



DynAmp

# **DYNAMP FLEXIBLE HIGH CURRENT PROBE**

## **MODEL RR 60000-SD/24, 36, 48 SINGLE PHASE, CURRENT PROBE**

### **Installation, Operation and Service Instructions**

**Manual Item No. 041097**

**Rev. E**



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## DynAmp, LLC WARRANTY

Items and components manufactured by Seller for permanent installation are warranted for two (2) years from the date of shipment.

Items and components manufactured by Seller for portable and temporary use in more than one location are warranted to be free from defects in material and workmanship for a period of eighteen (18) months from the date of shipment.

Items and components not manufactured and resold by Seller are warranted by their manufacturer.

Warranty repair shall be, at DynAmp's option, in the form of repair or replacement of the defective items or components. Concerning warranty repairs, DynAmp will be responsible for DynAmp provided time, material and transportation costs (shipping or travel). Actual method of warranty repair / correction will be determined by DynAmp at DynAmp's sole option. Such warranty repair shall constitute a fulfillment of all DynAmp, LLC liabilities in respect to said items and components. In no event shall DynAmp, LLC be liable for consequential damages.

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This manual includes detailed drawings, installation, operation, service and maintenance. Users should evaluate the information in the manual and their particular application. DynAmp assumes no liability for any incidental, indirect, or consequential damages arising from the use of this documentation.

While all information presented is believed to be reliable and in accordance with accepted engineering practices, DynAmp makes no warranties as to the completeness of the information.

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Caution! Refer to manual before using product.

High Current Probe Model RR 60000-SD conforms to the latest European directives and standards concerning safety and electromagnetic compatibility.

- European Low Voltage Directive 73/23/EEC and 93/68/EEC
- European EMC Directive 89/336/EEC and 93/68/EEC

## Safety Standards

EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use.

## EMC Standards

RF Susceptibility:

EN 50082-1 3V/m Residential, Commercial, and Light Industrial Equipment.

RF Emissions:

EN 55011, Group 1, Class B Industrial, Scientific, and Medical Equipment.

## SAFETY

This product is designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2000m
- Maximum  $R_H$  80% for temperatures up to 31°C decreasing linearly to 40%  $R_H$  at 85°C

Use of this product is limited to 600V  $AC_{RMS}$  or DC between uninsulated conductor and ground and for frequencies below 1kHz.



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**REVISION HISTORY**

<u>Page</u>	<u>Rev.</u>	<u>Revision Summary</u>	<u>Date</u>
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# 1. SAFETY

## 1.1 SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific *WARNINGS* given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

The DynAmp, LLC assumes no liability for the customer's failure to comply with these requirements.

### **!! WARNING !!** **(Do not use until you have read this!)**

**Hazardous potentials may exist in the vicinity of the desired current measurements. Use locally approved safety procedures when working near these hazardous potentials. It is recommended not to install the DynAmp Flexible Current Probe around a live bus that is at a hazardous potential. If installation is not possible when the bus is inactive or turned off, always use appropriate gloves and/or equipment that are approved when working around hazardous potentials when installing the DynAmp Flexible Current Probe in the vicinity of these hazardous potentials.**

The ac transducer and interconnection cable uses double insulation to protect the operator from possible high-voltage potentials of the bus. The ac transducer and interconnection cable are rated for Installation Category III, Pollution Degree 2. The maximum voltage to earth rating for the transducer and cable is 600V<sub>AC</sub>. The electronics package is not double insulated or protected against hazardous potentials from connected instruments or mains adapters. Make sure the electronics package is well away from the bus and that the inputs of instruments connected to the DynAmp flexible current probe outputs are not hazardous live.

## 1.2 SAFETY SYMBOLS

General definitions of safety symbols used on equipment or in manual.



Direct current (power line).



Equipment protected by DOUBLE INSULATION or REINFORCED INSULATION.



Caution (refer to accompanying documents).

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## 2. HANDLING AND STORAGE

DynAmp products are engineered and manufactured for use in industrial environments. However, they contain sensitive electronic and mechanical components which may be damaged and fail if not handled and stored properly. All products must be handled and stored with the same care as any precision measurement instrument. Severe bumps or jolts may damage internal parts and cause malfunction or premature failure. DynAmp products are designed and assembled with conformal coating, shock mounting, and environmental seals, when appropriate or when specified. However, this protection requires that the product must be properly installed and operational before the protection is fully functional. Therefore, adequate protection from humidity, shock, and temperature must be provided during handling and storage prior to installation.

The handling and storage of equipment must be sufficient to meet the storage temperature and humidity specifications of the product and to prevent any condensation or contact with water or any other liquid. The storage location and container or crate must provide adequate protection from precipitation (rain, snow, ice) and direct water contact. Adequate shelter must be provided to prevent the accumulation of precipitation (rain, snow, ice) and water which can lead to the deterioration or failure of shipping containers or crates and cause water ingress. Storage in coastal or industrial areas subject to salt-laden or corrosive air or areas of wind-driven sand or other abrasive dust must be adequate to prevent the deterioration or failure of shipping containers or crates and cause ingress. Frequent inspection of storage areas and storage containers or crates is required to ensure proper storage conditions are being maintained.

If the shipping container or crate is opened and/or the equipment is removed for inspection prior to installation, the equipment must be repackaged in the original undamaged container or crate in the same manner as it was shipped to prevent environmental damage or placed in a storage location that meets the required environmental and storage conditions.

General product storage temperature and humidity requirements:

Storage Temperature:       -40 to 70°C  
  -40 to 158°F

Storage Humidity:           85%, non-condensing

DynAmp, LLC does not assume liability for the customer's failure to comply with handling and storage requirements.

For further assistance, contact DynAmp customer support.

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### 3. SPECIFICATIONS

The specifications for the RR 60000-SD are given in table 3.1

**TABLE 3.1  
MODEL RR 60000-SD SPECIFICATIONS**

SIGNAL CONDITIONER	
Input:	Type RS5 Transducer
Output:	3.0VAC or $\pm 4.2$ VPK Load >500 ohm
Output Connector:	BNC FEMALE
Switchable Scaling:	6kA/60kA @ 2mV/0.2mV per amp
Accuracy:	$\pm 1.0\%$ of full scale
Linearity:	$\pm 0.2\%$ of reading 10%...100% of full scale
Repeatability:	$\pm 0.1\%$ of reading 10%...100% of full scale
Frequency Response:	8Hz to 100kHz (-3dB points)
Phase error:	$< \pm 0.5$ maximum 50-60 Hz
Noise:	$< 10.0$ mV ac maximum
DC offset:	$< 5.0$ mV dc maximum
Temperature range:	Operational -20°C to 85°C (-4°F to 185°F Gain Change $\pm 0.08\%/^{\circ}\text{C}$ maximum DC offset $\pm 0.3$ mV/ $^{\circ}\text{C}$ maximum)
Power:	+3.0VDC/100mA from (2) 1.5V "AA" alkaline cells or by mini power connector (2.1mm) on end of enclosure Battery life (full scale input current @ 60 Hz) 25...30 Hrs.
Controls:	Switch (Range and Power) LED Flashes once per 3 seconds if the Current Probe is on and the battery voltage is good. 6kA/OFF/60kA
Material:	ABS Plastic
Dimensions:	1.0H x 2.4W x 3.8D inches (25.4H x 71.0W x 96.5D) mm
Weight:	0.1 lbs. (0.045 kg)

**TABLE 3.1  
MODEL RR 60000-SD SPECIFICATIONS (CONTINUED)**

TRANSDUCER													
TRANSDUCER JACKET	TPE rubber; double insulated; flame retardant UL 94 V-0 rated												
Output Cable Jacket:	FEP Teflon; brown color												
Couplings:	Polypropylene; flame retardant UL 94 V-0 rated; black color												
Transducer Cover:	Silicone impregnated fiberglass; silver gray color												
Minimum Bending Radius:	1.5 in. (38.1 mm)												
Cable OD	0.625 in. (15.87 mm)												
Coupling O.D.	0.875 in. (22.20 mm)												
Connecting Cable:	Length 78.7 in. (2.0m) shielded												
Temperature:	Operational -20°C to 100°C (-4°F to 212°F)												
Position Sensitivity:	<±2.0% with measured bus > 1" from head												
External Magnetic Field:	<±1.0% with external bus > 8" from head												
Dimensions:	<table border="0"> <tr> <td>...SD/24</td> <td>Length (Open)</td> <td>24 in. (610 mm)</td> </tr> <tr> <td></td> <td>I.D. (Closed)</td> <td>8.3 in. (209.9 mm)</td> </tr> <tr> <td></td> <td>O.D. (Closed)</td> <td>7.0 in. (178.2 mm)</td> </tr> <tr> <td></td> <td>Weight</td> <td>0.4 lbs. (0.18 kg)</td> </tr> </table>	...SD/24	Length (Open)	24 in. (610 mm)		I.D. (Closed)	8.3 in. (209.9 mm)		O.D. (Closed)	7.0 in. (178.2 mm)		Weight	0.4 lbs. (0.18 kg)
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		I.D. (Closed)	8.3 in. (209.9 mm)										
	O.D. (Closed)	7.0 in. (178.2 mm)											
	Weight	0.4 lbs. (0.18 kg)											
<table border="0"> <tr> <td>...SD/36</td> <td>Length (Open)</td> <td>36 in. (915 mm)</td> </tr> <tr> <td></td> <td>I.D. (Closed)</td> <td>12.0 in. (305 mm)</td> </tr> <tr> <td></td> <td>O.D. (Closed)</td> <td>10.9 in. (277 mm)</td> </tr> <tr> <td></td> <td>Weight</td> <td>0.6 lbs. (0.27 kg)</td> </tr> </table>	...SD/36	Length (Open)	36 in. (915 mm)		I.D. (Closed)	12.0 in. (305 mm)		O.D. (Closed)	10.9 in. (277 mm)		Weight	0.6 lbs. (0.27 kg)	
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<table border="0"> <tr> <td>...SD/48</td> <td>Length (Open)</td> <td>48 in. (1220 mm)</td> </tr> <tr> <td></td> <td>I.D. (Closed)</td> <td>15.9 in. (404 mm)</td> </tr> <tr> <td></td> <td>O.D. (Closed)</td> <td>14.7 in. (372.2 mm)</td> </tr> <tr> <td></td> <td>Weight</td> <td>0.8 lbs. (0.36 kg)</td> </tr> </table>	...SD/48	Length (Open)	48 in. (1220 mm)		I.D. (Closed)	15.9 in. (404 mm)		O.D. (Closed)	14.7 in. (372.2 mm)		Weight	0.8 lbs. (0.36 kg)	
...SD/48	Length (Open)	48 in. (1220 mm)											
	I.D. (Closed)	15.9 in. (404 mm)											
	O.D. (Closed)	14.7 in. (372.2 mm)											
	Weight	0.8 lbs. (0.36 kg)											
Safety Rating:	Double Insulated Installation Category III, Pollution Degree 2, 600VAC to Earth												
Working Voltage:	600VAC to Earth												
Head/Cable Test:	5550VAC for 1 minute surface to output												
ACCESSORIES:													
Standard:	Output Cable: BNC Male to BNC Male 12 in. (304.8 mm)												
	Adapter: BNC Female to Dual Banana Plug												

# 4. DESCRIPTION

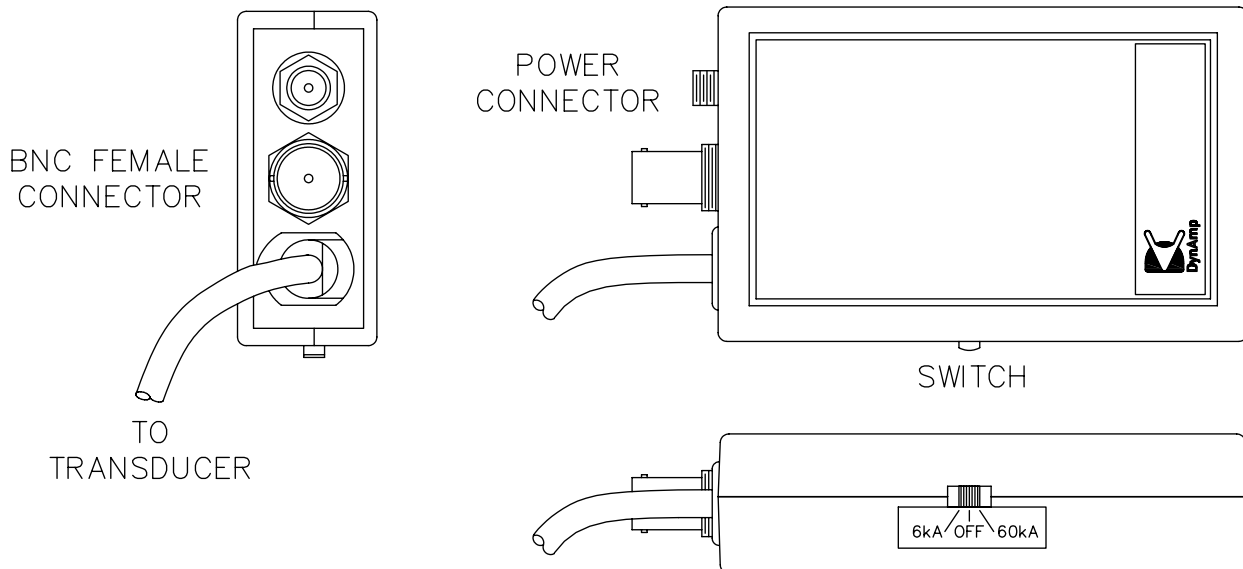
## 4.1 OVERVIEW AND DESCRIPTION

The DynAmp Flexible High Current Probe Model RR 60000-SD is an assembly similar in purpose to a CT or current transformer. It may be used to measure ac currents from as low as several amps to a maximum of 60.0kA rms. The device output is an analog voltage that is proportional to the current in the conductor. The output signal is isolated from the hazardous conductor potential and is an exact replica of the ac current waveform in the conductor. The output signal is available via a BNC connector and is quite easily connected to many different measurement devices. Output adapters have been included with the RR 60000-SD for your convenience. These adapters allow quick connection to an oscilloscope via a BNC connector or the voltage terminals of a multimeter via banana plugs.

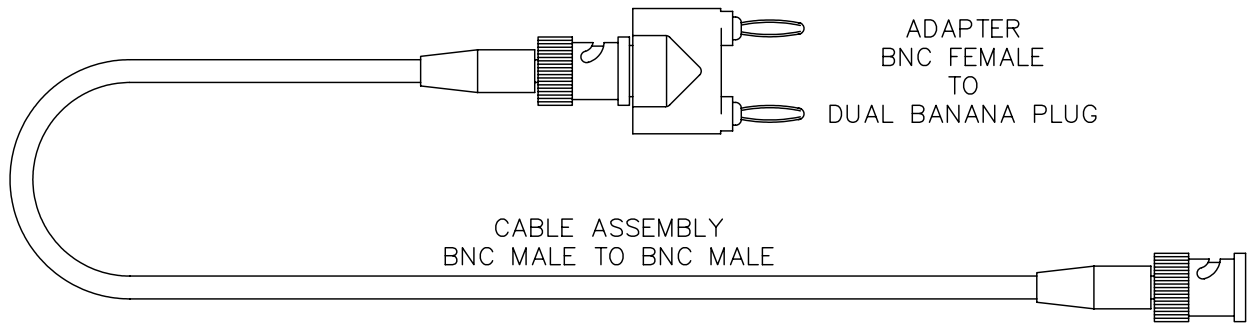
The RR 60000-SD comes standard with two ranges selectable by the switch mounted on the electronics package. The ranges are 6kA and 60kA yielding respectively 6kA and 60kA rms ac as the maximum current that can be measured. When the RR 60000-SD is turned on, the LED mounted behind the translucent ruby panel on the package end slowly blinks to indicate the unit is on and the battery voltage is sufficient to function properly on all ranges. This LED indication is characterized by blinking approximately once every three seconds. If no light is observed, the batteries of the RR 60000-SD should be replaced.

This LED indication is characterized by blinking approximately once every three seconds. If no light is observed, the batteries of the RR 60000-SD should be replaced.

The RR 60000-SD comes equipped with an external mini jack located on the package. This is for those wanting to supply power to the RR 60000-SD for a longer period than the internal battery life will allow. External dc adapters are available for this purpose but are sold as an option. The power required is +3.0V<sub>DC</sub>/100mA. Any external dc power supply adapter must be safety rated.



**FIGURE 4.1**  
**RR 60000-SD CURRENT PROBE ELECTRONICS PACKAGE**

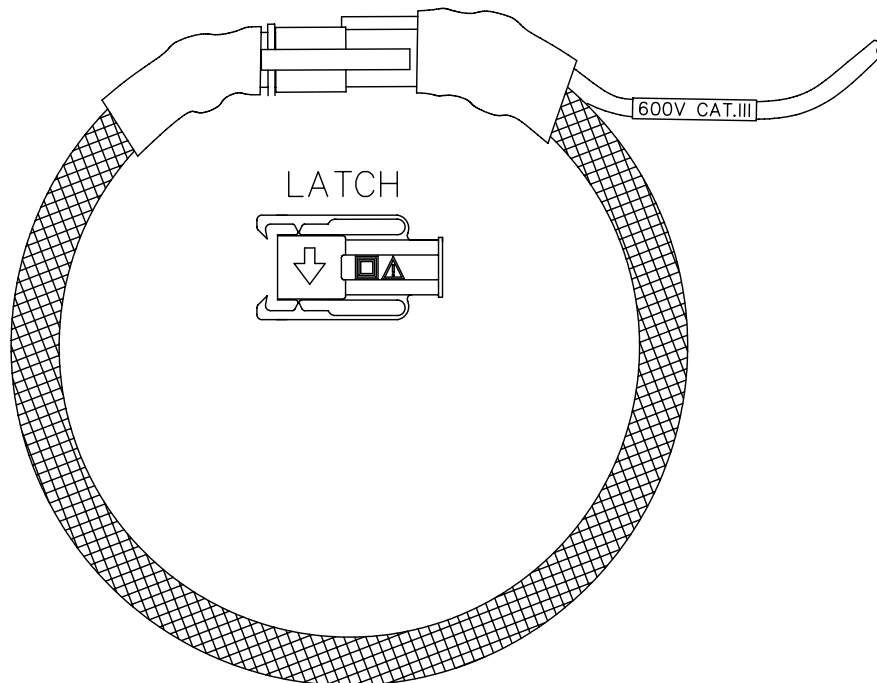


**Figure 4.2**  
**Output Signal Cable and Adapter**

## 4.2 AC CURRENT TRANSDUCER

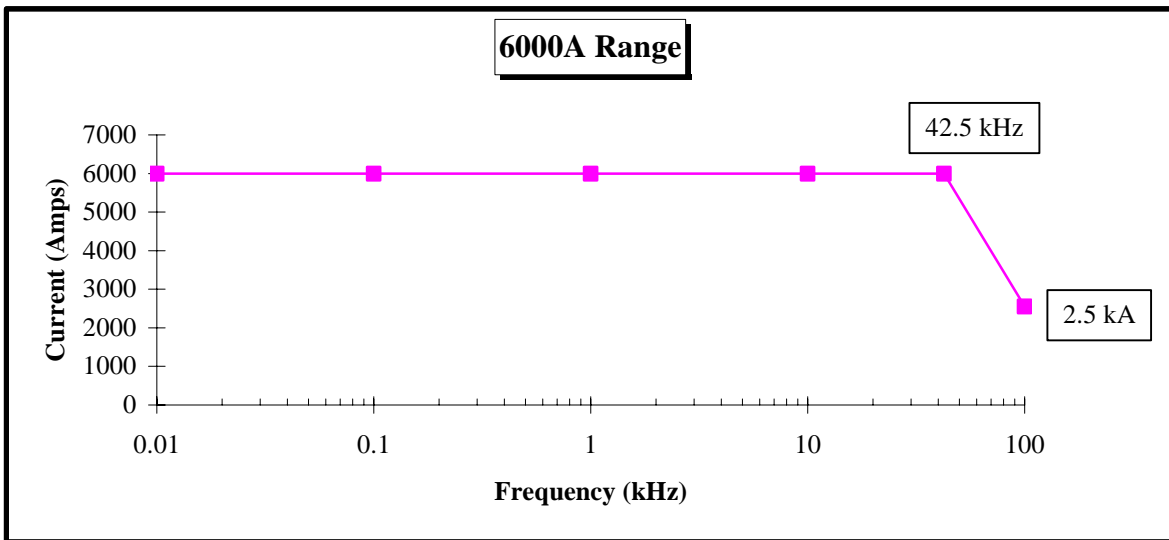
The RR 60000-SD design utilizes the lightweight and flexibility of the AC Current Transducer. This transducer is a versatile current probe that may be wrapped around most conductors. Three standard lengths are available. They are 24, 36, and 48 inches. It's application versatility and high-voltage isolation rating clearly distinguishes the RR 60000-SD from other current measuring methods. The measuring transducer is constructed from non-ferrous materials, minimizing any circuit loading.

The frequency response of the RR 60000-SD is wide compared to conventional CTs. This allows the user to monitor a much wider range of line harmonic components than conventional CTs allow. The RR 60000-SD was designed to be very flexible, larger in aperture and smaller in cross section than many conventional CTs. This allows measurement in tight places as never before possible.

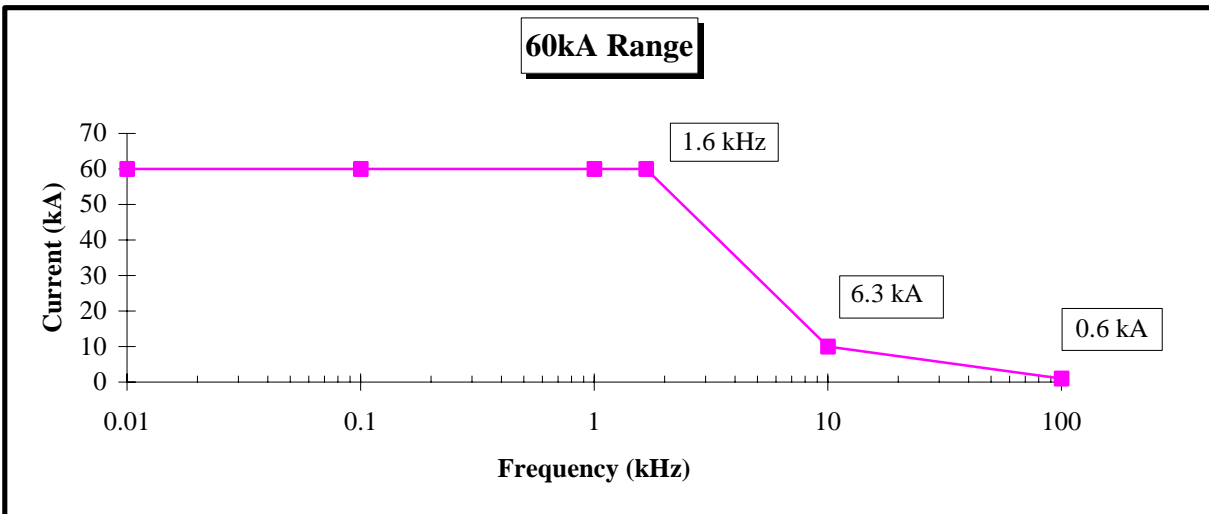


**Figure 4.3**  
**Type RS5 Flexible Transducer**

The output voltage of the transducer is proportional to the product of the current and the frequency. At higher frequencies, the output voltage of the transducer may damage the input circuits of the electronics package. Refer to Chart 4.1 and Chart 4.2 for the safe operating areas of the 6kA and the 60kA range respectively.



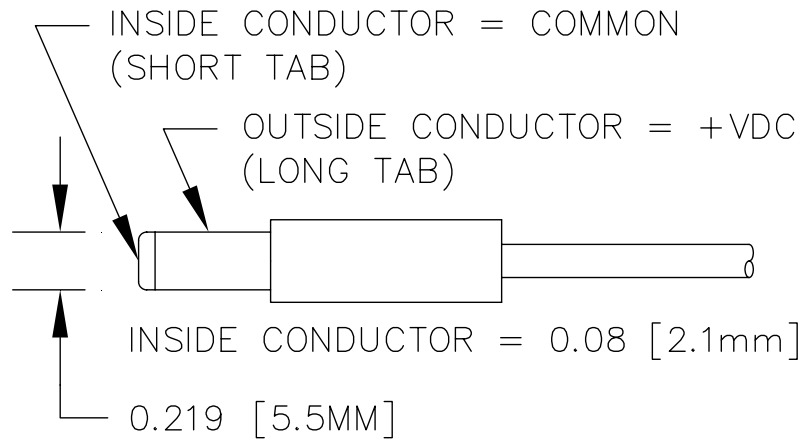
**Chart 4.1**  
**6kA Range Safe Operating Area**



**Chart 4.2**  
**60kA Range Safe Operating Area**

### 4.3 EXTERNAL POWER SUPPLY

The user may choose to purchase a suitable external power supply. Figure 4.4 shows the important dimensions of the power connector and the required polarity of the supply voltage. The external power supply should have the CE mark and must be rated for  $+3.0V_{DC}/340mA$ .



**Figure 4.4**  
**Input Power Connector**

## 5. INSTALLATION

### 5.1 INSTALLATION INSTRUCTIONS

The RR 60000-SD was made to allow the operator to connect this measurement device around a conductor without disconnecting the conductor, as many CTs presently demand. Even though the Flexible Transducer output is ac, there are instances where the user will want to orient the transducer so that proper polarity will exist at the output terminals. This is done by installing the transducer around the conductor with the molded-in arrow on the latch (see Figure 4.3) pointing in the direction of conventional current flow. Conventional current flow is defined as current flowing from the positive to the negative potential.

The Flexible Transducer must be installed with the interconnection cable on the outside of the loop when the latch is engaged. The polarity arrow, the double insulation, and the warning symbols will all be on the outside of the loop. It should also be noted that the current probe will produce twice the output voltage if you wrap the transducer around the conductor twice.

There is minimal shock hazard using the RR 60000-SD, as the transducer does not generate high voltages at low frequencies. Each transducer has been Hi-Pot tested to several thousand volts with no voltage breakdown. This particular characteristic allows high-current measurement (with a wide frequency bandwidth) of conductors at less than 600V<sub>AC</sub> potential to earth.

### **!! WARNING !!** **(Do not use until you have read this!)**

**Hazardous potentials may exist in the vicinity of the desired current measurements. Use locally approved safety procedures when working near these hazardous potentials. It is recommended not to install the DynAmp Flexible High Current Probe around a live bus that is at a hazardous potential. If installation is not possible when the bus is inactive or turned off, always use appropriate gloves and/or equipment that are approved when working around hazardous potentials when installing the DynAmp Flexible High Current Probe in the vicinity of these hazardous potentials.**

Do not exceed the minimum bending radius of the AC Current Transducer when installing the transducer around the conductor. Exceeding the bending radius will degrade the measurement accuracy.

Make sure the AC Current Transducer and its output cable are clean before installing them around the conductor. If the transducer and cable are not clean, the contaminants on them may provide a conductive path for a high-voltage breakdown. Also, check the transducer and output cable for cuts and abrasions. Do not use the transducer if damaged.

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# 6. MAINTENANCE

## 6.1 MAINTENANCE

Preventive maintenance primarily consists of cleaning the transducers and cables to prevent surface contamination. Use a mild detergent and a damp cloth to clean the transducers and cables. Remove the detergent with a damp cloth, then wipe with a clean, dry cloth.

<b>NOTE</b>
<b>The use of solvents as cleaners is not recommended unless thoroughly tested and found harmless to all surfaces and parts. Do not submerge current probe into water or other fluids.</b>

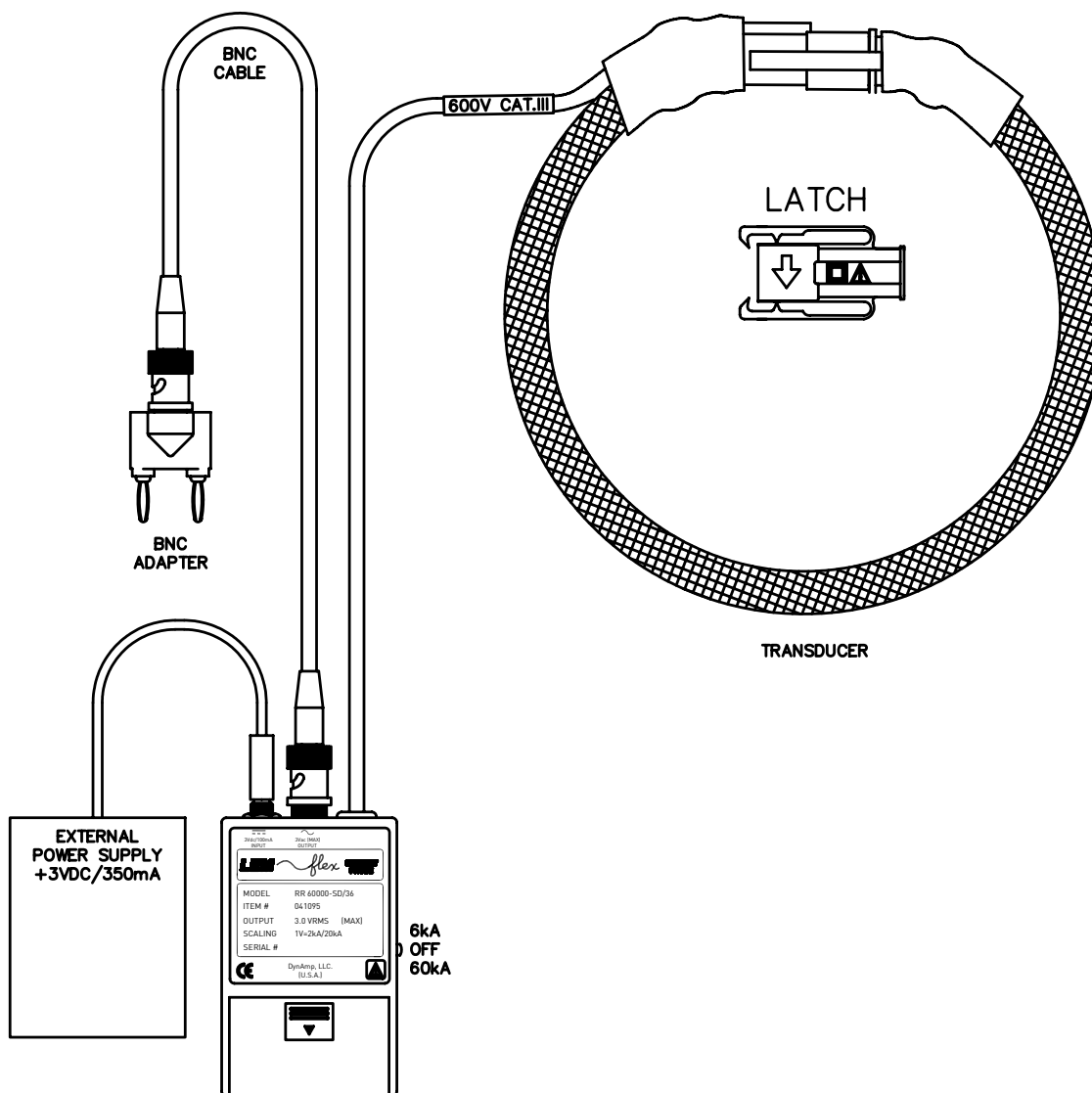


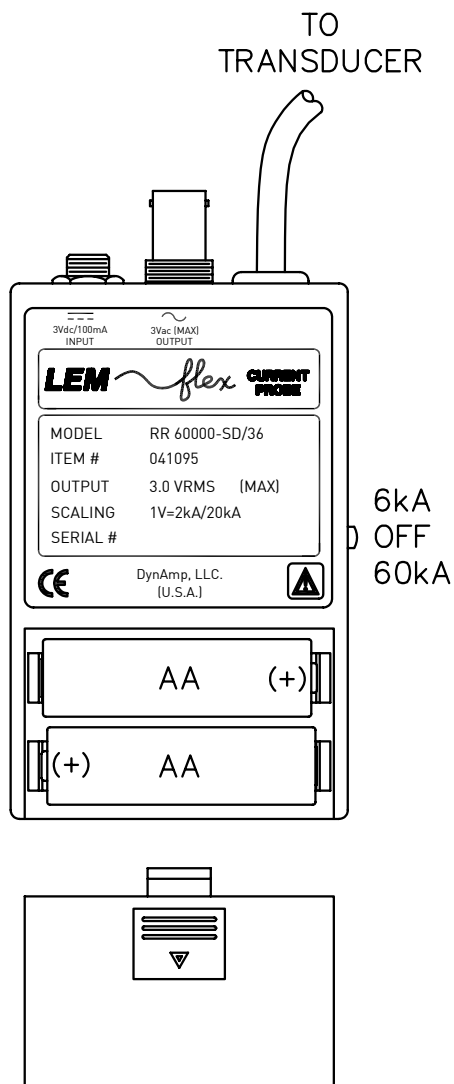
Figure 6.1  
RR 60000-SD Current Probe

## 6.2 BATTERY REPLACEMENT

### SAFETY WARNING

**Before removing the battery cover, make sure that the Transducer is removed from around any active conductor.**

The battery compartment may be accessed by pressing down on the arrow molded into the battery compartment cover to release the latch, then sliding the cover off. Remove the old batteries and install the new batteries in the position as shown in Figure 6.2. Slide the cover onto the enclosure until the latch engages. The batteries used in the RR 60000-SD Current Probe are type "AA" alkaline cells or equivalent. Replacement with other than the specified battery will invalidate the warranty.



**Figure 6.2**  
**Battery Replacement**

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## 6.3 DYNAMP, LLC CUSTOMER SUPPORT

For further assistance, contact DynAmp Customer Support at:

Americas:

Telephone: +1 614.871.6900

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8:00 AM to 5:00 PM USA Eastern Time

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