



# 1442 Eddy Current Probe System



**Allen-Bradley**

by ROCKWELL AUTOMATION

User Manual

Original Instructions

## Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

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

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

**IMPORTANT** Identifies information that is critical for successful application and understanding of the product.

These labels may also be on or inside the equipment to provide specific precautions.



**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.



Identifies information that is useful and can help to make a process easier to do or easier to understand.

## Preface

|  |   |
|--|---|
| Download Firmware, AOP, EDS, and Other Files . . . . . | 5 |
| Summary of Changes . . . . .                           | 5 |
| Measurement Principals . . . . .                       | 5 |
| System Configuration Example . . . . .                 | 6 |
| Additional Resources . . . . .                         | 7 |

## Chapter 1

### Installation

|  |    |
|--|----|
| Installation Environment . . . . .                               | 10 |
| Driver Installation Environment . . . . .                        | 10 |
| Probe Installation Environment . . . . .                         | 11 |
| Extension Cable Installation Environment . . . . .               | 15 |
| Outer Dimensions and Part Nomenclature . . . . .                 | 16 |
| 1442 Probe Outer Dimensions and Part Nomenclature . . . . .      | 16 |
| Extension Cable Outer Dimensions and Part Nomenclature . . . . . | 21 |
| Driver Outer Dimensions and Part Nomenclature . . . . .          | 22 |
| Install the Driver . . . . .                                     | 24 |
| Mount the Driver on the Housing or Panel . . . . .               | 24 |
| Mount the Driver to a DIN Rail . . . . .                         | 25 |
| Install the Probe . . . . .                                      | 26 |
| Use a Probe Mounting Bracket . . . . .                           | 26 |
| Use a Stinger . . . . .  | 27 |
| Adjust the Gap . . . . .   | 29 |
| Connect the Wiring . . . . .                                     | 30 |
| Connect the Extension Cable . . . . .                            | 31 |
| Connect the Probe . . . . .                                      | 32 |
| Connect the Module . . . . .                                     | 32 |
| Verify the Connections . . . . .                                 | 32 |
| Set Gap Voltage . . . . .  | 33 |
| Recommended Specifications for the Monitor Cable . . . . .       | 35 |

## Chapter 2

### Maintenance and Inspection

|   |    |
|---|----|
| Periodic Inspection Intervals . . . . . | 37 |
| Unit Life . . . . .                     | 37 |
| Troubleshoot the Unit . . . . .         | 38 |

|  |   |    |
|--|---|----|
|  | <b>Chapter 3</b>  |    |
| <b>Individual Characteristic Data</b>    | Characteristic Data.....  | 39 |
|  | Standard Static Characteristics .....                             | 39 |
|  | Probe Temperature Characteristics.....                            | 40 |
|  | Driver Temperature Characteristics .....                          | 41 |
|  | Static Characteristic Effect Due to Power Voltage Variation ..... | 42 |
|  | Static Characteristic Effect by Target Material.....              | 43 |
|  | Static Characteristic Effect Due to Target Diameter.....          | 44 |
|  | Static Effect by Target Curved Surface.....                       | 45 |
|  | Static Characteristic Effect Due to Target End Face .....         | 46 |
|  | Static Characteristic Effect Due to Side Wall .....               | 47 |
|  | Frequency Characteristics .....                                   | 48 |
|  | <b>Appendix A</b>   |    |
| <b>Wire the Unit to a Monitor System</b> | Cable Wiring/Laying Examples.....                                 | 50 |
|  | <b>Index</b> .....  | 51 |

This manual describes how to install and use the 1442 Series Eddy Current Probe System.

The 1442 Series eddy current probe system performs non-contact measurement of the distance between the probe and the measured object (target), and outputs a proportional voltage signal. The static component of the measurement is the "gap," the absolute (DC) distance from the target surface to the probe tip. The dynamic component of the measurement is the "vibration," the cyclical (AC) movement of the target towards and away from the probe.

By combining this system with an Allen-Bradley® 1440 or 1444 Series measurement module, you can measure the vibration of a rotating shaft, its eccentricity, thrust position, and rotating speed. The system is used for continuous measurement or monitoring of shafts rotating at high speeds, such as turbines, generators, and compressors.

## Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at [rok.auto/pcdc](http://rok.auto/pcdc).

## Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

| Topic   | Page       |
|---|------------|
| Added Electromagnetic Compatibility (EMC) Installation Conditions | 10         |
| Updated Temperature Ranges  | 10, 11, 15 |

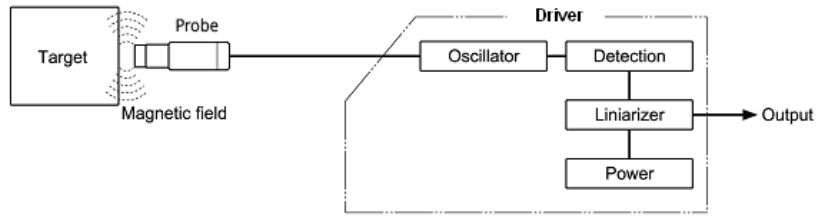
## Measurement Principals

The gap between the probe and the target is found according to the following principles:

- When an approximately 1 MHz high frequency current is supplied from the oscillator to the probe, a high frequency magnetic field is created at the probe tip.
- The inter-linkage of the high frequency magnetic flux on the target induces an eddy current that flows on the target surface.
- When the eddy current flows on the target surface, a magnetic field is created at the target side, and the probe impedance changes.
- When this change in output of the oscillator is detected, the distance versus output voltage is made linear by a linearizer circuit, and the result is output.

You can find the gap between the probe and the target by measuring the probe impedance if the following relationships are identified:

- Relationship between the probe and the target gap.
- Relationship of the probe impedance.

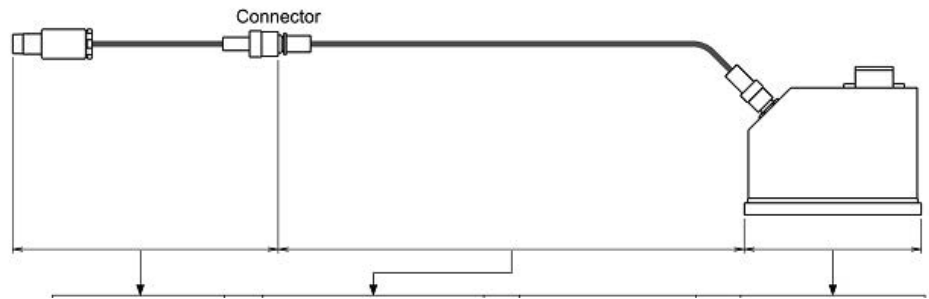


## System Configuration Example

This system is designed to fulfill the specifications when used under the following configuration.

**IMPORTANT** Combine the components of the system (probe, extension cable, and driver) as shown in this example. If the system is not configured as shown, or if the 1442 extension cable is not used to combine the 1442 probe and driver, the output characteristics differ significantly.

### System Configuration Example



| Probe           |   | Extension Cable  | = | System Cable     | Driver <sup>(1)</sup> |
|-----------------|---|------------------|---|------------------|-----------------------|
| 0.5 m (1.64 ft) | + | 4.5 m (14.76 ft) | = | 5.0 m (16.40 ft) | → 1442-DR-xx50        |
| 1.0 m (3.28 ft) | + | 4.0 m (13.12 ft) | = | 5.0 m (16.40 ft) | → 1442-DR-xx50        |
| 0.5 m (1.64 ft) | + | 8.5 m (27.89 ft) | = | 9.0 m (29.53 ft) | → 1442-DR-xx90        |
| 1.0 m (3.28 ft) | + | 8.0 m (26.25 ft) | = | 9.0 m (29.53 ft) | → 1442-DR-xx90        |

(1) Where xx = appropriate code for probe size.



## Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

| Resource   | Description   |
|--|---|
| 1442 Eddy Probe Systems Installation Instructions, publication <a href="#">1442-IN001</a>  | Provides information about how to install the components in a 1442 Eddy probe system.   |
| 1442 Eddy Current Probe Systems Specifications Technical Data, publication <a href="#">1442-TD001</a>                              | Provides specifications for the 1442 Eddy Current Probe System.   |
| EtherNet/IP Network Devices User Manual, <a href="#">ENET-UM006</a>  | Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP™ network.  |
| Ethernet Reference Manual, <a href="#">ENET-RM002</a>  | Describes basic Ethernet concepts, infrastructure components, and infrastructure features.  |
| CIP Security with Rockwell Automation Products Application Technique, publication <a href="#">SECURE-AT001</a>                     | Provides information on CIP Security™, including which Rockwell Automation products support CIP Security.   |
| System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a>   | Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.   |
| UL Standards Listing for Industrial Control Products, publication <a href="#">CMPNTS-SR002</a>                                     | Assists original equipment manufacturers (OEMs) with construction of panels, to help ensure that they conform to the requirements of Underwriters Laboratories.   |
| American Standards, Configurations, and Ratings: Introduction to Motor Circuit Design, publication <a href="#">IC-AT001</a>        | Provides an overview of American motor circuit design based on methods that are outlined in the NEC.  |
| Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication <a href="#">IC-TD002</a> | Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.  |
| Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication <a href="#">SGI-1.1</a>   | Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components. |
| Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>  | Provides general guidelines for installing a Rockwell Automation industrial system.   |
| Product Certifications website, <a href="#">rok.auto/certifications</a> .  | Provides declarations of conformity, certificates, and other certification details.   |

You can view or download publications at [rok.auto/literature](#).

**Notes:**



## Installation

This chapter describes how to install a 1442 Series Eddy Current Probe System.



**ATTENTION:** Confirm that the system is properly grounded. To avoid an electric shock hazard, confirm that all power to the system has been removed before performing the following. Failure to do so can result in electrical shock, causing severe burns, injury, or death. Installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel.



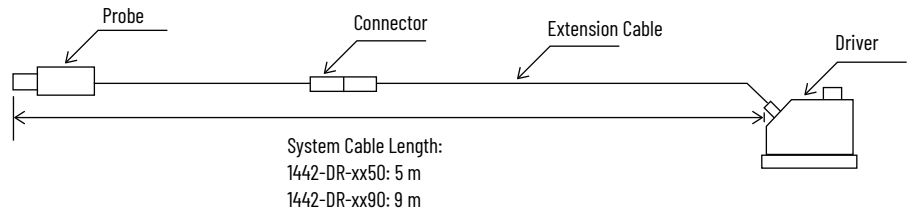
**ATTENTION:** Be sure to adhere to the following guidelines:

- Before touching this unit, be sure to touch a metal section near by to discharge any static electricity. The device can be damaged if exposed to static electricity from a person's body.
- Before applying power, make sure that all wiring is properly connected. There is a possibility of damage to the unit and fire if improperly connected.
- Install this unit away from motors and relays.
- Install the input/output signal cables away from the power system and control system cables. Noise occurring from the motor or relay can adversely affect the measurement value. We recommend using separate wiring ducts.
- Do not pull or bend the probe cables and extension cables with excessive force. The conductor in the cable can get cut off.
- The allowable tension of the probe cables and extension cables is 98.1 N•m (10 kgf•m). The allowable bend radius is as follows:
  - Without armored cable: 30 mm (1.18 in.)
  - With armored cable: 50 mm (1.97 in.)
- After completing the installation, make sure that all connections are correct and tight before powering the system.



See [Appendix A](#) for recommended cable wiring, and installation methods.

# Installation Environment



## Driver Installation Environment

Install the driver in a location that satisfies the following environmental and installation conditions.

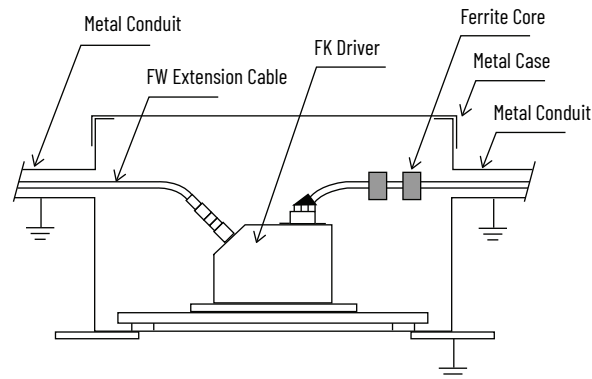
### Environmental Conditions

| Feature             | Specification  |
|---------------------|--|
| Ambient temperature | Must be in a range of -40...+80 °C (-40...+176 °F) when devices are operating.   |
| Ambient humidity    | Must be in a range of 30...95% RH (noncondensing) when devices are operating.  |
| Vibration condition | Must be 10 m/s <sup>2</sup> (1 g) or less at 10...150 Hz.  |
| Air cleanliness     | We recommend an air dust-particle amount of 0.2 mg/m <sup>3</sup> or less. We recommend an especially low amount of corrosive gasses, such as hydrogen sulfide, NOx gas, and chlorine, and conductive particles, such as iron dust and carbon. The allowable amounts of hydrogen sulfide and NOx gas, which are based on JEIDA-29 (1979) Class S1, are:<br>JEIDA: Japanese Electronic Industry Development Association<br>JEIDA-29 (1979) CLASS S1<br>Hydrogen sulfide: 0.01 ppm or less, NOx gas: 0.05 ppm or less<br>(Ambient temperature: 25 °C ± 5 °C (77 °F ± 9 °F), humidity: 40...80% RH) |

### Installation Conditions

Install the 1442-DRx drivers and 1442-ECx extension cables as shown to protect from electromagnetic interference.

### Electromagnetic Compatibility (EMC) Installation Conditions



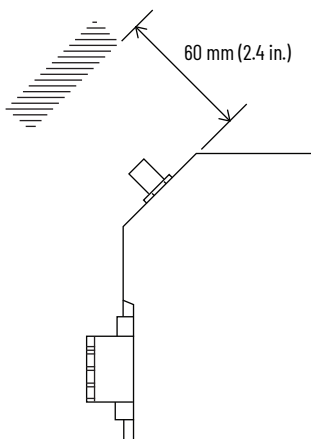
### EMC Test Condition

| Item                        | Material | Remark  |
|-----------------------------|----------|---|
| Metal Conduit               | Steel    | Thickness: 1.6 mm (0.063 in.) or more             |
| Metal Case                  | Steel    | Thickness: 1.6 mm (0.063 in.) or more             |
| Ferrite Core <sup>(1)</sup> | -        | Model: ZCAT3035-1330 equivalent (TDK Corporation) |

(1) Ferrite cores are only required for 1442-DR-58\* and 1442-DR-11\* driver models.

If there are walls or other obstacles at the cable connection surface of the driver, make sure to keep spacing as shown in the following illustration. Take care not to bend the cable beyond the allowable bend radius.

#### Cable Connection Spacing Conditions



- Do not locate above heat-emitting objects, with consideration for heating affects from adjacent equipment during normal operation.

## Probe Installation Environment

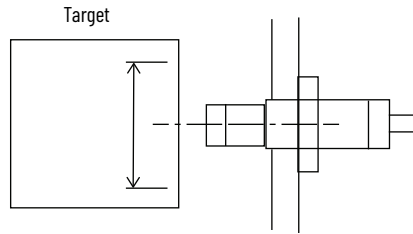
Install the probe at a location that satisfies the following environmental and installation conditions.

### Environmental Conditions

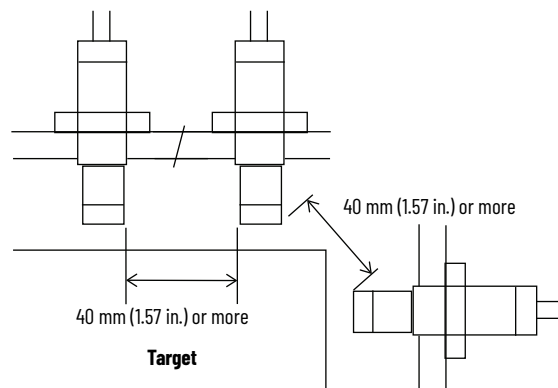
| Feature                | Specification  |
|------------------------|--|
| Ambient temperature    | ATEX applications must be in a range of -40...+80 °C (-40...+176 °F) when devices are operating.<br>CSA applications must be in a range of -40...+80 °C (-40...+176 °F) when devices are operating.<br>Other applications must be in a range of -40...+177 °C (-40...+350 °F) when devices are operating.  |
| Ambient humidity       | Must be in a range of 30...95% RH (noncondensing) when devices are operating.  |
| Vibrational conditions | Must be 10 m/s <sup>2</sup> (1 g) or less at 10...150 Hz. (If the probe vibrates, an accurate measurement cannot be made.)   |
| Air cleanliness        | We recommend an air dust-particle amount of 0.2 mg/m <sup>3</sup> or less.<br>We recommend an especially low amount of corrosive gasses, such as hydrogen sulfide, NOx gas, and chlorine, and conductive particles, such as iron dust and carbon. The allowable amounts of hydrogen sulfide and NOx gas, that are based on JEIDA-29 (1979) Class S1, are:<br>JEIDA: Japanese Electronic Industry Development Association<br>JEIDA-29 (1979) CLASS S1<br>Hydrogen sulfide: 0.01 ppm or less, NOx gas: 0.05 ppm or less<br>(Ambient temperature: 25 °C ± 5 °C (77 °F ± 9 °F), humidity: 40...80% RH) |

*Installation Conditions*

- Do not install at a location that is exposed to rain or other moisture. Moisture can lead to reduced sensitivity of the probe, and reduced insulation.
- A target surface area of not less than three times the tip diameter that is centered on the probe is required, as illustrated.



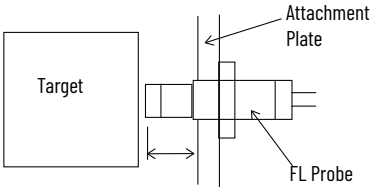
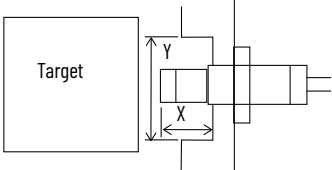
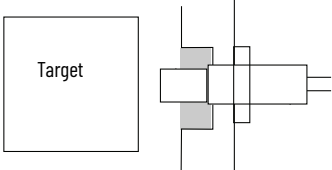
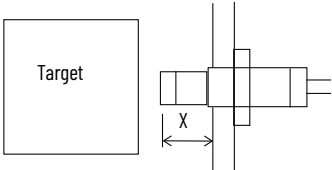
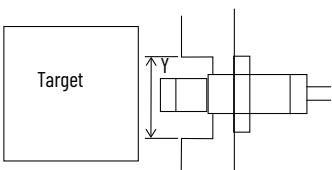
- When placing other probes next to each other, separate the probe tops by not less than 10 times the probe tip diameter to help prevent interference.



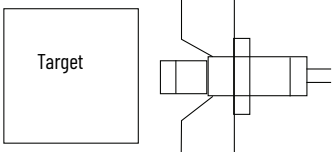
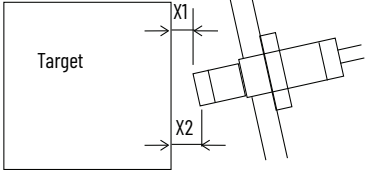
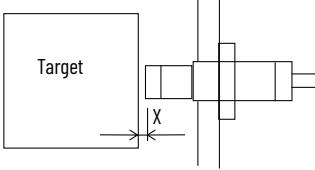
- The probe must be installed on a surface with adequate rigidity that is unaffected by outside vibration. If the probe vibrates, an accurate measurement cannot be taken.
- For shapes and dimensions around the probe, refer to the installation examples that follow. If a piece of metal other than the target is near the probe, an accurate reading cannot be taken.

If it is unavoidable to install the probe as illustrated in examples 4...7, check the characteristics at the attachment completed conditions.

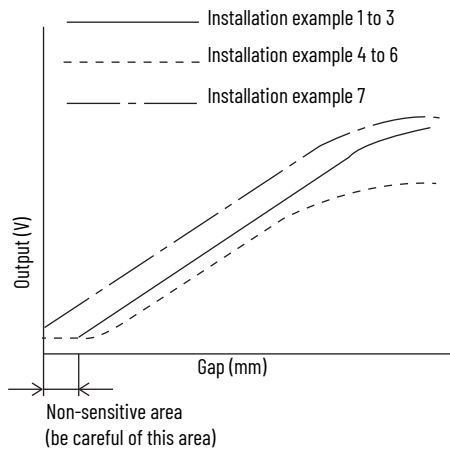
### Installation Examples

| Example   | Description   |
|---|---|
| <p>Example 1 (most recommended)</p>  | <p>Dimension X is to be not less than 1.2 times the tip diameter.</p>   |
| <p>Example 2 (recommended)</p>       | <p>Dimension X is to be not less than 1.2 times the tip diameter<br/>Dimension Y is to be not less than 3 times the tip diameter.</p>                                 |
| <p>Example 3 (recommended)</p>       | <p>After constructing as shown in example 2, the area that is indicated by the shaded line in the illustration is filled with resin or other insulating material.</p> |
| <p>Example 4</p>                   | <p>If dimension X is less than 1.2 times the tip diameter, the measurement is affected by the attachment plate.</p>   |
| <p>Example 5</p>                   | <p>If dimension Y is less than 3 times the tip diameter, the measurement is affected by the attachment plate.</p>   |

Installation Examples (Continued)

| Example  | Description  |
|--|--|
| <p>Example 6</p>  | <p>If the attachment plate around the probe top is chamfered, it will be affected by the attachment plate.</p>                               |
| <p>Example 7</p>  | <p>If the target and the probe top are not parallel (dimension X1 and X2 are not the same), it affects the reading.</p>                      |
| <p>Example 8</p>  | <p>If dimension X is less than the minimum linear range from the probe tip specification for the probe, the measurement is not accurate.</p> |

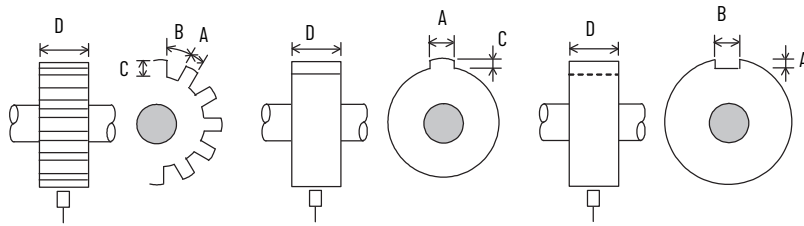
The characteristics of output (V) and gap (mm) are as shown in this graph.



## Speed Measurements

Measurements that are made with a 5 mm or 8 mm probe yield the following recommended dimensions.

### Dimension of Target Recommended For Rotational Speed Measurement



|                                      | mm           | mils         |
|--------------------------------------|--------------|--------------|
| Recommended dimension of target (mm) | $A \geq 6$   | $A \geq 236$ |
|                                      | $B \geq 7$   | $B \geq 276$ |
|                                      | $C \geq 2.5$ | $C \geq 98$  |
|                                      | $D \geq 15$  | $D \geq 591$ |
| Recommended set gap (mm)             | 1.0...1.5    | 39...59      |

## Extension Cable Installation Environment

Install the extension cable in a location that satisfies the following environmental and installation conditions.

| Feature             | Specification   |
|---------------------|---|
| Ambient temperature | Cable must be in a range of $-40...+177\text{ }^{\circ}\text{C}$ ( $-40...+350\text{ }^{\circ}\text{F}$ ) when devices are operating.<br>Connector must be in a range of $-40...+125\text{ }^{\circ}\text{C}$ ( $-40...+257\text{ }^{\circ}\text{F}$ ) when devices are operating.<br>ATEX applications must be within a range of $-40...+80\text{ }^{\circ}\text{C}$ ( $-40...+176\text{ }^{\circ}\text{F}$ ) when devices are operating.<br>CSA applications must be within a range of $-40...+80\text{ }^{\circ}\text{C}$ ( $-40...+176\text{ }^{\circ}\text{F}$ ) when devices are operating. |
| Ambient humidity    | Must be in a range of 30...95% RH (noncondensing) when devices are operating.   |

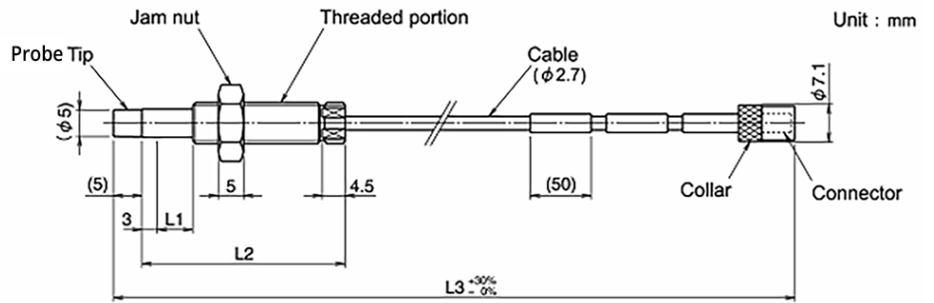


# Outer Dimensions and Part Nomenclature

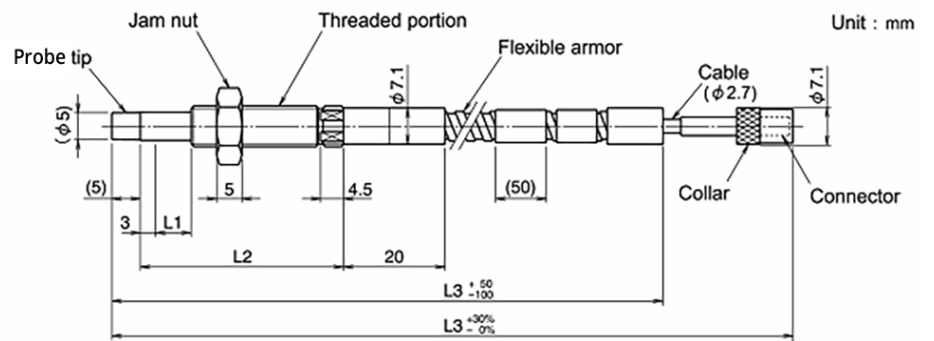
## 1442 Probe Outer Dimensions and Part Nomenclature

5 mm Probe

### 5 mm Probe - Not Armored



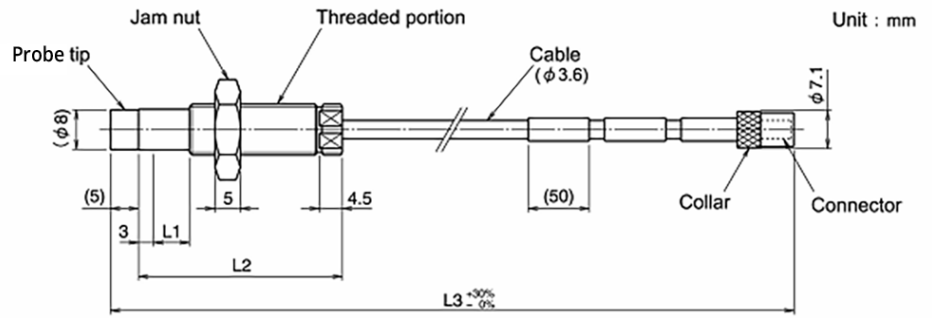
### 5 mm Probe - Armored



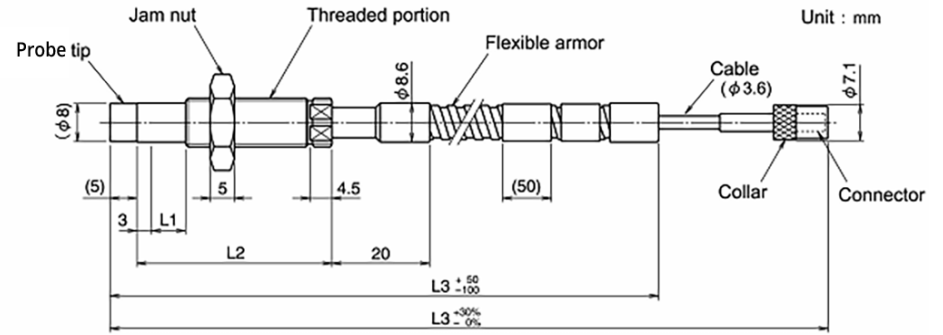
|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Case length       |
| L3 | Cable length      |

### 8 mm Probes

#### 8 mm Probe - Not Armored



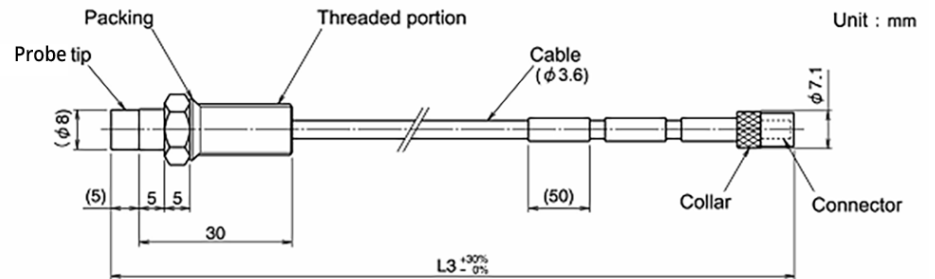
#### 8 mm Probe - Armored



|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Case length       |
| L3 | Cable length      |

#### Reverse 8 mm Probe

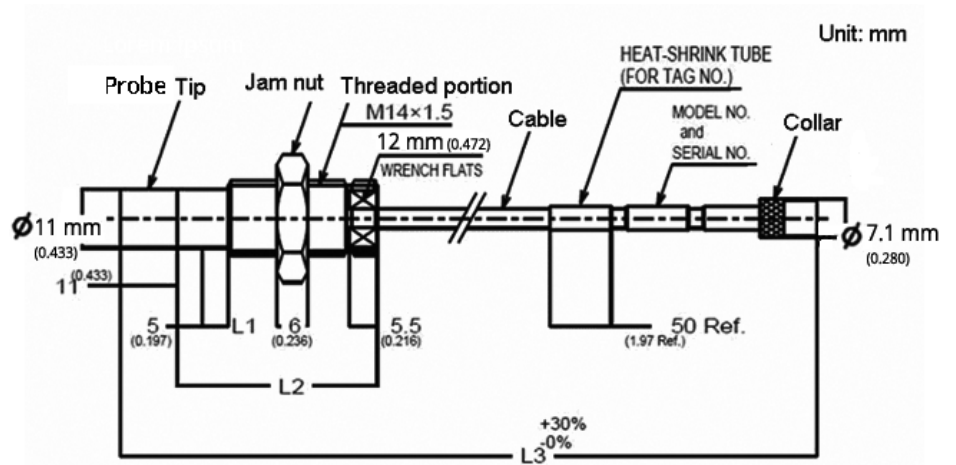
#### Reverse 8 mm Probe - Not Armored



|    |              |
|----|--------------|
| L3 | Cable length |
|----|--------------|

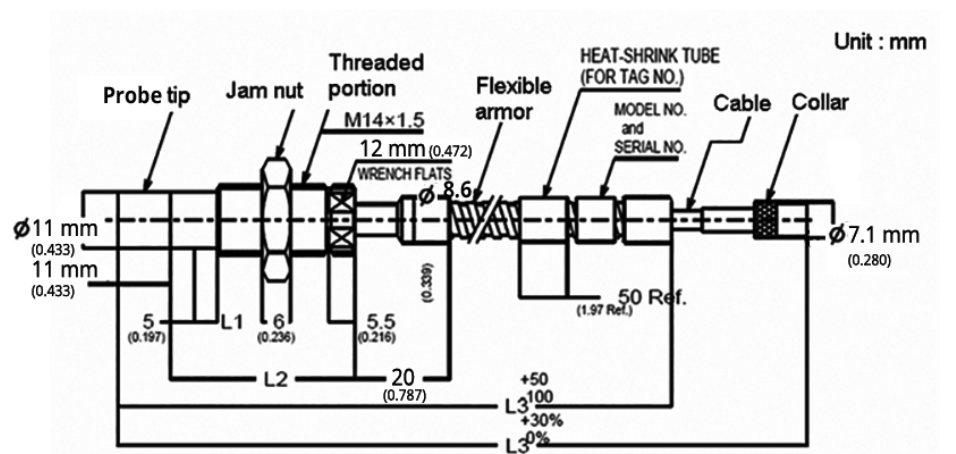
### 11 mm Probes

#### 11 mm Probe - Not Armored



|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Body length       |
| L3 | Cable length      |

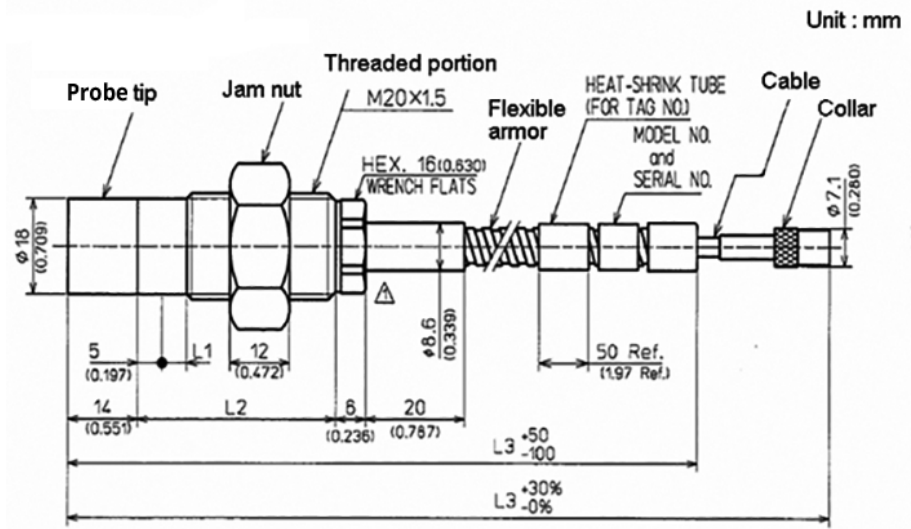
#### 11 mm Probe - Not Armored



|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Body length       |
| L3 | Cable length      |

18 mm Probe

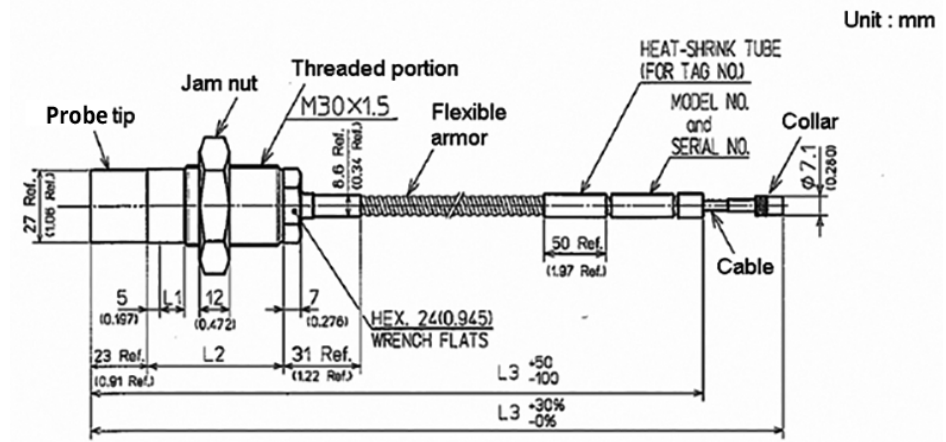
18 mm Probe - Armored



|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Body length       |
| L3 | Cable length      |

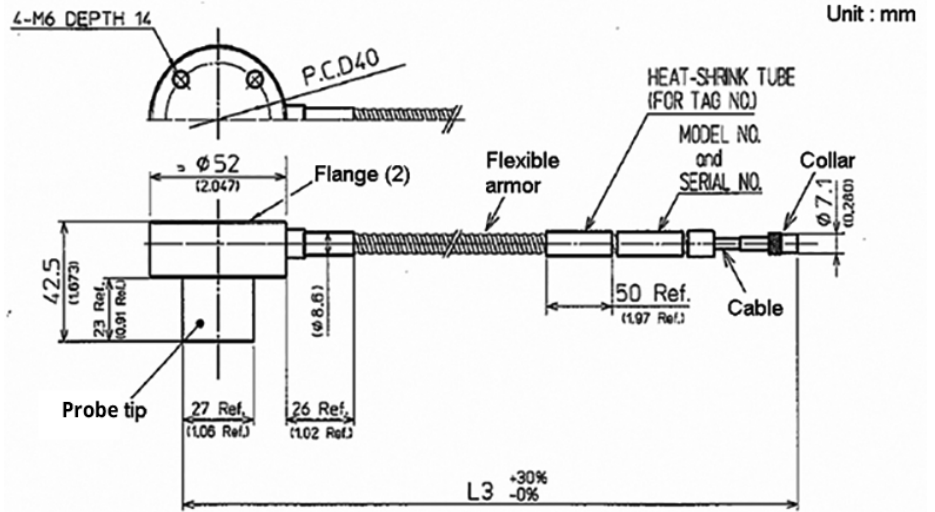
25 mm Probes

25 mm Probe - Armored



|    |                   |
|----|-------------------|
| L1 | Unthreaded length |
| L2 | Body length       |
| L3 | Cable length      |

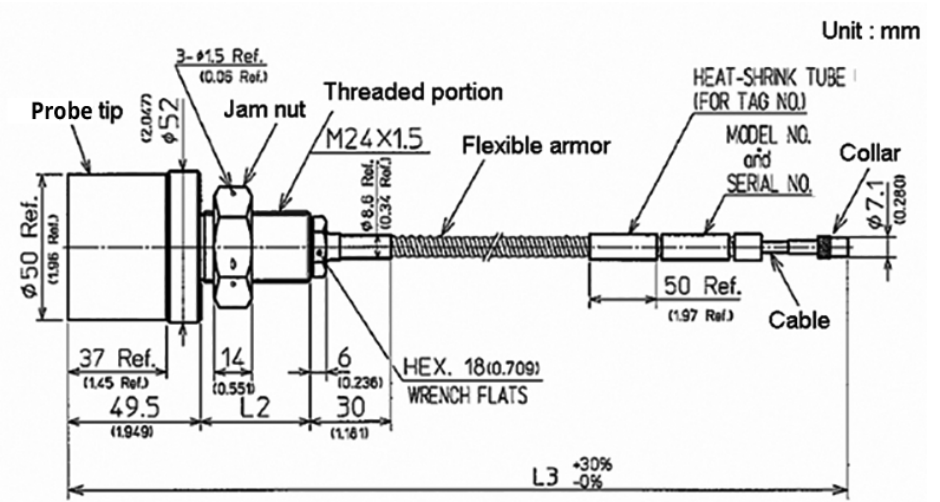
25 mm Probe - Flange Mount, Armored



|    |                         |
|----|-------------------------|
| #2 | Unthreaded length       |
| L3 | Cable length (+30% -0%) |

50 mm Probe

50 mm Probe - Armored

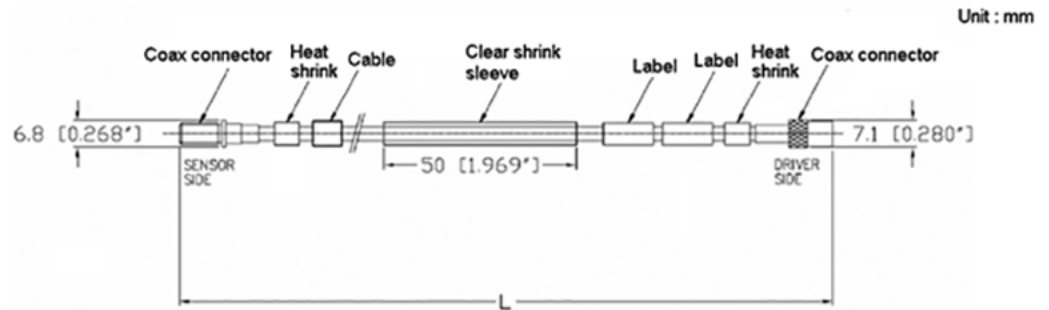


|    |              |
|----|--------------|
| L2 | Body length  |
| L3 | Cable length |

## Extension Cable Outer Dimensions and Part Nomenclature

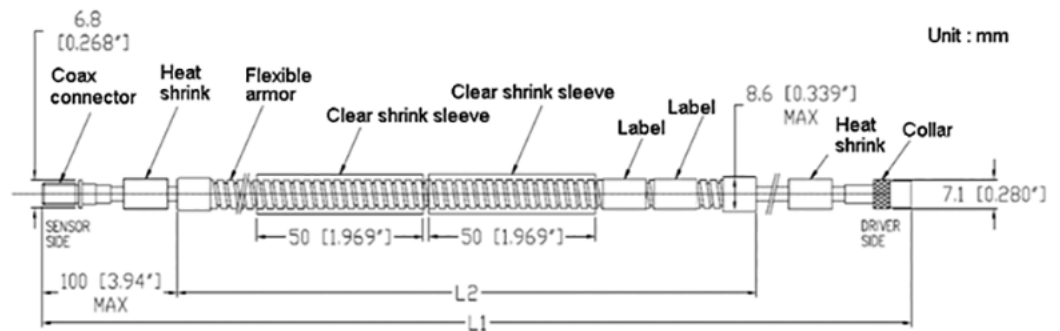
### 5...50 mm Probe Extension Cables

#### 5 mm, 8 mm, and 11 mm Probe Extension Cables - Non-Armored



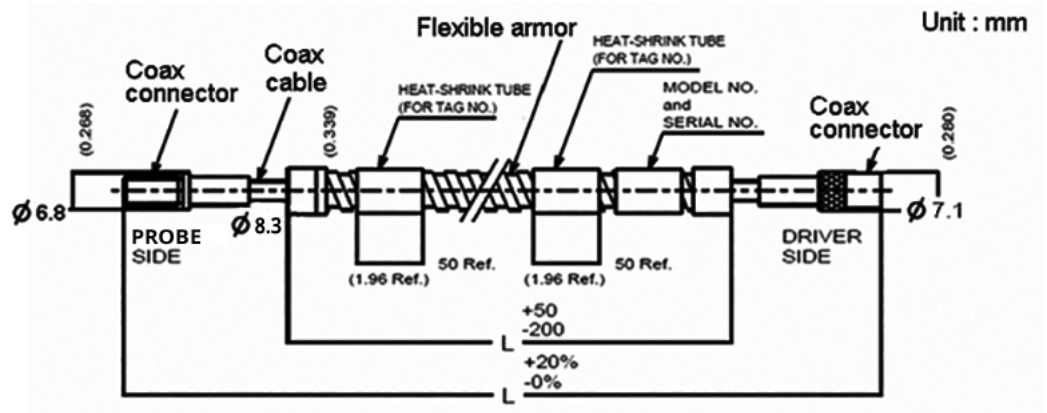
| Catalog Number | Length L, +20% -0% |
|----------------|--------------------|
| 1442-EC-5840N  | 4.0 m (13 ft)      |
| 1442-EC-5845N  | 4.5 m (14.76 ft)   |
| 1442-EC-5880N  | 8.0 m (26 ft)      |
| 1442-EC-5885N  | 8.5 m (26.89 ft)   |
| 1442-EC-1140N  | 4.0 m (13 ft)      |
| 1442-EC-1180N  | 8.0 m (26 ft)      |

#### 5 mm and 8 mm Probe Extension Cables - Armored



| Catalog Number | Length L1, +20% -0% | Length L2, Min   |
|----------------|---------------------|------------------|
| 1442-EC-5840A  | 4.0 m (13 ft)       | 3.8 m (12.47 ft) |
| 1442-EC-5845A  | 4.5 m (14.76 ft)    | 4.3 m (14.11 ft) |
| 1442-EC-5880A  | 8.0 m (26 ft)       | 7.8 m (25.59 ft) |
| 1442-EC-5885A  | 8.5 m (26.89 ft)    | 8.3 m (27.23 ft) |

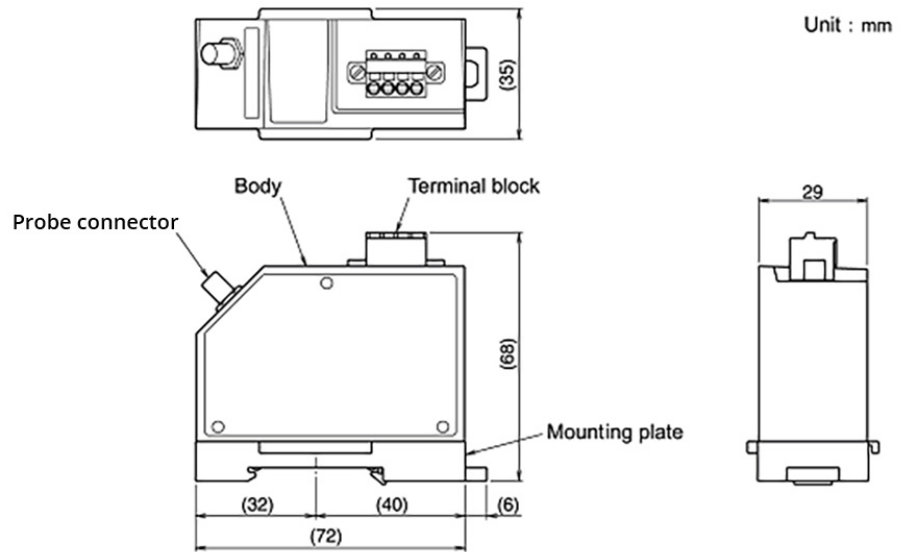
11...50 mm Probe Extension Cables - Non-Armored



| Catalog Number | Length L      |
|----------------|---------------|
| 1442-EC-1140A  | 4.0 m (13 ft) |
| 1442-EC-1180A  | 8.0 m (26 ft) |
| 1442-EC-1840A  | 4.0 m (13 ft) |
| 1442-EC-1880A  | 8.0 m (26 ft) |
| 1442-EC-2540A  | 4.0 m (13 ft) |
| 1442-EC-2580A  | 8.0 m (26 ft) |
| 1442-EC-5040A  | 4.0 m (13 ft) |
| 1442-EC-5080A  | 8.0 m (26 ft) |

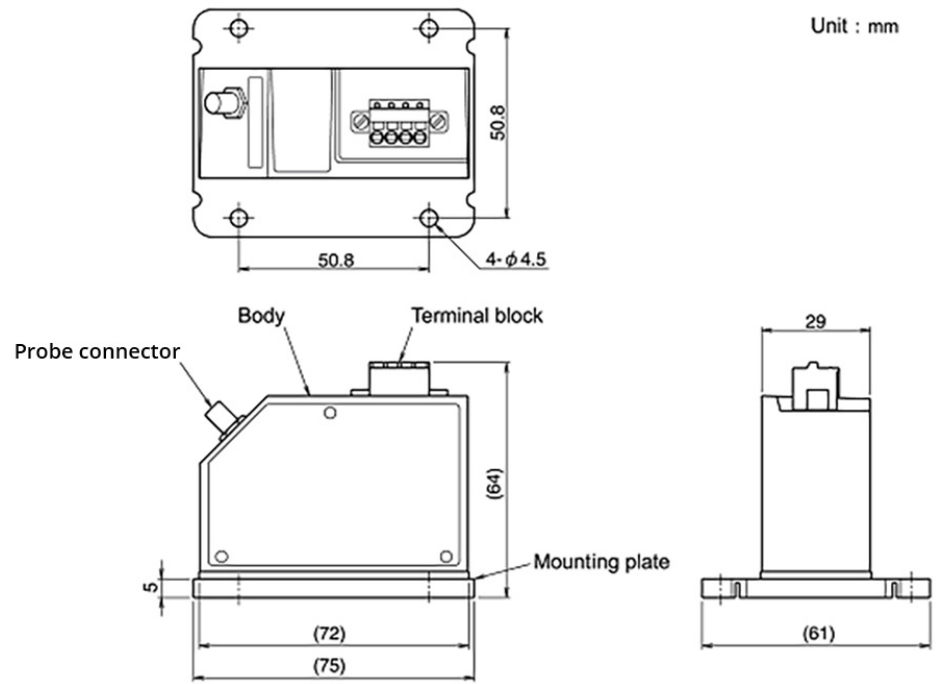
Driver Outer Dimensions and Part Nomenclature

Driver With DIN Rail Mount





Driver With Screw Mount



## Install the Driver

The driver can be installed on a DIN rail, or it can be mounted on a panel or wall by using the provided adapter.

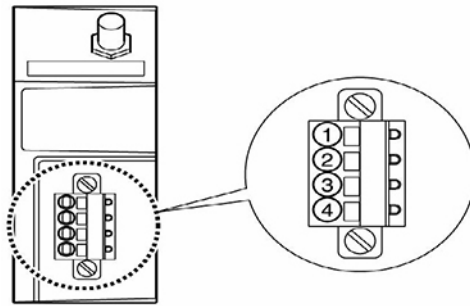
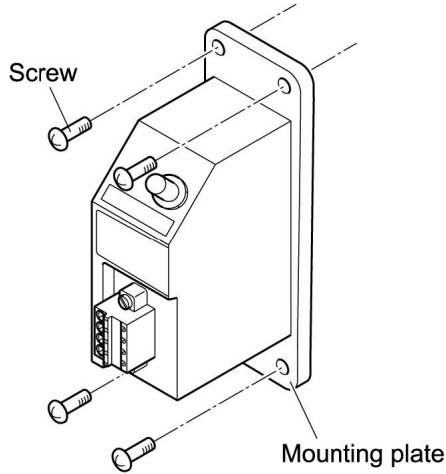
### Mount the Driver on the Housing or Panel

The driver can be directly mounted on the panel.



When attaching to panels or mounts, make sure that the surface is strong and flat.

Attach the driver to the panel mounting plate and affix with the provided four screws (M4 x 12 mm).



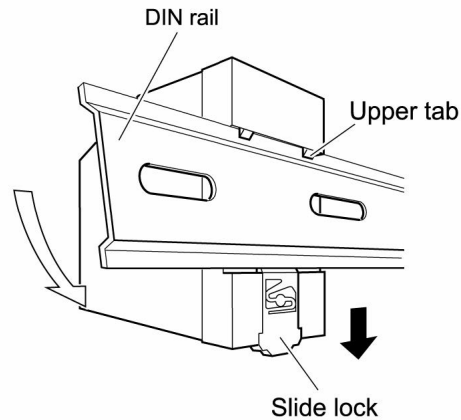
#### Terminal Arrangement

| Terminal No. | Signal       |
|--------------|--------------|
| 1            | OUTPUT       |
| 2            | COM          |
| 3            | -24 V        |
| 4            | Shield (COM) |

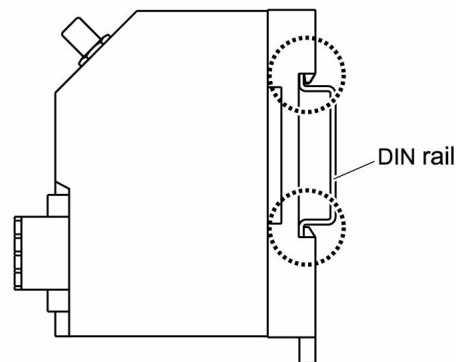
## Mount the Driver to a DIN Rail

The driver can be mounted to a 35 mm DIN rail.

1. Hook the upper tabs on the back of the driver onto the DIN rail.



2. Push the driver into the DIN rail until a click is heard from the slide lock. If the driver does not fit onto the DIN rail well, pull on the slide lock and push the driver against the DIN rail.
3. Make sure the upper tabs and the slide lock are securely fastened to the DIN rail.



Remove the driver by pushing down on the slide lock with a screwdriver.

## Install the Probe

Install the probe according to the conditions described in the Probe Installation Environment section, found on [page 11](#).



**ATTENTION:** Do not drop or otherwise subject the probe to shock.



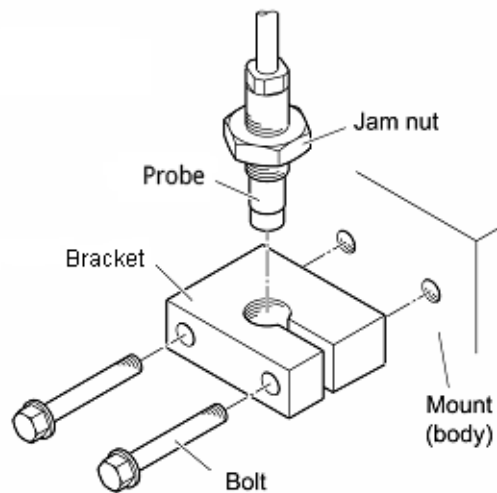
The probe installation instructions comply with API Standard 670.

### Use a Probe Mounting Bracket

If you need a mounting bracket for the probe, construct your own mounting bracket. The mounting bracket can be readily machined at your site. The bracket must provide a stable, secure, platform that satisfies the conditions that are described in the Probe Installation Environment section, found on [page 11](#).

When using a probe mounting bracket, follow these steps to install the probe.

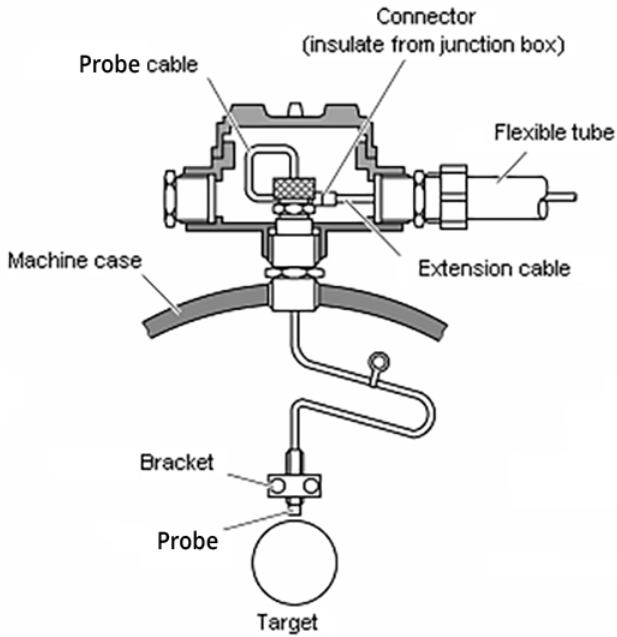
1. Attach the probe mounting bracket to the mount (body), and temporarily attach with bolts.



Insert the probe into the probe mounting brackets screw hole, and adjust the gap between the probe top face and the target. For more information, see the Set Gap Voltage section, found on [page 33](#).

2. Tighten the bolts further, and affix the probe mounting bracket.
3. Retighten the jam nut at the specified torque.

### Probe Mounting Bracket Installation Example



### Use a Stinger

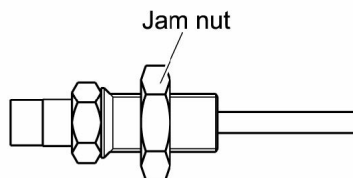
1442 Series 8-mm reverse-mount probes can be used with commonly available probe holders. Stingers (also known as probe sleeve), are provided with the probe holder. Stingers can also be purchased from probe holder suppliers or can often be machined locally.

The following instruction is a general guide, that is based on common probe holder designs. Consult your specific probe holder installation instructions for additional details.

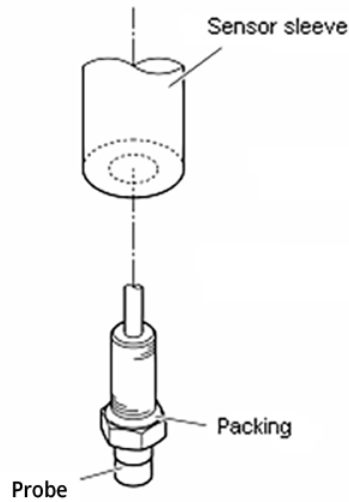


Install the probe holder and stinger assembly per installation instructions before mounting the probe onto the stinger.

1. Remove the jam nut of the reverse mount probe. (Remove at the Jam nut attachment.)

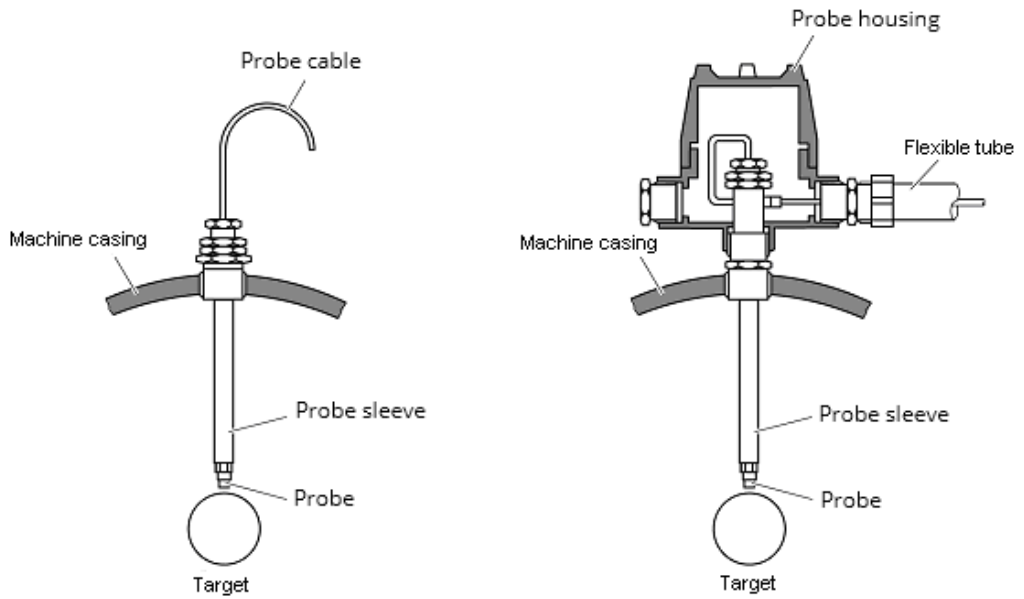


- 2. Attach the probe to the probe sleeve.



- 3. Attach the probe sleeve to the mounting (machine casing).
- 4. Adjust the gap between the probe top face and the target.

**Probe Sleeve Installation Example**



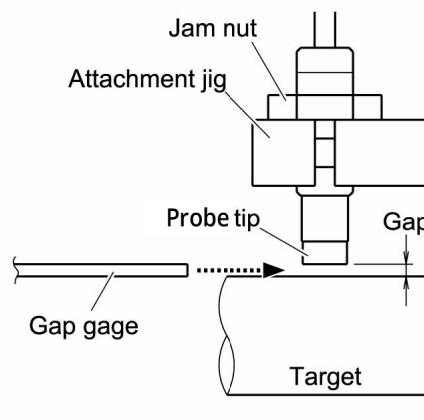
## Adjust the Gap

Adjust the gap, as described in the following procedure.



After completing all wiring connections, use a tester to perform gap adjustment. Make sure to understand the content that is described in this chapter and complete all connection work before performing the gap adjustment. For more information, see the Set Gap Voltage section on [page 33](#).

- See the Standard Static Characteristics that are found on [page 39](#) and prepare a gap gage that matches the gap.
  - Set the gap so that even when the target is at the nearest point to the probe, the target does not come into direct contact with the probe.
  - Set the gap so that it does not go beyond the linear range of the connection monitor.
- Take care to not scratch the probe top and target surface, and insert the gap gage between the probe top and target.



- Adjust the probe to a position where the gap gage just moves freely, and affix in place with the jam nut.
- Tighten the jam nut with the following torque.

### Torque Requirements

| Probe                                | Example            | Tightening Torque |        |       |
|--------------------------------------|--------------------|-------------------|--------|-------|
|                                      |                    | N·m               | kgf·cm | lb·in |
| 1442-PS-05xxM (5 mm metric)          | 1442-PS-0503M0010N | 4                 | 41     | 35.4  |
| 1442-PS-05xxE (5 mm English)         | 1442-PS-0512E0010N | 1.4               | 15     | 12.4  |
| 1442-PS-08xxM (8 mm metric)          | 1442-PS-0803M0010N | 8.5               | 87     | 75.2  |
| 1442-PS-08xxE (8 mm English)         | 1442-PS-0812E0010N | 6.8               | 69     | 60.2  |
| 1442-PS-11xxM (11 mm metric)         | 1442-PS-1104M0510N | 26.1              | 266    | 231   |
| 1442-PS-11xxE (11 mm English)        | 1442-PS-1116E0510N | 18.6              | 190    | 164   |
| 1442-PS-18xxM (18 mm metric)         | 1442-PS-1805M0510A | 58.8              | 600    | 520   |
| 1442-PS-18xxE (18 mm English)        | 1442-PS-1820E0510A | 88.2              | 900    | 780   |
| 1442-PS-25xxM (25 mm metric)         | 1442-PS-2505M0510A | 176               | 1800   | 1557  |
| 1442-PS-25xxE (25 mm English)        | 1442-PS-2520E0510A | 196               | 2000   | 1734  |
| 1442-PS-50xxM (50 mm metric)         | 1442-PS-5005M0010A | 176               | 1800   | 1557  |
| 1442-PS-50xxE (50 mm English)        | 1442-PS-5020E0010A | 196               | 2000   | 1734  |
| 1442-PR-08xxM (8 mm rev mnt metric)  | 1442-PR-0803M0505N | 8.5               | 87     | 75.2  |
| 1442-PR-08xxE (8 mm rev mnt English) | 1442-PR-0812E0205N | 6.8               | 69     | 60.2  |



**ATTENTION:** Make sure to tighten the jam nut at the specified torque. If tightened with excessive torque, the probe can be damaged. If the tightening torque is too small, it can come loose.



## Connect the Wiring

This section describes the wiring connections for the 1442 Series Eddy Current Probe system.

The 1442 Series includes color-coded bands on the ends of each component. The color-coded bands help you identify the length of the extension cable and the length of the probe so that the total system length (5 meters or 9 meters) can be matched to the appropriate driver. When the system is properly "sized," the color bands for the probe, extension cable, and driver match.

1442 Series Color Band Table

| Probe        |            | Extension Cable |                      |                       | Driver              |            |
|--------------|------------|-----------------|----------------------|-----------------------|---------------------|------------|
| Cable Length | Color Band | Length          | Probe End Color Band | Driver End Color Band | System Cable Length | Color Band |
| 0.5 m        | Yellow     | 4.0 m           | Black                | Blue                  | 5.0                 | Blue       |
| 1.0 m        | Black      | 4.5             | Yellow               | Blue                  | 9.0                 | Red        |
| 5.0 m        | Blue       | 8.0             | Black                | Red                   |                     |            |
| 9.0 m        | Red        | 8.5             | Yellow               | Red                   |                     |            |



**WARNING:** Confirm that the system is properly grounded. To avoid an electric shock hazard, confirm that all power to the system has been removed before performing the following. Failure to do so can result in electrical shock, causing severe burns, injury, or death. Installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel.



**ATTENTION:** Make sure to tighten the collar of the connector by hand. Using a tool to tighten the collar can damage the connector. If the installation environment does not allow proper tightening by hand and there is a possibility that it can come loose, tighten an additional 1/4 turn using pliers after tightening by hand:

- Do not apply excessive force on the screws of the connector. The connector can be damaged
- Do not cut the probe or extension cables shorter. It can cause problems, such as not being able to perform up to specifications.



Make sure that the cable is not twisted when connecting the connectors. Stress on the cable, caused by twisting, can slowly loosen the connection. If a twisting force is applied to the direction where the collar is loosened, twist the extension cable slightly to the opposite direction used to tighten the collar before connecting. Then connect the connector and tighten the collar.



We recommend that excessive extension cables be stored in the cable storage box. If it is unavoidable to store inside the driver housing, do not force excessive cables into the housing.

Connections are performed in the following order.

1. Connect the extension cable (when using the extension cable).
2. Connect the probe.
3. Connect the XM<sup>®</sup> module.
4. Verify the connections.
5. Check the gap voltage.

## Connect the Extension Cable

Use the following steps to connect the probe and extension cable.

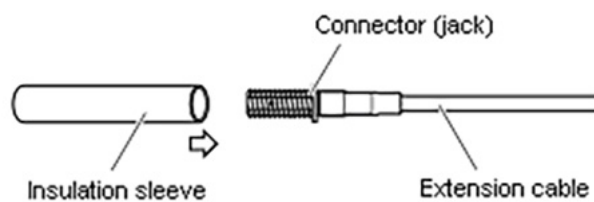


The connection area of the connector must not be exposed to water or oil. If water or oil enters the connector, the cable capacity increases, and causes a loss in sensitivity.

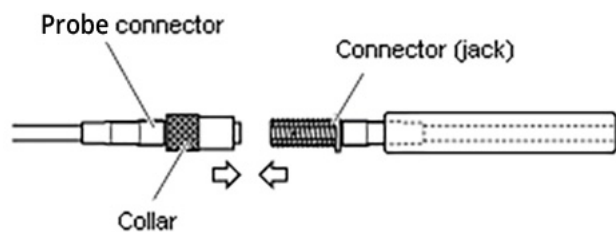


Make sure that the color band on the probe cable matches the color band on the probe end of the extension cable. See the 1442 Series Color Band Table on [page 30](#).

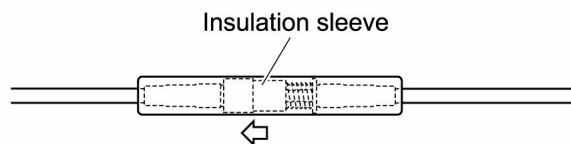
1. Confirm that there are no foreign objects in the probe and extension cable connectors.  
Foreign objects in the connector cause faulty connections or faulty characteristics.
2. Insert the extension cable through the provided insulation sleeve (clear heat shrink tube).



3. Connect the probe connector and extension cable connectors, and tighten the collar by hand.



4. Cover the insulation sleeve over the connector.



5. To shrink the insulation sleeve, apply hot air on the insulation sleeve.



**ATTENTION:** Never use vinyl tape to insulate.

- During extended periods of use or when the connector temperature exceeds 80 °C (176 °F), vinyl electrical tape can harden or the adhesive can deteriorate, leading to a dirty connector and faulty insulation.
- If there is not a spare insulation sleeve available, protect the connector with a fluorine resin tape. Recommended insulation tape is:
  - Manufacturer: Nitto Denko Corporation
  - Product Name: Nitoflon adhesive tape (Model Number: NO. 903UL)
- Temperature spec: -60...+180 °C (-76...+356 °F) 0.08 mm thickness.

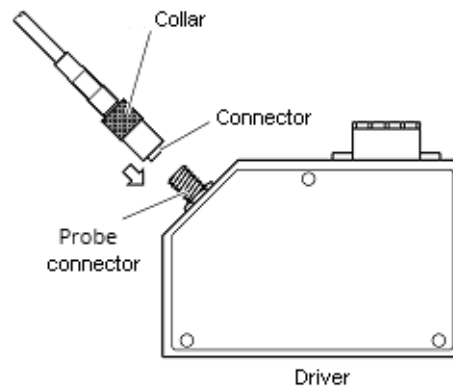
## Connect the Probe

Connect the probe by using the following steps. Connection is performed in the same manner when using an extension cable.



Make sure that the color band on the extension cable matches the color band on the probe driver. See the 1442 Series Color Band Table on [page 30](#).

1. Confirm that there are no foreign objects in the probe (or extension cable) and in the driver probe input connector.
2. Connect the probe (or extension cable) connector and the probe input connector, and tighten the collar by hand.



## Connect the Module

The 1442 probes can be connected to many different Allen-Bradley 1440 XM Series or 1444 Dynamix® Series modules. See the appropriate Module User Manual for wiring requirements and instructions on how to wire the probe to the module.

## Verify the Connections

Before turning on the power, verify the following connections:

- Be sure that there are no loose terminals, and that all wiring is properly connected.
- Check that the power line for the power source is connected to NEGATIVE PWR (-24V) on the measurement module or its terminal base.
- Be sure that the driver and probe are installed at locations where the installation environmental conditions are satisfied.
- Be sure that there are no problems with the driver and probe installation, and they are **not** installed at the following types of locations:
  - Locations with high temperatures and high humidity.
  - Locations with dust.
  - Location that is exposed to vibration.
  - Locations where there are metal objects, other than the target, near the probe.

After checking all items, check the set gap voltage values.

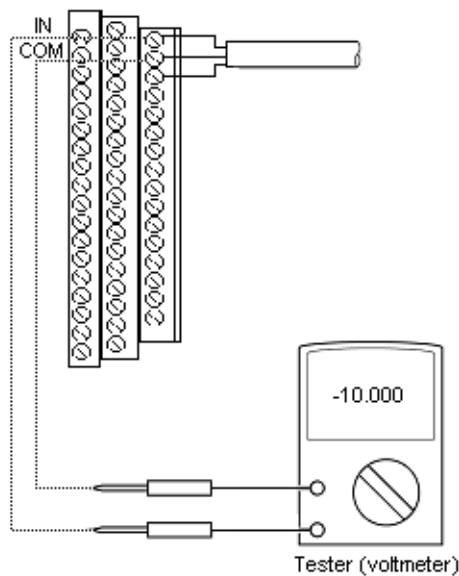
## Set Gap Voltage

Perform confirmation of set gap voltage to maintain the performance of this unit when doing the following:

- You supply power to the unit for the first time
- Multiple years have passed from the last confirmation
- The performance of the unit has been reduced due to a problem

Follow these steps to check the set gap voltage.

1. Turn on the power.
2. Allow the unit to warm up for 5 minutes to stabilize the output.  
Warm-up is necessary to collect accurate data.
3. Connect the tester (voltmeter) across the Input Signal and Input Common terminals on the measurement module base and read the voltage.



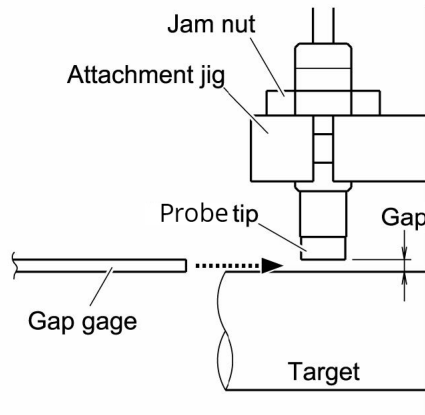
4. To make sure that the desired set gap voltage is indicated, see the Standard Static Characteristics found on [page 39](#).

---

**IMPORTANT** The data that is indicated in the Standard Static Characteristics which are found on [page 39](#) are measured for an SCM440 flat target (diameter more than 33 mm). When the target material or shapes differ, the output characteristics (gain) differ, and it will be necessary to compensate with later equipment.

---

- 5. If the desired set gap voltage is not attained, readjust the probe position by using the following procedure.
  - a. Loosen the probe jam nut.



- b. Adjust the probe position to attain the desired set gap voltage.
    - c. After adjustment, tighten the probe jam nut to the specified torque value. See the Torque Requirements table on [page 29](#).



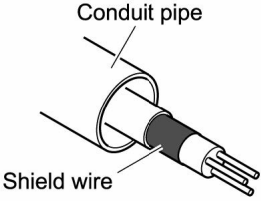
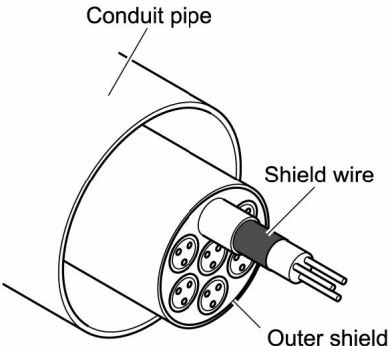
**ATTENTION:** Always tighten the jam nut at the specified torque.



The measurement precision that is described in the specifications will be satisfied approximately five minutes after turning on the power.

## Recommended Specifications for the Monitor Cable

Use a commercially sold cable to connect the probe driver to the monitor. A CVVS 3 core shielded cable (straight) is recommended, but if it is not available, a 3 line, multiple core cable for light electrical instruments (individually shielded) can be used. Use  $0.75 \text{ mm}^2 \dots 1.25 \text{ mm}^2$  (18...16 AWG) cables.

| Cable Name   | Note  |
|--|---|
| <p>CVVS 3 core shielded cable (straight)</p>    | <p>The CVVS 3 core shield is also recommended in the API Standard 670.<br/> <b>Recommendation:</b> Copper tape shield (core wire; soft copper wire); (Normally, silver plated braid)<br/>           Use conduit pipe (cable rack) for wiring.</p>   |
| <p>3 line, multiple core cable for light electrical instruments (individually shielded)</p>  | <p><b>Recommendation:</b> Outer shield is aluminum tape, copper tape shield.<br/>           The multiple core cable can contain a mixture of vibration signals and displacement signals. However, vibration signals for a high amplitude vibration can affect other vibration signals and displacement signals negatively; and they need to be wired on a separate cable.</p> |

**Notes:**

## Maintenance and Inspection

This chapter describes the maintenance and inspection procedures for the eddy current probe system.

### Periodic Inspection Intervals

To maintain performance and secure system stability of the system, inspect the system and its mounts for corrosion, properly tightened or torqued fittings and connections, and component conditions annually. Check probe gap settings annually and at any time measurements become suspect. For more information, see Set Gap Voltage on [page 33](#).

### Unit Life

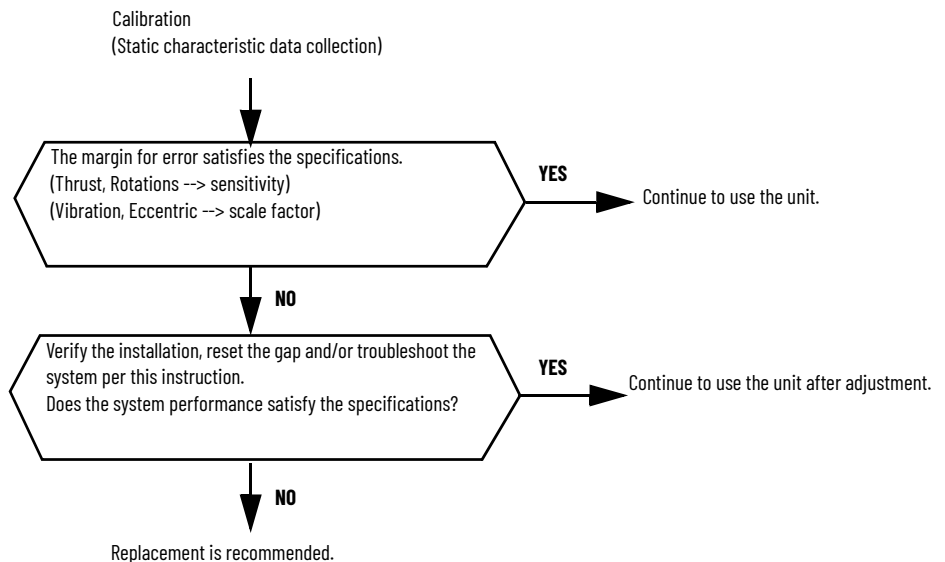
Plan to replace eddy current probe systems approximately every 10 years.

---

**IMPORTANT** Ten years is a general guideline for replacement. If otherwise undisturbed, eddy current probe systems deteriorate over time due to temperature and erosion. The deterioration rate for probes, extension cables, and drivers depends on the specific environmental conditions to which each component is subjected.

---

The following is a flowchart for determining when a replacement is required.





## Troubleshoot the Unit

Use this table to troubleshoot problems with the unit.

| Symptom  | Possible Cause  | Recommended Action   |
|--|---|--|
| Output is 0V DC and does not change.                   | Power is not on.  | Turn on the power.   |
|  | Unit is not connected properly.                                 | See the Connect the Wiring procedure on <a href="#">page 30</a> to make sure that the unit is wired correctly.   |
|  | The driver is faulty.   | Replace the driver.  |
| Output is approximately -0.7 V DC and does not change. | The target is beyond the measurement range.                     | See the Set Gap Voltage procedure on <a href="#">page 33</a> to adjust the gap.  |
|  | The probe failed or the probe cable is shorted or disconnected. | Measure the resistance between the probe connector, and if not normal, replace the probe.<br>Normal value:<br>Probe coil resistance: Approx. 5.5 $\Omega$<br>Probe cable resistance: Approx. 0.25 $\Omega$ /m  |
|  | The extension cable is shorted or disconnected.                 | Measure the resistance of the extension cable, and if it is not normal, replace the extension cable.<br>Normal value:<br>Center conductor resistance: Approx. 0.25 $\Omega$ /m<br>Outer conductor resistance: 0 $\Omega$<br>Center pin to outer conductor resistance: $\infty\Omega$ |
|  | There is a foreign object in the connector.                     | Disconnect the connector, and remove the foreign object in the connector.  |
|  | The driver is faulty.   | Replace the driver.  |
| Output is approximately -22V DC and does not change.   | The target is outside the possible measurement range.           | See the Set Gap Voltage procedure on <a href="#">page 33</a> to adjust the gap.  |
|  | The driver is faulty.   | Replace the driver.  |

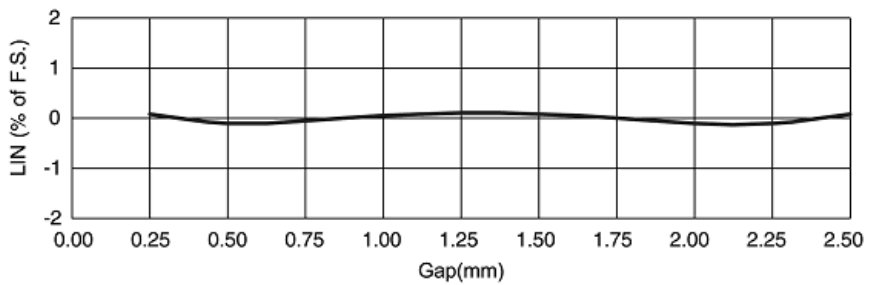
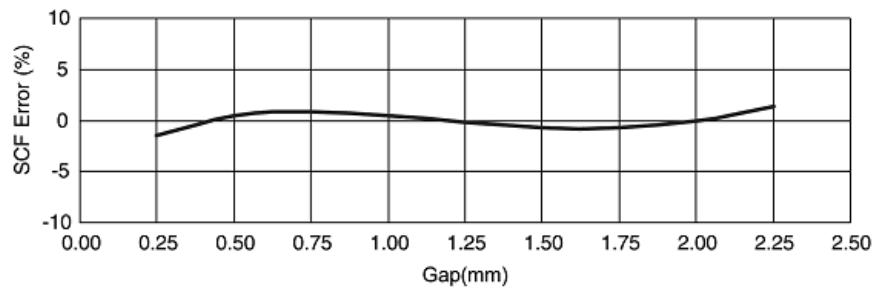
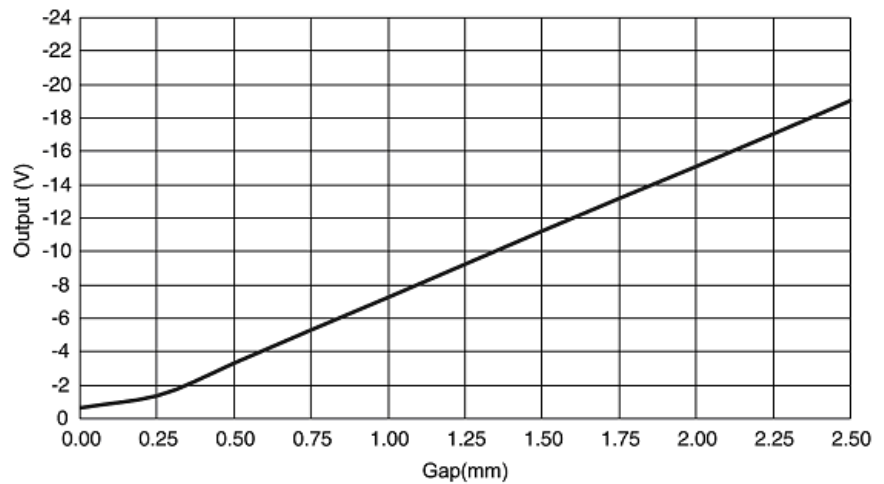
## Individual Characteristic Data

### Characteristic Data

This chapter describes static characteristics, temperature characteristics, and other characteristic data. Use this data to determine the gap.

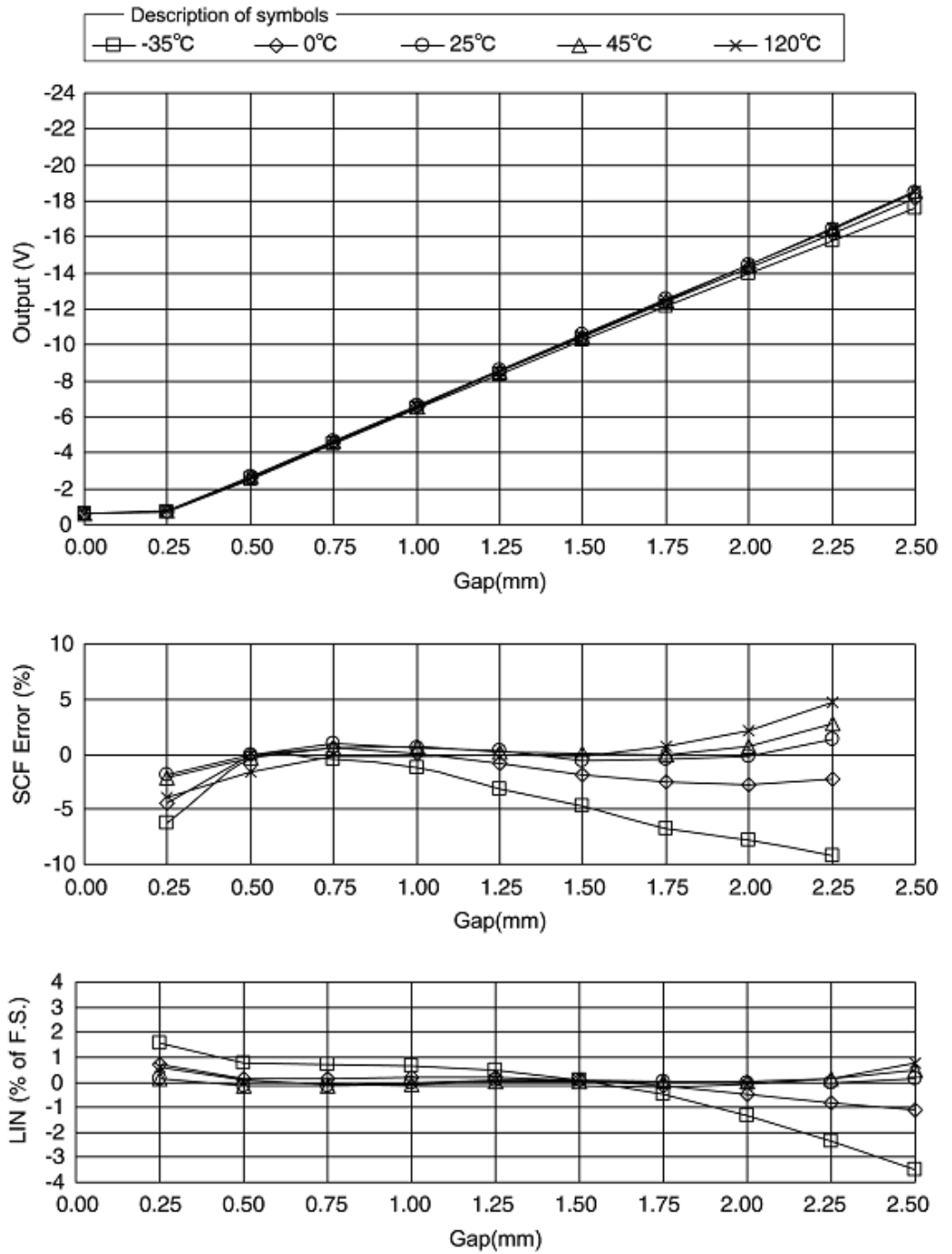
### Standard Static Characteristics

Target material is SCM440 flat face (diameter 15 mm or more).



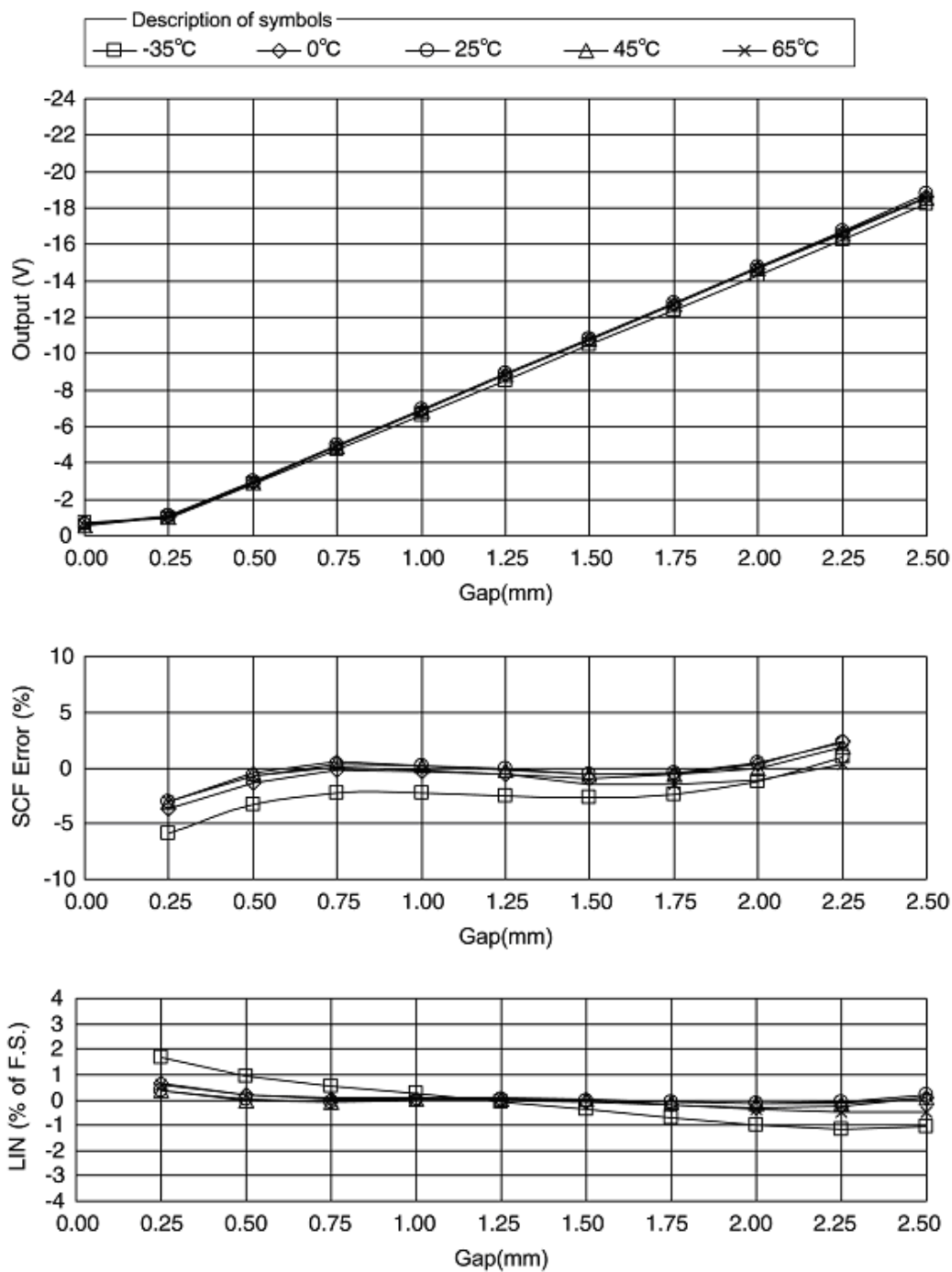
### Probe Temperature Characteristics

System cable length is 5 m.

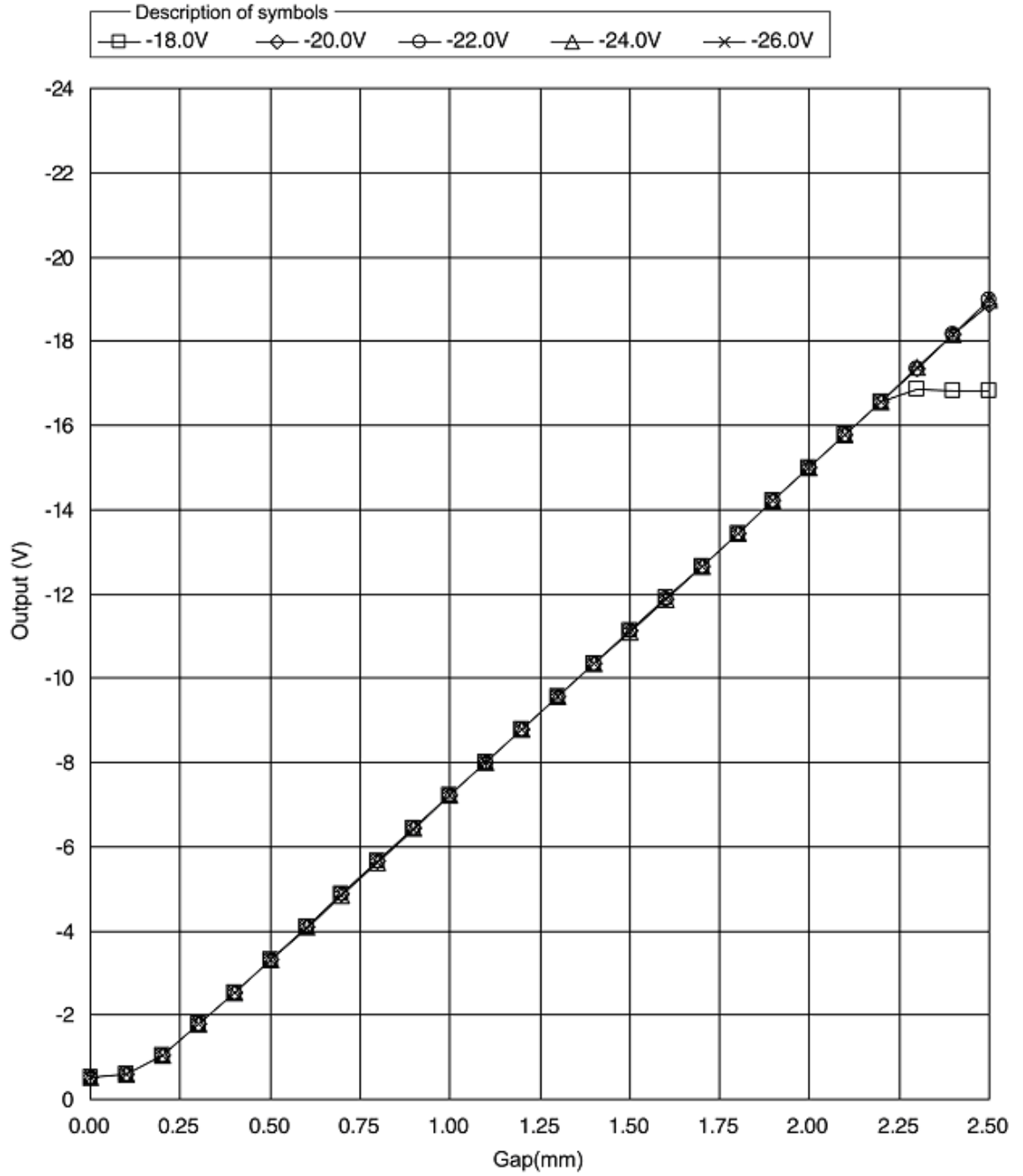


### Driver Temperature Characteristics

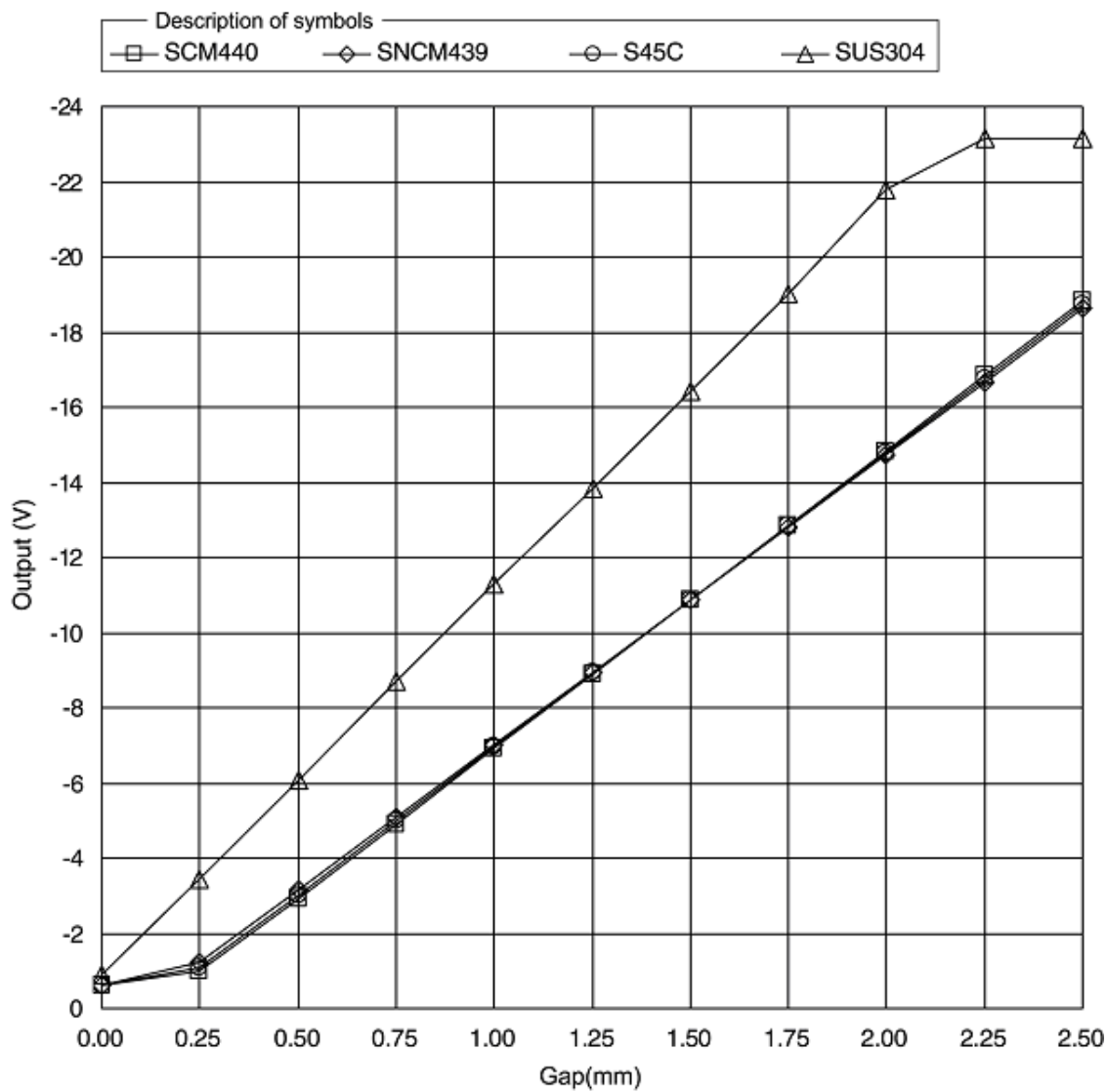
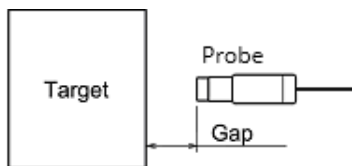
System cable length is 5 m.



### Static Characteristic Effect Due to Power Voltage Variation

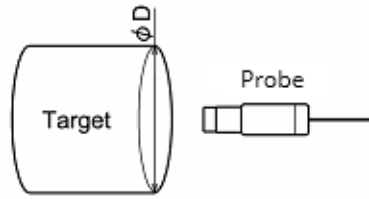


### Static Characteristic Effect by Target Material



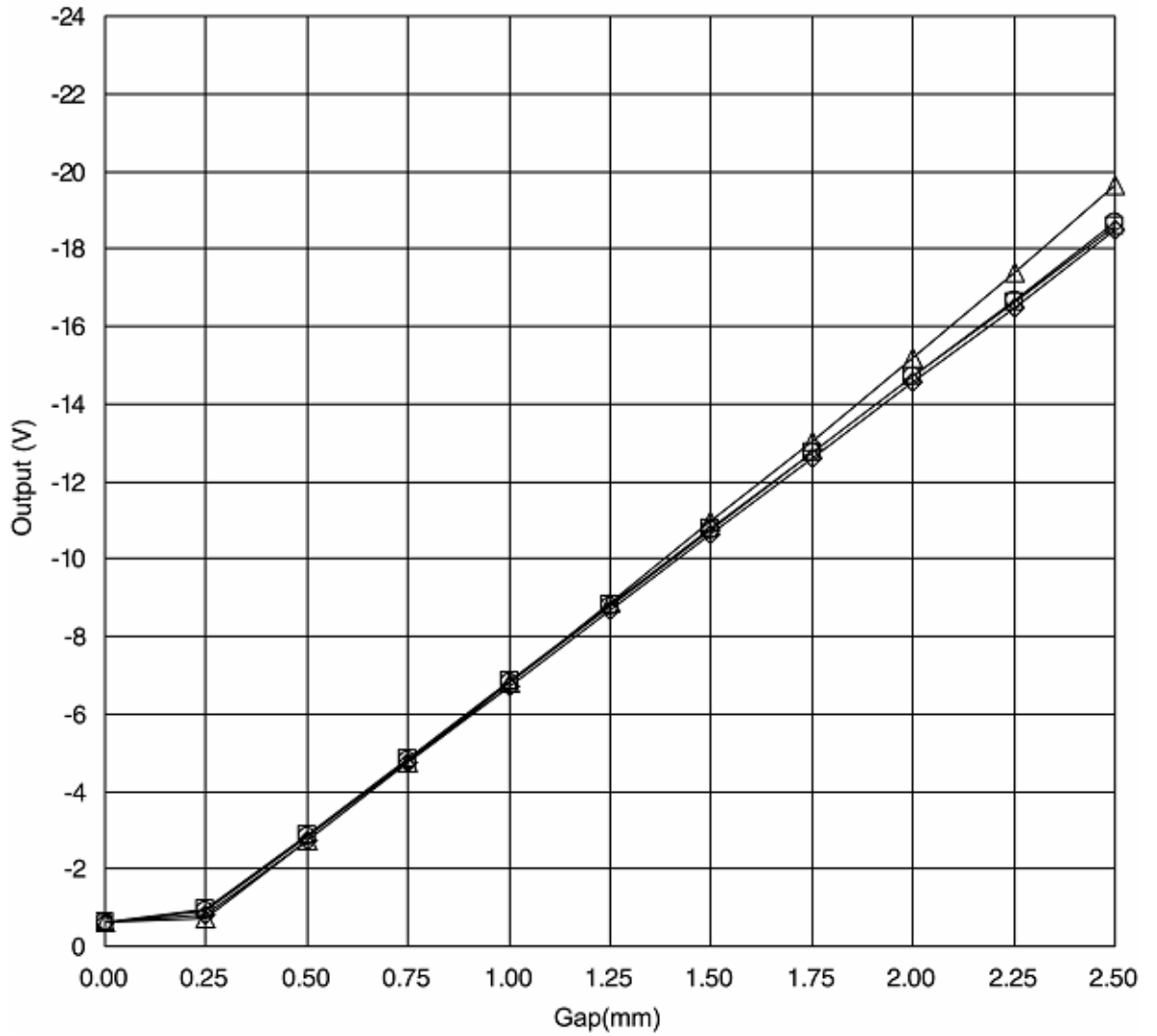
### Static Characteristic Effect Due to Target Diameter

Target material is SCM440.



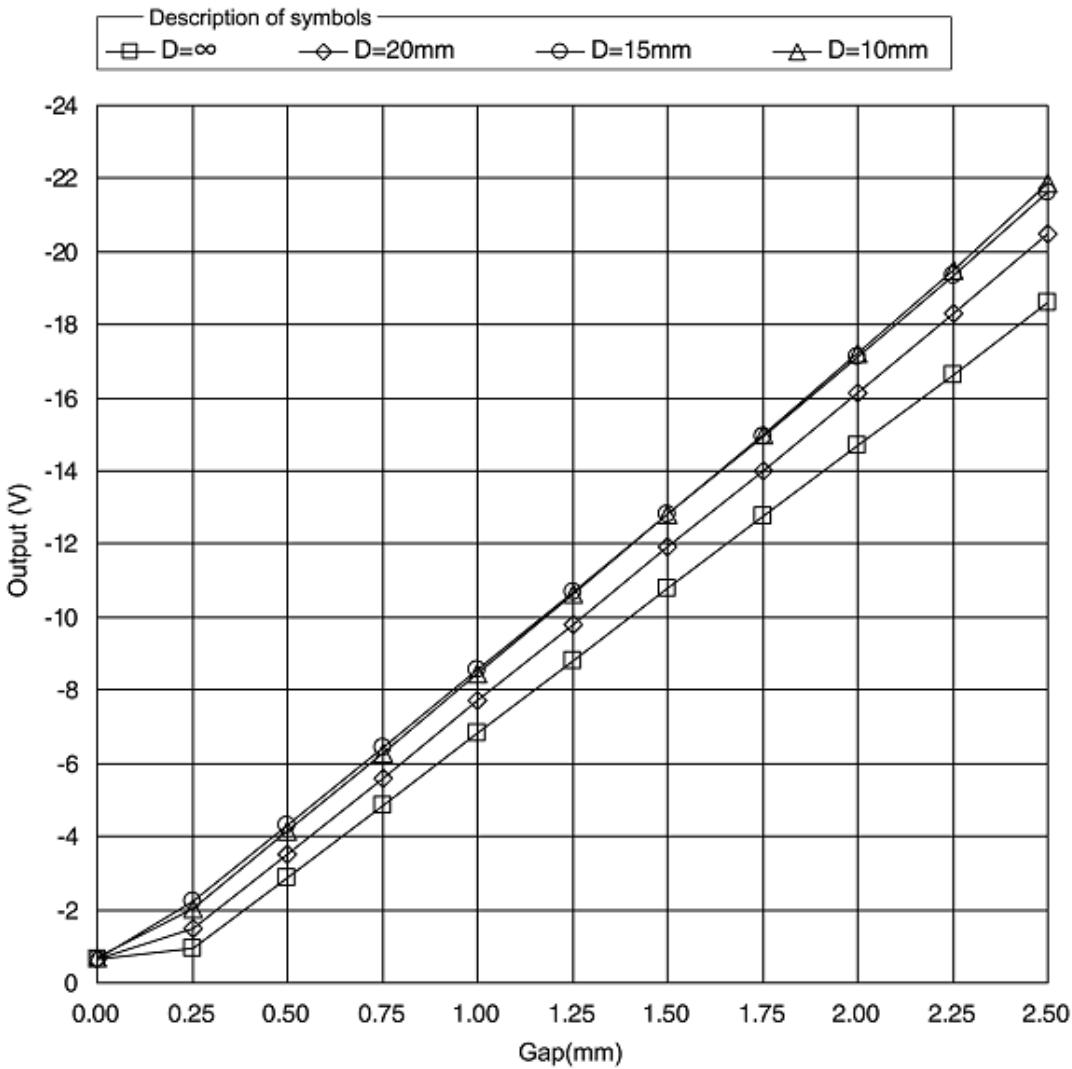
Description of symbols

|   |     |   |        |   |        |   |        |
|---|-----|---|--------|---|--------|---|--------|
| □ | D=∞ | ◇ | D=20mm | ○ | D=15mm | △ | D=10mm |
|---|-----|---|--------|---|--------|---|--------|



### Static Effect by Target Curved Surface

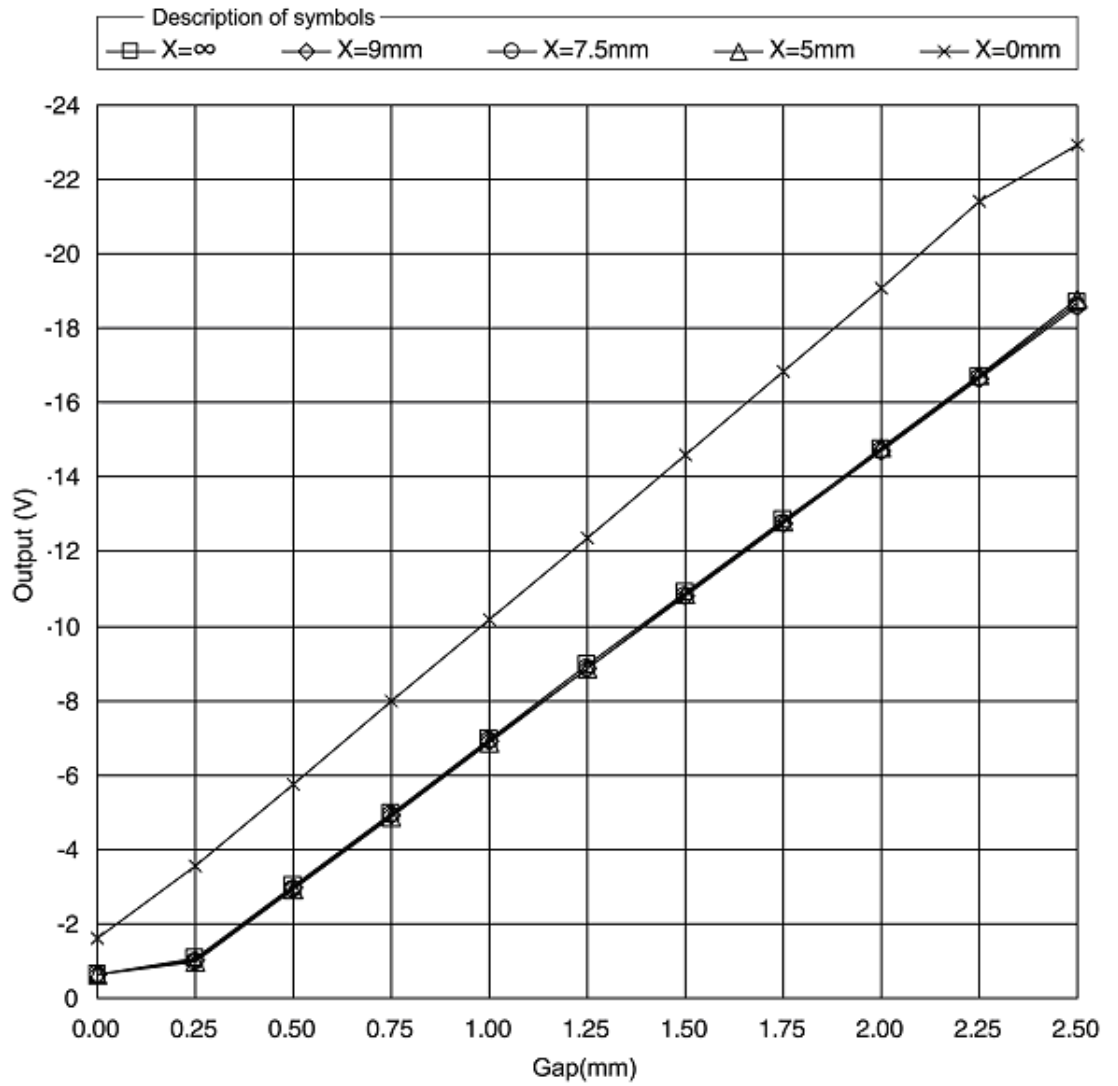
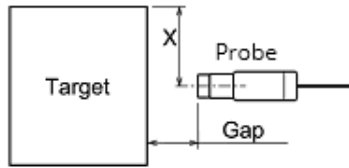
Target material is SCM440.





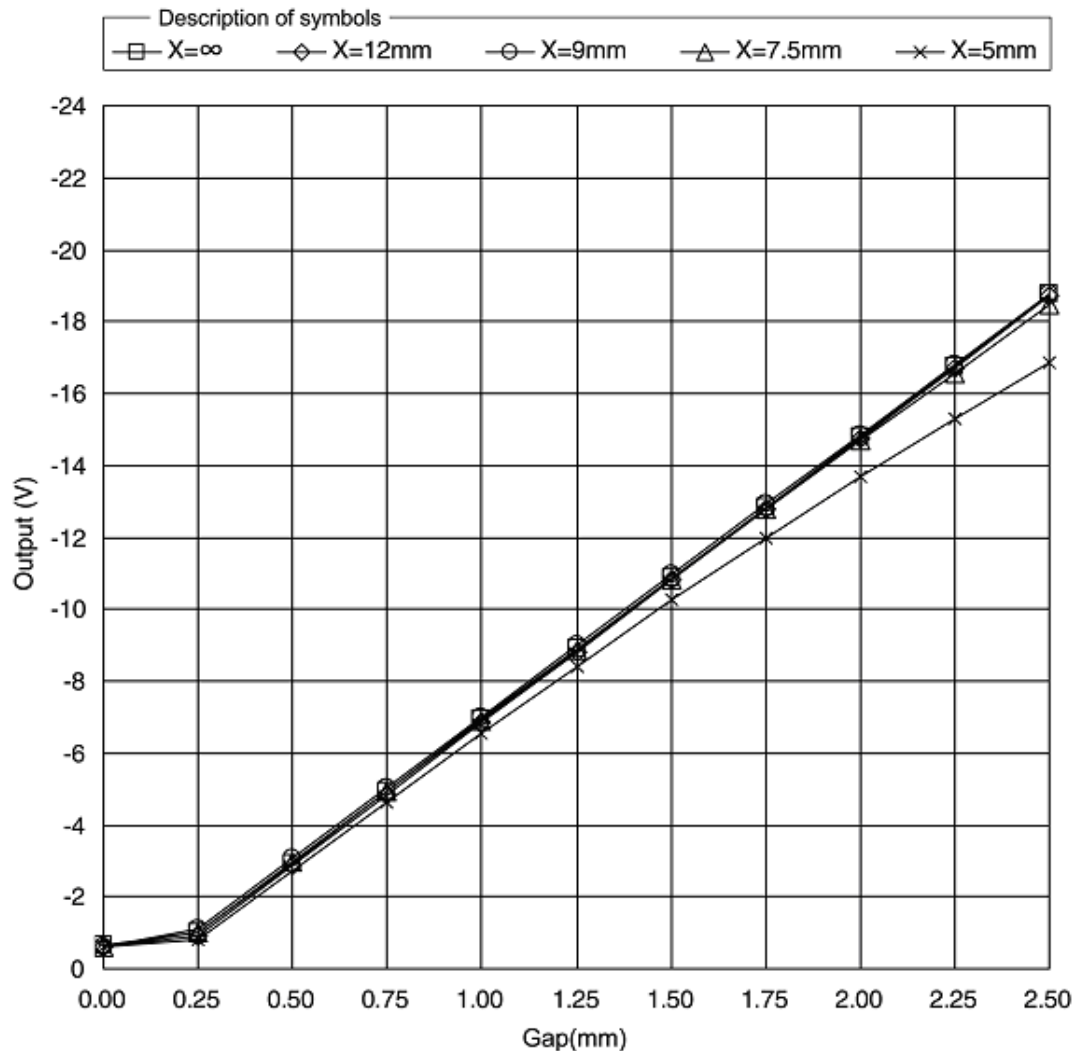
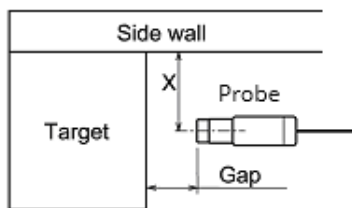
### Static Characteristic Effect Due to Target End Face

Target material is SCM440.

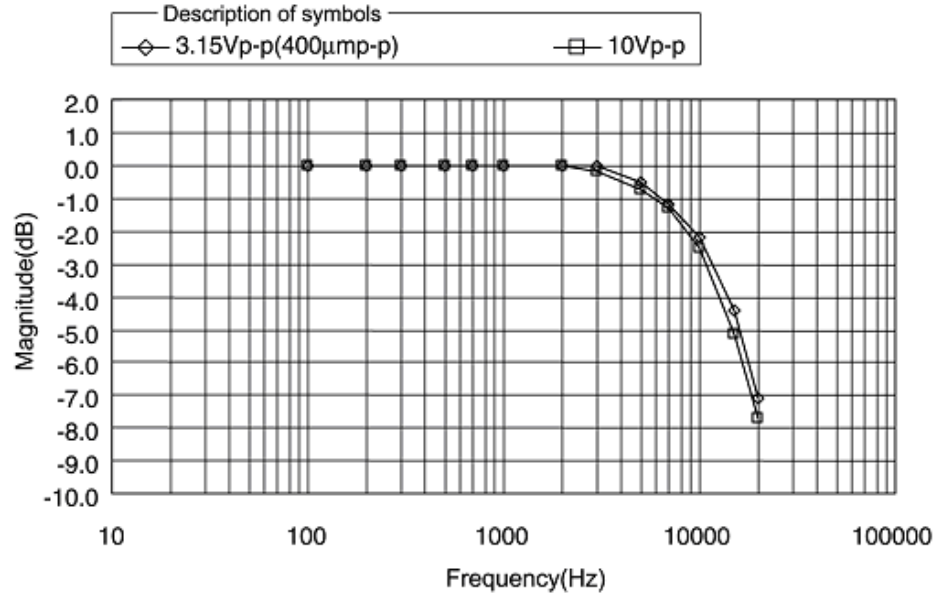


### Static Characteristic Effect Due to Side Wall

Target and side wall material is SCM440.



### Frequency Characteristics



## Wire the Unit to a Monitor System

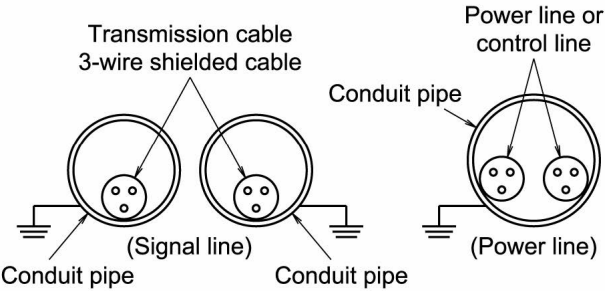
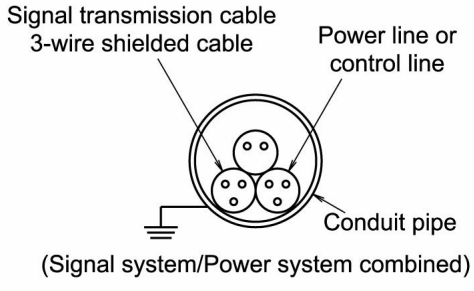
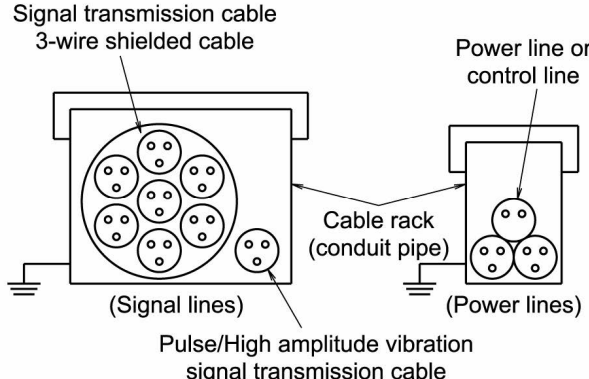
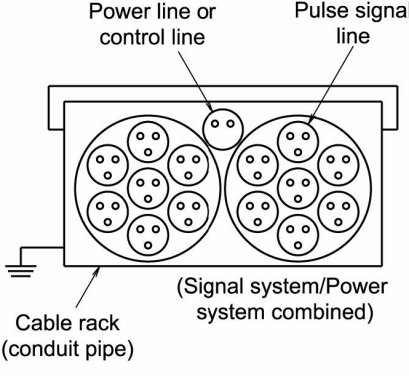
The 1442 Series Probe System is designed to satisfy the API-670 standard. Any monitor designed to connect API-670 probes can be used with these probes.

Consider the following recommendations when wiring the probe driver to a monitor:

- Use a good quality instrumentation cable with three-conductor stranded wire and shield.
  - Wire must be rated with a maximum capacitance of 60 pF/ft (197 pF/m) and inductance of 0.3  $\mu$ H/ft (1  $\mu$ H/m).
  - Use wire with insulation suitable for the environment and with adequate tensile strength and flexibility for the application.
  - Use wire with a foil shield for use in environments where radio frequency interference (RFI) is present. Use a wire with a braid shield for environments where electromagnetic interference (EMI) is present.
  - Use 0.75...1.25 mm<sup>2</sup> (18...16 AWG) gauge wire.
- Make sure that the wire is isolated from power cables and any other wiring that is transmitting high-voltage power or control signals.
- Any cable transmitting pulse-type vibration signals such as a phase marker or speed pulse must be isolated from any displacement and vibration signals.
- Run wire within conduit and cable trays and as per any local electrical codes.
- Do not exceed a wire length of 500 m (546.81 yd). However, if the length is limited to 300 m (328.08 yd), vibration signals in the 0...10 kHz frequency range are transmitted with minimal attenuation. When longer lengths are needed the capacitance of the cable and the desired frequency response of the system must be considered.
- In most cases, ground the cable shield at only one point, generally at the monitor.

# Cable Wiring/Laying Examples

The following illustrations provide examples on how to wire and lay the cable.

| Good Example   | Bad Example  |
|--|--|
|  <p>Transmission cable<br/>3-wire shielded cable</p> <p>Conduit pipe</p> <p>(Signal line)</p> <p>Conduit pipe</p> <p>Power line or control line</p> <p>Conduit pipe</p> <p>(Power line)</p>   |  <p>Signal transmission cable<br/>3-wire shielded cable</p> <p>Conduit pipe</p> <p>(Signal system/Power system combined)</p> <p>Power line or control line</p> <p>Conduit pipe</p> |
|  <p>Signal transmission cable<br/>3-wire shielded cable</p> <p>Cable rack (conduit pipe)</p> <p>(Signal lines)</p> <p>Pulse/High amplitude vibration signal transmission cable</p> <p>Power line or control line</p> <p>Cable rack (conduit pipe)</p> <p>(Power lines)</p> |  <p>Power line or control line</p> <p>Pulse signal line</p> <p>Cable rack (conduit pipe)</p> <p>(Signal system/Power system combined)</p> <p>Cable rack (conduit pipe)</p>        |

## Numerics

**1442 driver**  
dimensions 22  
installation 24  
installation environment 10

**1442 extension cable**

connecting 31  
dimensions 21

**1442 Probes**

connecting 32  
dimensions 16  
installation environment 11

**1442 reverse mount probe**

dimensions 17, 18, 19, 20

## C

**cable wiring** 49  
examples 49  
issues 49

**characteristic data** 39

## D

**dimensions** 16  
**din rail mounting** 25  
**driver installation** 24  
din rail mounting 25  
housing mounting 24  
panel mounting 24  
**driver installation environment** 10

## G

**gap adjustment** 29

## H

**housing mounting** 24

## I

**installation**  
driver 24  
probe 26  
**installation environment** 10  
driver 10  
probe 11

## M

**maintenance and inspection** 37  
**mounting bracket** 26

## P

**panel mounting** 24

**probe installation** 26  
gap adjustment 29  
mounting bracket 26  
stinger 27  
**probe installation environment** 11

## S

**set gap voltage** 33  
**specifications**  
monitor cable 35  
**Stingers** 27

## T

**troubleshooting** 38

## W

**wiring connections** 30  
extension cable 31  
probe 32  
set gap voltage 33  
verification 32  
XM module 32  
**wiring recommendations** 49







# Rockwell Automation Support

Use these resources to access support information.

|   |  |  |
|---|--|--|
| <b>Technical Support Center</b>                         | Find help with how-to videos, FAQs, chat, user forums, and product notification updates.           | <a href="http://rok.auto/support">rok.auto/support</a>             |
| <b>Knowledgebase</b>                                    | Access Knowledgebase articles.   | <a href="http://rok.auto/knowledgebase">rok.auto/knowledgebase</a> |
| <b>Local Technical Support Phone Numbers</b>            | Locate the telephone number for your country.  | <a href="http://rok.auto/phonesupport">rok.auto/phonesupport</a>   |
| <b>Literature Library</b>                               | Find installation instructions, manuals, brochures, and technical data publications.               | <a href="http://rok.auto/literature">rok.auto/literature</a>       |
| <b>Product Compatibility and Download Center (PCDC)</b> | Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes. | <a href="http://rok.auto/pcdc">rok.auto/pcdc</a>                   |

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## Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.





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