

Machinery Health™ Sensor

CON 041, Converter for PR 642x Eddy Current Sensors



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Patents

The product(s) described in this manual are covered under existing and pending patents.



Vermerk zur Installation der Messketten in explosionsgefährdeter Umgebung.

Soll die Messkette in explosionsgefährdeter Umgebung installiert werden, so ist auf die Einhaltung der in der Gebrauchsanweisung enthaltenen Installationshinweise zu achten. Sollten dabei sprachliche Schwierigkeiten auftreten, wenden Sie sich bitte an die Herstellerfirma, sie wird Ihnen eine Übersetzung der relevanten Artikel in der Landessprache des Verwendungslandes zukommen lassen.



Nota fuq l-installazzjoni tal-ktajjen tal-kejl f'ambjent esploziv

Jekk il-katina tal-kejl suppost li tigi installata f'ambjent esploziv, hu importanti li ssegwi l-istruzzjonijiet pertinenti tal-manwal. Jekk issib xi diffikultà bil-lingwa, jekk joghgbok ikkuntattja lill-manifattur biex tikseb traduzzjoni tal-paragrafi rilevanti fil-lingwa mehtiega.



Anmärkning beträffande installation av mätkedjorna i explosionsfarlig miljö.

Ska mätkedjan installeras i explosionsfarlig miljö, måste de anvisningar följas som ges i instruktionsboken beträffande installationen. Skulle därvid språkproblem uppstå, ber vi dig kontakta det tillverkande företaget som då kommer att sända dig en översättning av de relevanta artiklarna på användningslandets språk.



Opomba za namestitve merilne verige v eksplozivno ogroženem okolju

Če se merilna veriga namešča v eksplozivno ogroženem okolju, je potrebno upoštevati namestitvena opozorila, ki so v Navodilih za uporabo. Če se pri tem pojavijo jezikovne težave, se posvetujte z izdelovalcem; poslali vam bodo prevod ustreznih člankov v jeziku države, kjer se naprava uporablja.



Záznam k inštalácii meracích reťazcov vo výbušnom prostredí

Ak má byť merací reťazec inštalovaný vo výbušnom prostredí, treba dbať na dodržiavanie pokynov k inštalácii, uvedených v návode na použitie. V prípade, že by sa pritom vyskytli jazykové problémy, obráťte sa prosím na výrobcu, ktorý Vám zašle preklad relevantných článkov v jazyku Vašej krajiny.



Nota referente à instalação de cadeias de agrimensur em ambientes potencialmente explosivos

Caso a cadeia de agrimensur deva ser instalada em um ambiente potencialmente explosivo, é imprescindível observar e cumprir as indicações de instalação das instruções de serviço. Caso tenha dificuldades idiomáticas, queira entrar em contato com a firma produtora, esta poderá enviar-lhe uma tradução dos capítulos mais importantes no idioma do país onde o produto deverá ser empregado.



Wskazówka dotycząca instalacji łańcuchów mierniczych w otoczeniach zagrożonych eksplozją.

Jeżeli łańcuch mierniczy ma być zainstalowany w otoczeniu zagrożonym eksplozją, należy uwzględnić wskazówki dotyczące instalacji, które są zawarte w instrukcji obsługi. Jeżeli w trakcie lektury wystąpią jakiegokolwiek problemy związane ze zrozumieniem tekstu, prosimy zwrócić się do producenta, który chętnie wykona tłumaczenie wybranych części dokumentacji na język danego kraju.



Opmerking m.b.t. installatie van elektrische meet circuits in explosiegevaarlijke omgeving

Dient de installatie van elektrische meet circuits in een explosiegevaarlijke omgeving te geschieden, moet men toezien dat de in de gebruikshandleiding opgenomen installatieinstructies worden nageleefd. Bij taalkundige problemen gelieve contact op te nemen met de fabrikant, deze zal u vervolgens een vertaling in de taal van het gebruiksland doen toekomen.



Pastaba dėl matavimo grandinės įrengimo sprogimo atžvilgiu pavojingoje aplinkoje

Jei matavimo grandinė turi būti įrengta sprogimo atžvilgiu pavojingoje aplinkoje, privaloma laikytis vartotojo instrukcijose pateiktų įrengimo nurodymų. Jei kiltų sunkumų dėl kalbos, prašome kreiptis į gamintojo įmonę, kuri pateiks Jums reikiamo skyriaus vertimą į vartotojo valstybės kalbą.



Nota sull'installazione delle catene per misurazione in ambienti a rischio di esplosioni

Nel caso in cui si debbano installare le catene per misurazione in ambienti a rischio di esplosioni, è necessario attenersi alle avvertenze per l'installazione contenute nelle istruzioni d'uso. Per difficoltà di carattere linguistico, rivolgetevi alla ditta produttrice. Quest'ultima Vi farà pervenire una traduzione degli articoli rilevanti nella lingua del paese d'impiego.



Megjegyzés a mérőláncok robbanásveszélyes környezetben történő szereléséhez.

Ha a mérőláncot robbanásveszélyes környezetben kell felszerelni, akkor ügyeljen a Használati útmutatóban közölt szerelési utasítások betartására. Amennyiben nyelvi nehézségek merülnek fel, szíveskedjen a gyártó céghez fordulni, amely elküldni Önnök a felhasználó ország nyelvére lefordított, erre vonatkozó cikket.



Remarque concernant l'installation des chaînes de mesure dans un environnement présentant un risque d'explosion

Si la chaîne de mesure doit être installée dans un environnement présentant un risque d'explosion, il est impératif de veiller à respecter les consignes d'installation contenues dans les instructions de service. S'il devait ce faisant surgir des problèmes linguistiques, veuillez vous adresser à la société fabricante: elle vous fera parvenir une traduction des articles significatifs dans la langue du pays de mise en oeuvre.



Huomautus mittausketjun asentamisesta räjähdysalttiissa ympäristössä

Jos mittausketju tulee asentaa räjähdysalttiissa ympäristössä, on käyttöohjeessa annettu asennusohjeita noudatettava. Jos käyttöohjeessa käytetty kieli aiheuttaa ongelmia, kääntykää valmistajayrityksen puoleen. Se toimittaa käyttöönne tarvittavat artikkelit käyttömaan viralliselle kielelle käännettynä.



Juhend mõõdukettide ülespanemiseks plahvatusohtlikus piirkonnas.

Kui panna üles mõõdukettid plahvatusohtlikkus piirkonnas, nii tuleb jälgida kasutusjuhendis sisaldatud instalationimärkmeid. Juhul kui tekkivad raskused keelega, siis pöörduge palun tootja poole. Tootja saadab emakeelse tõlge vastavalt artiklile ning maale.



Notas sobre la instalación de cadenas de medición en un entorno potencialmente explosivo.

Si ha de instalar la cadena de medición en un entorno potencialmente explosivo, deberá respetar las indicaciones sobre la instalación, contenidas en el manual de uso. Si surgieran dificultades lingüísticas, póngase en contacto con la empresa fabricante, que le facilitará una traducción del artículo en la lengua del país donde se emplee.



Note on the installation of the measuring chains in an explosive environment

If the measuring chain is supposed to be installed in an explosive environment, it is important to follow the pertinent installation instructions in the manual. Should you encounter difficulties with the language, please contact the manufacturer to obtain a translation of the relevant paragraphs into the language required.



Σημείωση για την εγκατάσταση αλυσίδων μέτρησης σε περιβάλλον, στο οποίο υπάρχει κίνδυνος έκρηξης
Εάν η αλυσίδα μέτρησης πρόκειται να εγκατασταθεί σε περιβάλλον, στο οποίο υπάρχει κίνδυνος έκρηξης, πρέπει να τηρηθούν οπωσδήποτε οι οδηγίες εγκατάστασης που περιλαμβάνονται στις οδηγίες Χρήσης. Εάν υπάρξουν γλωσσικές δυσκολίες καταούησης, παρακαλούμε να απευθυνθείτε στην κατασκευάστρια εταιρεία, η οποία θα φρουτίσει για την αποστολή μιας μετάφρασης των σχετικών άρθρων στη γλώσσα της Χώρας Χρήσης.



Info vedrørende installation af målekæderne i eksplosionstruede omgivelser
Hvis målekæden skal installeres i eksplosionstruede omgivelser, skal installationsanvisningerne i brugsanvisningen følges. Hvis der i denne forbindelse opstår sproglige problemer, bedes De henvende Dem til produktionsfirmaet, som så vil sørge for, at De modtager en oversættelse af den relevante artikel på Deres sprog.



Poznámka k instalaci měřicích řetězců v prostředí s nebezpečím výbuchu.
Když má být měřicí řetězec (sestavající z čidla a konvertoru) instalován v prostředí s nebezpečím výbuchu, tak je třeba respektovat instalační pokyny, které jsou součástí návodu k upotřebení. Kdyby při tom došlo k jazykovým potížím, tak prosíme kontaktujte výrobní firmu, která Vám relevantní článek zašle v jazyku krajiny použití.



Piezīme par mērīšanas ķēžu instalēšanu sprādziena bīstamās zonās.
Ja mērīšanas ķēde jāuzstāda sprādzienbīstamā zonā, ir jāievēro lietošanas instrukcijā dotie instalēšanas norādījumi. Ja rodas kādas valodas grūtības, lūdzu griezties pie izgatavotāja firmas, kas Jums nosūtīs nozīmīgāko nodaļu tulkojumus lietotāja valsts valodā.

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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 CON 041 and CON 041/... Converters with serial number 20xx/07-xxxxxx (hardware revision 07). See type plate for serial number.

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

Note

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

Table 1-1 shows a list of documents that are referred to in this operating manual.

Table 1-1: Referenced documents

MHM-97866	Installation Guide PR642x, Eddy Current Sensors
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1.2 Symbols

Note

This symbol marks passages that contain important information.

⚠ CAUTION

This symbol marks operations that can lead to malfunctions or faulty measurements, but will not damage the device.

⚠ DANGER

A danger indicates actions that can lead to property damage or personal injury.

	According to IEC 61010, this symbol means that this device must be operated with DC voltage.
	According to IEC 61010, this symbol means that the documentation of the device must completely be read and understood before installing and commissioning of the device. Observe all safety related instructions in this document.

1.3 Liability and guarantee

Emerson is not liable for damages that occur due to improper use. Proper use also includes the knowledge of, and compliance with, this document.

Customer changes to the device that have not been expressly approved by Emerson will result in the loss of guarantee.

Due to continuous research and further development, Emerson reserves the right to change technical specifications without notice.

1.4 Incoming goods inspection

Check the content of the shipment to ensure that it is complete; visibly inspect the goods to determine if the device has been damaged during transport. The following parts are included in the scope of delivery and must be contained in the shipment.

- CON 041 or CON 041/... Converter
- Installation guide

If the contents are incomplete, or if you observe any defects, file a complaint with the carrier immediately. Inform the responsible Emerson sales organization so your device can be replaced. In this case, attach a tag with customer name and the observed defect.

1.5 Technical support

You may need to ship this product for return, replacement, or repair to an Emerson Product Service Center. Before shipping this product, contact Emerson Product Support to obtain a Return Materials Authorization (RMA) number and receive additional instructions.

Product Support

Emerson provides a variety of ways to reach your Product Support team to get the answers you need when you need them:

Phone	Toll free 1 800 833 8314 (U.S. and Canada) +1 512 832 3774 (Latin America) +63 2 8702 1111 (Asia Pacific, Europe, and Middle East)
Email	Guardian.GSC@Emerson.com
Web	http://www.emerson.com/en-us/contact-us

To search for documentation, visit <http://www.emerson.com>.

To view toll free numbers for specific countries, visit <http://www.emerson.com/technicalsupport>.

Note

If the equipment has been exposed to a hazardous substance, a Material Safety Data Sheet (MSDS) must be included with the returned materials. An MSDS is required by law to be available to people exposed to specific hazardous substances.

1.6 Storage and transport

Store and transport the device only in its original packaging. Technical data specifies the environmental conditions for storage and transport.

Related information

[Technical data](#)

[Input](#)

[Supply](#)

[Output](#)

[Errors and tolerances](#)

[Thermal response converter \(absolute deviation\)](#)

[Temperature influence on sensitivity](#)

[Environmental conditions](#)

1.7 Disposal of the device

Provided that no repurchase or disposal agreement exists, recycle the following components at appropriate facilities:

- Recyclable metal
- Plastic elements

Sort the remaining components for disposal, based on their condition. National laws or provisions on waste disposal and protection of the environment apply.

Note

Environmental hazards! Electrical waste and electronic components are subject to treatment as special waste and may only be disposed by approved specialized companies.

1.8 China RoHS Compliance

Our products manufactured later than June 30, 2016, and those which are sold in the People's Republic of China are marked with one of the following two logos to indicate the Environmental Friendly Use Period in which it can be used safely under normal operating conditions.

Products that do not have the following marking were either manufactured before June 30, 2026, or are not electrical equipment products (EEP).



Circling arrow symbol with "e": The product contains no hazardous substances over the Maximum Concentration Value and it has an indefinite Environmental Friendly Use Period.



Circling arrow symbol with a number: This product contains certain hazardous substances over the Maximum Concentration Value and it can be used safely under normal operating conditions for the number of years indicated in the symbol. The names and contents of hazardous substances can be found in chapter "Certificates".

1.9 CCC Certification – Eddy current measuring chains

With the announcement of the Chinese market regulation authority SAMR (State Administration for Market Regulation), a Compulsory Product Certification (CCC certification) is mandatory for many explosion protection products. This explosion proof ("Ex") product complies to the CCC obligation and is certified (certification number: 2020322315002448).



This China Compulsory Certificate mark (CCC), is a compulsory safety mark for many products imported, sold, or used in the Chinese market and indicates that the product is certified in accordance to GB/T 3836.1-2021 and GB/T 3836.4-2021. If the product label is too small to contain the CCC certification mark it is sufficient to have the mark printed on the minimum package and in the attached document.

1.10 Installation awareness

Note

When planning a measurement, follow these guidelines:

- Consider environmental conditions which might have an influence on the measurement such as temperature, humidity, substances aggressive to the sensor, and pollution.
- Always use a stiff and vibration-free sensor holder.
- Define a suitable measuring range, not larger than necessary, in consultation with the operator of the plant.
- Define the trip limit in consultation with the operator of the plant.
- Take measurement deviations into account when defining trip limits.
- Use a sensor that meets the requirements of the defined measuring range.
- Ensure an EMC-compatible installation including the use of proper cables.
- Ensure proper function of the measurement before activating the measurement in the production environment.

2 Safety instructions

To ensure safe operation, carefully follow all the instructions in this manual.

The correct and safe use of this device requires that both operating and service personnel understand and comply with general safety guidelines and observe the special safety comments listed in this manual. Where necessary, safety-sensitive points on the device are marked.

DANGER

Because the device is electrical equipment, only specially trained and authorized personnel may commission, service, and maintain this equipment.

2.1 Using the device

Install and use the device as specified in this manual.

If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

2.2 Owner's responsibility

If there is a reason to suspect that hazard-free operation, and thus, adequate machine protection is no longer possible, take the device out of operation and safeguard it from unintentional operation. This is the case:

- if the device shows visible damage.
- if the device no longer works.
- after any kind of overload that has exceeded the permissible limits (see technical data of the device for permissible limits).

DANGER

If device tests have to be completed during operation or if the device has to be replaced or decommissioned, it will impair the machine protection and may cause the machine to shut down. Make sure to deactivate machine protection before starting such work, and reactivate it after work has been completed.

Related information

[Technical data](#)

[Input](#)

[Supply](#)

[Output](#)

[Errors and tolerances](#)

[Thermal response converter \(absolute deviation\)](#)

[Temperature influence on sensitivity](#)

Environmental conditions

2.3 Radio interference

The device is carefully shielded and tested to be technically immune to radio interference and complies with current standards. However, if you operate this device together with other peripheral devices that are not properly shielded against radio interference, disturbances and radio interferences may occur.

2.4 ESD safety

DANGER

Internal components can be damaged or destroyed due to electrostatic discharge (ESD) during the handling of the device.

Take suitable precautions before handling the device to prevent electrostatic discharges through the electronics. Such measures might include, for example, wearing an ESD bracelet. Transport and storage of electronic components may only be made in ESD-safe packaging.

Handle the device with particular care during dry meteorological conditions with relative humidity below 30% as electrostatic discharges can occur more frequently.

3 Application and design

3.1 Application

The CON 041 Signal Converter in combination with sensors of type PR 6422 to PR 6426 form eddy current measuring chains to be used for static and dynamic distance measurements at all kinds of rotating machinery. This means that slow axial displacements as well as 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.

Sensors and signal converters are adjusted together and are delivered as complete measuring chains in order to achieve a maximum accuracy. For this reason it is important to always operate sensors and converters together. The type of the sensor and its serial number are marked on the type plate of the converter.

The characteristics of the measuring chain are adapted to the material mainly used for turbo machinery (reference material: 42 Cr Mo 4, according to SAE 4140). The standard adjustment of the measuring chains is generally related to this material – if necessary, other materials can be used for the adjustment (see installation guide PR 642x, Eddy Current Sensors). During installation at the machine only the distance between the head of the sensor and the measuring target are to be adjusted. Criterion for the adjustment of the sensor is the output signal of the converter.

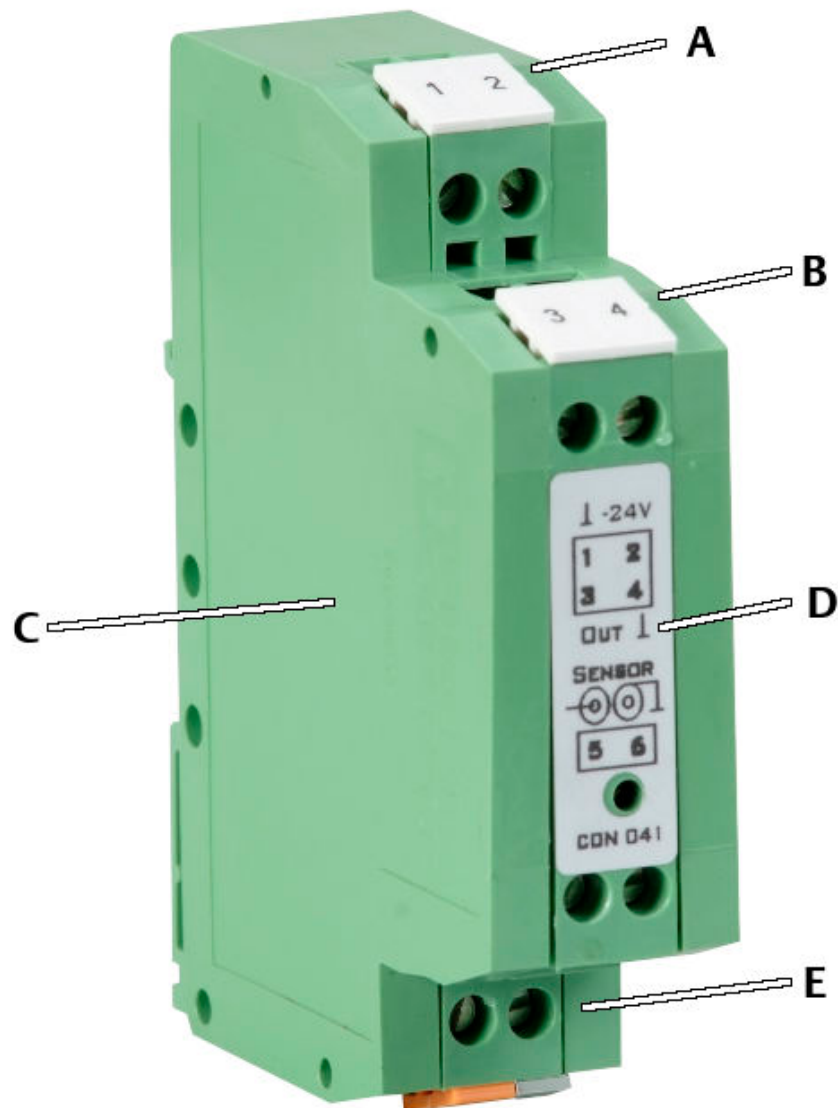
Supply circuits for the eddy current sensor and the measuring electronic are contained in the converter. The nominal supply voltage for the converter is -24 V DC, the nominal range of the output signal, proportional to the nominal measuring range of the sensor, may be set to either -4 to -20 V or -2 to -18 V. The output voltage of converters for special measuring ranges (CON 041 / 91x-xxx) have a firmly adjusted range of -4 to -20V.

Five eddy current probes are at disposal. The actual type to be used depends on the measuring range, on the available space for measuring and on the environmental temperature.

3.2 Design

The CON 041 Converter is accommodated in a housing for din rail mounting. Connection of the eddy current sensor, signal output, and converter supply is made by screw terminals. See [Figure 3-1](#) and [Figure 3-2](#) for details.

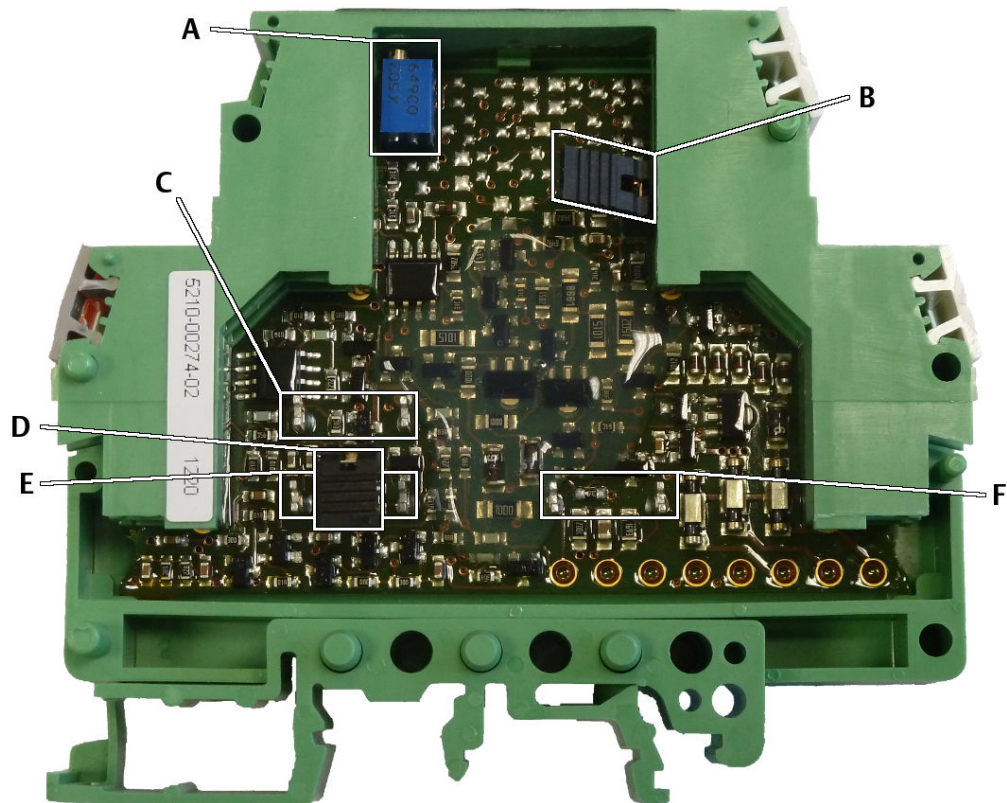
Figure 3-1: CON 041 Converter



- A. Screw terminals for voltage supply (-24 V DC)
- B. Screw terminals for sensor signal
- C. Place for label
- D. Label with screw terminal description

- E. Screw terminal for sensor connection (wires of the sensor cable has the same colors as the terminals)

Figure 3-2: Open CON 041 Converter



- A. Calibration element: Potentiometer for fine tuning - accessible via the converter front
B. Jumper for change of voltage output range (-2 to -18 V or -4 to -20 V). Not available for CON 041/91x-xxx converters.
C. Calibration element: Soldering point R24
D. Jumper for change of oscillator frequency.
E. Calibration element: Soldering point R22 (gain)
F. Calibration element: Soldering point R23 (zero point)

3.3 Functional safety

Measuring chains consisting of a converter of type CON 041/SF or CON 041/91x-xxx/SF with a sensor of type PR 6422, PR 6423 or PR 6424 may be used for safe generation of electric signal pulses for, for example, speed measurement and meets the SIL2 requirements according to IEC 61508:2010 with systematic qualification for SIL3.

Note

All safety related information, characteristics and requirements for achieving and preserving the functional safety according to IEC 61508 can be only found in the

respective safety manual “MHM-97853 Safety Manual Eddy Current Measuring Chain for Signal Pulse Generation”.

Converter of type CON 041/SF and CON 041/91x-xxx/SF can be used in hazardous areas according to the information in [Explosion proof installation](#).

The permissible ambient temperature range for operating SF converters is -35°C to +65°C.

3.4 CSA - Conditions of acceptability

- Converter shall be powered by 24 V DC supply double or reinforced from isolated from mains and with a maximum available current of 8 A.
- The converter is evaluated for a maximum ambient temperature of -30°C to +85°C. This is only valid for non-hazardous areas.

4 Function principle

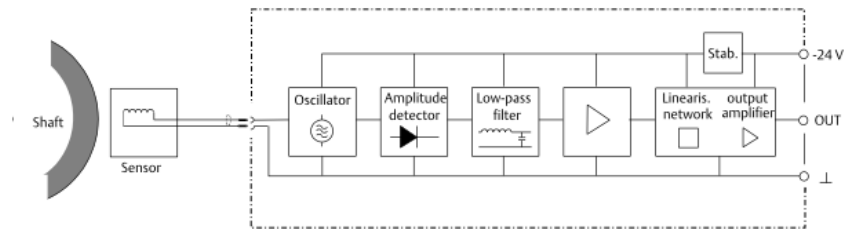
The measuring coil of the eddy current sensors PR 6422 to PR 6426 is connected to an oscillator circuit in the converter through a screened connection cable (see [Figure 4-1](#)).

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

The damping factor depends on the distance between sensor head 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 low frequent 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 $\perp$ provide a signal proportional to the actual distance between sensor head and target material (measurement object).

Figure 4-1: Block diagram



5 Extended measuring ranges

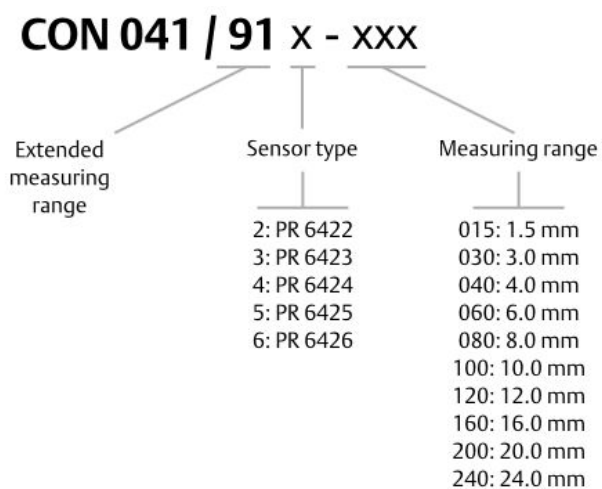
For larger measuring ranges use CON 041/91x-xxx converters. [Table 5-1](#) shows the available extended measuring ranges depending on the used sensor type and the resulting sensitivity of the measuring chain.

Table 5-1: Extended measuring ranges

Sensor	Extended measuring range	Sensitivity
PR 6422	1.5 mm	-10.67 V/mm
PR 6423	3.0 mm	-5.33 V/mm
	4.0 mm	-4.0 V/mm
PR 6424 and PR 6425	6.0 mm	-2.67 V/mm
	8.0 mm	-2.0 V/mm
	10.0 mm	-1.6 V/mm
PR 6426	12.0 mm	-1.33 V/mm
	16.0 mm	-1.0 V/mm
	20.0 mm	-0.8 V/mm
	24.0 mm	-0.67 V/mm

The output voltage range of converters with extended measuring range is generally -4 V to -20 V. The jumper for changing the output voltage range is missing at converters with extended measuring range because of the fixed output voltage range (see [Figure 3-2](#)). See [Figure 5-1](#) for decoding of the converter designation.

Figure 5-1: Designation of converter with extended measuring range



Note

Converter with extended measuring range and the addition “SF” in the label have an extended measuring range of maximal twice the standard measuring range.

6 Installation and commissioning

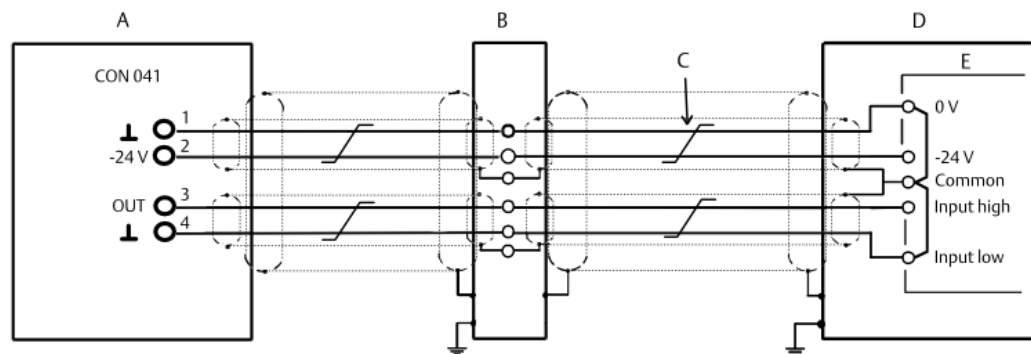
6.1 Hints for installation and connection

To ensure the electromagnetic compatibility of the eddy current measuring chain, Emerson recommends using a double screened twisted pair cable for connecting the signal converter to the measuring amplifier. For direct connections to the converter, preferably use cables of type LiYCY-CY 2x2x0.25 mm². Master connection cable may be any multicore cable with a corresponding cable structure. Emerson recommends to connect 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.

If only cables of type LiYCY-CY 2x2x0.25mm² are used, the maximum cable length is 400m. If longer cables are used set an intermediate distributor close to the converter and use cables with a higher cross section for connection to the measuring amplifier (for example LiYCY-CY n x2x1.5 mm²).

- Install measuring cables according to general standards for measuring and control cables. If possible, install cables in metallic cable channels or tubes. Observe that the measuring cables are arranged orthogonally.
- Use preferably cable protection tubes of type MPT 064 for the measuring cable from the transducer. They can be fitted directly to the cable glands of the mounting box.

Figure 6-1: Connection example



- A. CON 041 converter
- B. Junction box
- C. Twisted wires
- D. Control cubicle / Cabinet
- E. Measuring amplifier (for example: protection card)

6.2 Adjustment of measuring chains at the machine

6.2.1 General connection

Procedure

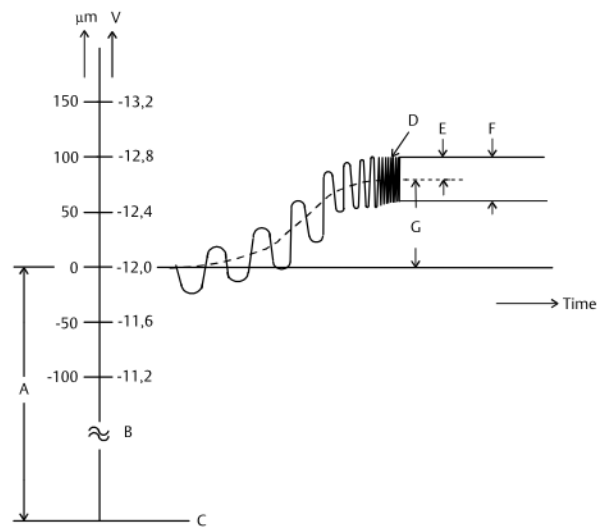
1. Connect the converter supply -24 V DC (+24 V to $\perp$).
2. Fit connector of sensor to converter input.
3. Measure output level at pins OUT and $\perp$.

6.2.2 Sensors PR 6422, PR 6423, PR 6424, and PR 6425

Procedure

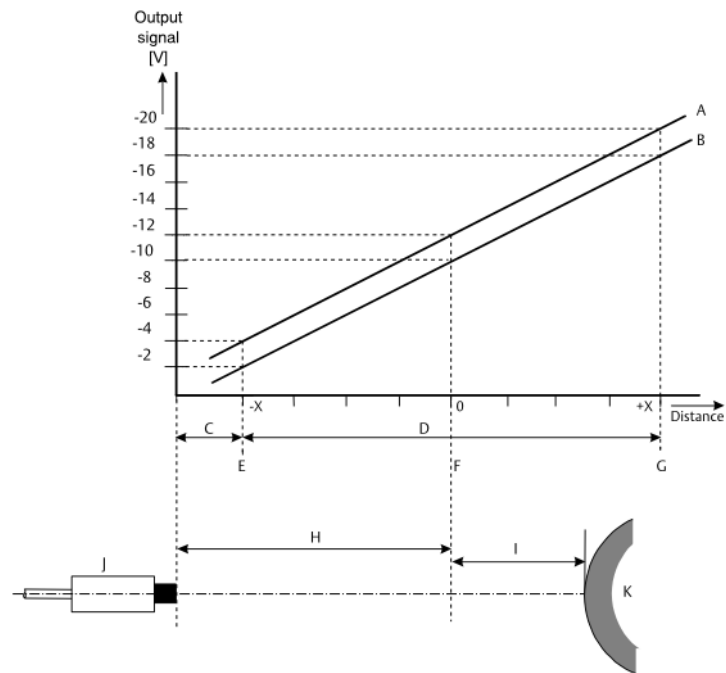
1. Loosen the lock nut from the sensor.
2. Remove the sensor cable to avoid twisting of the cable during mounting and turning the sensor.
3. Turn the sensor in the holder as long as the nominal distance between sensor head and measuring target is reached and the connected voltmeter indicates the desired point on the characteristic curve.
 - For measuring shaft vibrations it is sufficient to adjust the sensor to an output value of $-10\text{V} \pm 1\text{ V}$ (output range -2 V to -18 V) or $-12\text{ V} \pm 1\text{ V}$ (output range -4 V to -20 V). See [Figure 6-2](#).
 - For static measurements a precise adjustment to one output value is required, the sensor is preferably set to one of the three output levels of the converter:
For symmetrical displacements around the center point (see [Figure 6-3, F](#)) to -12 V (-4 V to -20 V) or -10 V (-2 V to -18 V) $\pm 0.05\text{ V}$ (recommended procedure) for the measuring range minimum (= minimum distance) to -4 V (-4 V to -20 V) or -2 V (-2 V to -18 V) $\pm 0.05\text{ V}$ for single-sided movements to greater distances ([Figure 6-3, E](#))
for the measuring range maximum (= maximum distance) to -20 V (-4 V to -20 V) or -18 V (-2 V to -18 V) $\pm 0.05\text{ V}$ for single sided movements to smaller distances. ([Figure 6-3, G](#))
or to any other value within the measuring range when different distances in both directions must be measured.

Figure 6-2: Characteristic curve - dynamic



- A. Nominal distance
- B. Selected voltage range: -4 V to -20 V
- C. Sensor face plane
- D. Shaft vibration signal
- E. 0-to-Peak
- F. Peak-to-Peak
- G. Quasi static displacement

Figure 6-3: Characteristic curve - static



- A. Characteristic curve -2 V to -18 V
- B. Characteristic curve -4 V to -20 V
- C. Basic air gap / zero gap
- D. Working range (-x to +x)
- E. Minimum distance
- F. Center point
- G. Maximum distance
- H. Nominal distance
- I. Instantaneous distance
- J. Sensor
- K. Shaft

4. Fix the sensor by means of the lock nut. The maximum torque is:

PR 6422: 1 Nm (0.1 kpm)

PR 6423: 15 Nm (1.5 kpm)

PR 6424 and PR 6425: 100 Nm (10 kpm)

6.2.3 Sensor PR 6426

If the distance between mounting flange and measuring target is not correct, adjust it by shifting the mounting flange (see PR 642x Installation Guide MHM-97866, chapter "PR 6426 installation"). In order to achieve a precise adjustment, Emerson recommends using

a linear guided support, for example, a bracket with a dovetail guide. Special solutions for the customer's application are available on request.

Procedure

1. Adjust the distance between sensor and measuring target by shifting the bracket, until the converter output signal has reached the required point of the characteristic curve. See [Figure 6-3](#) for details.
2. Fix the mounting flange in the correct position and secure screws and nuts to prevent them from getting loose. Ensure that the sensor is mounted vertically to the measuring target.

6.3 Mutual influences of two measuring chains

Two eddy current measuring chains mounted too close together can influence each other and generate invalid measuring results. This can, for example, occur with shaft vibration measurement (two PR 6423 sensors, mounted in a 90° angle at a shaft with ≤ 100 mm diameter), with shaft displacement measurements with two sensors in tandem arrangements, or with cone or double cone arrangements of two sensors.

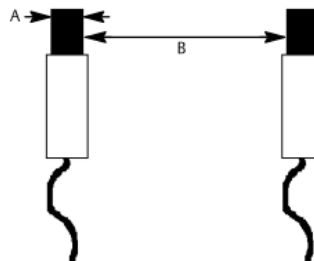
In this case the carrier frequency must be slightly shifted at one of the converters. Open the jumper for changing the oscillator frequency (see [Figure 3-2, D](#)).

Note

Recalibrate the measuring chain after changing the carrier frequency (see [Recalibration of the converter \(only necessary in special cases\)](#)).

Calculate the minimum distance between two sensors based on the sensor head diameter and a factor x (see [Figure 6-4](#)).

Figure 6-4: Minimum distance between two sensors



A. Sensor head diameter

B. Minimum distance between two sensors: $x \cdot \text{Sensor head diameter}$.

[Table 6-1](#) shows the necessary factor x for calculating the minimum distance between sensors at de-tuned (different oscillator frequency) and tuned (identical oscillator frequency) measuring chains depending on the sensor type. The mutual influence at the minimum distance is $<1\%$ of the static measuring range of the measuring chain.

Table 6-1: Factor for distance calculation

Sensor type	Factor x de-tuned	Factor x tuned
PR 6422/xxx-xxx	3	4

Table 6-1: Factor for distance calculation (continued)

Sensor type	Factor x de-tuned	Factor x tuned
PR 6423/xxx-xxx	2.5	3
PR 6424/xxx-xxx	1	2

Example for PR 6423 with sensor head diameter of 8 mm:

Minimum Distance_{de-tuned} = 8 mm * 2.5 = 20 mm

Minimum Distance_{tuned} = 8 mm * 3 = 24 mm

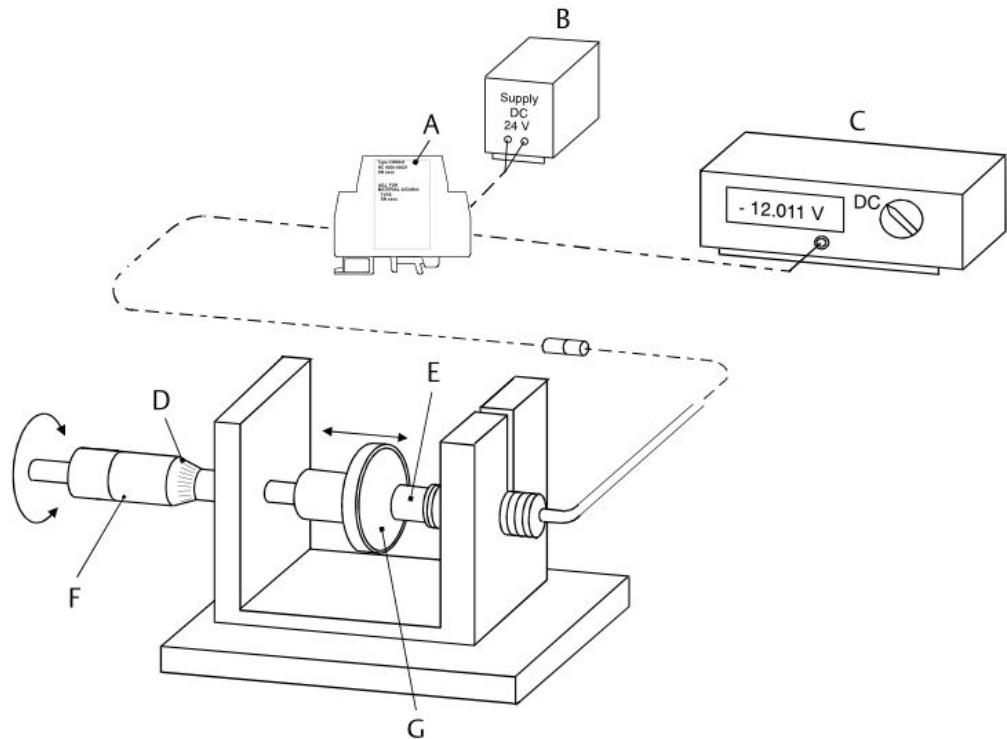
6.4 Recalibration of the converter (only necessary in special cases)

Prerequisites

- Calibration gauge (for example CAL 064) with micrometer screw gauge and material sample that matches the material of the measuring target (machine shaft).
- Multimeter with an accuracy of 1%
- Two resistance decades and connection cables
- Assortment of resistors (resistor series E48, 0.6W, accuracy 1%, temperature coefficient 50, axial leaded - for example, MRS25MBB0207 or SMA0207)
- Soldering iron and tin-solder
- +24V DC power supply
- Screwdriver for screw terminals

Figure 6-5 shows the calibration setup.

Figure 6-5: Setup for recalibration



- A. CON 041 converter
- B. 24 V DC volts power supply
- C. Voltmeter
- D. μm scale
- E. Sensor
- F. Calibration gauge
- G. Measuring object (target)

⚠ CAUTION

Before soldering at the converter, switch off the supply power. In respect to CSA & ATEX conformity, soldering is not approved. If it's necessary anyway, the converter loses its ATEX and CSA conformity.

Note

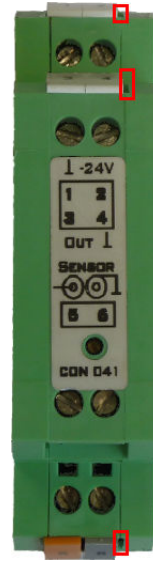
To change the output voltage range from -2 V to -18 V to -4 V to -20 V, open the wire bridge marked with B in [Figure 3-2](#). This action does only change the voltage range without any influence on linearity or adjustment of the measuring chain.

Values in [...] are valid for output voltage range -4 V to -20 V.

Procedure

1. Use the screwdriver to open the converter by gently levering the right housing side. See [Figure 6-6](#) for starting points to open the housing.

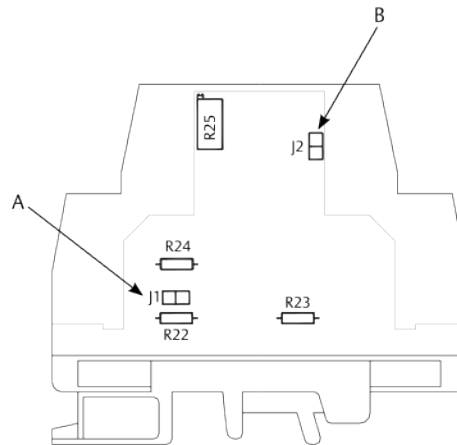
Figure 6-6: Starting points for opening the housing



2. Desolder resistance R22 (gain factor, approximately 0 to 10 k Ω) and R23 (zero point, approximately 10 k Ω to 200 k Ω) and connect resistance decades to these positions. Set potentiometer GAIN (R25) to center position.

Resistance R24 depends on the sensor type: PR 6422 / 6423 / 6425: 4.02 k Ω , PR 6424: 5.62 k Ω , and PR 6426: 10 k Ω . See [Figure 6-7](#) for position of the calibration elements.

Figure 6-7: Position calibration elements



- A. Wire bridge for change of oscillator frequency.
closed: approximately 1.25 MHz
open: +20% / 1.5MHz
- B. Wire bridge for change of voltage output range.
closed: -2 V to -18 V
open: -4 V to -20 V
Not available for CON 041/91x-xxx converters.

3. Set the distance measuring target – sensor head to minimum gap (PR 6423: 500 μm , refer to PR64x Installation Guide for minimum gap of further sensors)
4. Set the output level to -2.00 V [-4.00 V] with potentiometer R23.
5. Set the distance to half of the measuring range (+ minimum gap) (PR 6423: 1500 μm)
6. Calculate difference between output voltage and -10.00 V [-12.00 V] . Adjust output voltage with R22:
 - At $U_{\text{out}} > -10 \text{ V}$ [-12 V] reduce it by twice the difference.
 - At $U_{\text{out}} < -10 \text{ V}$ [-12 V] increase it by twice the difference.

Example

Table 6-2: Voltage adjustment example

	Measured value (at center of the range)	Adjustment value (with decade connected to R22)
$U_{\text{set point}} > -10 \text{ V}$	-10.5 V	-9.5 V
$U_{\text{set point}} < -10 \text{ V}$	-9.0 V	-11.0 V

7. Repeat [Step 3](#) to [Step 6](#) till the optimum accuracy is reached ($\leq 1\%$).
8. Set the distance to full range (+ minimum gap) (PR 6423: 2500 μm)
 - If the output voltage is -18.00 V [-20.00 V] (maximum $\pm 1\%$), the adjustment is correct, continue with [Step 9](#).

- If the output voltage is $< -17.8\text{ V}$ [$< -19.8\text{ V}$] repeat the adjustment with a slightly reduced minimum gap according to [Step 3](#) to [Step 7](#) (for example, PR 6423: $490\text{ }\mu\text{m}$).
 - With output voltages $> -18.2\text{ V}$ [$> -20.2\text{ V}$] repeat the adjustment with a slightly increased minimum gap according to [Step 3](#) to [Step 7](#) (for example, PR 6423: $510\text{ }\mu\text{m}$).
9. If the distances at -2 V , -10 V , and -18 V [-4 V , -12 V , and -20 V] are within the tolerances, check the linearity at intermediate steps -4 V , -6 V , -8 V , and so on.
 10. Set the distance to the full range, and note the output voltage. Solder the resistance values for R22 and R23, found with the decades, as fixed resistors.
After the resistors have cooled down, set the output voltage with potentiometer GAIN (R25) to the value noted before.
 11. Check the linearity according to [Step 9](#).
 12. Close the housing by gently pushing the housing parts together.

7 Maintenance, fault finding, and repair

7.1 Maintenance

During operation, sensors and converter do not require any maintenance.

7.2 Hints for fault finding

⚠ CAUTION

Any work at the system may impair machine protection.

For quick fault finding, Emerson recommends to temporarily connect an identical sensor to the converter. If the head of the sensor is moved to a metallic target, the output voltage of the converter must change from approximately -20 V to -4 V or -18 V to -2 V, depending on the selected converter output voltage range.

The converter output voltage can be an useful indicator for the cause of a faulty measuring chain. Measure the output voltage with a DC voltmeter at the output terminals **OUT** and **GND**. [Table 7-1](#) shows converter output voltages and their possible cause or meaning.

Table 7-1: Meaning of converter output voltages

Converter output voltage		Meaning / Error
Range -2 V to -18 V	Range -4 V to -20 V	
-18 V to -22 V	-20 V to -22 V	Distance between sensor and measuring object (shaft) is too large.
-2 V to -18 V	-4 V to -20 V	Output voltage range. Measuring chain is OK.
-10 V	-12 V	Center of the output voltage range. Measuring chain is OK.
-1 V to -2 V	-1 V to -4 V	Distance between sensor and measuring object (shaft) is too small. Sensor damaged, cable break, or open connection
0 to -1 V	0 to -1 V	Converter is defect. No supply voltage.

Eddy current sensors consist of a low impedance coil; you can use a resistance measurement to detect a break in the sensor cable. It is not possible to detect short circuits or defective coils in eddy current sensors. The cable shield must be isolated from the converter housing, from the metal protection tube, and from the housing of the LEMO connector. A possible error source could be a missing or incorrect shrinkage tube at the adapter between sensor and connection cable (at the protection tube cable in the protection sleeve).

7.3 Repair

It is not possible to repair a defective converter. In case of defects, the signal converters must be replaced. Emerson recommends to return the sensor to the factory to get a precise adjustment for the measuring chain with the new converter. If this is not possible, provide all information stated on the type plate of the converter together with the sensor type, and the material designation of the measuring target to get an equal replacement.

The typical exchange error with substitution of the sensor PR 6423 with 4m sensor cable or of the converter including an reference calibration at an Emerson factory is approximately 1.5% – 2%. Emerson assures a maximum exchange error of 5% related to the measuring range end value. The maximum exchange error can be higher at measuring chains consisting of other sensor types.

8 Technical data

Only specifications with indicated tolerances or limit values are required. 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 stated otherwise, the specifications are valid for the nominal supply voltage of -24V.

8.1 Input

Connection for eddy current sensors. Screw terminals for connection of Emerson sensors PR 6422/xxx-xx0, PR 6423/xxx-xx0, PR 6424/xxx-xx0, PR6424/xxx-xx0, and PR 6426/xxx-xx0.

8.2 Supply

Supply voltage range	-23 to -28 V for output voltage range -4 to -20 V
	-21 to -28 V for output voltage range -2 to -18 V
	-18 to -21 V with reduced output voltage range
Nominal supply current	<15 mA, with 10 kΩ load resistance
Reverse connect protection	Reverse connect protection of all 3 terminals (GND, Output, and -24 V)
Nominal operating frequency	approximately 1.25 MHz
De-adjustment of oscillator for adjacent arrangement of sensors	open Jumper D in Figure 3-2 (delivery state: closed)

8.3 Output

DC voltage with superimposed AC signal corresponding to vibration or displacement of the shaft. Open-circuit and short-circuit proof.

Output voltage range	Jumper B in Figure 3-2 closed: -2 to -18 V (factory setting)
	Jumper B in Figure 3-2 open: -4 to -20 V
	adjusted with 100kΩ load resistance
Limit range	-1 to -22 V (at -24 V supply voltage)
Nominal frequency range	0 to 20 kHz (-3 dB) with C - load = 10 nF
	0 to 15 kHz (-3 dB) with C - load = 20 nF
Rise time	<15 μs, with C - load = 1 nF
Output impedance	approximately 100 Ω
Load resistance	nominal value 100 kΩ (for R = 10 kΩ, error <1%)

8.4 Errors and tolerances

Error of gain factor	<1 % in range 0 to 1000 Hz and with C - load <20 nF
Supply voltage response of output signal	<20 mV/V
Long term drift	0.3 % maximum (in range: -30 to +70°C)
Temperature response - on the average output signal	Thermal response converter (absolute deviation)
Temperature response - on the sensitivity factor	Temperature influence on sensitivity
Interferences	< 10 mV rms with 1nF C - load
Calibration	With soldered resistors and potentiometers in the converter an adjustment on several sensor types and target materials is possible. The adjustment is made at the factory, but may be made by the customer or by a service engineer on site if special adjustment tools are available. See Recalibration of the converter (only necessary in special cases) for the adjustment procedure.

Errors of the measuring chain

These error definitions are related to the nominal measuring range (reference value). Linearity errors are defined as deviations from the linear curve, which crosses the -10 V value (-12 V if jumper D in [Figure 3-2](#) is open) and which gradient is defined by the nominal sensitivity.

Table 8-1: Absolute linearity errors for standard measuring ranges

Sensor type	Linearity error
PR 6422	$\leq \pm 1.5 \%$
PR 6423	$\leq \pm 1 \%$
PR 6424	$\leq \pm 1.5 \%$
PR 6425	$\leq \pm 0$ to -6 %
PR 6426	$\leq \pm 1.5 \%$

[Table 8-2](#) shows absolute linearity errors and sensor temperature influence for extended measuring ranges (CON 041 / 91x-xxx).

Table 8-2: Absolute linearity errors and sensor temperature influence for extended measuring ranges

Sensor type	Measuring range [mm]	Special version	Linearity failure [%]	Temperature failure ¹ [%/10K]	Initial Air Gap [mm] (approximately)
PR 6422	1.5	912-015	± 2.00	± 1.8	0.6
PR 6423	3	913-030	± 1.50	± 1.4	0.8

Table 8-2: Absolute linearity errors and sensor temperature influence for extended measuring ranges (continued)

Sensor type	Measuring range [mm]	Special version	Linearity failure [%]	Temperature failure ¹ [%/10K]	Initial Air Gap [mm] (approximately)
	4	913-040	±2.00	±1.8	1.0
PR 6424	6	914-060	±1.00	±0.7	1.0
	8	914-080	±1.50	±1.4	1.0
	10	914-100	±2.00	±2.6	1.0
PR 6425	4	915-040	±1.50		1.0
	6	915-060	±2.00	±1.5	1.0
	8	915-080	±3.00	±1.7	1.0
	10	915-100	±4.00	±3.0	1.0
PR 6426	12	916-120	±1.50	±2.2	1.5
	16	916-160	±2.00	±2.3	1.5
	20	916-200	±2.50	±2.8	1.5
	24	916-240	±3.50	±3.6	1.5

¹ Maximum temperature failure over the full sensor temperature range.

8.4.1 Thermal response converter (absolute deviation)

Table 8-3 and Table 8-4 show the converter temperature influence on the output voltage of the converter with standard measuring range as well as with extended measuring ranges. All values are based on +23°C. Sensors of type PR 6422 and PR 6426 have been used for completing the eddy current measuring chains. Due to their performance, these sensors set the adjustment range for gain and zero point. The permissible ambient temperature range for operating SF converter is -35°C to +65°C.

Table 8-3: Temperature influence - measurement with PR 6422

Temperature range [°C]	Middle voltage [V]	Output voltage range [V]	Deviation [mV]		
			Measuring Range		
			Standard	2x extended	3x extended ¹
-35 to 10	-12 (-10 ²)		0 / +1200	0 / +1800	0 / +2100
		-4 (-2 ²) to -20 (-18 ²)	0 / +1900	0 / +4300	0 / +6500
		-4 (-2 ²) to -16 (-14 ²) ³	0 / +1500	0 / +2700	0 / +4100
10 to 70	-12 (-10 ²)		±200	+400 / -300	-300 / +300
		-4 (-2 ²) to -20 (-18 ²)	±200	+800 / -500	-900 / +800

Table 8-3: Temperature influence - measurement with PR 6422 (continued)

Temperature range [°C]	Middle voltage [V]	Output voltage range [V]	Deviation [mV]		
			Measuring Range		
			Standard	2x extended	3x extended ¹
		-4 (-2 ²) to -16 (-14 ²) ³	±200	+500 / -400	-800 / +700
70 to 100 ¹	-12 (-10 ²)		+100 / -100	-200 / 0	±200
		-4 (-2 ²) to -20 (-18 ²)	+200 / -100	-500 / +100	-400 / +800
		-4 (-2 ²) to -16 (-14 ²) ³	-100 / 0	-400 / -100	±400

- ¹ The temperature range higher than 70°C as well as the 3x extended measuring range are irrelevant for SF types.
- ² Values in brackets for converter output range -2 V to -18 V.
- ³ Range up to 75 % of the output voltage range as the trigger levels for the speed measurement are generally within this range.

Table 8-4: Temperature influence - measurement with PR 6426

Temperature range [°C]	Middle voltage [V]	Output voltage range [V]	Deviation [mV]		
			Measuring Range		
			Standard	2x extended	3x extended ¹
-35 to 10	-12 (-10 ²)		0 / +1200	0 / +1800	0 / +2100
		-4 (-2 ²) to -20 (-18 ²)	0 / +1900	0 / +4300	0 / +6500
		-4 (-2 ²) to -16 (-14 ²) ³	0 / +1500	0 / +2700	0 / +4100
10 to 70	-12 (-10 ²)		±200	+400 / -300	-300 / +300
		-4 (-2 ²) to -20 (-18 ²)	±200	+800 / -500	-900 / +800
		-4 (-2 ²) to -16 (-14 ²) ³	±200	+500 / -400	-800 / +700
70 to 100 ¹	-12 (-10 ²)		+100 / -100	-200 / 0	±200
		-4 (-2 ²) to -20 (-18 ²)	+200 / -100	-500 / +100	-400 / +800
		-4 (-2 ²) to -16 (-14 ²) ³	-100 / 0	-400 / -100	±400

- ¹ The temperature range higher than 70°C as well as the 3x extended measuring range are irrelevant for SF types.
- ² Values in brackets for converter output range -2 V to -18 V.
- ³ Range up to 75 % of the output voltage range as the trigger levels for the speed measurement are generally within this range.

8.4.2 Temperature influence on sensitivity

Table 8-5 and Table 8-6 show the temperature influence on the sensitivity of the converter with standard as well as extended measuring ranges in the range -35°C to 100°C. The temperature range higher than +70°C is irrelevant for SF types. Sensors of type PR 6422 and PR 6426 have been used for completing the eddy current measuring chains. All values are based on +23°C environmental temperature. The indicated deviation is the deviation from sensitivity in the center of the measuring range.

Table 8-5: Temperature influence on sensitivity - PR 6422

Measuring range	Deviation from sensitivity in [%]					
	-35°C	-15°C	10°C	45°C	70°C	100°C
Standard	-5.60	-0.85	0.49	0.14	-0.43	-1.06
1.5 x extended	-11.80	-5.04	-1.51	1.16	-0.58	-0.42
2.0 x extended	-17.73	-8.02	-2.25	2.57	3.18	1.86
2.5 x extended ¹	-27.47	-14.56	-5.48	4.74	1.73	0.59
3.0 x extended ¹	-38.49	-23.08	-12.39	8.07	4.47	-2.31

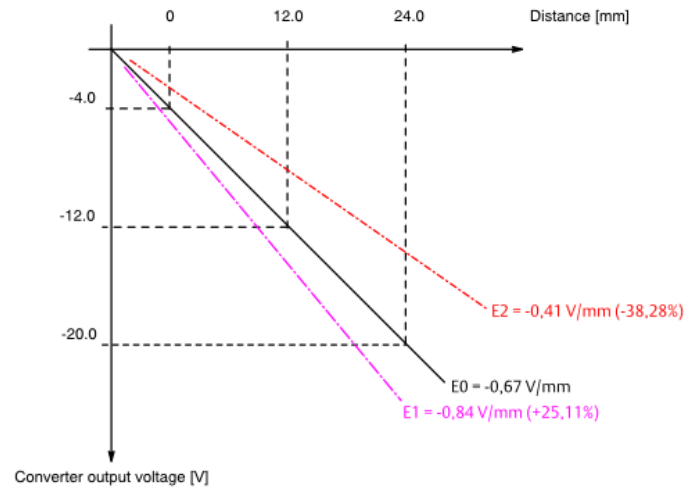
¹ Measuring chains with PR 6422 are not available with extended measuring ranges higher than 2x. This values are available for interpolation between sensors PR 6422 and PR 6426.

Table 8-6: Temperature influence on sensitivity - PR 6426

Measuring range	Deviation from sensitivity in [%]					
	-35°C	-15°C	10°C	45°C	70°C	100°C
Standard	-5.61	-3.44	-0.89	0.31	-0.26	-0.68
1.5 x extended	-11.61	-8.36	-2.94	2.14	1.70	0.85
2.0 x extended	-16.80	-11.82	-2.76	5.80	5.15	7.84
2.5 x extended	-28.90	-21.53	-7.28	8.17	11.71	17.44
3.0 x extended	-38.28	-29.21	-10.55	12.45	19.76	25.11

Figure 8-1 shows, for example, the temperature influence on the sensitivity of a measuring chain with PR 6426 and 3x extended measuring range (0 to 24mm).

Figure 8-1: Temperature influence on the sensitivity - PR 6426 with 0 to 24 mm measuring range



E0: Sensitivity at +23°C environmental temperature.

E1: Sensitivity at +100°C environmental temperature.

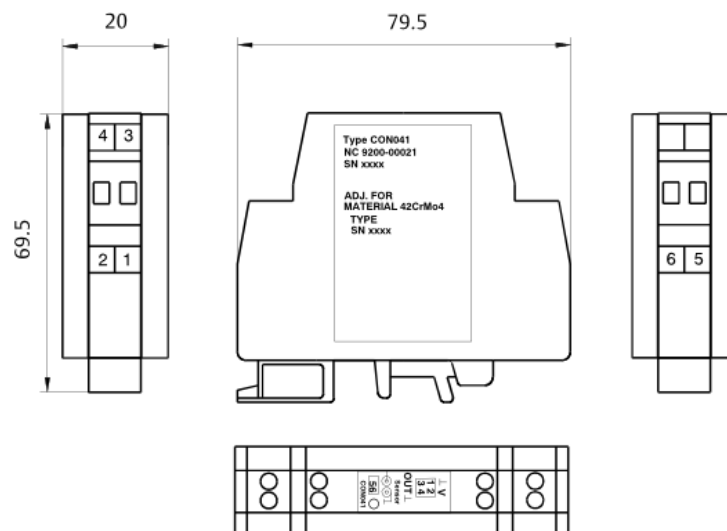
E2: Sensitivity at -35°C environmental temperature.

8.5 Environmental conditions

Temperatures	Reference value	+23°C
	Nominal operating range	-30 to +100°C
	Limit range for operating	-40 to +105°C only for non-Ex-i applications (see Technical data, explosion - proof) except SF types (see Functional safety) except CSA (see CSA - Conditions of acceptability)
	Storage and transport	-40 to +70°C
Relative humidity		0 to 95%, non condensing
Protection class		IP 20
Vibration according to IEC 68-2-6		10 to 60 Hz with $a = 0.35 \text{ mm}$
		60 to 150 Hz with 5 g constant
Shock		40 g for 6 ms according to IEC 68-2-29

CE – compatibility		Test according to: EN 55011(1998) & A1(1999) & A2(2001) (emitted interference) EN 61362(1997) & A1(1998) & A2(2001) & A3(2003) IEC 61326–1:2005 including EN 61000–4–5:2006 (interference resistance). The converter CON041/... meets the specifications mentioned above. The test specifications as setup, test levels, pass criteria, and so on, are described in the document “CON0x1_EMV –Testspezifikationen”. For copies of this document contact Emerson.
Housing	Dimensions	see Figure 8-2
	Material	Polyamide PA6.6
Weight		60 g net weight

Figure 8-2: Dimensions



All dimensions in mm.

9 Explosion proof installation

Version 1.5

⚠ CAUTION

The ATEX and CSA certification is only valid for manufacturer-calibrated converters. Manufacturer-calibrated converters are labeled up with a CSA- and an Ex- conformity sticker. In case that no label is pasted, this converter does not have ATEX and/ or CSA conformity.

⚠ CAUTION

In relation to the nominal supply voltage of the 6000 monitors the nominal voltage of the Ex- barriers with $U_0 = -28V$ is a little bit lower.

To reduce unintentional and disturbing effects, it is necessary to wire up a diode module into the converter supply circuit. This diode must be implemented between the Ex-barrier and the 6000 module (see [Figure 9-1](#)). This diode module is delivered together with the Ex-barrier in a package. The order code for the package is 9500-00125.

Under consideration of the following conditions, the sensors PR 6422 ... PR 6426 together with the CON 041 signal converter may be used for applications in hazardous areas for zone 1, protection class "Intrinsic safety" – Ex ia IIC T4:

Connection must be made according to [Figure 9-1](#) e.g. via safety barriers of type Stahl:

Supply circuit: 9001/00-280/085/101

Measuring circuit: 9001/00-280/020/101

The safety barriers must be installed outside the explosive area in cabinets or control cubicles with protection classes of at least IP 20 according to IEC 60529. With an appropriate approval the barriers can be also installed in zone 2. In this case the specifications of the manufacturer have to be observed.

In order to achieve compensations of electric potentials, the connectors for protective earth (mounting screw, internally connected to pin 2) must be linked to the corresponding protective earth connectors within the explosive areas via a compensation line. The mounting rail for the safety barriers has to be isolated.

Within the ATEX – field of application the compensation line has to be rated according to EN 60079-14 12.2.4 with minimum copper wire cross section $2 \times 1,5 \text{ mm}^2$ or $1 \times 4 \text{ mm}^2$. Outside of the ATEX – field of application the respectively valid installation instructions have to be observed.

The total capacity of the intrinsically safe circuit is calculated from the sum of the capacities of the used converter and the measuring signal output (between Out, $\perp$ and screen) as well as at the supply input (-24 V , $\perp$ and screen). The capacity of the sensor circuit is not effective, the capacity of the converter is 6,5 nF (refer to section [Technical data, explosion - proof](#) technical data).

The maximum permitted cable capacity and cable inductance between converter and safety barriers depends on the used barriers. The data of the following examples are

manufacturer's data¹ respectively has been calculated for use in Zone 1 by the program Ispark of the PTB² and are valid for the field of application of ATEX:

Supply Barrier	Evaluation Barrier	Permissible cable capacity (nF)		Permissible cable inductance (mH)	
		IIC	IIB	IIC	IIB
9002/00-260-138-001 ¹	9002/00-260-138-001	87,0 – 6,5 =70,5	670 – 6,5 =662,5	0,81 – 0,028=0,782	5,1 – 0,028 =5,072
9001/00-280/085/101 ²	9001/00-280/020/101	83,0 – 6,5 =76,5	230,0 – 6,5 =223,5	0,20 – 0,028=0,172	10,0 – 0,028=9,772
9001/00-280/100/101 ²	9001/00-280/020/101	–	220,0 – 6,5 =213,5	–	5,0 – 0,028 =4,772

- ¹ The barrier may be connected to a voltage supply of maximum -23,5 V, hence it can be only directly supplied from the 6000 system with an intercalated voltage reduction of minimum 3,2V (e.g. Z – diode 3,3 V).
- ² The barrier may be connected to a voltage supply of maximum -26,0 V. At supply from the 6000 system a diode has to be used (see above).

[Influence of safety barriers on the cable length](#) contains examples for cable length depending on the used safety barrier.

Note

When operating the CON 041 signal converter in hazardous areas, the following points have to be observed:

- The operation is only permitted in appropriate protective housings which ensure that converter and housing aren't exposed to strokes or mechanical shocks and that friction of metallic parts at the housing is avoided.
- The calibration resistor R22 to R24 must not be changed by customers. A recalibration has to be made by the manufacturer. Soldering at a converter that is permitted for use in hazardous areas causes loss of this approval.
- If sensors with extension cables are used, the adapter plug has to be isolated with two shrink sleeves: First the black and additionally the blue shrink sleeve have to be shrunk on the adapter plug.
- The transition resistance of housing to protective earth must not exceed 1 MOhm.

9.1 Special Requirements for CSA – approval installations

Note

Installation in protection class "ia":

- The installation has to be in accordance with the control drawing 9200-00006.

Installation in protection class "nA":

- The sensor may not be separated when energized.
- The used housing has to be in accordance with the requirements of CAN/CSA E60079-15-02 or UL 60079-25 2002.

WARNING – EXPLOSION HAZARD. DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.

WARNING – EXPLOSION HAZARD - DO NOT SEPARATE SENSOR WHEN ENERGIZED.

AVERTISSEMENT - RISQUE D'EXPLOSION. NE PAS DECONNECTER LORSQUE LE CIRCUIT EST SOUS TENSION OU SI LA ZONE N'EST PAS EXEMPTÉ DE CONCENTRATIONS INFLAMMABLES.

AVERTISSEMENT - RISQUE D'EXPLOSION - NE PAS SÉPARER LE CAPTEUR LORSQU'IL EST SOUS TENSION.

9.2 Technical data, explosion - proof

For connection to intrinsically safe electric circuit and for the use in hazardous areas the CON 041 signal converter is tested and certified for:

Explosion protection class

cCSAus

'Intrinsically safe (Ex ia)'	
Identification:	Class I, Div 1,
	Group ABCD T4
	(Class 1, Zone 0/1)
	$U_i = 28V$, $I_i = 140mA$, $P_i = 1W$
	$C_i = 6,5nF$, $L_i = 3\mu H + 25\mu H$
	T4: $-20^{\circ}C \dots +80^{\circ}C$
	Control Dwg CDG_9200-00006n (Figure 9-2)
Standards:	CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part II
	CSA C22.2 No.60079-0-19 Explosive Atmospheres – Part 0 : Equipment – General requirements
	CSA C22.2 No. 60079-11-14 (R2018) Explosive Atmospheres – Part 11 : Equipment – Protection by intrinsic safety “i”
	UL 60079-0-2019 Explosive Atmospheres – Part 0 : Equipment – General requirements
	UL 60079-11-2018 Explosive Atmospheres – Part 11 : Equipment – Protection by intrinsic safety “i”
	CAN/CSA-C22.2 No. 25-17 Enclosures for Use in Class II, Division 1, Groups E, F, and G Hazardous Locations
	CSA C22.2 No. 61010-1-04 Safety requirements for Electrical equipment for Measurement control, and Laboratory Use - Part 1:General requirements
	UL 61010-1 Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements
'non – incentive (Ex nA)'	

Identification:	Class I, Div 2,
	Group ABCD T4
	(Class 1, Zone 2)
	AEx nA II T4
	T4: -20°C ... + 80°C
Standards:	CAN/CSA-C22.2 No. 213-17 Non-Incendive Electrical Equipment for Use in Class I and Class II, Div 2 and Class III, Division 1 and 2 Hazardous Locations
	UL 121201 9th Edition Non-Incendive Electrical Equipment for Use in Class I and Class II, Div 2 and Class III, Division 1 and 2 Hazardous Locations
	CAN/CSA-E60079-15-02 (R2006) Apparatus for Explosive Gas Atmospheres – Part 15: Type of Protection “n”
	UL 60079-15 2002 Electrical Apparatus for Explosion Gas Atmospheres – Part 15: Type of Protection “n”

ATEX

‘Intrinsically safe’ (ia)	
Identification:	II 2G Ex ia IIC T4 -20°C <Ta < 80°C Gb
EC–Design test certificate	according to EU standard 2014/34/EU (PTB 03 ATEX 2151 edition 1)
Standards	EN 60079-0:2012+AMD11:2013, Equipment – general requirements
	EN 60079-11:2012, Intrinsically safe “i”
IECEx approval number	IECEx PTB 13.0032

Installation: see [Figure 9-1](#).

Connection of circuits via safety barriers of e.g. company Stahl, Künzelsau:

Supply circuit: Type 9001/00–280/085/101

Measuring circuit: Type 9001/00–280/020/101

General

Electrical Data	
Output and supply circuits:	with explosion protection class "Intrinsically safe" (Ex ia IIC) only for connection to certified intrinsically safe circuits with the following maximum values:
Terminals -24V, output and $\perp$	open-circuit voltage: $U_i = -28V$
	Sum of the short-circuit currents: $\Sigma I_i = 140mA$
	Total power: $\Sigma P_i = 1W$

Within output – and supply circuit effective internal capacity and inductance	$C_i = 6,5 \text{ nF}$,
	$L_i = 0,003 + L_{\text{Sensor}} [\text{mH}]$
Sensor circuit:	in protection class "Intrinsically safe" (Ex ia IIC) only for connection of sensors, which are together with their connection and if necessary extension cable do not exceed the total maximum capacities and inductances.

Capacities and inductances of the sensors including connection and extension cable.		
Sensor:	Capacity (C_{Sensor})	Inductance (L_{Sensor})
PR6422 ... 6426 with 4m cable	$\leq 450 \text{ pF}$	$\leq 25 \text{ } \mu\text{H}$
per additionally meter cable	$+ 110 \text{ pF}$	not relevant

Temperature classification of sensors PR6422 ... 6426:	T3: -20 °C ... 155 °C
	T4: -20 °C ... 114 °C
	T6: -20 °C ... 64 °C

Figure 9-1: Connection diagram for intrinsically safe installation

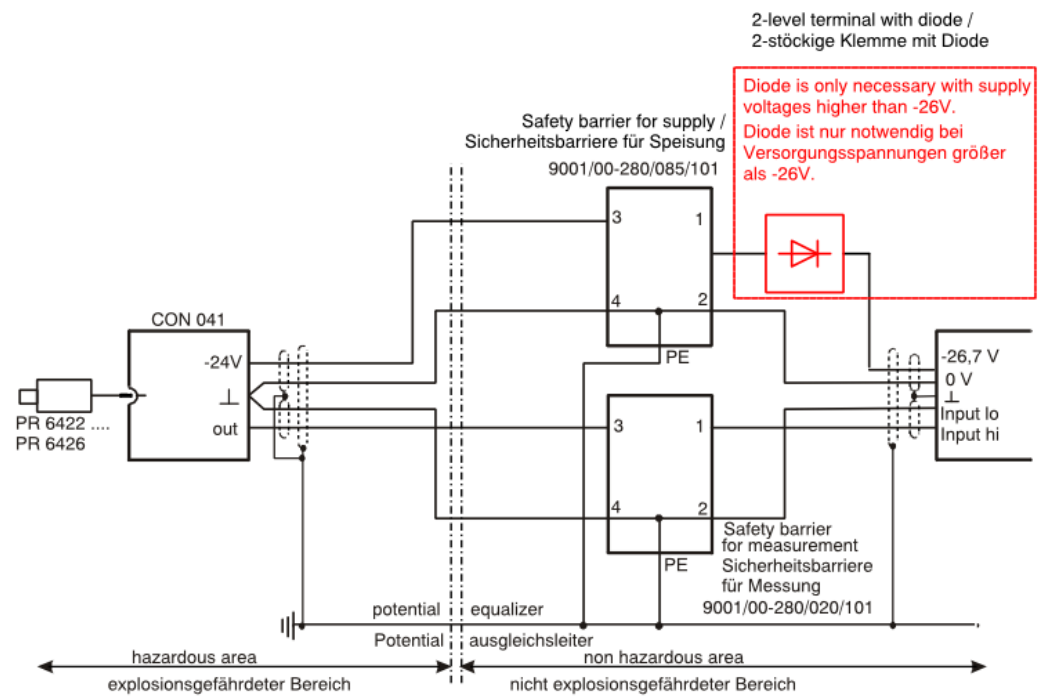
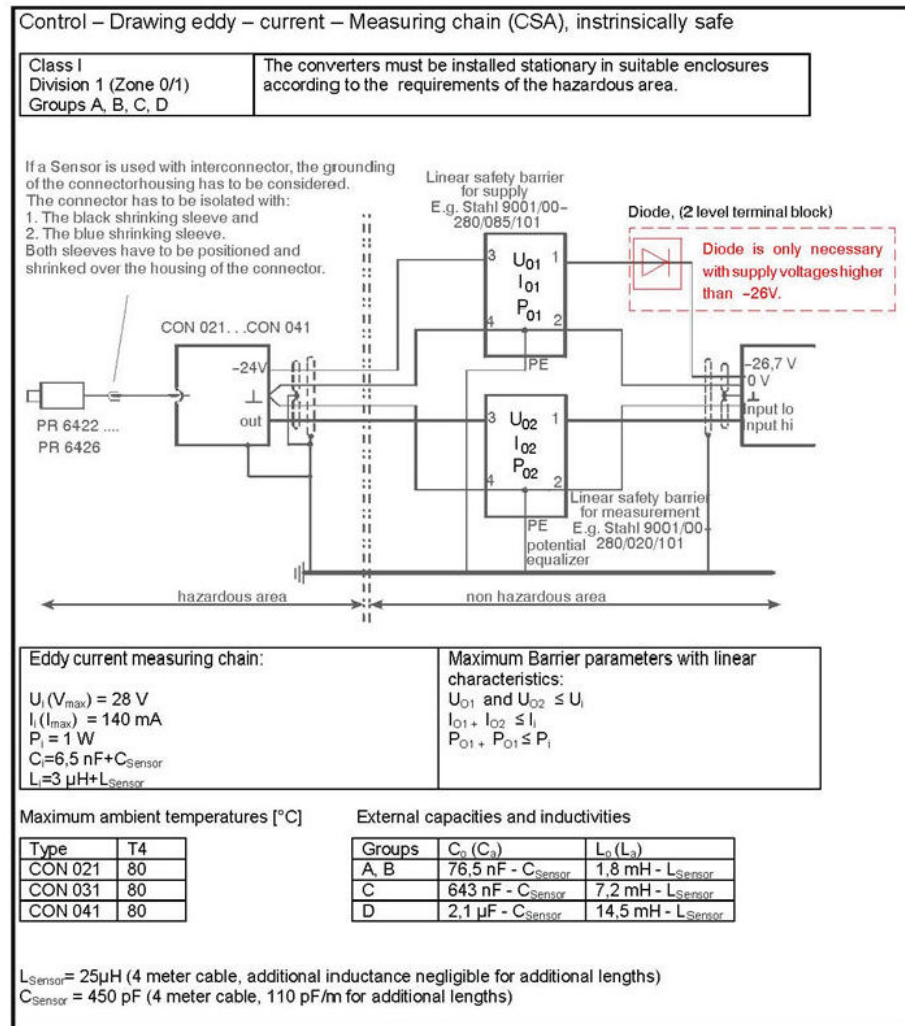


Figure 9-2: Control drawing 9200–00006n, Rev.: 02



9.3 Status of chapter "Explosion Proof Installation"

Version	Date	Remarks / Changes
1.0	20. March 2013	Initial version, translation of chapter "Explosiongeschützte Installation"
1.1	19. May 2014	IECEx approval number added
1.2	13. January 2016	Standards update and minor changes
1.3	18. June 2021	Update technical data
1.4	28. April 2022	Correction of temperature classification sensors
1.5	1. June 2023	CSA standards update and additional warnings for CSA nA, typo correction

10 Ex-Application

This chapter provides an example of the influences of the safety barrier on the cable length between sensor and converter as well as on the sensor signal.

10.1 Influence of safety barriers on the cable length

The maximum permissible cable length depends on the used safety barrier and the consequentially maximum cable capacity C_L , cable inductance L_L , and the electrical characteristics of the selected cable. With use of the following safety barriers of the company Stahl

Supply circuit: Type 9001/00-280/085/101

Measuring circuit: Type 9001/00-280/020/101

is for protection class IIC: $C_{L\max} = 76.6 \text{ nF}$, $L_{L\max} = 0.172 \text{ mH}$ and for IIB: $C_{L\max} = 223.5 \text{ nF}$, $L_{L\max} = 9.772 \text{ mH}$ (wire/wire and wire/screen). Table 10-1 shows the maximum cable length between converter and safety barrier depending on selected cable and safety barrier type for Zone 1 and protection class IIC.

If the cable capacities and inductance are not known then the values for a standard cable have to be assumed according to EN 60079-14, chapter 12. These values are defined with a cable capacity of 200 nF/km and a cable inductance of 1 $\mu\text{H}/\text{m}$.

Table 10-1: Maximum cable length

Barrier supply circuit: 9001/00-280/085/101			
Barrier measuring circuit: 9001/00-280/020/101			
Cable type	$C_{\text{cable}}[\text{nF}/\text{m}]$	$L_{\text{cable}}[\mu\text{H}/\text{m}]$	Cable length $l_{\max} [\text{m}]$
Standard cable according to EN60079-14 Cap. 12	2x200	1	172
LiYCY-CY 2x2x0,25 (Helu cable, Type 21077)	2x150	1	172
Li2YCY (TP) 2x2x0,22(Lapp cable, Type 0031320)	2x60	0.65	256
Li2YCYv 2x2x0,22 (Helu cable, Type 21129)	2x72	0.66	261
Li2YCY -PIMF2x2x0,22(TKD, Helu cable Type 43553)	2x75	0.4	430

10.2 Influence of safety barriers on the sensor signal

The use of safety barriers of type Stahl 9001/00-280-085-101 for the supply circuit and 9001/00-280-020-101 for the measuring circuit results in the following influence on the maximum output voltage at converter supply voltage of -26V:

CON 041: maximum output voltage approximately -17.0 V

CON 041/91x-xxx: maximum output voltage approximately -15.5 V

In case of longer cables between safety barriers and measuring amplifiers, the upper cut-off frequency might be reduced by the series resistor of the barrier (1510 Ω at barrier 9001/00-280-020-101) and the cable capacity:

-3dB at $f = 2$ kHz and $C_L = 50$ nF, corresponding to 330 m cable length with 150 nF/km

-1dB at $f = 2$ kHz and $C_L = 25$ nF, corresponding to 165 m cable length with 150nF/km

11 Certificates



EU-Declaration of Conformity (Translation)

We: epro GmbH, Jöbkesweg 3, 48599 Gronau
declare under our sole responsibility that following product(s):

Part numbers: CON011, CON011 / 91(2-6) - (015-240)
CON021, CON021 / 91(2-6) - (015-240)
CON031, CON031 / 91(2-6) - (015-240)
CON041, CON041 / 91(2-6) - (015-240)
with
PR 6422 / (0-1) (0-1) (0-8) – (0-1) (0-4, F) (0-2)
PR 6423 / (0-1) (0-1) (0-9, E, H, S) – (0-1) (0-4, F) (0-2)
PR 6423 / (0-1) (0-1) (0-9, E, H, S) – (0-1) (0-4, F) (0-2)-HT
PR 6424 / (0-1) (0-1) (0-6, B, G, M, R) – (0-1) (0-4) (0-1)
PR 6425 / 0 1 0 – 1 (0-4) (0-1)
PR 6426 / 0 (0-1) 0 – (0-1) (0-4) (0-1)

Product description: Signal converter for eddy current measuring chains with sensors PR642x

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

2014/30/EU	Electromagnetic compatibility
2014/34/EU ¹⁾	Equipment and protective system intended for use in potentially explosive atmospheres
2011/65/EU	The restriction of the use of certain hazardous substances in electrical and electronic equipment

Following harmonized standards have been applied:

2014/30/EU	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements.
2014/34/EU ¹⁾	EN 60079-0	Part 1. General requirements Explosive atmospheres -
	EN 60079-11	Part 0: Equipment - General requirements Explosive atmospheres -
	EN 60079-26	Part 11: Equipment protection by intrinsic safety "i" Explosive atmospheres -
	2011/65/EU	EN 63000

For the type examination according to EN 60079-0, EN 60079-11 and EN 60079-26 the following notified body has been involved;

PTB Braunschweig
Type examination certificate PTB 03 ATEX 2151

Authorized person for technical documentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau

Gronau, 19 December, 2024
Place, Date

Managing Director

Quality



EU-Declaration of Conformity (Translation)



We: epro GmbH, Jöbkesweg 3, 48599 Gronau
declare under our sole responsibility that following product(s):

Part numbers: CON011/SF, CON011 / 91(2-4) - (015-080)/SF
CON041/SF, CON041 / 91(2-4) - (015-080)/SF
with
PR 6422 / (0-1) (0-1) (0-8) – (0-1) (0-4, F) (0-2)
PR 6423 / (0-1) (0-1) (0-9, E, H, S) – (0-1) (0-4, F) (0-2)
PR 6424 / (0-1) (0-1) (0-6, B, G, M, R) – (0-1) (0-4) (0-1)

Product description: Signal converter for eddy current measuring chains with sensors PR642x

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

2014/30/EU	Electromagnetic compatibility
2014/34/EU	Equipment and protective system intended for use in potentially explosive atmospheres
2011/65/EU	The restriction of the use of certain hazardous substances in electrical and electronic equipment
2006/42/EC	Machinery Directive

Following harmonized standards have been applied:

2014/30/EU	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Part 1: General requirements
2014/34/EU	EN 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements
	EN 60079-11	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
	EN 60079-26	Explosive atmospheres - Part 26: Equipment with Equipment Protection Level (EPL) Ga
2011/65/EU	EN 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
2006/42/EC	DIN EN 62061	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems

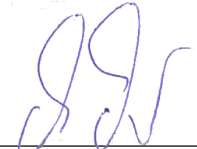
For the type examination according to EN 60079-0, EN 60079-11 and EN 60079-26 the following notified body has been involved;

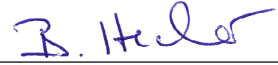
PTB Braunschweig
Type examination certificate PTB 03 ATEX 2151

Authorized person for technical documentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau

Gronau, 19 December 2024
Place, Date


Managing Director


Quality





Certificate

No. 1435.IM.171914/22, Ver. 1.0

TÜV NORD Systems GmbH & Co. KG hereby certifies to

**Emerson Automation Solutions
epro GmbH**

Jöbkesweg 3
48599 Gronau

that the safety-related measuring chain

**CON 011/SF, CON 011/9../SF, CON 041/SF
und CON 041/9../SF**

in combination with sensors

PR 6422, PR 6423 und PR 6424

is capable for safety-related applications up to SIL 2 with systematic capability
up to SIL 3 and meets the requirements listed in the following standards.

IEC 61508:2010; capable up to SIL 2, with systematic capability up to SIL 3

DIN EN 62061:2016; capable up to SIL_{CL} 3; together with 6300 SIS

DIN EN 61511-1:2019; capable up to SIL 2, with systematic capability up to SIL 3

Certification program Leittechnik (SEB-ZE-SEECERT-VA-320-20, Rev. 5.1/ 04.19)

**Basis of certification is the report
1435.IM.171914/22TB in the valid version.
This certificate entitles the usage of the
adjacent conformity mark.**

**Valid until: 2027-12-15
Reference: 8120299340**

Hamburg, 2022-12-15


Bianca Pfuff

Certification Body SEECERT
TÜV NORD Systems GmbH & Co. KG
Große Bahnstraße 31, 22525 Hamburg, Germany





Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product - CON011

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements

表1：有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PCBD ASSY	X	O	O	O	O	O	25
围堵 ENCLOSURE	O	O	O	O	O	O	e
硬件 HARDWARE	O	O	O	O	O	O	e
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
环保期限 (EFUP) 的产品及其部件是每个列出的符号。除非另有标明。使用期限只适用于产品在产品手册中规定的条件下工作 The Environmentally Friendly Period (EFUP) for the product and its parts are per the symbol listed, unless otherwise marked. Use Period is valid only when the product is operated under the conditions defined in the product manual.							

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Statement Regarding the China RoHS Compliance of Emerson Product - CON011/SF

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Table 1: Names and Contents of Toxic or Hazardous Substances or Elements

表1：有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PCBD ASSY	X	O	O	O	O	O	
围堵 ENCLOSURE	O	O	O	O	O	O	
硬件 HARDWARE	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
环保期限（EFUP）的产品及其部件是每个列出的符号，除非另有标明。使用期限只适用于产品在产品手册中规定的条件下工作 The Environmentally Friendly Period (EFUP) for the product and its parts are per the symbol listed, unless otherwise marked. Use Period is valid only when the product is operated under the conditions defined in the product manual.							

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Statement Regarding the China RoHS Compliance of Emerson Product - CON041

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements

表1：有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PCBD ASSY	X	O	O	O	O	O	25
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
环保期限 (EFUP) 的产品及其部件是每个列出的符号，除非另有标明。使用期限只适用于产品在产品手册中规定的条件下工作 The Environmentally Friendly Period (EFUP) for the product and its parts are per the symbol listed, unless otherwise marked. Use Period is valid only when the product is operated under the conditions defined in the product manual.							

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Statement Regarding the China RoHS Compliance of Emerson Product - CON041/SF

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印刷电路板组装 PCBD ASSY	X	O	O	O	O	O	25
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
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