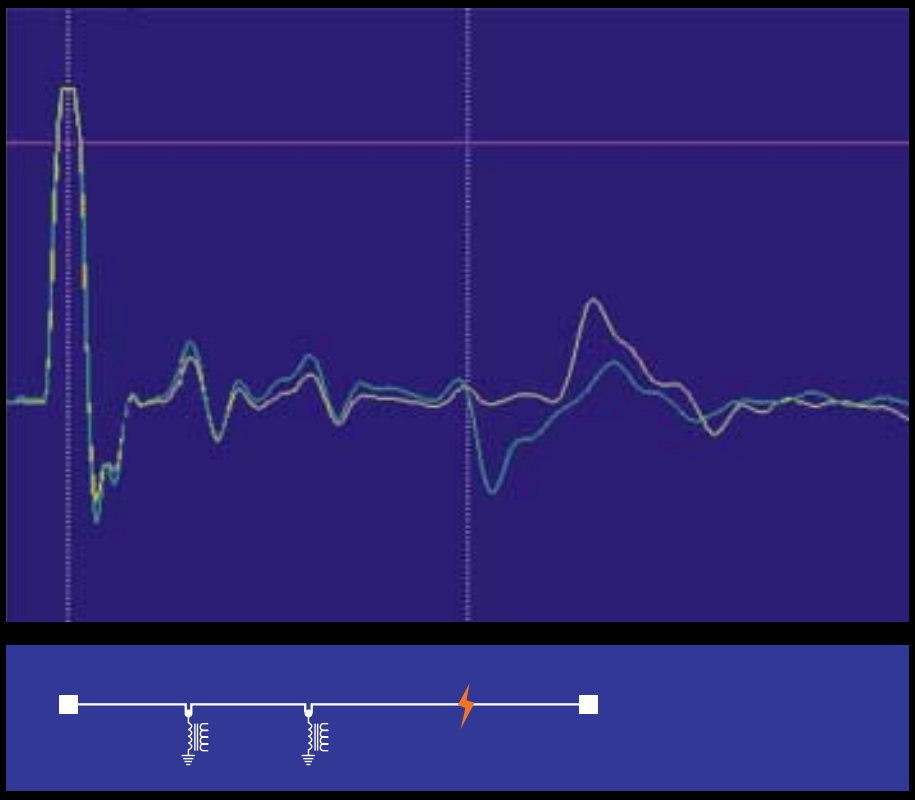
Cable Fault Locating Equipment



HUBBELL HIPOTRONICS®
THE MEASURE OF A LEADER

Solutions Today for the Challenges

For over 35 years, Hipotronics has been your partner when your underground cables faulted and your customers were without power. As your needs changed, Hipotronics changed with them, and offered you the full range of equipment from installation tests on buried cable to HV radar for fault locating; from "thumping" to sectionalizing of loop feed URD cables. In every instance, Hipotronics was there, in the field, working side by side with you to understand your problems and to provide solutions to your needs.

Today, the utility industry is undergoing its most massive, radical restructuring in years. Gone are the old problems, the old methods, and the old organizations. No longer is it acceptable to wait until a failure occurs—you must ***prevent*** *the failure from happening in the first place. No longer can you afford to be saddled with high costs and unproductive methods—you must operate leanly, entrepreneurially, and quickly. New goals, methods and organizational structures demand new ideas—and new equipment to support those ideas.*

That's where Hipotronics can help. With the widest range of fault locating and other HV field testing products on the market, we are in a position to serve your needs ***as they exist today****, not as they existed yesterday. Our newest range of products offers exciting possibilities to change the way you do business, to serve your customers better, and to operate more profitably in a deregulated environment.*

Call us and arrange to see today's solutions to tomorrow's problems.

The Solutions to the Problems

No matter what your need or test requirement, if it concerns buried underground cable, Hipotronics has a solution to your problem. Our advanced HV TDR systems help you pinpoint problems after cables have failed. Our complete line of capacitive-discharge cable fault locators provide pulse energy ("thumps") to assist in locating faults on any type of cable in any location. Our portable Power Frequency AC Test Equipment allows you to proof test in the field with AC instead of less desirable VLF or DC. Should you require a complete, turn-key package, our "solutions" team can put together an integrated package that meets your needs and is ready to test.

High Voltage TDR Our newest line of HV TDRs combines the most extraordinary ease-of-use and flexibility of any TDR package on the market. Not

# of Tomorrow

only are the Hipotronics TDRs very simple to use, but the Windows CE™-based software package uses the testing Wizard to guide an untrained operator through the proper setup and use of the equipment. Most Hipotronics TDRs are equipped with large, color displays and multiple operating modes to adapt to how you currently test, making it easy to begin using the new equipment. When your field testing becomes more integrated with the rest of your operations, our TDRs will be ready with laptop computer links and remote communications capabilities. To please your customer and the person who operates the backhoe, our TDRs have the highest sampling rates in the industry, which means better fault finding accuracy and less digging. We understand that you probably won't replace all your fault locating equipment at once, so in most cases we've made it easy and inexpensive to integrate the newest and best TDRs with your existing capacitive-discharge cable fault locators.

Capacitive-Discharge Cable Fault Locators

Our newest controlled-energy fault locators allow high energy outputs even at low output voltages to allow precise fault finding on any type of cable. Plus, it's contained in a highly portable package. Our First Response™ 5100 Fault Locating System allows an operator to quickly and easily sectionalize loop-feed URD systems and restore power to your customers within minutes—all in package that can be easily rolled around with a minimum of damage to your customer's property. Of course, when there is nothing better than brute force (such as on network systems) our higher voltage and energy CF70 and CF100 fault locators do the job reliably.

System Solutions Not every utility has the expertise or is willing to put together a complete system. That's where Hipotronics System Solutions can help. Hipotronics can analyze your test system needs and propose a complete, turn-key solution to meet your testing requirements, including capacitive-discharge cable fault locators, HV TDRs, AC test sets, or other portable fault locating accessories or equipment. Since we make all of our own equipment, you have the assurance of working with a vendor who can support you now and in the future.

No lights. No power. No problem.

Windows CE™-based Operating Software

The TDR software is based on the newest industry standard software packages. It provides all of the interfacing and ease of operation that you expect for Windows-based programs. Your operators will be comfortable using the software package.

Finds Difficult Faults Easily

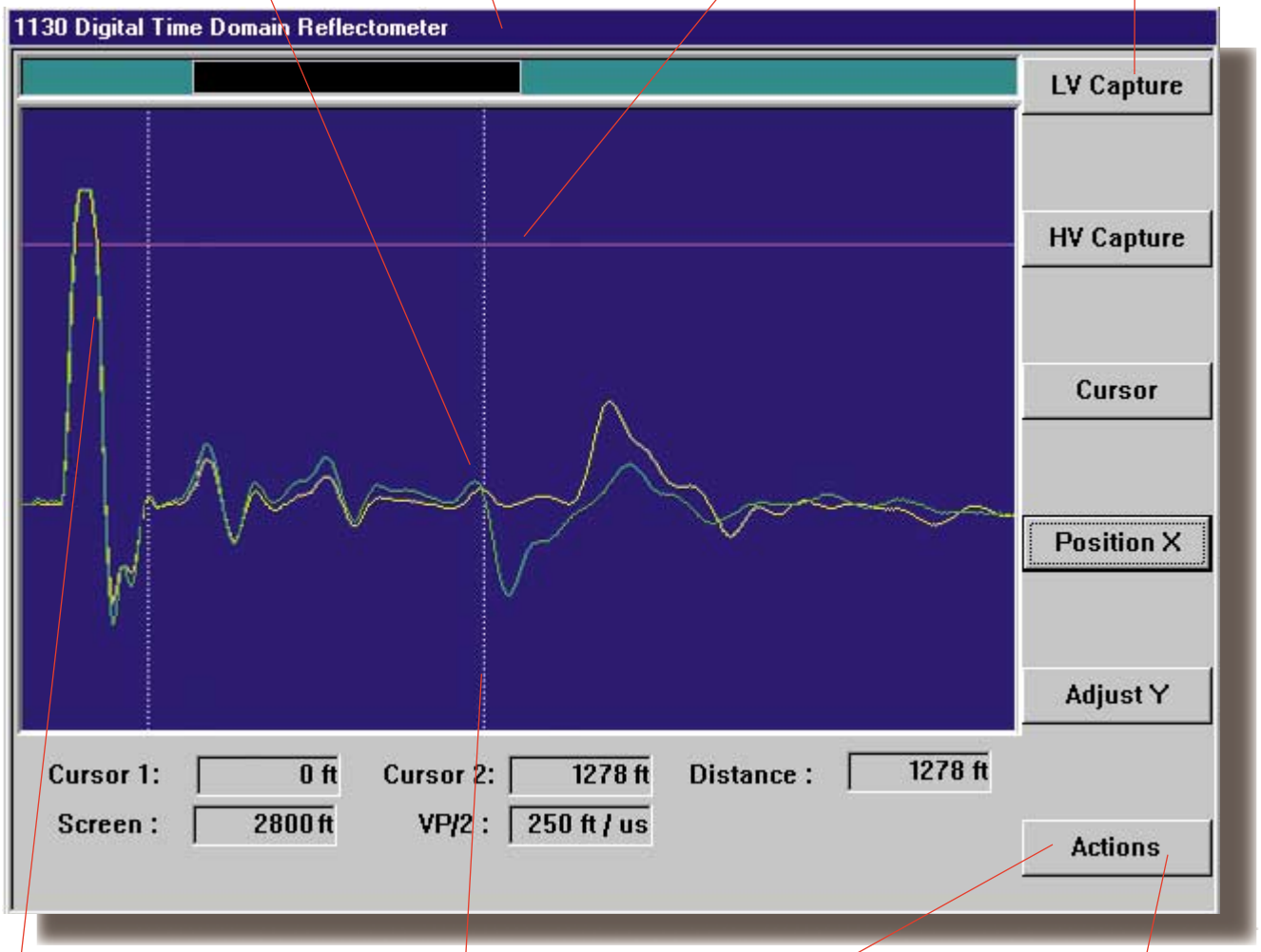
The TDR is highly sensitive. A 0.01% fault reflection will be displayed on the monitor as a .5" (12mm) high pulse.

Menu Operation

All the functions your operators need are located in a first level menu. Factory settings, calibrations, standard setups, etc., are password protected and can be easily modified.

Intuitive Screen Display

The TDR display gives the operator a clear image of the cable. Faults (either open, shorts, or other types) are clearly displayed in a way that an operator can understand (i.e., beginning and end of cable).



Maximize Your Ability to Test

Pulse width and amplifier gain controls allow you to optimize the TDR settings so as to increase the accuracy of fault location on difficult faults.

Cursors

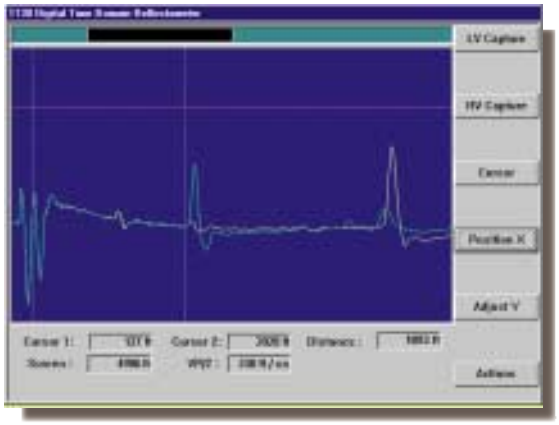
Markers are easily placed on the display to indicate the beginning of the cable and the fault location.

Find Details Easily

The Zoom feature of our TDRs allow you to look at a smaller or larger section of cable, depending on your needs.

User Selectable Operating Modes

Various modes are possible to allow use of the TDR with capacitive-discharge “thumpers,” burners, or hipots. To simplify operation, you can make the TDR “mimic” the operation of any other instrument available!

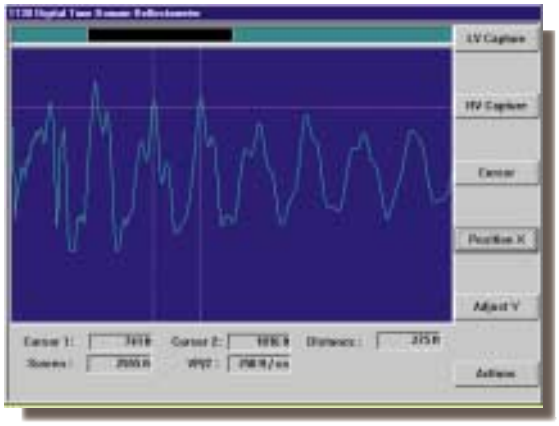


Arc Surge Reflection Mode

In this mode, the TDR is coupled to the cable under test through a HV Coupler and a Capacitive Discharge Fault Locator. A cable “signature” is generated by the TDR (displayed as yellow). When the fault locator “thumps” the cable, a fault flashover occurs and the TDR captures the fault breakdown and displays it simultaneously with the previously recorded low voltage cable signature. In this view, it can be easily seen that a failure has occurred.

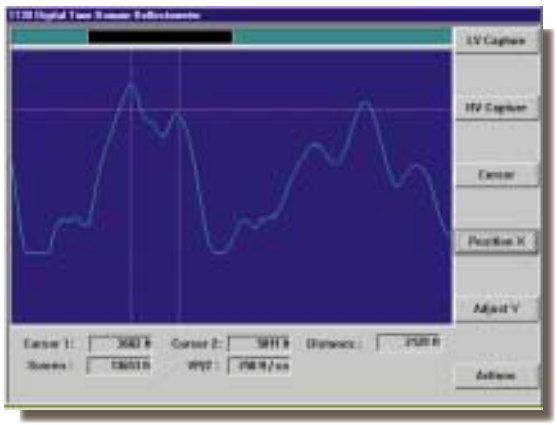
Three-Phase Cable Testing Capability

Hipotronics TDRs permit recording and saving three cable and/or fault traces. This allows easy testing of three-phase cables. In the test shown at left, low voltage samples were acquired for all three phases of a cable. The samples were arranged on the display so that the “bad” phase B is overlayed on one of the “good” phases. This fault is indicative of a splice that is becoming resistive.



Current Surge Mode

This mode is beneficial in cases where an appropriately rated HV Coupler is not available, is not affordable, or is not desirable. In this mode, the TDR is coupled to a Capacitive Discharge Fault Locator through a current pick-up. The fault locator is used to “thump” the cable and the TDR captures the standing wave of the fault breakdown and displays it on the screen. The distance between oscillatory peaks is the distance to the fault.



Voltage Decay Mode

This mode is especially useful for higher voltage cables where a Capacitive Discharge Fault Locator with a high enough “thump” voltage to break down the fault is not available. Instead, a DC hipot is used to charge the cable at a progressively higher voltage until the cable fault flashes over. When that occurs, the TDR will capture the standing decaying wave of the fault breakdown and will display it on the screen. The distance to the fault is the distance indicated between the peaks of the voltage pulse.

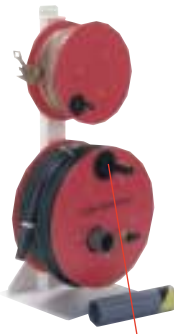
A Complete Range of Cable Fault Locating Equipment

Our Controlled Energy Capacitive Discharge Fault Locator provides more energy at lower voltages so as to improve fault locating capability on lower voltage cables.

HV TDRs and Couplers interface to Hipotronics and other makes of Capacitive Discharge Fault Locators to allow quick location of cable faults using a variety of different measurement modes/techniques.

CF70 Capacitive Discharge Fault Locator is especially useful in providing high energy/high voltage capacitive discharges into network systems, in addition to providing burn and hipot features.

5100 First Response Cable Fault Locators are highly portable, complete fault locating systems for quickly and accurately locating faults in underground systems.



Resonant Set Portable AC Resonant Test Sets allow true power frequency testing in a compact, lightweight package without the drawbacks of VLF or Variable Frequency test sets.

8100 Cable Reels provide a simple and safe means to extend the output cable range of Hipotronics truck mounted thumpers so as to allow easy connection to faulted cables.

HSDAD Dual Acoustical Detector allows simple, fast and accurate pinpointing of cable faults on all types of surfaces using a patented, acoustical method.

Hipotronics Complete Test Vans provide you with the solution that you need in a complete, turn-key package.

5100

The 5100 Series First Response Systems meet the demanding needs of utilities, industrials and contractors who require a highly portable, easy to use, complete fault location system. The 5100 Series First Response Systems combine a cable fault locator, high voltage filter, digital ARC reflection high voltage TDR, and battery power into one complete, cost-effective package. Connection to the cable under test is easy—a wide variety of connectors are available. In addition, there is no need to disconnect transformers while fault locating. These systems will reduce your fault location time by 80% by allowing quick and easy sectionalizing of faulted loop feed URD installations and fast fault location in cables rated up to 35kV.

Controlled Energy Capacitive Discharge Fault Locator

This series provides more energy at lower voltages through the use of a tapped energy storage capacitor. Up to 10 times the normal fault energy compared to standard units can be delivered when capacitive discharging at 5kV. This provides for faster pulse rise times and a louder sound, which aid pinpointing of faults with HV TDRs or acoustical detectors.

CF70

The CF70 Series Capacitive Discharge Fault Locators meet the needs of utilities who must test higher voltage cables or network installations. Each CF70 contains a 70kVdc proof tester, 100mA burner, up to 25kV/7500J pulse output, and a visible indication of solid ground. These units may be used as either a simple “thumper,” or can be used with a HVC Series High Voltage Coupler and Hipotronics HV TDR for a complete fault locating solution.

CF100

Network distribution systems provide their own challenges for fault location. Due to the branching nature of network underground cable systems, more energy must be delivered to the cable to allow enough to reach the faulted portion. In addition, a large burn supply is sometimes required to continuously pulse the cable while locating the fault by means of sheath current tracing. The CF100 contains a 100kVdc proof tester, 10kV/10A burner, and a 25kV/7500J pulse output. The CF100 is ideal for location of paper oil lead cable faults via the current impulse method (using a Hipotronics TDR).

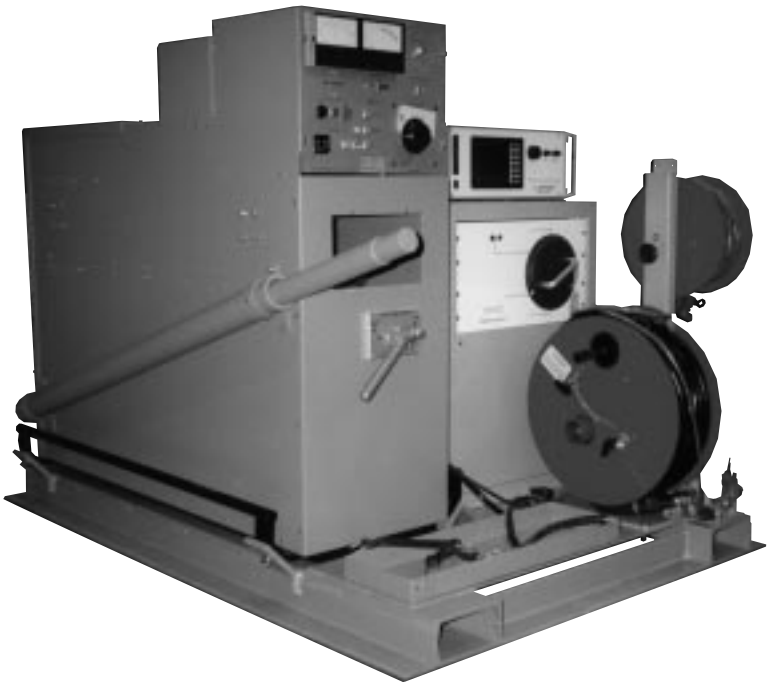
System Solutions

Controlled Energy Discharge Fault Locating System

For maximum flexibility when testing all types of underground distribution power cables, Hipotronics Controlled Energy is the ideal solution. This unit can be supplied stand-alone, mounted in a Hipotronics van or assembled on a test “skid” to allow convenient customer mounting. A HV TDR and Coupler can be added to make a complete fault locating system.

Skid-Mounted Test Solutions

All types of Hipotronics field portable cable test equipment can be skid-mounted for quick transport among vehicles and rapid response to system problems. Shown at right is a Hipotronics CF70 Capacitive-Discharge Fault Locator, HVC4170 HV Coupler, TDR1100 HV TDR, 8100 Cable Reels and HSDAD Acoustical Detector. All the equipment is permanently interwired for fast setup and can be easily moved from one vehicle to another by a small forklift truck.



Portable AC Test Systems

Hipotronics truck-mounted AC test systems provide pure 50 or 60 Hz sinewave output in a compact package that can easily fit into a standard truck or van. Power frequency resonant test systems with capability to test common distribution/ generation cable classes and lengths are typically smaller in size than variable frequency resonant test sets and similar in size to VLF test sets. Power frequency AC tests cables in the field the same way they are tested in the factory, and is the optimum method for field PD testing.

Fault Locating Cable Test Vans

Hipotronics provides complete test van solutions for cable fault locating, with your choice of capacitive-discharge cable fault locator, HV TDR, and fault locating accessories all mounted in a physically appealing, ergonomic way. Consult Hipotronics for a quotation on your specific needs.

Other Portable Field Test Equipment

In addition to the equipment previously mentioned, Hipotronics provides numerous other test instruments to assist in field testing of generation, transmission, and distribution equipment, including:

- Oil Dielectric Testers
- Microhmmeters
- Megohmmeters
- DC Hipots
- Portable AC Hipots
- Bucket Truck Testers
- Vacuum Bottle Testers
- Phase Tracers
- Turns Ratio Test Sets
- High Current Circuit Breaker Test Sets

Additional Equipment Commonly Used by Power Utilities:

- Modular Series Resonant Test Sets (GIS Testing)
- Tank-Type Series Resonant Test Sets (Generator Testing)
- AC Dielectric Test Sets
- Partial Discharge Detectors
- Transformer-Loss Test Sets
- UHV DC Test Sets
- Impulse Generators and Accessories
- Kilovoltmeters

Hardware and Software Technical Specifications

CF70 Series Capacitive Discharge Fault Locators

INPUT VOLTAGE	Model number suffix–A 120 V/ 60 Hz Model number suffix–B 220V/ 50/60 Hz		
OUTPUT	CF70 Proof Tester Continuously variable to 70 kV dc–0 to 60 kV above 5,000 ft. altitude Burner 100 mA		
MODEL	**CAPACITOR DISCHARGE**	**ENERGY DELIVERED TO FAULT**	
CF70-12	0-25 kV AT 12 µF	3,750 Joules	
CF70-24	0-25 kV AT 24 µF	7,500 Joules	
METERING	CF70 Proof Test Voltage 0-70 kV dc ± 2% Proof Test Current 0-1, 10, 100 mA ± 2% Burner Current 0-100 mA		
DUTY CYCLE	Continuous		
TERMINATIONS	CF70 Input Line 50 Ft. (15.2 m) cable Return & High Voltage 100 ft. (30.4 m) double shielded cable Ground 25 ft. (7.6 m) No. 2 welding cable		
MODEL	**DIMENSIONS (W x H x D)**	**NET WEIGHT**	**SHIP WEIGHT**
CF70-12	16" x 36" x 36" (41 x 91 x 91 cm)	540 lb. (246 kg)	750 lb. (341 kg)
CF70-24	16" x 50" x 36" (41 x 127 x 91 cm)	675 lb. (307 kg)	894 lb. (352 kg)

5100 First Response Cable Fault Locating System

MODEL NUMBER	**5100**	**5100-FC**	**5100-HE**
TDR OPERATING SYSTEM	Windows™		
MEASURING ACCURACY	2.5 ft. (77 cm) – Sampling Rate of 100 MHz		
PULSE AMPLITUDE	25V into 50 Ohm		
PULSE WIDTH	100 nS to 20 µS		
RANGE– TIME/DISTANCE	1.28 µS to 0.66 mS/1 to 196,000 ft. (0.3 to 59,740 m)		
TRACE STORAGE	Stores 16 sets of 3 cable and fault signatures		
MONITOR	LCD Display 7" (18 cm) Diagonal		
INPUT PROTECTION/ ISOLATION	480V AC		
HV SECTION POWER REQUIREMENTS	12V DC Rechargeable Battery Charger Avail. with 120V AC/60 Hz (-A) or 230 V AC/50/60 Hz (-B)		
PULSE OUTPUT	7.5 kV or 15 kV pulse		
ENERGY	480J at 15 kV	480J at 15 kV	1000J at 15 kV
CHARGE TIME	15 seconds	6 seconds	15 seconds
DC PROOF OUTPUT	0-15 kV DC		
ENTIRE UNIT WEIGHT NET	203 lbs.	236 lbs.	240 lbs.
SHIP	255 lbs.	288 lbs.	292 lbs.
DIMENSIONS	52" H x 25" W x 24" D (132 cm H x 64 cm W x 61 cm D)		
ENVIRONMENTAL	Operating Temp. 32°F to 122°F (0°C to 50°C) Storage Temp. -40°F to 140°F (-40°C to 60°C)		

CET-1500 Controlled Energy Capacitive Discharge Fault Locator

INPUT VOLTAGE	Model number suffix–A 120 V, 60 Hz Model number suffix–B 230V, 50/60 Hz
OUTPUT	
PROOF TESTER	0-30 kV DC @ 40 mA
BURN CURRENT	160 mA
CAPACITOR DISCHARGE	0-8 kV dc @ 48 µF 0-16 kV dc @ 12 µF 0-32 kV dc @ 3 µF } Front Panel Switch Selectable
REPETITION RATE	20 or 30 Pulses/minute (continuous) w/ single pulse manual mode
STORED ENERGY	1500 J @ 8, 16 or 32 kV DC
TERMINATIONS	5 ft. (1.5 m) w/ pigtail termination
SIZE/WEIGHT	22.5" W x 30" H x 27" D (57 x 76 x 69 cm) 300 lbs.
STORAGE TEMP.	-4°F to 130°F (-20°C to 55°C)
OPERATING TEMP.	10°F to 130°F (-8°C to 55°C)

TDR 1100

INPUT	90 V to 250 V, 50/60 Hz Filter included for suppression of line interference
MEASURING ACCURACY	2.5 ft. (77 cm) – Sampling Rate of 100 mHz
PULSE AMPLITUDE	25 V into 50 Ohm
PULSE WIDTH	100 nS to 20 µS
RANGE (TIME + DISTANCE)	128 µS to 0.66 µS 1 to 196,000 ft. (1 m to 59,740 m)
TRACE STORAGE	Stores 16 sets of 3 cable + fault signatures
MONITOR	Color LCD 7.5" diagonal
INPUT PROTECTION/ ISOLATION	480 V AC
DIMENSIONS	19" W x 7" H x 15" D (48 x 18 x 38 cm)
WEIGHT	27 lbs. (12 kg)
ENVIRONMENTAL	Operating Temp. 32°F to 122°F (0°C to 50°C) Storage Temp. -40°F to 140°F (-40°C to 60°C)

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