

1 General

1.1 Using this manual

This manual contains information concerning the use of the device.

Read the operating manual completely prior to starting installation and operating the device. Comply with all safety instructions.

This operating manual applies for all variants of the AMS EZ 1000 Converter with a hardware revision listed in [Table 1-1](#) and for AMS Machine Studio 4.x. See type plate for hardware revision.

Table 1-1: Hardware revision of the AMS EZ 1000 Converter variants

Variant	Hardware revision	Serial number	Remarks
EZ1000	≥ 22	≥ P2540xxxxx	
EZ1000-EX	≥ 18	< P2540xxxxx	
EZ1000-SIS	≥ 20	≥ P2540xxxxx	Safety-related
EZ1000-SIS-EX	≥ 18	< P2540xxxxx	

[Table 1-2](#) shows which sensors are supported from which firmware version.

Table 1-2: AMS EZ 1000 Converter firmware versions and supported sensors

Firmware version	Supported sensors
1.0.0 and higher	EZ105x-xx-xx-xxx, EZ108x-xx-xx-xxx, and BN 33010x-xx-xx-yy ¹ -xx-xx
1.0.6 and higher	PR 6424/0xx-xx0, PR 6425/010-1x0, and PR 6426/0x0-xx0

¹ yy: 10, 50, or 90

Include the operating manual when transferring the device to third parties.

Note

When requesting technical support, indicate type and serial number from the type plate.

[Table 1-3](#) shows a list of documents that are referred to in this operating manual.

Table 1-3: Referenced documents

MHM-97879	Operating Manual Machine Studio - General Functions
MHM-97883	Installation Guide AMS EZ 1000 Sensor
MHM-97887	Safety Manual AMS EZ 1000 Converter and Sensor

3 Application and design

3.1 Application

The AMS EZ 1000 Converter is a signal converter for different types of eddy current sensors. The converter is designed for the connection of eddy current sensors of the AMS EZ 1000 Sensor series, the listed types of the PR 642x series, and a selection of third party sensors:

- EZ105x-xx-xx-xxx and EZ108x-xx-xx-xxx
- PR 6424/0xx-xx0, PR 6425/010-1x0, and PR 6426/0x0-xx0
The sensor adapter EZ1900-003-ADAP-1 is required for the connection of these sensors.
- Bently Nevada™ 3300 XL 8 mm Proximity Probe types:
 - 33010x-xx-xx-10-xx-xx with extension cables 330130-040-xx-xx or 330130-080-xx-xx
 - 33010x-xx-xx-50-xx-xx
 - 33010x-xx-xx-90-xx-xx

The sensor adapter EZ1900-003-ADAP-2 is required for the connection of 33010x probes.

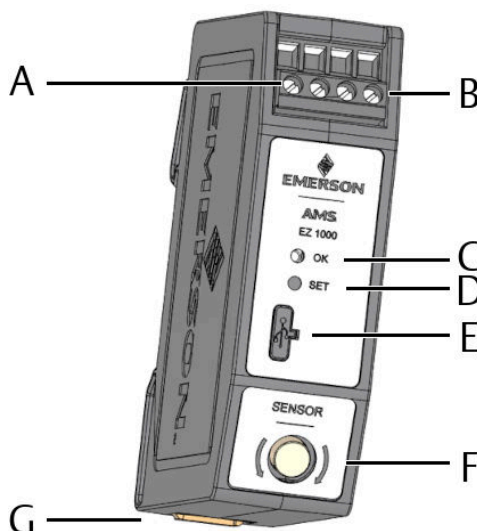
The AMS EZ 1000 Converter, in combination with eddy current sensors listed above, can be used for static and dynamic distance measurements at a variety of different rotating machinery. This means that slow axial displacements and fast radial vibrations of rotating machines can be measured. By using pulse wheels or key marks stuck on the shaft, the speed of the machine can be measured and key pulses generated.

The AMS EZ 1000 Converter is integrated into AMS Machine Studio which allows an easy on-site calibration of the converter to the sensor. AMS Machine Studio also provides the opportunity of detuning the converter if sensors are fitted closely together or to extend the standard measuring range of several sensors.

Supply circuits for the eddy current sensor and the measuring electronic are contained in the converter. The nominal supply voltage for the converter is -24 V DC, the nominal range of the output signal, proportional to the nominal measuring range of the sensor, is -2 to -18 V.

3.2 Design

The AMS EZ 1000 Converter is designed for DIN rail mounting within a field housing or cabinet. The connection of converter supply and sensor signal is made by screw terminals. The converter is equipped with a LEMO connector for connection of an eddy current sensor. The USB 2.0 Micro-B socket is the interface for the configuration. [Figure 3-1](#) explains the connections and operating elements.

Figure 3-1: AMS EZ 1000 Converter


- A. Two screw terminals for -24 V DC supply voltage.
- B. Two screw terminals for sensor output signal (range: -2 V to -18 V)
- C. Green Channel OK LED (see [Table 3-1](#))
- D. Button for offline calibration (Easy calibration) without AMS Machine Studio and for Firmware update
- E. Configuration interface (USB 2.0 Micro-B socket with cover)
- F. Sensor socket with external thread for sensor connection
- G. Build-in spring DIN rail clip

Table 3-1: LED blinking pattern

Event	Blinking pattern	Sequence ¹
Normal operation	Steady green light	
Offline (Easy) calibration	Slow flashing (1 Hz) for approximately 5 seconds; request of calibration – before measurement	
	Double flashing (1 Hz) for approximately 5 seconds during measurement (see Offline (Easy) calibration for details)	
Offline (Easy) calibration – failure detected	Unlimited fast flashing (5 Hz) – until power off/on the converter	
Automatic calibration with AMS Machine Studio	Slow flashing (1 Hz) for approximately 5 seconds; request of calibration – before measurement	

4 Function principle

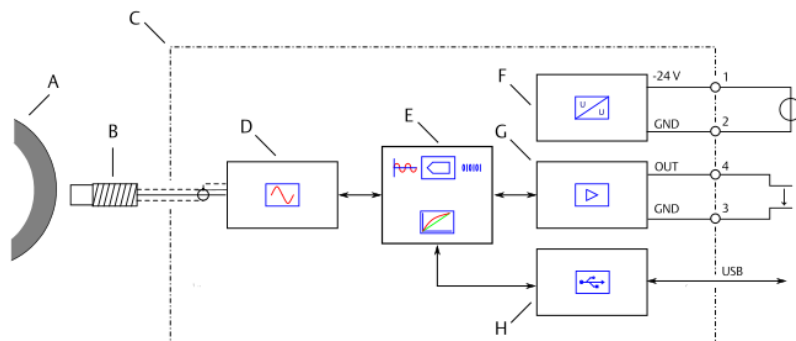
The measuring coil of the eddy current sensor (for example EZ105x-xx-xx-xxx or EZ108x-xx-xx-xxx) is connected to an oscillator circuit in the converter through a shielded connection cable.

The oscillator circuit generates a high-frequency signal resulting in a high-frequency magnetic field around the tip of the eddy current probe. If this magnetic field meets a metallic target, it induces high-frequency currents and another magnetic field which is inversely induced to the original one. According to the rule of Lenz, the induced current damps the oscillator signal.

The damping factor depends on the distance between sensor tip and target material. The smaller the distance to the sensor, the smaller the amplitude of the oscillator.

The demodulator at the output of the oscillator generates a distance proportional signal from the amplitude modulated HF-signal. The following units serve the purpose of linearization and amplification of the signal. The output connectors OUT and GND provide a signal proportional to the actual distance between sensor tip and target material (measurement object).

Figure 4-1: Block diagram



- A. Metallic target (for example: machine shaft)
- B. Sensor
- C. AMS EZ 1000 Converter
- D. Oscillator
- E. Micro controller for signal processing
- F. Power supply
- G. Signal output
- H. USB interface

The target material, the sensor, and the sensor cable length have an influence on the oscillator circuit and consequently on the output signal. The AMS EZ 1000 Converter must be calibrated on the connected sensor, the sensor cable length, and the material of the target to reduce this influence. Sensor, sensor cable, and calibrated AMS EZ 1000 Converter form the measuring chain.

5 Installation and commissioning

5.1 CSA - General safety

Equipment to be installed within another enclosure which provides the safety aspects and protects the operator from hazards and is suitable for outdoor environment conditions.

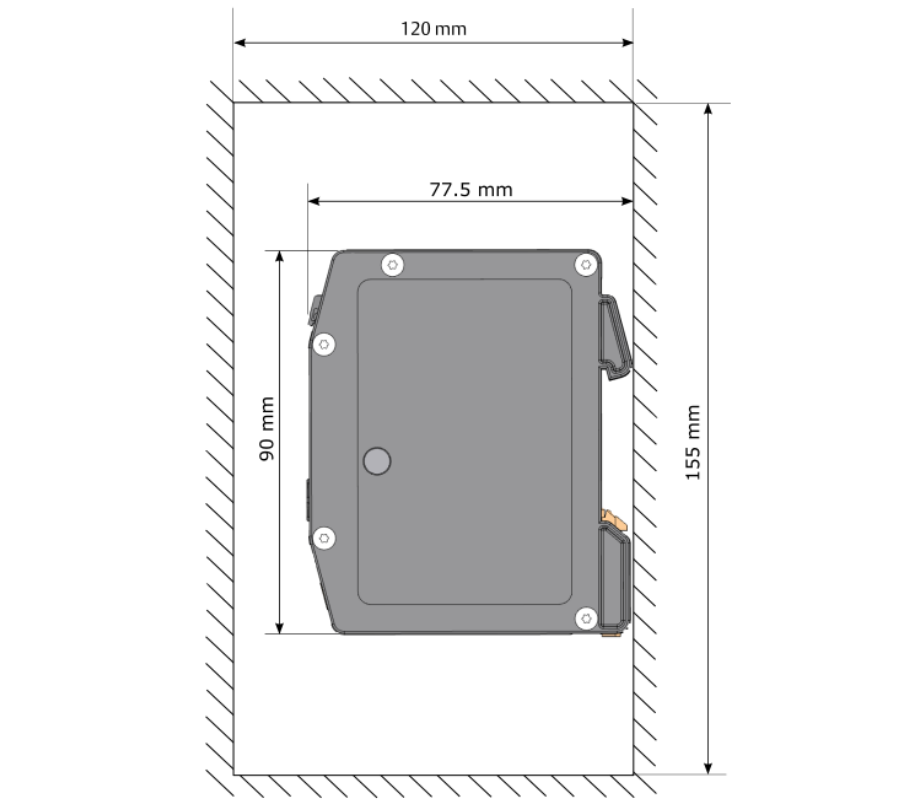
5.2 Mounting

Mount the AMS EZ 1000 Converter into a suitable housing that contains a mounting rail of type NS 35/7.5. The minimum space on the DIN rail is equal to the converter width of 26 mm. The minimum mounting space for the AMS EZ 1000 Converter within a housing is shown in Figure 5-1.

Note

Ensure that there is no heated surface beneath the converter.

Figure 5-1: Minimum required mounting space



5. Snap the DIN Rail for Horizontal Mount adapter including the AMS EZ 1000 Converter(s) on a mounting rail of type NS 35/7.5 mounted in a suitable housing. See [Figure 5-1](#) for the minimum required mounting space.

Figure 5-10: DIN Rail for Horizontal Mount with AMS EZ 1000 Converter snapped on a mounting rail



A. Mounting rail, type NS 35/7.5

B. DIN Rail for Horizontal Mount adapter including AMS EZ 1000 Converter(s)

5.3 Hints for installation and connection

To ensure the electromagnetic compatibility of the eddy current measuring chain, Emerson recommends using a double shielded twisted pair cable for connecting the AMS EZ 1000 Converter to the measuring amplifier, for example to an A6500-UM Universal Measurement Card of the AMS 6500 ATG system. For direct connections to the converter, LiYCY-CY 2x2x0.25 mm² or equivalent cables are preferred. Master connection cable may be any multicore cable with a corresponding cable structure. Emerson recommends connecting the outer cable shield to protective earth/measuring ground close to the measuring amplifier directly at the cable inlet of the control cubicle. Moreover, connect the outer cable shield to protective earth as often as possible, for example, at every intermediate distribution frame or cable gland.

A higher electromagnetic compatibility can be achieved by connecting the cable shield to protective ground at either end of the cable – provided that no ground loop current (equalizing current) occurs.

The maximum cable length, for installation in non-hazardous locations, between an converter and a measuring amplifier, such as an A6500-UM card, depends on the electrical properties of the used cable. [Figure 5-11](#) explains the influence of the used cable on the output signal of the converter. The signal frequency has the most significant influence on the maximum cable length. The higher the signal frequency and the longer the cable, the higher the signal damping.

Table 5-1: Permissible wire cross-section

Wire description	Wire cross-section	
	Minimum	Maximum
Conductor cross section solid	0.34 mm ²	2.5 mm ²
Conductor cross section flexible	0.2 mm ²	2.5 mm ²
Conductor cross section flexible, with ferrule without plastic sleeve	0.25 mm ²	2.5 mm ²
Conductor cross section flexible, with ferrule with plastic sleeve	0.25 mm ²	2.5 mm ²
Conductor cross section AWG	24	12
2 conductors with same cross section, solid	0.2 mm ²	1 mm ²
2 conductors with same cross section, stranded	0.2 mm ²	1.5 mm ²
2 conductors with same cross section, stranded, ferrules without plastic sleeve	0.25 mm	1 mm ²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve	0.5 mm ²	1.5 mm ²
AWG according to UL/CUL	30	12

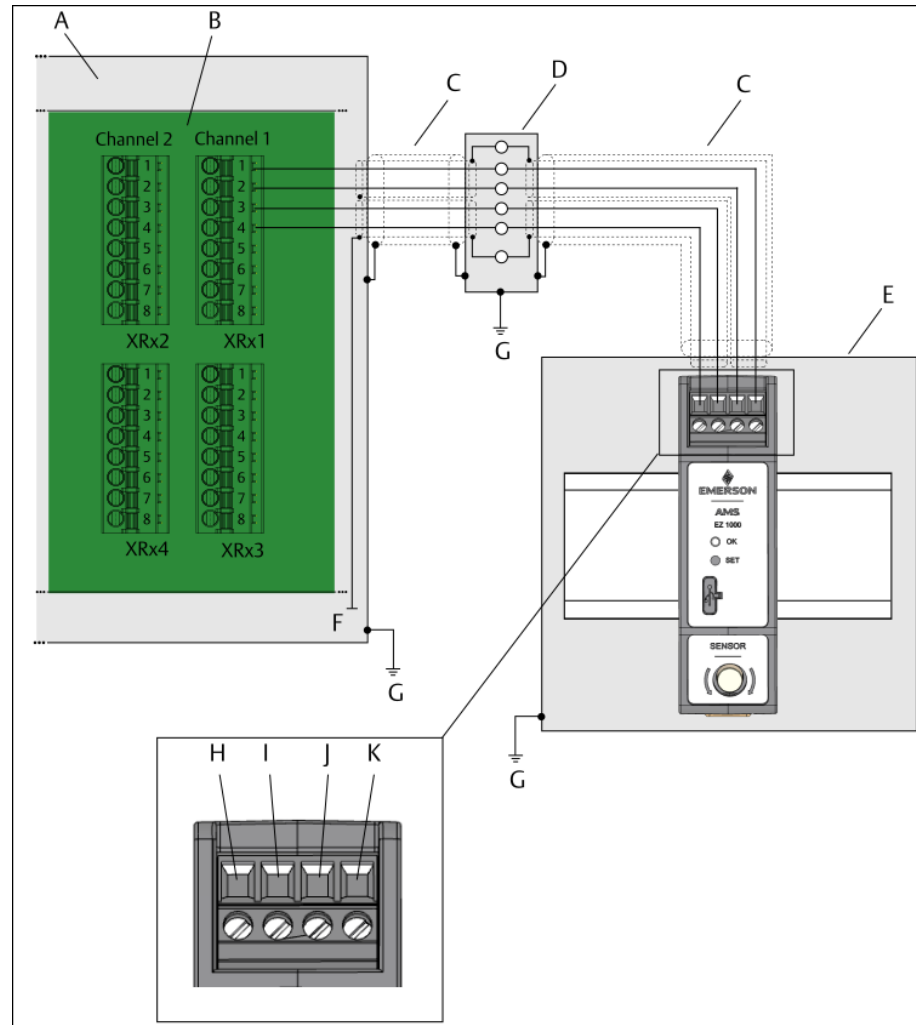
The required wire stripping length is 10 mm.

Power supply and output signal connection

The AMS EZ 1000 Converter requires a -24 V DC power supply and is typically supplied by the used measuring amplifiers such as an A6500-UM Universal Measurement Card. Usage of a suitable external power supply is also possible.

If using an external power supply, ensure that it is a Class 2 power supply or a Limited Energy source in accordance to CSA 61010-1-12.

[Figure 5-12](#) exemplifies the connection of an AMS EZ 1000 Converter. The shown grounding concept is one possibility. Adapt the grounding concept to the on-site requirements.

Figure 5-12: Connection example


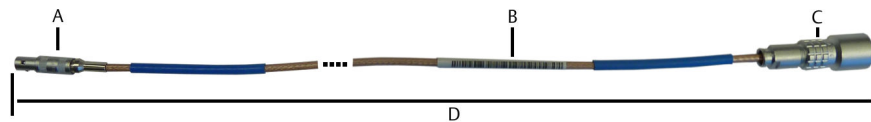
- A. Cabinet
- B. Rear view of a slot of an AMS 6500 ATG backplane (x = slot number).
- C. Double shielded and twisted pair cable, for example LiYCY-CY 2x2x0.25mm²
- D. Junction box
- E. Field housing with AMS EZ 1000 Converter
- F. Shield earth
- G. Protection earth
- H. Screw terminal for power supply: -24 V
- I. Screw terminal for power supply: $\perp$ (GND)
- J. Screw terminal for output signal: $\perp$ (GND)
- K. Screw terminal for output signal: Out

Sensor connection

The following sensor types can be connected.

- EZ105x-xx-xx-xxx and EZ108x-xx-xx-xxx
 - PR 6424/0xx-xx0, PR 6425/010-1x0, and PR 6426/0x0-xx0
- The sensor adapter EZ1900-003-ADAP-1 is required for the connection of these sensors.

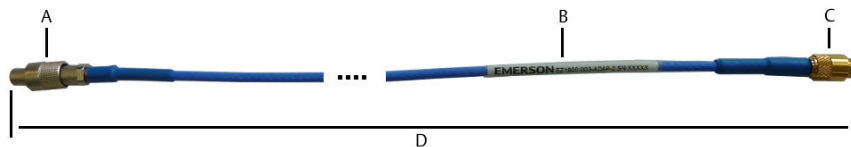
Figure 5-14: Sensor adapter EZ1900-003-ADAP-1



- A. Connector to the AMS EZ 1000 Converter (without cap nut)
 - To connect, plug the connector into the sensor socket. The connector locks with an audible click.
 - To unlock, pull the connector out of the sensor socket.
- B. Label
- C. Connector to PR 6424/0xx-xx0, PR 6425/010-1x0, or PR 6426/0x0-xx0
- D. Total adapter length: approximately 365 mm

- Bently Nevada 3300 XL 8 mm Proximity Probes 33010x.
- The sensor adapter EZ1900-003-ADAP-2 is required for the connection of 33010x probes.

Figure 5-15: Sensor adapter EZ1900-003-ADAP-2



- A. Connector to the AMS EZ 1000 Converter
See [Connect](#) and [Disconnect](#) for how to use the connector.
- B. Label
- C. Connector to BN 33010x
- D. Total adapter length: approximately 365 mm

The sensor socket of the converter is a mini LEMO socket with an external thread to secure the sensor against unintentional removing.

EZ1900-ADAP-90 adapter for EZ108x-xx-xx-xxx

Use the EZ1900-ADAP-90 adapter, shown in [Figure 5-16](#), to connect an EZ108x-xx-xx-xxx sensor to an AMS EZ 1000 Converter mounted in a housing with limited space in depth. See [Figure 5-17](#) for dimensions.

Also, use AMS Machine Studio to get an overview of the converter state. See [Online View](#) for details.

10.3 Replace an AMS EZ 1000 Converter

It is not possible to repair a defective AMS EZ 1000 Converter. In case of defects, the converters must be replaced. Follow the steps listed below if an AMS EZ 1000 Converter needs to be replaced.

⚠ CAUTION

Any work on the system may impair machine protection.

Procedure

1. Save the AMS EZ 1000 Converter configuration, if possible.
 - a) Connect the configuration device (PC/Laptop) through the USB connection to the AMS EZ 1000 Converter.
 - b) Switch on the power supply of the converter to be replaced – if not already done.
 - c) Start AMS Machine Studio. The software automatically connects to the AMS EZ 1000 Converter and opens the online view of the converter.
 - d) Click **Configure** to open the configuration of the AMS EZ 1000 Converter.
 - e) Click **Reload** to load the configuration and the calibration data⁶ from the converter.
 - f) Save the configuration file including the calibration data⁶. Go to **File**, and select **Save as**.
 - g) Go back to the editor and close it. Do not close AMS Machine Studio.
 - h) Switch off the power supply.
2. Disconnect all wires from the AMS EZ 1000 Converter including sensor and USB cable.
3. Remove the AMS EZ 1000 Converter from the mounting rail.
4. Install the new AMS EZ 1000 Converter.
5. Reconnect all wires including sensor and USB cable.
6. Switch on the power supply.

The converter will automatically be detected by AMS Machine Studio.
7. Load the configuration file including the calibration data⁶ from the memory of the configuration device to the AMS EZ 1000 Converter. If a defect prevents reading the configuration from the AMS EZ 1000 Converter to be replaced, use a back-up configuration file or create a new configuration.
 - a) Click the new AMS EZ 1000 Converter to open the online view.

⁶ Only configuration files of measuring chains calibrated with the **Manual calibration** method contains reusable calibration data.

11 Technical data

Only specifications with indicated tolerances or limit values are binding. Data without tolerances or without error limits are informative data and not guaranteed. Technology is under constant development, and specifications are subject to change without notice. If not otherwise specified, all data refer to a nominal supply voltage of -24 V, an environmental temperature of +23°C, an output load of 100 kΩ, material 42CrMo4, a standard measuring range, a 5 meter system cable length⁷, and no detuning.

All technical data is based on Emerson reference target material samples.

11.1 Input

Sensor connector for eddy current sensors	EZ105x and EZ108x
	PR 6424, PR 6425, and PR 6426
	Third party sensors which meet the technical requirements of the sensor input such as: Bently Nevada 3300 XL 8 mm Proximity Probes 33010x-xx-xx-yy ¹ -xx-xx
Connector	For plugs with or without cap nut.
Protection against short circuit	Yes

¹ yy: 10, 50, or 90

11.2 Supply

Overvoltage protection	Yes, maximal voltage -60 V DC
Reverse connect protection	Yes
Nominal supply voltage	-24 V
Permissible voltage range	-19 V to -31.2 V DC
Nominal supply current	12 mA
Load resistor	100 kΩ

11.3 Output

Short-circuit prove	Yes
Nominal output voltage range	-2 V to -18 V
Limit range	-1.1 V to -22.4 V
Nominal frequency range	0 to 20 kHz (-3 dB) without cable capacity

⁷ Sensor cable length or sensor cable length plus extension cable length.

Supply voltage influence on the output signal	<20 mV/10 V
Output voltage ripple	<10 mV rms
Output resistance	200 Ω
Signal switch-on time and converter warm-up-time	See Table 11-1

Table 11-1: Influence of the signal switch-on-time and the converter warm-up-time on the linearity

Signal switch-on-time ¹	Converter warm-up-time ²	Linearity error
60 seconds ³		<0.1%
	<10 minutes ⁴	<1.5%
	<60 minutes ⁴	<0.5%
	>60 minutes ⁴	<0.1%

¹ Valid for a restart after the AMS EZ 1000 measuring chain has been in operation for at least 60 minutes.

² Valid for the operation a complete measuring chain (converter + connected sensor)

³ Time until output signal change.

⁴ Signal change within this time.

11.4 Errors and tolerances

Note

For measurements that require a higher measuring accuracy, factory calibrated measuring chains are available.

The deviation from straight line (DSL) error is the maximum error (in mm) in the sensor gap reading at a given voltage compared to a straight line (see [Table 11-2](#)). DSL errors are associated with errors in axial position or sensor gap readings.

The incremental scale factor (ISF) error is the maximum amount the scale factor varies from a default scale factor (see [Table 11-2](#)) when measured at specified increments throughout the linear range. Measurements are taken at defined increments (see [Table 11-2](#)). The ISF error is associated with errors in radial vibration readings.

Table 11-2: DSL and ISF default values depending on sensor type and output sensitivity setting

Sensor type	Extended range factor	Straight line and default scale factor		ISF incremental steps	Recommended dynamic measuring range peak-peak
		ISO ¹	API ¹		
EZ105x	1.0	16.0 V/mm	15.74 V/mm	125 μ m	$\leq 625 \mu$ m
	1.5	10.67 V/mm	10.59 V/mm	---	---
	2.0	8.0 V/mm	7.87 V/mm	---	---

Table 11-16: Sensor temperature inaccuracies (continued)

Measuring range	Temperature range	Additional DSL ¹
	-35°C to +150°C (Operating range sensor)	-34.0%/+14.0%

¹ Maximum linearity errors for all cable lengths and mentioned maximum temperatures. Linearity errors for specific cable lengths and lower temperatures may be lower. Contact support for details.

11.5 Environmental conditions and mechanical design

The measuring chain is designed for industrial applications and may be used in heights of up to 2000 m above sea level.

The application environment must be verified not to exceed the environmental specifications listed in the operating manual of each part of the measurement chain.

Environmental temperature	
Reference value	+23°C
Nominal operating range	-35°C to +85°C
Limits for storage and transport	-35°C to +85°C
maximal Vibration	5 g at 60 Hz
Humidity	5 to 95%, non-condensing Additional linearity error of ±0.2% for EZ 105x and EZ 108x with 5 meter sensor cable and standard measuring range at 10 to 100 % relative humidity (rh), condensing.
Airborne contaminants resistance	ISA-S71.04-1985 class G3 Deviation of linearity error <1%
Dimensions	Height: 90mm Width: 26mm Depth: 75mm See also Mounting
Weight	Approximately 160 g



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