INSTRUCTION MANUAL

ACTIVE LOOP ANTENNA

MODEL ALR-30A

9 kHz – 30 MHz

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ELECTRO-METRICS

MODEL ALR-30A

SERIAL NO: N/A

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WARRANTY

This Model ALP-30A Active Loop Antenna is warranted for a period of 12 months (USA only) from date of shipment against defective materials and workmanship. This warranty is limited to the repair of or replacement of defective parts and is void if unauthorized repair or modification is attempted. Repairs for damage due to misuse or abnormal operating conditions will be performed at the factory and will be billed at our commercial hourly rates. Our estimate will be provided before the work is started.

DESCRIPTION AND USE ELECTRO-METRICS MODEL ALR-30A ACTIVE LOOP ANTENNA

1.0 Introduction

The Electro-Metrics Model ALR-30A is an active broadband loop antenna operating from 9 kHz to 30 MHz and is specifically designed to perform three meter VDE 0871 Limit B magnetic emissions testing. It is also suitable for FCC Part 15 and 18 testing plus SAE and other government and commercial standards.

The loop has a diameter of 43.2 cm (17") and is fastened to a square base. The loop and base are made of aluminum. The base of the antenna contains a preamplifier that matches the low impedance of the loop to the 50-ohm impedance of most receivers (e.g., the Electro-Metrics Model EMC-30 Analyzer/Receiver) plus a battery operated power supply and battery charge circuit.

Power is supplied by rechargeable sealed lead acid batteries that are recharged using an internal battery charger. The nominal operating time on a fully charged battery is 4 hours while the battery charging time is approximately 12 hours.

The controls--indicators--connectors located on the base of the antenna include:

a. Power Switch,

b. Power Indicator (red LED),

c. Overload Indicator (red LED),

d. AC Input Connector,

e. BNC (female) Output Connector.

The bottom of the base has a 5/8-20 threaded receptacle for mounting to the Model TRI-136 Tripod.

2.0 Specifications

2.1 Electrical

Frequency Range:	9 kHz to 30 MHz.
(Antenna Factor Graph furnished with each antenna.)	
Dynamic Range:	85 dB at 10 kHz. 125 dB at 1 MHz.
Sensitivity:	50 dB(µV/m) at 10 kHz. -1 dB(µA/m) at 10 kHz.

		10 dB(µV/m) at 1 MHz. -41 dB(µA/m) at 1 MHz.

(At 200 Hz bandwidth and Average detector function on receiver.)

1 dB compression Point:		5 V/m, 13 mA/m.
Input Impedance:		50Ω nominal.
Power Source:		18 V rechargeable battery (sealed lead acid).
Operating Time:		Nominal 4 hours
Recharge Time:		Nominal 12 hours.
Connector:		Type BNC.

2.2 Mechanical

Loop Diameter:		432 mm (17").
Base Dimensions:	Height: Width: Depth:	102 mm (4"). 232 mm (9.1"). 181 mm (7.1").
Height (overall):		552 mm (21.8"). (Base + Loop Diameter)
Weight:		3.3 kg (7.25 lbs).

3.0 ALR-30A Description

The ALR-30A consists of an approximate 0.5-meter (17-inch) loop mounted onto a rectangular base containing the active circuitry and rechargeable battery plus charging circuit.

3.1 Power Switch

Type: Two position toggle switch.

Function: Turns on DC regulator circuit to supply +15 VDC for the antenna active circuitry.

3.2 Power Indicator

Type: LED.

Color: Amber.

Location: Above power switch.

Function: To indicate that the loop preamplifier is activated and functional.

Whenever the battery voltage has decreased to the point that recharging is required, the LED will be extinguished. At this point all the active circuitry is disabled and no measurements can be made until the battery is recharged.

Battery recharging should be initiated as soon as possible after the Power Indicator LED is extinguished. Failure to do so could compromise the useful life of the battery.

3.3 Overload Indicator

Type: LED.

Color: Amber.

Function: To indicate when the input signal intensity exceeds the 1 dB compression level of 5 V/m.

3.4 AC Input Connector

Type: Combined voltage selector and fuse holder.

Function: Self-explanatory.

3.5 Signal Out Connector

Type: BNC (female).

Function: To connect the RF Output of the ALR-30A to the RF INPUT Connector of a 50Ω input instrument.

4.0 Theory Of Operation

4.1 Amplifier

Magnetic field signals are intercepted by the 0.5-meter loop antenna and coupled to an amplifier circuit that matches the low impedance of the loop to the 50Ω impedance of most analyzers/receivers.

4.2 Battery/Charger/Regulator Circuitry

The battery supplies the operating voltage for the active circuitry of the ALR-30A. When the Power Switch is in the ON position, the output of the battery is connected to the Cutoff/Monitor and Regulator circuits. If the battery voltage is a minimum of +15.5 VDC, a transistor switch will be biased by a zener diode to turn on the "POWER" LED giving a visual indication that the battery charge level is sufficient to operate the antenna. Another transistor switch is biased to turn on the regulator circuitry. The conduction of a series pass transistor is controlled by a feedback network. A potentiometer is adjusted for a regulated +15 VDC output to the active circuitry. Whenever the battery voltage goes below +15.5 VDC, the transistor switches turn off the "POWER" LED (indicating the need for recharging the battery) and the regulator circuit.

To recharge the internal battery, the ALR-30A is connected to the selected AC power source that automatically disconnects the battery power from the amplifier and regulator circuits. This is accomplished by a relay within the charger circuitry.

NOTE: **1) The position of the power switch has <u>NO EFFECT</u> on the operation of the charger circuit.**

2. The ALR-30A will not operate when connected to an AC power source.

A transformer steps down the input AC line voltage that is then rectified and filtered. A constant voltage charge circuit is used to supply a constant voltage for charging the battery. A zener diode functions as a current limiter for a series-pass transistor, while additional resistors and diodes serve as a feedback network. A potentiometer is used to adjust the level of the charge voltage.

5.0 Operating Procedure

5.1 Recharging Battery

a. AC power sources:

1) 105-130 VAC, 50-60 Hz.

2) 210-260 VAC, 50-60 Hz.

5.1.1 Power Source Selector

The Power Source Selector is incorporated as part of the power input connector. The number visible in the window indicates the nominal AC power source for which the receiver is set. To change the power source setting:

a. Remove the power cord from the connector plug.

b. Pull the handle marked **FUSE PULL** and remove the fuse.

c. Push the handle up and gently pull the printed circuit voltage selector card from its slot.

d. Orient the card so that the desired operating voltage appears on the bottom-left side.

e. Firmly push the voltage selector card back into its slot.

f. Push the **FUSE PULL** handle down and install the correct rating fuse.

g. Reconnect the AC power cord to the connector.

CAUTION

Verify that the Power Source Selector setting corresponds to the AC power source being used. Operation on "220" VAC with the module set for "110" VAC can cause extensive circuit damage.

5.1.2 Fuse Specifications

The ALR-30A uses the following fuses:

a. 115 VAC operation: 0.25 AMP 3AG SLO-BLO.

b. 230 VAC operation: 0.125 AMP 3AG SLO-BLO.

5.1.3 Battery Recharging Procedure

a. Connect the ALR-30A to the selected AC power source.

b. Leave the unit connected to the AC power source for a minimum of 12 hours before operating the antenna.

5.2 Antenna Set-Up Procedure

a. Mount the antenna base to the Model TRP-136 Tripod. The antenna base is secured to the tripod by screwing it in a clockwise direction, as viewed from above.

5.3 Electrical Connections

a. Connect the 7.6 m (25-foot) coaxial cable from the "Signal Out" BNC Connector on the antenna base to the "RF Input" TNC Connector on the EMC-30 front panel or equivalent 50-ohm instrument.

NOTE: **The internal circuitry of the ALR-30A Is designed to operate only with the internal battery. THE ALR-30A WILL NOT OPERATE CONNECTED TO AN AC POWER SOURCE.**

5.3.1 CHECKOUT

NOTE: **The following procedure can be performed using any similar 50-ohm receiver. The EMC-30 is used as an example.**

a. Turn "ON" the EMC-30.

b. Set the EMC-30 front panel controls as follows:

DETECTOR.....PEAK
BANDWIDTH.....WIDE BAND
position of the frequency range selected.
ATTENUATION Setting.....20 dB
FREQUENCY RANGE.....9 kHz-35 kHz.
(Frequency Range 1)
FREQUENCY INDICATION.....0.022 MHz.
Mid-range frequency point of Frequency Range 1.

c. With the EMC-30 set to RF Frequency Range 1 (9 kHz-35 kHz), turn on the ALR-30A and note an increase in the noise level on the front panel digital meter of the EMC-30.

6.0 ALR-30A Calibration Information

6.1 Calibration Data Usage

a. ELECTRIC FIELD STRENGTH

In order to calculate the Electric Field Strength of a detected signal, the following equation is used:

ELECTRIC FIELD STRENGTH	=	SIGNAL LEVEL	+	CABLE LOSS	+	ELECTRIC ANTENNA FACTOR
[dB(µV/m)]		[dB(µV)]		(dB)		(dB/m)

b. MAGNETIC FIELD STRENGTH

In order to calculate the Magnetic Field Strength of a detected signal, the following equation is used:

MAGNETIC FIELD STRENGTH	=	SIGNAL LEVEL	+	CABLE LOSS	+	MAGNETIC ANTENNA FACTOR
[dB(µA/m)]		[dB(µV)]		(dB)		(dB/Sm-1)

NOTE: Both signal level and cable loss must be measured.

6.2 Calibration Method

Loop antennas are calibrated using the IEEE Std-302 Induction-Field Method of Calibration. The test geometry is shown in Figure 3.

The antenna factor (dB/m) is the difference between the field strength [dB(µV/m)] at the antenna and the voltage [dB(µV)] at the terminals of the antenna. By determining each of these values, the antenna factor is calculated. The antenna factor of the loop can be used to measure the field strength at any distance from an object being tested.

FIGURE 1

ANTENNA FACTORS

MAGNETIC & ELECTRIC

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ACTIVE LOOP ANTENNA

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