■ FAULT MAPPER PRO® GRAPHICAL TDR

CA7027

Graphical TDR

Vp=78% Z=50Ω

237ft

TEST / ▼   TDR / •)))

☼   ⏻

FAULT MAPPER PRO®
MODEL CA7027

AEMC® INSTRUMENTS

ENGLISH   **User Manual**

AEMC®
INSTRUMENTS
CHAUVIN ARNOUX GROUP

Find Quality Products Online at: www.**GlobalTestSupply**.com   sales@GlobalTestSupply.com

Statement of Compliance

Chauvin Arnoux®, Inc. d.b.a. AEMC® Instruments certifies that this instrument has been calibrated using standards and instruments traceable to international standards.

We guarantee that at the time of shipping your instrument has met its published specifications.

The recommended calibration interval for this instrument is 12 months and begins on the date of receipt by the customer. For recalibration, please use our calibration services. Refer to our

Serial #: _____

Catalog #: 2127.84

Model #: CA7027

Please fill in the appropriate date as indicated:

Date Received: _____

Date Calibration Due: _____

AEMC® INSTRUMENTS
CHAUVIN ARNOUX GROUP

Table of Contents

INTRODUCTION

<div style="border:1px solid black;">

⚠ **Warning** ⚠

- This instrument meets the safety requirements of IEC61010-1

- The Model CA7027 is designed for use on de-energized circuits only.

- Connection to line voltages will damage the instrument and could be hazardous to the operator.

- This instrument is protected against connection to telecom network voltages according to EN61326-1.

- Safety is the responsibility of the operator.

</div>

1.1   International Electrical Symbols

Symbol	Description
▣	Signifies that the instrument is protected by double or reinforced insulation.
⚠	**CAUTION - Risk of Danger!** Indicates a WARNING and that the operator must refer to the user manual for instructions before operating the instrument in all cases where this symbol is marked.
⚡	Risk of electric shock. The voltage at the parts marked with this symbol may be dangerous.
CE	Compliance with the Low Voltage & Electromagnetic Compatibility European directives (73/23/CEE & 89/336/CEE).
⌧	In the European Union, this product is subject to a separate collection system for recycling electrical and electronic components In accordance with directive WEEE 2002/96/EC.

1.2 Receiving Your Shipment

Upon receiving your shipment, make sure that the contents are consistent with the packing list. Notify your distributor of any missing items. If the equipment appears to be damaged, file a claim immediately with the carrier and notify your distributor at once, giving a detailed description of any damage. Save the damaged packing container to substantiate your claim.

1.3 Ordering Information

Fault Mapper Pro® Model CA7027 ....**Cat. #2127.84**
Includes carrying case, 4mm color-coded banana plugs with alligator clips, 4x1.5V AA batteries, set of 2 color-coded 4 ft red/black leads, user manual and product warranty card.

1.3.1 Accessories and Replacement Parts

Lead - Replacement set of 2, Color-coded 4 ft (Red/Black), Test Probes & Alligator Clips ....**Cat. #2152.01**

PRODUCT FEATURES

2.1   Description

The Fault Mapper Pro® is a hand-held graphical TDR (Time Domain Reflectometer) designed for identifying and locating faults on power and communication cables, given access to one end only.

The Fault Mapper Pro® measures cable length and indicates the length and distance to cable faults to a range of 9 ft (3m) to 19,000 ft (6000m) on virtually any type of cable. It injects a series of pulses into the cable under test. The velocity at which the pulses travel is determined by the type of cable, which is known as the velocity of propagation (Vp) of the cable. The Velocity of Propagation (Vp) is adjustable between 1% and 99% enabling accurate calibration to the cable under test.

The Vp value is expressed as a percentage of the speed of light (e.g. 67% or ft/mtrs/micro-second), this value will vary according to the type of cable under test. The Fault Mapper Pro® can accept user selectable values between 1 and 99% (or the equivalent value in feet or meters per micro-second).

Based on the selected Vp and the time taken for the pulses to travel through the cable, a reflection profile of the cable under test is displayed. An adjustable cursor assists in locating faults and termination.

The Fault Mapper Pro® incorporates an oscillating tone tracer, which is detectable with a standard tone tracer, for use in the tracing and identification of cable pairs.

2.2   Key Features:
- Vp Setting
- Hand-held graphical TDR (Time Domain Reflectometer)
- Measures cable length and indicates distance to faults to a range of 19,000 ft (6000m)
- Graphical LCD
- Easy identification of short range faults
- Emits an audible tone, used to trace and identify the type of fault

2.3   Fault Mapper Pro® Features
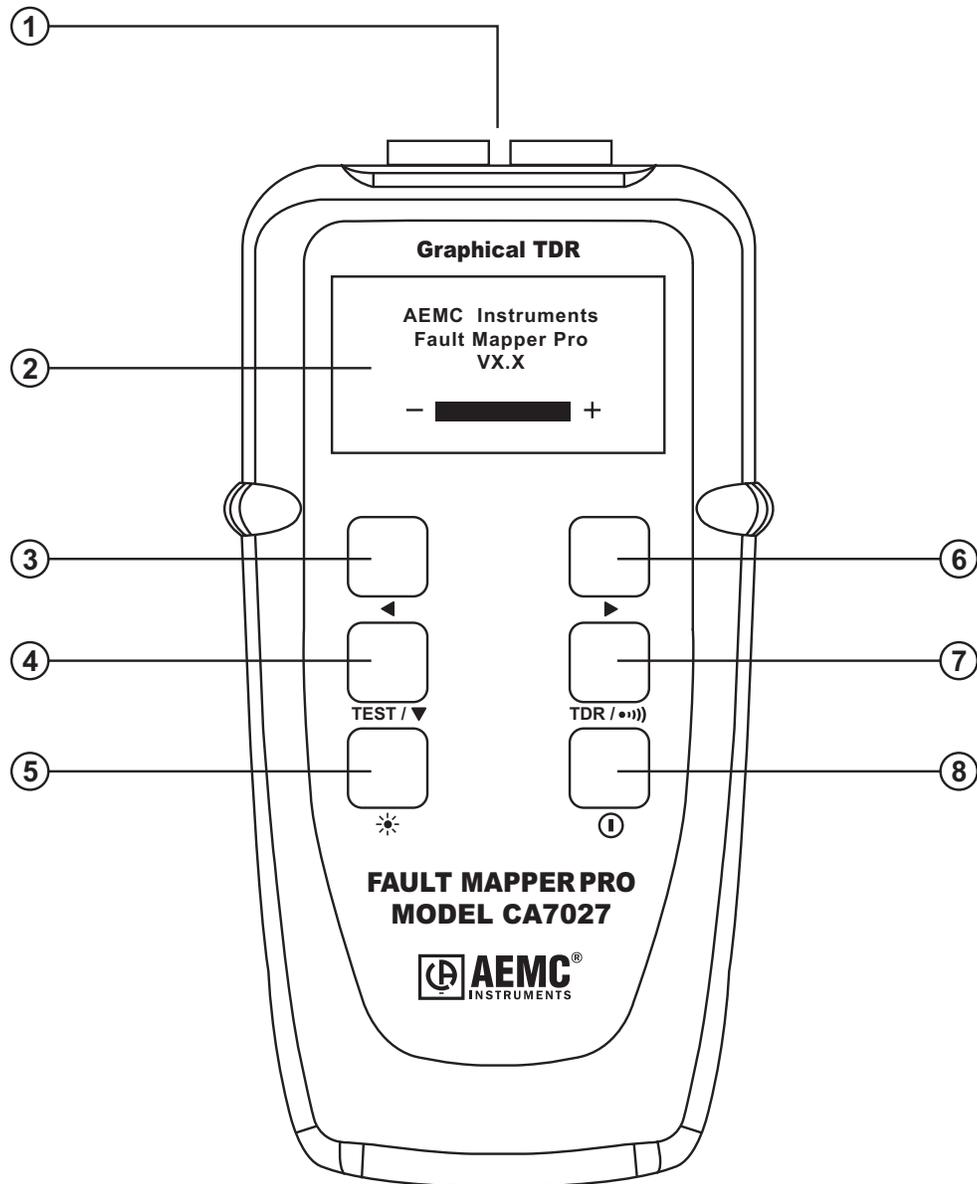
1. Banana plug input (Red/Black)

2. Graphical LCD

3. Cable select and Vp (Velocity of Propagation) decrement button

4. Test/function select button

5. Backlight button

6. Cable select and Vp (Velocity of Propagation) increment button

7. Mode select button (TDR/Tone tracer)

8. Power ON/OFF button

CHAPTER 3

<u>SPECIFICATIONS</u>

MODEL	CA7027
ELECTRICAL	
Ranges @ Vp=70%	23, 49, 98, 197, 394, 820, 1640, 3280, 6560, 9850, 19000 ft
Range Selection	Manual range control
Accuracy*	±1% of range
Resolution	Approximately 1% of selected range
Minimum Cable Length	1.5 ft (0.5m)
Sensitivity	Minimum 3 pixel return on a fault at 4km on 0.6mm 0, PE, TP
Vp (Velocity of Propagation)	Adjustable from 1% to 99%
Output Pulse	+5V peak to peak into an open circuit
Output Impedance	Selectable between 25, 50, 75 & 100Ω
Output Pulse Width	3 ns to 3 ms, Automatic with range
Scan Rate:	2 scans / second or scan held
Tone Generator	Oscillating tone 810Hz to 1110Hz
Voltage Protection	250VAC
Power Supply	4 x 1.5V AA alkaline batteries
Battery Life	60 hours continuous scanning
Auto-off	Selectable 1, 2, 3, 5 minutes or disabled
MECHANICAL	
Dimensions	6.5 x 3.5 x 1.5" (165 x 90 x 37mm)
Weight (with battery)	12oz (350g)
Display Resolution	128 x 64 pixel Graphical LCD
Display Backlight	Electroluminescent
ENVIRONMENTAL	
Operating Temperature	14 to 122°F (-10° to 50°C)
Storage Temperature	-4 to 158°F (-20 to 70°C)
Relative Humidity	5 to 95% RH non-condensing
Altitude	6000 ft (2000m)
SAFETY	
Safety Rating	IEC61010-1; EN60950
Protection Degree	IP54
Electro-Magnetic Compatibility	EN61326-1
CE Approved	Compliant with current EU directives

Measurement accuracy of ±1% assumes the instrument setting for velocity of propagation (Vp) of the cable under test to be accurately set, and homogeneity of the velocity of propagation (Vp) along the cable length. Accurate positioning of the cursor is also required.

**Specifications are subject to change without notice.

3.1   Accuracy

The CA7027 is able to measure distances to faults and cable lengths to an accuracy of ±1%.

This measurement accuracy is based on the correct value of Vp being used for the cable under test, and homogeneity of the Vp along the cable length.

If the Vp is set incorrectly by the operator, or the Vp varies along the length of the cable, then additional errors will be incurred and the measurement accuracy will be affected.

NOTE: The Vp is less well defined with unshielded multicore cable, including power cable, and is lower when a cable is tightly wound on a drum than when installed.

OPERATION

4.1 Principles of Operation

The Fault Mapper Pro® works by measuring the time taken for a signal to travel to the far end of the cable under test, or to an intermediate fault and return. The velocity at which the signal travels Vp (Velocity of Propagation) will depend on the characteristics of the cable.

Based on the selected Vp and the measured travel time of the test pulse, the Fault Mapper Pro® calculates and displays impedance anomalies and their distances along the cable.

4.2 Accuracy and Velocity of Propagation (Vp)

The Fault Mapper Pro® measures distances to faults and cable lengths to an accuracy of ±1%. This measurement accuracy is based upon the correct value of Vp being used for the cable under test, and homogeneity of the Vp along the cable length.

If the Vp is set incorrectly by the operator, or the Vp varies along the length of the cable, then additional errors will be incurred and the measurement accuracy will be affected.

**See § 4.8 for setting the Vp.**

⚠ **NOTE:** The Vp is less well defined with unshielded multi-conductor cable, including power cable, and is lower when a cable is tightly wound on a drum than when it is installed in a linear fashion.

Correct measurement of fault distances is also dependent on the cursor being positioned accurately by the operator. When locating faults with the Fault Mapper Pro® the cursor should be positioned at the beginning of the feature on the cable waveform as shown below.
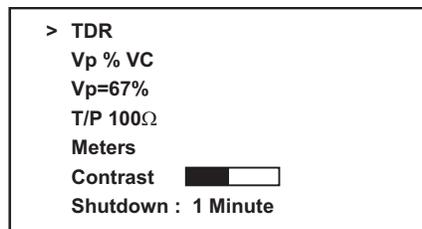
Vp=72%   Z=100Ω

621ft
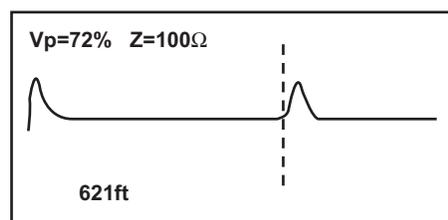
4.3   Getting Started

The instrument is switched on and off using the green power button Ⓘ on the lower right side of the front panel. When the unit is first switched on it will display the opening screen giving the software version, the currently selected Vp (Velocity of Propagation), cable impedance and battery status indicator.

```
        AEMC  Instruments
        Fault Mapper Pro
             VX.X

    −  ████████   +
```
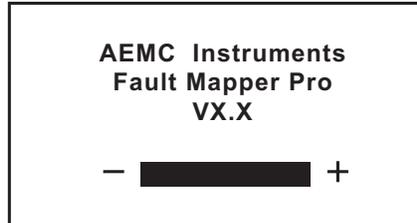
4.4   Set-up Mode

1. Hold down the **TDR / •))** button, then press the **TEST / ▼** button to enter set-up mode.

```
    >  TDR
       Vp % VC
       Vp=67%
       T/P 100Ω
       Meters
       Contrast  ███░░░
       Shutdown :  1 Minute
```

2. The following options can be configured:
    • TDR or Tone Generation
    • Set Vp to % (1 to 99%) or speed in micro-seconds (see § 4.8)
    • Set cable impedance (Z) to 25, 50, 75 or 100Ω Twisted pair (T/P)
    • Set measurement units to Feet or Meters
    • Adjust the display contrast
    • Disable/Enable Auto-off function

3. Press the **TEST / ▼** button to move the line selector (**>**) down the screen.

4. Press the ◄ and ► buttons to change the setting of the line selected.

5. Press **TDR / •))** again to save changes and exit set-up mode.

NOTE: When the Fault Mapper Pro® is turned off, it will retain the current set-up parameters.

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Upon completion of configuring the instrument, a test screen will appear displaying the following information:

- Vp Setting
- Impedance setting (Z)
- Range scale 7 meters
- Battery condition indicator
- Distance of cursor
- Cursor
- Output pulse
- Scan mode icon (indicating scan mode selected)

4.5   Backlight

The LCD display is fitted with an electroluminescent backlight to enable easy viewing under a variety of different lighting conditions. The backlight is switched on and off with the ☀ button.

4.6   Tone Generator

The Fault Mapper Pro® can also be used as a tone generator, to trace and identify cables and wires. This requires a cable tone tracer, purchased separately from an outside vendor.

Pressing the **TDR / •))** button will inject a warbling (oscillating) tone into the cable or link under test. When set, the following will be displayed:

The injected signal oscillates between 810 and 1110Hz, six times per second.

NOTE: The auto-off function is disabled in Tone Generator mode, so that the tone can be injected into a cable for an extended period of time while tracing takes place.

See §4.10 for attaching a cable to the Fault Mapper Pro®.

4.7   Selecting Full Scale Sensitivity

The Fault Mapper Pro® has 11 range scales covering the range of 1.5 to 19,000 ft (0.5 to 6000m).

To select a range scale, or scan the cable run, press and hold down the **TDR / •)))** button, then press the ◄ button to decrease the range or the ► button to increase the range.

4.8   Adjusting the Vp Value

To adjust the Vp, press and hold the **TDR / •)))** button and press the **TEST / ▼** button to enter the setup mode. Release both buttons. Press the **TEST / ▼** button until the pointer (**>**) is next to Vp.

Next use the ◄ and ► buttons to adjust the Vp to scroll between v/2, M/Ms or Vp % UC.

Press the **TDR / •)))** button to exit the set up mode.

4.9   Determining and Measuring Vp Values

Vp, or Velocity of Propagation, values are characteristic of each cable type and brand. The Vp is used to measure the length of a cable and to measure a fault location. The more accurate the Vp, the more accurate the measurement result will be.

The cable manufacturer may list the Vp on their specification sheet or may be able to provide it when asked. Sometimes this value is not readily available, or the user may wish to determine it specifically to compensate for cable batch variations or for special cable applications.

1. Take a cable sample of exact length increments (ft or m) longer than 300 ft (100m).

2. Measure the exact length of the cable using a tape measure.

3. Connect one end of the cable to the Fault Mapper Pro®. Leave the end unterminated and make sure the wires do not short to each other.

4. Measure the length and adjust the Vp until the exact length is displayed.

5. When the exact length is displayed, Vp is established.

4.10   Attaching a Cable to the Fault Mapper Pro®

⚠ **WARNING:** Make sure that there is no power supply or equipment attached to the cable to be tested.

1. Check that the far end of the cable is either open or shorted (not fitted with a resistive termination).

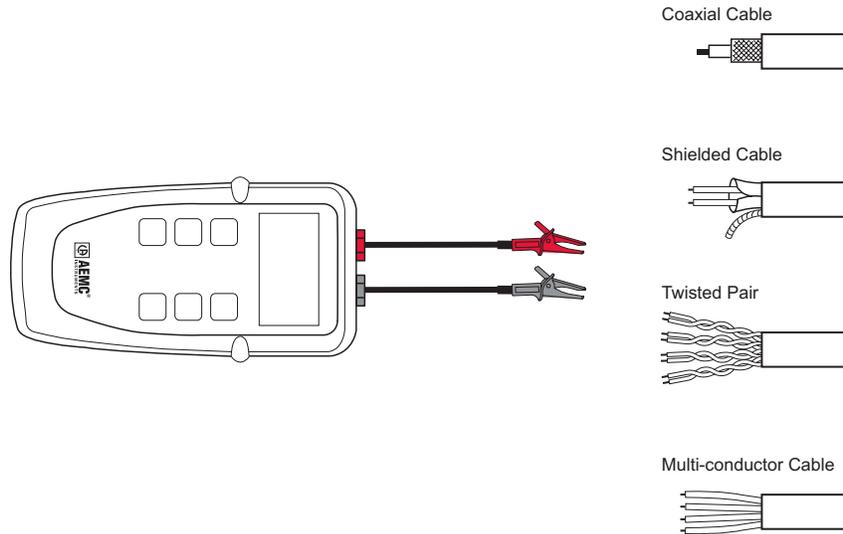2. Attach the Fault Mapper Pro® to one end of the cable to be tested.

The cable attachment is via a banana plug input located at the top of the unit. For unterminated cables use the alligator clip attachment provided.

Coaxial Cable: Connect the **Red clip to the center wire** and the Black clip to the shield/screen.

Shielded Cable: Connect the **Red clip to a wire adjacent to the shield** and the Black clip to the shield.

Twisted Pair: Separate out one pair and connect the red and black clips to the two wires of the pair.

Multi-conductor Cable: Connect the clips to any two wires.

Coaxial Cable
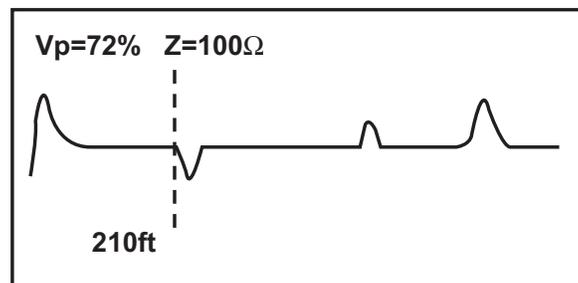
Shielded Cable

Twisted Pair

Multi-conductor Cable

4.11   Testing a Cable

After setting the Vp value and cable impedance (Z) to match the tested cable, attach the Fault Mapper Pro® to the cable, as described in § 4.10.

Press the **TEST / ▼** button, to get to the test screen.

Vp=72%   Z=100Ω

413ft
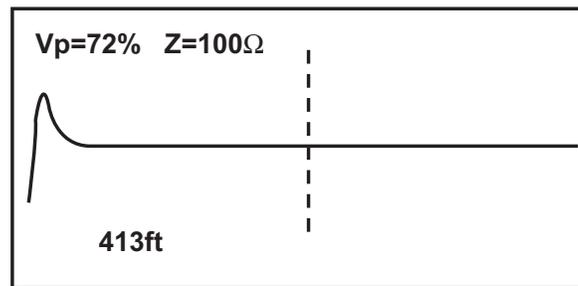
The following display shows a cable with impedance anomalies on it.

Vp=72%   Z=100Ω

210ft

The vertical cursor line is moved left and right along the line of the trace by pressing the ◄ and ► buttons.

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To determine the distance to an event, position the cursor at the beginning of the event and read off the distance as shown below.
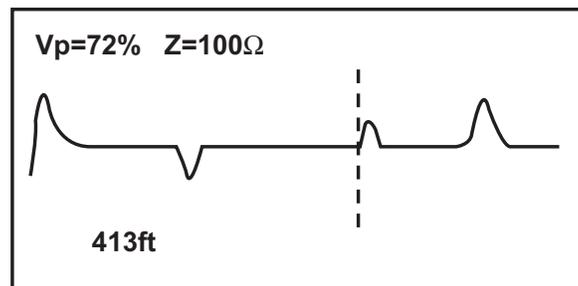
On the fault curve shown in the previous two screens, a low impedance event occurs at 210 ft, shown by a downward spike on the curve, and a high impedance event occurs at 413 ft.

The open end of the cable is shown as a large positive spike This is used to determine the end (length) of the cable.

4.12 Single Shot and Continuous Scanning Modes

When the Fault Mapper Pro® is first switched on, it is set to **"Single Shot"** mode.

In this mode, the Fault Mapper Pro® only fires a pulse into the cable under test when either the ◄ and ► buttons or the **TEST / ▼** button is pressed.

> **Single Shot Mode:** Saves on battery life and also enables the Fault Mapper Pro® to be disconnected from the cable while still leaving the fault display on the screen.

To enter **"Continuous Scanning"** mode press and hold down the **TEST / ▼** button.

The ⬤ icon will appear at the bottom right of the display, when Continuous Scanning mode is active.

> **Continuous Scanning Mode:** Fires pulses into the cable under test at the rate of 6.7 pulses per second. In this mode the Fault Mapper Pro® is able to more easily identify intermittent cable faults.

4.13 Typical Fault Displays

The following table shows typical fault traces to assist you in the identification of faults using the CA7027:

Type	Vp	Z	Type	Vp	Z
Cat5 STP	72	100	T/Pair Jelly PE	64	100
Cat5 UTP	70	100	T/Pair PE	67	100
Coax Air	98	50/75	T/Pair PTFE	71	100
Coax Air Space	94	50/75	T/Pair PVC	58	100
Coax Foam PE	82	50/75	T/Pair Paper 72nF	88	100
Coax Solid PE	67	50/75	T/Pair Paper 83nF	72	100

MAINTENANCE

Use only factory specified replacement parts. AEMC® will not be held responsible for any accident, incident, or malfunction following a repair done other than by its service center or by an approved repair center.

5.1 Changing the Battery

⚠ **Disconnect the instrument from any cable or network link.**

1. Turn the instrument OFF.

2. Loosen the 2 screws and remove the battery compartment cover.

3. Replace the batteries with 4 x 1.5V AA alkaline batteries, observing the polarities.

4. Reattach the battery compartment cover.

5.2 Cleaning

⚠ **Disconnect the instrument from any source of electricity.**

- Use a soft cloth lightly dampened with soapy water.

- Rinse with a damp cloth and then dry with a dry cloth.

- Do not splash water directly on the instrument.

- Do not use alcohol, solvents or hydrocarbons.

5.3 Storage

If the instrument is not used for a period of more than 60 days, it is recommended to remove the batteries and store them separately.

Repair and Calibration

To ensure that your instrument meets factory specifications, we recommend that it be scheduled back to our factory Service Center at one-year intervals for recalibration, or as required by other standards or internal procedures.

For instrument repair and calibration:

You must contact our Service Center for a Customer Service Authorization Number (CSA#). This will ensure that when your instrument arrives, it will be tracked and processed promptly. Please write the CSA# on the outside of the shipping container.

Ship To:

(Or contact your authorized distributor)

Costs for repair and standard calibration are available.

NOTE: You must obtain a CSA# before returning any instrument.

Technical Assistance

If you are experiencing any technical problems, or require any assistance with the proper operation or application of your instrument, please call, fax or e-mail our technical support team:

Contact:

Limited Warranty

The Model CA7027 is warranted to the owner for a period of two years from the date of original purchase against defects in manufacture. This limited warranty is given by AEMC® Instruments, not by the distributor from whom it was purchased. This warranty is void if the unit has been tampered with, abused or if the defect is related to service not performed by AEMC® Instruments.

For full and detailed warranty coverage, please read the Warranty Coverage Information, which is attached to the Warranty Registration Card (if enclosed) or is available at www.aemc.com. Please keep the Warranty Coverage Information with your records.

What AEMC® Instruments will do:

If a malfunction occurs within the warranty period, you may return the instrument to us for repair, provided we have your warranty registration information on file or a proof of purchase. AEMC® Instruments will, at its option, repair or replace the faulty material.

Warranty Repairs

What you must do to return an Instrument for Warranty Repair:

First, request a Customer Service Authorization Number (CSA#) by phone or by fax from our Service Department (see address below), then return the instrument along with the signed CSA Form. Please write the CSA# on the outside of the shipping container. Return the instrument, postage or shipment pre-paid to:

Ship To:

Caution: To protect yourself against in-transit loss, we recommend you insure your returned material.

NOTE: You must obtain a CSA# before returning any instrument.