

The *magnetostrictive* Position Sensors

Instruction Manual

Smart, Linear Position Sensors Model Types Temposonics-RP & RH Interface: DeviceNet

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MTS Sensor Technologie, Lüdenscheid, Germany

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- Supplement: Sensor Object Classes DeviceNet



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Safety Instructions

Preface

The general safety instructions given below are intended to ensure the personnel safety and to avoid damage. TEMPOSONICS are state-of-the-art position measurement systems built in accordance with the standard safety regulations. Nevertheless, hazards to the life and health of the user or other persons, or impairments of the sensor or other objects may arise in conjunction with the use of TEMPOSONICS Sensors.

Application

1. The position measurement systems of all series TEMPOSONICS may be used only for the purposes for which they were designed, i.e. they may be used exclusively for measurement tasks in industrial, commercial and laboratory applications. E.g. positions, displacements and speeds can be measured (more detailed information is given in the relevant product documentation).

The position sensors are accessories of an installation and must be connected to a suitable evaluating unit as included in a PLC, IPC, indicator or other electronic control unit. Correct use for the intended purpose implies that all instructions given in the product documentation are followed. Using sensor Temposonics beyond these limits is incorrect. MTS Sensor Technologie refuse any liability for damage resulting from incorrect use.

2. The displacement sensors may be used only in safe condition. In order to maintain this condition and to ensure safe operation, installation, connection and service work may be done only by trained and qualified personnel *), whereby the relevant instructions for accident prevention and safety as well as the information given in the product documentation must be followed.

Functional trouble

Hazards to the safety of persons or risks of damage to operating facilities due to sensor failure or malfunction must be avoided by additional safety measures such as plausibility checks, limit switches, emergency off systems, protective devices, etc. In case of trouble, the sensor must be shut down and protected against accidental operation.

Repair

Repair of the sensor may be done only by MTS or an explicitly authorized organization.

Installation and operation

To ensure perfect functioning, following the information given below is indispensable

1. Protect the sensors against mechanical damage during installation and operation.
2. Do not open or dismantle the sensors.
3. Connect the sensors with utmost care related to polarity of connections, supply voltage as well as type and duration of control pulses.
4. Use only approved power supplies.
5. Meeting the permissible sensor limit values e.g. for supply voltage, environmental conditions etc. specified in the product documentation is indispensable.
6. Check the correct function of the position sensors at regular intervals and provide test documentation.
7. Before switching on the installation, ensure that the starting machine does not threaten the safety and health of persons.

*) *Trained personnel means persons who*

- *related to projecting, are familiar with the safety concepts of automation,*
- *are informed of the electromagnetic compatibility,*
- *have received a special training for commissioning and servicing,*
- *are familiar with the operation of the unit and informed of the specifications for correct operation given in the product documentation.*

1. General Informations

Manufacturer: MTS Sensor Technologie, Auf dem Schüffel 9, D-58513 Lüdenscheid, Germany

Product name: Position Sensor TEMPOSONICS, Series R

Following description is valid for all R-Series TEMPOSONICS sensors, model types

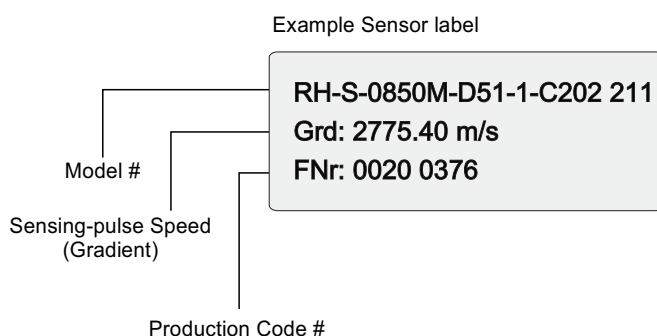
TEMPOSONICS-RP (Profile style) and

TEMPOSONICS-RH (Rod style) with the

Interface: DeviceNet and

Measuring range: 25 - 4800 Millimeters

The exact sensor description is given on the sensor type label containing the ordering information shown in section 10, page 18, which is coded as follows:

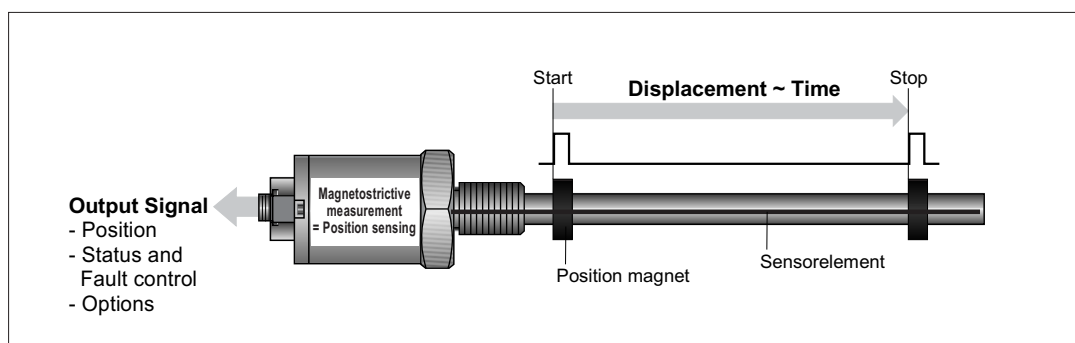


2. Industrial application

The position sensors are used for displacement measurement and conversion in mechanical and plant engineering applications.

3. Operating principle and system construction

TEMPOSONICS are absolute position sensors for measuring linear movements. The sensor associates various magnetomechanical effects in a magnetostrictive measurement principle, which uses the defined propagation speed of an ultrasonic wave (torsion pulse in a sensor element) for displacement measurement. This contactless measurement principle features a permanent magnet without separate power supply, which marks the position point through the sensor housing wall. The torsion pulse travel time can be converted into a high-accuracy output signal strictly proportional to the measured displacement.



The modular sensor comprises a sensing element (waveguide) for transmission of the measurement pulse, which is fitted in a pressure-proof housing (sensing rod), and an integrated electronic interface (sensor head) with active signal conditioning. The interface output is dependent of electronics module*. Dependent of version, connection of the position sensor is via connector or integrated cable.

*shown: DeviceNet, version 1.002

4. Technical Specifications

Input	Measured variable: Displacement Measuring range: Profile / Rod 25 - 4800 mm
Output	Output signal: CAN-Fieldbus System according ISO-DIS 11898 Data format: DeviceNet Data transmission rate, kBit/s: 500 (factory set), 250, 125
Accuracy	Resolution: 5 µm, 2 µm Linearity, uncorrected: $\pm 0,01$ % F.S.; Minimum ± 40 µm (± 20 µm <i>future</i>), independent of outside temperature variations Repeatability: $\pm 0,001$ % F.S. (Minimum $\pm 2,5$ µm) Cycle time: 2,0 ms up to 4800 mm stroke Hysteresis: < 4 µm
Operating Conditions	Sensor mounting position: Any orientation Magnet speed: Any Operating temperature: -40° C ... +75° C Temperature coefficient: < 15 ppm/° C Dew point, humidity: 90% rel. humidity, no condensation Pressure rating (rod version): 350 bar (530 bar peak pressure) Ingress protection*: Profile style IP 65 / Rod style IP 67 Shock rating: 100 g (Single hit) / IEC-Standard 68-2-27 Vibration rating: 5 g / 10 - 150 Hz / IEC-Standard 68-2-6 EMC test: DIN IEC 801-4 / Type 4 CE qualified
Construction, Material	Profile Model Sensor head: Aluminum diecasting housing Sensor housing style: Aluminum profile Magnet type: Captive sliding magnet or open ringmagnet Rod Model Sensor head: Aluminum diecasting housing Sensor rod with flange: Stainless steel 1.4301 / AISI 304 Magnet type: GF plastic with permanent magnets (Ringmagnet)
Installation	Profile model: Adjustable mounting feet or T-slot nut M5 in base channel Rod model: Threaded flange M18 x 1,5 or 3/4"-16 UNF-3A
Electrical Connection	Sensor connectors: 5 pin DeviceNet connector 'Micro' M12 x 1 Input voltage: 24 Vdc (+20 % / -15 %) Current drain: 90 mA typical Ripple: < 1 % peak to peak Electric strength: 500 V (DC ground to machine ground)

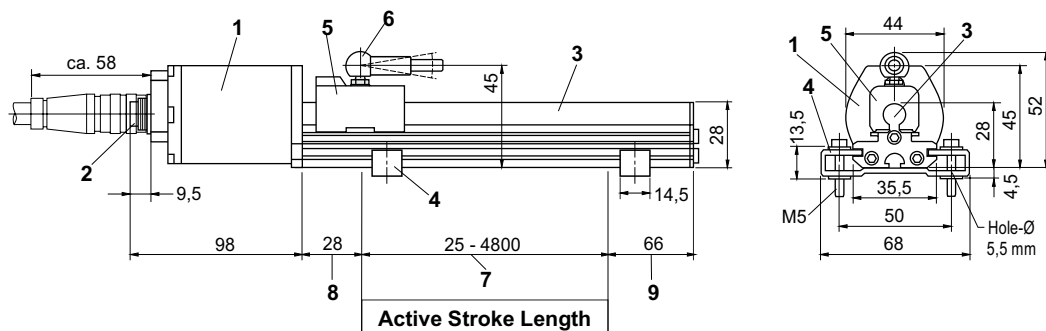
* In the case of sensors with receptacle connection type, the IP rating is valid only if the mating cable connector is correctly fitted.

5. Mechanical Construction / Dimensions

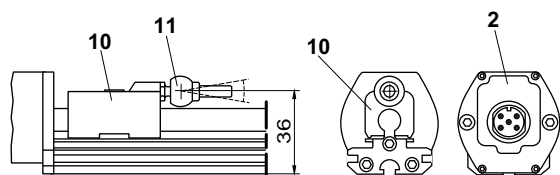
5.1 Profile Model

Temposonics-RP, Style »S«

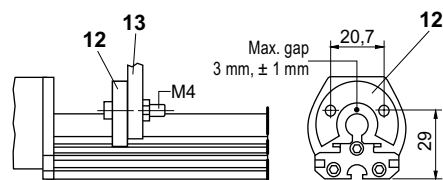
mm



Temposonics-RP, Style »V«



Temposonics-RP, Style »M«



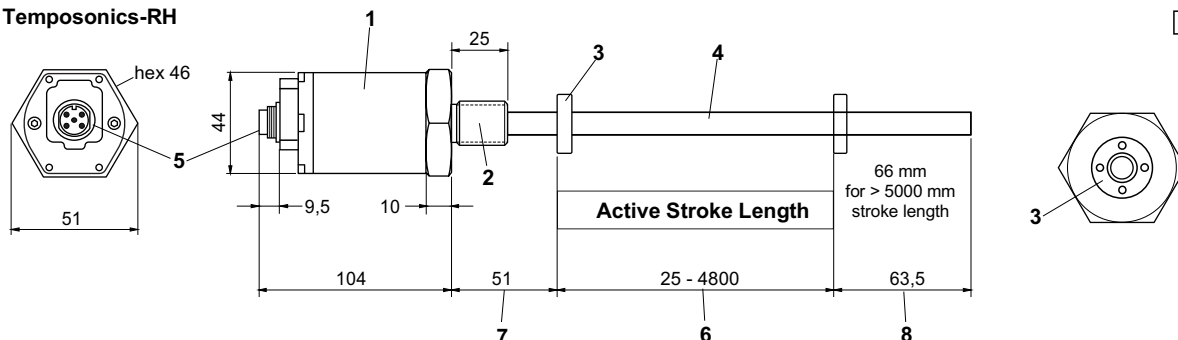
- 1 Sensor head with electronics
- 2 Male receptacle, metal shell, type D51
- 3 Sensor housing with built-in sensing element
- 4 Mounting foot
- 5 Captive sliding magnet style S
- 6 Ball jointed arm (M5 thread), vertical 18°, horizontal 360°
- 7 Measuring range / Order length

- 8 Mounting zone
- 9 Damping zone
- 10 Captive sliding magnet style V
- 11 Ball jointed arm (M5 thread), rotation 18°
- 12 Floating magnet style M (open ring)
- 13 Nonferrous support, screws

5.2 Rod Model

Temposonics-RH

mm



- 1 Sensor head with electronics
- 2 Threaded flange, M18 x 1,5 or 3/4"-16 UNF-3A
- 3 Position magnet
- 4 Sensor rod with built-in sensing element, Ø 10

- 5 Male receptacle, metal shell, type D51 (see profile version)
- 6 Measuring range / Order length
- 7 Mounting zone
- 8 Damping zone

5.3 Accessories

Position Magnets for Profile Model

Rotation:
Vertical 18°
Horizontal 360°

Rotation: 18°

Position Magnets for Rod Model

Standard magnet

mm

1 Open ring magnet Ø33, **Part No. 251 416**
2 Position magnet Ø33, **Part No. 201 542**
3 Position magnet Ø25,4 mm, **Part No. 400 533**

1 Captive sliding magnet type »S«, **Part No. 252 182**
2 Captive sliding magnet type »V«, **Part No. 252 184**
3 Open ring magnet type »M«, **Part No. 251 416**

Cable connectors (Pls. order separately)

Housing material: Brass
Termination: Solder
Contact insert: Female (silver plating)
Cable clamp: Pg 9
Cable Ø max.: 6-8 mm
Cable type: According DeviceNet specification:
Thin cable, Table B.3 - B.6,
e.g. Belden YR 399 39 E34 972

mm

1 5 pin female connector DeviceNet »Micro« M12 x1, **Part No. ST 933 171-100**
2 5 pin female connector DeviceNet »Micro« M12 x1, twisting contact insert in 90° angles, **Part No. ST 933 176-100**

6. Installation Guide

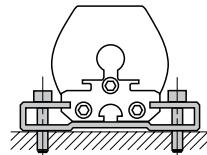
Attention. Ensure the sensor mounting is kept away from strong magnetic and electrical noise-fields.

The sensor may be operated in any position. Normally, the sensor is firmly installed, whilst the magnet head is mounted at the mobile machine part and taken over the tube contactlessly.

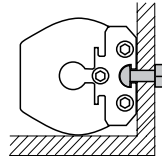
Note!
To avoid damaging of slider, magnet and sensor housing be aware of a careful parallel mounting of the transducer.

Profile Style Sensor

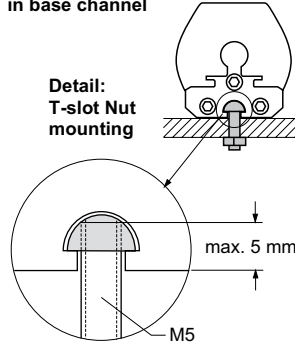
The sensor requires at least two mounting feet which simply slide on to the transducer and are held in place with screws M5 x 20 (DIN 6912) or M5 screws in base channel. Mount the floating style magnet using non-magnetic material and screws.



Mounting foot with machine screws M5 x 20 (Tightening torque < 1,1 Nm)

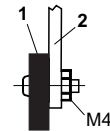
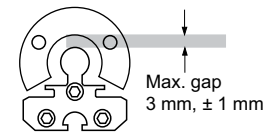


T-slot Nut M5 in base channel



Detail: T-slot Nut mounting

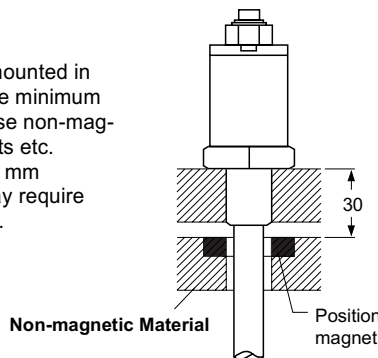
Open Magnet type M, removable



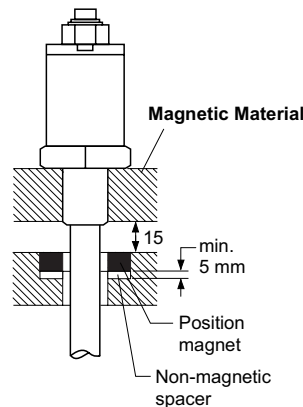
1 Magnet
2 Non-magnetic mounting plate and screws

Rod Style Sensor

The sensor can be mounted in any position. Note the minimum clearances (right). Use non-magnetic screws, supports etc. Sensors above 1000 mm measuring stroke may require mechanical supports.



Non-magnetic Material
Position magnet

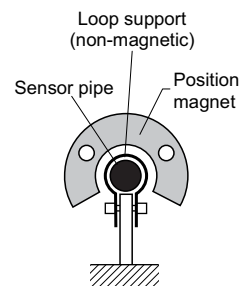


Magnetic Material

min. 5 mm

Position magnet
Non-magnetic spacer

Example: Sensor Supports



Cylinder Installation

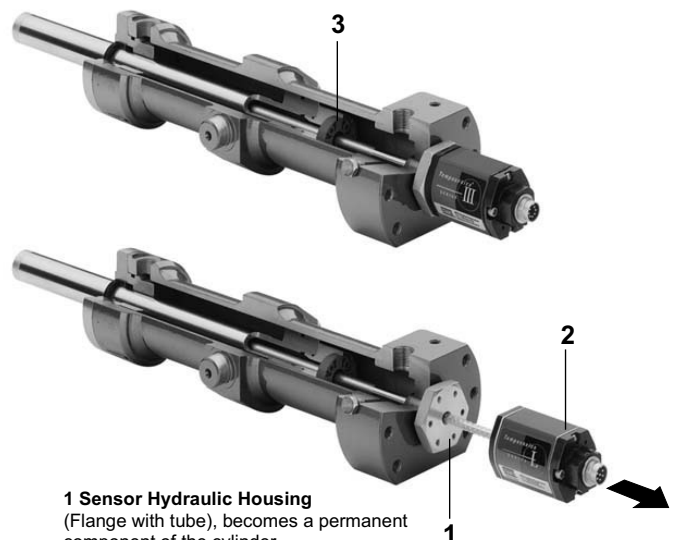
The basic sensor unit comprising electronic head and sensing element is mounted in the high pressure sensor housing (flange with rod) with only 2 screws and fits into the piston rod. The magnet on the bottom of the piston floats contactlessly over the sensor rod and marks the measuring point through the rod wall. Due to this construction, the sensor tube is part of the cylinder and the hydraulic system has **not** to be **opened** in case of service.

When installing the sensor in hydrocylinders, note

- Magnet must not slide along the sensor tube
- The bore in the piston rod and type of sealing are determined by cylinder manufacturers as these depend on hydraulic pressure and piston velocity. We recommend 13 mm bore hole diameter at minimum and O-rings or copper gaskets for sealing
- Do not exceed peak pressure of 530 bar
- Protect sensor rod from wear

ATTENTION

After chagement of sensor cartridge, the screws must be fastened with e.g. Loctite 243.



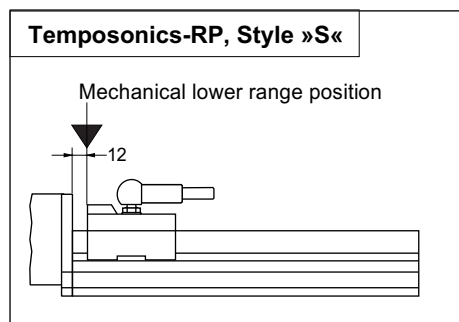
1 Sensor Hydraulic Housing (Flange with tube), becomes a permanent component of the cylinder

2 Sensor Cartridge (Electronic head + Sensing element): Easy to replace in the field with 2 screws Torx 20

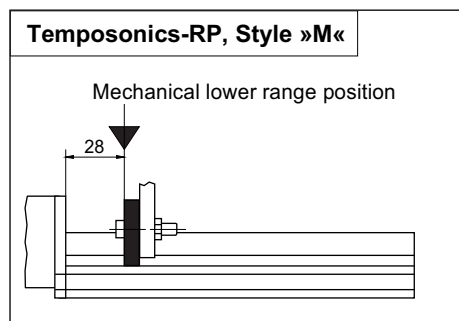
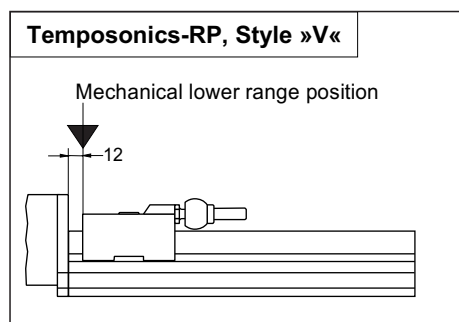
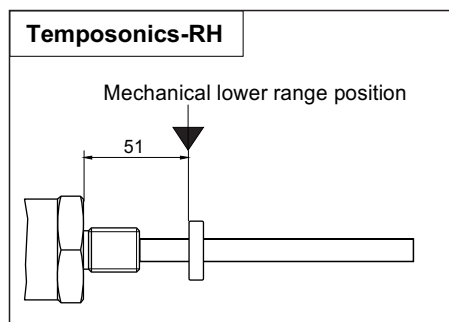
3 Position magnet

7. Measuring Range

The technical data of each TEMPOSONICS sensor are checked and recorded at the final inspection. At the same time the active measuring range (see page 5) is adjusted. In order to guarantee the total electrical stroke is available, the position magnets must be fixed as follows



mm



8. Electrical Connection

IMPORTANT

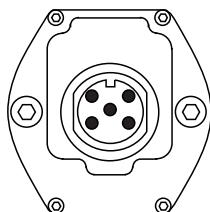
Temposonics sensors are active electronic systems. When installing the unit it is essential that correct sensor connections are ensured. Before turn-on, pls. check if the sensor was connected correctly, in order to prevent destruction of the sensor electronics by voltage peaks or faulty connection.

CAUTION: During wiring, disconnection from all voltage sources must be ensured.

To prevent interference affecting the electronic measuring equipment, the connecting cables must be installed with utmost care. Therefore...

- Keep cables away from motor cables, frequency inverters, valves, pipings, relays, etc.
- Avoid ground loops.
- Use only stabilized power supplies.
- Take care that the specified connection values are not exceeded.
- Use only low-impedance, twisted pair and screened cables.

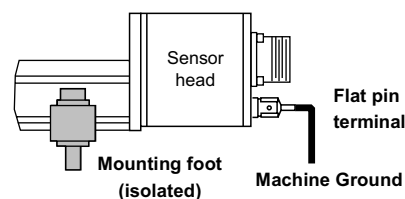
Connection type D51



5 pin male connector
DeviceNet »Micro« M12 x 1

ATTENTION. (For Profile Sensors only).

The profile sensor is equipped with mounting feet for isolation from machine ground. It is necessary that you apply ground to the sensor housing. Connection is made with the flat pin connector on the sensor head.



CE-Labeling.

The devices agree with the European Guideline 89/336/EEC (changed through 91/386/ECC and 93/44/ECC), "Electromagnetics Compatibility". The following European special basic standards will be fulfilled:

Electromagnetic Emission: EN 50081-1 and Electromagnetic Susceptibility: EN 50082-2

Mounting Instructions!

To fulfill the above mentioned basic standards require a prescribed standard cable. Ensure that the sensor has a flawless machine grounding. The cable shield must be fixed to the cable connector and has to be connected to machine ground on the controller electronic side.

Wiring

Temposonics-RP (Profil style) and RH (Rod style) with DeviceNet Interface

Connector Pin		DeviceNet Cable	Signal
<div>Front face of insert</div> <div>5 pin male connector M12 x 1</div>	Pin	Wire color	Function
	1*	Shield	Shield
	2	red	+24Vdc (+20% / -15%)
	3	black	DC Ground
	4	white	CAN-H
	5	blue	CAN-L

* Pin 1 is connecting to housing

Wiring Instructions: Following cable, according to DeviceNet specification is requested: Thin Cable; Table B.3 - B.6; z.B. Belden YR 399 39 E34 972.

Be care for a flawless sensor machine grounding. The cable shield must be connect to the cable connector and has to be connected to machine ground on the controller electronic side.

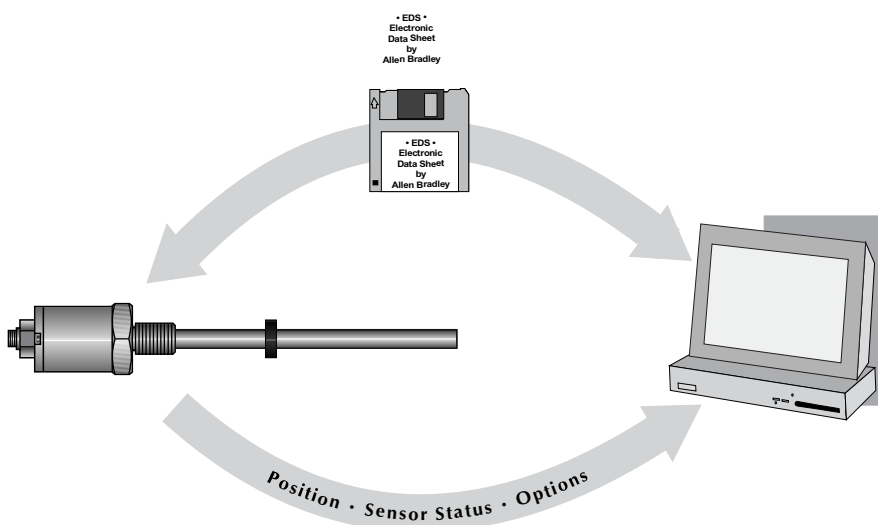
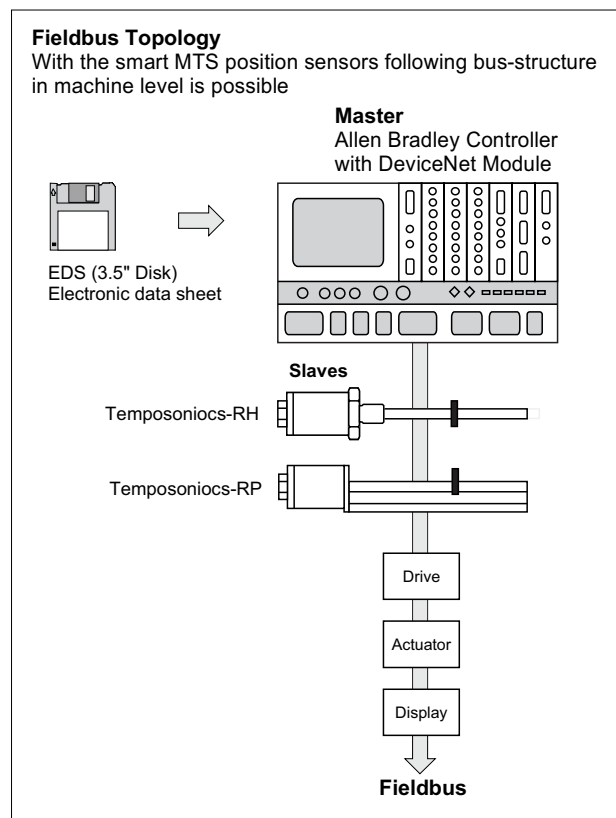
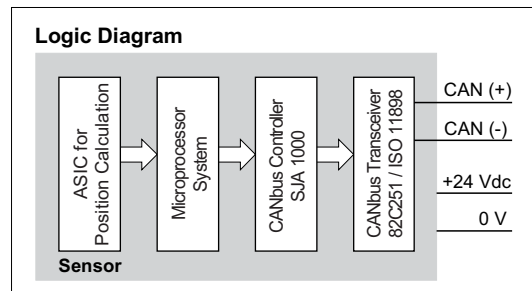
9. DeviceNet System Configuration

The smart DeviceNet TEMPOSONICS can be connected directly to a CANbus. The diagram right, shows the function of these fully digital sensing system. The position of a magnet - at the mobile machine part - is determined by the unique magnetostrictive principle, which MTS pioneered. The travel time-based measurements are converted into a bus oriented data format in the micro-processor system. The CAN Controller SJA 1000 generates the transmission protocol, after that the CAN-Transceiver 82C251 triggers the data lines. The bus access permits the 11 bit Identifier. Data transfer is possible via twisted pair, coaxial or glass fiber cable.

The Temposonics sensors with built-in DeviceNet output are connected via the fieldbus to the **Allen Bradley** controller (PLC). DeviceNet sensors makes the set-up operation of our position sensors into the network quick and easy. Each sensor is provided with an electronic copy (3,5" disk) of an Electronic Data Sheet (EDS) for sensor parameters loading into the network. A Statement of Conformance contains the network regulations defined and recommended by the Open DeviceNet Vendor Association (ODVA), that details the DeviceNet specifications. Additional a PC programming tool, such as DeviceNet Manager offered by Allen Bradley, is used to set customer specific data.

DeviceNet Protocol offers

- **Status**
- **Position (1 Magnet)**
- **Error Detection**
- **Polling and Bit-strobe**



Plug and Play!

During sensor initiation all system parameters are read, checked and stored via an EDS to ensure perfect communication between sensor and machine controller.

**Pls. continue with
Sensor object Classes DeviceNet
(Statement of Conformance)
on pages 1 - 8**

10. Ordering Guide

Position Sensor

Scope of Delivery

1. Profile Model

Sensor with captive sliding magnet or floating magnet and two mounting feet up to 1250 mm measuring stroke. Additional 1 mounting foot per 500 mm longer strokes.

2. Rod Model

Sensor only. Position magnets are not included with rod-style sensors. They must be ordered separately.

Installation guide + 3.5" EDS disc
(Electronic Data Sheet with stan-
dardized Device Data Base File).

Pls. order accessories separately!

*** Measuring Range**

1. Profile Model

Standard:

- up to 1000 mm in 50 mm steps
 - up to 4800 mm in 250 mm steps
- Option: Other lengths upon request

Option: Other lengths upon request

2. Rod Model

Standard:

- up to 1000 mm in 50 mm steps
 - up to 4800 mm in 250 mm steps
- Option: Other lengths upon request

Option: Other lengths upon request

Temposonics

						M				1	C	2	0	2			
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Sensor Model

RP = Profile housing

RH = Hydraulic Rod with threaded flange

Style

1. Temposonics-RP (Profile)

S = Captive sliding magnet, joint at top

V = Captive sliding magnet, joint at front

M = Floating magnet, Ø 33 mm (open ring)

2. Temposonics-RH (Rod)

M = Flange with metric thread M18 x 1,5 (Standard)

S = Flange with english thread 3/4" - 16 UNF - 3A

Measuring Range/Order Length*

0025 / 50 - 4800 mm

Connection Type

D51 = 6 pin male receptacle, DeviceNet 'Micro' M12 x 1

Input Voltage.

1 = +24 Vdc

Output

C202 (4)(5)(6) = DeviceNet Protocol

(4) Baud rate: 2 = 500 kBit/s (factory set) • 3 = 250 kBit/s • 4 = 125 kBit/s

(5) Resolution: 1 = 5 μm (Standard) • 2 = 2 μm

(6) Cycle time: 1 = Standard

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