# Eddy Probe Systems

## Technical Manual


Part number: CMSS 31075800
Revision G
October 2008

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# SKF Reliability Systems Limited Warranty

## WARRANTY

Subject to the terms and conditions contained herein, 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, MARLIN QuickConnect (MQC), 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 MARLIN data managers (MDM), all MARLIN Condition Detectors (MCD), all Wireless Machine Condition Detectors (WMCD), all Multilog Condition Monitoring Units (CMU, TMU), Multilog Local Monitoring Units (LMU), all Wireless Monitoring Systems V/T, all Vibration Pen$^{Plus}$, all transmitters, all SKF software, all Monitor Interface Modules (MIM), all Machine Condition Transmitters (MCT), MicroVibe P and Custom Products with the prefix of CMCP (with the exception of any consumable or expendable items).

## TWO-YEAR WARRANTY

Products warranted for two (2) years by SKF are as follows: all standard Eddy Probes, Eddy Probe Drivers, and Eddy Probe Extension Cables, Multilog On-line Monitoring system (DMx), and all M800A and VM600 Machinery Monitoring Systems.

For all On-line Systems 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 Condition Monitoring Unit (CMU), Multilog Local Monitoring Unit (LMU), 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 Condition Monitoring Unit(s) (CMU), Multilog Local Monitoring Unit(s) (LMU), and any sensing or input devices, the interconnect cabling between the sensing or input devices and the Multilog Condition Monitoring Unit(s) (CMU), Multilog Local Monitoring Unit(s) (LMU), and the cabling between the Multilog Condition Monitoring Unit (CMU), Multilog Local Monitoring Unit (LMU) and the proprietary SKF communications interface with the host computer.

### FIVE-YEAR WARRANTY

Products warranted for five (5) years by SKF are as follows: all standard seismic sensors (accelerometers and velocity transducers).

### 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.


CM-F0001 (Revision P, 12-07)

# Section 1
# General information

## Introduction

This manual provides for the use, installation, and maintenance information for the following SKF Eddy Current Probe Systems.

***Probe diameter, probe/extension cable/driver***

- 5 mm CMSS 61/CMSS 900/CMSS 606 Series
- 8 mm CMSS 60/CMSS 900/CMSS 600 Series
- 5 mm CMSS 65/CMSS 958/CMSS 665/CMSS 665P Series
- 8 mm CMSS 68/CMSS 958/CMSS 668/CMSS 668P Series
- 19 mm CMSS 62/CMSS 900/CMSS 620-2 Series

This manual also explains how to use optional equipment associated with Eddy Probe Systems.

Eddy Probe Systems are integral components and typically consist of a non-contacting probe, an extension cable, and a driver (Figure 1-1).

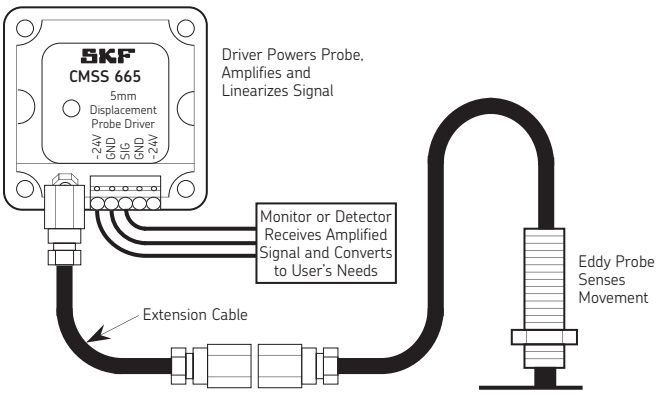



***Figure 1-1. The SKF Eddy Current Probe System.***

An Eddy Probe senses mechanical movement and converts this movement (displacement) into a usable electrical signal. The signal can then be sent to a monitor system for conditioning, analysis and/or alarm protection.

***Table 1-1. Component compatibility.***

| Probe | Extension cables | Driver | System length |
|---|---|---|---|
| CMSS 60 | CMSS 900 | CMSS 600 | 5 meters |
| CMSS 60 | CMSS 900 | CMSS 600-1 Series | 10.5 meters |
| CMSS 61 | CMSS 900 | CMSS 606 | 5 meters |
| CMSS 61 | CMSS 900 | CMSS 627 | 9 meters |
| CMSS 61 | CMSS 900 | CMSS 606-10 | 5 meters |
| CMSS 62 | CMSS 900 | CMSS 620-2 | 10.8 meters |
| CMSS 65 | CMSS 958 | CMSS 665 | 5 meters |
| CMSS 65 | CMSS 958 | CMSS 665-1 | 10 meters |
| CMSS 65 | CMSS 958 | CMSS 665-8 | 5 meters |
| CMSS 65 | CMSS 958 | CMSS 665-16-9 | 5 meters |
| CMSS 65 | CMSS 958 | CMSS 665-16-15 | 10 meters |
| CMSS 65 | CMSS 958 | CMSS 665-20-00 | 5 meters |
| CMSS 68 | CMSS 958 | CMSS 668 | 5 meters |
| CMSS 68 | CMSS 958 | CMSS 668-1 | 10 meters |
| CMSS 68 | CMSS 958 | CMSS 668-2 | 15 meters |
| CMSS 68 | CMSS 958 | CMSS 668-8 | 5 meters |
| CMSS 68 | CMSS 958 | CMSS 668-16-9 | 5 meters |
| CMSS 68 | CMSS 958 | CMSS 668-16-15 | 10 meters |
| CMSS 68 | CMSS 958 | CMSS 668-20-00 | 5 meters |

*Table 1-2. Probe compatibility.*

| Probe | CMSS 60 | CMSS 61 | CMSS 62 | CMSS 65 | CMSS 68 |
|---|---|---|---|---|---|
| Case thread | 3/8"-24 (M10-1) | 1/4"-28 (M8-1) | 1"-12 (Not available) | 1/4"-28 (M8-1) | 3/8"-24 (M10-1) |
| Tip diameter | 8 mm | 5 mm | 19 mm | 5 mm | 8 mm |
| Usable range | 90 mil (2.3 mm) | 75 mil (1.9 mm) | 60-300 mil (1.5-7.6 mm) | 80 mil (2.0 mm) | 90 mil (2.3 mm) |
| Sensitivity * | 200 mV/mil * | 200 mV/mil | 50 mV/mil | 200 mV/mil | 200 mV/mil * |
| Driver | CMSS 600 | CMSS 606/CMSS 627 | CMSS 620-2 | CMSS 665 Series | CMSS 668 Series |
| Extension cable | CMSS 900 | CMSS 900 | CMSS 900 | CMSS 958 | CMSS 958 |
| Overall length → (Probes) | 0.5 to 5.0 meters | 0.5 to 3.8 meters | 1.0 to 4.0 meters | 0.5 to 10.0 meters | 0.5 to 15.0 meters |
| Case lengths | 0.8 to 9.0" (20 to 230 mm) | 0.8 to 9.0" (20 to 230 mm) | 1.0 to 5.0" (25.4 to 127 mm) | 0.8 to 9.0" (20 to 230 mm) | 0.8 to 9.0" (20 to 230 mm) |

* 100 mV/mil systems are also available for these two probes.
→ Consult factory for other non-standard lengths.

*Table 1-3. Driver compatibility.*

| Driver | CMSS 600 | CMSS 606 | CMSS 620-2 | CMSS 665 | CMSS 668 |
|---|---|---|---|---|---|
| Power requirements | -18 to -24 Vdc | -18 to -24 Vdc | -18 to -24 Vdc | -24 to -30 Vdc | -24 to -30 Vdc |
| Maximum current requirements | 35 mA | 25 mA | 35 mA | 15 mA | 15 mA |
| Case material | Aluminum | Aluminum | Aluminum | RYTON® | RYTON® |
| Output signal | Minus voltage | Minus voltage | Minus voltage | Minus voltage | Minus voltage |
| Label color | Black | Blue | Black | Blue | Black |
| Reversible terminal strip | No | No | No | Yes | Yes |
| Permanent connection option | Yes | Yes | Yes | Yes, CMSS 665P Series | Yes, CMSS 668P Series |
| Output impedance | Less than 100 ohms | Less than 100 ohms | Less than 100 ohms | Less than 100 ohms | Less than 100 ohms |

# Introduction to manual

This manual is a "generic" Eddy Probe Manual. It contains generalized information for all probes as well as specific information.

Figures in this manual are for illustrative purposes and might not be drawn in exact proportion to emphasize certain items.

Units of measurement are usually in English units with the metric equivalent in parenthesis.

# Initial inspection

The eddy probe and accessories are thoroughly inspected, mechanically and electrically, before packing for shipment. However, you should inspect them upon receipt for shipping damage.

### *Unpacking*

Use care when removing the items from their shipping container to prevent damage. Save the shipping container and all packing materials until the items have been thoroughly inspected for damage and checked for proper operation.

### *Equipment furnished*

Ensure that each item on the packing list is included with the shipment. Accessory kit may be shipped in separate containers.

### *Inspection for physical damage*

Inspect all surface for dents, chips, or scratches. Check for broken or bent connectors. Photographs of damage are helpful in substantiating subsequent claims.

### *Reshipment procedure*

If the probe system and/or accessories must be reshipped, use the original shipping container and packing materials. If the original packing materials are not available, the following materials are recommended.

- At least 2" (50 mm) of shock absorbing material such as ester foam or any other material designed to absorb light to medium shock loads.
- The package should provide protection for "normal" handling. For example, a 3 feet (1 meter) vertical drop.

### *Returned equipment with warranty or damage claims*

If the probe system or accessories are damaged in transit or do not operate as specified when received, notify the carrier and the nearest SKF Condition Monitoring, Inc. sales/service office or SKF representative immediately. Telephone 1-800-523-7514 or 1-858-496-3627. Email address comoRA-USA@skf.com.

The local office will arrange for repair or replacement. SKF Condition Monitoring, Inc. will assign a Return Material Authorization (RMA) number to assure identification and tracking of your equipment.

# Selecting an eddy probe system

A wide variety of SKF systems are offered to meet the requirements of virtually any application. Probe range is limited largely by the probe's diameter. The standard SKF probe diameters are 5 mm (CMSS 65), 8 mm (CMSS 68), and 19 mm (CMSS 62).

The following should be considered when selecting a system:

### *Range*

Gap over which the system must accurately operate.

### *Sensitivity*

Must be compatible with monitors or other companion instruments.

### *System length*

The physical length of the systems is approximate to the electrical length. Excess cable in certain installations is typically coiled and tied with no harmful effects.

### *Probe case*

The size of the probe mounting case may be a factor in some installations.

*Table 1-4. Standard SKF Eddy Probe Systems.*

| System | Usable range | Sensitivity | System length | Standard case | Comments |
|---|---|---|---|---|---|
| CMSS 60/CMSS 600 | 90 mils | 200 mV/Mil | 5 meters | 3/8-24 | Standard length |
| CMSS 60/CMSS 600-1 | 90 mils | 200 mV/Mil | 10 meters | 3/8-24 | Long system length |
| CMSS 61/CMSS 606 | 80 mils | 200 mV/Mil | 5 meters | 1/4-28 | Standard length |
| CMSS 61/CMSS 627 | 80 mils | 200 mV/Mil | 9 meters | 1/4-28 | Long system length |
| CMSS 62/CMSS 620-2 | 60-300 mils | 50 mV/Mil | 10.8 meters | 1"-12 UNF | Long range |
| CMSS 65/CMSS 665 | 80 mils | 200 mV/Mil | 5 meters | 1/4-28 | Standard length |
| CMSS 65/CMSS 665-1 | 80 mils | 200 mV/Mil | 10 meters | 1/4-28 | Long system length |
| CMSS 65/CMSS 665-16-9 | 45 mils | 200 mV/Mil | 5 meters | 1/4-28 | Intrinsically safe |
| CMSS 65/CMSS 665-20-00 | 80 mils | 200 mV/Mil | 5 meters | 1/4-28 | Non-incentive |
| CMSS 68/CMSS 668 | 90 mils | 200 mV/Mil | 5 meters | 3/8-24 | Standard length |
| CMSS 68/CMSS 668-1 | 90 mils | 200 mV/Mil | 10 meters | 3/8-24 | Long system length |
| CMSS 68/CMSS 668-2 | 90 mils | 200 mV/Mil | 15 meters | 3/8-24 | Long system length |
| CMSS 68/CMSS 668-16-9 | 65 mils | 200 mV/Mil | 5 meters | 3/8-24 | Intrinsically safe |
| CMSS 68/CMSS 668-20-00 | 90 mils | 200 mV/Mil | 5 meters | 3/8-24 | Non-incentive |

# Some eddy probe options

### *Armor*

A flexible stainless steel jacket protects the cable. Recommended when the cable is not protected by conduit (such as inside a machine). Available on probe cables and extension cables.

### *Certification*

Approved probes and drivers can be supplied with certification tags attached (SIRA, CSA, and FM Factory Mutual Systems).

# A word about . . .

### *Probe Tips*

SKF uses RYTON® for eddy probe tips because it is simply the best material for the job. RYTON® has high dimensional stability reducing probe coil shape variations with temperature and humidity and maintaining system accuracy, linearity, and resolution. RYTON® is a "super plastic" that has no known solvent below +400 °F (+205 °C) and therefore highly resistant to the acids, bases and solvents handled by process machinery.

### *Installation*

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). If long cable runs between the driver and monitor are required, consult the table in Figure 1-2 to determine the maximum recommended wire length (use 3-conductor shielded wire).

| Wire Size (AWG) | Distance (Maximum) |
|---|---|
| 22 | 1,000 Feet (303 Meters) |
| 20 | 2,000 Feet (606 Meters) |
| 18 | 3,000 Feet (909 Meters) |
| 16 | 4,000 Feet (1,212 Meters) |

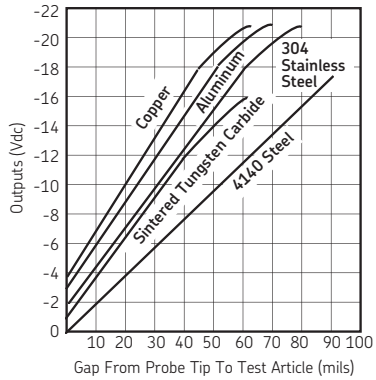



***Figure 1-2. Wiring distance and system response variances with target material.***

# Target material

Standard systems are calibrated to observe 4140 steel. As recommended by API Standard 670, probe calibration should be verified on a target with the same electrical characteristics as the shaft. The SKF CMSS 601 Series Static Calibrator and the driver trim control, permit verification and convenient field calibration within a ±5% range on the shaft itself. Response is dependent upon the conductance of the target material, as illustrated in Figure 1-2. Drivers may be special ordered for calibrated response to different metal types. Customers will be requested to provide samples of the metal types. Special calibration will be "best effort" and is not a guarantee full linear range will be attained.

### *Runout*

Because the eddy probe works on the principle of conductivity, shaft irregularities (flat spots, scratches, plating, hardness variations, carbon inclusions, magnetized regions, etc.) may produce false vibration signals. API Standard 670 recommends runout be limited to 0.25 mils maximum. Some irregularities, such as plated shafts, cannot be reduced to an acceptable level with traditional methods (peening, knurling, etc.).

### *Intrinsic safety*

SKF monitors provide current limited power to eddy probe systems which meet safety requirements of most applications. However, if intrinsic safety barriers (Zener barriers) will be used, consult the local sales representative to ensure range, linearity, and power requirements will be met.

### *API Standard 670*

The American Petroleum Institute has published Standard 670 as an aid to the procurement of standardized non contacting vibration, axial position, and temperature monitoring systems. The standard is based on the accumulated knowledge and experience of petroleum refiners and monitoring system manufacturers. API Standard 670 is a valuable reference tool for all machinery users and manufacturers, and is highly recommended as a guide for defining, purchasing, and installing machinery monitoring systems.

API 670 was written to define reliable protection systems for rotating equipment operating in the harsh conditions found in oil production, refining, and chemical processing. RYTON® based SKF Eddy Current Probes were designed using a unique temperature chamber to test the probes

over the wide temperature range required by API. The output sensitivity of conventional eddy current probe systems typically falls off as temperature increases. A unique probe winding technique was developed by SKF that maintains output sensitivity not only over the entire API specified temperature range, but over an extended range as well.

"Super tough" eddy current probe systems are thoroughly field tested and proven, with thousands of units installed.

SKF has been using RYTON® in its transducer designs for many years. RYTON's strength approaches that of metal.

RYTON® is impervious to any solvent at temperatures up to +400 °F (+205 °C). For this reason, SKF driver housings are also made of the same super tough material. An added benefit is there is no longer a need to electrically isolate drivers during installation to prevent troublesome ground loops. RYTON's proven resistance to extreme harsh environments protects the complex electronics required to operate eddy current probes. An internal sealing system of conformal coating protects these components from moisture ingression and corrosion. This increases system reliability by eliminating the need to totally encapsulate the components. Due to unique construction, both the driver housing and the internal circuits react to severe thermal excursions at the same rate. This reduces internal stresses created by routine machinery transients or load changes, providing for a longer driver life.

SKF drivers are EMI/RFI shielded, and the mounting scheme allows them to fit the same "footprint" as previous SKF driver housings, or they can be snapped onto type C-DIN rails for high density applications and quick installation. The compression connector for terminating the power and signal wiring further aids in the ease and cost of installation. A fixed connector version is also available.

SKF Eddy Current Probe Systems are constantly temperature and performance tested in a continuing effort to improve what is already the best probe available for the measurement of vibration in rotating equipment. They are available with armored and fiberglass sleeving, and may be offered SIRA/CSA/FM certified.

SKF Eddy Current Probes are available in a variety of case mounting configurations and length options to meet difficult installation requirements.

The small tip diameter (5 mm) of the CMSS 65 Eddy Current Probe Systems, coupled with the stringent controls under which they are produced, effectively reduces calibration error due to shaft curvature. This makes the CMSS 65 an exceptional choice for measuring vibration in small diameter shafts. The CMSS 65 is available in 5 or 10 meter systems (probe with integral cable, or a combination of probe cable and extension cable) and has a typical usable range of 10 mils to 90 mils with a 200 mV/mil sensitivity. A specific CMSS 665 Driver is required for each of the standard length systems (refer to Table 1-1).

The larger tip diameter (8 mm) of the CMSS 68 SKF Eddy Current Probe is used for large diameter shafts as well as long range axial position (thrust) measurements. The CMSS 68 is available in 5, 10 or 15 meter systems and has a typical usable range of 10 mils to 100 mils with a 200 mV/mil (7.87 V/mm) sensitivity.

***Table 1-5. Temperature conversion table.***

Fahrenheit to Celsius: °C = 5/9 (°F – 32)
Celsius to Fahrenheit: °F = 9/5 (°C) + 32

**Conversion Between °F and °C**

| ← °F | | | ← °F | | |
|---|---|---|---|---|---|
| °C | °C → °F | | °C | °C → °F | |
| -40.0 | -40.0 | -40.0 | +4.4 | +40.0 | +104.0 |
| -28.9 | -20.0 | -4.0 | +10.0 | +50.0 | +122.0 |
| -23.3 | -10.0 | +14.0 | +15.6 | +60.0 | +140.0 |
| -20.6 | -5.0 | +23.0 | +21.1 | +70.0 | +158.0 |
| -17.8 | -0 | +32.0 | +26.7 | +80.0 | +176.0 |
| -15.9 | +5.0 | +41.0 | +32.2 | +90.0 | +194.0 |
| -12.2 | +10.0 | +50.0 | +37.8 | +100.0 | +212.0 |
| -6.7 | +20.0 | +68.0 | +93.3 | +200.0 | +392.0 |
| -1.1 | +30.0 | +86.0 | | | |

***Table 1-6. Length conversion table.***

0.5 Meter ≈ 20 Inches (1.7 Feet)
1.0 Meter ≈ 39 Inches (3.3 Feet)
5.0 Meters ≈ 196 Inches (16 Feet)
10.0 Meters ≈ 393 Inches (33 Feet)
15.0 Meters ≈ 590 Inches (49 Feet)

Mils x $(25.4 \times 10^{-6})$ = Microns
Microns ÷ (2.54) = Mils

| | | | | | |
|---|---|---|---|---|---|
| 1 Mils | ≈ | 25.4 Microns | 80 Mils | ≈ | 2032.0 Microns |
| 5 Mils | ≈ | 127.0 Microns | 90 Mils | ≈ | 2286.0 Microns |
| 10 Mils | ≈ | 254.0 Microns | 100 Mils | ≈ | 2540.0 Microns |
| 20 Mils | ≈ | 508.0 Microns | 110 Mils | ≈ | 2794.0 Microns |
| 30 Mils | ≈ | 762.0 Microns | 120 Mils | ≈ | 3048.0 Microns |
| 40 Mils | ≈ | 1016.0 Microns | 130 Mils | ≈ | 3302.0 Microns |
| 50 Mils | ≈ | 1270.0 Microns | 140 Mils | ≈ | 3556.0 Microns |
| 60 Mils | ≈ | 1524.0 Microns | 150 Mils | ≈ | 3810.0 Microns |
| 70 Mils | ≈ | 1778.0 Microns | | | |

# Operating considerations

Consider the following guidelines before actually installing any eddy probe system to assure proper operation.

### *Target material*

The type of metal of the observed surface (target material) affects the eddy current probe's sensitivity.

SKF probes are normally factory-calibrated for 4140 Steel (either factory or user can calibrate for other metals). If your target material is not 4140 Steel, the probe must be calibrated for the specific type of target material to get a linear 200 mV/mil sensitivity. Use a CMSS 601 Field Calibrator for on-site adjustments.

Figure 1-2 shows the typical sensitivity response for various materials.

***Note:*** *Depending upon difference from 4140, user calibration is limited.*

### *Mounting area*

Probes must be rigidly mounted to ensure signal accuracy. Probe adapters, probe holders, mounting brackets and machinery casings must not be resonate to frequencies generated within the machine.

Internally mounted probes are installed on brackets or clips and should have armored cables. The cables must be attached to the inside of the machine casing to prevent internal whipping and rubbing. Cable connections should be avoided inside the machine to the extent possible.

For external installations, the probe can be mounted directly on the bearing housing or it can be held in place by a probe holder. The holder passes through an adapter fitting mounted on the bearing housing and the probe is threaded into the holder. When properly installed, the probe (including tip) should extend 1/2" from the face of the holder.

Do NOT force the probe into the holder or the bearing housing. If necessary, remove the probe and chase both internal and external threads.

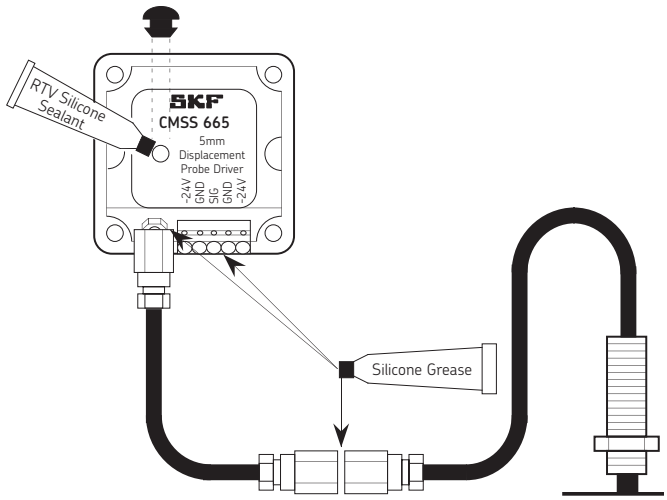



***Figure 1-3. Sealing against adverse environments.***

Probe leads and extension cable external to the machine require physical protection such as flexible conduit for short runs and rigid conduit for long runs. Use junction boxes where extension cable and probe leads connect.

### *Environment*

Fill the cable connectors with silicone grease to prevent moisture intrusion at the time the interconnect is made. Silicon grease will not adversely affect the conductance of the connector and will act as an insulator.

The action of acids or strong bases in the environment can adversely affect the probe.

Oil will not affect the probes' performance. However, sealing the driver's calibration hole with silicone sealant (RTV) is good practice if the driver's environment is extremely oily. If the driver is used in corrosive atmospheres (e.g. H2S above 15 ppm), consult the factory for special "potting" of components.

### *Hazardous areas*

In hazardous areas where Intrinsic Safety is a consideration, please abide by local installation codes and regulations.

# Pre-installation checklist

Use this section as a guide for eddy probe installation.

Make sure no other part of the system, including additional amplifiers, filters, and readout devices establish any limitations that will tend to degrade the probe-driver characteristics.

***Instrument selection***

## Eddy Current Probe

**Check:**

*Measurement environment*

- Temperature range
- Maximum shock and vibration
- Humidity
- Pressure
- Magnetic and RF fields
- Nuclear radiation
- Corrosive gases
- Transient temperatures

*Data accuracy*

- Sensitivity
- Frequency response
- Amplitude linearity
- Temperature linearity

*Ready-to-use*

- Physical condition
- Case
- Mounting surface
- Connector
- Inspect for clean connector
- Corrosion

## Cables

**Check:**

*Measurement environment*

- Temperature range
- Corrosive gases

*Data accuracy*

- Flexibility
- Length
- Seal connection requirement

*Ready-to-use*

- Physical condition
- Cable kinked or crushed
- Connector threads
- Center pins of connector
- Inspect for clean connectors
- Continuity
- Insulation resistance

## Driver

**Check:**

*Measurement Environment*

- Temperature range
- Maximum shock and vibration
- Humidity
- Corrosive gases
- Nuclear radiation
- Transient temperatures

*Data Accuracy*

- Output sensitivity
- Frequency response
- Linearity
- Transient response
- Output current and voltage
- Residual noise
- Input impedance
- Overload capability

*Ready-to-Use*

- Physical condition
- Connector
- Output cables
- Inspect for clean connectors
- Case

***Installation***

## Cable

**Check:**

- Cable connected securely to probe.
- Cable tied down within 6” to 10” (150 to 254 mm) from probe.
- Excess cable is coiled and tied down.
- Cable is connected securely to driver.

## Driver

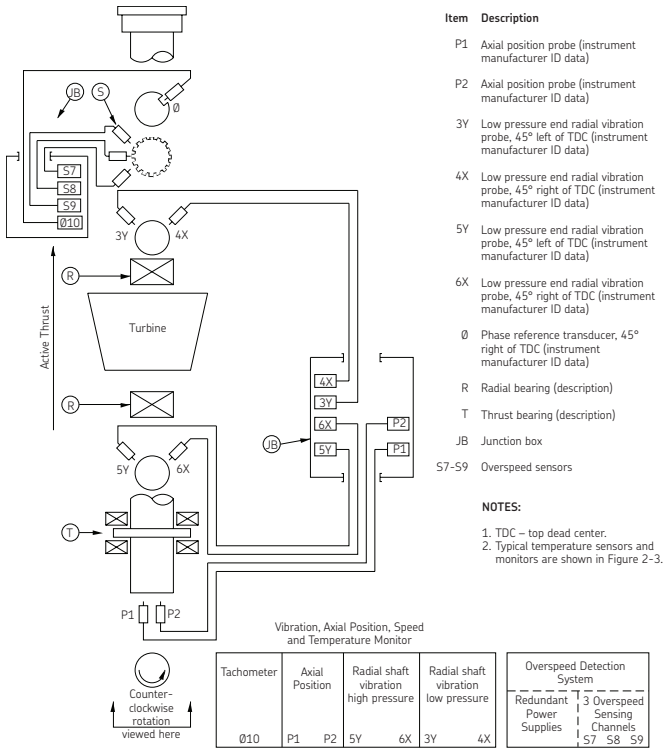
**Check:**

- Mounted securely.
- All cable connections secure.
- Recommended grounding is in use.

# Section 2
# Typical eddy probe arrangement plans

## Typical eddy probe arrangement plans

Figures 2-1 through 2-6 depicts sample typical eddy probe arrangements.  Illustrations courtesy of API Standard 670.

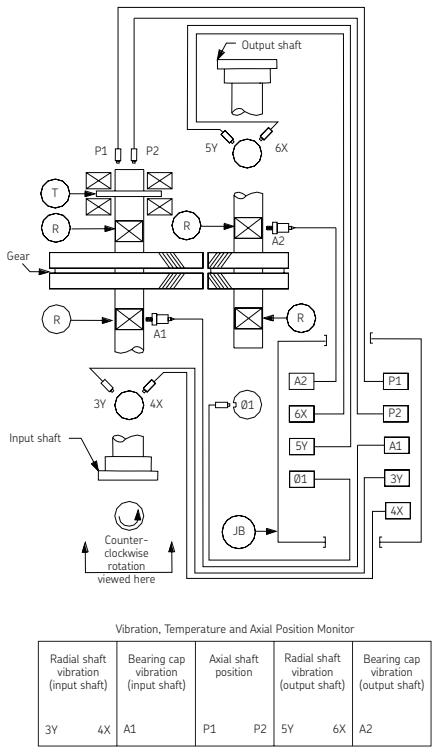



| Item | Description |
|---|---|
| P1 | Axial position probe (instrument manufacturer ID data) |
| P2 | Axial position probe (instrument manufacturer ID data) |
| 3Y | Low pressure end radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 4X | Low pressure end radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| 5Y | Low pressure end radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 6X | Low pressure end radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| Ø | Phase reference transducer, 45° right of TDC (instrument manufacturer ID data) |
| R | Radial bearing (description) |
| T | Thrust bearing (description) |
| JB | Junction box |
| S7-S9 | Overspeed sensors |

**NOTES:**

1. TDC – top dead center.
2. Typical temperature sensors and monitors are shown in Figure 2-3.

***Figure 2-1.  Typical system arrangement for a turbine with hydrodynamic bearings.***



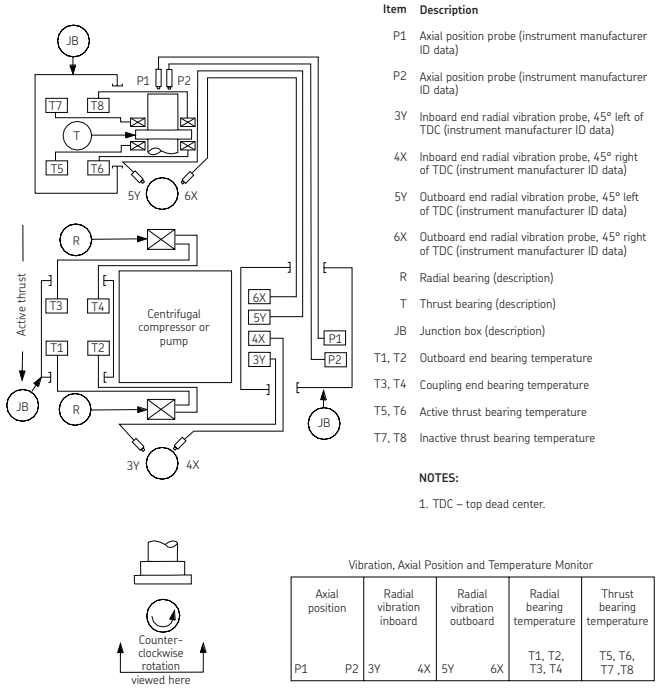

| Item | Description |
|---|---|
| 3Y | Input shaft coupling end Y radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 4X | Input shaft coupling end X radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| A1 | Input shaft coupling end horizontal radial accelerometer, 90° off TDC (instrument manufacturer ID data) |
| P1 | Input shaft thrust bearing end axial position probe number 1 (instrument manufacturer ID data) |
| P2 | Input shaft thrust bearing end axial position probe number 2 (instrument manufacturer ID data) |
| A2 | Output shaft coupling end horizontal radial accelerometer, 90° off TDC (instrument manufacturer ID data) |
| 5Y | Output shaft coupling end Y vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 6X | Output shaft coupling end X radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| Ø1 | Output shaft noncoupling end phase reference probe, 90° left of TDC (instrument manufacturer ID data) |
| R | Radial bearing (description) |
| T | Thrust bearing (description) |
| JB | Junction box |

**NOTES:**

1. TDC – top dead center.
2. For a single-helical gear, a pair of axial probes should be installed at each thrust-bearing end.
3. Typical temperature sensors and monitors are shown in Figure 2-3.

***Figure 2-2.  Typical system arrangement for a double-helical gear.***

# Typical eddy probe arrangement plans




| Item | Description |
|---|---|
| P1 | Axial position probe (instrument manufacturer ID data) |
| P2 | Axial position probe (instrument manufacturer ID data) |
| 3Y | Inboard end radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 4X | Inboard end radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| 5Y | Outboard end radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 6X | Outboard end radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| R | Radial bearing (description) |
| T | Thrust bearing (description) |
| JB | Junction box (description) |
| T1, T2 | Outboard end bearing temperature |
| T3, T4 | Coupling end bearing temperature |
| T5, T6 | Active thrust bearing temperature |
| T7, T8 | Inactive thrust bearing temperature |

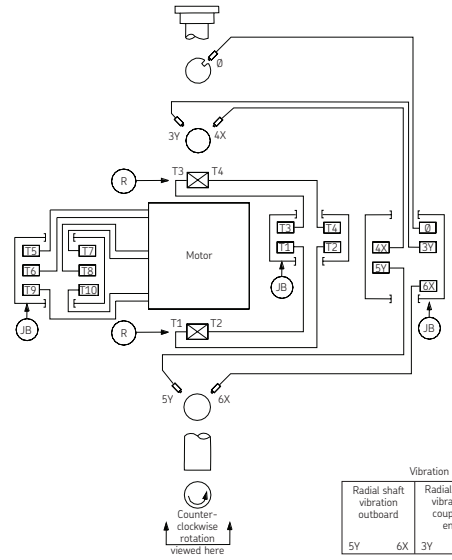
**NOTES:**

1. TDC – top dead center.

Vibration, Axial Position and Temperature Monitor

| Axial position | | Radial vibration inboard | | Radial vibration outboard | | Radial bearing temperature | Thrust bearing temperature |
|---|---|---|---|---|---|---|---|
| P1 | P2 | 3Y | 4X | 5Y | 6X | T1, T2, T3, T4 | T5, T6, T7 ,T8 |

*Figure 2-3. Typical system arrangement for a centrifugal compressor or a pump with hydrodynamic bearings.*




| Item | Description |
|---|---|
| 5Y | Outboard end Y radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 6X | Outboard end X radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| 3Y | Inboard end Y radial vibration probe, 45° left of TDC (instrument manufacturer ID data) |
| 4X | Inboard end X radial vibration probe, 45° right of TDC (instrument manufacturer ID data) |
| Ø | Phase reference probe, 45° right of TDC (instrument manufacturer ID data) |
| T1, T2 | Outboard end bearing temperature |
| T3, T4 | Inboard end bearing temperature |
| R | Radial bearing (description) |
| JB | Junction box (description) |
| T5, T6 | Motor winding temperature (phase A) |
| T7, T8 | Motor winding temperature (phase B) |
| T9, T10 | Motor winding temperature (phase C) |

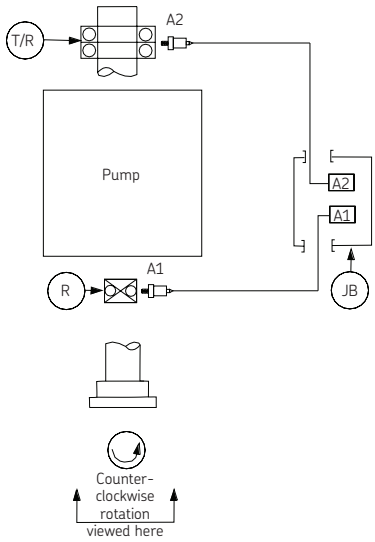
**NOTES:**

1. TDC – top dead center.

Vibration and Temperature Monitor

| Radial shaft vibration outboard | | Radial shaft vibration coupling end | | Bearing temperature | Motor winding temperature |
|---|---|---|---|---|---|
| 5Y | 6X | 3Y | 4X | T1, T2, T3, T4 | T5, T6, T7, T8, T9, T10 |

*Figure 2-4. Typical system arrangement for an electric motor with sleeve bearings.*




| Item | Description |
|---|---|
| A1 | Inboard end radial horizontal accelerometer, 90° off TDC (instrument manufacturer ID data) |
| A2 | Outboard end radial horizontal accelerometer, 90° off TDC (instrument manufacturer ID data) |
| R | Radial bearing (description) |
| T/R | Thrust/Radial bearing (description) |
| JB | Junction box (description) |

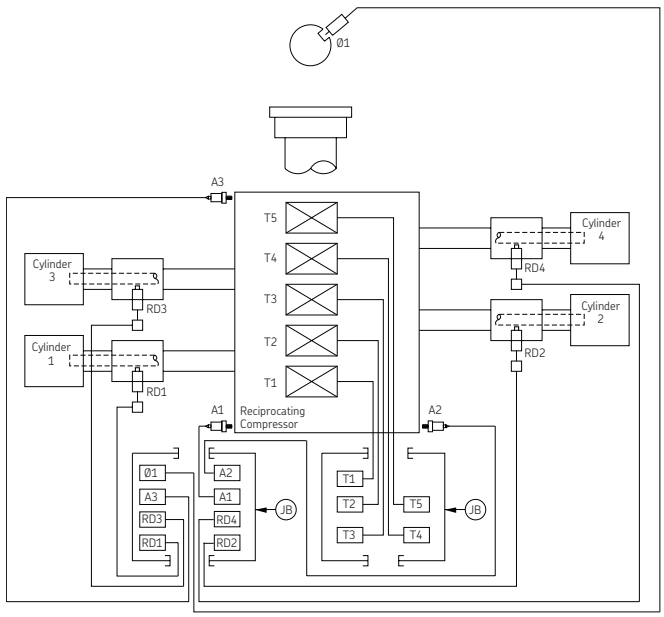
**NOTES:**

1. TDC – top dead center.
2. The same arrangement would be used for a motor with rolling element bearings but would be viewed from the outboard end.

Vibration Monitor

| Bearing cap vibration | |
|---|---|
| Inboard end A1 | Outboard end A2 |

*Figure 2-5. Typical system arrangement for a Pump or Motor with rolling element bearings.*




Rod Drop, Vibration and Bearing Temperature Monitor System

| Piston Rod Drop Channels | Casing Vibration Channels | Bearing Temperature Channels |
|---|---|---|
| RD1, RD2, RD3, RD4 | A1, A2, A3 | T1, T2, T3. T4, T5 |

| Item | Description |
|---|---|
| Ø1 | Phase reference transducer |
| R | Radial bearing (description) |
| JB | Junction box (description) |
| T1-T5 | Main bearing temperatures |
| RD1-RD4 | Rod drop probes (instrument manufacturer ID data) |
| A1, A2,A3 | Casing Accelerometers |

*Figure 2-6. Typical system arrangement for a reciprocating compressor.*

# Radial shaft vibration probes

Referenced such that when viewed from the driver end of the machine train, the Y (vertical) probe is on the left side of the vertical center, and the X (horizontal) probe is on the right side of the vertical center regardless of the direction of shaft rotation.

# Bearing cap mounting

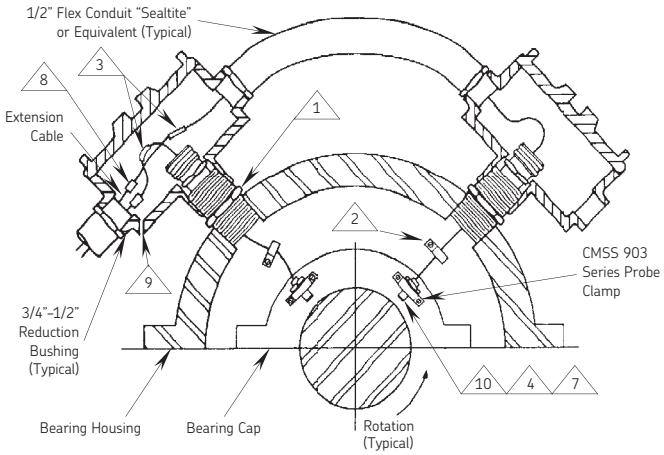



*Figure 2-7. End view (preferred).*

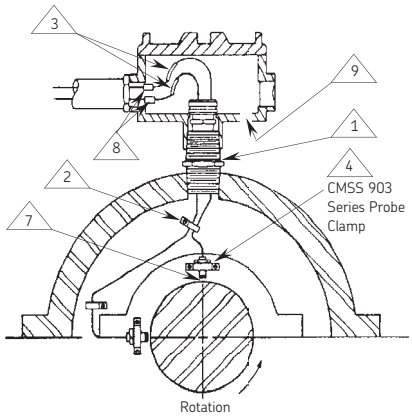



*Figure 2-8. End view (alternate).*

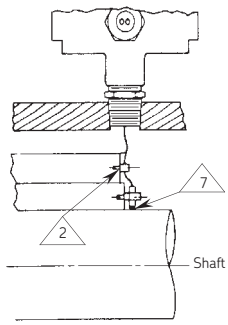



*Figure 2-9. Side view.*

**Notes:**

1. Set sealing adapter tight in bearing housing before pulling lead wires.
2. Probe lead wires must be secured against internal whipping and rubbing.
3. Identify leads prior to installation. Use tag numbers as required.
4. Probes must be mounted perpendicular to shaft.
5. Do not pull thermocouple wire and probe lead wires into same outlet without engineering department approval.
6. Set gap volts after assembly has been installed.
7. Set gap at -8.0 ±1/2 volt (example: 40 ±2.5 mils [1 mm ±0.06 mm]).
8. Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Wrap connectors with teflon tape.
9. Drill 1/4" drain hole at lowest point of box (typical).
10. Preferred arrangement for probe installation: Viewed from the driver end of the machine train, the Y-probe (vertical) shall be to the left of vertical center. The X-probe (horizontal) shall be to the right of vertical center.

**Notes:**

1. Set sealing adapter tight in bearing housing before pulling lead wires.
2. Probe lead wires must be secured against internal whipping and rubbing.
3. Identify leads prior to installation. Use tag numbers as required.
4. Probes must be mounted perpendicular to shaft.
5. Do not pull thermocouple wire and probe lead wires into same outlet without Engineering Department approval.
6. Set gap volts after assembly has been installed.
7. Set gap at -8.0 ±1/2 volt (example: 40 ±2.5 mils [1 mm ±0.06 mm]).
8. Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Wrap connectors with teflon tape.
9. Drill 1/4" drain hole at lowest point of box (typical).
10. Preferred arrangement for probe installation: Viewed from the driver end of the machine train, the Y-probe (vertical) shall be to the left of vertical center. The X-probe (horizontal) shall be to the right of vertical center.

# Bearing housing mounting

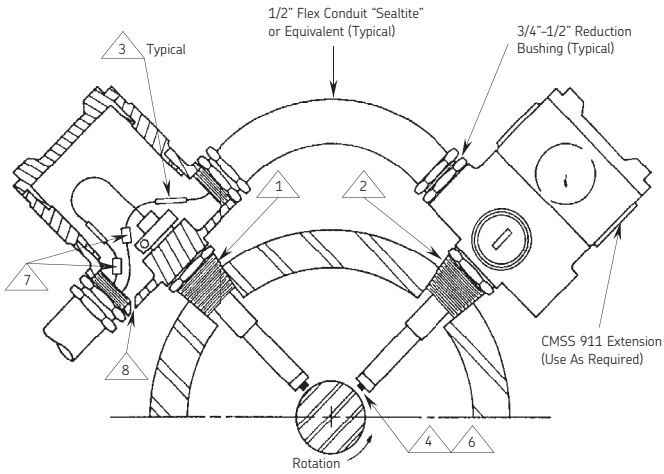



*Figure 2-10. End view.*

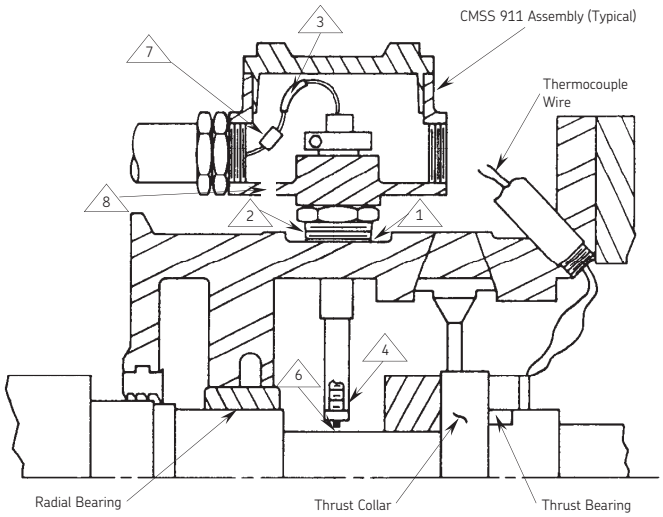



*Figure 2-11. Side view.*

**Notes:**

1. Drill and tap housing for 3/4" (19 mm) NPT (typical).
2. Set sealing adapter tight in bearing housing before pulling lead wires.
3. Identify leads prior to installation. Use tag numbers as required.
4. Probes must be mounted perpendicular to shaft.
5. Do not pull thermocouple wire and probe lead wires into same outlet.
6. Check gap volts after CMSS 911 assembly has been installed. Set gap at -8.0" ±1/2 volts (40 ±2.5 mils [1 mm ±0.06 mm]).
7. Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Wrap connectors with teflon tape (typical).
8. Drill 1/4" drain hole at lowest point of box (typical).

**Notes:**

1. Drill and tap housing for 3/4" (19 mm) NPT (typical).
2. Set sealing adapter tight in bearing housing before pulling lead wires.
3. Identify leads prior to installation. Use tag numbers as required.
4. Probes must be mounted perpendicular to shaft.
5. Do not pull thermocouple wire and probe lead wires into same outlet.
6. Check gap volts after CMSS 911 assembly has been installed. Set gap at -8.0" ±1/2 volts (40 ±2.5 mils [1 mm ±0.06 mm]).
7. Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Wrap connectors with teflon tape (typical).
8. Drill 1/4" drain hole at lowest point of box (typical).

# Axial probe installation

### *Axial probe installation recommendations*

1. At least two probes per rotor are recommended.
2. Where the probes cannot be changed without shutting down the machine, install spare probes
3. Calibrate probe, cable and driver and record final response curves for primary as well as spare probes. The SKF CMSS 601 Series Static Calibrator may be used.
4. Try to observe the thrust collar with one probe and the shaft with the other.
5. Probes must be mounted within one foot of the thrust collar.
6. Avoid mounting probes through thin plates or bell housings that may bow with thermal expansion.
7. Determine the float zone of the rotor by jacking the rotor in both directions.
8. Measure and compare the rotor movement with dial indicators on the shaft, the eddy probe voltage change at the driver and the monitor reading. (All three should agree.)
9. Jack the shaft several times each way to verify readings.
10. Set the probe gap so the center of the probe's range is in the center of the float zone.
11. Securely lock the probe and any adapters in place.
12. Be sure the probe tip has a side clearance of at least half the probe diameter.

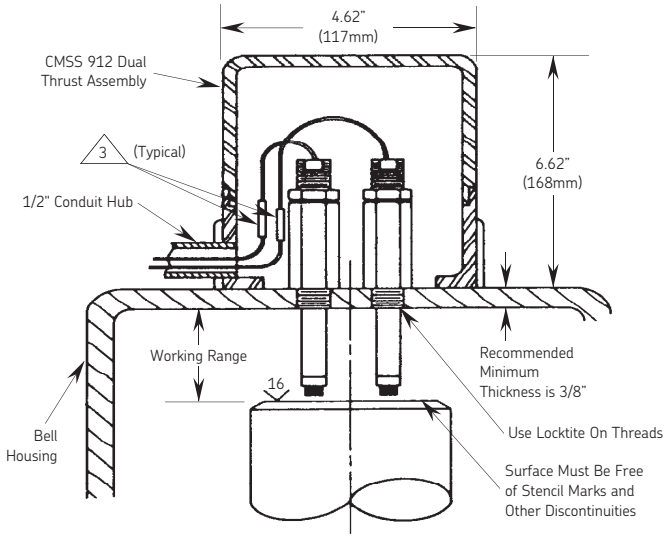



*Figure 2-12.*

**Notes:**

1 Set sealing adapter tight in housing before pulling lead wires through.

2 Probe lead wires must be secured against internal whipping and rubbing.

3 Identify probe leads prior to installation. Use tag numbers as required.

4 Probes must be mounted perpendicular to shaft or surface it is "seeing".

5 Do not pull thermocouple wires and probe lead wires into same outlet.

6 Check gap volts after CMSS 911 or CMSS 912 assemblies have been installed.

7 Set gap at midpoint of probe range at the center of the shaft float zone.

8 Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Then wrap connectors with teflon tape.

# Axial probe installation

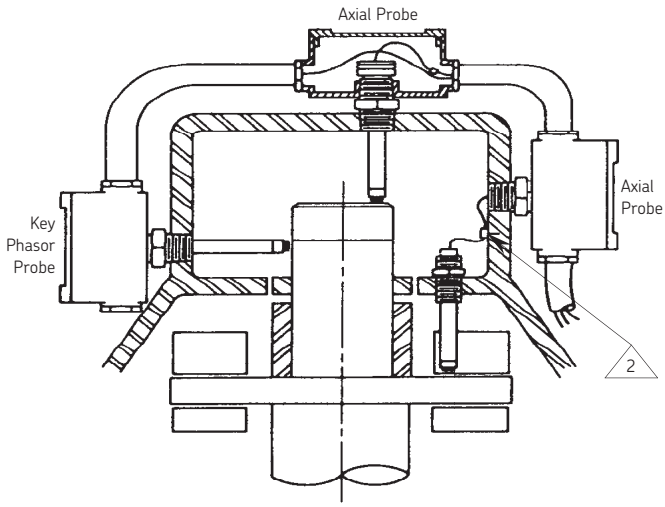



***Figure 2-13.***

**Notes:**

1 Set sealing adapter tight in housing before pulling lead wires through.

2 Probe lead wires must be secured against internal whipping and rubbing.

3 Identify probe leads prior to installation. Use tag numbers as required.

4 Probes must be mounted perpendicular to shaft or surface it is “seeing”.

5 Do not pull thermocouple wires and probe lead wires into same outlet.

6 Check gap volts after CMSS 911 or CMSS 912 assemblies have been installed.

7 Set gap at midpoint of probe range at the center of the shaft float zone.

8 Torque mating connectors to 145 ±5 inch-ounces (1.02 ±0.035 N-m). Then wrap connectors with teflon tape.

# Section 3
# Probe installation

## Introduction

The effectiveness and accuracy of an eddy current probe is critically dependent upon proper installation. This section discusses general probe installation techniques and specific difficulties you may encounter installing probe mounting brackets. Figure 3-1 shows a typical probe.

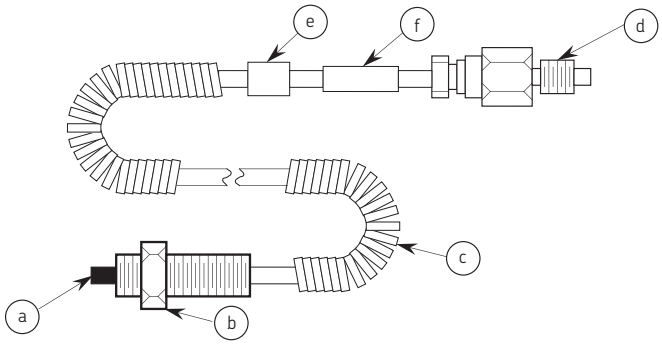



*Figure 3-1. Typical SKF Eddy Probe.*

(a) ***Probe tip***

The tip is placed in proximity to observed surface. Contains the radio- frequency coil which generates the electrical (eddy current) field.

(b) ***Jam nut***

Rides on threaded probe case. Locks probe into place.

(c) ***Coaxial cable (Flexible armor optional)***

Conducts r-f current from driver to extension cable to probe-tip coil.

(d) ***Coaxial connector***

Subminiature coaxial connector mates with connector on extension cable.

(e) ***Floating sleeve***

Unshrunk shrink-tubing sleeve for customer's identification label. Shrinks at +300°F (+150°C).

(f) ***SKF identification label***

Shows SKF model number.

Before installing the eddy current probe system, the system components should be identified using the API 670 numbering system. To ensure permanent identification, the probe lead and both ends of the extension cable are supplied with pieces of clear shrink tubing about 2.00" (50 mm) long. For clarity, type the transducer numbers on white paper and then cut out in strips approximately 0.25" (6 mm) wide by 1.75" (44 mm) long. This size is usually easy to put under the shrink tubing prior to shrinking with a heat gun or ordinary match. See Figure 3-2.

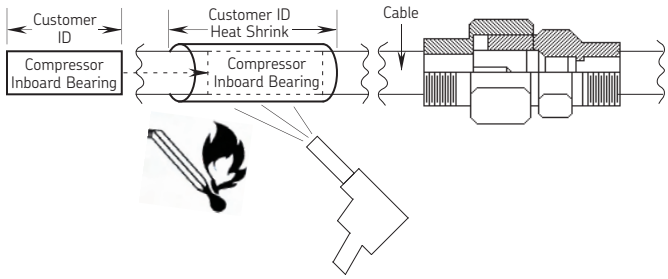



*Figure 3-2. Using heat shrink tubing to identify cables.*

Major installation considerations include temperature, pressures and mechanical stress to which the probe, driver, and cables are subjected. It is essential that the probe be rigidly mounted, yet easily adjustable. If long cable runs between the driver and monitor system are required, consult the following table to determine the maximum recommended wire-length (use 3-conductor shielded wire).

# Mounting the probe

SKF makes four types of mounting brackets for eddy probes.

- CMSS 904 Probe Holder
- CMSS 911 Probe Holder with housing
- CMSS 912 Dual Axial Probe Adapter
- CMSS 903 Series Mounting Brackets

Electrical output of the eddy current probe which is due to vibration of the probe itself is not distinguishable from output due to vibration of the observed surface. Therefore, the eddy probe must be mounted rigidly to prevent it from vibrating.

Probes can be mounted by threading it through a hole in an existing part of a machine, such as the casing, or by using a special mounting bracket. The probe must be firmly locked in place with a jam nut. See Figures 3-3 and 3-4.

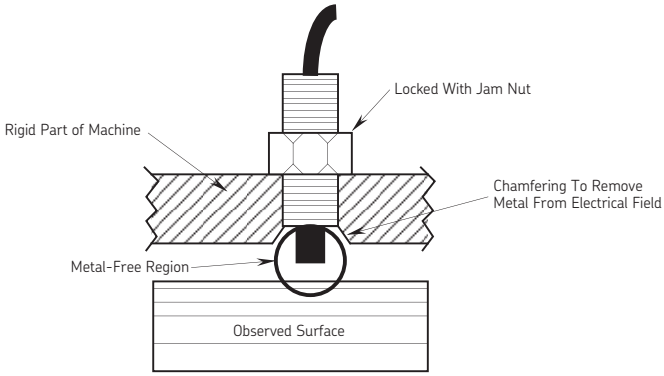
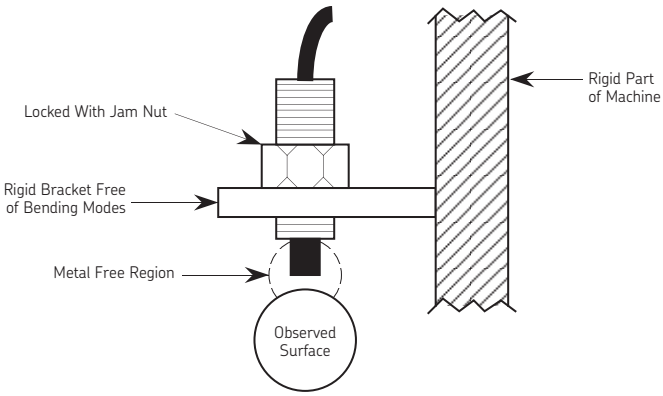



*Figure 3-3. Probe mounting through casing.*

Probes must not be installed closer than the ratio of half the probe tip diameter to a shaft shoulder or other discontinuity. Otherwise, probe target calibration will be altered. This clearance must also be maintained with all stationary components so that the entire electric field is concentrated on the observed surface only. If necessary, surfaces should be chamfered.

Back the probe locknut off of the probe and over the probe lead. Thread the probe into the bracket or clip (tip first) taking care not to damage the probe or target surface. Turn the probe clockwise until the tip is within 0.125" (3 mm) of the shaft. Do not use probe lead to thread probe into place (turn the probe case). With the extension cable connected between the probe and driver, set the gap at mid-range (approximately: -8 Vdc for CMSS 61 and CMSS 65; -10 Vdc for CMSS 60 and CMSS 68; -9 Vdc for CMSS 62). Tighten the cap screws or locknut, depending upon the mount type, then recheck the gap.




| Tip diameter | Metal-free region |
|---|---|
| 5 mm | 0.10" (2.5 mm) |
| 8 mm | 0.16" (4.0 mm) |
| 19 mm | 0.38" (9.5 mm) |

*Figure 3-4. Probe mounting on bracket.*

# CMSS 904 Probe Holder

The CMSS 904 Probe Holder provides a rigid mount with provision for external gap adjustment. Conduit may be readily mounted at the cable exit. The CMSS 904 provides 0.75" (19 mm) of adjustment range after installation; a set screw securely locks the adjustment. It is recommended that probes be ordered with a case length of 1.2 inches or use the standard reverse mount probe.

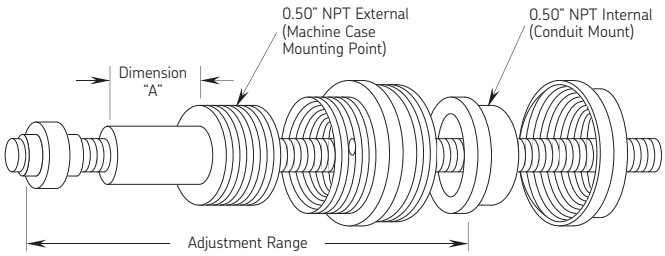



***Figure 3-5. By trimming stinger, working range of long CMSS 904 is 4.00" to 7.75" (100 mm to 194 mm) from mounting surface to probe tip (combination of stinger length and adjustment inside threaded stock); range of short CMSS 904 is 2.50" to 4.75" (63 mm to 119 mm).***

Probe adapter 1/4–28 to 3/8–24 threads, part number CMSS 30221900 is required when using CMSS 61 and CMSS 65 Eddy Probes with the larger diameter stringers.

"Stingers" may be cut down in the field within the indicated ranges.

# Installation instructions for CMSS 904 Probe Holder

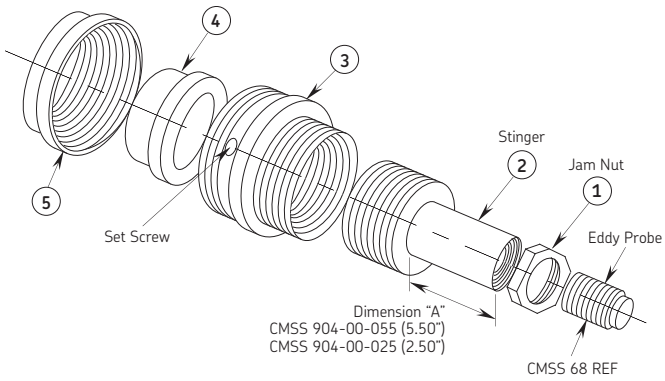



***Figure 3-6. CMSS 904 Probe Holder.***

1. Cut threaded extension of stinger (part 2) to desired length, deburr, and chase threads using a 1/4–28 or 3/8–24 tap.

2a. Armored probe installation.

Thread probe through threaded extension. The probe should screw in easily. It may be necessary to chase thread on probe using a 1/4–28 or 3/8–24 die.

Thread probe through the end exposing the majority of the threads, apply Loc-Tite and thread probe back to desired position. Lock probe into place with the jam nut (1).

***Caution:*** *The probe must turn freely. Forcing the probe can destroy both the probe and the holder.*

2b. Non-armored probe installation.

Push connector through threaded extension (2) from small end, apply Loc-Tite, screw probe into extension to desired length and lock in place with jam nut (1).

3. Thread UNY fitting (3) into 1/2" (12.7 mm) NPT machine case. Tighten firmly.

4. Thread assembled unit through UNY fitting until probe tip is gapped at 0.040" (1 mm) or the driver output reads -8 Vdc. (There must be -24 Vdc applied to the driver.)

***Note:*** *To oil-proof a CMSS 904 Probe Holder, apply Loc-Tite Pipe thread sealant liberally to both pipe threads and machine threads of probe holder during installation. This is good for temperatures from -65 to +300 °F (-18 to +149 °C). Cure time is 48 hours, but this can be accelerated significantly using Loc-Tite "Klean N' Prime" or Loc-Tite "Locquic Primer NF."*

5. Tighten the set screw on the UNY fitting (3) when probe is properly gapped.

6. Attach UNY–UNF (4 and 5) to conduit and fasten conduit securely to (3) or attach a conduit for probe to extension cable connection.

7. Recheck gap voltage to assure that securing conduit (4 and 5) has not affected gap setting.

# CMSS 911 Probe Holder with Housing/Dual Sensor Holder with Housing

**The CMSS 911 Probe Holder (Figure 3-7)** with Housing offers an adjustable probe mount with a variety of penetration depths. The integral housing protects the probe cable exit and permits easy access for probe adjustment without machine disassembly. It is recommended that probes be ordered with a case length of 1.2 inches or use the standard reverse mount probe and an overall length of 0.5 or 1.0 meters. The housing has four 3/4" (19 mm) NPT hubs for conduit attachment (3 close-up plugs provided).

(1) Outlet body (part number 10699400) GRR-2
(2) Outlet body extension (part number 10699300) GRCEX-0
(3) Outlet body hub, 3/4" (19 mm) NPT (4 each)
(4) Probe adapter union, 3/4" (19 mm) NPT (part number 30180900)
(5) Probe adapter collar (part number 30187900)
(6) Hex head steel cap screw (part number 10702200)
(7) Probe Holder ("Stinger") (part number–various depending on length)
(8) Jam nut: CMSS 68: 3/8–24 (part number 30126800)
CMSS 65: 1/4–28 (part number 30053500)
(9) "O" Ring union seal (part number 10711803)
(10) "O" Ring tip seal

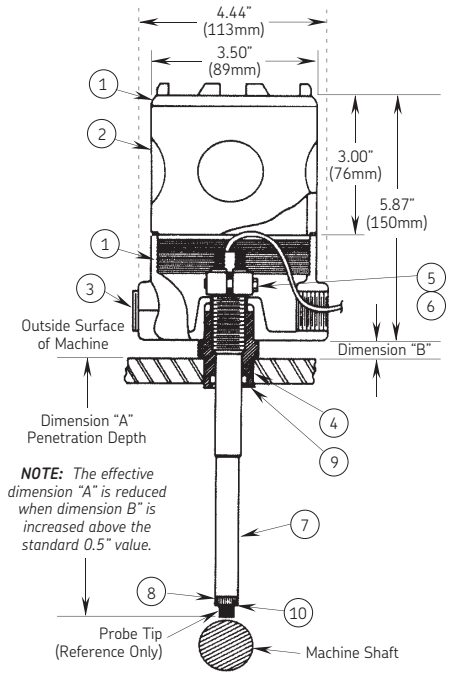



*Figure 3-7. CMSS 911 Probe Holder with housing.*

**The CMSS 911 Dual Sensor Holder (Figure 3-8)** with or without the housing provide for the mounting, adjustment and protection of the eddy probe, in addition to mounting an accelerometer or velocity sensor on the same axis as the eddy probe for absolute vibration measurements. It is recommended that probes be ordered with a case length of 1.2 inches or use the standard reverse mount probe and an overall length of 0.5 or 1.0 meters. The housing has four 3/4" (19 mm) NPT hubs for conduit attachment (3 close-up plugs provided).

1 Outlet dome (part number 10699402) 4GOU
2 Seismic sensor mounting adapter (part number 31194200)
3 Outlet body (part number 10699401) GECXAT-2
4 End plug (part number 10746003) CUP-2
5 Probe adapter union (part number 30180900)
6 "O" Ring union seal (part number 10711803)
7 Jam nut: CMSS 68: (part number 30126800)
CMSS 65: (part number 30053500)
8 Seismic sensor accelerometer/velocity
9 Probe adapter collar (part number 30187900)
10 Hex head steel cap screw (part number 10702200)
11 Probe Holder ("Stinger") (part number–various depending on length)
12 "O" Ring tip seal

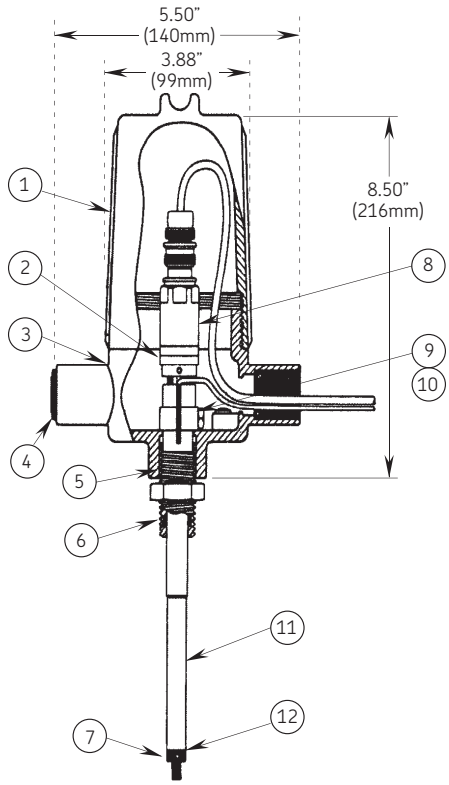



*Figure 3-8. CMSS 911 Dual Sensor Holder with housing.*

# Probe Adapter

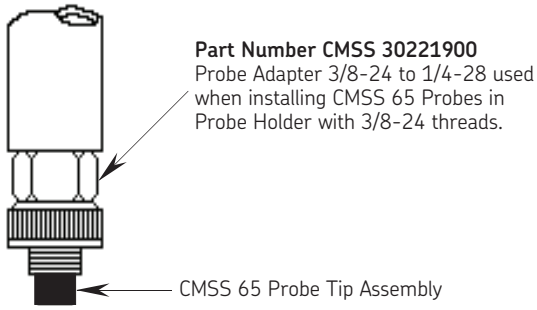



***Figure 3-9. Probe Adapter.***

# Installation instructions for CMSS 911 Probe Holder with Housing and CMSS 911 Dual Sensor Holder

1. Cut thread extension part 7 or (part 11) to desired length if necessary, deburr, and chase threads using a 1/4–28 or 3/8–24 tap.

   ***Caution:*** *The probe must turn freely. Forcing the probe can destroy both the probe and the holder.*

2. Push connector through threaded extension 7 or (11) from small end, apply Loc-Tite, screw probe into extension to desired length and lock in place with jam nut 8 or (7).

3. Thread probe adapter union 4 or (5) into 3/4" (19 mm) NPT machine case. Tighten firmly.

4. Attach outlet body 1 or (3) to probe adapter union 4 or (5) and tighten.

5. Thread probe holder through probe adapter union until probe tip is gapped at 0.040" (1 mm) or the driver output reads -8 Vdc. (There must be -24 Vdc applied to the driver.)

6. Slide probe adapter collar 5 and 6 or (8 and 9) over the probe holder and tighten hex screw 6 or (10). This locks the probe and holder into place.

7. Screw outlet body cover (1) into the outlet body extension 2 and tighten.

8. Connect conduit to outlet body 1 or (3) and plug extra conduit entries.

# CMSS 912 Dual Axial Probe Adapter

The CMSS 912 Dual Axial Probe Adapter provides mounting and protection for two parallel probes for measuring axial thrust position. The probes are mounted on adapters which are installed directly on the machine case through 1/2" (12.7 mm) NPT threaded holes. The adapters provide for easy gapping of the probes. The enclosure bolts directly to the machine case and protects the probe installation. A removable cover provides access to the installed probe.

It is recommended that probes be ordered with a case length of 1.2 inches and an overall length of 0.5 or 1.0 meters.

***Table 3-1.***

| Model number | Working range * | Probe thread |
|---|---|---|
| CMSS 912-1 | 1.10" to 2.35" (28 mm to 60 mm) | 1/4-28 CMSS 61/CMSS 65 |
| CMSS 912-3 | 0.75" to 2.00" (19 mm to 51 mm) | 3/8-24 CMSS 60/CMSS 68 |
| CMSS 912-4 | 0.95" to 5.00" (24 mm to 127 mm) | 3/8-24 CMSS 60/CMSS 68 |

** Working range with field trim of probe holder.*

### *CMSS 61/CMSS 65 Eddy Probe unique installations*

The connector body (0.28") is larger than the 1/4–24 hole. Take the connector apart, slide the cable and nut through the stinger, and then reassemble the connector. Refer to section on connectors for detailed explanation.

Requires the CMSS 912 with a 3/8–24 stinger and a 3/8–24 to 1/4–28 adapter nut (the CMSS 65 connector will not fit through the 1/4–24 stinger). See Figure 3-10.

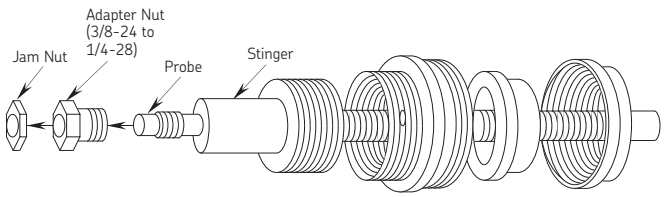



***Figure 3-10. Adapter used for mounting CMSS 65 Probes.***

# Installation instructions for CMSS 912 Dual Axial Probe Adapter

1. Prepare the mounting surface as shown in Figure 3-11.
2. Cut threaded extension (Part 2) Figure 3-12 to desired length, deburr, and chase the threads with a tap.
3. Thread probe connector through threaded extension (2) from small end and screw probe into extension to desired length. Lock in place with lock nut (1).
4. Thread fitting (3) into 1/2" (12.7 mm) NPT hole in machine case.
5. Thread assembled unit through fitting until the probe tip is gapped at approximately 0.040" (1.0 mm) or the driver output reads -8 Vdc.

   ***Note:*** *To oil-proof a CMSS 912 Probe Adapter, apply Loc-Tite pipe thread sealant liberally to both pipe threads and machine threads of probe holder during installation. This is good for temperatures from -65 to +300 °F (-18 to +149 °C). Cure time is 48 hours, but this can be accelerated significantly using Loc-Tite "Klean N' Prime" or Loc-Tite "Locquic Primer NF."*

6. Tighten the jam nut (1) on the extension when probe is properly gapped.
7. Install CMSS 912 housing on machine.

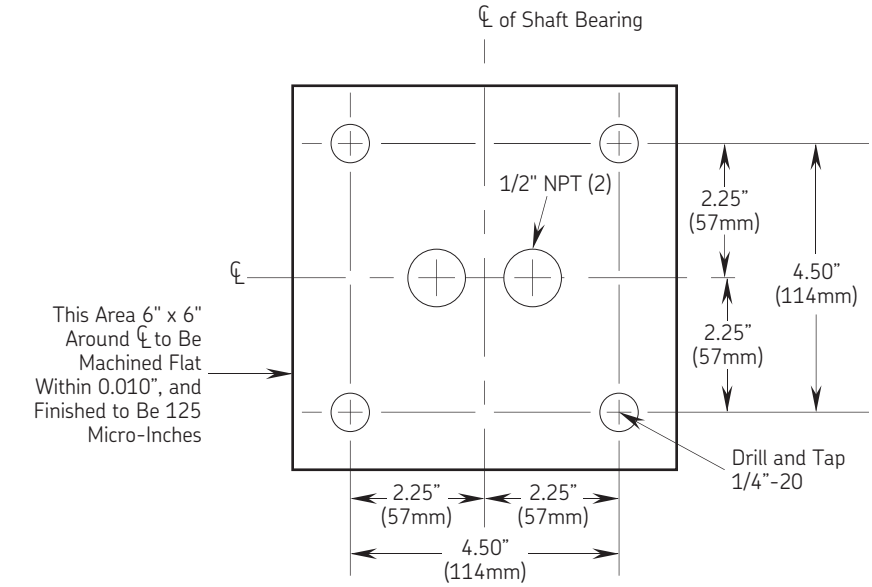



***Figure 3-11. Mounting surface requirements.***

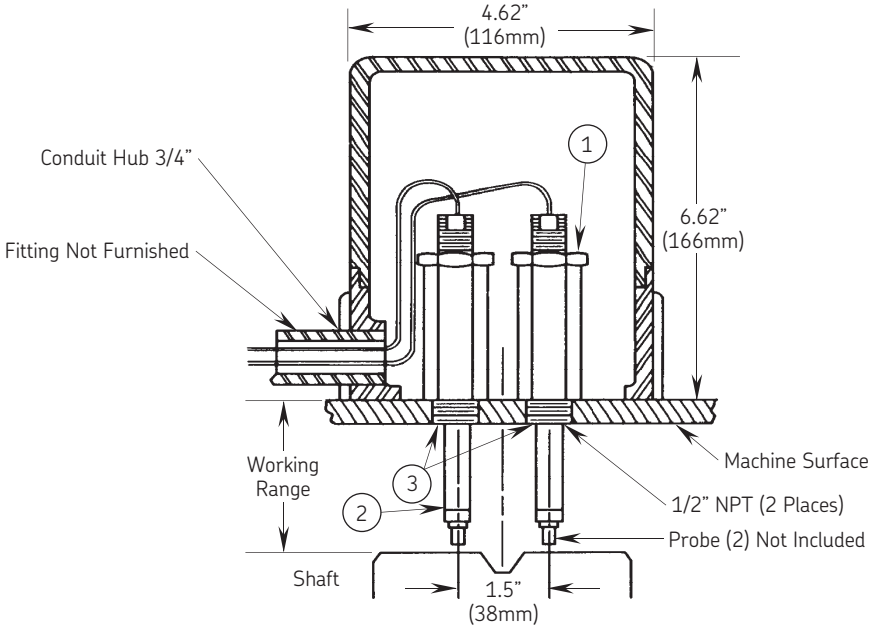



***Figure 3-12. CMSS 912 Dual Probe installation diagram.***

# CMSS 903 Series Mounting Brackets

***Mounting devices, adapters and packing glands***

The basic design and construction of the SKF Eddy Probes insures long, dependable service life. However, proper installation is essential; once adjusted to its optimum position, a probe must be absolutely immovable.

Standardized installation devices are offered for this specific purpose. They eliminate the chore of making special brackets or fixtures for each installation. They also help insure that every SKF Eddy Probe will continue to deliver all the accuracy built into it ... year after year.

***CMSS 903 Mounting Brackets*** are used in those installations requiring probe mounting in the machine's internal area.

***CMSS 903-1 Probe Holders*** are used to install CMSS 60/CMSS 68 Series Eddy Probes on flat machine surfaces. Threaded (3/8–24) and slotted, they insure a firm grip on the probe, once it is adjusted to final operating position. Two mounting holes accommodate #10 high tensile Allen head cap screws (not provided) which are normally secured with safety wires.

Material: Anodized aluminum.

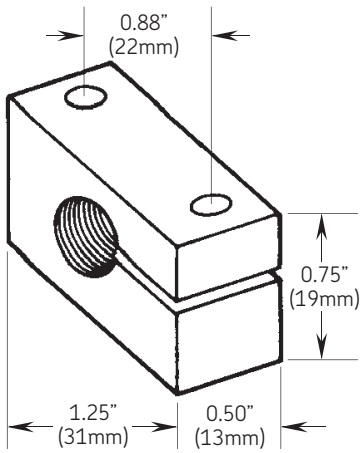



***Figure 3-13. CMSS 903-1 mounts CMSS 60/CMSS 68 Series Probes (3/8–24 case).***

***CMSS 903-2 Probe Holders*** are used for installing CMSS 61/CMSS 65 Series Eddy Probes on flat machine surfaces when space is at a premium. They are threaded (1/4–28) and slotted to insure a firm grip after final adjustment. Mounting holes accommodate two #6 high tensile Allen head cap screws with safety wire holes (not provided).

Material: Stainless Steel.

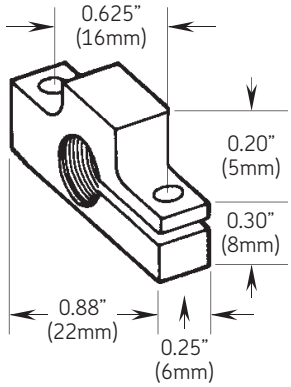



***Figure 3-14. CMSS 903-2 mounts CMSS 61/CMSS 65 Series Probes (1/4–28 case).***

***CMSS 903-3 Probe Holders*** are similar to the CMSS 903-1 but are designed to hold CMSS 61/CMSS 65 Series Eddy Probes and, in addition, permit final adjustment where it is not possible to turn the probe itself. This is especially convenient for installation of probes with armored or otherwise protected leads.

The probe is threaded into a sleeve, which mates with a left-hand thread in the main body of the Holder. Turning the sleeve then sets the probe position; it is not necessary to turn the probe itself. Both Holder and sleeve are slotted to insure a firm grip on the Probe. Mounting holes accommodate two #10 high tensile Allen head cap screws with safety wire holes (not provided).

Material: Anodized aluminum.

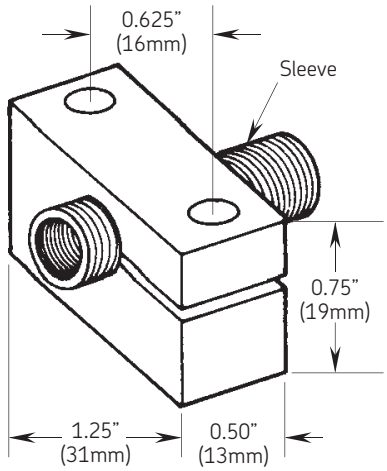



***Figure 3-15. CMSS 903-3 mounts CMSS 61/CMSS 65 Series Probes (1/4–28 case).***

# Installation instructions for CMSS 903 Series Mounting Brackets

1. Prepare a flat mounting surface with a good machine finish. A lapped surface is best. Make sure that there are no burrs or other foreign objects that can prevent a smooth mating surface.
2. Drill and tap two mounting holes to accommodate high-tensil Allen-head cap screws using probe holder as a template. Use 10-28 machine screws for anodized aluminum holders and 6-32 screws for stainless steel holders.
3. Install the screws, but do not tighten until eddy probe has been threaded into the holder.

*Table 3-2. CMSS 903 Series Eddy Probe Holders.*

| Eddy Probe | Holder | Holder material |
|---|---|---|
| CMSS 60 or CMSS 68 | CMSS 903-1 | Aluminum |
| CMSS 61 or CMSS 65 | CMSS 903-2 | Stainless steel |
| CMSS 61 or CMSS 65 Armored | CMSS 903-3 | Aluminum with sleeve |

# Mounting and positioning the probe

The prepared mounting surface must be free from dirt, dust, paint and oils before mounting the unit.

1. Thread the probe into the previously prepared hole or mounting bracket until it is gapped to about where it will normally operate.
2. Connect an ordinary digital voltmeter between the signal and ground terminals on the driver.
3. Move the probe up and down the threaded hole until the desired voltage reading appears on the meter.

   (For example, a 40 mil [1 mm] gap using a 200 mV/mil [8 mV/µm] probe would be -8.0 Vdc.)
4. Finger tighten the jam nut and then torque to 10 foot-pounds (13.56 N-m).

### *Normal and counter motion (thrust probes)*

With machine uncoupled, physically bar the shaft to one extreme of the thrust bearing clearance. Set the probe gap so that the monitor meter reads half the distance of the float zone (where zero reading -40 mils [-1 mm] gap).

Bar the shaft to the other extreme of the float zone to verify that gap is set at half the distance.

Readjust the gap, if necessary, to ensure halfway setting.

### *Normal motion*

When more range is needed (*) and thrust in only one direction must be considered, bar the shaft to the end of the float zone that is against the active thrust shoes and set the probe for a reading on the monitor meter of approximately 10 mils (0.25 mm) or 2 volts.

(*) Use 100 mV/mil (4mV/µm) calibration CMSS 600-12 or CMSS 668-5 if necessary.

### *Setting gap electrically*

When a calibrated probe is gapped at -8 Vdc from the eddy probe driver output, the gap will be 40 mil (200 mV/mil x 40 mils = 8 Vdc [8 mV/µm x 1.0 mm = 8 Vdc]).

(sensitivity) x (displacement) = probe output voltage

If the monitor system is near the machinery, watch the monitor's meters and turn the probe in and out until the desired level is reached.

If the monitor system is not near the machinery, use a voltmeter to set the gap.

### *Documentation*

After correctly positioning the probe, always record the probe setting, float zone, normal and counter direction of thrust, and probe location as shown in Figure 3-16. Keep this information with all other records of the system installation.

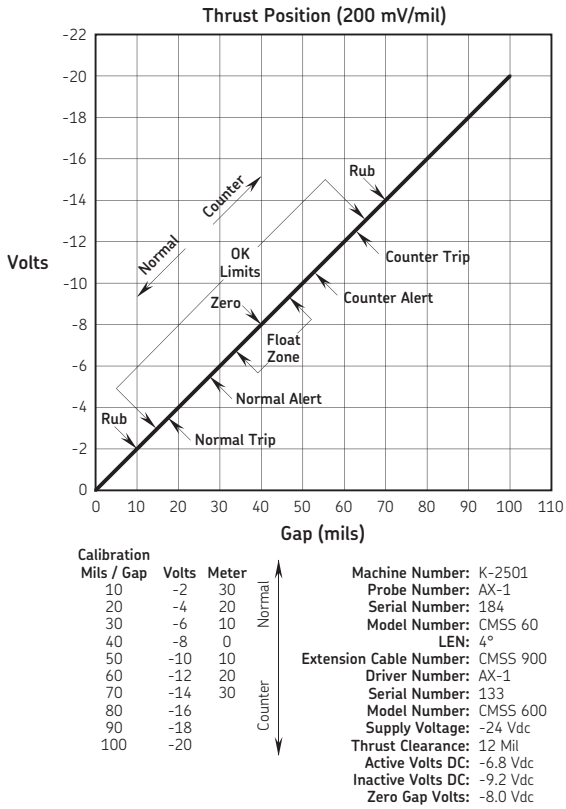



*Figure 3-16. Documentation of thrust-position probe.*

# Cables and connections

The probe and driver are always interconnected with the CMSS 900 or CMSS 958 Extension Cable which is specifically manufactured to have the proper electrical characteristics. Any reference to cable length is to its electrical length and not its physical length.

When threading the probe through a tapped hole, disconnect the extension cable and rotate the probe cable with the probe to minimize twisting. The probe and cable are manufactured for 1.0 meter length to help in installation (especially in tight areas).

***Caution:*** *Excessive twisting can eventually cause damage to the cable.*

Wrap the connectors with insulating tape or heat shrink sleeving to reduce ground loop problems (isolate from ground). Plumber's teflon tape is best because it is oil-proof and meets the electrical requirements. Taping is also extremely important in hazardous locations to prevent sparks if the cable and connector "whip around" during normal operation.

Avoid tight bends (any bend that exceeds the natural bending radius of the cable) in the installed interconnect cable. Tight bends can induce noise and cause undue cable wear.

Cabling should be tied down (Figure 3-17) about 6" to no more than 10" (152 to 254 mm) from the probe to prevent undesired movement of the cable which is also a source of noise and wear.

Figure 3-18 shows the different parts of a connector.

Figure 3-19 shows how to disassemble the CMSS 61/CMSS 65 connector.

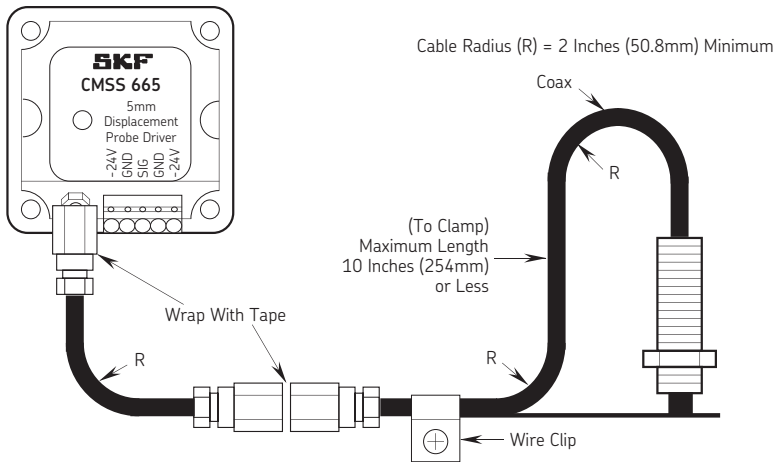



***Figure 3-17. Probe cable tie-down requirements.***

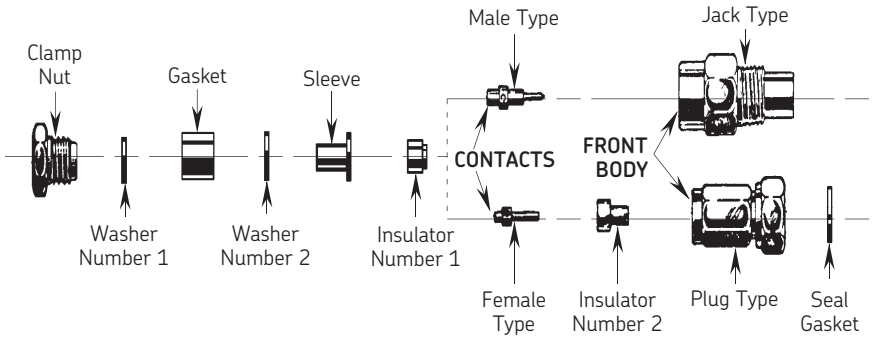



***Figure 3-18. Exploded view of subminiature coaxial connector.***

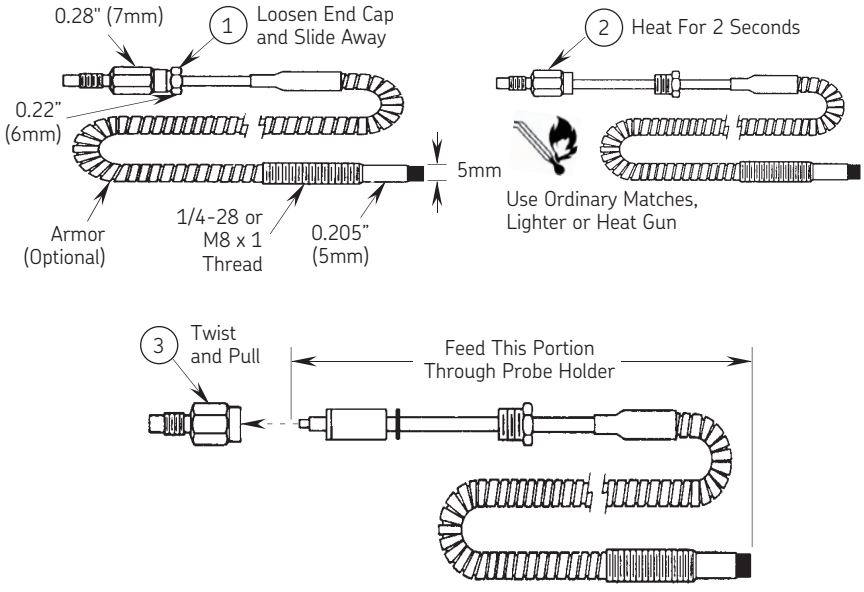



***Figure 3-19. Disassembling the CMSS 61/CMSS 65 Connector.***

Figure 3-20 shows how to reassemble the connector.

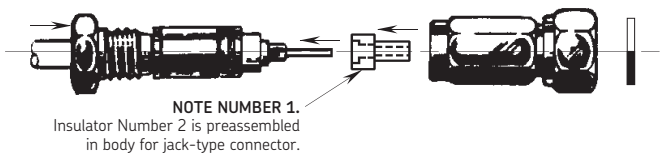



***Figure 3-20. Reassembling the connector.***

Assemble insulator number 2 over contact for plug type (see Note Number 1), slip front body onto clamp nut and tighten to 140-150 inch-ounces (0.99 N-m – 1.06 N-m).

***Important:*** *Gasket will flow.*

Wait (24 hours room temperature or 2 hours 257 °F [125 °C]) and re-torque to 140-150 inch-ounces (0.99 N-m – 1.06 N-m). If reassembling from having just removed body to allow passage through a 1/4–28 threaded hole, apply heat during reassembly. It will not be necessary to re-torque after 2 hours in this case.

***Note Number 2:*** *A seal gasket is optional and if installed in plug, provides seal from hostile environment when mated to jack.*

# Probe mounting don'ts

1. Don't use probes with the wrong extension cables or drivers (see Table 3-3).

***Table 3-3. Component compatibility.***

| Eddy probe | Driver (material) | Extension cable |
|---|---|---|
| CMSS 60 | CMSS 600 (Aluminum) | CMSS 900 |
| CMSS 61 | CMSS 606 (Aluminum) | CMSS 900 |
| CMSS 62 | CMSS 620-2 (Aluminum) | CMSS 900 |
| CMSS 65 | CMSS 665 (RYTON™) | CMSS 958 |
| CMSS 68 | CMSS 668 (RYTON™) | CMSS 958 |

2. Don't use a wrench to thread probe into hole. If probe doesn't turn with finger twisting, something is obstructing the passage or the threads of the hole should be cleaned up (chased).
3. Don't make probe-to-cable connection with connectors left inside the machine housing.
4. Don't leave probe lead or extension cable connections unprotected. Wrap them with insulating tape.
5. Don't use probe to observe a plated surface. Different permeability and conductivity and possible irregular thickness of the plating material are sources of calibration error.
6. Don't mount axial-position probes more than 12 inches (305 mm) from thrust collar. Shaft thermal growth distorts measurements.
7. Don't mount probes within half the tip diameter of:
   a. The end of a shaft
   b. A step-down
   c. A collar
   d. Any conductive surface other than the surface to be monitored
8. Don't mount probes on structures that have a natural resonance within machine operating range.
9. Don't attach conduit to probe body.
10. Don't twist probe lead when threading probe into place. Always use the probe case "flats" to turn probe into threads.
11. Don't forget to label the probe leads, extension cables, and monitor wires at the time of installation.
12. Don't forget to clamp probe's extension cable within 6" to 10" (152 to 254 mm) of probe tip.
13. Don't leave probe loose in threads; tighten jam nut or locking device.

# Mounting "Button" eddy probes

"Button" probes are used in locations with very small clearances. These probes are not threaded and must be mounted with some type of adhesive (except CMSS 62).

The type of adhesive depends upon several factors – permanent or temporary mounting, temperature, humidity, immersion, or the quality of the mounting surface.

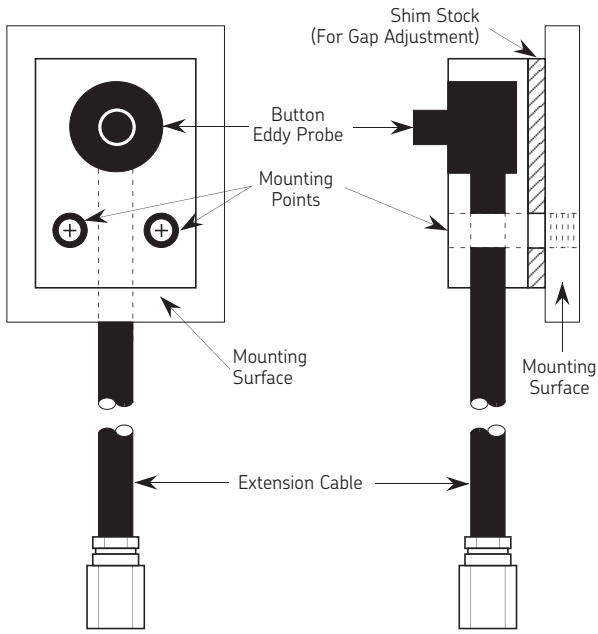
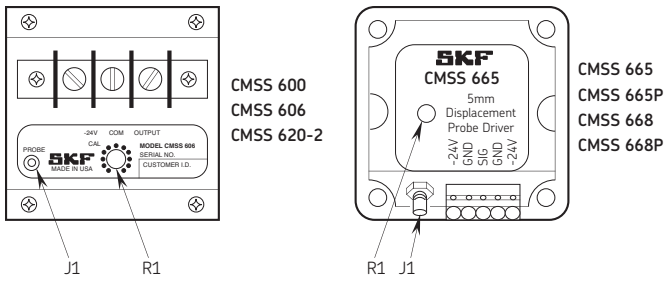



***Figure 3-21. Button eddy probe mounting diagram.***

# Section 4
# Driver installation

## Introduction

This section explains how to install SKF Eddy Probe Drivers (electrical and mechanical). Figure 4-1 shows typical drivers.




CMSS 600
CMSS 606
CMSS 620-2

CMSS 665
CMSS 665P
CMSS 668
CMSS 668P

*Figure 4-1. Typical SKF Eddy Probe Driver.*

### *CAL adjustment (R1)*

Adjusts sensitivity of probe and driver (slope of volts/mil calibration curve). Adjustment voids factory calibration. Used for adjustment to alternate target materials.

### *PROBE connector (J1)*

Subminiature coaxial connector. Mates with connector on CMSS 900 or CMSS 958 Extension Cable. In unique special probe application where extension cable is integral to the probe, then this connector can mate with connector on the probe.

### *Terminal strip connectors*

- -24 Vdc accepts power for electronic circuits.
- COM is the common connection for -24 Vdc and OUTPUT terminals.
- ***OUTPUT*** provides voltage-proportional-to-gap output for monitor system or readout instrument.

The driver must be mounted where it can be connected to the probe via the extension cable (probe to driver = 5 meters). Because the eddy probe is a "tuned" circuit, the extension cable must be used; it must not be eliminated from the installation, shortened, or extended.

SKF Eddy Probe Drivers have a power supply rejection ratio of approximately 100 to 1 (a 1-volt drift in power supply voltage will cause no more than a 0.01 volt change in the driver OUTPUT signal). Exception – CMSS 600, CMSS 606, and CMSS 620-2.

***Note:*** *Refer to Table 1-1 for probe/driver compatibility.*

## Electrical

Power/signal cable should be a shielded 3-wire cable. The shield helps prevent "electrical noise" found in most operating environments from affecting the probe's signal. The shield should be grounded at one place only (floating or differential).

The shield can be grounded to any of the following points (do not ground at both ends to prevent ground loops).

- Monitor chassis ground screw
- Monitor circuit ground "COM" terminal
- Driver chassis (Machinery ground)
- Facility instrumentation "Earth" ground

The cable's wire size (AWG) affects the usable distance from the driver and the monitor equipment. See Table 4-1.

***Table 4-1. Driver to monitor maximum wire lengths.***

| Wire size (AWG) | Distance (Maximum) |
|---|---|
| 22 | 1,000 feet (303 meters) |
| 20 | 2,000 feet (606 meters) |
| 18 | 3,000 feet (909 meters) |
| 13 | 4,000 feet (1,212 meters) |

### *Power requirements*

#### *CMSS 600, CMSS 606 and CMSS 620-2 Drivers*

Usually the monitor system used with the probe provides this power, however, any adequate power supply can be used. Each driver needs 35 mA. For example, four eddy probe drivers require 4 x 35 mA = 140 mA.

Voltage can vary from -18 to -26 Vdc. Operation below -24 Vdc can reduce the probe's operating range. See Figure 4-2.

#### *CMSS 665, CMSS 665P, CMSS 668 and CMSS 668P Drivers*

Voltage can vary from -24 to -32 Vdc and each driver requires 15 mA. Voltages beyond this range will seriously affect the calibration accuracy.

All the power requirements are usually supplied from installed instrumentation or may be supplied using SKF DIN-rail mounted power supply model CMSS 31123300. This power supply is rated at 0.175 amperes.

### *Wiring connections*

Figure 4-3 shows the electrical and signal connections for the CMSS 600, CMSS 606, and CMSS 620-2 Eddy Probe Drivers.

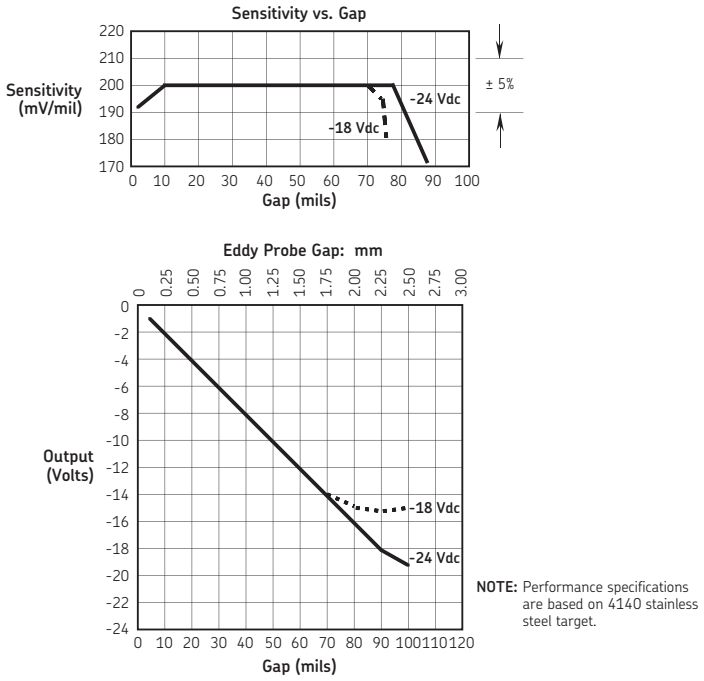



*Figure 4-2. Effects of power supply voltage on linearity.*

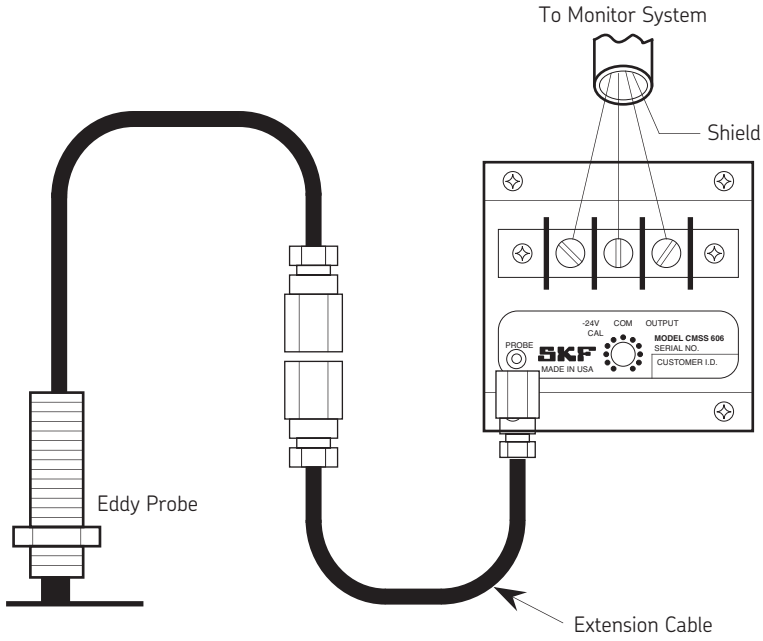



*Figure 4-3. Electrical and signal connections for probe drivers (CMSS 600, CMSS 606, and CMSS 620-2).*

Figure 4-4 shows the electrical and signal connections for the CMSS 665, CMSS 665P, CMSS 668 and CMSS 668P Eddy Probe Drivers.

***Note:*** *The power and signal terminal block (Part number 10818407 for the CMSS 665 and CMSS 668) can be plugged onto the mating pins two different ways (depending upon where the cables are routed). This plug is fail-proof because you cannot accidentally damage the driver by plugging it in backwards. A permanently affixed connector option (CMSS 665P and CMSS 668P) is also available and is mainly utilized in hostile environments.*

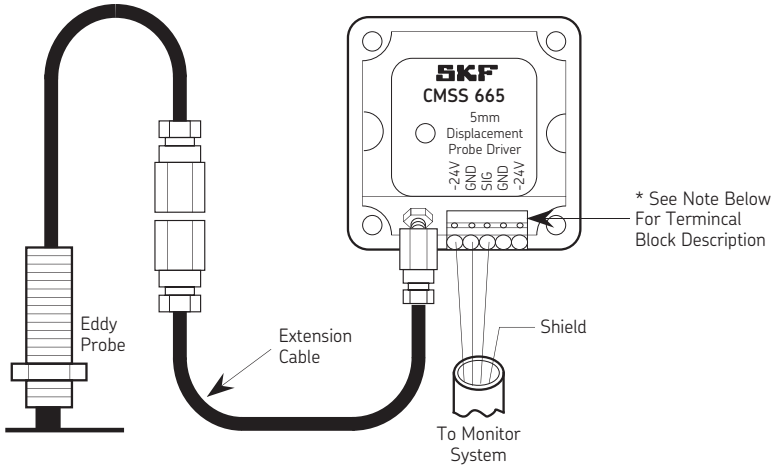



***Figure 4-4. Electrical and signal connections for probe drivers (CMSS 665, CMSS 665P, CMSS 668 and CMSS 668P).***

# Mounting (Mechanical)

SKF drivers can be directly mounted on any stable surface like a wall or panel, through the four mounting holes. For the CMSS 600, CMSS 606 and CMSS 620-2 Series, a special isolation plate and non-metallic screws are required to maintain driver/system isolation. See figure 4-7. For the CMSS 665, CMSS 665P, CMSS 668, and CMSS 668P Series, there is no special isolation plate required as the driver housings themselves are non-conductive and therefore keep all circuits isolated. For the CMSS 665, CMSS 665P, CMSS 668, and CMSS 668P Series in order to conserve space, use ordinary steel DIN-rails (available from SKF and most electrical supply outlets) and the DIN-rail boot or clip (available from SKF). See figures 4-6 and 4-8.

***Note:*** *CMSS 600, CMSS 606, and CMSS 620-2 Drivers can not use DIN-mounts.*

Figure 4-5 shows the driver dimensions.

Figure 4-6 shows the DIN-mount boot (clip).

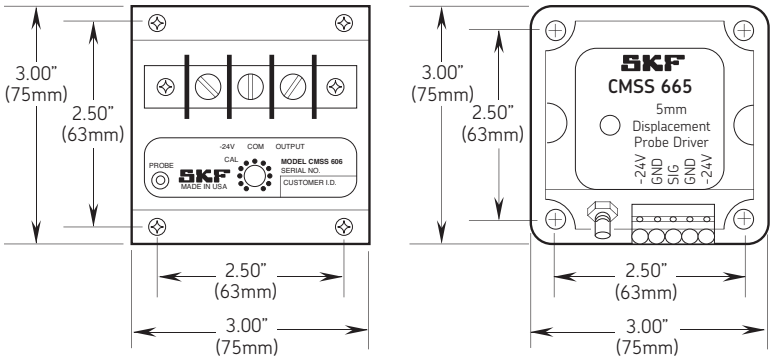



***Figure 4-5. Dimensions of drivers.***

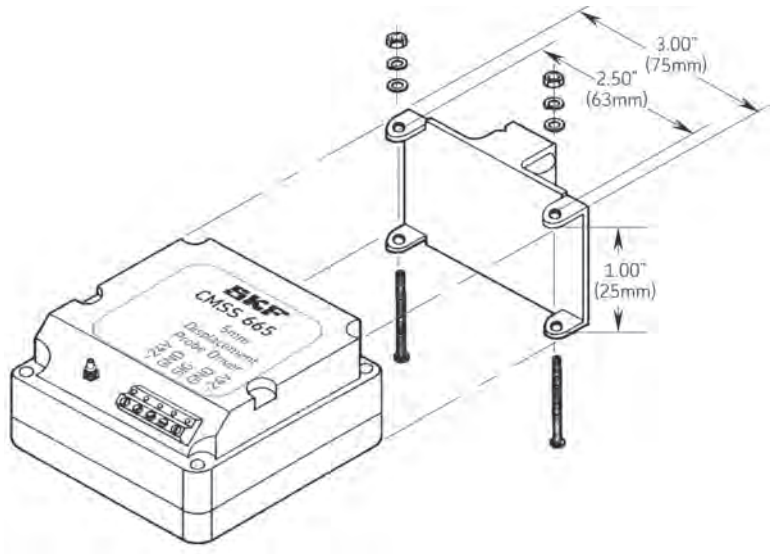



***Figure 4-6. Dimensions of DIN-Mount Boot (Clip).***

### *Isolation plate for CMSS 600, CMSS 606, and CMSS 620-2 Drivers*

The CMSS 600, CMSS 606, and CMSS 620-2 Drivers have a metallic case and must be electrically isolated from the mounting surface to prevent ground-loop problems.

The Isolation Plate is especially important with installations in hazardous locations that use Intrinsic Safety Barriers.

Figure 4-7 shows how to install the isolation plate. Use non-metallic screws or use inserts so screw doesn't provide continuity.

Figure 4-8 shows a DIN-rail with various components attached.

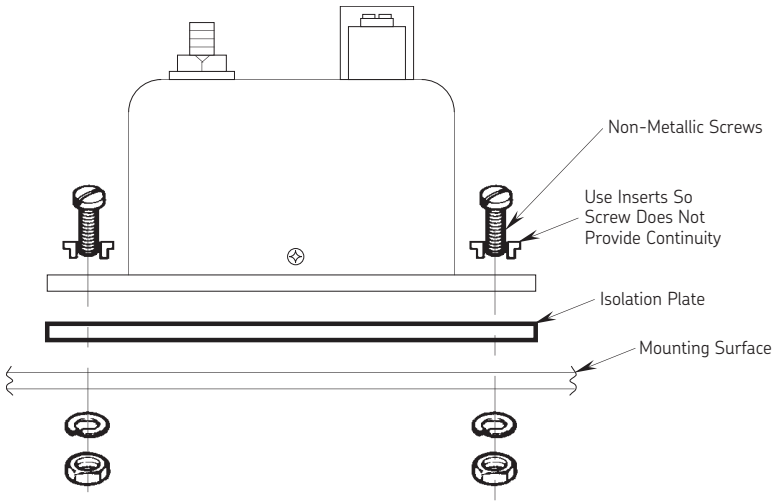



*Figure 4-7. CMSS 600, CMSS 606, and CMSS 620-2 Isolation Plate.*

# Weatherproof housings

### *Weatherproof housings (NEMA 4 and 4X)*

- Meets requirements for NEMA Type 4, Type 4X, Type 12 and Type 13.
- UL 508 Type 4 and Type 4X
- CSA Type 4.
- IEC 529, IP66 (European Standard)

### *Weatherproof housings for protection from adverse environmental conditions*

SKF Condition Monitoring product line offers three types of housings to provide protection from adverse environmental conditions for DIN-rail mountable eddy probe drivers.

### *Water resistant housing*

Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure. The housings are constructed of 14 or 16 gauge steel with seams continuously welded. Holes and cable clamp fittings are provided. The cover is held in place by steel clamps on four sides of cover to assure water tight integrity. There is an oil-resistant gasket held in place with oil resistant adhesive. Finish is ANSI 61 gray polyester powder coating. Meets NEMA 4 criteria.

### *Water and corrosion resistant housing (Stainless steel)*

Meets the same criteria as the Water Resistant Housing in addition to being manufactured of stainless steel to meet the CORROSION RESISTANT criteria. Finish is unpainted polished surface. Meets NEMA 4X criteria.

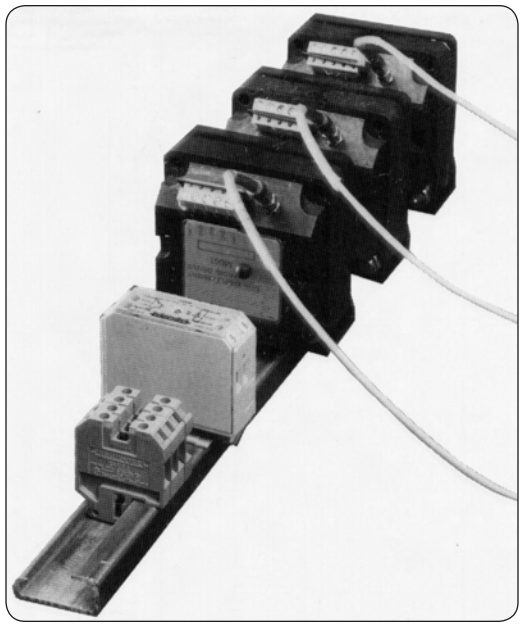


*Figure 4-8. Example Type C DIN-rail mounting.*

### *Weatherproof housing configurations*

**Weatherproof housings for RYTON™ DIN-rail mount Drivers.**

**Area classification — (Clamp cover)**

NEMA/EEMAC Type 4, Type 12 and Type 13

UL50 Type 4, Type 12, Type 13

UL508 Type 4, Type 12, Type 13

CSA Type 4

IEC 529, IP66

- CMSS 31092100 Weatherproof housing for maximum three drivers
- CMSS 31092200 Weatherproof housing for maximum six drivers
- CMSS 31092300 Weatherproof housing for maximum ten drivers

**Area classification — (Stainless steel, clamp cover)**

NEMA/EEMAC Type 4, Type 4X, Type 12 and Type 13

UL50 Type 4, Type 4X

UL508 Type 4, Type 4X

CSA Type 4, Type 4X

IEC 529, IP66

- CMSS 31092101 Weatherproof housing for maximum three drivers
- CMSS 31092201 Weatherproof housing for maximum six drivers

**Area classification — (Stainless steel) continuous hinge on one side, clamps on other three sides of cover.**

NEMA/EEMAC Type 4, Type 4X, Type 12 and Type 13

UL50 Type 4, Type 4X

UL508 Type 4, Type 4X

CSA Type 4, Type 4X

IEC 529, IP66

- CMSS 31092103 Weatherproof housing for maximum three drivers
- CMSS 31092303 Weatherproof housing for maximum ten drivers

# Weatherproof housings for DIN-rail mount drivers

*Table 4-2. Weatherproof housing dimensions.*

| SKF model number | Box size A x B x C | Mounting D x E | Clamp style overall L x W | Hinge style overall L x W |
|---|---|---|---|---|
| CMSS 31092100<br>CMSS 31092101<br>CMSS 31092102 | 8.00 x 6.00 x 3.50" (203 x 152 x 89 mm) | 8.75 x 4.00" (222 x 102 mm) | 9.50 x 7.38" (24 x 187 mm) | 9.50 x 6.94" (24 x 176 mm) |
| CMSS 31092200<br>CMSS 31092201 | 10.00 x 8.00 x 4.00" (254 x 203 x 102 mm) | 10.75 x 6.00" (273 x 152 mm) | 11.50 x 9.38" (292 x 238 mm) | 11.50 x 8.94" (292 x 227 mm) |
| CMSS 31092300 | 12.00 x 10.00 x 5.00" (305 x 254 x 127 mm) | 8.75 x 4.00" (324 x 203 mm) | 13.50 x 11.38" (343 x 289 mm) | 13.50 x 10.94" (343 x 278 mm) |

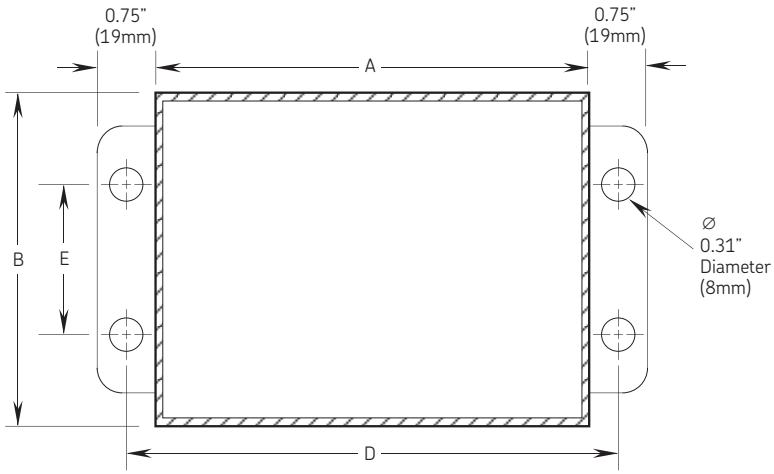



*Figure 4-9. Weatherproof housing dimensions.*

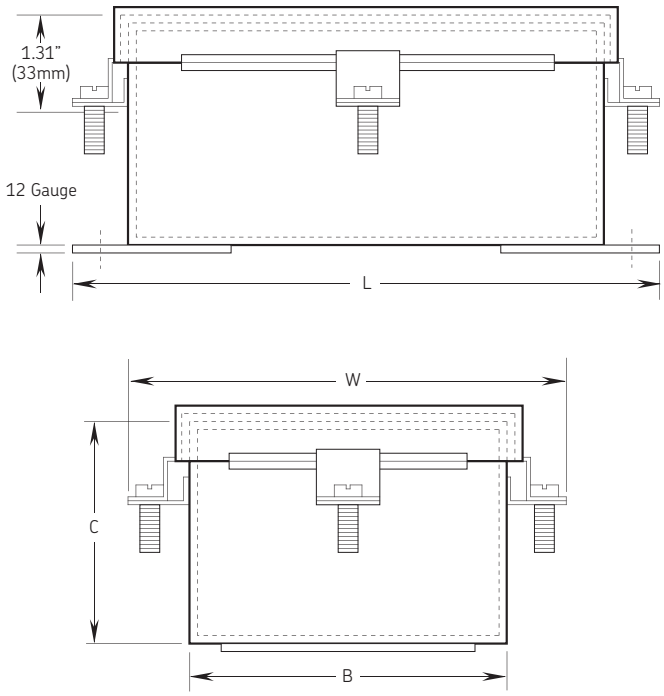



*Figure 4-10. Clamp style weatherproof housing dimensions.*

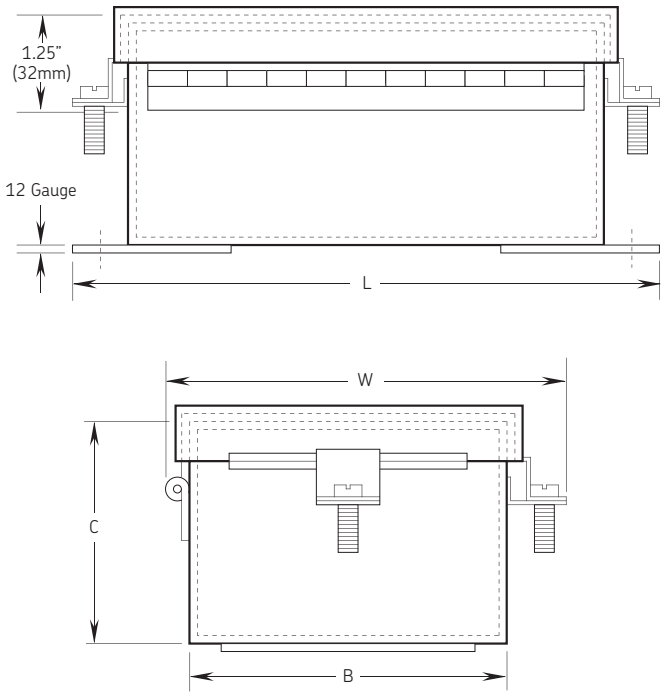



*Figure 4-11. Hinge style weatherproof housing dimensions.*

The drivers can be mounted inside the housing on ordinary steel "Type C DIN-rails" available from SKF. There are two sizes, 9" (225 mm) and 15" (375 mm) lengths. Use part number CMSS 31093101 and CMSS 31093100 respectively.

Figure 4-12 shows how to install the drivers using the DIN-rail and clip.

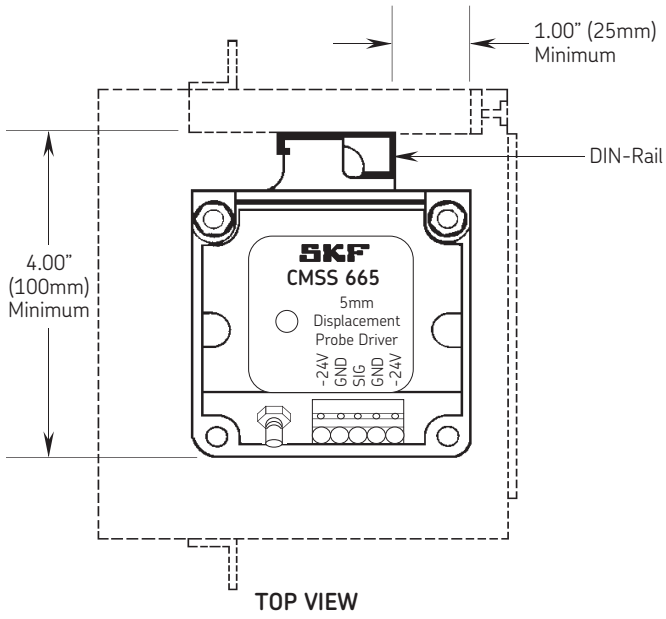



*Figure 4-12. Installation of drivers in recommended weatherproof housings.*

Figure 4-13 shows the minimum clearances needed to install the drivers in weatherproof housings. These clearances allow for the cables and for the "swing" involved in snapping the driver clip into the DIN-rail.

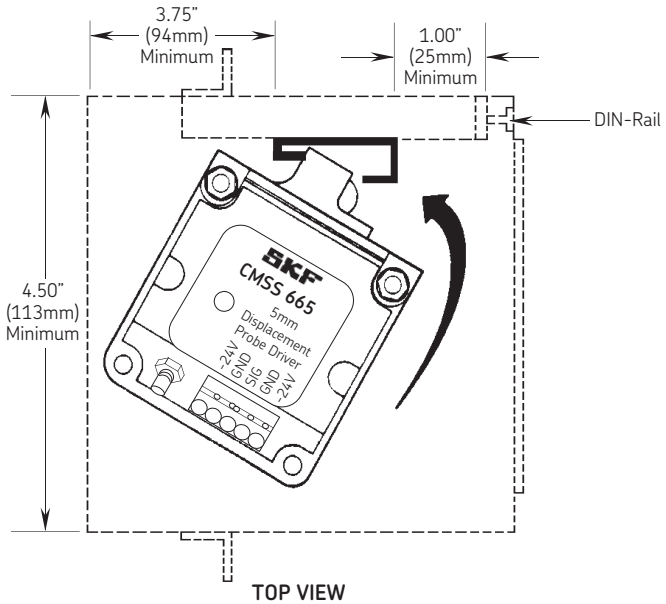



*Figure 4-13. Minimum clearances needed to install drivers in weatherproof housings.*

# Explosion-proof housings for DIN-rail mount drivers

***Explosion-proof housings***

- Explosion-proof and dust-tight housings
- Class I, Group C and D
- Class II, Groups E, F, and G
- Class III,
  - UL Standard 886
  - CSA Standard C22.2, Number 30 1970

The Explosion-proof housing is designed for use in environments classified as hazardous. The housing is manufactured of aluminum alloy with a copper content less than 0.3% maximum. On three sides the bosses are drilled and tapped for 3/4 inch (19 mm) NPT conduit fittings. The dome type housing is specified requiring a minimum of floor space for fixture mounting. Two sizes are available which should normally meet criteria for an explosion-proof housing at each bearing or a larger size where the drivers from multiple bearings can be housed.

# Explosion-proof housing dimensions

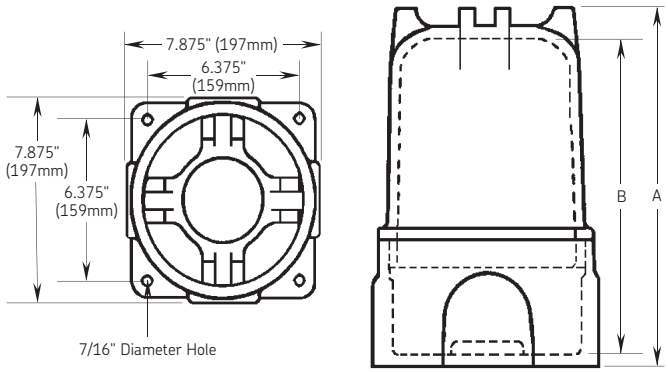



***Figure 4-14. Explosion-proof housing dimensions.***

Explosion-proof housings for RYTON™ DIN-rail mount drivers. The units come with all hardware ready for assembly and installing the drivers.

CMSS 31091700 Explosion-proof dousing for maximum four drivers.

***Table 4-3. Explosion-proof housing dimensions.***

| Catalog number | A Inside dome | B Inside dome | Diameter cover opening | Mounting hole size | Weight each - pound |
|---|---|---|---|---|---|
| CMSS 31091700 | 10-1/4" (290 mm) | 11-7/16" (290 mm) | 6-7/8" (175 mm) | 7/16" | 15 (6.5 kg) |

The drivers can be mounted inside the housing on ordinary steel “Type C DIN-rails” which is available from almost any electrical supply outlet.

Figure 4-15 shows how to install the drivers using the DIN-rail and clip.

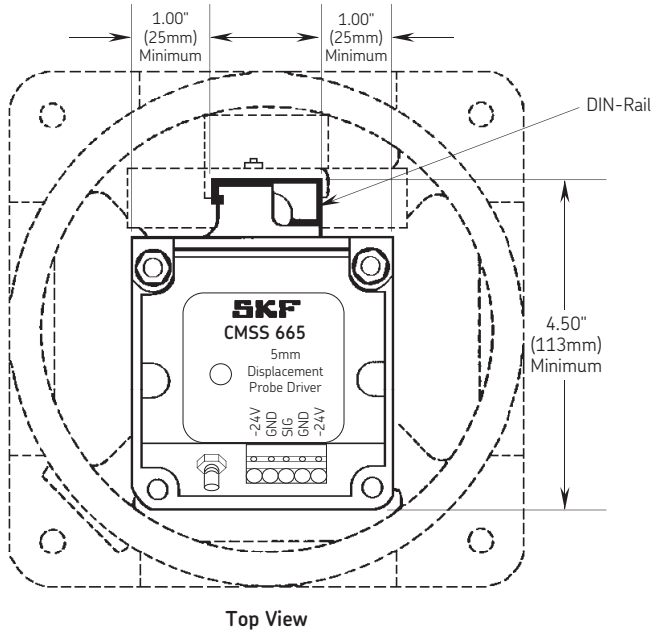



*Figure 4-15. Installation of srivers in recommended explosion-proof housings.*

Figure 4-16 shows the minimum clearances needed to install the drivers in explosion-proof housings. These clearances allow for the cables and for the “swing” involved in snapping the driver clip into the DIN-rail.

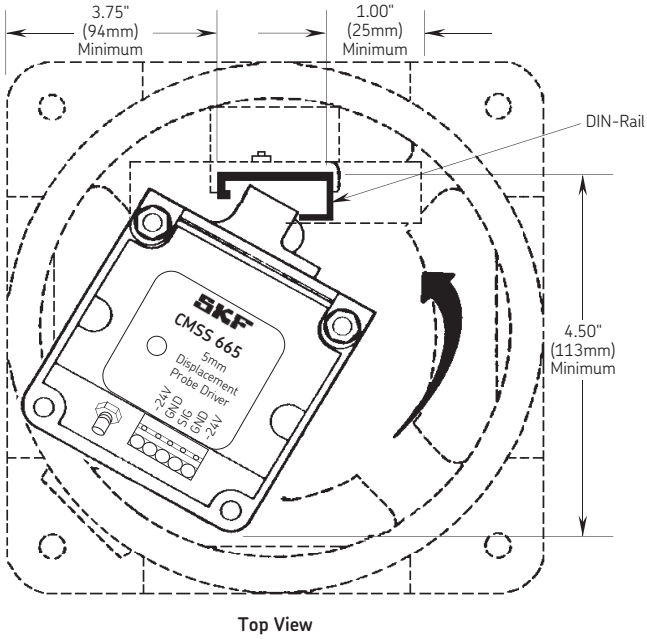



*Figure 4-16. Minimum clearances needed to install drivers in explosion-proof housings.*

# Section 5
# Optional equipment

## Introduction

This section explains some of the options used with SKF Eddy Probe Systems.

## CMSS 920 High Pressure Feedthrough

The SKF Condition Monitoring Model CMSS 920 is a low cost, general purpose high pressure feedthrough. The CMSS 920 is principally used to provide a cable exit for internally mounted eddy probes in high pressure areas. The unit is available in configurations for one, two, or three cables and the cable lengths on the high pressure and low pressure side may be specified as required to meet particular eddy probe system configurations. The internal modular construction allows configuration to customer's specifications.

The CMSS 920's bi-directional pressure rating of 2,000 psi enables the unit to withstand both pressure and vacuum, a critical requirement for refrigeration units which are dehumidified under vacuum and pressurized in normal operation. The 3/4" (19 mm) NPT mounting threads on either end enables the CMSS 920 to be installed in a smaller hole.

An optional 1" (25 mm) NPT thread adaptor is available and may be used to directly replace the previously supplied CMSS 918 or other high pressure feedthroughs with the CMSS 920.

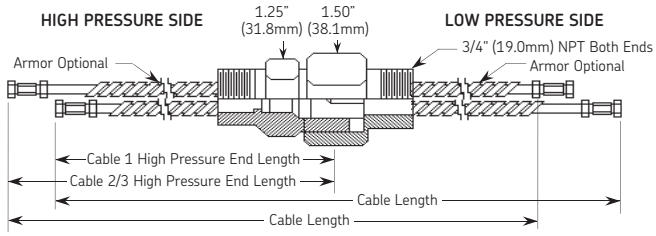



***Figure 5-1. CMSS 920 High Pressure Feedthrough.***

Use the following procedure to install the CMSS 920 High Pressure Feedthrough.

1. Remove unit from shipping container. Inspect for damage to cables during shipping. Use an ohmmeter to check for continuity.
2. Be sure the probe and feedthrough cable are compatible with the driver.
3. Type your monitor point identification number(s) on white paper, then cut out in strip(s) approximately 0.25" (6.4 mm) wide by 2.50" (63.5 mm) long. This size is usually easy to put under the shrink tubing prior to shrinking with a heat gun.
4. Insert identification strips under the clear heat shrink tubing and then use a heat gun to shrink tubing.
5. Prepare a 3/4" (19 mm) NPT threaded hole into the pressure area (through machine casting).
6. Insert the high pressure cable(s) through NPT hole and roll both ends of the cable(s) into a fairly tight knot and secure them with tape or "tie wraps." This helps prevent the cables from "snagging" when you screw the feedthrough into the 3/4" (19 mm) NPT hole.
7. Screw the high pressure end into the machinery. Wrap threads with plumber's Teflon tape if desired.

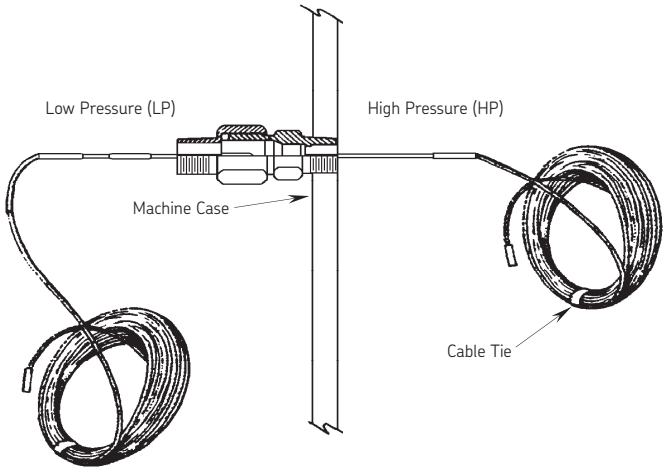



*Figure 5-2. CMSS 920 installation diagram.*

8. Verify that the torque on the 1.50" (38.1 mm) nut is 60 to 80 foot-pounds (81.35 to 108.5 N-m) to ensure a good seal.

9. Connect the cable-end connectors to the probe and the driver.

   ***Note:*** *Hand tightening is not sufficient. Tighten to 140 to 150 inch-ounces (0.99 to 1.06 N-m).*

10. Wrap all cable-end connectors with suitable insulating tape to isolate them from ground.

11. Secure cables with tie wraps (inside and out) to prevent mechanical abrasion of jacket material during operation.

    ***Note:*** *The CMSS 920 High Pressure Feedthrough is not field repairable. If it becomes damaged return it to the factory for rebuild.*

# CMSS 30112000 Series Cable Packing Gland Assembly

The CMSS 30112000 Series Cable Packing Gland Assembly offers a splash-proof cable exit from the machine case. They are available in 1 or 2 cable exit versions and with either a 1/2" (12.7 mm) or 3/4" (19 mm) NPT male thread for screwing into the machine housing. It is an effective and easily installed low pressure (10 atmospheres maximum) seal. The internal oil resistant neoprene packing as well as washers are split to allow cable installation without connector removal.

- **CMSS 30112000** One (1) cable exit, 1/2" (12.7 mm) NPT thread
- **CMSS 30112001** Two (2) cable exit, 1/2" (12.7 mm) NPT thread
- **CMSS 30112003** One (1) cable exit, 3/4" (19 mm) NPT thread
- **CMSS 30112004** Two (2) cable exit, 3/4" (19 mm) NPT thread
- **CMSS 30112006** Two (2) cable exit, 1/2" (12.7 mm) NPT thread

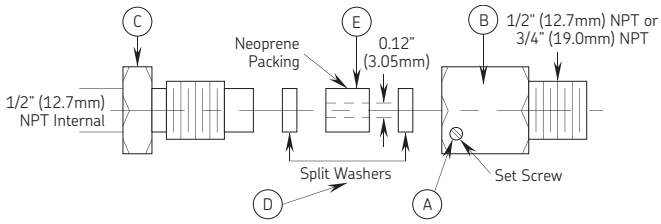



*Figure 5-3. Cable packing gland assembly.*

1. Loosen set screw (A), loosen and separate gland body (B) and gland nut (C), remove split washers (D) and neoprene packing (E).

2. Insert probe cable and connector through the body (B) and nut (C).

3. Screw gland body (B) into machine case.

4. Slide washers (D) and packing (E) over probe cable.

5. Carefully mate the nut (C) and body (B) together making sure the washers and packing fit inside without being crimped or cut.

6. Tighten nut (C) to 60 to 80 foot-pounds (81.35 to 108.50 N-m).

7. Tighten setscrew (A) to prevent nut (C) from vibrating loose during operation.

# CMSS 30837800 1/2” (12.7 mm) or 3/4” (19 mm) NPT Probe Adapter

The probe adapter is used to mount a probe with a 1/4–28 or 3/8–24 thread in a machine case which will accept the 1/2” (12.7 mm) or 3/4” (19 mm) NPT fitting. Conduit or a junction box may be mounted on the exterior side of the adapter.

- **CMSS 30837800**
  - 3/8–24 internal thread for CMSS 68 style probes.
  - 1/2” (12.7 mm) NPT external thread.
- **CMSS 30837801**
  - 1/4–28 internal thread for CMSS 65 style probes.
  - 1/2” (12.7 mm) NPT external thread.
- **CMSS 30837802**
  - 3/8–24 internal thread for CMSS 68 style probes.
  - 3/4” (19 mm) NPT external thread.
- **CMSS 30837803**
  - 1/4–28 internal thread for CMSS 65 style probes.
  - 3/4” (19 mm) NPT external thread.

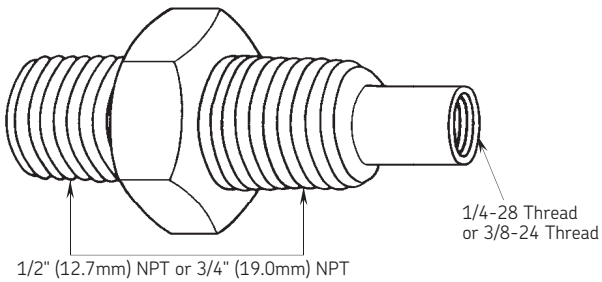



***Figure 5-4. 1/2” (12.7 mm) or 3/4” (19 mm) NPT probe adapter.***

# Section 6
# Maintenance

## Introduction

All SKF Eddy Current Probes are sealed units and contain no user-serviceable parts. The only maintenance performed by the user consists of making sure all connections are tight and clean. This section explains how to calibrate the probe drivers and troubleshooting techniques associated with suspected probe failures.

## Periodic/preventative maintenance

SKF Eddy Probes will give many years of maintenance-free service if used within the parameters listed in the eddy probe specification data sheets. See SKF Condition Monitoring publication "Eddy Probe Systems Catalog" (CM2004).

## Calibration

Calibrating probes just prior to extensive equipment testing ensures the accuracy of test information and optimizes very costly test time.

## CMSS 601 Series Field Calibrators

***Description***

The Model CMSS 601 Series Field Calibrators are basically a micrometer with a magnetic base and adapters to accept either the CMSS 60, CMSS 61, CMSS 65, or CMSS 68 Series Eddy Probes. The CMSS 601-1 measures the gap in milli-inches (mil) and the CMSS 601-2 and CMSS 601-8 measures in micrometers. The CMSS 601-1 and CMSS 601-2 can be used with the more common short eddy probe case lengths however the Model CMSS 601-8 ***MUST BE*** used with eddy probe case lengths ***GREATER*** than 2.5 inches (65 mm).

The field calibrator provides an adjustable static gap across which the probe observes a target of precisely the same material that the probe will observe when installed as part of the machine monitoring system. Due to differences in conductivity and permeability, different materials (metals) have different gap-to-voltage sensitivity. The length of the gap and the output of the eddy probe can be both accurately measured, and a calibration curve can be generated from the readings. The calibration potentiometer on the various models of the eddy probe drivers is then adjusted for a 200 mV/mil scope of the calibration curve.

***Note:*** *Wherever possible, mount the field calibrator on the actual shaft to be observed by the eddy probe being calibrated. Calibrators for long probes use an integral calibrator target only ... will not observe actual shaft.*

# CMSS 601-1 and CMSS 601-2 Field Calibrator

***Set-up procedure*** *(Figure 6-1)*

1. Insert the adapter through the hole in the magnetic base B.
2. Slip the probe into the adapter and lock into place with the set screw A. Be sure that the entire non-metallic portion of the probe tip extends beyond the end of the adapter.
3. Slip the adapter over the end of the micrometer head C. Lock it into place with set screw D.
4. Attach magnetic base to the machine shaft or to the target plate E supplied with the kit or a target provided by the user.
5. Connect the probe lead to the appropriate CMSS 900 or CMSS 958 Extension Cable and connect the extension cable to the appropriate probe driver (CMSS 600 Driver for CMSS 60 Series Probes, CMSS 606 Driver for CMSS 61 Series Probes, CMSS 665 Driver for CMSS 65 Series Probes, CMSS 668 Driver for CMSS 68 Series Probes).
6. Apply -24 Vdc power to the driver, and connect a voltmeter to the driver output (Figure 6-2).
7. Rotate spindle scale F to read “40 mils” (1 mm). Loosen set screw D, and move Probe to read -8 Vdc on the voltmeter (without disturbing reading; spindle continues to read “40 mils” [1 mm] ). Lock set screw D, and proceed with calibration.
8. Proceed with calibration procedure on page 6-4.

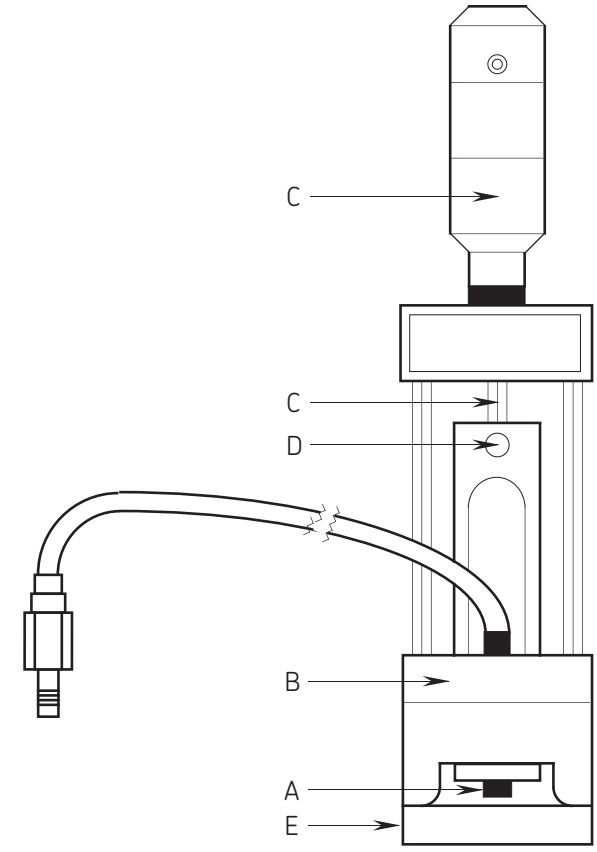



***Figure 6-1. CMSS 601-1 and CMSS 601-2 Model Field Calibrator shown.***

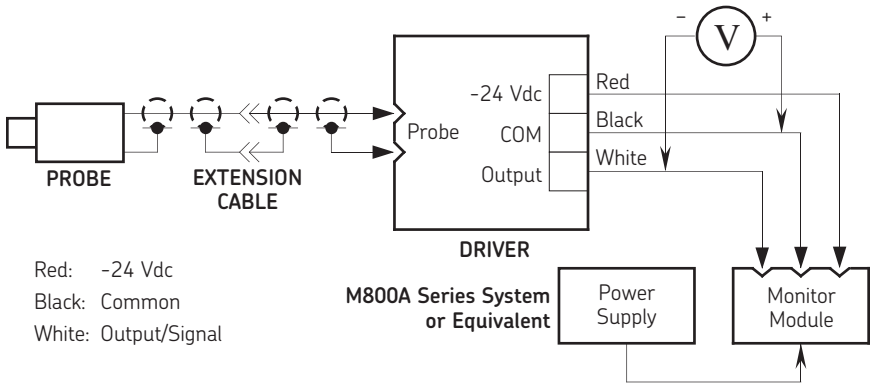



***Figure 6-2. Interconnect to vibration monitor system.***

# CMSS 601-8 Field Calibrator

***Set-up procedure*** *(Figure 6-3)*

1. Slip the small target A, onto the micrometer shaft B, and lock into place with set screw C.
2. Screw the appropriate disc-shaped probe adapter D, onto the probe E. There is one disk adapter for the CMSS 60/CMSS 65 Probes and one for the CMSS 61/ CMSS 68 Probes.
3. Insert probe tip carefully through center hole in magnet F, until adapter clamps to magnet. Align adapter circumference with magnet circumference.
4. Turn the micrometer spindle to 40 mils (1 mm) position and screw the probe into the calibrator assembly (allow cable to turn freely and not twist) until probe tip is about 40 mils (1 mm) from target.
5. Connect the probe lead to the appropriate CMSS 900 or CMSS 958 Extension Cable and connect the extension cable to the appropriate probe driver (CMSS 600 Driver for CMSS 60 Series Probes, CMSS 606 Driver for CMSS 61 Series Probes, CMSS 665 Driver for CMSS 65 Series Probes, CMSS 668 Driver for CMSS 68 Series Probes).
6. Apply -24 Vdc power to the driver, and connect a voltmeter to the driver output (Figure 6-4).
7. Check that the micrometer is set to 40 mils (1 mm). Turn probe to get a reading of -8 V on the voltmeter (without disturbing the 40 mils (1 mm) reading on the micrometer) and tighten lock nut G.
8. Proceed with calibration procedure on page 6-4.

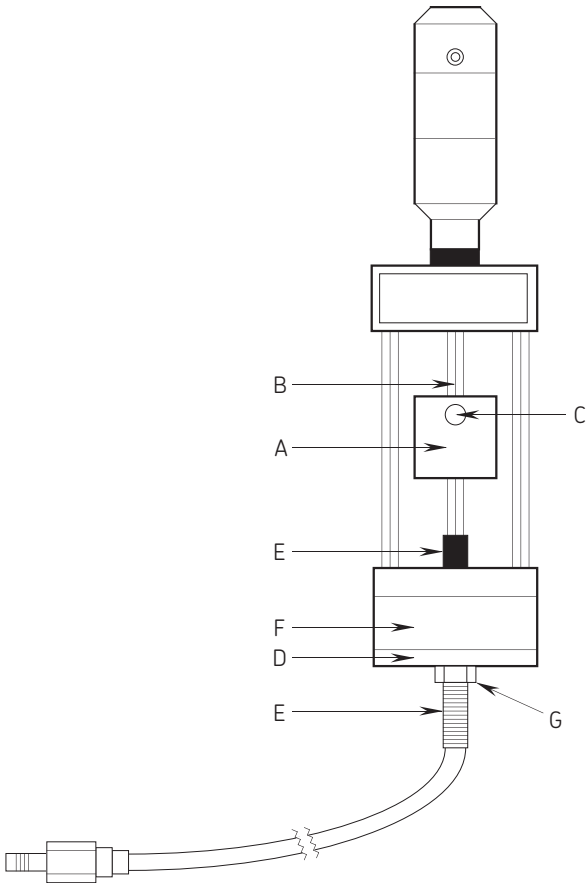



*Figure 6-3. CMSS 601-8 Model Field Calibrator shown.*

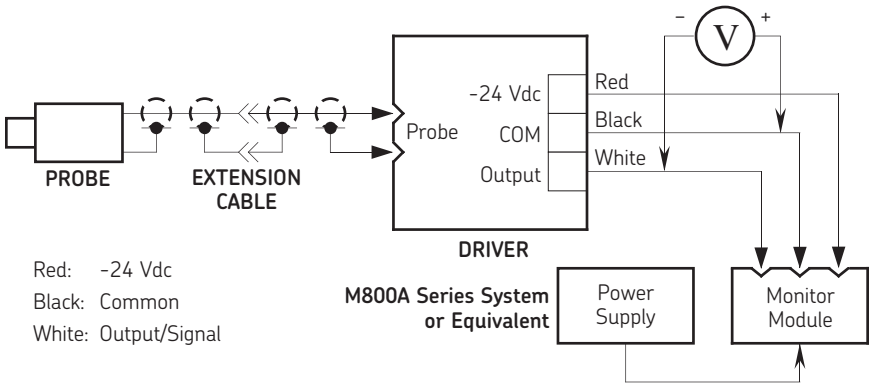



*Figure 6-4. Interconnect to vibration monitor system.*

***Calibration procedure***

1. Slowly adjust the micrometer dial, first increasing and then decreasing from the 40 mil (1 mm) starting gap, and record the new voltmeter readings for each 5 mil (125 µm) increment.

***Note:*** *Contact is not necessarily zero volts, since the gap is measured from the coil within the tip, and not from the surface of the tip itself. The distance from the coil to the tip surface varies ±3 milli-inches. Ordinarily, the first 10 or 12 milli-inches of gap is not usable.*

2. Plot a straight-line graph through the recorded points. A probe that is in calibration should have a graph with a 200 mV/mil (8 mV/µm) slope. Each volt equals five milli-inches (125 µm), as shown in Figure 6-5.

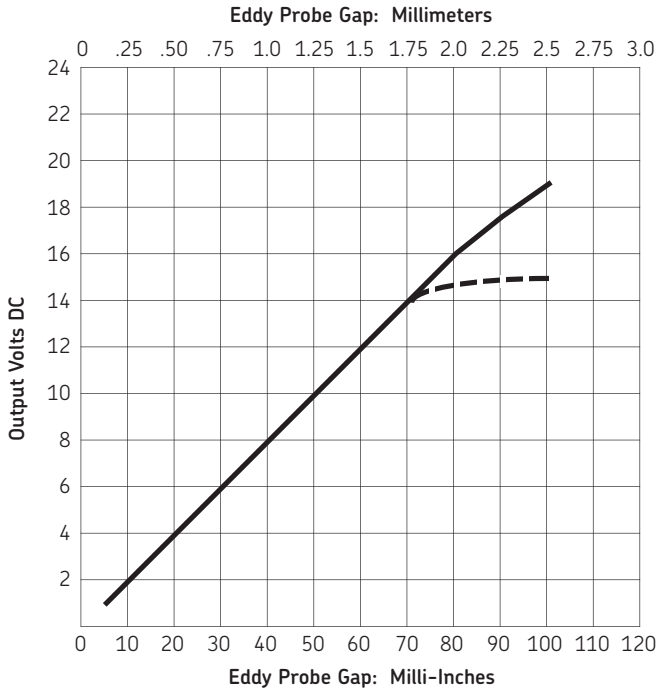



***Figure 6-5. Typical response curve.***

3. If slight adjustment of the slope is necessary to calibrate to a particular shaft material, the CALIB (calibrate) control on the eddy probe driver unit provides a ±10% adjustment for sensitivity.

***Note:*** *After a driver unit is calibrated, any probe (of the proper model number) and any extension cable may be substituted without recalibration, and maintain an accuracy of ±5%.*

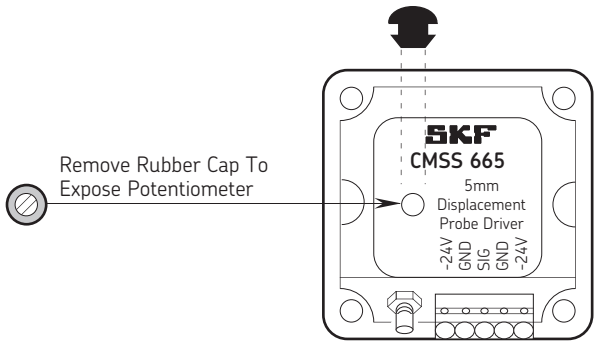



***Figure 6-6. Location of calibration (Slope) adjusting potentiometer.***

# Probe gap voltage test setup

1. Connect -24 to -30 volts to driver (CMSS 500-PWRSUP).
2. Connect driver output to digital voltmeter.
3. Connect probe and extension cable to driver.
4. Adjust probe into machine to reach specified voltage.
5. Tighten lock nut on probe to maintain proper adjustment.

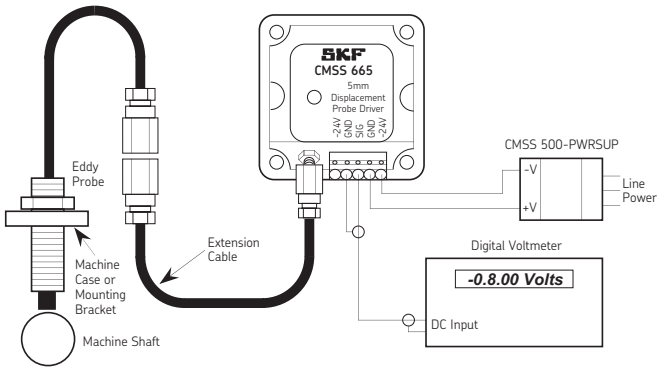



***Figure 6-7. Probe gap voltage test setup.***

- To gap a CMSS 65-xxx-xx-xx-10 Probe, use a CMSS 958-xx-040 Extension Cable and a CMSS 665 Driver.
- To gap a CMSS 68-xxx-xx-xx-10 Probe, use a CMSS 958-xx-040 Extension Cable and a CMSS 668 Driver.
- To gap a probe at 40 mils (1.0 mm), adjust the probe for a -8.00 volt reading on the digital voltmeter.
- To gap a probe at 50 mils (1.2 mm), adjust the probe for a -10.00 volt reading on the digital voltmeter.
- System sensitivity is 200 mV/mil (8 mV/µm) for both systems.

# Troubleshooting notes

If a fault is suspected in the probe, the following items may be checked to verify its failure.

1. Make sure the probe and the connection cable are properly mounted and secured.
2. Check the output of the driver using an oscilloscope or other similar general purpose test equipment.
3. Check the performance of power supplies, or other in-line accessories.
4. Check the continuity and insulation ability of any interconnecting cables using a Meg ohmmeter. Be aware that a non-wrapped connector or the abrasion of jacket material on coaxial cables could cause the shield to short to ground which creates possible ground loop problems.
5. Check the performance of any readout devices used with the probe.
6. Change out probe to a known good one to see if problem is probe or driver.

If the output of the probe is incorrect, it should be replaced.

A loose or dirty cable connection can cause erratic output of the probe. Make sure the cable connections are clean and tight.

# Repairs

Eddy current probes produced by SKF are not normally repairable except for the end connector.

***Caution:*** *Do not repair probe cables or extension cables by cutting the cable and replacing failed connectors.*

The probe and cable are cut to a specific length to produce a “tuned” circuit. Changing the length of a cable will seriously affect the accuracy of its measurements.

# SKF Condition Monitoring, Inc.

## Service information

SKF Condition Monitoring, Inc. has sales and service offices around the world. In addition, an international network of sales representatives is available to assist you anywhere in the world.

## Product support programs

***Customer support***

At SKF Condition Monitoring, we are committed to supporting the products we sell. This philosophy is demonstrated through a world-wide sales and service organization which provides a variety of services to our customers.

***Warranty service***

Each SKF Condition Monitoring manufactured product is tested and inspected to conform to its published specifications and to be free of defects in materials and workmanship. SKF Condition Monitoring will repair or replace products which prove to be defective within the warranty period. Detailed warranty information is included in the applicable product instruction manual. For more information, contact SKF Condition Monitoring headquarters.

***Annual service agreement***

An annual service agreement is an economical and effective way to assure continued high product performance. Periodic scheduled maintenance and calibration is the best insurance against equipment failure. It is a cost-effective means of preventing expensive production interruptions or delays in development programs. You are assured of timely, competent service without the expense of maintaining in-house maintenance capability, specialized test equipment, and replacement parts inventories.

Some of the outstanding advantages of an Annual Service Agreement are:

- Regularly scheduled maintenance and calibration.
- Reduced labor rates–approximately 20% saving over unscheduled field service.
- Quick response on emergency service–normally within 48 hours.
- Facilitates maintenance budgeting.
- Minimizes paperwork–one purchase order covers the entire year.
- On-site service of instruments or entire systems–reduces downtime, eliminates problems related to individual instruments to the calibration laboratory.

***Field service***

Field Service is available to assist you with stubborn maintenance problems, installations, and other technical problems. If field service is required, contact SKF Condition Monitoring.

## Replacement parts

In most cases, emergency orders for parts, printed circuit boards, subassemblies, and supplies can be filled within 24 hours. Ordering parts from SKF Condition Monitoring provides you with a single source of supply and assurance of part compatibility.

When ordering parts from SKF Condition Monitoring, please provide a description, part number, model number, and serial number.

*For additional information on SKF Reliability Systems products, contact:*

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Publication **CMSS 31075800** (October 2008)