User manual

Eddy Current Probe Systems

CMSS 785 Series, API-670 Proximity transducers, 5 and 8 mm

Important information

Thank you for purchasing the CMSS 785 Proximity Transducer System. This instruction manual (referred to as "this manual" hereafter) explains handling instructions and precautions to be taken in respect of the CMSS 785 Transducer system (referred to as "this unit" hereafter).

Read this manual carefully before using the unit. If you have any questions regarding this manual or the unit, please contact SKF technical support group.

Product support – contact information

Product support – To request a Return Authorization, Product Calibration or a Product Support Plan, go to skf.com/cm and use the contact and support links on the web site.

Product sales – For information on purchasing condition monitoring products, services or customer support, contact your local SKF sales office.

Technical support group

Discuss/review issues of specific interest with maintenance and reliability specialists from around the world at the Knowledge Centre's "forum and blog". For technical support on issues like troubleshooting product installation or product performance, etc., use our technical support web page to contact one of our technical support groups.

- When using this product, it is necessary to be not only knowledgeable about the contents of this manual, but also in respect of other instrumentation and equipment connected to this unit. For safety, it is necessary to be familiar with safe working practices and procedures, appropriate to the installation site.
- Whilst the CMSS 785 series has been comprehensively evaluated in respect of EMC (electro-magnetic compatibility), test and real world conditions can differ substantially because of:
  - Intensity/source of EMI (interference)
  - Temperature and humidity
  - Equipment layout

So, it remains important to observe the precautions and follow the instructions contained in this manual.

- This unit is comprised of the following components:
  - CMSS 75/78 sensor (referred to as probe hereafter)
  - CMSS 985 cable (hereafter known as extension cable)
  - CMSS 785 transducer (referred to as driver hereafter)

Only specific combinations of these components can be used to build a measurement system. For guidance and examples, refer to section 2.3.

- This manual contains some explanations for supplementary parts (sold separately), in order to explain their relationship to this unit.
- Any illustrations in this manual of such parts, should only be regarded as illustrative and not definitive as to their actual appearance, dimensions etc.
- Any company names and product names listed in this manual are the trademarks or registered trademarks of their respective companies.
- When disposing of this product, make sure to follow all local laws and regulations.

Contents

1. Safety information

Read this section carefully in order to be able to use this product safely.

1.1. Warning symbols

In this document, rules that must be followed in order to prevent injury or financial loss and for the safe usage of this unit, are labeled with the following markings. Make sure to understand the content of these cautions and to follow the guidance provided.

⚠ DANGER

This symbol is used to warn against the possibility of serious or fatal injury. Always follow the instructions to ensure safety.

⚠ WARNING

This symbol is used to warn of the possibility of injury. Always follow the instructions to ensure safety.

⚠ CAUTION

This symbol is used to draw attention to the potential for damage. Always follow these instructions to prevent damage to equipment.

NOTE

This symbol is used to emphasize important items or to provide useful information.

1.2 Important precautions

Be sure to observe the following instructions for safe use of this unit.

Prohibited actions

⚠ DANGER

Never disassemble or modify this unit.

Do not use the unit under conditions outside the limits detailed in the specifications. Doing so may lead to equipment failure, fire, or personal injury.

⚠ CAUTION

Do not use transceivers and other radio equipment/cellular phones in close proximity to this unit. If it or the signal cables are exposed to EMI (Electromagnetic Interference), the unit may not satisfy the precision and performance characteristics indicated in the specifications.

Rules to follow

⚠ DANGER

When installing this unit, be sure to follow the procedures described in sections 4 and 5. If the procedures indicated are not followed, it may lead to failures of the unit, fires, or personal injury.

⚠ CAUTION

- Before operating this unit, be sure to also read the instruction manuals for instruments that will be connected to this unit (IMx/ monitoring equipment).
- Installation work, wiring and connections must be performed by a person with appropriate knowledge of and experience in, instrumentation systems.
- Before physically handling this unit, be sure to touch a grounded metal item to discharge any static electricity. The device may be damaged if exposed to static discharges.
- Do not perform insulation resistance measurements or voltage endurance tests at locations other than those with insulation resistance and voltage endurance specifications indicated. Doing otherwise, may damage the unit.
- If performing a megger test (insulation test) of the signal transmission cable, always disconnect the cable from the unit and the monitor. When reconnecting the cable, first short it to ground so as to discharge any remaining potential. Connecting cables to the unit or the monitor in a charged condition, may damage that equipment.
- Perform the following measures to ensure the stability of the system.
  - Be sure to install surge suppressors for each and every relay used in the vicinity of this system.
  - Include provision for the measuring loop to be bypassed or inhibited at the monitoring system so that maintenance/fault finding can be performed.
- If there is any likelihood of EMI (interference), the driver should be placed inside an EMC shielding enclosure. Section 4.2 shows a typical arrangement with probe and monitor cables also run within grounded conduit.
- If any one of the following conditions occurs, stop using the unit and contact support.
  - There is a strange odor coming from the unit.
  - It is heating up abnormally.
  - If the unit has been dropped.
  - The casing of the unit has been damaged.

Continuing to use the unit in an abnormal condition may result in fires or further failures.

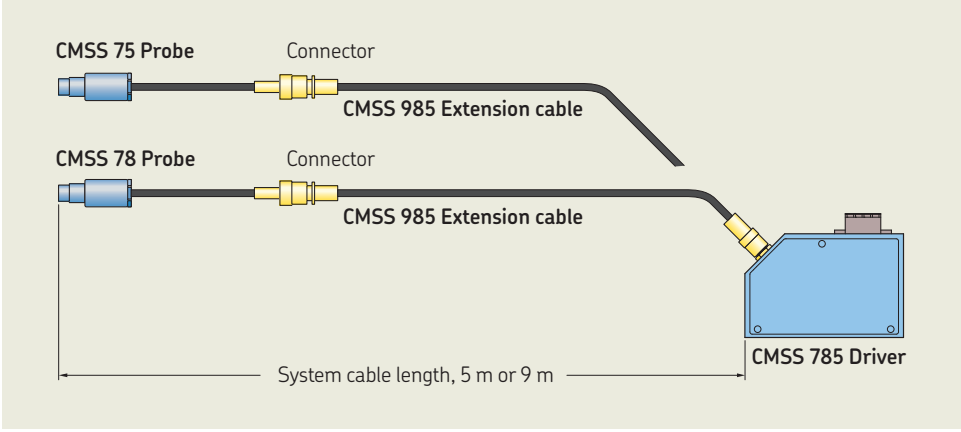
- Store this unit in a location away from direct sunlight, under the following conditions.
  - Temperature within the range: –40 to 80 °C
  - Humidity: 30 to 95% RH (no condensation)

Do not store in a location exposed to high temperatures and/or humidity, or where corrosive gasses are present.

2. Introduction

2.1 Measurement principles

This unit (probe, extension cable, driver system) provides a means for non-contact measurement of the distance (gap) between the probe tip and the measured object (target), by outputting a voltage signal corresponding to that gap.

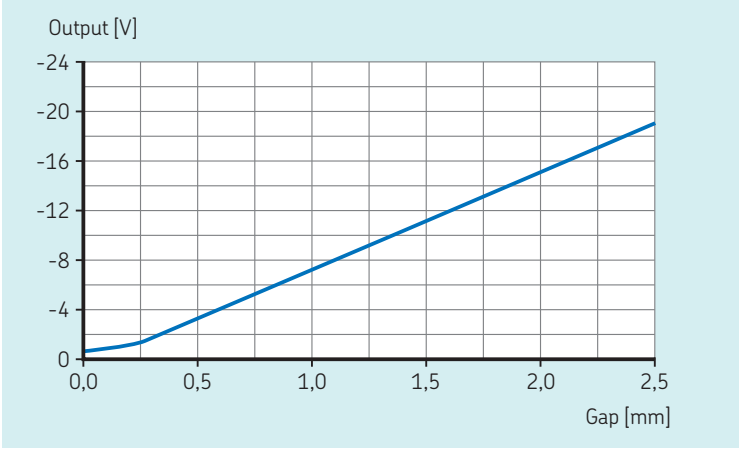


An oscillator in the driver provides a high frequency signal (circa 1 MHz) that radiates from a coil encapsulated in the probe tip.

As a conductive surface approaches the coil, eddy currents are generated on the target, and this in turn causes a detectable decrease in the field's strength that is reflected by a corresponding decrease of the driver's output.

The driver linearizes and normalizes its output to a standard sensitivity; 7,87 mV/µm *(200 mV/mil)*, across its working range.

The signal's DC bias represents the average probe gap or position and its AC component, the relative motion or vibration. It is readily used in many applications concerned with machinery monitoring.



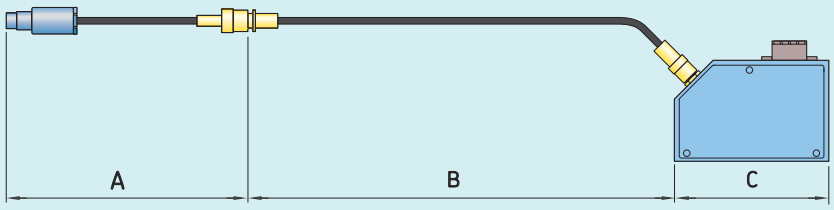
2.2 Applications

When suitably installed and combined with an appropriate (IMx) monitoring system, it is possible to measure the vibration of a rotating shaft, its eccentricity, (thrust) position, rotating speed or to provide phase data etc.

The unit aims to facilitate continuous measurement or monitoring of shafts rotating at either high or low speeds, across a range of machine types. This unit is not designed for use in any other application.

2.3 Permissible system combinations

The unit can be provided as either a 5 or 9 m system. This refers to the total, nominal, cable length being used irrespective of whether this is made up solely of probe cable or probe and extension cabling. In each case an appropriate 5 or 9 m driver completes the system. Only the component combinations shown in the graphic below are allowed.



CMSS 75 or CMSS 78 probe		CMSS 985 extension cable		System cable length		CMSS 785 driver
A		**B**				**C**
0,5 m	+	4,5 m	=	5 m	→	CMSS 785-11/-12
1,0 m	+	4,0 m	=	5 m	→	CMSS 785-11/-12
5,0 m		–	=	5 m	→	CMSS 785-11/-12
0,5 m	+	8,5 m	=	9 m	→	CMSS 785-21/-22
1,0 m	+	8,0 m	=	9 m	→	CMSS 785-21/-22
9,0 m		–	=	9 m	→	CMSS 785-21/-22

Any excess cable is typically coiled and tied, and doing so does not affect the measurement capability or performance of the system.

NOTE

Performance specifications for the system are presented in Appendix A, noting that a non-functioning/non-conforming system will result from:

- Any combination of system components that results in a system length that is not 5 or 9 m.
- A 5 m driver being used in a 9 m system (or vice versa).
- The shortening or lengthening of the cable between the probe and driver.
- The inclusion of any non-CMSS 785 system components, including from earlier SKF systems.

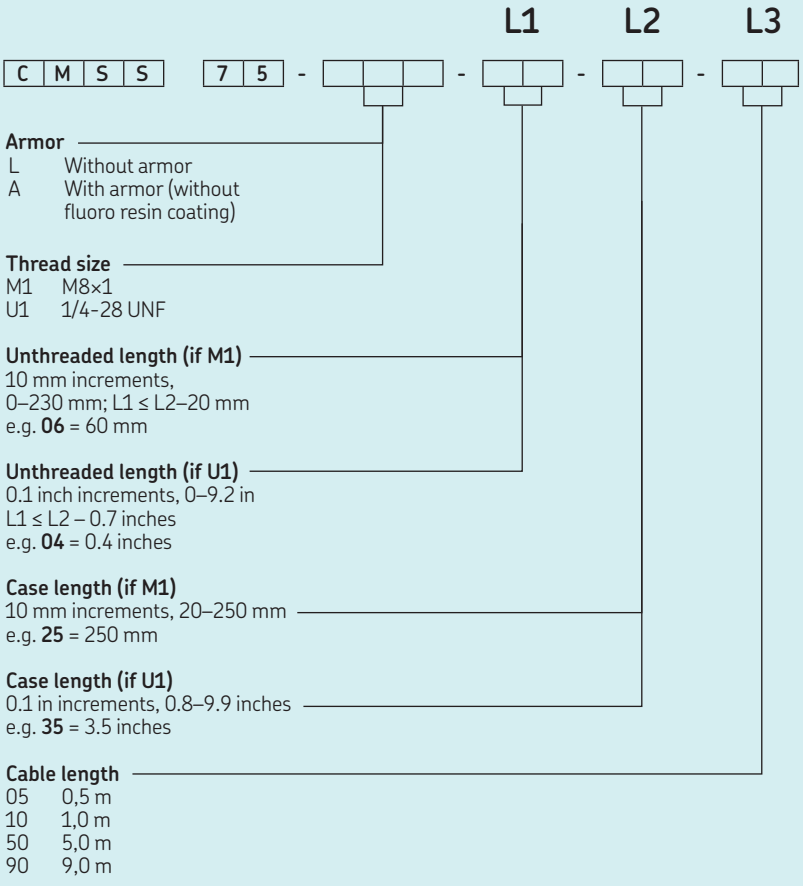
3. Part no. and dimensional data

3.1 Probes

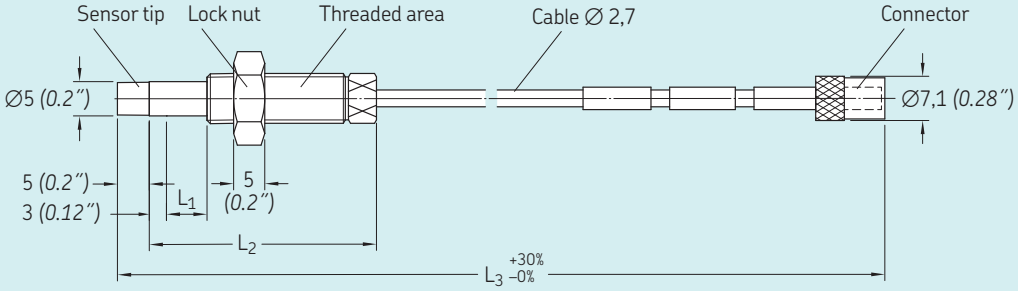
Three basic probe types are available: a 5 mm diameter tip, 8 mm tip and a reverse mount 8 mm tip. These three are mechanically different but electrically equivalent: when considering permissible system combinations only the cable length has to be considered, as described in 2.3 above. Note that as indicated on the dimensional drawings, the actual physical length of probes and cables may be longer than but not shorter than, the nominal length.

3.1.1 Probes: 5 mm

CMSS 75: 5 mm probe



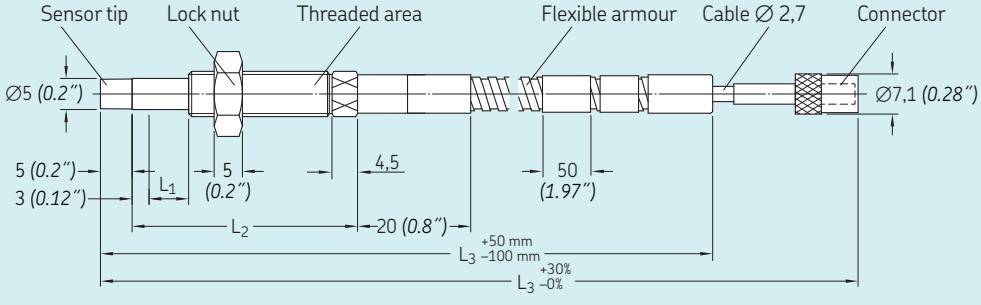
CMSS 75-L standard probe (without armour)



Example

CMSS 75-LM1-06-25-10 5 mm, no armour, thread size M8x1, unthreaded length (L_1) 60 mm (06 = 60 mm), case length (L_2) 250 mm (25 = 250 mm), cable length (L_3) 1,0 m

CMSS 75-A armoured probe

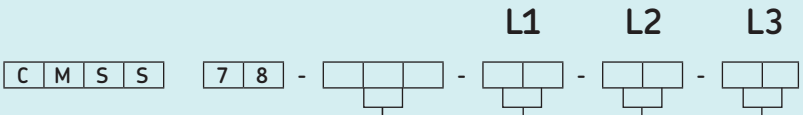


Example

CMSS 75-AU1-02-10-05 5 mm, armour, thread size UNF 1/4-28, unthreaded length (L_1) 0.2 in, case length (L_2) 1.0 in, cable length (L_3) 0,5 m

3.1.2 Probes: 8 mm

CMSS 78: 8 mm probe



Armor
L Without armor
A With armor (without fluoro resin coating)

Thread size
M2 M10×1
U2 3/8-24 UNF

Unthreaded length (if M2)
10 mm increments, 0–230 mm;
L1 ≤ L2–20 mm
e.g. **06** = 60 mm

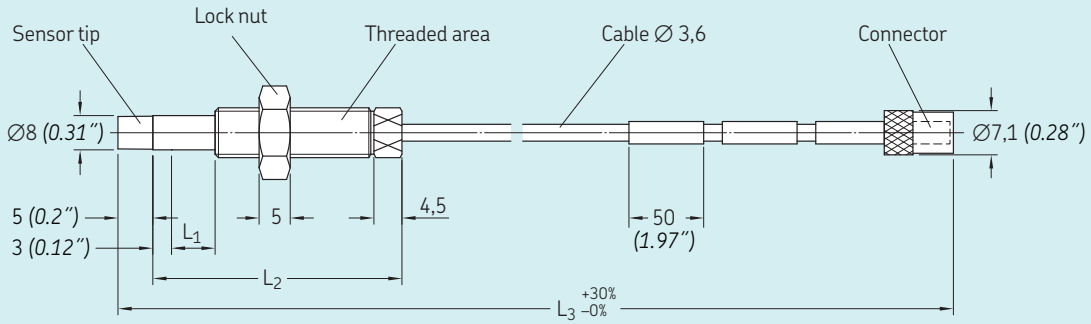
Unthreaded length (if U2)
0.1 inch increments, 0–9.2 in
L1 ≤ L2 – 0.7 inches
e.g. **04** = 0.4 inches

Case length (if M2)
10 mm increments, 20–250 mm
e.g. **25** = 250 mm

Case length (if U2)
0.1 in increments, 0.8–9.9 inches
e.g. **35** = 3.5 inches

Cable length
05 0,5 m
10 1,0 m
50 5,0 m
90 9,0 m

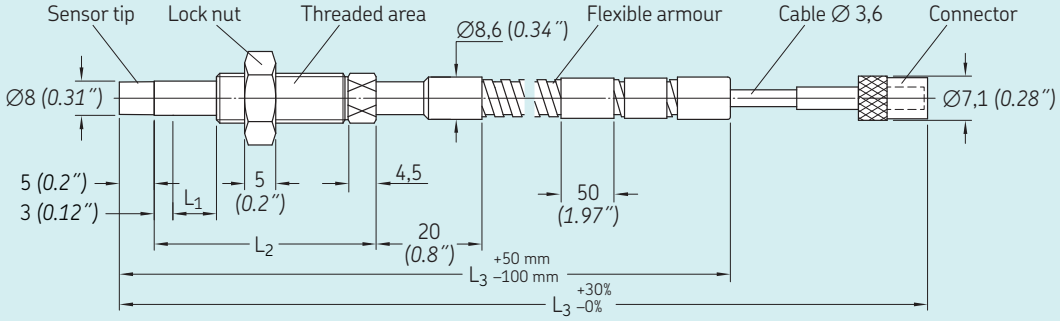
CMSS 78-L standard probe (without armour)



Example

CMSS 78-LU2-00-12-10 8 mm diameter probe, no armour, 3/8-24 UNF thread, unthreaded case length (L_1) 0 in, case length (L_2) 1.2 in, pigtail cable length (L_3) 1 m

CMSS 78-A standard probe (with armour)



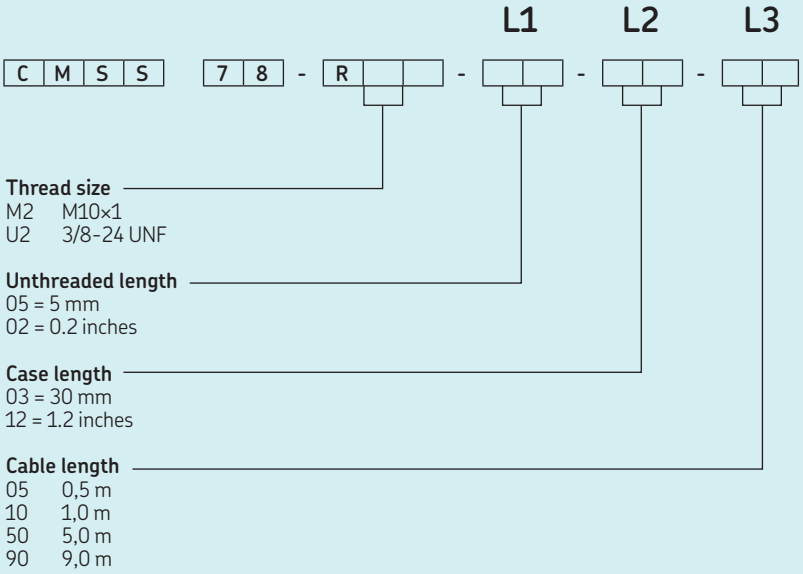
Example

CMSS 78-AM2-04-20-90 8 mm diameter probe, armoured, M10x1 thread, unthreaded case length (L_1) 40 mm, case length (L_2) 200 mm, pigtail cable length (L_3) 9,0 m

Without fluoro resin coating

3.1.3 Probes: 8 mm reverse mount

CMSS 78-R: 8 mm reverse mount probe

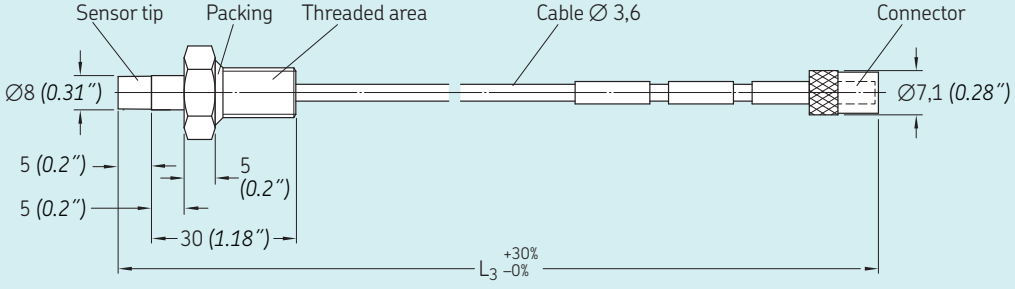


Example

CMSS 78-RM2-05-03-05 8 mm probe, reverse mount, thread size M10x1, unthreaded length (L_1) 5 mm, case length (L_2) 30 mm (03 = 30 mm), cable length (L_3) 0,5 m

CMSS 78-RU2-02-12-90 8 mm probe, reverse mount, thread size 3/8-24 UNF, unthreaded length (L_1) 0.2 in, case length (L_2) 1.2 in (12 = 1.2 in), cable length (L_3) 9,0 m

CMSS 78-R reverse mount



3.2 Extension cables

Extension cables are chosen such that the probe + extension cable lengths match the desired system length (5 or 9 m). If a probe with a full system length integral cable is used, no extension cable is required/can be used.

CMSS 985 **L**

C	M	S	S		9	8	5	-		-		

Armor

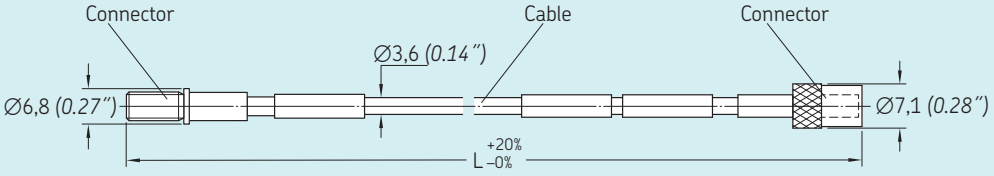
L	Without armor
A	With armor (without fluoro resin coating)

Cable length

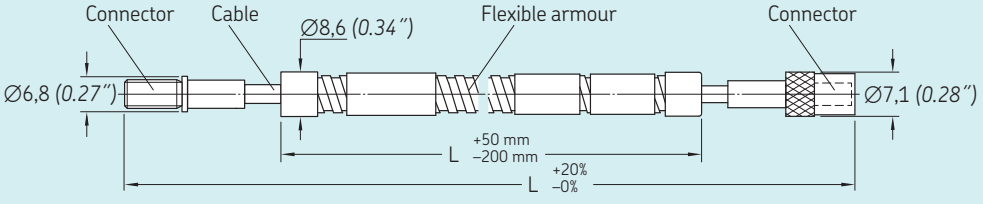
40	4,0 m
45	4,5 m
80	8,0 m
85	8,5 m

Extension cables

CMSS 985-L extension cable without armour



CMSS 985-A extension cable with armour



Example

CMSS 985-L-40	No armour, not agency approved, 4,0 m length
CMSS 985-L-45	No armour, not agency approved, 4,5 m length
CMSS 985-L-80	No armour, not agency approved, 8,0 m length
CMSS 985-L-85	No armour, not agency approved, 8,5 m length
CMSS 985-A-40	Armoured, not agency approved, 4,0 m length
CMSS 985-A-45	Armoured, not agency approved, 4,5 m length
CMSS 985-A-80	Armoured, not agency approved, 8,0 m length
CMSS 985-A-85	Armoured, not agency approved, 8,5 m length

3.3 Drivers

In addition to the two available system lengths, the drivers can be provided with a choice of mechanical mounting.

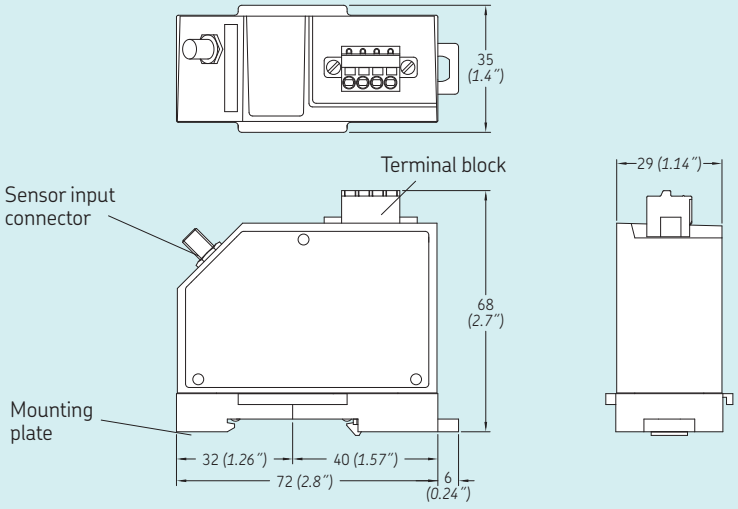
CMSS 785

C	M	S	S		7	8	5	-		

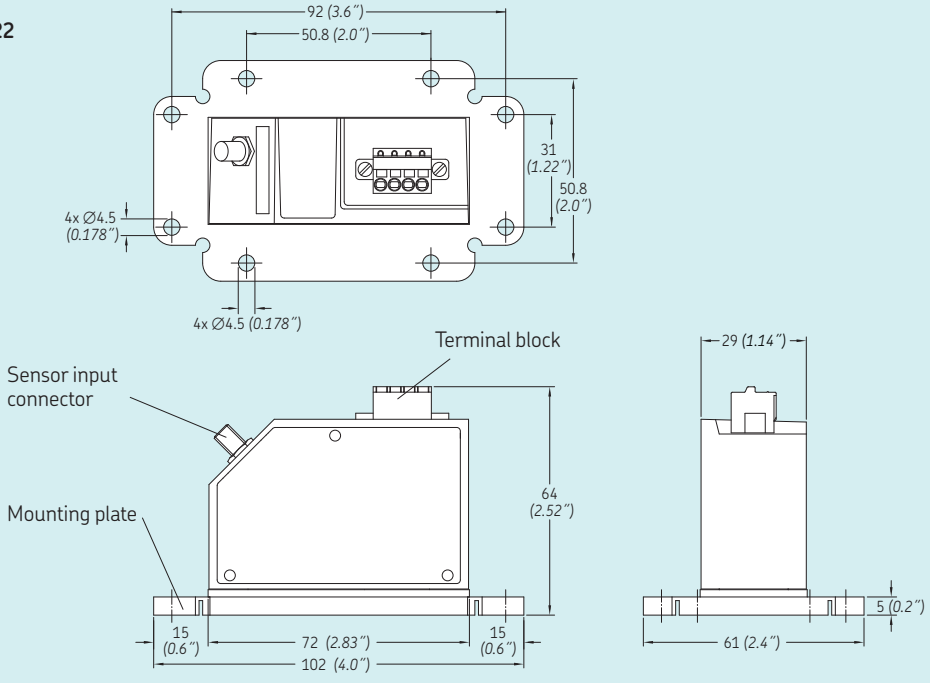
System cable length
1 5 m
2 9 m

Mounting plate
1 DIN rail (35 mm) mount
2 Screw mount, multi-pitch (50,8 × 50,8 mm and 92 × 31 mm)

CMSS 785-11, CMSS 785-21
Unit: mm



CMSS 785-12, CMSS 785-22
Unit: mm



4. Installation guidelines/planning

⚠ CAUTION

- Locate the driver away from motors and relays. Install the input/output signal cables away from power and control system cables. Noise occurring due to motor or relay operation can adversely affect the unit. We recommend using separate wiring ducts.
- Allow sufficient space in housings etc. to respect the minimum allowed bend radius of the probe and extension cables:
  - Without armoured cable: 30 mm
  - With armoured cable: 50 mm

NOTE

For information regarding typical/recommended cable wiring and installation methods, refer to Appendix C: “Cable wiring/laying recommendations”.

4.1 System installation requirements

4.1.1 General

Major considerations include temperatures, pressures and mechanical stress to which the probe, driver and cables are subjected. It is essential that the probe be rigidly mounted, yet easily adjusted (SKF mounting accessories are ideal for this).

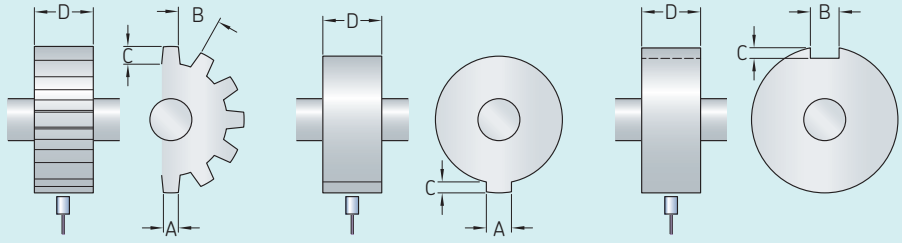
The target material, target surface finish, flatness and size can all affect the output characteristic. It is expected that the target area will have been prepared so as to minimize both mechanical and electrical run-out, that may otherwise cause a false vibration indication.

In Appendix B, the effect that the precise nature of the target, operating environment etc. can have on the system output characteristic is quantified by way of examples B1 through B9. Further guidance on the installation requirements for probes is given in 4.1.2 and 4.1.3.

4.1.2 Probes used for speed/phase detection

Special recommendations are made for target sizing where the probe is to be used for speed or phase detection. Three scenarios are shown:

1 Multi-tooth or multi target wheel (speed only)
2 Raised, single target for speed and/or phase detection
3 Single slot target for speed and/or phase detection



Dimension of target (recommended for rotational speed measurement) mm	**Set gap (recommended)** mm
A ≥ 6 B ≥ 7 C ≥ 2,5 D ≥ 16	1,0 to 1,5

4.1.3 Probe mounting

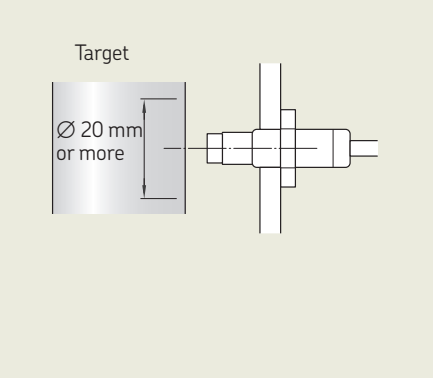
Ensure that the probe mounting location satisfies the following environmental and installation requirements.

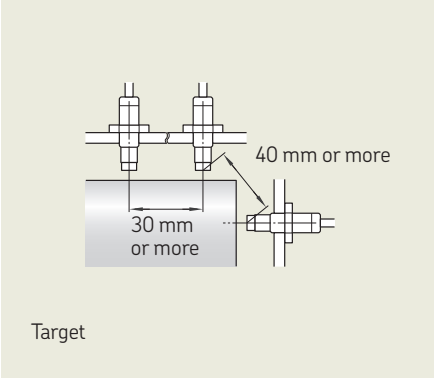
Environmental conditions

- Probe temperature: must always be in the range between –40 to 177 °C.
- Vibration levels at the probe: must be 10 m/s² or less (10 to 150 Hz), noting however that if the sensor vibrates, an accurate measurement cannot be made.
- Locate the probe so as to avoid immersing it in fluid (particularly the probe cable/cable exit)

Installation conditions

- The probe must be installed on a surface or bracket with adequate rigidity, that will not allow the probe to vibrate. If the probe vibrates, an accurate measurement of the target/shaft will not be possible.
- The field radiating from the probe tip extends out from the probe tip in all directions. To maintain the nominal characteristic, a minimum target diameter of 15 mm, centered on the probe is required.
- Similarly, when placing probes near to each other, separate the sensor tips as shown below. If they are placed too close together, the probes will interfere with each other.





- For the preferred detailing of the probe mounting, refer to the installation examples 1–3 below. If the mounting or other metal object other than the target is near the probe/within the field, the measurement will be affected.

To ease probe mounting and adjustment, various accessories are separately available:

- CMSS VZ-03A probe mounting bracket (versions for 5 and 8 mm probes, metric/UNF threads)
- CMSS VZ-10A sensor sleeve (for 8 mm reverse mount probes)
- CMSS VZ-05A sensor housing (usable with 5, 8 mm and reverse mount probes)

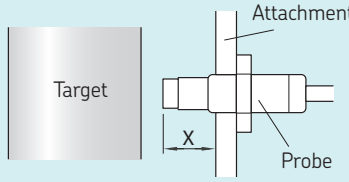
See section 5.1 for examples of how these mounting accessories can be utilized.

If it is unavoidable to install the probe in a non-ideal way (examples 4 to 7), some guidance is given on the likely effect. In case of any doubt, where possible, perform an in-situ check of the actual characteristics of the installation.

Be aware that the probe/driver output will not reduce to zero volts, and that the probe should not be used/relied upon in situations where the gap between probe and target is small (0.25 mm or less, example 8).

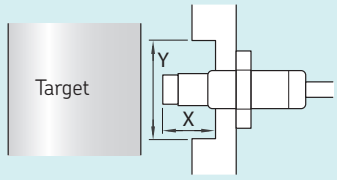
Recommended

Installation example 1 (most recommended)



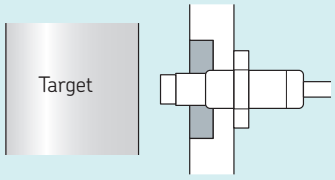
Dimension X is to be 9 mm or more.

Installation example 2 (recommended)



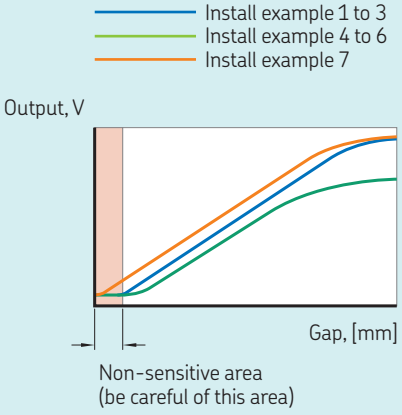
Dimension X is to be 9 mm or more. Dimension Y is to be 15 mm or more.

Installation example 3 (recommended)



After constructing as shown in installation example 2, the area shown by the shaded line in the illustration is filled with resin or other insulating material.

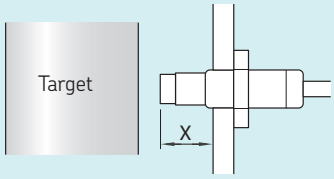
The characteristics of output (V) and gap [mm]



For further information, refer Appendix B: Influences on the Output Characteristic.

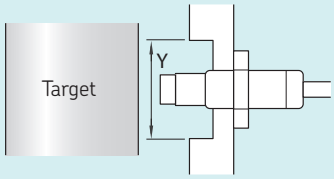
System characteristic affected

Installation example 4



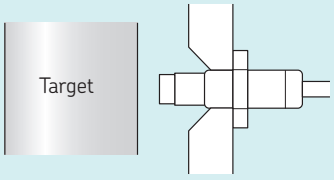
If dimension X is less than 9 mm, it will be affected by the attachment plate.

Installation example 5



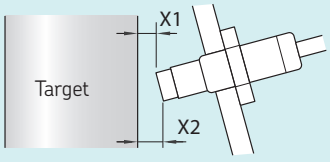
If dimension Y is less than 15 mm, it will be affected by the attachment plate.

Installation example 6



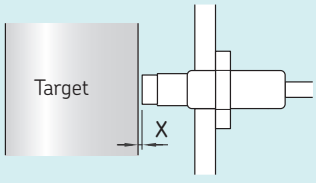
If the attachment plate around the sensor tip is chamfered, it will be affected by the attachment plate.

Installation example 7



If the target and the sensor tip are not parallel (dimension X1 and X2 are not the same), it will affect the reading.

Installation example 8



If dimension X is 0,25 mm or less, measurement will not be possible. The area 0,25 mm or less is a non-sensitive area.

4.1.4 Driver

The driver should be installed in a location that satisfies the following environmental and installation requirements.

Environmental conditions

- Temperature: the temperature of the driver must remain within the range –40 to 80 °C.
- Ambient humidity: must be in the range 30 to 95% RH (non condensing).
- Vibration levels at the driver: must be 10 m/s² or less (10 to 150 Hz).
- Air cleanliness: it is desirable to have an air dust particle amount of 0,2 mg/m³ or less. It is also desirable to have an especially low concentration of corrosive gasses such as hydrogen sulfide, NOx gas, and chlorine, and conductive particles such as iron dust and carbon. (The allowable amount of hydrogen sulfide and NOx gas is based on JEIDA-29 (1979) CLASS S1.)

JEIDA: Japanese Electronic Industry Development Association

- JEIDA-29 (1979) CLASS S1
- Hydrogen sulfide: 0,01 ppm or less
- NOx gas: 0,05 ppm or less
- (Ambient temperature: 25 °C ± 5 °C, humidity: 40 to 80% RH)

Installation conditions

- Do not locate the driver enclosure directly above heat sources.
- Take into account both conducted and radiated heat from the machine, when it is running and when it is shutting down.

The driver is not weatherproof, so always mount it in a suitable cabinet or enclosure, see also the EMC considerations that follow in section 4.2.
The detail of the driver mounting differs according to the model chosen:

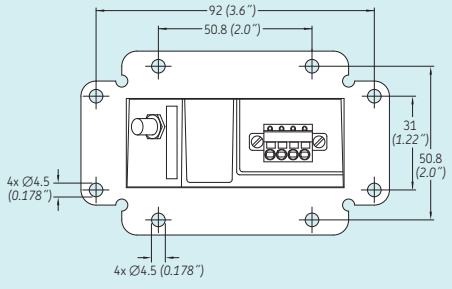
CMSS 785-12 and CMSS 785-22 are screw mounting

The driver/mounting plate assembly offers two mounting options to the user's enclosure/ panel:

- 4x mounting holes on a 50,8 mm pitch, or
- 4x mounting holes on a 31 x 92 mm pitch

All mounting holes are 4,5 mm diameter, refer drawing below.

CMSS 785-12, CMSS 785-22
Unit mm

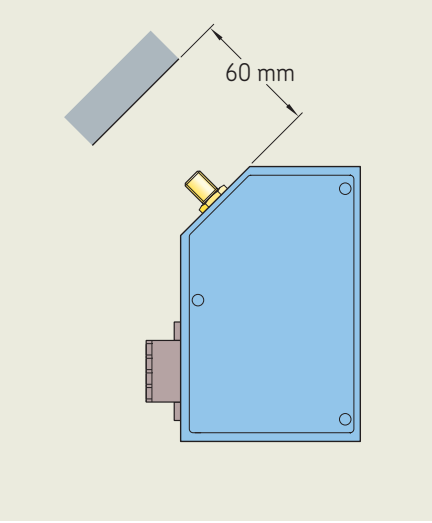


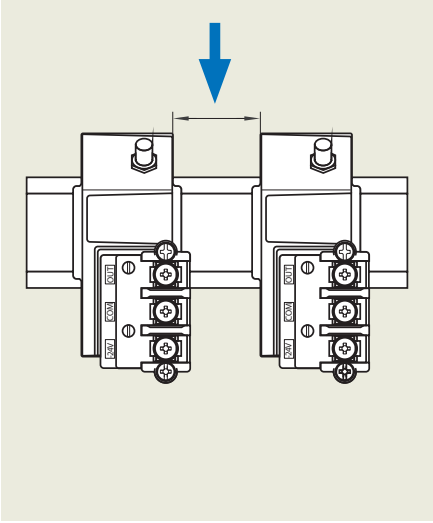
CMSS 785-11 and CMSS 785-21 types are DIN Rail mounting

The CMSS 785 rail mount versions are designed to be mounted on a 35 mm DIN rail, (symmetrical/top hat/TS35).

In both cases:

- Be sure to allow sufficient space between the driver and the enclosure walls for the probe cable connection to the driver and also allow an appropriate spacing between drivers for the monitor cabling.





NOTE

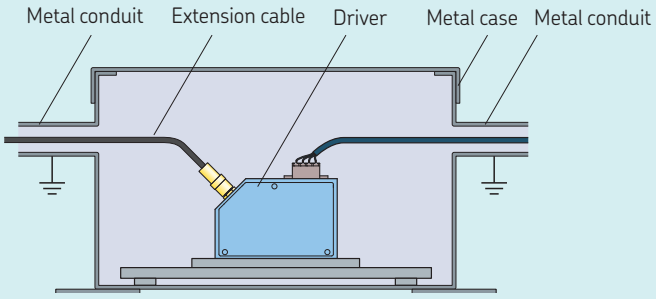
- Always ensure that a rigid, flat surface is available for driver/rail mounting.
- Observe the minimum allowable bend radius for the probe/extension cable.

4.2 EMC considerations

⚠ CAUTION

The driver and extension cable should be installed as shown below to protect from electromagnetic influence.

EMC test conditions



Item	Material	Remark
Metal conduit	Steel	Thickness: 1,6 mm or more
Metal case	Steel	Thickness: 1,6 mm or more

4.3 Connections to the monitoring system

Use a good quality, commercially available control cable to connect the driver to the monitoring system.

If multicore shielded pair is used, two pairs should be used for one driver. One pair should be connected to signal and common and the second pair to power input and common as well.

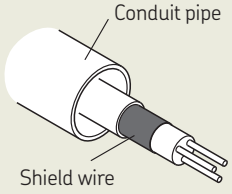
A single, 3-core CVV-S control cable is recommended but if that is not available/appropriate, an overall and individually screened/ shielded multicore cable for light electrical instruments can be used, refer adjacent illustration. In all cases an installation using cable conduit/piping is preferred.

The cable, conductor size should be suitable for both the driver and the monitor terminals, typical availability 0,5, 0,75 or 1,0 mm^2 (nominal cross sectional area). The conductor should be twisted, seven-strand or greater.

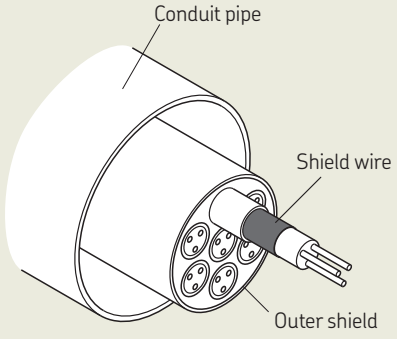
Driver Terminal Type	Cable conductor size
Spring lock terminal	AWG. No.20 to 16 (0,5 mm^2 to 1,25 mm^2)

Cable name

CVVS 3 core shielded cable (straight)



3 line multiple core cable for light electrical instruments (individually shielded)



5. Fitting system components

⚠ DANGER

Installation work, wiring and connections must be performed by a person with appropriate knowledge of and experience in, instrumentation systems.

⚠ CAUTION

- Before handling this unit, be sure to touch a grounded metal item to discharge any static electricity. The device may be damaged if exposed to static discharges.
- When using a cable that has been subject to a megger test, make sure to short the cable to ground before connecting, so as to discharge any electric charge in the cable. Connecting the cable in a charged condition to the unit or the monitor may cause damage.
- Do not pull or bend the probe cables and extension cables with excessive force: inappropriate handling can result in connector and/or cable damage.
- Observe the minimum allowed bend radius for the probes and extension cables:
  - Without armoured cable: 30 mm
  - With armoured cable: 50 mm
- Gap setting:
  - Set the gap so that even when the target is at the nearest point to the probe, the target will still not come into direct contact with the probe.
  - Set the gap so that the shaft/target will not move beyond the linear range of the measurement system.
  - When using a gap/feeler gage, insert between the senor tip and target to measure the gap.
  - Adjust the probe to a position where the gage just moves freely.
  - Take care when making adjustments, not to scratch the target surface.
  - Be aware that if the monitoring system is 'live', insertion of a metallic gage will temporarily disrupt the reading.
  - Make sure to tighten the jam/lock nut at the specified torque.
- After completing installation work and before placing the system in operation ensure all components and connections are secure.
- Before applying power, make sure that all wiring is properly connected. There is a possibility of damage to the unit and fire if improperly connected.

NOTE

For information regarding typical/recommended cable wiring and installation methods, refer to Appendix C: "Cable wiring/laying recommendations".
After powering the system, please allow approximately 5 minutes before performing any conformance check.

5.1 Probe and Extension Cable installation

Ensure the probe location and target preparation meets the objectives/requirements of section 4.

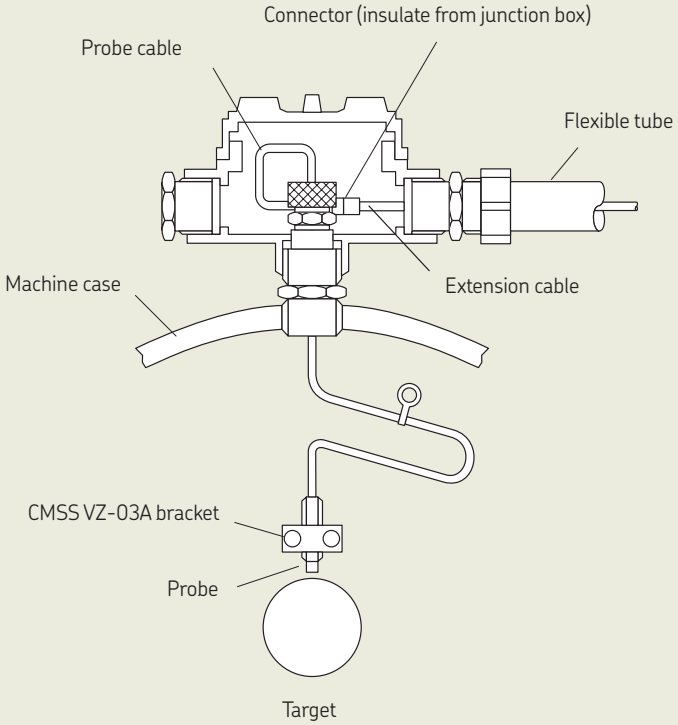
The following describes the actual installation of the probe. Both examples illustrate the use of a CMSS VZ-05A sensor housing, at the interface to the machine, to potentially contain the probe to extension cable connection. Having this accessible, greatly improves the maintainability of the system.

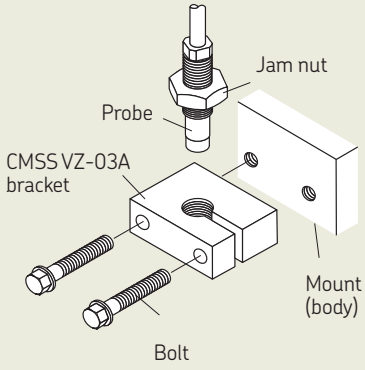
Depending on the state of the system and access to the machine, it may be possible to use mechanical (gap or feeler gage) and/or electrical (Section 5.4) methods to verify the probe to target gap.

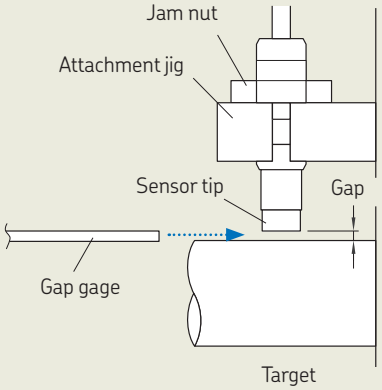
5.1.1 When using the CMSS VZ-03A bracket

1 Attach the CMSS VZ-03A bracket to the mount (body/machine), and temporarily attach with bolts.
2 Insert the probe into the CMSS VZ-03A bracket screw hole, and adjust the gap between the probe tip face and the target.
3 Tighten the bolts further, to fully secure the CMSS VZ-03A bracket.
4 Retighten the lock/jam nut again at the specified torque.
5 Verify the final probe to target gap.

Installation example





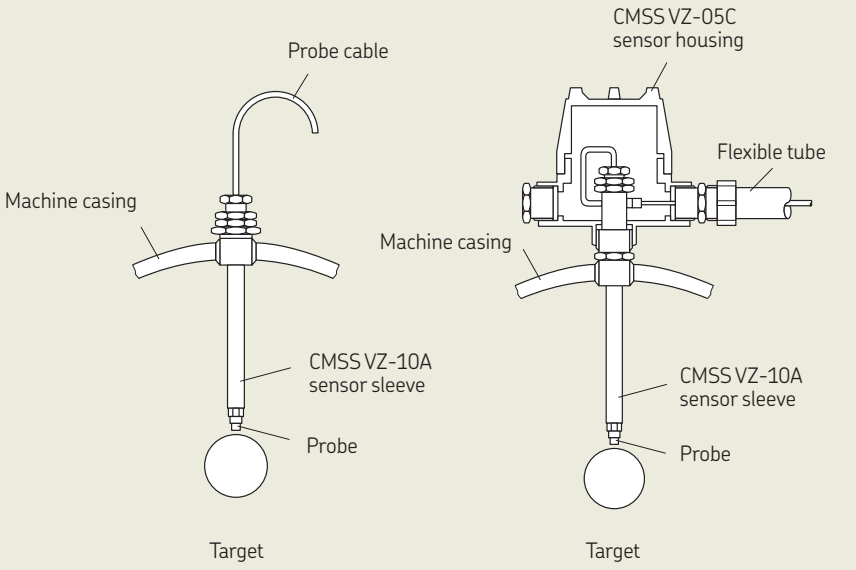


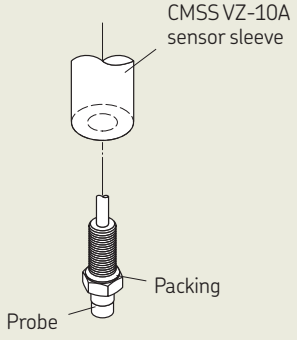
5.1.2 When using the CMSS VZ-10A sensor sleeve

The sensor sleeve is designed to be used with the reverse mount probe.

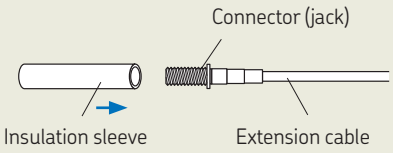
1 Ensure the supplied aluminum gasket (packing) is fitted to the CMSS 78-R probe.
2 Install the probe into the CMSS VZ-10A sensor sleeve.
3 Attach the CMSS VZ-10A sensor sleeve to the mounting (machine casing).
4 Adjust the gap between the probe and the target.
5 Lock the sleeve in position
6 Verify the final probe to target gap.

Installation example

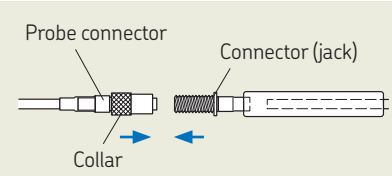




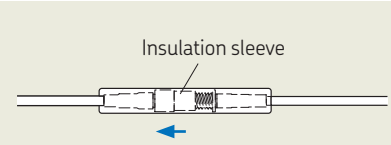
5.1.3 Probe to Extension cable connection (when used)



When using the extension cable, connect the probe and extension cable as shown in the adjacent diagrams.



1 Confirm that there are no foreign objects in either the probe or extension cable connectors. Dirt or debris trapped in the connector will cause a poor connection and produce unwanted measurement characteristics.
2 Insert the extension cable through the provided insulation sleeve (clear heat shrink tube).
3 Connect the probe and extension cable connectors, and tighten the collar by hand.
4 Position the insulation sleeve over the connector.
5 Apply hot air on the insulation sleeve, to shrink it over the connector.



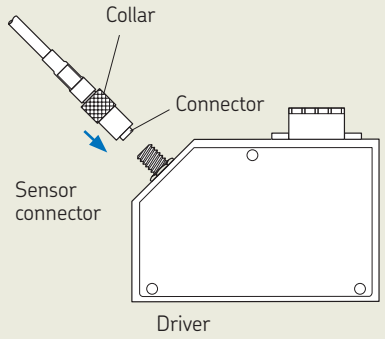
⚠ CAUTION

- Normally, only tighten the connector by hand. If it is tightened using a tool, there is a risk that the connector may be damaged. If the installation environment does not allow proper tightening by hand and there is a risk that it may come loose, tighten only by an additional 1/4 turn using pliers. Applying excessive force to the connector may damage it. Cutting either the probe or the extension cable to a shorter length will result in a measurement system that no longer conforms with the specification.
- Never use vinyl tape to insulate. During extended periods of use or when the connector temperature exceeds 80 °C, vinyl electrical tape may harden or the adhesive may deteriorate, leading to a dirty connector and loss of isolation.
- If no spare insulation sleeve is available, protect the connector with a suitable PTFE adhesive tape.
  Recommended supplier: Nitto Denko Corporation. Product name: Nitoflon adhesive tape (903uL, 0,08 mm thickness) Temperature spec.: –60 to +200 °C

NOTE

- The connector must not be located in a position where it is exposed to water or oil. If water or oil enters the connector, the cable capacitance will increase, and that will cause a loss in sensitivity.
- When making the connections, try to ensure that the cable is not twisted. If there is twisting/torsional stress on the cable, it may slowly loosen the connection. If a twisting force is inevitable, disconnect, slightly pre-twist one cable so that when reconnected it tends to 'tighten' the connection.

5.1.4 Probe/extension cable connection to driver



Connect the probe or extension cable to the driver, as follows.

- Confirm that there are no foreign objects in the probe (or extension cable) connector, or in the driver sensor input connector. Dirt or debris trapped in the connector will cause a poor connection and produce unwanted measurement characteristics.
- Connect the probe (or extension cable) to the driver, and tighten the collar by hand.

⚠ CAUTION

- Normally, only tighten the connector by hand. If it is tightened using a tool, there is a risk that the connector may be damaged.
- Cutting either the probe or the extension cable to a shorter length will result in a measurement that no longer conforms with the specification.

NOTE

- When making the connections, try to ensure that the cable is not twisted. If there is twisting/torsional stress on the cable, it may slowly loosen the connection. If a twisting force is inevitable, disconnect, slightly pre-twist the cable so that when reconnected it tends to 'tighten' the connection.
- If it is unavoidable to store excess cable inside the driver housing, do not force excessive amounts of cabling into it.

5.2 Driver installation

The driver installation differs according to the model/method of attachment:

- CMSS 785-12 and CMSS 785-22 are screw mounting
- CMSS 785-11 and CMSS 785-21 are DIN Rail mounting

5.2.1. Installation of panel mounting drivers

The CMSS 785 screw mount versions are designed to be directly mounted on an enclosure back panel or plate.

The driver provides two mounting options to the user's enclosure/panel:

- 4x clearance holes on a 50,8 mm pitch, or
- 4x clearance holes on a 31 mm x 92 mm pitch

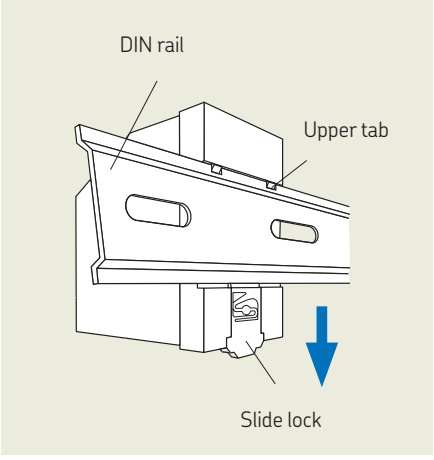
All mounting holes are 4,5 mm diameter, refer to the drawing in section 4.1.4 for further details.

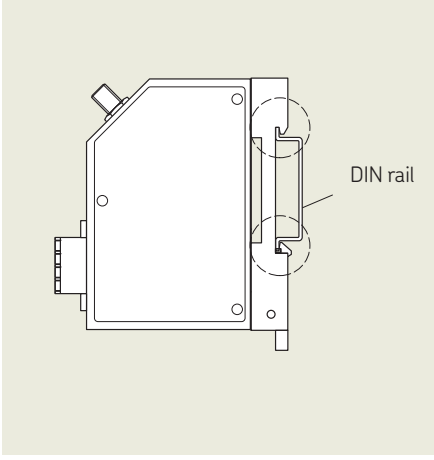
5.2.2. Installation of DIN rail mount drivers

The CMSS 785 rail mount versions are designed to be mounted on a 35 mm DIN rail.

Install according to the following steps:

1 Hook the upper tabs on the back of the driver onto/over the DIN rail.
2 "Rotate down"/push the driver into the DIN rail until a "click" is heard from the slide lock. In case of difficulty, pull the slide lock down with a flat tip screwdriver whilst pushing the driver against the DIN rail.
3 Make sure that the upper tabs and the slide lock are securely fixed onto the DIN rail (circled in the drawing below).





NOTE

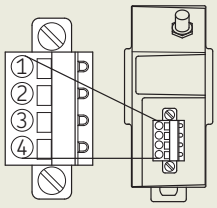
To remove the driver push down on the slide lock with a flat tip screwdriver, rotate up and pull away the driver.

5.3 Making connections to the monitoring system

The driver has four spring loaded terminals for connections with the monitoring system.
At the driver these are marked, OUT (Output), COM (Common), –24 V (Supply) and Shield(COM):

Terminal arrangement

Case of spring lock terminal



Terminal no.	Signal
1	OUTPUT
2	COM
3	–24 V
4	Shield (COM)

Use the following procedure to connect those cables to the driver:

1 On each core, remove the insulation so that there is 9 mm of exposed wire, and twist the (stranded) wire together.
2 Use a flat tip screwdriver to push down the operation lever of the terminal (the orange area). Recommended flat tip screwdriver size: W 2,5 mm × T 0,4 mm.
3 Insert the prepared cable (the 9 mm of exposed wire) all the way into the cable port, as far as possible.
4 Release the flat tip screwdriver, the cable is locked and the connection is complete.

NOTE

The terminal block is secured by the 2 screws on the ends of the terminal block. If these screws are loosened for installation or inspection work, make sure to tighten them after the work is complete (0,2 Nm or 2.03 kgf.cm).

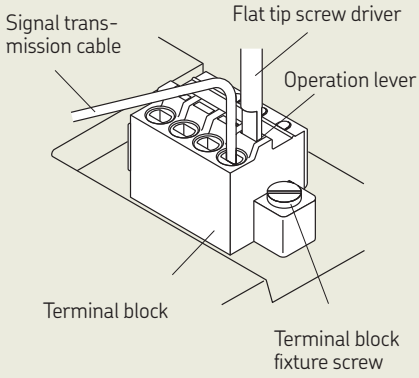


Table 1

Maximum recommended wire length

Wire size (AWG)	Distance (maximum)
20	300 m *(1 000 ft.)*
18	600 m *(2 000 ft.)*
16	900 m *(3 000 ft.)*

NOTE

We recommend using cables of the type described in “4.3 Connections to the Monitoring System” between the unit and monitor. As a small signal is being transmitted, inferior cables may be subject to interference from external noise, and the measurement may be affected.

We recommend that the length of non-shielded cable (at both monitor and driver) be kept under 100 mm.

To avoid noise being induced into the system, connect the shield wire of the signal cable (the 3-core shielded cable between driver and monitor) to both the driver’s “Shield” terminal and monitor’s “COM” terminal. For the connection details of the IMx/monitoring system, refer to the relevant user manual.

If long cable runs between the driver and (IMx) monitoring system are required, consult table 1 to determine the maximum recommended wire length (use three-conductor shielded wire).

5.4 Probe gap voltage confirmation

It will be necessary to confirm the probe gap voltage in the following circumstances.

- During installation/commissioning of the system.
- Thereafter annually (unless the gap voltage is continuously/regularly monitored).
- If a problem is suspected or the monitoring system indicates unexpected gap changes or sensor fault.

The gap voltage can be confirmed in the following ways:

1 The system should have been powered for at least 5 minutes before performing any check
2 Measure the gap voltage by one or more of the following methods:
  2.1 View the gap/bias voltage reported by the IMx/monitoring system
  2.2 Use a DVM (Digital Voltmeter) to confirm the DC voltage measured at the monitor's input terminals
  2.3 Use a DVM to confirm the DC voltage measured at the driver's output terminals
3 If the probe is to be gapped/adjusted:
  3.1 Loosen the jam nut of the probe.
  3.2 Adjust the probe position so that the desired gap voltage is achieved.
  3.3 After adjustment, be sure to tighten the jam nut of the probe at the specified torque.

⚠ CAUTION

Always tighten the jam/locknut nut to the specified torque (refer specifications).
If tightened with excessive torque, probe damage may result and if insufficiently tightened, it may work loose from the mounting.

NOTE

The response indicated in Appendix B1 "Standard static characteristic" relates to a SCM440 flat target (diameter more than 15 mm). When the target material or shape/size differ, the output characteristics (gain) will change, and it may be necessary to compensate at the monitoring system by use of an appropriate sensitivity, rather than the nominal/standard value.

6. Service/inspection recommendations

The following is a description of maintenance and inspection procedures applicable to this unit.

6.1 Periodic inspection

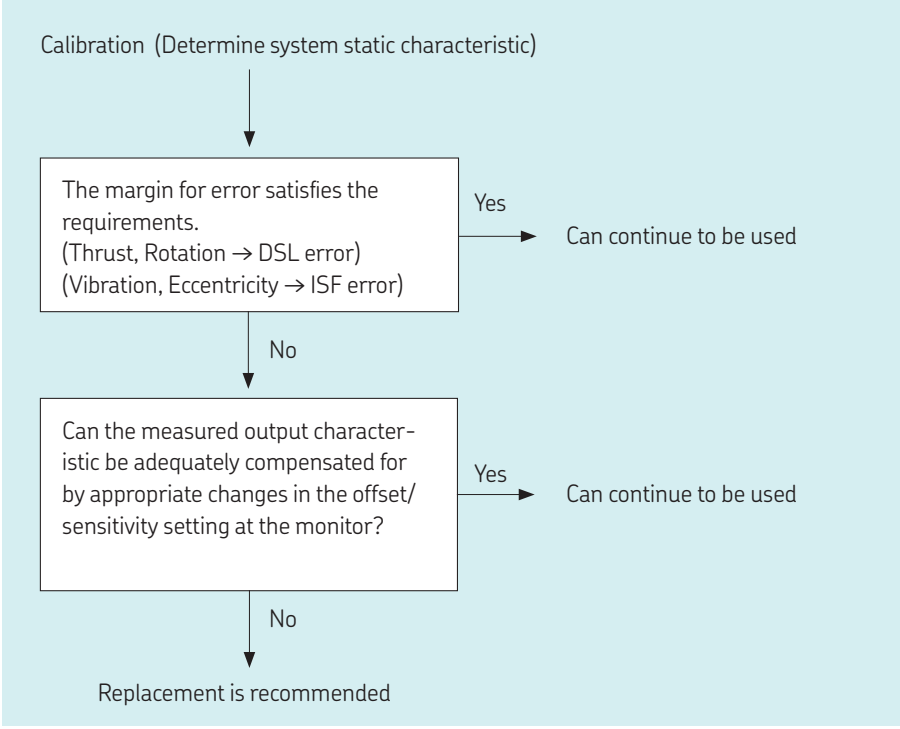
In order to maintain system performance and stability, check the probe gap voltage at least once a year. Refer to “5.4 probe gap voltage confirmation” for relevant guidance.

6.2 Unit life

Even if no problem is apparent, we recommend that the product be replaced every 10 years.

NOTE

The deterioration of this unit depends on the operating environment, therefore in order to ensure system performance, 10 years should be considered a guideline, with earlier replacement desirable. In the flowchart below, a system calibration check (output voltage against static gap, at incremental positions across the working range) provides the base-line data on which to judge the correctness of the measurement system.
Deviation from a straight line (DSL/Linearity) and Incremental Scale factor (ISF/SCF error) are key measures. For graphs of the standard/nominal characteristic refer to Appendix B1.



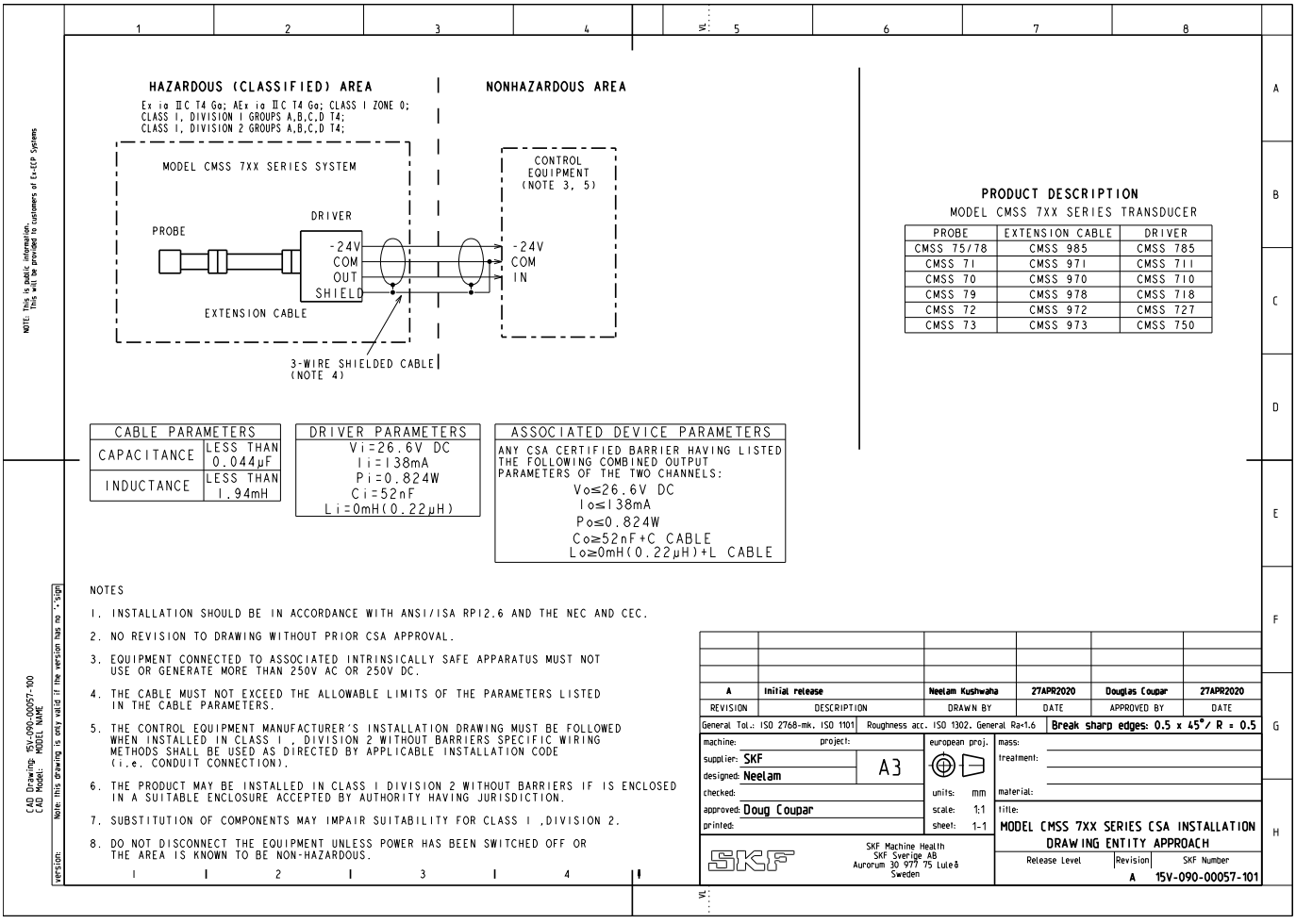
6.3 Troubleshooting

Symptom	Possible cause	Investigative/corrective actions
Output is 0 V and unchanging.	Power is not ON.	Turn the power ON. Check directly at the driver terminals that the correct supply voltage is present.
	The driver is not connected properly.	Refer to 5.3 “Making connections to the monitoring system”, and wire correctly.
	The driver is faulty.	If practical, verify by substituting a known good unit of the same system length and if found necessary, replace the driver.
Output is approximately -0.6 V and unchanging.	The target is outside the measurement range.	Check the physical positions of the probe/target and if necessary adjust to obtain a suitable, in range, gap voltage.
	Probe failure, or the probe cable is shorted or disconnected.	Disconnect the probe/extension cable from the driver and then measure the resistance between the connector central pin and the outer conductor/connector shell. **Normal/expected values:** Sensor coil resistance: approx. 5,5 Ω + Sensor cable resistance: approx. 0,25 Ω/m If an abnormal reading is obtained, inspect the probe and cable for damage. If appropriate repeat the measurement at the probe connector, and replace the probe/extension cable as found necessary (see also next test).
	The extension cable is shorted or disconnected.	With the extension cable disconnected from both probe and driver, measure the resistance of the extension cable (end to end and connector pin to shell). **Normal/expected values:** Center conductor resistance: Approx. 0,25 Ω/m Outer conductor resistance: 0 Ω Center pin to outer conductor resistance: ∞Ω If an abnormal reading is obtained, replace the extension cable.
	Poor connection (probe/extension cables).	Disconnect the probe/extension cable connectors, and check that there is no dirt or debris trapped in the connectors. Refit/retighten, by hand, and re-sleeve probe/extension cable connectors.
	The driver is faulty.	If practical, verify by substituting a known good unit of the same system length and if found necessary, replace the driver.
Output is approximately -22 V and unchanging.	The target is beyond the possible measurement range.	Check the physical positions of the probe/target and if necessary adjust to obtain a suitable, in range, gap voltage.
	The driver is faulty.	If practical, verify by substituting a known good unit of the same system length and if found necessary, replace the driver.

7. Information about intrinsically safe applications

7.1 CSA Installation

7.1.1 System drawing



⚠ DANGER

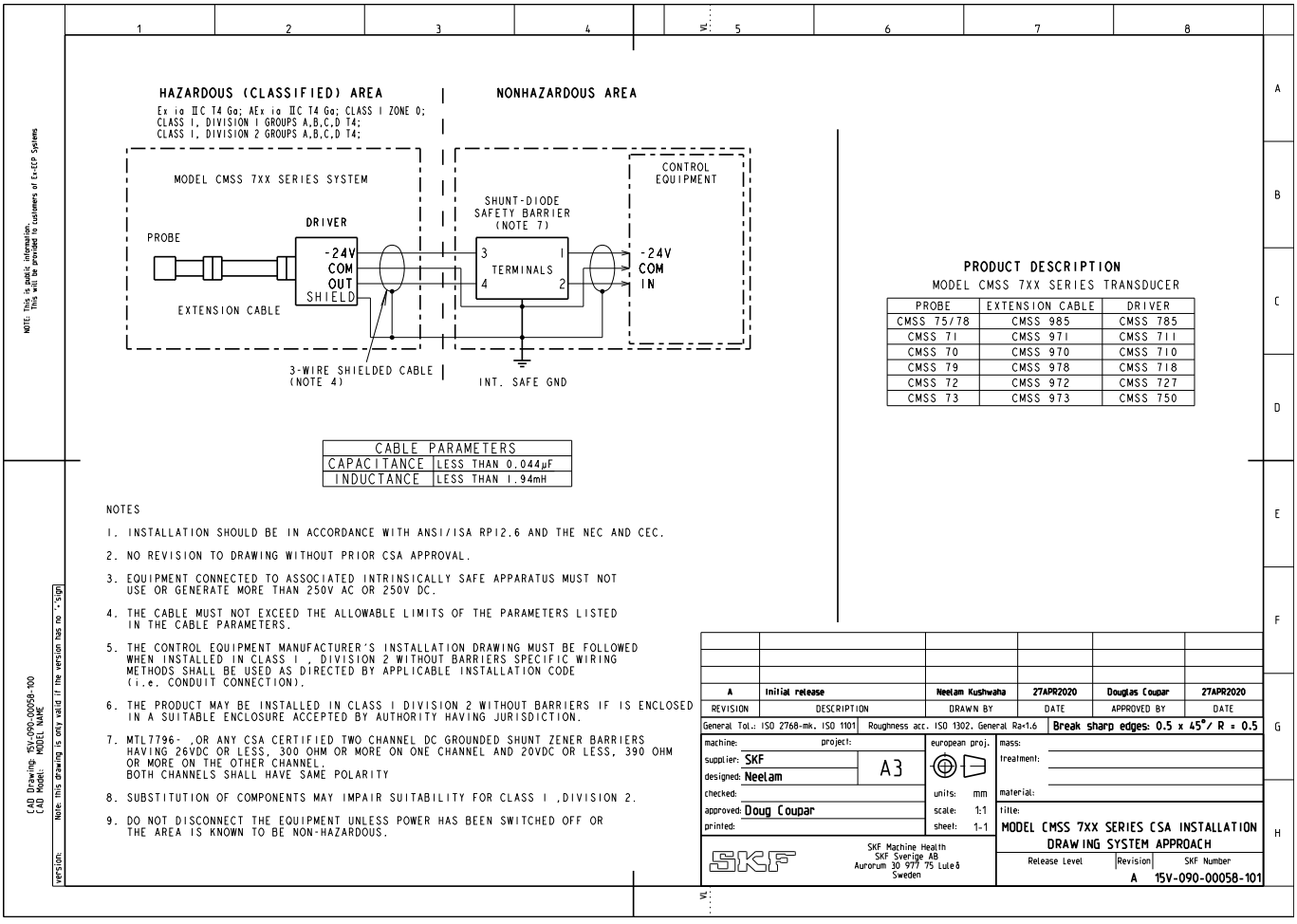
- Non-hazardous area apparatus unspecified except that it must not be supplied from nor contain under normal or abnormal conditions. A source of potential with respect to earth in excess of 250 V RMS or 250 V DC.
- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY AVERTISSEMENT: LA SUBSTITUTION DE COMPOSANTS PEUT COMPROMETTRE LA SECU-RITE INTRINSEQUE
- WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUITS IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
  AVERTISSEMENT - RISQUE D'EXPLOSION. NE PAS DEBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, A MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DENGEREUX.
- INTRINSICALLY SAFE
  SECURITE INTRINSEQUE

⚠ WARNING

Mixing probe, cable or driver revisions in hazardous areas will invalidate intrinically safe approval. Revision 2 probe, cable or driver can be identified by;

- Probe, cable or driver's serial number with R2 suffix.
  e.g. S/N xxxxx R2
- CSA and ATEX labels on driver match drawings information in chapter 7.

7.1.1 System drawing, cont.



PRODUCT DESCRIPTION

MODEL CMSS 7XX SERIES TRANSDUCER

PROBE	EXTENSION CABLE	DRIVER
CMSS 75/78	CMSS 985	CMSS 785
CMSS 71	CMSS 971	CMSS 711
CMSS 70	CMSS 970	CMSS 710
CMSS 79	CMSS 978	CMSS 718
CMSS 72	CMSS 972	CMSS 727
CMSS 73	CMSS 973	CMSS 750

CABLE PARAMETERS	
CAPACITANCE	LESS THAN 0.044µF
INDUCTANCE	LESS THAN 1.94mH

NOTES

1. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP12.6 AND THE NEC AND CEC.
2. NO REVISION TO DRAWING WITHOUT PRIOR CSA APPROVAL.
3. EQUIPMENT CONNECTED TO ASSOCIATED INTRINSICALLY SAFE APPARATUS MUST NOT USE OR GENERATE MORE THAN 250V AC OR 250V DC.
4. THE CABLE MUST NOT EXCEED THE ALLOWABLE LIMITS OF THE PARAMETERS LISTED IN THE CABLE PARAMETERS.
5. THE CONTROL EQUIPMENT MANUFACTURER'S INSTALLATION DRAWING MUST BE FOLLOWED WHEN INSTALLED IN CLASS I , DIVISION 2 WITHOUT BARRIERS SPECIFIC WIRING METHODS SHALL BE USED AS DIRECTED BY APPLICABLE INSTALLATION CODE (i.e. CONDUIT CONNECTION).
6. THE PRODUCT MAY BE INSTALLED IN CLASS I DIVISION 2 WITHOUT BARRIERS IF IS ENCLOSED IN A SUITABLE ENCLOSURE ACCEPTED BY AUTHORITY HAVING JURISDICTION.
7. MTL7796- ,OR ANY CSA CERTIFIED TWO CHANNEL DC GROUNDED SHUNT ZENER BARRIERS HAVING 26VDC OR LESS, 300 OHM OR MORE ON ONE CHANNEL AND 20VDC OR LESS, 390 OHM OR MORE ON THE OTHER CHANNEL. BOTH CHANNELS SHALL HAVE SAME POLARITY
8. SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I ,DIVISION 2.
9. DO NOT DISCONNECT THE EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

REVISION	DESCRIPTION	DRAWN BY	DATE	APPROVED BY	DATE
A	Initial release	Neelam Kushwaha	27APR2020	Douglas Coupar	27APR2020

General Tol.: ISO 2768-mk, ISO 1101 | Roughness acc. ISO 1302, General Ra<1.6 | Break sharp edges: 0.5 x 45° / R = 0.5

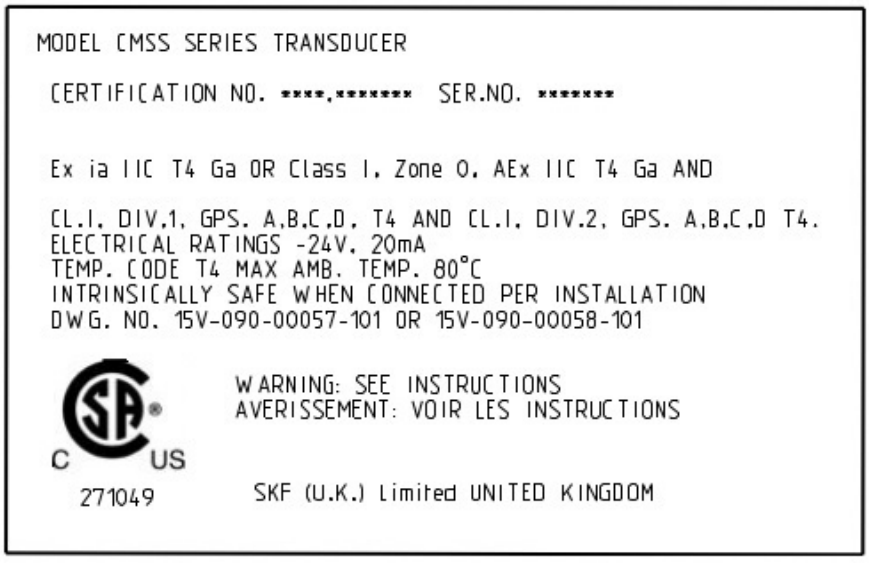
machine: | project: | european proj. | mass:
supplier: SKF | A3 | treatment:
designed: Neelam | material:
checked: | units: mm
approved: Doug Coupar | scale: 1:1 | title: MODEL CMSS 7XX SERIES CSA INSTALLATION DRAWING SYSTEM APPROACH
printed: | sheet: 1-1

SKF Machine Health
SKF Sverige AB
Aurorum 30 977 75 Luleå
Sweden

Release Level: A | Revision | SKF Number: 15V-090-00058-101

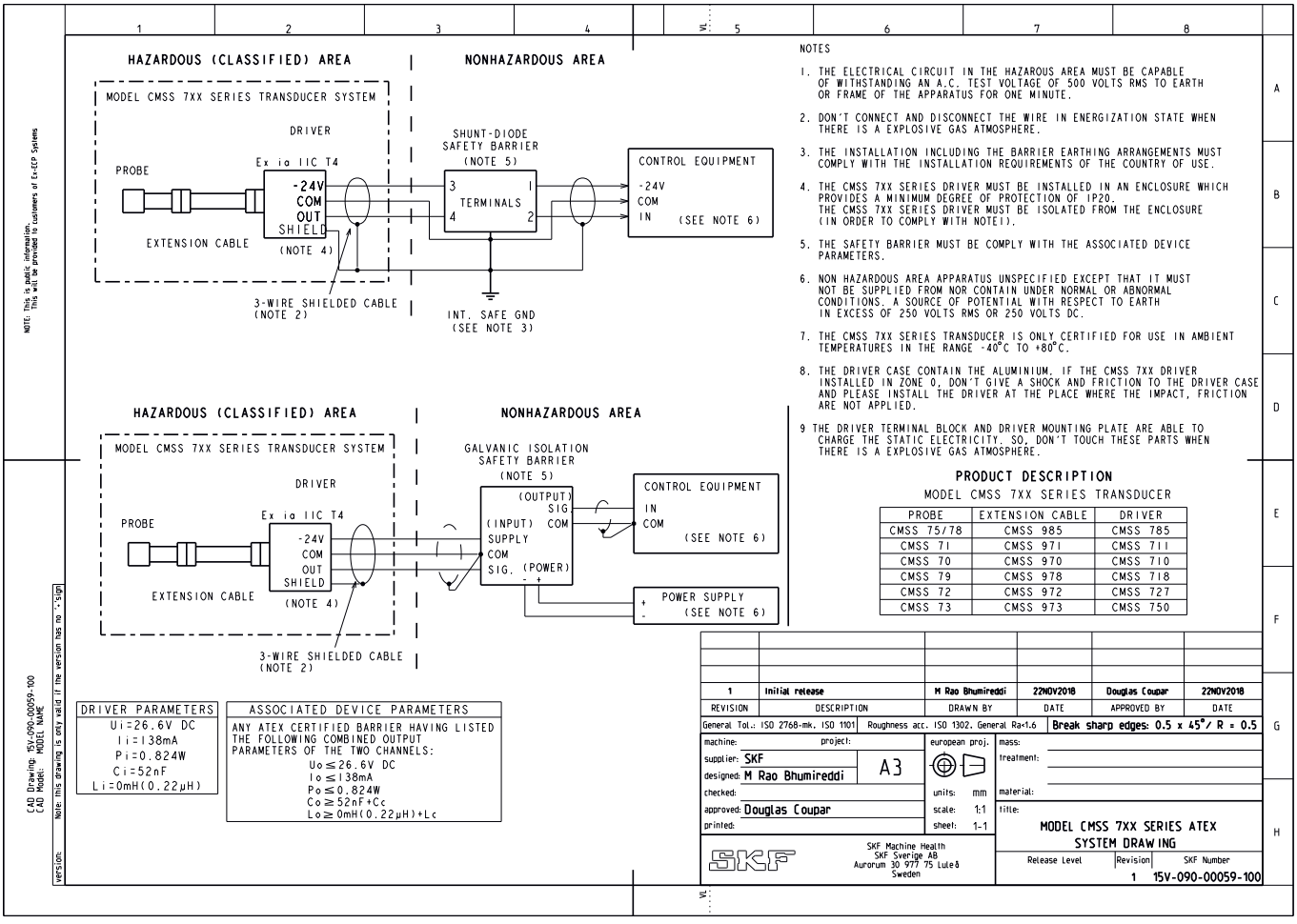
7.1.2 Label information

The label is applied to the driver module case.



7.2 ATEX Installation

7.2.1 System drawing



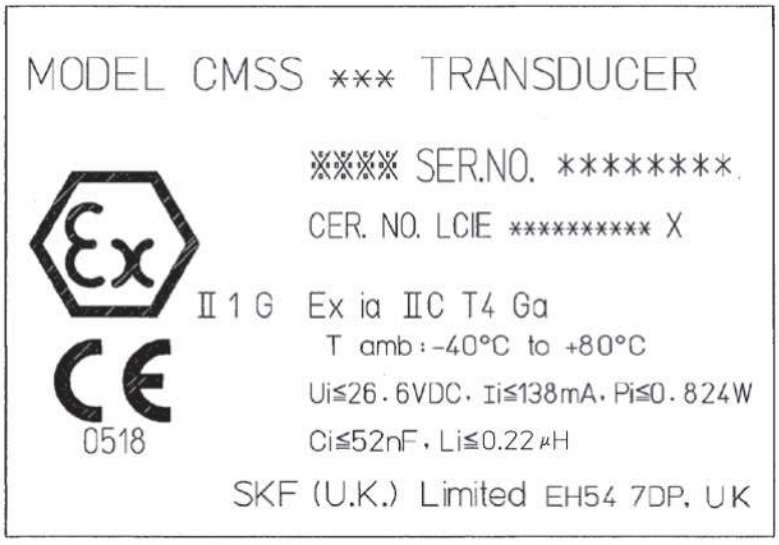
7.2.2 Applicable standards

ATEX

- EN 60079-0 : 2012 + A11 : 2013
- EN 60079-11 : 2012

7.2.3 Label information

XXX represents the year of manufacture.
(eg. 2015 is written in the part of ****** if the production is manufactured in 2015.) The label is applied to the driver module case.



Appendix A – product specifications

Measurement Capability*

Linear range	2 mm (*78.7 mil*)
Measurement range	0,25 to 2,25 mm *(9.8 to 88.5 mil)* from sensor tip
Scale factor	7,87 V/mm *(200 mV/mil)*
Scale factor tolerance	±5% for 5 m systems, ±6,5% for 9 m systems
Linearity (5 m systems)	Within ±25 µm *(±1 mil)* of a straight line of 7,87 V/mm *(200 mV/mil)*
Linearity (9 m systems)	Within ±38 µm *(±1.5 mil)* of a straight line of 7,87 V/mm *(200 mV/mil)*
Frequency response	DC to 10 kHz *(–3dB)* – see frequency response graph, A2 below.
Maximum output voltage	Approximately –23 V DC
Sensor fault output voltage	Approximately –0,6 V DC (Probe OPEN/ Probe SHORT)

Environmental

Temperature limits

Probe	–40 to +177 °C *(–40 to +350 °F)*
Extension Cable	–40 to +177 °C *(–40 to +350 °F)*
Driver	–40 to +80 °C *(–40 to +176 °F)*
System storage	As per the driver rating: –40 to +80 °C *(–40 to +176 °F)*

Temperature characteristic*

Probe	0 to 80 °C - Less than ±3% of full scale
Extension cable	0 to 80 °C - Less than ±4% of full scale
Driver	0 to 60 °C - Less than ±3% of full scale
Loop	0 to 60 °C - Less than ±6% of full scale
Humidity range	30 to 95% RH (non-condensing, non-submerged). Probe only is 100% RH
Environmental Vibration	10 m/s² or less *(10 to 150 Hz)*

Probes and Extension cables

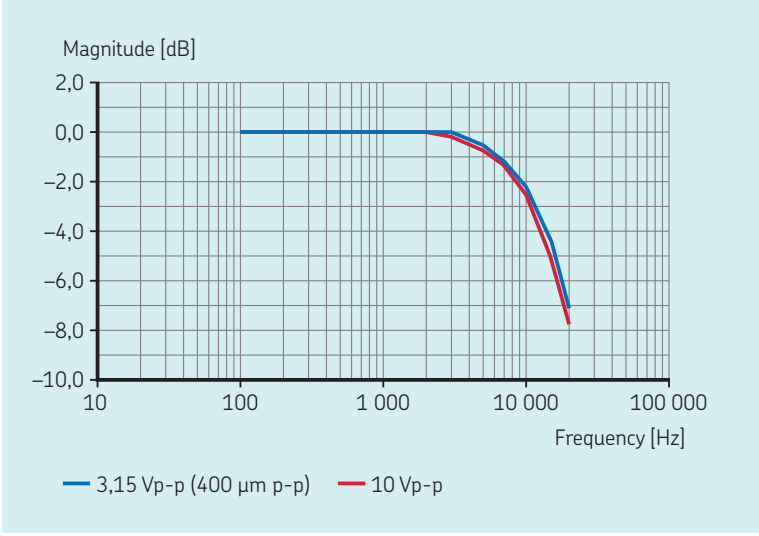
Sensor tip diameter	Approximately 5 mm and 8 mm
System cable length	5 or 9 m
Maximum cable tension	98,1 N *(10 kgf)*
Minimum bend radius	30 mm (without armoured cable) 50 mm (with armoured cable)
Jam/locknut torque	
CMSS 75-xU1	1,4 Nm (*15 kgf.cm*) – 5 mm UNF thread
CMSS 75-xM1	4,0 Nm (*41 kgf.cm*) – 5 mm metric thread
CMSS 78-xU2	6,8 Nm (*69 kgf.cm*) – 8 mm UNF thread
CMSS 78-xM2	8,5 Nm (*87 kgf.cm*) – 8 mm metric thread, including reverse mount

Driver

Power Requirement	Within -25.5 VDC +/- 10%
Current consumption (10 kΩ load)	Maximum 15 mA
Output impedance	50 Ω, current 5 mA (maximum)
Output noise	Approximately 15 mV pk-pk + power supply noise
Dielectric strength of driver	Between terminals and mounting plate: 1 mA or less (*500 V AC / 1 minute*)
Insulation resistance of driver	Between terminals and mounting plate: 100 MΩ or more at 500 V DC
Terminal type	Spring lock terminals
Wire gauge range (for the terminals)	0,2 to 1,5 mm² cross sectional area
Screwdriver (to open the terminals)	Recommended flat tip screwdriver size: W 2,5 mm × T 0,4 mm
Fixing screw tightening torque	1,18 Nm *(12 kgf.cm)* or less (for panel mounting drivers)
Weight of driver	Approximately 200 g *(7 oz.)*

* Under controlled conditions (in-situ / site tests may yield wider variances) Target material: JIS SCM440, flat surface, diameter > 15 mm, at 20 °C, 2 mm gap for temperature characteristic. JIS SCM440 is an equivalent to AISI 4140.

A1 – Frequency response graph

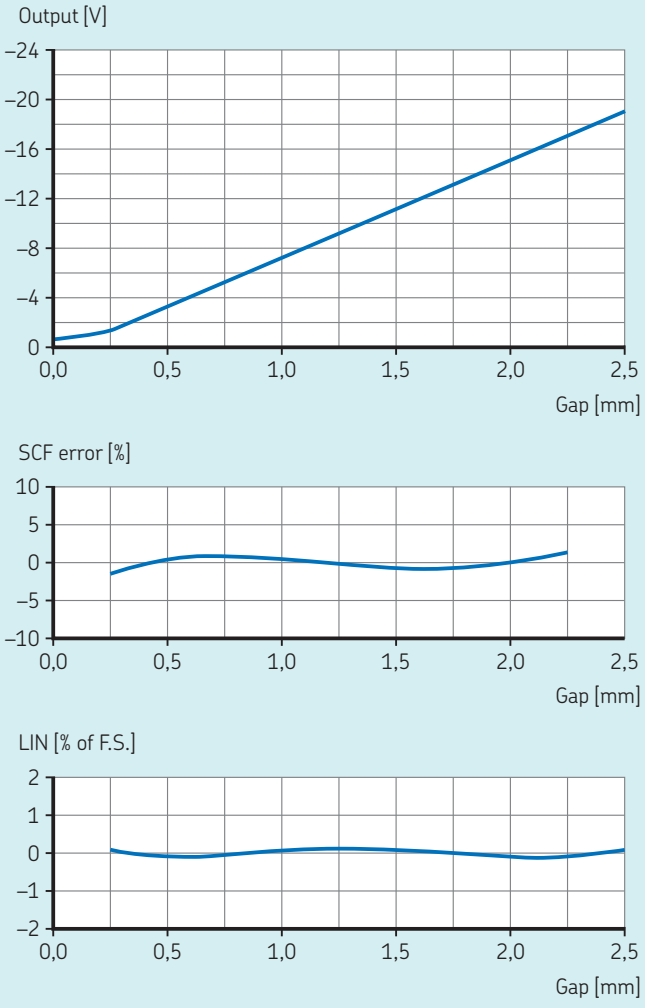


Appendix B – Influences on the output characteristic

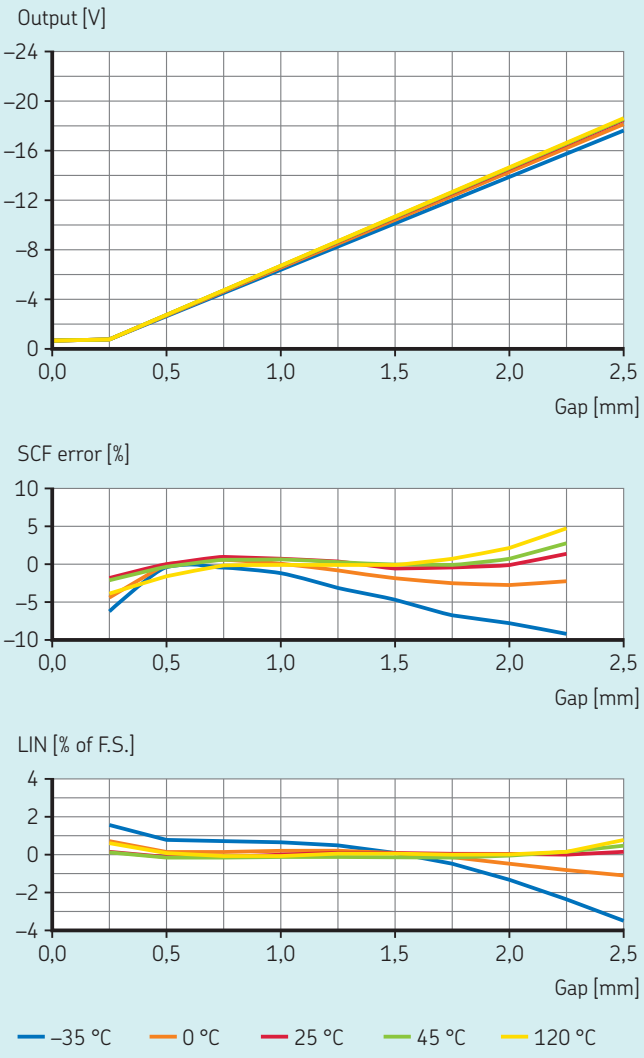
Comparison of the standard & likely actual output characteristics due to environment, driver power supply and target condition, influences.

B1 – Standard static characteristic

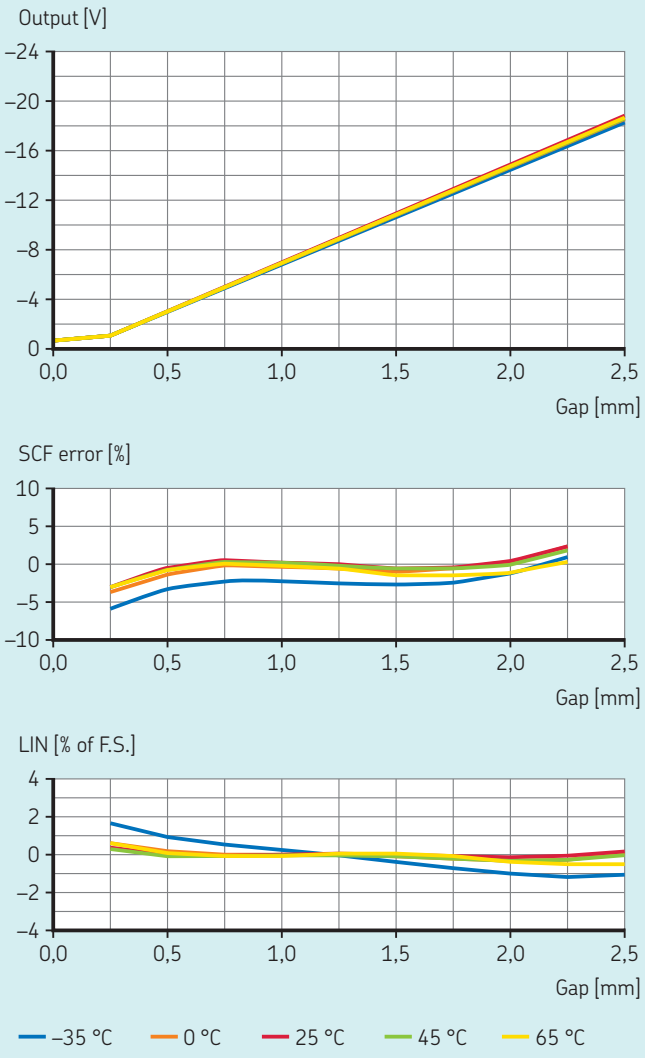
Target material: SCM440, flat face (dia. 15 mm or more). Nominal Scale Factor (SCF) is 7,87 mV/µm (200 mV/mil).



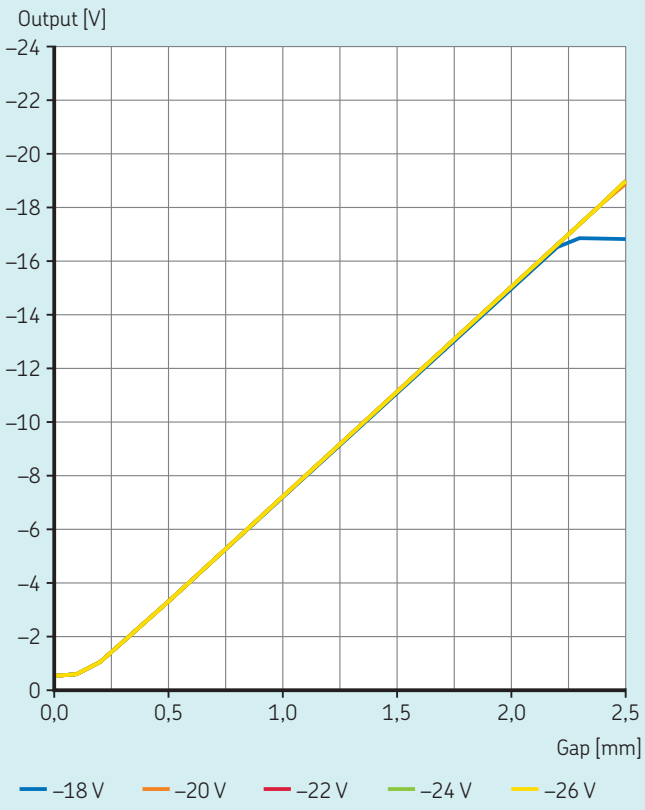
B2 – Sensor temperature characteristics (5 m system)



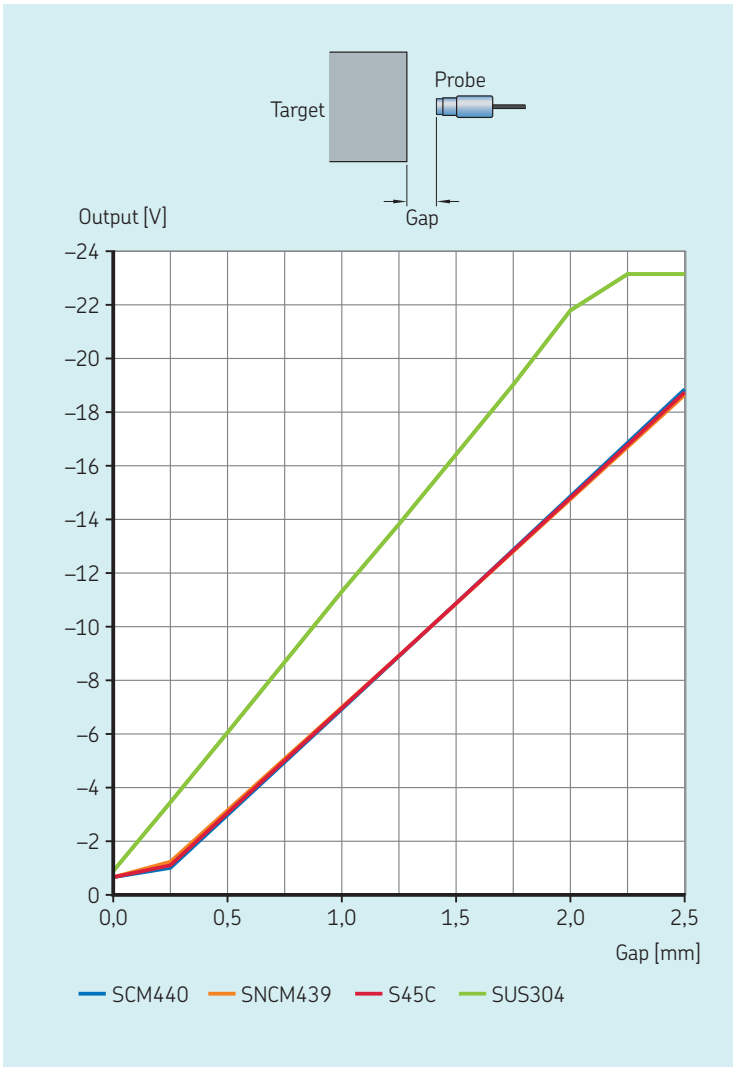
B3 – Driver temperature characteristics (5 m system)



B4 – Effect due to driver supply voltage variation

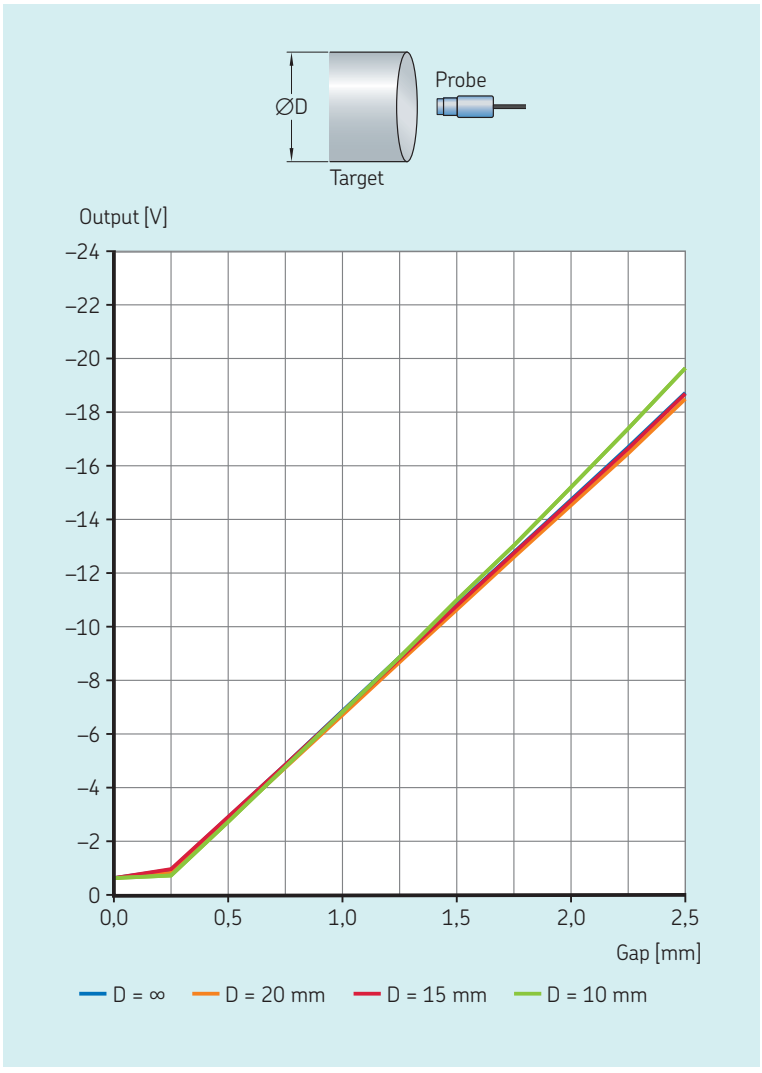


B5 – Response to different target materials



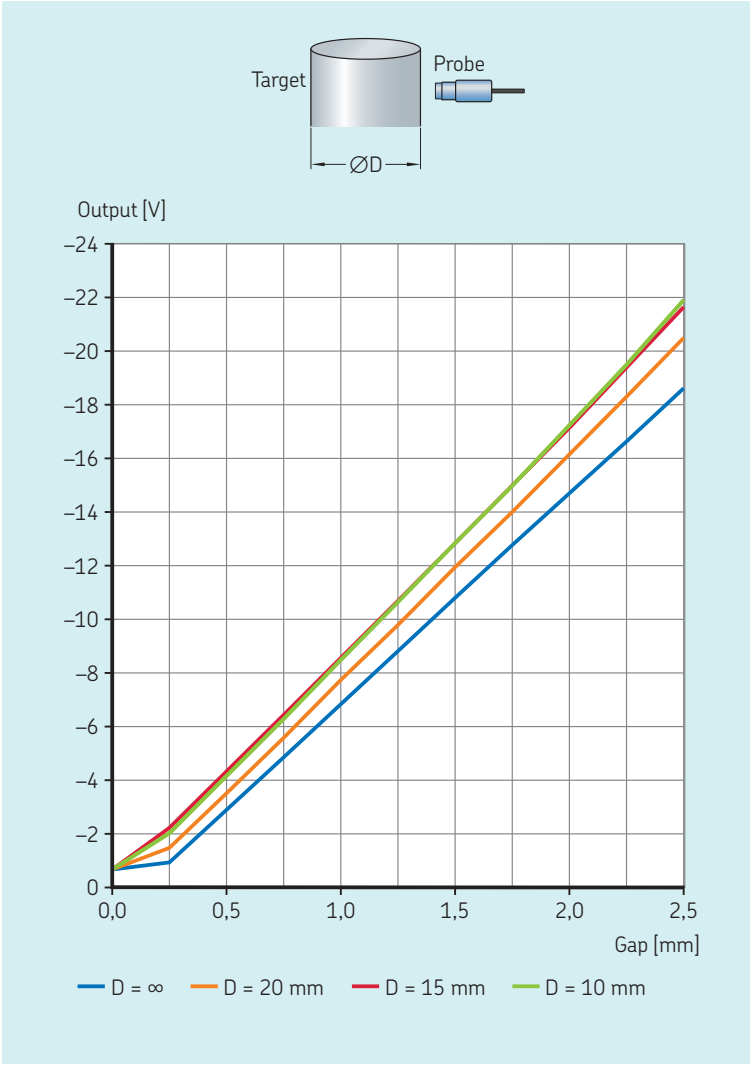
B6 – Effect due to target diameter

Target material: SCM440



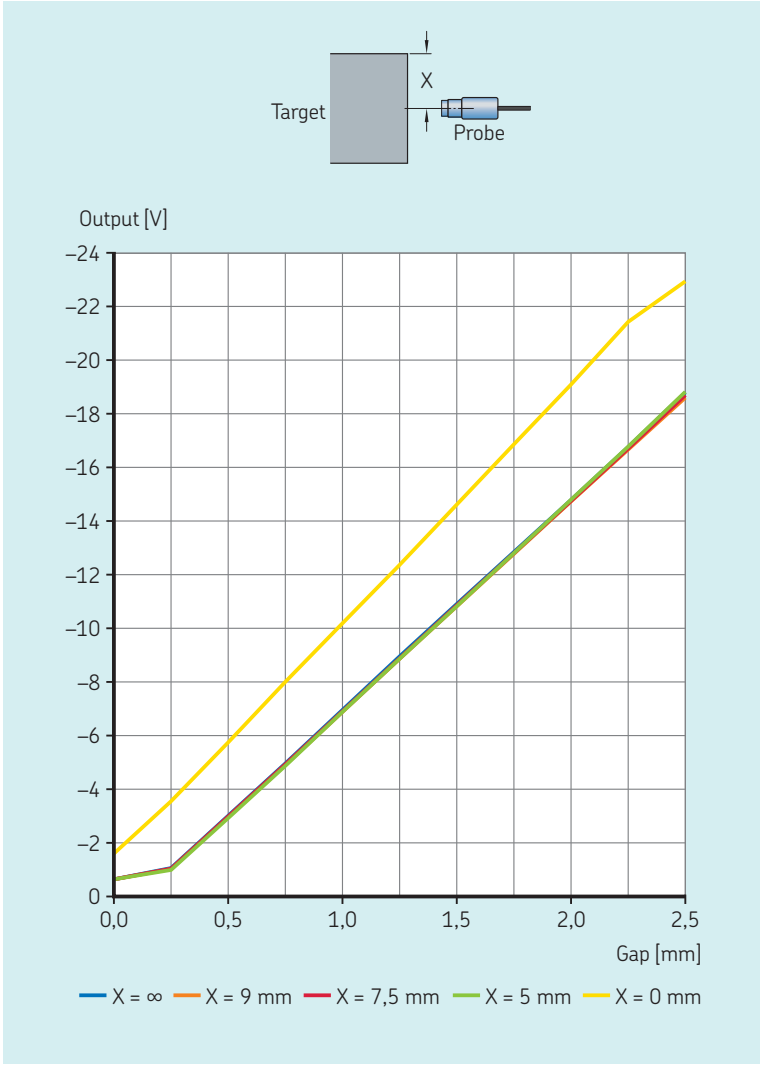
B7 – Effect of a curved target surface

Target material: SCM440



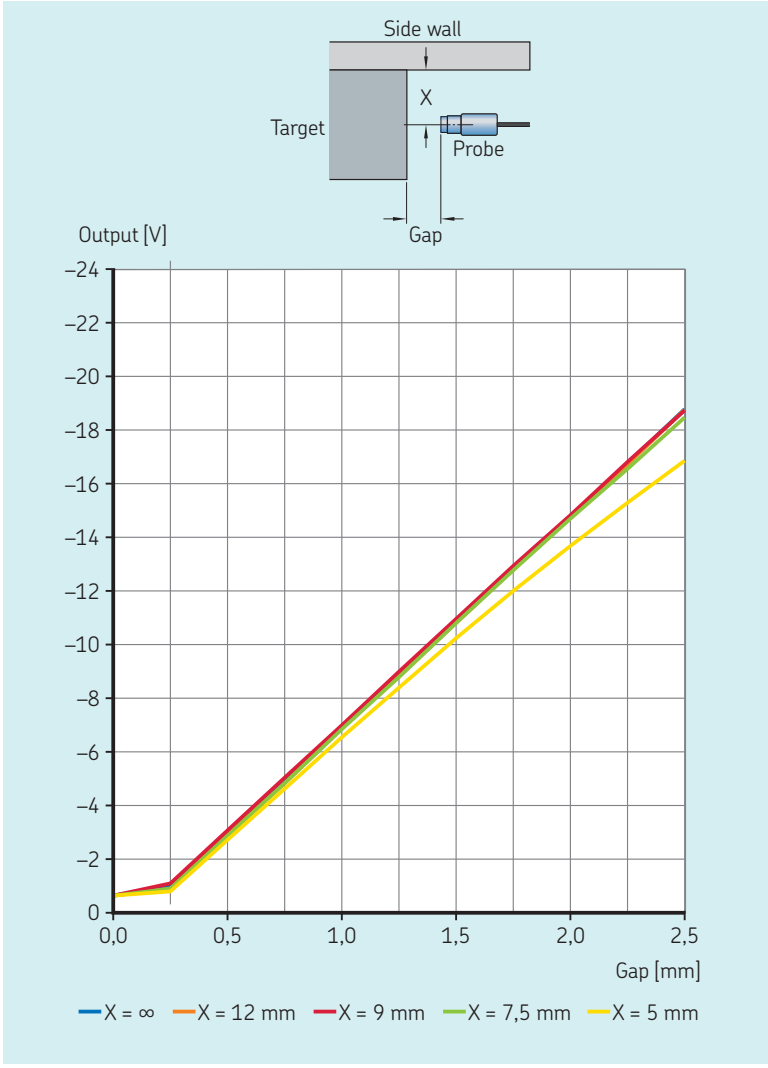
B8 – Effect due to (abrupt) target edge

Target material: SCM440



B9 – Effect due to the proximity of a side wall

Target and side wall material: SCM440



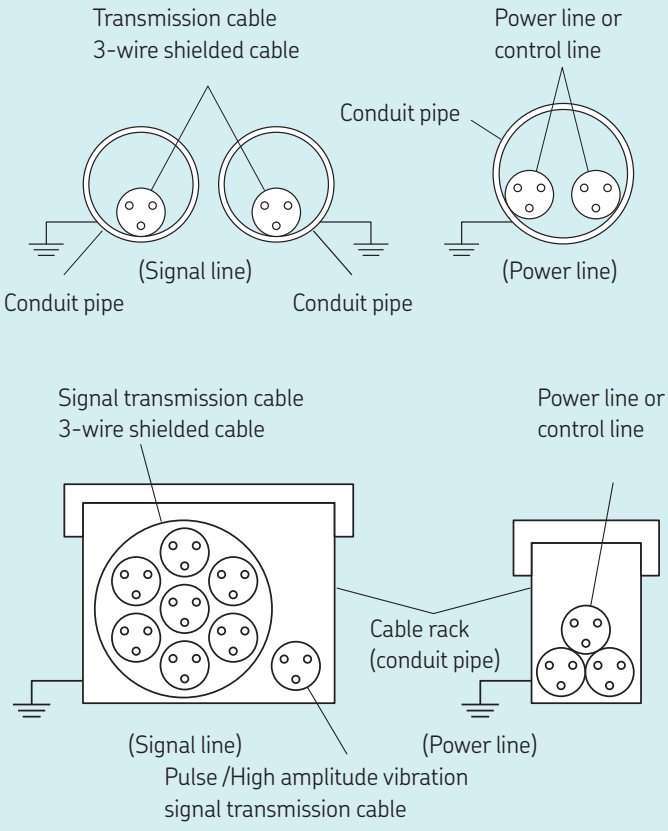
Appendix C – Cable wiring/laying recommendations

The following recommendations are typically made to avoid issues arising from cable laying and installation.

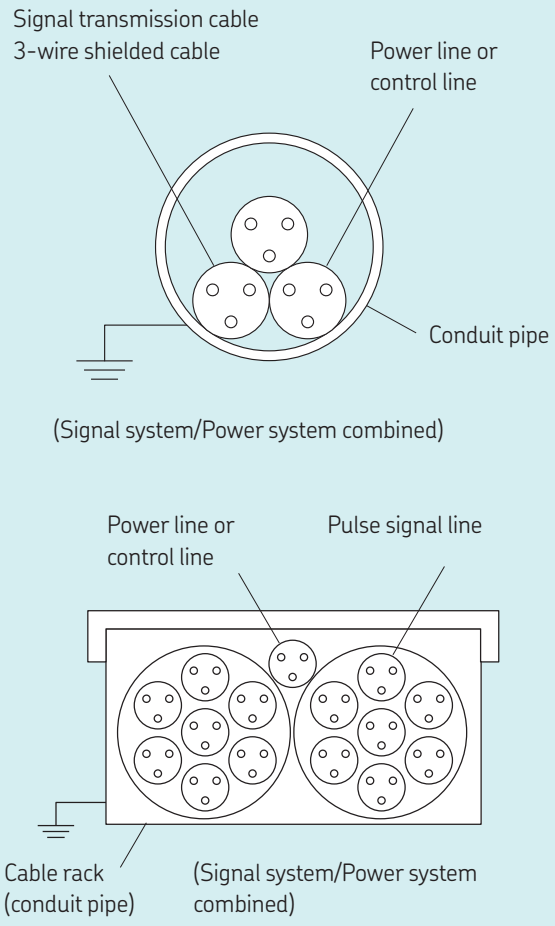
- Pulsed signals (phase marker, rotation) are preferably to be on a separate cable from vibration and similar signals.
- Do not mix signal transmission cables and control/power system cables.
- All cable installations are to be made using grounded conduit pipe or cable racks.

Cable wiring/laying example:

Good example



Bad example



Appendix D – SKF Limited Warranty

WARRANTY

Subject to the terms and conditions contained herein and provided that there is no applicable written agreement between the selling entity in the SKF Group ("SKF") and the Buyer specifically covering the sale of the Products (as defined below) that includes a product warranty, SKF warrants to the Buyer that for the warranty period indicated below the products sold by SKF that are listed below (the "Products"), when properly installed, maintained and operated, will be free from defects in material and workmanship and shall be fit for the ordinary purposes for which the Products are designed.

BUYER'S LIMITED REMEDIES

This limited warranty defines SKF's sole and exclusive liability and Buyer's sole and exclusive remedy for any claim arising out of, or related to, any alleged deficiency in any Product sold by SKF, even if such claim is based on tort (including negligence or strict liability), breach of contract, or any other legal theory. If the Product does not conform to this limited warranty, Buyer must notify SKF or SKF's authorized service representative within thirty (30) days of discovery of the nonconformity; provided, however, that SKF shall not be liable for any claim for which notice is received by SKF more than thirty (30) days following the expiration of the applicable warranty period for the Product. Upon receipt of timely notification from Buyer, SKF may, at its sole option, modify, repair, replace the Product, or reimburse Buyer for any payment made by Buyer to SKF for the purchase price of the Product, with such reimbursement being pro-rated over the warranty period.

WARRANTY PERIOD

Except as expressly provided below, the warranty period for each Product shall commence on the date the Product is shipped by SKF to Buyer.

90-DAY WARRANTY

Products warranted for ninety (90) days by SKF are as follows: cable assemblies, magnetic temperature probes, and all refurbished equipment.

ONE-YEAR WARRANTY

Products warranted for one (1) year by SKF are as follows: all Microlog products and accessories, all Insight Rail products, seismic sensors not covered by Limited Lifetime warranty, all Multilog Wireless Monitoring Units (WMx), all Machine Condition Advisors (MCA), all Machine Condition Indicators (MCI), Machine Condition Transmitters (DCL/CTU).

TWO-YEAR WARRANTY

For all On-line Systems (as defined below) that have satisfied Criteria 1 and 2 below, the warranty period shall be either thirty (30) months from the date the On-line System is shipped by SKF to Buyer, two (2) years from the date the On-line System is installed and commissioned by SKF, or two (2) years from the date on which the installation of the On-line System has been audited and commissioned by SKF or its authorized service representative, whichever period ends first.

Criteria 1.

Devices used with a Multilog On-line System IMx, including, but not limited to, the sensing device, the interconnect cabling, junction boxes, if any, and the communications interface, must consist only of SKF-supplied or SKF-approved devices and/or components. The computer provided by Buyer must meet the requirements stipulated by SKF.

Criteria 2.

SKF or its authorized service representative has installed the On-line System or has audited the installation and commissioned the On-line System.

"On-line Systems" are defined as systems consisting of Multilog On-line System IMx, and any sensing or input devices, the interconnect cabling between the sensing or input devices and the Multilog On-line System IMx, and the cabling between the Multilog On-line System IMx, and the proprietary SKF communications interface with the host computer.

THREE-YEAR WARRANTY

Products warranted for three (3) years by SKF are as follows: Eddy Current CMSS 785 series drivers, probes and cables.

LIMITED LIFETIME WARRANTY

Products covered under this Limited Lifetime Warranty (as set forth below) are as follows: QuickCollect sensor (CMDT 39x), standard seismic sensors of the CMSS 2XXX and CMSS 7XX series (accelerometers and velocity transducers) as marked and published in the SKF Vibration Sensor Catalogue.

(A) Subject to the terms herein, SKF will provide a "Limited Lifetime Warranty" for the products specified above sold by SKF after April 15, 2014. Under the Limited Lifetime Warranty, those products shall, at the time of shipment, be free from defects in material and workmanship. If any of these products fail to meet the terms of this Limited Lifetime Warranty during the life of such products, SKF, in its sole discretion, will repair, replace or exchange the products for the same model if the necessary components for the products are still available to SKF on a commercially reasonable basis. SKF will not provide a Limited Lifetime Warranty on products damaged by accident, abuse, misuse, neglect, improper installation, problems with electrical power, natural disaster, or by any unauthorized disassembly, repair or modification.

(B) Upon receipt of any product covered by the Limited Lifetime Warranty, SKF will pay all shipping charges to send the repaired, replaced or exchanged product to the original point of shipment. SKF reserves the right to decline repair or replacement if no fault is found in the product.

(C) For any warranty claim, the original Buyer must provide SKF with the applicable model and serial numbers, the date of purchase, the nature of the problem, and proof of purchase. SKF, in its sole discretion, will determine if the Buyer must return the product covered under this warranty to SKF.

(D) The express warranty set forth in the Limited Lifetime Warranty is in lieu of and excludes any and all other warranties express or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

(E) SKF's sole obligations under this Limited Lifetime Warranty are set forth in paragraphs (A) and (B), and SKF's liability under this Limited Lifetime Warranty shall not exceed the purchase price of the

product, plus any shipping and handling charges that SKF may be obligated.

(F) IN NO EVENT SHALL SKF BE LIABLE OR OBLIGATED TO THE BUYER OR ANY OTHER PERSON FOR SPECIAL, EXEMPLARY, PUNITIVE, INCIDENTAL, DIRECT, INDIRECT, GENERAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BY WAY OF EXAMPLE ONLY, LOST PROFITS OR SAVINGS, LOSS OF BUSINESS OR LOSS OF USE) OR ANY OTHER LOSS, COST OR EXPENSE IN CONNECTION WITH THE PRODUCTS REGARDLESS OF WHETHER OR NOT ANY OF THE FOREGOING WERE FORESEEABLE OR THAT SKF WAS ADVISED AS TO THE POSSIBILITY OF SUCH DAMAGES, LOSS, COST, OR EXPENSE.

(G) The Limited Lifetime Warranty applies solely to the original Buyer and is non-transferrable.

OTHER SKF PRODUCTS

Any SKF product supplied hereunder but not covered by this limited warranty shall be either covered by the applicable SKF limited warranty then in place for such product or, if no such warranty exists, shall be covered by the 90-day warranty stated above.

THIRD PARTY PRODUCT WARRANTIES

For any third party products sold to Buyer by SKF, SKF will transfer to Buyer any warranties made by the applicable third party product vendor to the extent such warranties are transferable.

CONDITIONS

As a condition to SKF's warranty obligations hereunder and if requested or authorized in writing by SKF, Buyer shall forward to SKF any Product claimed by Buyer as being defective. Buyer shall prepay all transportation charges to SKF's factory or authorized service center. SKF will bear the cost of shipping any replacement Products to Buyer. Buyer agrees to pay SKF's invoice for the then-current price of any replacement Product furnished to Buyer by SKF, if the Product that was replaced is later determined by SKF to conform to this limited warranty.

SKF shall not be obligated under this limited warranty or otherwise for normal wear and tear or for any Product which, following shipment and any installation by SKF (if required by the contract with the Buyer), has, in SKF's sole judgment, been subjected to accident, abuse, misapplication, improper mounting or remounting, improper lubrication, improper repair or alteration, or maintenance, neglect, excessive operating conditions or for defects caused by or attributable to the Buyer, including without limitation Buyer's failure to comply with any written instructions provided to Buyer by SKF.

SKF shall be free to conduct such tests, investigations and analysis of the Products returned to SKF, as it deems reasonable and proper in the exercise of its sole judgment. As a further condition to SKF's obligations hereunder, Buyer shall offer its reasonable cooperation to SKF in the course of SKF's review of any warranty claim, including, by way of example only, Buyer's providing to SKF any and all information as to service, operating history, mounting, wiring, or re-lubrication of the Product which is the subject of the Buyer's warranty claim.

EXCEPT WARRANTY OF TITLE AND FOR THE WARRANTIES EXPRESSLY SET FORTH IN HEREIN, IT IS UNDERSTOOD AND AGREED THAT:

(A) SKF MAKES NO OTHER WARRANTY, REPRESENTATION OR INDEMNIFICATION, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT;

(B) IN NO EVENT SHALL SKF BE LIABLE OR OBLIGATED FOR SPECIAL, EXEMPLARY, PUNITIVE, INCIDENTAL, DIRECT, INDIRECT, GENERAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BY WAY OF EXAMPLE ONLY, LOST PROFITS OR SAVINGS, LOSS OF BUSINESS OR LOSS OF USE) OR ANY OTHER LOSS, COST OR EXPENSE IN CONNECTION WITH THE PRODUCTS AND RELATED SERVICES, IF ANY, PROVIDED BY SKF, AND THIS DISCLAIMER SHALL EXTEND AS WELL TO ANY LIABILITY FOR NONPERFORMANCE CAUSED BY SKF'S GROSS OR ORDINARY NEGLIGENCE, AND IN ALL CASES REGARDLESS OF WHETHER OR NOT ANY OF THE FOREGOING WERE FORESEEABLE OR THAT SKF WAS ADVISED AS TO THE POSSIBILITY OF SUCH DAMAGES, LOSS, COST, OR EXPENSE; AND

(C) NO PERSON HAS BEEN AUTHORIZED BY SKF TO MAKE ANY FURTHER OR CONTRARY INDEMNITIES, REPRESENTATIONS OR WARRANTIES ON BEHALF OF SKF. THE FOREGOING LIMITATIONS AND DISCLAIMERS OF LIABILITY SHALL BE MADE APPLICABLE TO THE SALE OF ANY PRODUCT BY SKF TO THE FURTHEST EXTENT PERMITTED BY APPLICABLE LAW.

The exclusive remedies provided in this limited warranty shall not be deemed to have failed of their essential purpose so long as SKF is willing and able to perform to the extent and in the manner prescribed in this limited warranty.

skf.com | www.skf.com/cm

PUB CM/I4 17533/1 EN · August 2020

User manual No.
15V-090-00062-100
Published in August 2020
Revision C