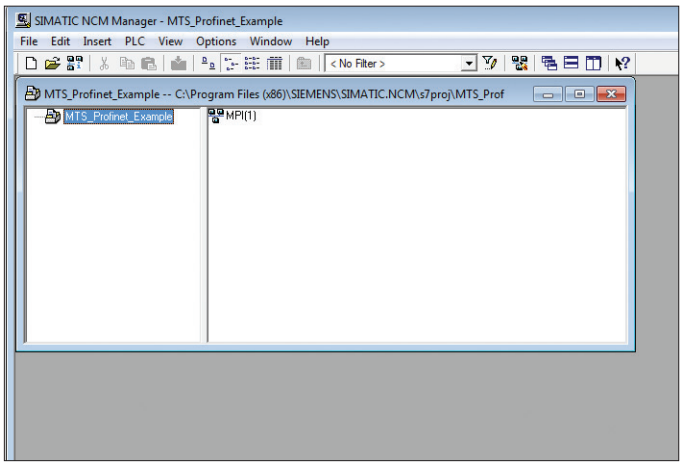


Fig. 25: Project overview (source: Siemens)

3. Add a controller to the project. For this, proceed as described below (Fig. 26):
   – Right-click project (MTS_Profinet_Example)
   – Insert new object
   – Select the SIMATIC PC Station

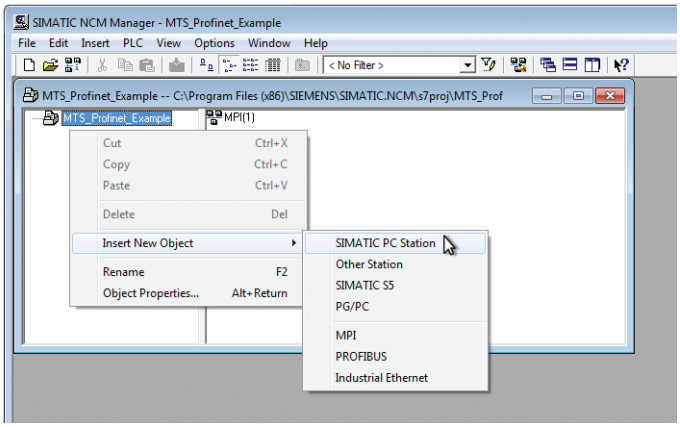


Fig. 26: Add a controller to the project (source: Siemens)

The SIMATIC PC station (controller) is displayed in the right area of the project overview. Double-click the SIMATIC PC station to display the controller in the left area of the project overview (Fig. 27).

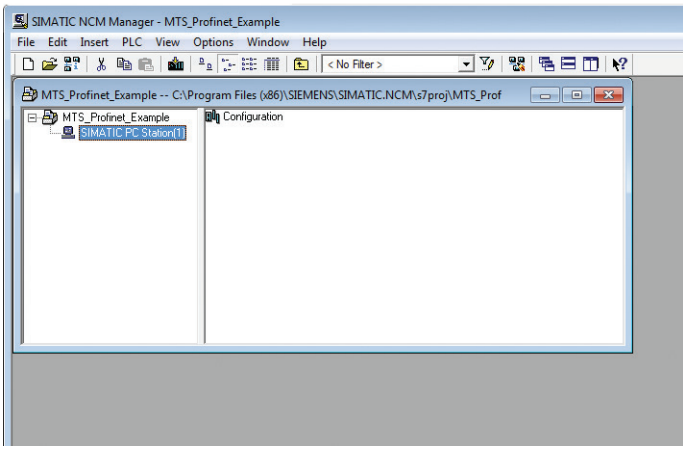


Fig. 27: Controller kink to project (source: Siemens)

4. Double-click “Configuration” with the “Station” selected to open the window “Module HW Config” to determine the network and sensor configuration (Fig. 28).

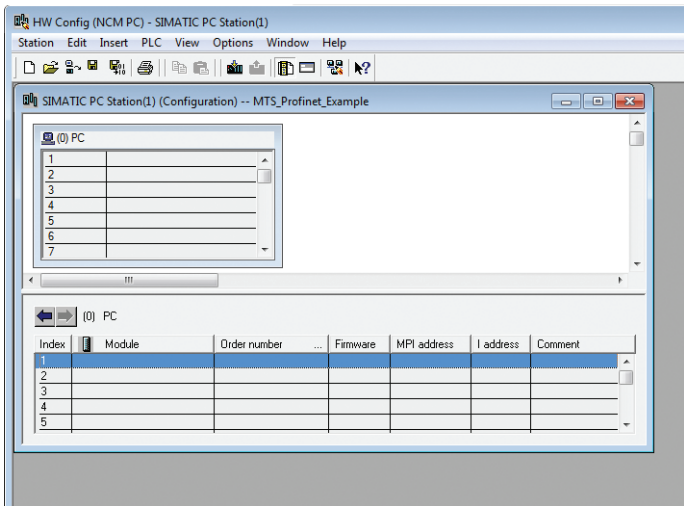


Fig. 28: Module HW Config (source: Siemens)

5. Right-click to insert the network controller, as described below:
   – Insert Object (Fig. 29)
   – CP Industrial Ethernet (Fig. 30)
   – CP1616 (Fig. 30)

   Select the appropriate firmware version of your CP1616. The dialog box “Properties – Ethernet interface” opens (Fig. 31). Set the IP address of your CP1616.

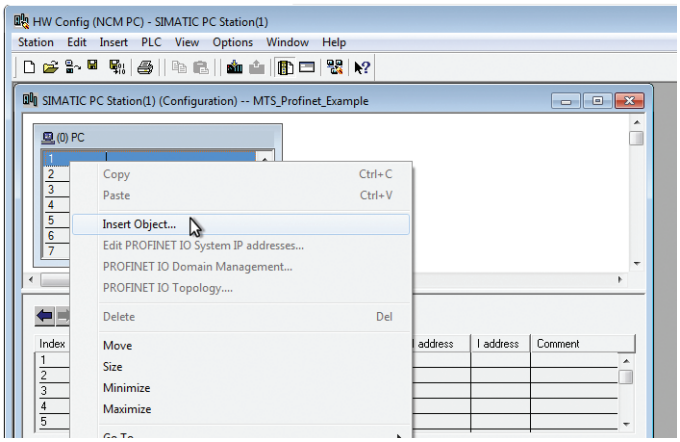


Fig. 29: Insert controller into the network (step 1) (source: Siemens)

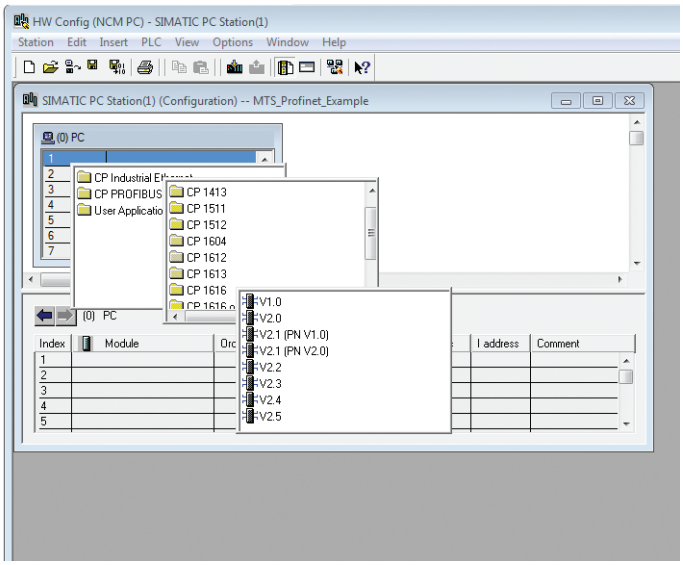


Fig. 30: Insert controller into the network (step 2) (source: Siemens)

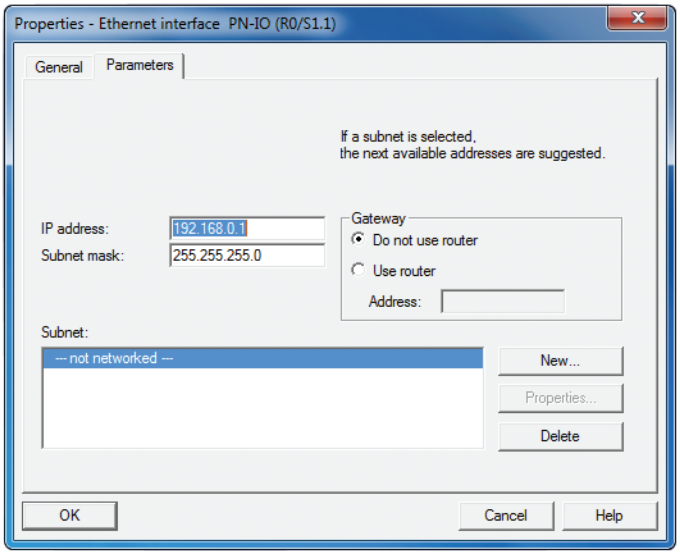


Fig. 31: Set IP adress of CP1616 (source: Siemens)

6. To create a subnet, click button “New” (Fig. 31). Window “Properties – New subnet” opens (Fig. 32). Define a name and press “OK” to confirm your entry.

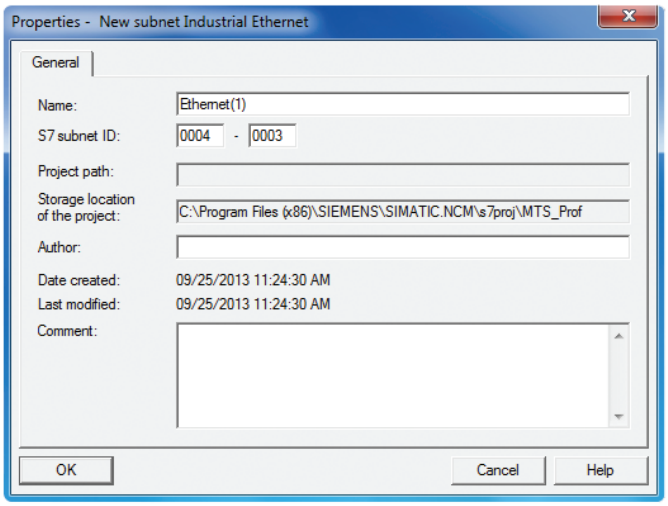


Fig. 32: Create a subnet (source: Siemens)

7. A network without sensors has been configured (Fig. 33).

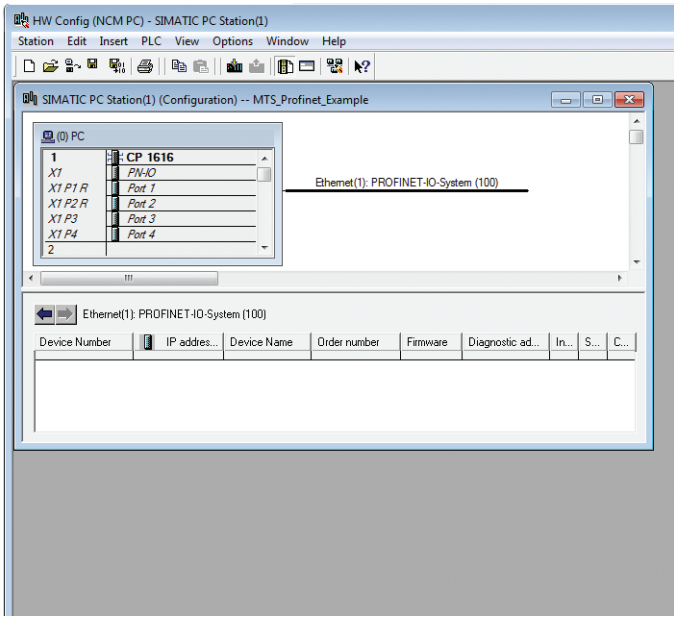


Fig. 33: Configuration of network without sensors (source: Siemens)

☑ Step 1: Configuration of the network interface
☑ Step 2: Configuration of the sensor designation
☑ Step 3: Controller setting and preparation of the network
☐ **Step 4: Integration of the Profinet sensor GSDML files**
☐ Step 5: Integration and configuration of the sensors
a) with MTS profile
b) with encoder profile 4.1

To operate the sensor in a network, the sensor data is loaded from the GSDML file into the control system.

1. For this purpose, select the following options in window “HW Config” (Fig. 34):
   – Options
   – Install GSD File

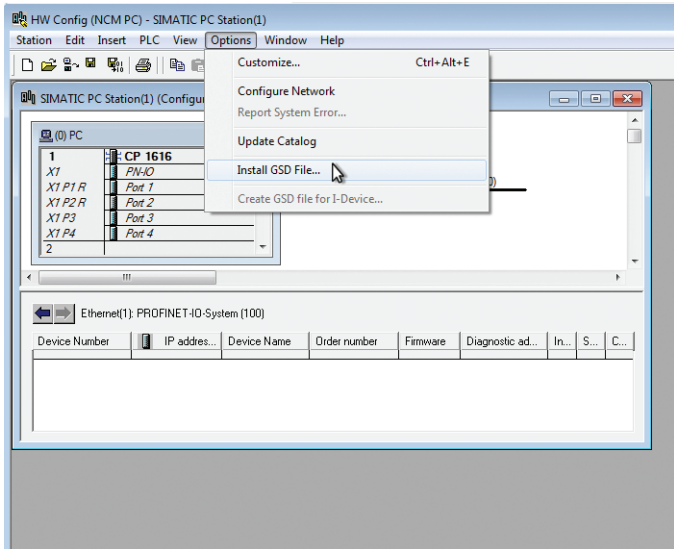


Fig. 34: HW Config (source: Siemens)

2. Window “Install GSD Files” is opened. Click button “Browse” to select one of the following GSD files (see customer CD delivered with the sensor [10]):
   – MTS Profile (GSDML-V2.25-MTS_RSERIES_PNIO_RT…)
   – Encoder Profile 4.1
   (GSDML-V2.25-MTS_RSERIES_PNIO_RT_EP…)

3. Click button “Install” to install the selected GSDML file.

☑ Step 1: Configuration of the network interface
☑ Step 2: Configuration of the sensor designation
☑ Step 3: Controller setting and preparation of the network
☑ Step 4: Integration of the Profinet sensor GSDML files
☐ **Step 5: Integration and configuration of the sensors**
a) with MTS profile
b) with encoder profile 4.1

1. Select the MTS communication protocol from the directory displayed on the right (Fig. 35).

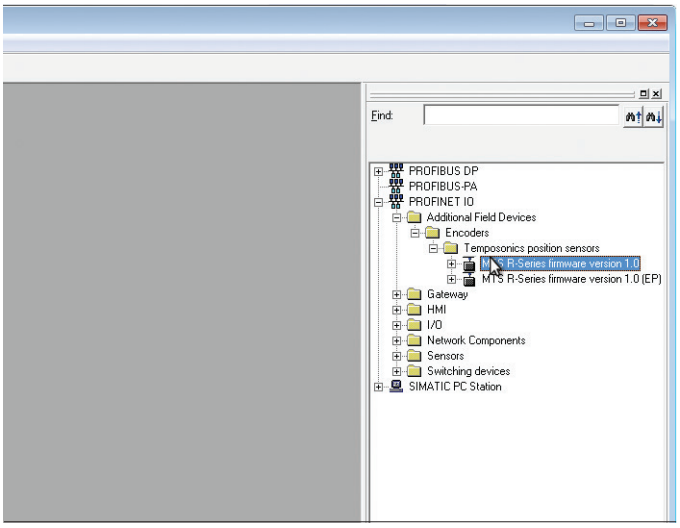


Fig 35: Select MTS communication protocol (source: Siemens)

2. While keeping the left mouse key pressed, draw the MTS sensor with MTS profile from the directory into the network (dashed line) and release the left mouse key. The sensor has been added to the network (Fig. 36).

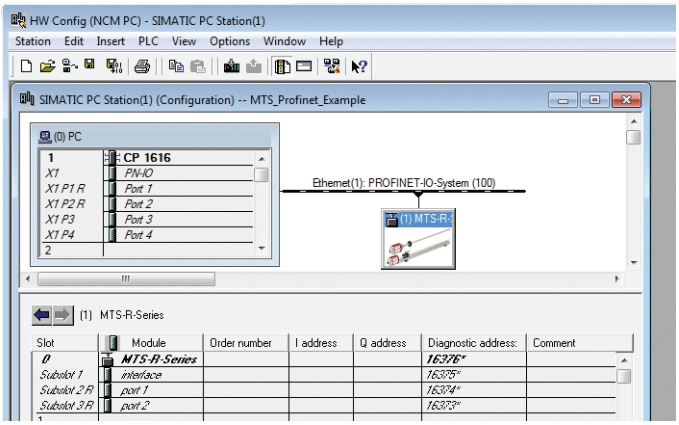


Fig. 36: Add sensor to the network (source: Siemens)

10/ Depending on the integrated profile

3. Double-click to select the sensor and enter the previously defined name into field “Device name” (Fig. 22). Press “OK” to confirm your entries.

4. Double-click Slot “0” to open a configuration dialog box (Fig. 37). Select tab “Parameters” to realize the following sensor settings (Fig. 38):
   a) *Resolution:* 1, 2, 5, 10, 50, 100 µm
   b) *Number of averages:* 1, 2, 4, 8
   c) *Velocity window:* 2, 4, 8, 16
   d) *Velocity unit* [11]*:* steps/s, steps/100ms, steps/10ms, mm/s
   e) *Measurement direction:* forward/reverse
   f) *Measurement mode:* position/velocity

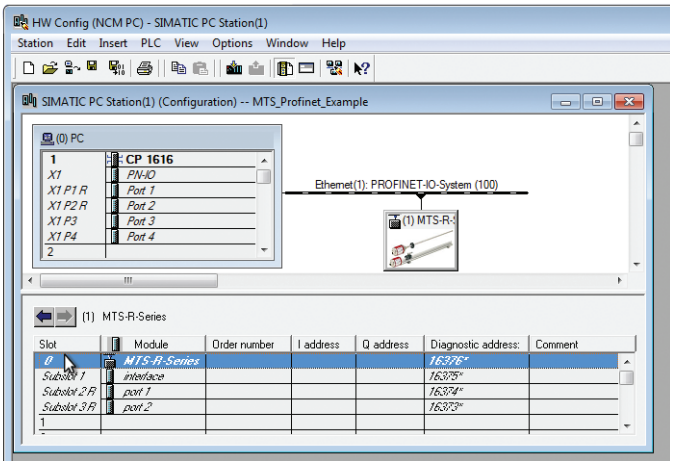


Fig. 37: HW Config (source: Siemens)

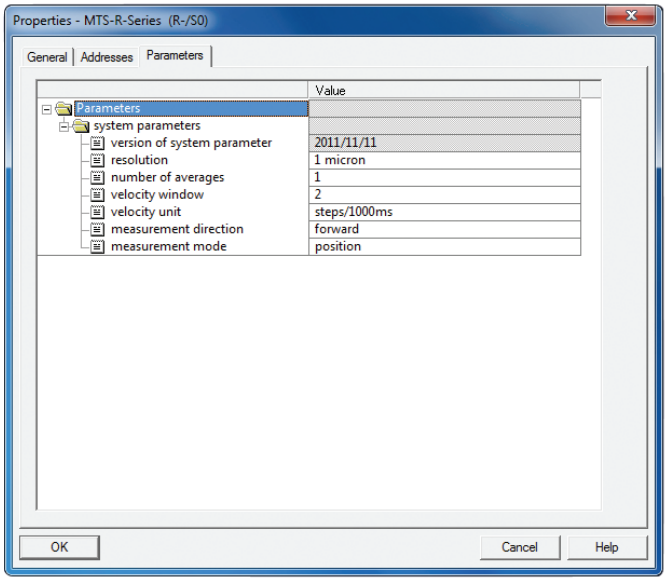


Fig. 38: Properties – MTS-R-Series (source: Siemens)

5. Double-click Slot “0”→Subslot “1” (Interface) (Fig. 39). Go to tab “IO Cycle” to enter the cycle time setting (Fig. 40).

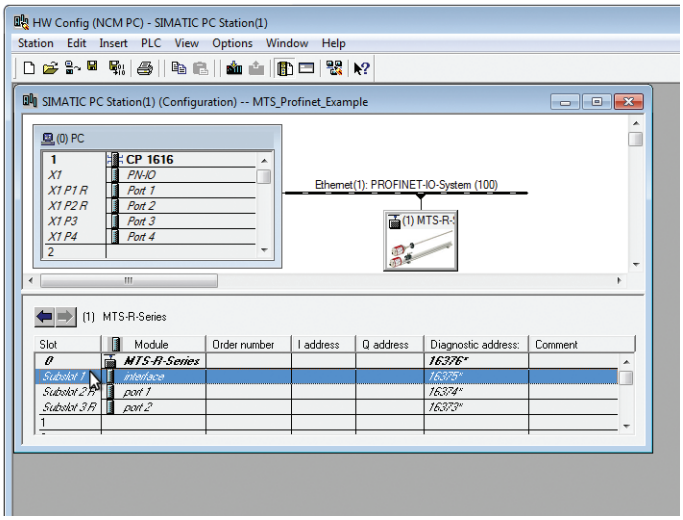


Fig. 39: HW Config (source: Siemens)

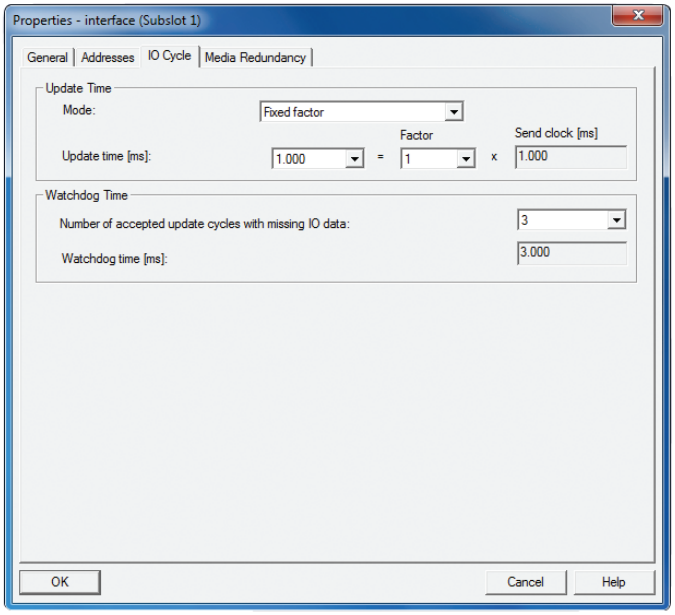


Fig 40: Properties – interface (Subslot 1) (source: Siemens)

11/ A “step” corresponds to the selected resolution.

6. Add the number of magnets specified in your order as described below:
   – Right-click Slot 1 (Fig. 41)
   – Insert Object (Fig. 41)
   – MTS R-Series Firmware Version X (Fig. 42)
   – Magnet (Fig. 42)

   To add another magnet, repeat the steps described under item 6. for Slot 2, etc.

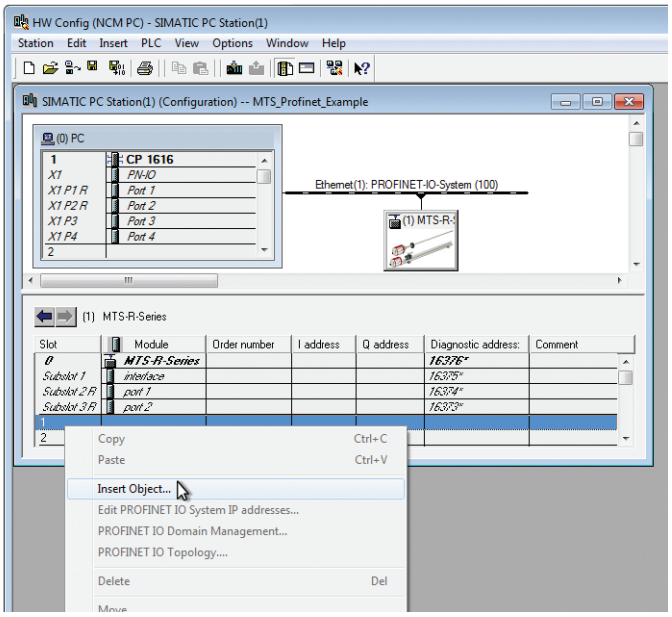


Fig. 41: Add magnet step 1 (source: Siemens)

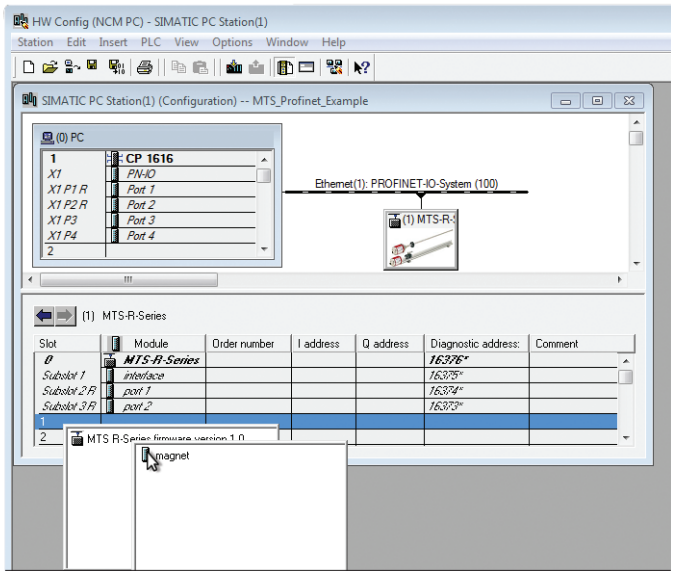


Fig. 42: Add magnet step 2 (source: Siemens)

7. Double-click a magnet to open window “Properties – magnet”. Select tab “Parameters” and adjust the position offset of the magnet with unit µm (Fig. 43).

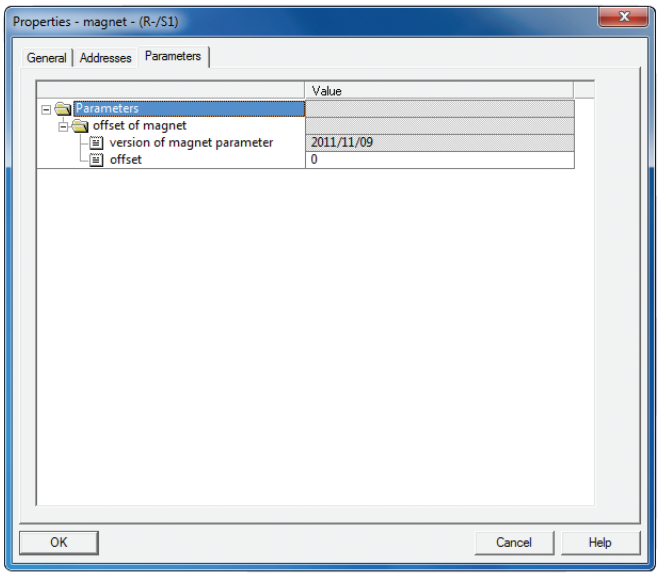


Fig. 43: Adjust the position offset of the magnet (source: Siemens)

8. Transfer your settings to the control system as described below (Fig. 44):
   – PLC
   – Download
   – CP1616.

   From your control program, you can now access the position data of the first magnet, etc., via addresses 512…515 (example).

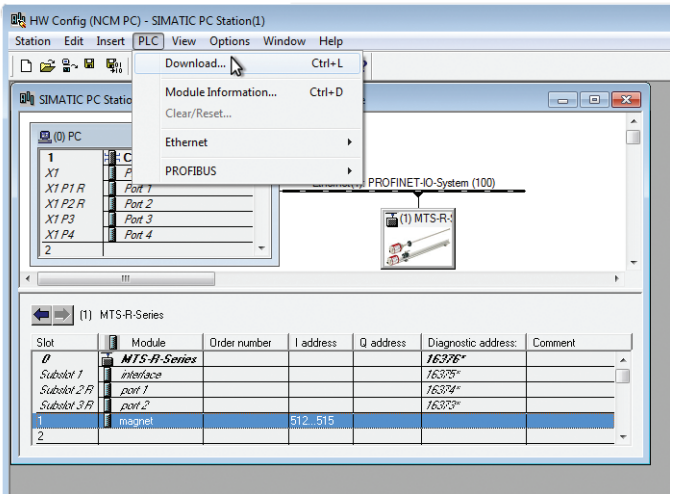


Fig. 44: Transfer settings to the control system (source: Siemens)

☑ Step 1: Configuration of the network interface
☑ Step 2: Configuration of the sensor designation
☑ Step 3: Controller setting and preparation of the network
☑ Step 4: Integration of the Profinet sensor GSDML files
☐ **Step 5: Integration and configuration of the sensors**
a) with MTS profile
b) with encoder profile 4.1 [12]

1. Select the Encoder profile 4.1 from the directory displayed on the right (Fig. 45).

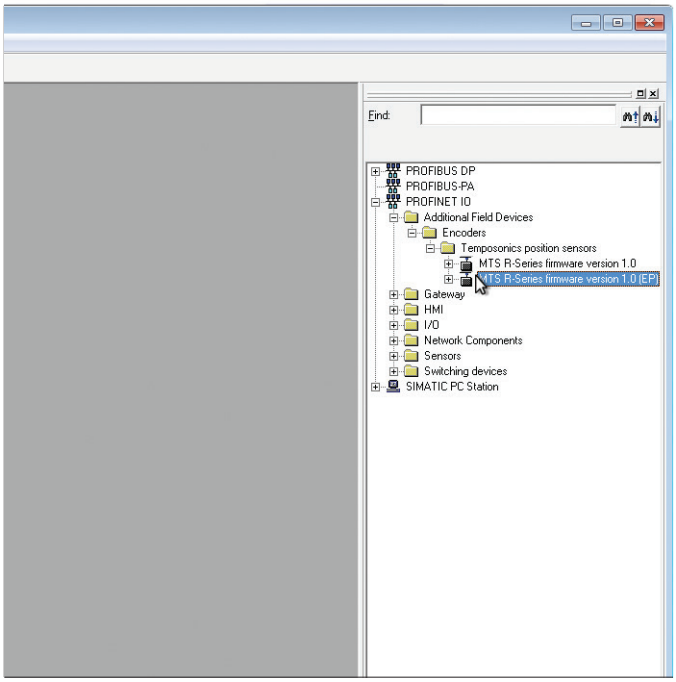


Fig. 45: Select Encoder profile 4.1 (source: Siemens)

2. While keeping the left mouse key pressed, draw the MTS sensor with Encoder profile 4.1 from the directory into the network (dashed line) and release the left mouse key. The sensor has been added to the network (Fig. 46).

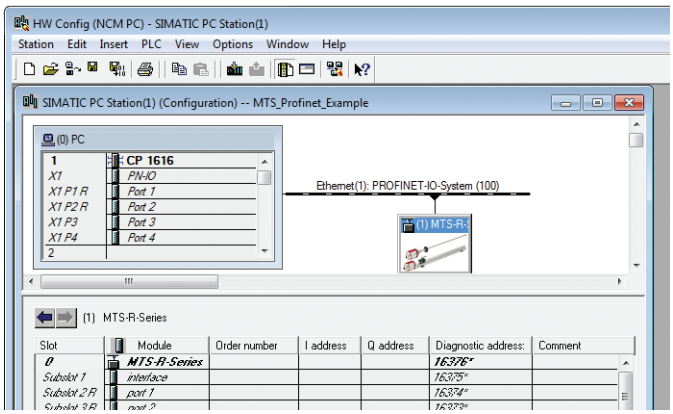


Fig. 46: Add sensor to the network (source: Siemens)

3. Double-click to select the sensor and enter the previously defined name into field “Device name” (Fig. 22). Press “OK” to confirm your entries.

4. Now you can double-click to configure “Slot 1”, “Subslot 1” (process data) (Fig. 47). Select tab “Parameters” to realize the following sensor settings (Fig. 48):
   a) *Code sequence:* clockwise (CW)/counter clockwise (CCW) (measurement direction clockwise/counterclockwise)
   b) *Class 4 functionality:* Activating/de-activating the following parameters: Code sequence, Scaling function, Measuring step, Total measuring range, Velocity unit and G1_XIST1 preset control. With “Class 4 functionality” de-activated, the sensor measures with a resolution of 1 µm. Any configured “Preset” is not taken into account and the measuring direction is forward.
   c) *G1_XIST1 preset control:* Should be selected, if the Preset should have an impact not only on G1_XIST2 and G1_XIST3, but also on G1_XIST1.
   d) *Scaling function control:* Scaling function control: Activating/de-activating the scaling function. The “Scaling function”- parameter can be used to change the encoder resolution. Note that the “Scaling function” parameters can be activated only, if “Class 4 functionality” and “Scaling function control” are activated.
   e) *Alarm channel control:* Activating/de-activating the alarm channel (can be de-activated only in Compatibility mode)
   f) *Compatibility mode*: Activating/de-activating the Compatibility mode. This parameter indicates, if the encoder should run in a mode compatible with encoder profile 3.1.
   g) *Measurement step (high DWORD):* Position measurement resolution 1, 2, 5, 10, 50, 100 µm, provided that the “Scaling function” is activated.
   h) *Measurement step (low DWORD):* Position measurement resolution 1, 2, 5, 10, 50, 100 µm, provided that the “Scaling function” is activated.
   i) *Measurement range (high DWORD)*: Limits the measuring range to the number of measurement steps, provided that the “Scaling function” is activated.
   j) *Measurement range (low DWORD):* Limits the measuring range to the number of measurement steps, provided that the “Scaling function” is activated.
   k) *Maximum master sign-of-life failures*
   l) *Velocity unit* [13]*:* steps/s, steps/100ms, steps/10ms, mm/s

12/ Cf.: PROFIBUS Nutzerorganisation e.V.; 2008; Profile Encoder, Technical Specification *for PROFIBUS and PROFINET related to PROFIdrive Version 4.1*

13/ A “step” corresponds to the selected resolution

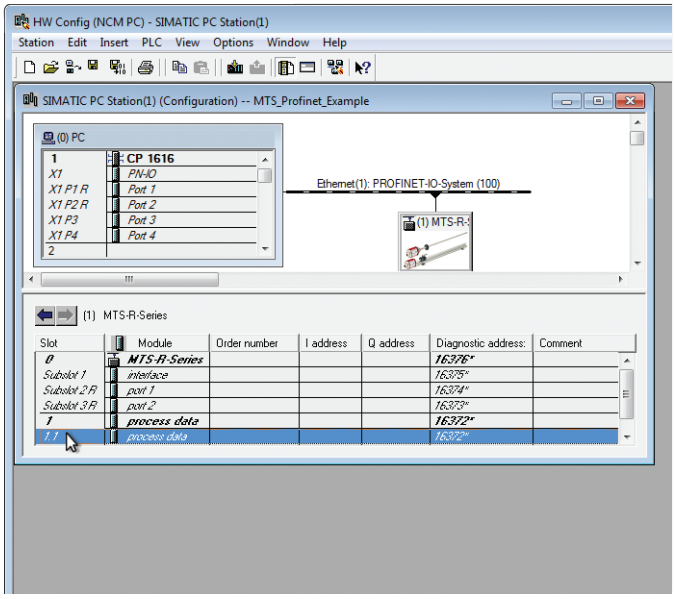


Fig. 47: Properties – process data (source: Siemens)

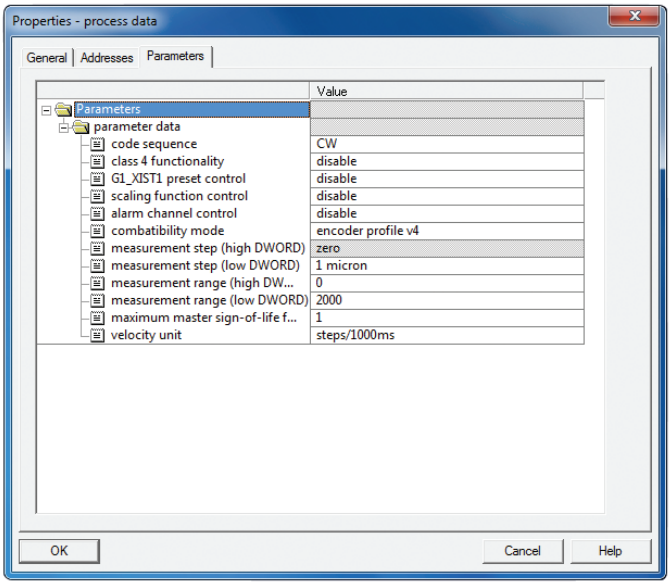


Fig. 48: Properties – process data (source: Siemens)

5. Select a standard telegram for output of the sensor position (Fig. 49).
   For this purpose, right-click “Slot 1”, Subslot “2”. Then, select:
   – Insert object
   – MTS R-Series Firmware Version X
   – Process data
   – Standard telegram

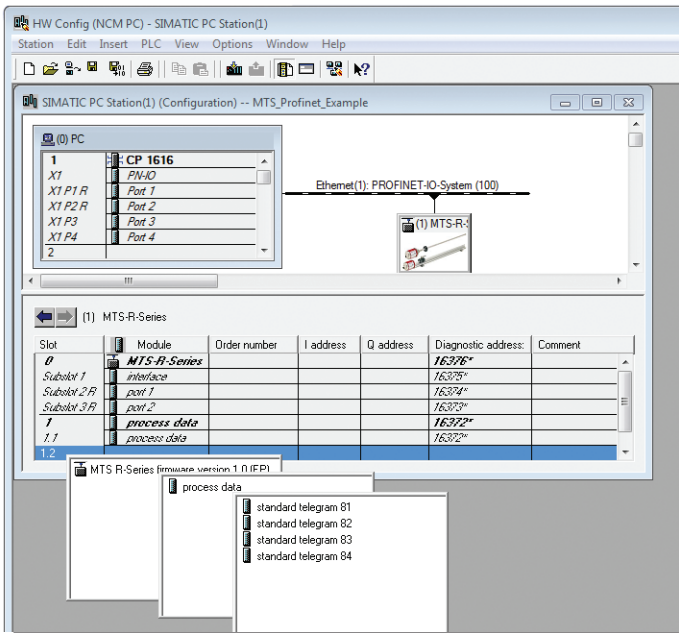


Fig. 49: Select standard telegram (source: Siemens)

For a description of the standard telegrams, see page 22.

8. Transfer your settings to the control system as described below (Fig. 50):
   – PLC
   – Download
   – CP1616.

   Now you can access the input or output data of standard telegram 81 from your control program via addresses (example) 0…11 (I address) and 0…3 (Q address).

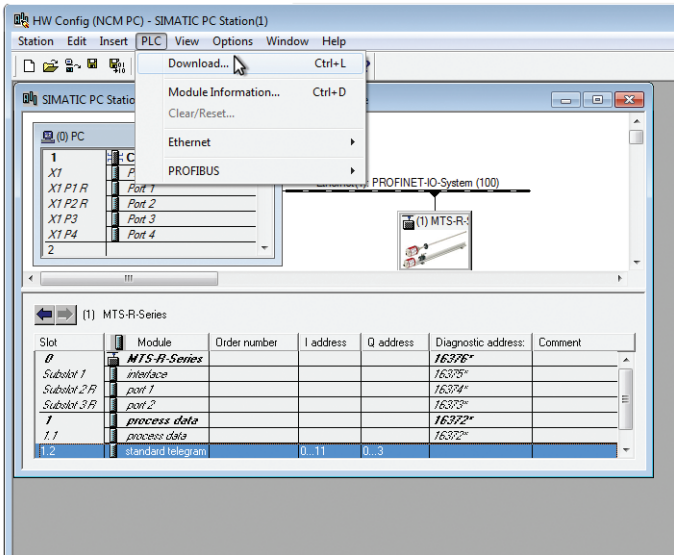


Fig. 50: Transfer settings to the control system (source: Siemens)

Description of standard telegrams

Sensor → Control

Standard telegram 81:

2 bytes	ZSW2_ENC Encoder Status Word 2
2 bytes	G1_ZSW Sensor Status Word
4 bytes	G1_XIST1: Position Value
4 bytes	G1_XIST2: Alternative Position Value

Standard telegram 82:

2 bytes	ZSW2_ENC Encoder Status Word 2
2 bytes	G1_ZSW Sensor Status Word
4 bytes	G1_XIST1: Position Value
4 bytes	G1_XIST2: Alternative Position Value
2 bytes	NISTA: Velocity

Standard telegram 83:

2 bytes	ZSW2_ENC Encoder Status Word 2
2 bytes	G1_ZSW Sensor Status Word
4 bytes	G1_XIST1: Position Value
4 bytes	G1_XIST2: Alternative Position Value
4 bytes	NISTB: Velocity

Standard telegram 84:

2 bytes	ZSW2_ENC Encoder Status Word 2
2 bytes	G1_ZSW Sensor Status Word
8 bytes	G1_XIST3: Position Value
4 bytes	G1_XIST2: Alternative Position Value
4 bytes	NISTB: Velocity

Control → Sensor

2 bytes	STW2_ENC Encoder control word 2
2 bytes	G1_STW Sensor control word

Description of the sensor control and status words

Sensor control word (G1_STW):

Bits 0…7	Function requests: Reference mark search, measurement on the fly *(not supported)*
Bits 8…10	Reserved (without effect)
Bit 11	Home position mode
Bit 12	Request set/shift of home position
Bit 13	Request absolute value cyclically
Bit 14	Activate parking sensor
Bit 15	Acknowledging a sensor error

Sensor status word (G1_ZSW):

Bits 0…7	Function status: Reference mark search, measurement on the fly *(not supported)*
Bit 8	Probe 1 deflected *(not supported)*
Bit 9	Probe 2 deflected *(not supported)*
Bit 10	Reserved, set to zero
Bit 11	Requirement of error acknowledgement detected
Bit 12	Set /shift of home position executed
Bit 13	Transmit absolute value cyclically
Bit 14	Parking sensor active
Bit 15	Sensor error

Encoder control word 2 (STW2_ENC):

Bits 0…6	Reserved
Bit 7	Fault acknowledge
Bits 8, 9	Reserved
Bit 10	Control by PLC
Bit 11	Reserved
Bits 12…15	Controller Sign-Of-Life *(not supported)*

Bit	Value	Significance	Comments
7	1	Fault acknowledge (0→1)	The fault signal is acknowledged with a positive edge; the Encoder reaction to a fault depends on the type of fault.
	0	No significance	
10	1	Control by PLC	Control via interface, EO IO Data is valid.
	0	No Control by PLC	EO IO Data not valid; except Sign-Of-Life.
12…15		Controller Sign-Of-Life	not supported

Source: PROFIBUS Nutzerorganisation e.V.; 2008; Profile Encoder Technical Specification for PROFIBUS and PROFINET related to PROFIdrive Version 4.1

Encoder status word 2 (ZSW2_ENC):

Bits 0…2	Reserved
Bit 3	Fault present / No fault
Bits 4…8	Reserved
Bit 9	Control requested
Bit 10, 11	Reserved
Bits 12…15	Encoder Sign-Of-Life *(not supported)*

Bit	Value	Significance	Comments
3	1	Fault present	Unacknowledged faults or currently not acknowledgeable faults (fault messages) are present (in the fault buffer). The acknowledging of a fault may only be successful, if the fault cause has disappeared or has been removed before. The related fault numbers are in the fault buffer.
	0	No fault	
9	1	Control requested	The automation system is requested to assume control.
	0	No control requested	Control by the automation system is not possible, only possible at the device or by another interface.
12…15		Encoder Sign-Of-Life	not supported

Source: PROFIBUS Nutzerorganisation e.V.; 2008; Profile Encoder Technical Specification for PROFIBUS and PROFINET related to PROFIdrive Version 4.1

Error diagnosis

From HW Config, connect with the Profinet network for error diagnosis (Fig. 51). Subsequently, the actual device and controller status is displayed (Fig. 52).

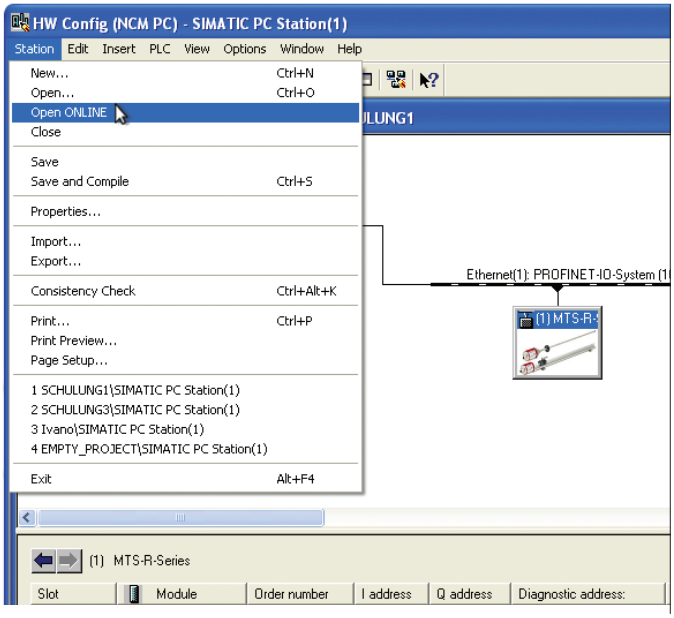


Fig. 51: Connect to Profinet sensor (source: Siemens)

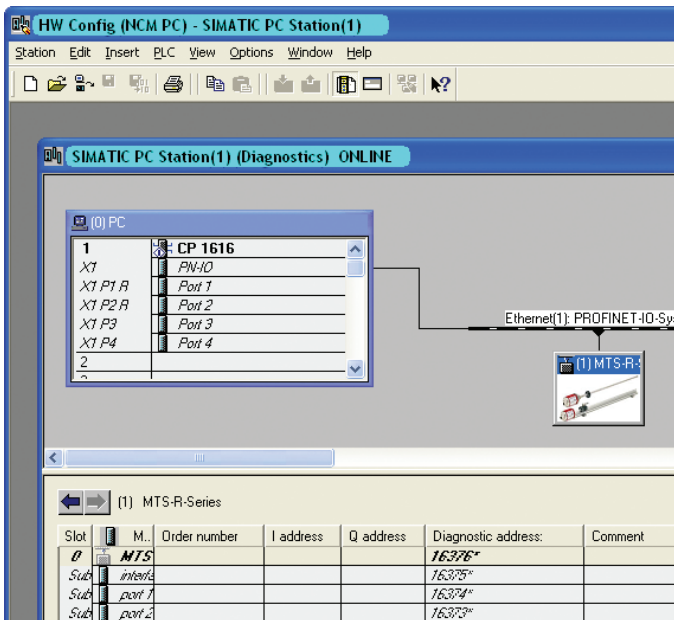


Fig. 52: Device and controller status (source: Siemens)

With an error, devices are marked with symbol .

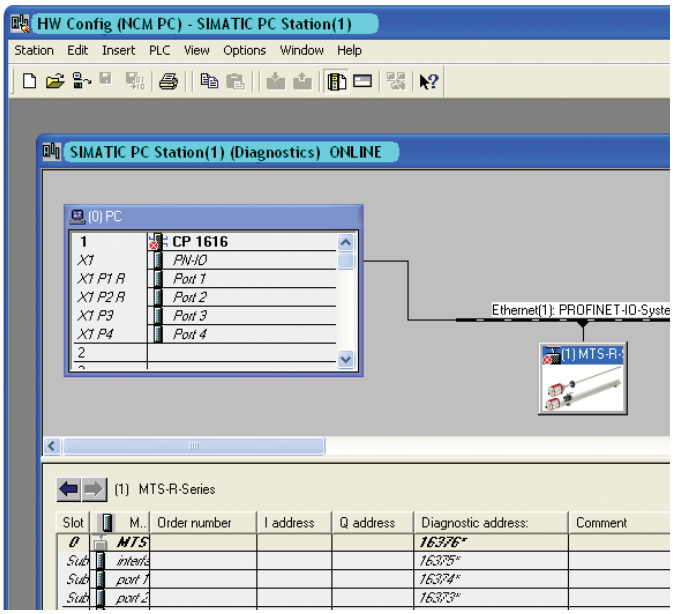


Fig. 53: Device marking in case of error (source: Siemens)

For error diagnosis, please, double-click the device marked with symbol . Select tab “IO device diagnosis” to view the error details. In the example, a position magnet is missing for a Temposonics® sensor with MTS profile (Fig. 54).

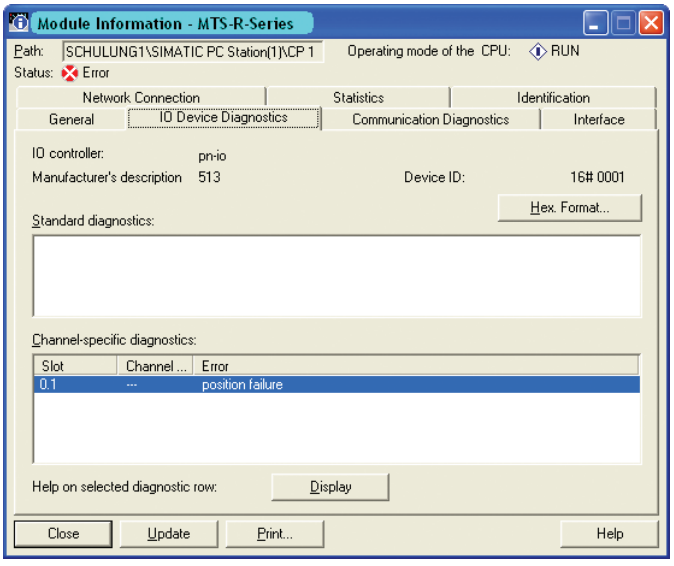


Fig. 54: Error diagnosis (example) (source: Siemens)

These diagnosis outputs are realized via alarm messages and Profinet interface. Temposonics® sensors support the following diagnosis alarms:

MTS profile	
ALARM-ID	Meaning
17	Inadmissible operating voltage
27	Bad number of magnets

Encoder profile	
ALARM-ID	Meaning
36865	High operating voltage
36866	Low operating voltage
36874	Bad number of magnets

6. Maintenance and troubleshooting

6.1 Error conditions, troubleshooting

See chapter 5 “Operation” Fig. 17.

6.2 Maintenance

The sensor is maintenance-free.

6.3 Repair

Repairs on the sensor may be performed only by MTS or an explicitly authorized body.

6.4 List of spare parts

Omitted.

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 Input

Measured value	Position or velocity, option: 2…19 multi-position measurement
Stroke length	Profile: 25…5000 mm / rod: 25…7600 mm

8.2 Output

Interface/Data protocol	Profinet IO RT
Data transmission rate	100 MBit/s max.

8.3 Performance

Resolution	
– Position	1…100 µm selectable
– Velocity	1 mm/s
Linearity [14]	< ± 0.01 % F.S. (minimum ± 50 µm)
Repeatability	< ± 0.001 % F.S. (minimum ± 2.5 µm)
Cycle time	Dependent on stroke length
Process data	Maximum 1 kHz
Temperature coefficient	< 15 ppm/°C
Ripple	< 5 µm
Hysteresis	< 4 µm

8.4 Operating conditions

Magnet movement velocity	Any
Operating temperature	0…+75 °C
Dew point, humidity	90% rel. humidity, no condensation
Ingress protection[15]	Profile: IP65, rod: IP67 if appropriate mating cable connector is correctly fitted
Shock test	100 g (single shock) IEC-Standard 60068-2-27
Vibration test	15 g / 10...2000 Hz, IEC-Standard 60068-2-6 (resonance frequencies excluded)
EMC test	Electromagnetic emission EN 61000-4-6 (for industrial environments) Electromagnetic immunity EN 61000-4-3 The sensor meets the requirements of the EC directives and is marked with CE

8.5 Design and material

Diagnostic display	LED beside connector
<u>Profile model:</u>	
Sensor electronics housing	Aluminum
Sensor profile	Aluminum
Position magnet	Magnet slider or removable U-magnet
<u>Rod model:</u>	
Sensor electronics housing	Aluminum
Sensor rod	Stainless steel 1.4301 / AISI 304
Operating pressure	350 bar, 700 bar peak
Position magnet	Ring- or U-magnets

14/ with position magnet # 251 416-2
15/ The IP rating is not part of the UL approval

8.6 Installation

Mounting position	Any
Sensor profile	Adjustable mounting feet or T-slot nut in bottom groove
– Position magnet	Mounting plate and screws from antimagnetical material; U-magnet, removable
Sensor rod	Threaded flange M18×1.5 or 3/4" -16 UNF-3A
– Position magnet	Mounting plate and screws from antimagnetical material

8.7 Power supply

Operating voltage	24 VDC (-15 / +20 %); connection to an approved power supply with energy limitation (IEC 61010-1) resp. class 2 according to National Electric Code (USA) / Canadian Electric Code
Current consumption	Typ. 110 mA
Ripple	≤ 0.28 Vpp

8.8 Electrical connection

Connection type	2 × 4 pin M12 (d-coded); 1 × 4 pin M12 (a-coded)
Polarity protection	Up to -30 VDC
Overvoltage protection	Up to 36 VDC
Dielectric strength	500 VDC (DC ground to machine ground))

9. Annex

Safety Declaration

Dear Customer,
If you return one or several 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 any danger to persons when handling these items is excluded.

MTS order number: _____ Sensor type(s): _____

Serial number(s): _____ Sensor length: _____

The sensor has been in contact with the following materials:

Don't 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 MTS to determine measures to be taken before shipment, if necessary.

Short description of malfunction:

Corporate information

Company: _____

Address: _____

_____

Contact partner

Name: _____

Phone: _____

E-Mail: _____

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 _____

MTS Sensor Technologie GmbH & Co.KG
Auf dem Schüffel 9
58513 Lüdenscheid, Germany

Tel. +49-23 51-95 87 0
Fax +49-23 51-5 64 91
info@mtssensor.de
www.mtssensor.com

Notes

Notes

Notes

MTS®
SENSORS

Document Part Number:
551416 Revision A (EN) 10/2013

Locations

Germany
MTS Sensor Technologie GmbH & Co. KG
Auf dem Schüffel 9
58513 Lüdenscheid, Germany
Tel. +49-23 51-95 87 0
Fax +49-23 51-5 64 91
info@mtssensor.de
www.mtssensor.de

USA
MTS Systems Corporation
Sensors Division
3001 Sheldon Drive
Cary, N.C. 27513, USA
Tel. +1-919-677-0100
Fax +1-919-677-0200
sensorsinfo@mts.com
www.mtssensors.com

Japan
MTS Sensors Technology Corp.
737 Aihara-cho,
Machida-shi, Japan
Tel. +81-42-775-3838
Fax +81-42-775-5516
info@mtssensor.co.jp
www.mtssensor.co.jp

France
MTS Systems SAS
Zone EUROPARC
Bâtiment EXA 16
16/18, rue Eugène Dupuis
94046 Creteil, France
Tel.: +33-1 58 43 90 28
Fax: +33-1 58 43 90 03
mtssensor.france@mts.com
www.mtssensor.com

Italy
MTS Systems Srl.Sensor Division
Via Diaz,4
25050 Provaglio d'Iseo (BS), Italy
Tel.: +39-030 988 38 19
Fax: +39-030 982 33 59
karin.arlt@mtssensor.com
www.mtssensor.com

China
MTS Sensors
Room 504, Huajing Commercial
Center, No. 188, North Qinzhou Road
200233 Shanghai
Tel: +86-21 6485 5800
Fax: +86-21 6495 6329
info@mtssensors.cn
www.mtssensors.cn

Legal notices