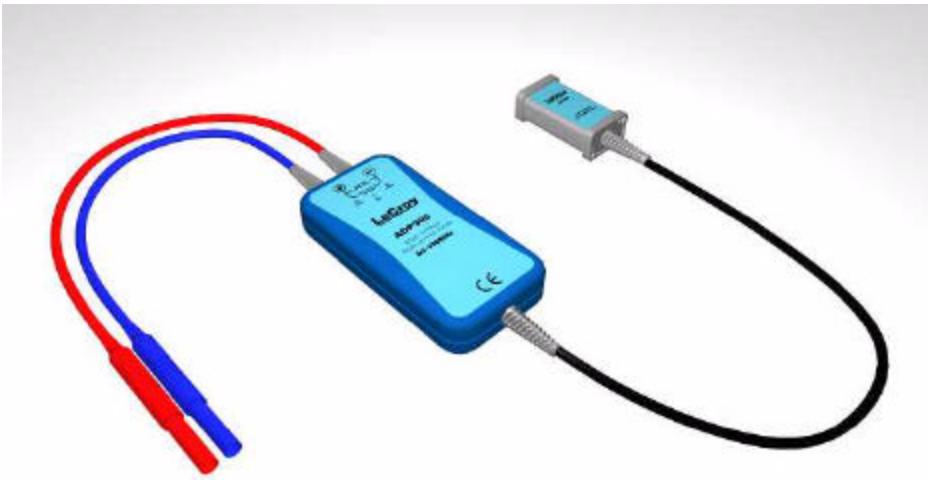

Instruction Manual

LeCroy ADP300/305

REVISION A — JUNE 2000

Warranty

LeCroy warrants this oscilloscope accessory for normal use and operation within specification for a period of one year from the date of shipment. Spare parts, replacement parts, and repairs are warranted for 90 days.

In exercising its warranty, LeCroy, at its option, will either repair or replace any assembly returned within its warranty period to the Customer Service Department or an authorized service center. However, this will be done only if the product is determined by LeCroy's examination to be defective due to workmanship or materials, and the defect is not caused by misuse, neglect, accident, abnormal conditions of operation, or damage resulting from attempted repair or modifications by a non-authorized service facility.

The customer will be responsible for the transportation and insurance charges for the return of products to the service facility. LeCroy will return all products under warranty with transportation charges prepaid

This warranty replaces all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purposes or use. LeCroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise.

Corporate Headquarters:

LeCroy Corporation
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977-6499
Tel: (914) 578-6020, Fax: (914) 578-5985

Internet: www.lecroy.com

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ADP30X-OM-E Rev A 0600

ISO 9001 Registered
KPMG Quality Registrar
The Quality Advantage

CE

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014:1998

Manufacturer's Name: LeCroy Corporation

Manufacturer's Address: 700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

herewith declare that

Product(s) Name: High Voltage Differential Probe
Model Number(s): ADP300, ADP305

are in conformity with the provisions of the following EC directive(s), including the latest amendments, and with national legislation implementing these directives:

73/23/EEC Low Voltage Directive
89/336/EEC EMC Directive

and that conformity with Council Directive 73/23/EEC is based on

EN 61010-1: 1993	Safety requirements for electrical equipment for measurement control and laboratory use Part 1: General requirements
EN 61010-2-031: 1994	Part 2-031: Particular requirements for hand-held probe assemblies for electrical measurement and test

and that conformity with Council Directive 89/336/EEC is based on

EN 61326-1: 1997	EMC requirements for electrical equipment for measurement control and laboratory use	
Emissions:	EN 55011: 1998	Radiated Emissions Group1 Class B
Immunity:	EN 61000-4-2: 1995	Electrostatic Discharge
	EN 61000-4-3: 1996	RF Radiated Electromagnetic Field
	EN 61000-4-4: 1995	Electrical Fast Transient/Burst
	EN 61000-4-5: 11995	Surge
	EN 61000-4-6: 1996	RF Conducted Electromagnetic Field

European Contact: Your local LeCroy Sales Office or
LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany
Tel: (49) 6221 82700
Fax: (49) 6221 834655

By: R. Kalyandrug
Product Compliance Manager

Place: LeCroy Corporation
Chestnut Ridge, NY 10977

Date: May 24, 2000

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Table of Contents

1 Overview

DESCRIPTION

The ADP30X family of high voltage active differential probes is safe, easy-to-use, and ideally suited for power measurements.

The 20 MHz ADP300 is perfect for troubleshooting low frequency power circuits, and other circuits where the reference potential is elevated from ground or the location of ground is unknown.

The 100 MHz ADP305 is designed for measuring high-speed floating voltages found in today's power electronics, like switching power supplies.

These probes can be used only on a LeCroy oscilloscope with firmware version 8.5 or higher. With the ProBus interface, the ADP30X becomes an integral part of the oscilloscope. For the ADP305, the attenuation, offset, and bandwidth limit are all controlled from the oscilloscope's front panel or by means of remote control commands. This means that the complete measurement setup can be saved and recalled by the oscilloscope and all measurement values will be correct. The oscilloscope provides power to the probe, so there is no need to worry about a separate power supply or changing batteries.

The sensitivity of the ADP300 ranges from 1 V/div to 350 V/div; and the sensitivity for the ADP305 ranges from 200 mV/div to 350V/div.

Attenuation is automatically selected by the oscilloscope to either ?100 or ?1000.

KEY BENEFITS

- True Differential Measurements
- EN 61010 1000 V CAT III Safety Compliance
- ProBus Interface with Automatic Scaling
- Auto-Zeroing

CONVENTIONS USED IN THIS MANUAL

The following conventions may appear in this manual:

Note

A Note contains information relating to the use of the product.

CAUTION

A Caution contains information that should be followed to avoid possible damage to the instrument or the device under test.

WARNING

A Warning alerts you to a potential hazard. Failure to adhere to the statement in a WARNING message could result in personal injury.

The following symbols may appear on the product:

CAUTION: Refer to accompanying documents

This refers you to additional information contained in this manual. The corresponding information in the manual is similarly denoted.

CAUTION: Risk of electric shock

This is a reminder that high voltage may be present and that appropriate caution should be taken.

This is the symbol for earth ground.

STANDARD ACCESSORIES

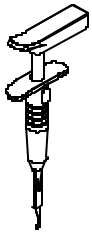
	ADP300	ADP305
Instruction Manual	x	x
Certification of Compliance	x	x
Hook and Loop Strap for holding probe	x	x
Plunger Hook Tip	x	x
Safety Alligator Clip		x
Plunger Jaw Clip		x
Plunger Clamp Clip		x
Spade Terminal		x
Soft Accessory Case		x

DESCRIPTION OF ACCESSORIES

WARNING

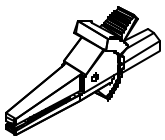
For electric shock protection, only attachment accessories rated for 1000 V Installation Category III, per EN 61010-1:1993 should be used with this product

Plunger Hook Clip (1 Red, 1 Blue)



Insulated, 1000 V, CAT III. Designed to attach to wire leaded parts, the overall length is 117 mm (4.60 inches), and the hook extends 10 mm (0.41 inch) when the plunger is fully pressed.

Safety Alligator Clip (1 Red, 1 Blue)

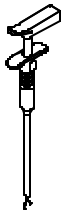


Insulated, 1000 V, CAT III. Designed to attach to large components, such as busbars and large bolts, the overall length is 90 mm (3.5 inches) and the jaw opens to 22 mm (0.87 inch) max.

Plunger Jaw Clip (1 Red, 1 Blue)

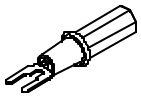
Insulated, 1000 V, CAT III. The clip is designed to securely grasp thick wires, cables, ground leads, rails, and even screw heads. The overall length is 134 mm (5.26 inches). The steel jaw extends 12 mm (0.48 inch) and opens to 25 mm (1 inch).

Plunger Clamp Clip (1 Red, 1 Blue)



Insulated, 1000 V, CAT III. Designed for attaching to hard-to-reach test points, the entire body is fully insulated. The overall length is 190 mm (7.5 inch). The clamp can grab leads, pins and wires up to 5 mm (0.2 inch) in diameter.

Spade Terminal



Insulated, 1000 V, CAT III. Designed to connect to terminal strips, posts, and screws, the overall length is 63mm (2.48 inch).

Soft Accessory Case

This can be used to carry probes and accessories. It can also be mounted on your oscilloscope for storing all your accessories and manuals. See Appendix B for installation instructions.

# # #

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2 Safety Information

OPERATOR SAFETY

To avoid personal injury and to prevent damage to the probe or any products connected to it, review the following safety precautions. To avoid potential hazards, use the probe only as specified.

Warning

To avoid fire or personal injury, comply with the following:

The probe is intended to be used only with measurement instruments that are connected to earth ground through the input BNC connector.

Connect the probe to the measurement instrument before connecting the test leads to a voltage source.

Do not disconnect the probe from the instrument while the test leads are connected to a voltage source.

Use of the probe (or the oscilloscope it is connected to) in a manner other than that specified may impair the protection mechanisms.

Observe all terminal ratings. Do not apply a potential to any input that exceeds the maximum rating of that input. See chapter 9 for detailed specifications of the probe.

To avoid RF burns, do not handle the probe while the input leads are connected to potentials above the RF Burn Limits shown on the derating curve (page9–4).

When measuring signals above 2 MHz, be sure to comply with the voltage vs. frequency derating curve (page9–4). Otherwise the probe may overheat, thereby compromising the insulation system.

Avoid exposed circuitry. Do not touch exposed connections and components when power is on.

Do not use in wet or explosive atmospheres. Remove any contamination from the probe housing before connecting the probe inputs to any circuits. Be sure that the surface of the probe is completely dry before connecting the inputs.

Do not use the probe if any part is damaged. All maintenance should be referred to qualified service personnel.

Any test lead or accessory must comply with EN61010-1 Installation Category III, 1000 V rating. Use only accessories supplied by LeCroy with the probe, or order replaceable parts listed in the Replacement Parts list.

Do not operate with suspected failures. If you suspect there is damage to the probe, have it inspected by qualified service personnel.

# # #

3 Operation

CONNECTING THE PROBE TO THE TEST INSTRUMENT

The ADP30X series of probes has been designed for use with LeCroy oscilloscopes equipped with the ProBus interface. When you attach the probe output connector to the scope's input connector, the scope will recognize the probe, set the scope input termination to 1 M? ?and activate the probe control functions in the user interface.

Figure 3–1A shows the oscilloscope user interface menu for a ADP305 probe and Figure 3–1B for the ADP300 probe. Both menus allow you to select the probe's input coupling (**DC** or **Grounded**) and the "Auto Zero" function. In addition, the ADP305 has a probe bandwidth limit menu ("Probe BWL") to select between full bandwidth and a bandwidth limit of 20 MHz.

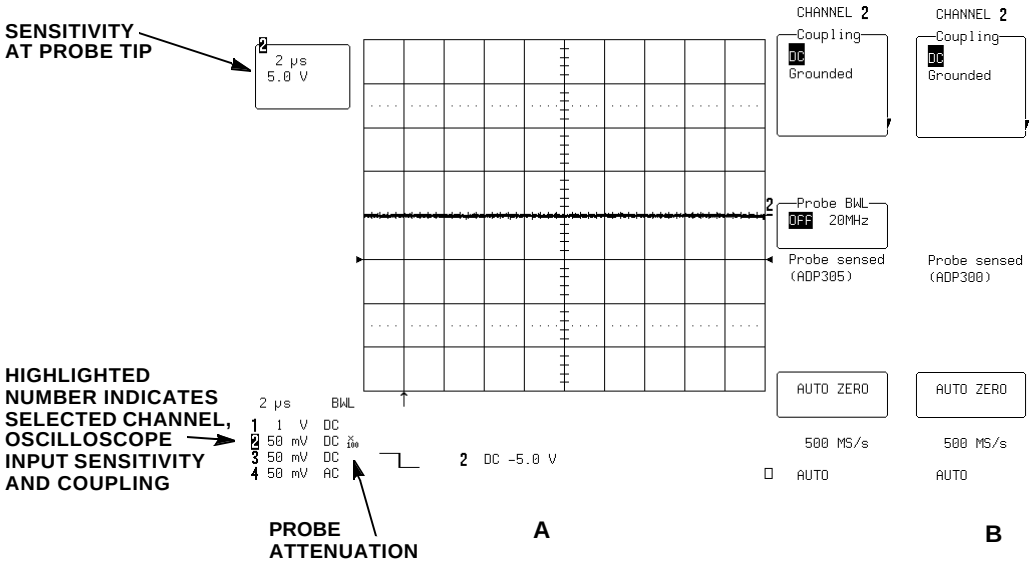

Figure 3–1. A: Oscilloscope display with ADP305 menu. B: ADP300 menu.

CONNECTING THE PROBE TO THE TEST CIRCUIT

The ADP30X series of probes is ideally suited for applications where no ground is available or where the location of a ground connection is unknown.

Two inputs are available at the probe tip to connect the probe to a circuit under test. For accurate measurements, the **+** and **–** inputs both must always be connected to the test circuit. Positive voltages applied to the **+** input (red) relative to the **–** input (blue) will deflect the oscilloscope trace toward the top of the screen.

To maintain the high performance capability of the probe in measurement applications, care must be exercised in connecting the probe to the test circuit. Increasing the parasitic capacitance or inductance in the input paths may introduce a “ring” or may slow the rise time of fast signals. Input leads that form a large loop area will pick up any radiated electromagnetic field that passes through the loop and may induce noise into the probe inputs. Because this signal will appear as a differential mode signal, the probe’s common mode rejection will not remove it. This effect can be greatly reduced by twisting the input leads together to minimize the loop area.

High common mode rejection requires precise matching of the relative gain or attenuation in the + and **–** input signal paths. Mismatches in additional parasitic capacitance, inductance, delay, and a source impedance difference between the **+** and **–** signals will lower the common mode rejection ratio. Therefore, it is desirable to use the same length and type of wire and connectors for both input connections. When possible, try to connect the inputs to points in the circuit with approximately the same source impedance.

OPERATION WITH A LECROY OSCILLOSCOPE

When the ADP30X is connected to a LeCroy oscilloscope loaded with software version 8.5 or higher, the displayed scale factor and measurement values will be adjusted to account for the effective gain of the probe.

Through the oscilloscope software, the probe’s internal attenuation and offset can be conveniently controlled through the oscilloscope’s user interface. Control through the oscilloscope user interface can be found in the "Coupling" menu of the channel to which the probe is connected. Figure 3–1A shows the

oscilloscope/probe menu for the ADP305, and Figure 3–1B the menu for the ADP300.

Turning the **VOLTS/DIV** knob will control the oscilloscope's scale factor and the probe's internal attenuation to give full available dynamic range from 1 V/div to 350 V/div for the ADP300 and from 200 mV/div to 350 V/div for the ADP305. Some of the transition of the scale factor will result in a change of the ADP30X attenuation.

SMART OFFSET

The ADP30X has offset capability. This allows you to remove a DC bias voltage from the differential input signal while maintaining DC coupling.

The offset range of the probe is a function of the oscilloscope's sensitivity and the probe's attenuation. This ensures that the probe will never be overdriven on screen. In addition, it will prevent the oscilloscope from being overdriven and getting inaccurate measurements.

Table 3–1 shows the offset ranges available at the different probe sensitivities:

Table 3–1. Offset Ranges

	Offset range (Volt)	
Probe's V/div	LC Series	LT Series
200 mV – 499 mV	±40	±100
500 mV – 9.9 V	±100	±100
10 V – 99 V	±1000	±1000
100 V – 350 V	±(1400 – 4 x V/div)	±(1400 – 4 x V/div)

BANDWIDTH LIMIT (ADP305 ONLY)

To comply with various test standards used for quantifying output noise of power supplies, the ADP305 is capable of switching the bandwidth limit from **Off** (maximum bandwidth) to **20 MHz** by pressing the button next to the "Probe BWL" menu in the user interface.

AUTO ZERO

The ADP30X incorporates an Auto Zero function to remove the DC offset from the Differential Amplifier's output. Auto Zero must

be invoked by the user. You may do this even while the probe is connected to a live circuit.

After several minutes of warm-up, or when the probe is exposed to a large shift in ambient temperature, some DC offset drift may occur from thermal effects in the amplifier. To initiate an Auto Zero cycle, press the button next to "AUTO ZERO" in the oscilloscope's user interface menu. During an Auto Zero cycle the oscilloscope will automatically disconnect the ADP30X inputs from the circuit under test, perform the auto zero function, and reconnect the inputs.

# # #

4 Remote Control Commands

INTRODUCTION

When attached to a LeCroy oscilloscope equipped with ProBus interface, the ADP30X Active Differential Probe can be remotely controlled, along with the other oscilloscope functions. The control interface can be either the RS-232 or IEE-488 (GPIB) buses. The commands that control the probe are described below. The text for the command description is formatted in a style consistent with the oscilloscope command description contained in the *LeCroy Digital Oscilloscopes Remote Control Manual* supplied with the oscilloscope. Please refer to this manual for additional information on the remote control buses and the conventions used in the command descriptions.

The commands begin with the "PRx:" prefix, where "x" is the channel that the ADP30X is connected to. These commands are similar to the channel commands that use the prefix "Cx:". The difference is that the "PRx:" form refers to the probe tip, whereas the "Cx:" form refers to the oscilloscope input connector. For example, "PRx:VDIV" sets the volts per division at the probe tip, while "Cx:VDIV" sets the volts per division at the BNC input connector, without factoring the gain or attenuation factor of ADP30X probe. The "PRx:" form of these commands are only active when the ADP30X probe is connected to the selected channel. An error will result when an ADP30X specific command is sent to the oscilloscope without a differential probe connected to the selected channel.

COMMAND LIST

PRx:AUTOZERO	Initiates an auto zero cycle in the probe.
PRx:BWL	Selects the probe upper bandwidth limit.
PRx:COUPLING	Selects the input coupling of the probe.
PRx:OFFSET	Selects the probe offset voltage.
PRx:VDIV	Selects the vertical scale factor of the probe/oscilloscope system.

PROBE AUTO ZERO

PRx:AUTOZERO, PRx:AZ
Command

Description

The PRx:AUTOZERO command initiates an auto zero cycle in the ADP30X probe to remove any offset drift.

The probe input can remain connected to the test circuit during the auto zero cycle.

Command Syntax

```
<channel>:AutoZero

<channel>:= {PR1, PR2, PR3, PR4}
```

Example

The following command initiates an auto zero in the ADP30X Differential Probe attached to channel 1:

```
CMD$="PR1:AZ":CALL IBWRT(SCOPE%,CMD$)
```

PROBE BANDWIDTH LIMIT

PRx:BANDWIDTH_LIMIT, PRx:BWL
Command/Query

Description

The `PRx:BANDWIDTH_LIMIT` command sets the upper (HF) –3 dB bandwidth limit of the ADP305 probe. The arguments are in Hertz.

Note

The PRx:Bandwidth_Limit command is not available with model ADP300.

The `PRx:Bandwidth_Limit` query returns the upper bandwidth limit setting for the differential probe connected to the specified channel.

Command Syntax

```
<channel>:BWL<upper bandwidth>
<channel>:={PR1, PR2, PR3, PR4}
<upper bandwidth>:={OFF, 20M}
```

Query Syntax

```
<channel>:BWL?
```

Response Format

```
<channel>:BWL <upper bandwidth>
```

Example

The following command sets the upper bandwidth of the ADP305 connected to channel 1 to 20 MHz.

```
CMD$="PR1:BWL 20M": CALL IBWRT(SCOPE%,CMD$)
```

PROBE COUPLING

PRx:COUPLING, PRx:CPL
Command/query

Description

The PRx:COUPLING command selects the coupling mode of the ADP30X probe.

The PRx:COUPLING? query returns the coupling mode of the selected channel.

Command Syntax

```
<channel>:CouPLing<coupling>

<channel>:={PR1, PR2, PR3, PR4}

<coupling>:={DC, GND}
```

Query Syntax

```
<channel>:CouPLing?
```

Response Format

```
<channel>:CPL <coupling>
```

Example

The following command sets the coupling to DC in the ADP30X differential probe connected to channel 2.

```
CMD$=:PR2:CPL DC": CALL IBWRT(SCOPE%,CMD$)
```

PROBE OFFSET

PRx:OFFSET, PRx:OFST
Command/Query

Description

When an ADP30X probe is connected to a channel, the OFFSET command sets the probe offset value.

The maximum range and resolution is determined by the V/DIV setting. If an out-of-range value is entered, the differential probe will set the offset to the closest valid value, and the VAB bit (bit 2) in the STB register will be set.

The OFFSET? query returns the offset voltage of the differential probe connected to the specified channel.

Command Syntax

`<channel>: OFfSeT<offset>`

`<channel>:={PR1, PR2, PR3, PR4}`

ADP305:

`<offset>={-40V to +40V}` for 200 mV/div to 499 mV/div (LC series) or

`={-100V to +100V}` for 200 mV/div to 499 mV/div (LT series) or

`={-100V to +100V}` for 500 mV/div to 9.9 V/div or

`={-1000V to +1000V}` for 10V/div to 99 V/div or

`={-(1400V-4(V/Div setting)) to (1400V-4(V/Div setting))}` for 100 V/div to 350 V/div

ADP300:

`<offset>={-100V to +100V}` for 1 V/div to 9.9 V/div or

`={-1000V to +1000V}` for 10 V/div to 99 V/div or

`={-(1400V-4(V/Div setting)) to (1400V-4(V/Div setting))}` for 100 V/div to 350 V/div

Note: The suffix V is optional

Query Syntax

`<channel>:OFfSeT?`

Response Format

`<channel>:OFST <offset>`

Example

The following command sets the offset at the probe tip of the ADP30X differential probe connected to 1 to 5 volts:

```
CMD$="PR1:OFST 5": CALL IBWRT(SCOPE%,CMD$)
```

PROBE VOLTS/DIV

PRx:VOLT_DIV,PRx:VDIV
Command/Query

Description

The PRx:VOLT_DIV command sets the vertical sensitivity at the ADP30X input. The effective gain of the differential probe is factored into the vertical sensitivity.

The valid range of arguments is fixed by the probe type. If an out-of-range value is entered, the oscilloscope will set the vertical sensitivity to the closest value and set the VAB bit (bit 2) in the STB register.

The PRx:VOLT_DIV? query returns the vertical sensitivity at the probe input of the specified channel.

Command Syntax

<channel>:Volt_DIV <sensitivity>

<channel>:={PR1, PR2, PR3, PR4}

<sensitivity>:={200 mV to 350 V} for the ADP350

<sensitivity>:={1 V to 350 V} for the ADP300

Note: The suffix V is optional

Query Syntax

<channel>:Volt_DIV?

Response Format

<channel>:VDIV <sensitivity>

Example

The following command sets the vertical sensitivity at the probe tip of the ADP30X probe connected to channel 3 to 2 volts/div:

```
CMD$="PR3:VDIV 2":CALL IBWRT(SCOPE%,CMD$)
```

# # #

5 Reference Information

DIFFERENTIAL MODE AND COMMON MODE

Differential amplifiers amplify the voltage difference that appears between the **+** input and **–** input. This voltage is referred to as the Differential Mode or Normal Mode voltage. The voltage component that is referenced to earth and is identical on both inputs is rejected by the amplifier. This voltage is referred to as the Common Mode voltage and can be expressed as:

$$V_{CM} = \frac{V_{+\ Input} + V_{-\ Input}}{2}$$

DIFFERENTIAL MODE RANGE AND COMMON MODE RANGE

Differential Mode range is the maximum signal that can be applied between the **+** and **–** inputs without overloading the amplifier, which otherwise would result in clipping or distorting the waveform measured by the oscilloscope.

The Common Mode Range is the maximum voltage with respect to earth ground that can be applied to either input. Exceeding the common mode range can result in unpredictable measurements. Because the Common Mode signal is normally rejected and not displayed on the oscilloscope, you need to be careful to avoid accidentally exceeding the common mode range.

COMMON MODE REJECTION RATIO

The ideal differential amplifier would amplify only the differential mode voltage component and reject all of the common mode voltage component. Real differential amplifiers are not perfect, so a small portion of the common mode voltage component appears at the output. Common Mode Rejection Ratio (CMRR) is the measure of how well the amplifier rejects the common mode voltage component. CMRR is equal to the differential mode gain (or normal gain) divided by the common mode gain. The common mode gain is equal to the output voltage divided by the input voltage when both inputs are driven by only the common mode signal. CMRR can be expressed as a ratio (e.g., 10 000:1) or implicitly in dB (e.g., 80 dB). The higher the number the greater the rejection the better the performance.

The first order term that determines the CMRR is the relative gain matching between the **+** and **–** input paths. To obtain high CMRR

values, the input attenuators in a differential amplifier are precisely matched to each other. This matching includes the DC attenuation as well as the capacitance that determines the AC attenuation. As the frequency of the common mode component increases, the effects of stray parasitic capacitance and inductance in determining the AC component becomes more pronounced. The CMRR becomes smaller as the frequency increases. Hence, the CMRR is usually specified in a graph of CMRR versus common mode frequency.

The common mode frequency in these graphs is assumed to be sinusoidal. In real life applications, the common mode signal is seldom a pure sine wave. Signals with pulse wave shapes contain frequency components much higher than the repetition rate may suggest. As such, it is very difficult to predict actual performance in the application for CMRR versus frequency graphs. The practical application of these graphs is to compare the relative common mode rejection performance between different amplifiers.

# # #

6 Care and Maintenance

CLEANING

The exterior of the probe and cable should be cleaned using only a soft cloth lightly moistened with water or isopropyl alcohol. The use of abrasive agents, strong detergents, or other solvents may damage the probe. Always ensure that the input leads are free of debris.

Note

The probe case is not sealed and should never be immersed in any fluid.

CALIBRATION INTERVAL

This probe has no adjustments. The recommended calibration interval is one year. (A Performance Verification Procedure is included in this manual.)

SERVICE STRATEGY

The ADP30X series probes utilize fine-pitch surface mount devices. It is, therefore, impractical to attempt repair in the field. Defective probes must be returned to a LeCroy service facility for diagnosis and exchange. A defective probe under warranty will be replaced with a factory refurbished probe. A probe that is not under warranty can be exchanged for a factory refurbished probe for a modest fee. You must return the defective probe in order to receive credit for the probe core.

TROUBLESHOOTING

If the probe is not operating properly the problem may be the way in which it is used. Before assuming that the probe is defective, perform the following troubleshooting procedures:

1. Verify that you are using it on a LeCroy oscilloscope with firmware version 8.5 or higher. The current firmware version of your oscilloscope can be verified by pressing **SCOPE STATUS**, then selecting the **System** menu option.
2. Waveform is inverted. — Make sure that the **+** lead (Red) is connected to the proper test point.
3. No DC. — Make sure that the attachment accessory is completely plugged onto the lead.

4. No output signal. — Make sure that **DC** coupling is selected in the "COUPLING" menu.

RETURNING A DEFECTIVE PROBE

The procedure for returning a defective probe is as follows:

Contact your local LeCroy sales representative to find out where to return the product. All returned products should be identified by model number and serial number. Provide your name and contact number and, if possible, describe the defect or failure. In case of products returned to the factory, a Return Authorization Number (RAN) should be used. The RAN can be obtained from your nearest LeCroy office or the New York Customer Care Center.

Return shipment should be made prepaid. LeCroy cannot accept COD or Collect Return shipments. We recommend shipping by air freight. It is important that the RAN be clearly shown on the outside of the shipping package for prompt forwarding to the appropriate department.

1. Contact your local LeCroy sales or service representative to obtain a Return Authorization Number.
2. Remove all accessories from the probe. Do not include the manual.
3. Pack the probe in its case. Surround the probe with its original packing material (or equivalent) and box.
4. Label the case with a tag containing
   - The RAN
   - Name and address of the owner
   - Probe model and serial number
   - Description of failure
5. Pack the probe case in a cardboard shipping box with adequate padding to avoid damage in transit.
6. Mark the outside of the box with the shipping address given to you by the LeCroy representative; be sure to add the following:
   - ATTN: <RAN assigned by the LeCroy representative>
   - FRAGILE
7. Insure the item for the replacement cost of the probe.
8. Ship the package to the appropriate address.

REPLACEMENT PARTS

The probe connection accessories and other common parts can be ordered through the regional customer care centers. Refer to the list below for LeCroy part numbers. Defective probes can be replaced on an exchange basis. Replacement probes are factory repaired, inspected, and calibrated to the same standards as a new product. In order to obtain a replacement probe, you must return the defective probe. The returned probe should be sent back to the regional customer care center without any accessories, manual, or case.

Item	LeCroy P/N	Alternate P/N
ADP300 Exchange Unit	FADP300	
ADP305 Exchange Unit	FADP305	
Instruction Manual	ADP30X-OM-E	
Soft Carrying Case	SAC-01	
Plunger Hook Clips	PK30X-1	Mueller: BU-20431-2 (Red) Mueller: BU-20431-6 (Blue)
Safety Alligator Clips	PK30X-2	Mueller: BU-656-2 (Red) Mueller: BU-656-6 (Blue)
Plunger Jaw Clips	PK30X-3	Mueller: BU-20434-2 (Red) Mueller: BU-20434-6 (Blue)
Plunger Clamp Clips	PK30X-4	Mueller: BU-20433-2 (Red) Mueller: BU-20433-6 (Blue)
Safety Spade Terminals	PK30X-5	Mueller: BU-30214-2 (Red) Mueller: BU-30214-6 (Blue)

Supplier of alternate accessories:

Mueller Electric Co.
1583 East 31st Street
Cleveland, OH 44114
Phone: 216-771-5225 or 800-955-2629
Fax: 216-771-3068
www.muellerelectric.com

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7 Functional Test

This procedure should be performed to confirm the basic operation of the probe, or to aid in determining the source of a problem, rather than to verify the accuracy of the probe. You can perform the Functional Test without removing the probe covers.

TEST EQUIPMENT REQUIRED

Other than a LeCroy oscilloscope with firmware 8.5 or higher, no special test equipment is required for the functional test.

TEST PROCEDURE

1. Connect the ADP300 or ADP305 to any vertical channel on the oscilloscope.
2. Select the channel to which the probe is connected.
3. Press the **AUTO ZERO** button in the user interface menu.
4. If necessary, adjust the **OFFSET** to 0.000 V.
5. Using accessory clips, attach the **Red** clip to the + CAL out and the **Blue** clip to the ground post of the CAL out signal. For oscilloscopes with the CAL signal on a BNC connector, a BNC-to-Banana adapter (e.g., Pomona model 1296) may be used.
6. Press **AUTOSETUP**.
7. Set the sensitivity of the probe to 1 V/div.
8. Set the CAL output to 1 V_{p-p} square wave.
9. Verify that the displayed square wave is 1 V_{p-p} centered at +0.5 V.
10. Reverse the accessory leads on CAL out and verify that the displayed square wave is still 1 V, but is now centered at –0.5V.
11. Change the **COUPLING** on the user interface menu to **Grounded** to verify that the signal disappears and that the trace is still centered on the screen.
12. Verify that the probe attenuation shows X100.
13. Set the **VOLTS/DIV** to 100 V.
14. Verify that the probe attenuation now shows X1K.

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8 Performance Verification

This procedure can be used to verify the warranted characteristics of the ADP30X series Active Differential Probes.

If the product does not meet specifications, it should be returned to a LeCroy service center. There are no user accessible adjustments, so there is no adjustment procedure.

TEST EQUIPMENT REQUIRED

Table 8–1 lists the test equipment and accessories (or their equivalents) that are required for performance verification of the ADP30X Active Differential probe.

This procedure is designed to minimize the number of calibrated test instruments required.

Table 8–1. List of Required Equipment

Description	Minimum Requirements	Test Equipment Examples
Digital Multimeter	**DC: 0.1% Accuracy** **AC: 0.2% accuracy** to measure 700 mV at 70 Hz	Agilent Technologies 34401A or Fluke 8842A-09 or Keithley 2001
Function Generator	Sine Wave output waveforms 20 V_{p-p}	Agilent Technologies 33120A or Stanford Research Model DS340 or Leader LAG-120B
BNC Coaxial Cable	Male-to-Male 50?? ?Cable	Pomona 5697-36
Calibration Fixture	ProBus Extender Cable	LeCroy PROBUS-CF01
Banana Plug Adapter	Female BNC-to-Dual Banana Plug	Pomona 1269 or Mueller BU-00260
Insulated Banana Plug Insulated Banana Couplers (2)	Insulated BNC-to-Shrouded Banana Plug	Mueller BU-5671-B-12-0 Mueller BU-32601-2 (Red) Mueller BU-32601-6 (Blue)

Only the parameters listed in **boldface** in the "Minimum requirements" column must be calibrated to the accuracy indicated.

Because the input and output connector types may vary on different brands and models of test instruments, additional adapters or cables may be required.

PRELIMINARY PROCEDURE

1. Connect the ADP30X under test to the female end of the ProBus Extension Cable. Connect the male end of the ProBus Extension Cable to any channel of the oscilloscope.
2. Turn the oscilloscope on and allow at least 30 minutes warm-up time before performing the Certification Procedure.
3. Turn on the other test equipment and allow these to warm up for the time recommended by the manufacturer.
4. While the instruments are reaching operating temperature, make a photocopy of the Performance Verification Test Record (located in Appendix A), and fill in the necessary data.

PROCEDURE

1. Set the function generator to sine wave, 70 Hz, and an output voltage of approximately 7.00 V rms (into a high impedance output).
2. Set the DMM to measure AC Volts.
3. Connect the function generator output to the DMM, using a BNC cable and a female BNC to dual banana plug adapter.
4. Adjust the function generator output voltage until the DMM reads 7.000 V ±0.01 V.
5. Record the DMM reading to 1 mV resolution in the Test Record.
6. Disconnect the BNC cable from the function generator and from the BNC-to-banana plug adapter on the DMM. (Leave the banana plug adapter connected to the DMM).
7. Connect the BNC connector from the probe under test to the BNC-to-banana plug adapter on the DMM.
8. Connect the insulated banana plug adapter to the function generator.
9. Using the insulated banana couplers, connect the positive lead (**Red**) of the probe under test to the positive output of the BNC-to-banana plug adapter and the negative lead (**Blue**) to the negative or return output.
10. Set the oscilloscope scale factor to 20 V/div.

11. Record the DMM reading to 0.01 mV resolution in the Test Record.
12. Multiply the measured output voltage recorded in step 11 by 1000 and divide this number by the function generator output voltage (probe input voltage) recorded in step 5. Subtract 1 from this number and multiply the result by 100 to get the error in percent:

$$\%Error = \left(\frac{1000 \times MeasuredOutputVoltage}{InputVoltage} - 1\right) \times 100$$

13. Record the answer to two significant places (±x.xx%) on line 13 in the Test Record.
14. Verify that the error ≤ 1.00%.
15. Decrease the oscilloscope scale factor to 5 V/div.
16. Record the DMM reading to 0.01 mV resolution in the Test Record.
17. Multiply the measured output voltage recorded in step 16 by 100 and divide this number by the function generator output voltage (probe input voltage) recorded in step 5. Subtract 1 from this number and multiply the result by 100 to get the error in percent.

$$\%Error = \left(\frac{100 \times MeasuredOutputVoltage}{InputVoltage} - 1\right) \times 100$$

18. Record the answer to two significant places (±x.xx%) on line 18 in the Test Record.
19. Verify that the error is ≤ 2.00%.

This completes the Performance Verification Procedure. Complete and file the Test Record, as required to support your internal calibration procedure. If the criteria in steps 14 or 19 are not met, contact your local LeCroy service center.

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9 Specifications

NOMINAL CHARACTERISTICS

Nominal characteristics describe parameters and attributes that are guaranteed by design, but do not have associated tolerances.

Sensitivity:	
ADP300	1 V/div to 350 V/div
ADP305	200 mV/div to 350 V/div
Input Configuration	True Differential, + and – inputs
Maximum Input Voltage (Figure 9–1)	1000 V rms, either input to ground, CAT III. 1400 Vp, between inputs
Output Configuration	Single ended, Ground referenced
Intended Output Load	1 M?
Output Connector	ProBus
Input Attenuation	?100 or ?1000
Bandwidth Limit Filter (ADP305 only)	20 MHz
Interface	ProBus
Oscilloscope Compatibility	LeCroy oscilloscope with firmware version 8.5 or higher. (Not available for 9300 series oscilloscopes)

WARRANTED CHARACTERISTICS

Warranted characteristics are parameters with guaranteed performance. Unless otherwise noted, tests are provided in the "Performance Verification Procedure" for all warranted specifications.

Low Frequency Accuracy (probe only)	?1% of reading (?1000 Atten) ?2% of reading (?100 Atten)

TYPICAL CHARACTERISTICS

Typical characteristics are parameters with no guaranteed performance. Tests for typical characteristics are not provided in the "Performance Verification Procedure."

Bandwidth:	
ADP300	20 MHz
ADP305	100 MHz
Rise Time:	
ADP300	< 17.5 ns
ADP305	< 3.5 ns
Slew Rate, referenced to input:	
ADP300	60 000 V/? s
ADP305	300 000 V/? s
AC Noise	< 50 mV rms
Common Mode Rejection (Figure 9–2):	
50 Hz / 60 Hz	80 dB (10 000:1)
100 kHz	50 dB (300:1)
Input Impedance	4 M? ?|| 8 pF either input to ground
Propagation Delay	20 ns

ENVIRONMENTAL CHARACTERISTICS

Temperature, operating	0 °C to 50 °C (32 to 122 °F)
Usage	Indoor
Relative Humidity	80% max. up to 31 °C, decreasing linearly to 40% max. at 50 °C
Altitude	4600 m (15 090 ft) max. at 25 °C

PHYSICAL CHARACTERISTICS

Weight	300 g
Overall Length	2 m
Input Lead Length	40 cm

COMPLIANCE AND CERTIFICATIONS

CE Declaration of Conformity

The Oscilloscope meets requirements of the EMC Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety.

EMC Directive:	EN 61326-1:1997+Amd1:1998 EMC requirements for electrical equipment for measurement, control, and laboratory use.	
Electromagnetic Emission:	EN 55011:1998, Group 1, Class B Radiated and conducted emissions	
Electromagnetic Immunity:	EN 61000-4-2:1995*	Electrostatic Discharge (4 kV/8 kV contact/air)
	EN 61000-4-3:1996*	RF-Radiated Electromagnetic Field (3 V/m)
	EN 61000-4-4:1995*	Electrical Fast Transient/ Burst (1 kV - I/O signals)
	EN 61000-4-6:1996*	RF Conducted Electro-magnetic Field (3 V - I/O signals)

*Meets Performance Criteria “B” limits at certain test levels, during the disturbance, product undergoes a temporary degradation or loss of function of performance which is self recoverable.

Low Voltage Directive:	EN 61010-1:1993+Amd2:1995 Safety Requirements for electrical equipment for measurement, control and laboratory use Part 1: General Requirements Part 2-031: Particular requirements for hand-held probe assemblies for electrical measurement and test The probe has been qualified to the following EN 61010-1 category: 1000 V Installation (Over-voltage) Category III Pollution Degree 2

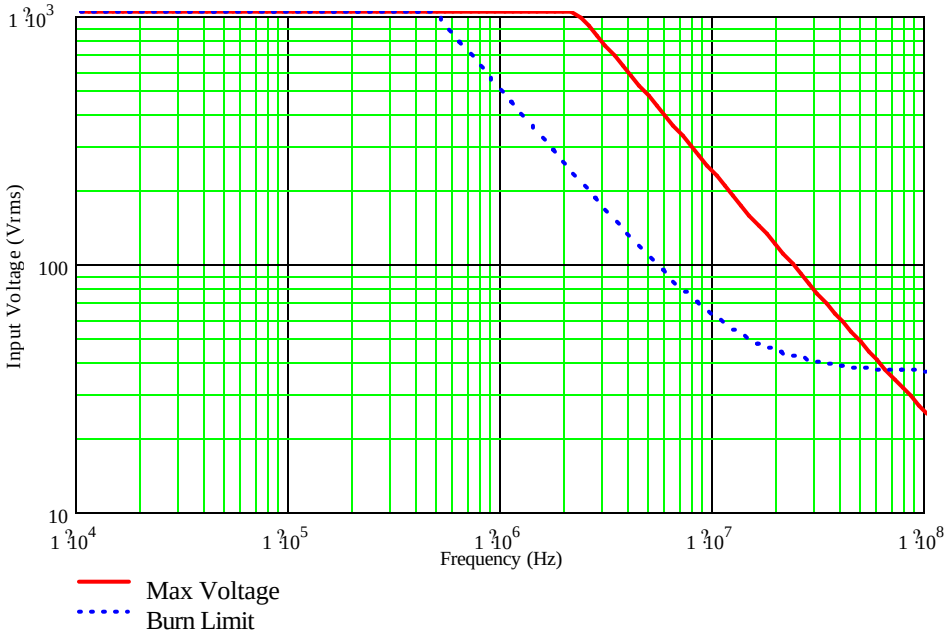

Figure 9–1. Input Voltage & Burn Limit vs. Frequency

Note

The voltage derating curve provides the maximum voltage that can be applied to the probe inputs without risking damage to the probe.

The Burn Limit is the voltage limit that should be used when the input leads are being hand-held. This limit is derived using the methodology described in EN 61010-1 section 6.3.1.2.

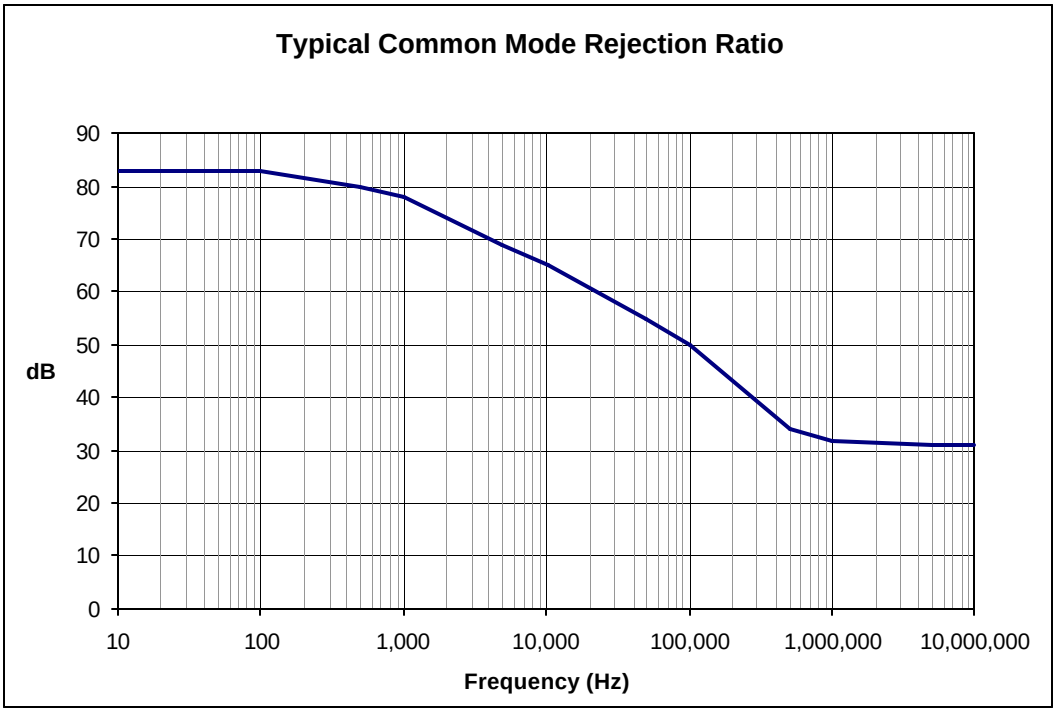

Figure 9–2. Typical CMRR vs. Frequency

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Appendix B

SAC-01 MOUNTING INSTRUCTIONS

Instructions for mounting the SAC-01 Oscilloscope Accessory Case onto your LC or LT series oscilloscope.

1. Wipe the top surface of the oscilloscope with a clean cloth moistened with isopropyl alcohol and allow it to dry. The surface should be clean and free of any lubricant.
2. Position the pouch on top of the oscilloscope. Verify that there is enough clearance for the swing-up handle.
3. Peel off the paper backing from the top of the hook-and-loop strips.
4. Press the pouch firmly against the top surface of the oscilloscope, in the position determined in step 2.
5. Open the pouch and use a small roller to squeeze out any air bubbles from under the hook-and-loop strips.
6. Allow the adhesive to cure for 24 hours before standing the oscilloscope up on end.

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Appendix A

PERFORMANCE VERIFICATION TEST RECORD

This record can be used to record the results of measurements made during the performance verification of the ADP300/ADP305 Active Differential Probe.

Photocopy this page and record the results on the copy. File the completed record, as required by applicable internal quality procedures.

The test record corresponds to the parameters tested in the performance verification procedure. The numbers preceding the individual data records correspond to the steps in the procedure that require the recording of data. Results to be recorded in the column labeled "Test Result" are the actual specification limit checks. Test limits are included in all of these steps.

Other measurements, and the results of intermediate calculations that support the limit check, are to be recorded in the column labeled "Intermediate Results".

Permission is granted to reproduce these pages for the purpose of recording test results.

Model: _____

Serial Number: _____

Asset or Tracking Number: _____

Date: _____

Technician: _____

Equipment Used:

	MODEL	SERIAL NUMBER	CALIBRATION DUE DATE
OSCILLOSCOPE			
DIGITAL MULTIMETER			
FUNCTION GENERATOR[1]			**N/A**

[1]The function generator used in this Performance Verification Procedure is used for making relative measurements. The output of the generator is measured with a DMM or oscilloscope in this procedure. Thus, the generator is not required to be calibrated.

ADP300/ADP305 TEST RECORD

Step	Description	Intermediate data	Test Result
Gain Accuracy			
5	Function Generator Output Voltage	_____ V	
11	Probe Output Voltage	_____ V	
13	?1000 Gain Error (Test limit ±1%)		_____%
16	Probe Output Voltage	_____ V	
18	?100 Gain Error (Test limit ±2%)		_____%

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