Cable Fault Locating and Test Equipment

MULTI-TEK INTERNATIONAL
140 – 144 Freston Road (Industrial Area), London W10 6TR, England
Tel.: +44-(0)20-73133190  Fax: +44-(0)20-73133191
E-Mail: mti@multitekintl.com
Website: www.multitekintl.com

V.2013
## Cable Fault Locating and Test Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transportable 32kV power cable fault locating system type <strong>PFL32M1500</strong></td>
</tr>
<tr>
<td>2</td>
<td>Power Cable Fault Locating System up to 20kV type <strong>PFL22M1500</strong></td>
</tr>
<tr>
<td>3</td>
<td>Power Cable Fault Locating System up to 16kV type <strong>ST16</strong></td>
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<td>4</td>
<td>Portable cable fault locating system up to 12kV type <strong>EZ-THUMP</strong></td>
</tr>
<tr>
<td>5</td>
<td>Cable pin pointer type Megger <strong>DIGIPHONE</strong></td>
</tr>
<tr>
<td>6</td>
<td>Cable tracing equipment (10W) with current and depth measurement facility type <strong>FERROLUX FL10</strong></td>
</tr>
<tr>
<td>7</td>
<td>Cable Avoidance Tools for underground services type <strong>XD Cable Tracing</strong></td>
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### TDR UNITS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>TDR Cable fault Locator with tone generator type <strong>TDR500</strong></td>
</tr>
<tr>
<td>9</td>
<td>TDR Cable fault Locator with tone generator type <strong>TDR500/3</strong></td>
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<tr>
<td>10</td>
<td>TDR Cable Fault Locator up to 3 km type <strong>TDR1000/3 + TDR100/3P</strong></td>
</tr>
<tr>
<td>11</td>
<td>TDR Cable Fault locator up to 20km type <strong>TDR2000/2 + TDR2000/2P</strong></td>
</tr>
<tr>
<td>12</td>
<td>3 phase automatic TDR type <strong>MTDR300</strong></td>
</tr>
<tr>
<td>13</td>
<td>AC and DC Cable Test Set up to 30 kV</td>
</tr>
<tr>
<td>14</td>
<td>AC test set up to 50kV type <strong>KV50-20D</strong></td>
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<tr>
<td>15</td>
<td>DC cable Test Sets from 25kV up to 120kV</td>
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<tr>
<td>16</td>
<td>High voltage DC Dialectic Test Set 70,120 and 160kV</td>
</tr>
<tr>
<td>17</td>
<td>VLF Portable Test Sets type <strong>KPG20kV, KPG36kV and KPG38kV</strong> (RMS)</td>
</tr>
<tr>
<td>18</td>
<td>Cable Mapping System type <strong>PD Mapping</strong></td>
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</table>
## Cable Fault Locating and Test Equipment

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>19</td>
<td>Cable PD Detector type <strong>PDS Air</strong></td>
</tr>
<tr>
<td>20</td>
<td>Cable test Van and trailer (will be provided on request)</td>
</tr>
</tbody>
</table>
ITEM
1
PFL32M1500
Portable Cable Fault Location System

- Portable, rugged fault locating system
- HV insulation testing up to 32 kV
- Proof/burn up to 32 kV, 65/35 mA
- 16/32 kV, 1500 Joules surge output
- Arc reflection method
- Arc reflection plus
- Differential arc reflection
- Impulse current (ICE)
- Integrated 10.4” screen color TDR

DESCRIPTION
The PFL32M1500 Power Cable Fault locator is designed to provide quick, effective, accurate and safe fault location, thereby reducing system outages and minutes lost.

The instrument comes in a rugged yet portable enclosure, which makes it suitable for use in and outdoor conditions.

The PFL32 provides all typical methods for cable testing: cable and fault diagnosis, pre-location of cable faults, fault conditioning, and pinpoint fault location using magnetic acoustic methods.

FEATURES AND BENEFITS
- Innovative MTDR100 mounted in the lid features:
  - Single knob (jog-dial) control
  - Large 10.4” color (XGA) display
  - Auto ranging
  - Cable library
- Multiple fault locating techniques
  - Pre-location
  - TDR method
  - Arc reflection
  - Arc reflection plus
  - Differential arc reflection
  - Impulse Current (ICE)
- Pinpoint
- Surge/voltage impulse
- High-voltage module
  - 2-range / dual capacitors
  - Safety interlocks
  - HV ON indicator

APPLICATIONS
HV Testing (proof/insulation testing)
Used to prove the integrity of and identify / confirm fault conditions in cable networks. The variable output voltage can also be used for sheath testing at 5 or 10 kV.

Fault Pre-location
After identifying the type of fault, the location of the fault can be determined using the following pre-locating of methods:
- A TDR is used to pre-locate cable faults using TDR, Arc reflection, Impulse Current (ICE). The MTDR100 features auto-ranging, auto distance to fault and operator assist functions that guide the operator through the fault locating process.
- In the Arc reflection mode, faults are stabilized by creating a temporary “bridge” to earth. During this condition, a standard TDR measurement is taken into what is basically a short circuit fault.
- Arc reflection plus provides the operator the added advantage of being able to view and analyze up to 1024 traces (range dependent) taken during the period of the arc.
- During Differential arc reflection mode unwanted and confusing reflection are removed leaving a clean trace with only the fault position point being displayed as a positive pulse. This method is especially suited in locating high-resistance faults in complex cable systems.
- Impulse current, or ICE, is the analysis of the transients current signal on the HV return to obtain the fault distance.

Fault Conditioning
Fault conditioning is used to stabilize unstable flashing or high resistance faults. The PFL32M1500 incorporates both proof/burn and arc reflection modes.
**Proof/Burn**
Following a breakdown of the cable under test, a current is applied to condition the fault. This allows easier and faster pre-location and pinpointing of the unstable faults.

**Pinpoint fault location**
Accurate pinpoint fault location is achieved using the magnetic acoustic method whereby the powerful 16/32 kV 1500 Joule surge generator (thumper) and magnetic acoustic receiver (Digiphone Plus) is used.

**SPECIFICATIONS**

**Testing**
- **Output:**
  - 0 - 32 kV (negative with regard to earth)
  - 0 – 32 kV, 35 mA constant
  - 0 – 16 kV, 65 mA constant
- **Resolution:**
  - 5 mA
- **Metering:**
  - Analog metering of current and voltage

**Low-voltage Pre-location**

**MTDR100**
- **Range:**
  - 10 ranges; 100 m – 55 km (328 ft - 34 miles)
  - 100 m - 220 km (328 ft - 137 miles) - transient methods
- **Pulse width:**
  - 50, 100, 200, 500 ns, 1, 2.5, 10 µs, and auto
- **Pulse Amplitude:**
  - 25 V into 50 Ω
- **Sampliing Rate:**
  - 100 MHz
- **Timbase Accuracy:**
  - 200 ppm
- **Resolution:**
  - 0.82 m (2.8 ft)@ 82.5 m / µsec
- **Display:**
  - 26.4 mm (10.4 in.), full XGA, 1024 X 768 color display
- **Cursors:**
  - Dual independent control
- **Gain:**
  - 60 dB range in 5 dB Steps
- **Input:**
  - Impedance 50 Ω
- **Inputs:**
  - 1 x TDR/ARC, 1 x current impulse
- **Ports:**
  - 1 x printer/USB memory device
- **Software:**
  - CAS1 (Cable analysis software)

**High Voltage Pre-location**
- **Arc Reflection:**
  - 0 - 16 and 0 - 32 kV, 1500 Joule
- **Arc Reflection Plus:**
  - 0 - 16 and 0 - 32 kV, 1500 Joule
  - 1024 – 16 traces dependent on range
- **Differential Arc Reflection:**
  - 0 - 16 and 0 - 32 kV, 1500 Joule
- **Impulse Current:**
  - 0 - 16 and 0 - 32 kV, 1500 Joule

**Fault Conditioning**
- **Proof/burn:**
  - 0 - 32 kV 35 mA
  - 0 - 16 kV 65 mA

**Pinpoint Fault Location**
- **Surge:**
  - 0 - 16 and 0 - 32 kV, @ 1500 Joule
- **Impulse Sequence:**
  - Adjustable
  - 5 – 30 seconds
  - Single Shot

**Cables**
- **HV:**
  - Detachable 15 m (50 ft) 1-phase flexible shielded cable with HV crock-clips
  - 120/230V Input/Supply: Input Cable
  - Safety Ground: 15 m (50 ft) 8 mm² flexible ground cable with vice grips

**Safety**
- High visibility “status” bar
- Emergency stop
- Safety Interlock circuit
- External beacon circuit (beacon optional)

**Supply**
- Universal AVSM 2-ranges: 108 - 132 V ac and 208 - 265 V ac 47 – 63 Hz

**Environmental**
- Operating Temperature: -20 ° to +50 °C (-4 ° to 122 °F)
- Storage Temperature: -20 ° to +55 °C (-4 ° to 131 °F)
- Elevation: 1600 m (De-rate voltages at higher altitudes)
- Humidity: 5 to 95% RH non-condensing

**IP Rating**
- IP64 (with top/back flaps closed)

**Weight**
- 131 kgs (290 lbs)

**Dimensions**
- 965 mm H x 536 mm W x 503 mm D
- (38 in. H x 21 in. W x 20 in. D)

**ORDERING INFORMATION**

**Included Accessories**
- High-Voltage shielded output cable 15 m including MC terminations with HV Clamps
- 1001-123

**Supplied/Supplied accessories**
- (1xea USA, UK, SHUKO, International)
- 17032-4/5/12/13

**Flexible ground cable, 15 m (50 ft)**
- 19265-15

**Interlock Quick Release Pin**
- 90003-606

**Included Accessories**
- High-Voltage shielded output cable 15 m including MC terminations with HV Clamps
- 1001-123

**Optional Accessories**
- HV Vice Grips
- 18944-2
- PFL32 Transit case
- 2001-289
- Pinpointer Digiphone Plus
- 871500500100000
- Stand alone cable reel assembly
- CBL100HV

**Software**
- CAS-1

**Included Accessories**
- Instruction manual, English
- AVTMPFL32-EN
- Instruction manual, Spanish
- AVTMPFL32-ES
- Instruction manual, French
- AVTMPFL32-FR

**Software**
- CAS-1

**Included Accessories**
- Instruction manual, English
- AVTMPFL32-EN
- Instruction manual, Spanish
- AVTMPFL32-ES
- Instruction manual, French
- AVTMPFL32-FR

**Software**
- CAS-1

**Included Accessories**
- Instruction manual, English
- AVTMPFL32-EN
- Instruction manual, Spanish
- AVTMPFL32-ES
- Instruction manual, French
- AVTMPFL32-FR

**Software**
- CAS-1

**Included Accessories**
- Instruction manual, English
- AVTMPFL32-EN
- Instruction manual, Spanish
- AVTMPFL32-ES
- Instruction manual, French
- AVTMPFL32-FR

**Software**
- CAS-1
ITEM

2
PFL22M1500
Portable Cable Fault Location System

- Portable, rugged fault locating systems
- HV insulation testing to 20 kV
- Proof/burn up to 20 kV, 115 mA
- 8/16 kV, 1500 Joules surge output
- Arc reflection method
- Arc reflection plus
- Differential arc reflection
- Impulse current (current impulse)
- Integrated large screen color TDR
- Optional onboard inverter

DESCRIPTION
The PFL22M1500 Power Cable Fault locator is designed to provide quick, effective, accurate and safe fault location, thereby reducing system outages and minutes lost.

The instrument comes in a rugged yet portable enclosure. Its IP64 rating makes it suitable for use in even environmentally hostile conditions.

All systems offer the facility to undertake cable testing: cable and fault diagnosis, pre-location of cable faults, fault conditioning, and pinpoint fault location using acoustic methods.

FEATURES AND BENEFITS
- Innovative MTDR100 mounted in the lid features:
  - Single knob (jog-dial) control
  - Large easy-to-view color (XGA) display
  - Auto ranging
  - Cable library
- Multiple fault locating techniques
  - Pre-location
  - Pulse echo
  - Arc reflection
  - Arc reflection plus
  - Differential arc reflection
  - Impulse current
- Pinpoint
- Surge/voltage impulse
- High-voltage module
  - 2-range
  - Safety interlocks
  - HV on indicator
- The handle and foot-step allows for easy and comfortable transport

APPLICATIONS

HV Testing (proof/insulation testing)
Used to prove the integrity of and identify and confirm fault conditions in cable networks. The variable output voltage can also be used for sheath testing at 5 or 10 kV.

Fault Pre-location
After identifying the type of fault, pre-location of the fault position can be determined using the following methods:
- A TDR is used to pre-locate cable faults using pulse echo, arc reflection, impulse current (ICE). The MTDR100 features auto-ranging, auto distance to fault and operator assist functions that guide the operator through the fault locating process.
- In the Arc reflection mode, faults are stabilized by creating a temporary “bridge” to earth. During this condition, a standard pulse echo measurement is taken into what is basically seen as a short circuit fault.
- Arc reflection plus provides the operator the added advantage of being able to view and analyze up to 1024 traces (range dependent) taken during the period of the arc.
- During Differential arc reflection mode unwanted and confusing reflection are removed leaving a clean trace with only the fault position, point being displayed by a positive pulse. This method is especially suited in locating high-resistance faults in complex cable systems.
- Impulse current, or ICE, is a transient analysis method of pre-location utilizing the integrated linear coupler.

Fault Conditioning
Fault conditioning is used to stabilize unstable flashing or high resistance faults. The PFL22M1500 incorporates both proof/burn and arc reflection modes.
Proof/Burn
Following a breakdown of the cable under test, a high current is applied that stabilizes the fault condition. This allows easier and faster pre-location and pinpointing of the unstable faults.

Pinpoint fault location
Accurate pinpoint fault location is achieved using the acoustic method whereby the powerful 8/16 kV 1500 Joule surge generator (thumper) and an acoustic receiver (Megger MPP2000) is used.

SPECIFICATIONS

Testing
Output:
- 0 - 20 kV (negative with regard to earth)
- 0 - 10 kV, 115 mA constant
- 0 – 20 kV, 58 mA constant
Resolution: 5 mA
Metering: Analog metering of current and voltage

Low-voltage Pre-location
MTDR100
Range: 10 ranges; 100 m – 55 km (328 ft - 34 miles)
100 m – 220 km (328 ft - 137 miles) - transient methods
Pulse width: 50, 100, 200, 500 ns, 1, 2, 5, 10 µs, and auto
Pulse Amplitude: 25 V into 50 Ω
Sampling Rate: 100 Mhz
Timbase Accuracy: 200 ppm
Resolution (Vp=55%): 0.82 m (2.8 ft)
Display: 26.4 mm (10.4 in.), full XGA, 1024 X 768 color display
Cursors: Dual independent control
Gain: 60 dB range in 5 dB Steps
Input: Impedance 50 Ω
Inputs: 1 x TDR/ARC, 1 x current impulse
Ports: 1 x printer/USB memory device
Software: CAS1 (Cable analysis software)

High Voltage Pre-location
Arc Reflection: 0-8 and 0-16 kV, 1500 Joule
Arc Reflection Plus: 0-8 and 0-16 kV, 1500 Joule
1024 – 16 traces dependent on range
Differential Arc Reflection: 0-8 and 0-16 kV, 1500 Joule
Impulse Current: 0-8 and 0-16 kV, 1500 Joule

Fault Conditioning
Proof/burn:
- 0 - 20 kV 58 mA
- 0 - 10 kV 115 mA

Pinpoint Fault Location
Surge: 0 - 8 and 0 -16 kV, @ 1500 Joule
Impulse Sequence: Adjustable 5 – 30 seconds
Single Shot

Cables
HV: Detachable 15 m (50 ft) 1-phase flexible shielded cable with HV crock-clips
Input/Supply: Input Cable
Earth: 15 m (50 ft) 8 mm² flexible earth cable with vice grips

Safety
High visibility “status” bar
Emergency stop
Safety Interlock circuit
External beacon circuit

Supply
Universal AVSM 2-ranges: 108 - 132 V ac and 208 - 265 V ac 47 – 63 Hz
Inverter: 11.5 – 14 V dc (Optional)

Environmental
Operating Temperature: -20 ° to +50 °C (-4 ° to 122 °F)
Storage Temperature: -20 ° to +55 °C (-4 ° to 131 °F)
Elevation: 1600 m (De-rate voltages at higher altitudes)
Humidity: 5 to 95% RH non-condensing

IP Rating
IP64 (with top/back flaps closed)

Weight
131 kgs (290 lbs)

Dimensions
965 mm H x 536 mm W x 503 mm D
(38 in. H x 21 in. W x 20 in. D)

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Item</th>
<th>Cat. No.</th>
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<tbody>
<tr>
<td>20 kV dc, 8/16 kV @ 1550 Joule surge</td>
<td>PFL22M1500-EN</td>
</tr>
<tr>
<td>As above but including 12 V inverter</td>
<td>PFL22M1500INV-EN</td>
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Included Accessories

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<thead>
<tr>
<th>Item</th>
<th>Cat. No.</th>
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<tbody>
<tr>
<td>High-Voltage shielded output cable 15 m including MC terminations with HV Clamps</td>
<td>1001-123</td>
</tr>
<tr>
<td>Supply/Input cables (1x EA USA, UK, SHUKO, International)</td>
<td>17032-4/5/12/13</td>
</tr>
<tr>
<td>Flexible ground cable, 15 m (50 ft)</td>
<td>19265-15</td>
</tr>
<tr>
<td>Interlock Quick Release Pin</td>
<td>90003-606</td>
</tr>
<tr>
<td>Cable bag</td>
<td>2001-813</td>
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<thead>
<tr>
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<tr>
<td>Instruction manual</td>
<td>AVTMPFL22</td>
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<tr>
<td>Software</td>
<td>CAS-1</td>
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Optional Accessories

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<th>Item</th>
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<tr>
<td>HV Vice Grips</td>
<td>18944-2</td>
</tr>
<tr>
<td>PFL20M Transit case</td>
<td>2001-289</td>
</tr>
<tr>
<td>12 V Stand alone battery kit</td>
<td>1001-690</td>
</tr>
<tr>
<td>Accoustic/Electromagnetic Receiver</td>
<td>MPP2000</td>
</tr>
<tr>
<td>Stand alone cable reel assembly</td>
<td>CBL100HV</td>
</tr>
</tbody>
</table>

NB: Refer to factory for full list of cable reel assemblies
ITEM 3
SMART THUMP ST16
Portable Cable Fault Location System

- Delivers 1500 J at 8/16 kV
- 16-kV DC high voltage proof test and insulation resistance test
- Easy Go automatic test sequence to proof test, prelocate and pinpoint
- Interprets test results for user
- 5.7 in. transflective color display
- Safety / grounding check
- USB interface

DESCRIPTION
The SMART THUMP ST16 Portable Cable Fault Locating System provides safe, efficient and extremely easy-to-use solutions for quickly identifying, prelocating and pinpointing various types of cable faults for power cables. The ST16 was developed to meet the requirements for typical low- and medium-voltage distribution cable fault location markets.

Circuit parameters include:
- System voltage up to 35 kV
- Insulation EPR or XLPE
- Typical conductor sizes between #2 and 500 MCM (34 mm² to 250 mm²)
- Typical circuit lengths from a few hundred feet (100 m) up to 3 miles (17,000 ft or 5,000 m)

Typical end users include: operations department of power utility companies, electrical departments within municipalities including street light maintenance, private network operators, high voltage electrical contractors, service companies, port authorities, mining, airports, military bases, petrochemical and paper companies.

The ST16 unit incorporates HDW’s “E-Tray” technology, a concept that has been already proven in other products (EZ-Thump, EZ-Restore Overdrive, and TDR T3090) and which will be carried forward into new Megger products in the future. The E-Tray adds the unique capability to access and operate every function through an innovative and intuitive user interface, without the need to make adjustments and the software suggesting the next logical step.

APPLICATIONS
The SMART THUMP ST16 represents a new generation of advanced underground cable fault locating systems that require less training than a traditional thumper-only system. It is the only fault locator with built-in intelligence to interpret the results of the initial test sequence. The “turn & click” rotary button operation lets the user automatically proof test, pre-locate, and pinpoint the fault from one convenient control console. No adjustments are required. The unit automatically sets the thump voltage to minimize the stress applied to the cable. The ST16 features an automatic safety check to protect the user from incorrect or faulty ground connections (F-Ohm).

The heavy-duty wheels of the unit are ideal for use in rough terrain. The ST16 is capable of being permanently installed in a vehicle (truck mount version).

FEATURES AND BENEFITS
This fully integrated system can be operated from either its internal battery/inverter, external 12 VDC or 120/230 VAC. Additional features are:
- “Quick-Steps” is especially convenient where operators may not be called upon to use the equipment on a regular basis
- “Expert Mode” provides up to 20 individual TDR features to the experienced user for optimum fault locating results
- Custom configurable menus for the TDR function
- DC testing up to 16 kV with indication of insulation resistance value
- Rugged, powder coated IP54 designed enclosure
- Safe Op check protects user from incorrect or faulty and ground connections (F-Ohm)
- Easy Go operation eliminates lengthy training
- Quick access to all components in case of service
SMART THUMP ST16
Portable Cable Fault Location System

SPECIFICATIONS

Impulse Generator (Thumper)

Operating modes:
- Arc Reflection Method (ARM®) 0-8/0-16 kV
- ICE surge pulse (optional in North America), standard other countries 0-8/0-16 kV
- Direct surge (Thumping) 0-8/0-16 kV
- DC-HV proof test and resistance readout (Ω)
- Burning / Fault Conditioning 0-8/0-16 kV
- Sheath fault test & pinpointing / Secondary Fault Locating (optional) 0-5/10 kV

TDR
- TDR mode and all prelocation functions (25,000 ft, optional 100,000 ft)

Energy Output
- Dual stage: 1500 J @ 8 kV and 16 kV
- Proof test: 0 to 16 kV continuous
- Burn current: 60 mA max

Key Features
- Single-shot thump in ARM
- Built-in inductive type ARM filter
- 8 second thump cycle @ max output
- Automatic cable and system discharging

Display Features
- Transflective TFT color display, sunlight proof
- 5.7 in., 640 x 470 pixel resolution

Power Options
- 120/230 V, 60/50 Hz ac operation
- 12 V deep cycle marine battery with internal dc charger/inverter (standard)

SMART Features
- Entirely automatic test sequences includes proof test, prelocate, and pinpoint
- Automatic interpretation regarding type of fault (i.e. open, burnt in the clear, short)
- Automatic adjustment of thump voltage (uses selectable)
- Automatic alphanumeric display of cable and fault distance

USB
- Host interface 2.0
- TDR trace export and system upgrades

Mounting and Enclosure
- Mounted on heavy-duty wheels (14”)
- Rain tight powder coated enclosure IP54 (open)
- (Also available as vehicle-mount unit)

Digital “Analog” Meter
- Displayed on LCD screen

Environmental
- Operating Temperature: -20C to +50C; -4F to +122F
- Storage Temperature: -25C to +65C; -13F to +149F

IP Rating
- IP54 (with top open)

Weight
- 318 lbs (134 kg) includes wheels, battery and inverter & 50 ft of HV / Ground Cable

Dimensions
- 20 x 46 x 24 in. (500 x 1170 x 600 mm) W x H x D
### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>MODEL</th>
<th>ST16</th>
<th>--</th>
<th>WW</th>
<th>XX</th>
<th>YY</th>
<th>Z</th>
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<tbody>
<tr>
<td>SELECT MOUNTING OPTION</td>
<td>Cart Mount</td>
<td>M1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vehicle Mount with Inverter</td>
<td>M2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vehicle Mount w/o Inverter/Battery (AC only)</td>
<td>M3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cart Mount AC Only</td>
<td>M4</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Remote interface, available only with vehicle mount</td>
<td>M5</td>
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<td>SELECT CABLE LENGTH</td>
<td>12 ft Custom Cable</td>
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<td>25 ft Custom Cable</td>
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<td>50 ft Standard Cable</td>
<td>50</td>
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<tr>
<td>SELECT CABLE TERMINATION</td>
<td>14 mm Male MC with Hotline Clamps (North America)</td>
<td>T1</td>
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<tr>
<td></td>
<td>14 mm Male MC with Vise Grips (North America)</td>
<td>T2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Hardwired to Battery Clamps on HV &amp; “G” Clamp to Ground (No MC Connectors)</td>
<td>T3</td>
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<tr>
<td></td>
<td>10 mm Female MC with Battery Clamps (excluding North America)</td>
<td>T4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>***SELECT SOFTWARE OPTION</td>
<td>ICE (Surge Pulse)</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sheath fault testing / Secondary Fault Locating</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sectionalizing Software</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manual voltage Selection</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***Selection of software option can be any combination

#### Included Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Cat No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 ft (1.8 m) mains supply lead set (US/SCHUKO/UK)</td>
<td>1002-889</td>
</tr>
<tr>
<td>Instruction manual</td>
<td>AVTMST16</td>
</tr>
</tbody>
</table>

#### Optional Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Cat No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-kV elbow 14 mm female MC connector</td>
<td>865000100100000</td>
</tr>
<tr>
<td>25-kV elbow 14 mm female MC connector</td>
<td>865000200100000</td>
</tr>
<tr>
<td>35-kV Elbow 14 mm female MC connector</td>
<td>865000300100000</td>
</tr>
<tr>
<td>Digiphone Plus surge wave receiver</td>
<td>871500500100000</td>
</tr>
<tr>
<td>ESG NT digital earth fault locator</td>
<td>871500200200000</td>
</tr>
</tbody>
</table>

**Cable racks and reels - terminations typical in North America and Mexico**: *Standard* North America and Mexico terminations on cable reels:
- HV output cable: 14mm female MC, w/ battery clamp
- HV Return (far end): 14mm female MC, w/ battery clamp
- HV Reel HV input: 14mm male MC
- HV Return: Open spade lug (hook)
- HV output cable: 10mm female MC, w/ battery clamp
- HV Return (far end): 10mm female MC, w/ battery clamp
- HV Reel HV input: 10mm male MC

**Cable racks and reels - terminations typical in markets North America and Mexico**: **Standard** Rest-of-world terminations on cable reels:
- HV output cable: 10mm female MC, w/ battery clamp
- HV Return (far end): 10mm female MC, w/ battery clamp
- HV Reel HV input: 10mm male MC

<table>
<thead>
<tr>
<th>Item</th>
<th>Cat No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C401 Cable rack system, HV 50kV, 230Vac mains, GND cable, 125 ft each</td>
<td>1003-916</td>
</tr>
<tr>
<td>C403 Cable rack system, HV 50kV, GND cable, 125 ft each</td>
<td>1003-917</td>
</tr>
<tr>
<td>C403HT Cable rack system, HV 50kV, GND cable, 125 ft each, mounted on 15” wheel hand cart</td>
<td>1003-918</td>
</tr>
<tr>
<td>C403-150 Cable rack system, HV 50kV, GND cable, 150 ft each</td>
<td>1003-919</td>
</tr>
<tr>
<td>C403P Set of 2 individual hand reels (HV and GND), 125 ft each</td>
<td>1003-920</td>
</tr>
</tbody>
</table>

---

* Standard North America and Mexico terminations on cable reels:
  - HV output cable: 14mm male MC
  - Cable reel HV input: 14mm female MC
  - HV Return: Open spade lug (hook)
ITEM 4
The new 2\textsuperscript{nd} Generation EZ-THUMP\textsuperscript{TM}

Transflective Color
Sun Readable Display
First in Industry

“See the cable & fault”
“Cable End & Fault” are marked with distances

DC Hipot Test with $\Omega$ Display
ARM\textsuperscript{®} Prelocation
Thumping - Pinpointing

4 & 12kV Models
Output Energy 500 Joules
NiMH Battery > 30 minutes
Rainproof Operation

Live Trace Confirms Fault
Sectionalizing Optional
F-OHM Assures User’s Safety
USB Up- & Download Interface

SMART FAULT LOCATION System
....the unit that accommodates the User !
Technical Specifications **EZ-THUMP™**

The EZ-THUMP is a compact & light weight, battery and or AC line operated fault locating system for primary URD cables. It is ideally suited for use in a “satellite” fault locating concept for outlaying areas with a lesser fault frequency, when speed, simple operation, weight and economics are the driving factors. Unit requires no adjustments and is operated via rotary control knob.

**Convenience Features:**
- Pre-locate and Pinpoint using only one tool
- Computer controlled automatic fault locating procedure
- Unit is operated rotary control knob
- No special operator training required
- **OPTIONAL:** Sectionalizing Software*

**Safety Features:**
- Operator always in control of HV output
- “Emergency Off” discharges & powers unit off
- Key Switch Interlock
- Auto “Time out” discharges & grounds unit
- F-OHM feature protects from unsafe grounding

**Power Supply:**
- **Internal** 24V NiMH Battery 5 AH for > 30 minutes of pinpointing – thumping
- **External** 120/230V AC Operation

**Outdoor Suitability**
- Rugged design, weather proof operation
- High impact resistant PP enclosure
- High impact resistant ABS lid & SS hardware

**Operating Temperature:**
- -5 F to 122 F (-20 °C + 50 °C)

**Leads / Terminations**
- 15 ft HV cable MC Con. / Hotline Clamp
- HV return with Hotline Clamp,
- 15 ft Ground Cable with Hotline Clamp (50’ lead length optional)

**Dimensions:** 14” x 11” x 21”

**Weight:** 70 lbs

**Options**
- Optional Elbow Adapter available, 15 / 25 / 35 kV
- Optional Cart available
ITEM
5
digiPHONE+

Surge wave receiver for acoustic and electromagnetic fault pinpointing

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>RECEIVER</th>
<th>DPP-CU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>TFT-colour display, 320 x 240 Pixel</td>
</tr>
<tr>
<td>Safety</td>
<td>Volume limitation to 84 dB(A)</td>
</tr>
<tr>
<td>Gain</td>
<td>&gt;120 dB, automatic</td>
</tr>
<tr>
<td>Supply</td>
<td>6 x RR6 Alkali-Mangan batteries</td>
</tr>
<tr>
<td>Operation time</td>
<td>&gt; 10 hours</td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP 54</td>
</tr>
<tr>
<td>Dimensions receiver (H x W x D)</td>
<td>65 x 225 x 100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.9 kg (including batteries)</td>
</tr>
<tr>
<td>SENSOR</td>
<td>DPP-SU</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Diameter 230 mm (outer rim)</td>
</tr>
<tr>
<td>Height</td>
<td>140 mm</td>
</tr>
<tr>
<td>Handle length</td>
<td>450 ... 750 mm adjustable</td>
</tr>
<tr>
<td>Weight</td>
<td>2.2 kg (incl. batteries and handle)</td>
</tr>
<tr>
<td>Dynamic range</td>
<td>Magnetic channel &gt;110 dB</td>
</tr>
<tr>
<td>Acoustic channel</td>
<td>&gt;110 dB</td>
</tr>
<tr>
<td>Frequency range</td>
<td>100 ... 1500 Hz</td>
</tr>
<tr>
<td>Filter stages</td>
<td></td>
</tr>
<tr>
<td>Off</td>
<td>100 ... 1500 Hz</td>
</tr>
<tr>
<td>Low pass</td>
<td>100 ... 400 Hz</td>
</tr>
<tr>
<td>Band pass</td>
<td>150 ... 600 Hz</td>
</tr>
<tr>
<td>High pass</td>
<td>200 ... 1500 Hz</td>
</tr>
<tr>
<td>Protection rating</td>
<td>IP 65</td>
</tr>
</tbody>
</table>

Fully automatic trigger level adjustment for acoustic as well as for magnetic channel
Intelligent noise suppression (Background Noise Reduction)
Automatic headset mute function during the handling of the sensor (Automatic Proximity Mute)

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Product</th>
<th>Order Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver unit DPP-CU with shoulder strap</td>
<td></td>
</tr>
<tr>
<td>Headset KR22-5</td>
<td></td>
</tr>
<tr>
<td>Sensor unit DPP-SU with:</td>
<td></td>
</tr>
<tr>
<td>Telescopic handle</td>
<td></td>
</tr>
<tr>
<td>Tips (18 mm and 75 mm), tripod</td>
<td></td>
</tr>
<tr>
<td>Sensor connection cable</td>
<td></td>
</tr>
<tr>
<td>Set of batteries</td>
<td></td>
</tr>
<tr>
<td>Carrying bag with foam inserts</td>
<td></td>
</tr>
<tr>
<td>Ground plate</td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td></td>
</tr>
<tr>
<td>Vehicle installation kit (instead of the carrying bag)</td>
<td></td>
</tr>
</tbody>
</table>

**digiPHONE+**

- Perfect acoustic quality and noise immunity
- Automatic mute function to protect your ears
- Bright, transflective sun readable display
- Easiest handling with automatic adjustment
- Earphone volume limitation to 84 dB(A)

**Description**

The new digiPHONE+, the new definition of silence!
The innovation for the cable fault pinpointing!

A combination of different technologies for the efficient noise suppression provides you with a maximised, perfect acoustic performance, which passes only the fault noise.

**The technologies of the digiPHONE+**

**BNR – Background Noise Reduction**
The new, intelligent BNR technology with filtering and background noise suppression produces an undisturbed acoustic experience, and lets only the fault sound to your ears.

**APM Automatic Proximity Mute**
The second silent technology in the new digiPHONE+. As soon as one approaches the handle, the sound switches off, before the hand touches the handle. No cracks or bangs. After removing the hand, a short delay ensures that the digiPHONE+ sensor is standing stable and possible mechanical oscillations have ceased, before the headset is activated.

**Housing**
The new housing concept of the sensor in connection with a floating microphone suspension reduces the body sound of the sensor itself and provides a solid standing of the digiPHONE+ sensor even on sloped surfaces.

**Tracing**
The left-right indication keeps the operator always on top of the cable and the compass indicates the fault direction.

Distance to fault can be displayed in meter/feet
ITEM 6
Systematic line and fault location

Ferrolux FL 10

Benefits

- Precise direction guidance with right/left arrows
- “SignalSelect” for clear route location
- Depth and signal current intensity measurement at the push of a button
- Route sensor weighs less than 1 kg for non-tiring use
- “DirectSignal” for effective line location
The Ferrolux location system is the solution for your day-to-day tasks. You can use the system to quickly and easily find cable faults. You can locate lines just as quickly, measure how deep they are and save data including GPS co-ordinates in the memory. The route sensor for location tasks weighs less than 1 kg, which means you can use it for lengthy periods without getting tired. Special features such as the SuperMax Signal, DirectSignal and SignalSelect make your job easier and the results more accurate.

**SignalSelect**

SignalSelect, a patented method for finding the direction of a signal on a line, greatly increases the certainty and efficiency of route location. This method is particularly useful in areas where several systems are in close proximity. The Ferrolux generators produce a specially encoded audio frequency signal, which is fed in directly or inductively. The FLE 10 / FS 10 receiver system selects the signal via the target line and identifies the direction of signal flow.

**SuperMax**

The existing Maximum method is relatively inaccurate, and has therefore mostly been used for ground surveys. The Ferrolux FLE 10 / FS 10 receiver system combines the conventional Maximum and Minimum methods to achieve a new, improved method called SuperMax. Even relatively untrained operators can use this method to achieve excellent location results.

**DirectSignal**

Directly audible analogue reception signal through internal loudspeaker or headphones. Listening to the reception signal increases the information, supports the visually displayed information on the receiver and facilitates effective line location. There are separate knobs for setting the signal amplification and volume.
Directional left/right guidance

The arrows show you whether to move the FS 10 route sensor to the left or right in order to keep it directly above the line. The arrow shaft shortens the closer you are to the line. A marking across the arrow shaft appears when the FS 10 route sensor reaches a 45° angle to the side to the line.

- Clear direction display
- Distance-based direction display
- Clear indication when the user is standing over the line

All the advantages of the SebaKMT Ferrolux generators at a glance

- Automatic impedance adjustment
- Automatic or manual frequency selection
- Multi-frequency operation - transmits three frequencies simultaneously
- Displays output voltage which is dangerous to touch
- Overload protection/display

<table>
<thead>
<tr>
<th></th>
<th>FLG 10</th>
<th>FLG 50</th>
<th>FLG 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output power</td>
<td>0 - 10 Watt</td>
<td>0 - 50 Watt</td>
<td>0 - 200 Watt</td>
</tr>
<tr>
<td>Increment</td>
<td>0.5 Watt</td>
<td>2.5 Watt</td>
<td>10 Watt</td>
</tr>
<tr>
<td>Output frequencies</td>
<td>491 Hz / 982 Hz / 8440 Hz</td>
<td>491 Hz / 982 Hz / 8440 Hz</td>
<td>491 Hz / 982 Hz / 8440 Hz</td>
</tr>
<tr>
<td>Custom frequencies available (&lt;10 kHz)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 °C ... +50 °C</td>
<td>-20 °C ... +50 °C</td>
<td>-20 °C ... +50 °C</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 54</td>
<td>IP 54</td>
<td>IP 20</td>
</tr>
<tr>
<td>Dimensions</td>
<td>250 x 120 x 170 mm</td>
<td>410 x 175 x 335 mm</td>
<td>450 x 320 x 133 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>2.9 kg</td>
<td>14 kg</td>
<td>12 kg</td>
</tr>
<tr>
<td>SignalSelect</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Measuring functions</td>
<td>Loop impedance Voltage Current</td>
<td>Loop impedance Voltage Current</td>
<td>Loop impedance Voltage Current</td>
</tr>
<tr>
<td>Power supply</td>
<td>NiMh 12 V / 4 Ah</td>
<td>Lead gel battery 12V /12 Ah</td>
<td>100 … 240 V AC</td>
</tr>
<tr>
<td>Operating time</td>
<td>approx. 2.5 h at 10 W</td>
<td>approx. 6 h</td>
<td>Mains operation only</td>
</tr>
<tr>
<td>Impedance adjustment</td>
<td>0.5 ... 1024 Ω</td>
<td>0.5 ... 1024 Ω</td>
<td>0.5 ... 1024 Ω</td>
</tr>
</tbody>
</table>
Our range of products: Equipment and systems to locate faults in power and communications networks, as well as for leak location on pipe networks · line location equipment · CCTV inspection · seminars · service · contracting.

Technical data subject to change without notice.  

ISO 9001:2008

FLE-I Log PC software

The SebaKMT I-Log software allows you to import the route data stored in the Ferrolux receiver. Combined with the optional GPS module, it provides precise data on the route, position and detected faults.

Special accessories

- Transmitter clamp (50 mm and 100 mm) (fig. 1)
- DEB 3-10 step voltage sensor with three frequencies (fig. 2)
- Cable selection drum (fig. 3)
- GOK 50-R location cable for locating non-metallic pipelines (fig. 4)
- MLS pipeline transmitter available in different frequencies (fig. 5)
ITEM

7
Cable Avoidance Tools

XD Cable Tracing (33KHz System)

essential site equipment for locating and tracing underground services

Cable & Pipe Locator
Site safety must be your **number one concern.**

Cable strikes result in death, injury, disruption. **You** are responsible for taking the necessary steps to minimise this workplace hazard. Follow the HSE recommendations for safe digging practice. Get some serious cable locating equipment on the job and make sure it gets used.

**INSIST ON THE POWER, PERFORMANCE AND QUALITY OF CABLE AVOIDANCE TOOLS.**

These locators are from , world famous specialists in underground location for over 25 years.

The **CABLE AVOIDANCE TOOL** is a full function, industry standard locator which every ground working operative will find familiar and easy to use.

Better by design, the Cable Avoidance Tool is rugged, lightweight and packed full of features: LCD METER, precision locating as standard. DETACHABLE LOUDSPEAKER held next to the ear in noisy work situations. FINGERTIP CONTROLS, adjust sensitivity and rapid switching between the locator’s three operating modes. ADD a powerful range of accessories and the Cable Avoidance Tool becomes the main component of a versatile pipe and cable tracing system.

---

1. New Signal Generator SG-V with multisegment LCD. Enhances detectability of pipes and cables. Trace out the route of specific services. Use the Signal Generator to transmit an easily identifiable signal along a pipe or cable.

2. Trace the line using the Cable Avoidance Tool.

3. New Signal Generator SG-A

---

**CABLE AVOIDANCE TOOLS**

**Essential site equipment for locating and tracing underground services**

Backed up nationally by a network of approved sales and service centres. On-site or factory based operator training courses available. Detailed Operator Tutorial on CD-ROM.
It’s a tough world for today’s hard pressed ground working contractor. You have to get the job done fast but not break pipes or cables. Now, in this demanding situation, powerful help is at hand. The CABLE AVOIDANCE TOOL XD provides ultimate information about underground services before you dig.

The CABLE AVOIDANCE TOOL XD has all the familiar user-friendly features of the standard model but delivers more power, more precision and more information from underground. The XD has a depth mode activated by a simple push-button. Signal Generators SG-A and SG-V are designed to operate in conjunction with the Cable Avoidance Tools in a wide range of tracing applications. A 33kHz signal can be applied to a pipe or cable and traced along its length with the Cable Avoidance Tool. The Signal Generators are new for 2005, with smart robust styling, extra features and all round greater operating efficiency resulting in longer battery life.

When you need MAXIMUM TECHNOLOGY in your hand. When you want to find pipes and cables fast, make sure it’s the XD LOCATION SYSTEM. ESSENTIAL SITE EQUIPMENT FOR LOCATING AND TRACING UNDERGROUND SERVICES.

Controls
1) On/off control. Press for 'on', release for 'off'. Battery check tone at switch on.
2) 3 position function select switch: P - Power Mode for detecting live imbalanced cables. R - Radio Mode for detecting re-radiated radio signals. G - Generator Mode for detecting conductors carrying the signal generated by the Signal Generator or from the Sonde Transmitter.
3) Sensitivity Control.
4) Push button to activate depth measurement - XD only.

Display
Large, easy to read liquid crystal display. Shock resistant, mounted behind polycarbonate lens for maximum protection. The display indicates:
1) Signal strength.
2) Battery condition.
3) Confirmation of selected mode.
4) Depth in G mode - XD only.

Frequency
P - 50-400 Hz  R - 15-20 kHz  G - 33 kHz

Depth of detection (guide)
The Cable Avoidance Tool will typically detect at the following depths:
P - 3 metres  R - 2 metres  G - 3 metres
Depth measurement - XD only
Range: 0.25 - 3.0m (line)  1.0 - 6.0m (sonde)

Batteries
8 x AA (IEC type LR6)
Typical life (guide) - 40 hours

Weight
3.0 kgs (including batteries)
Moisture/dust resistant to IP65

Specifications and labelling subject to change without notice.
ITEM

8
DESCRIPTION

The Megger, TDR500 cable fault locator breaks new ground as a cost effective high specification hand held Time Domain Reflectometer (TDR) for locating faults on metallic cables.

Designed for the field engineer requiring a low cost solution to field testing, the TDR500 offers all the benefits of Megger build quality and reliability in a high quality affordable package.

Transmission line testing
The TDR500 is suitable for virtually all types of transmission cable including twisted pair, coaxial and parallel conductors. Condition of the entire cable or section is displayed graphically.

30m to 3 km Range
Suitable for identifying and locating a range of cable faults from a few metres up to 3 Km on non-energised cables. Cable characteristics are clearly displayed on the 122 x 32 pixel LCD display.

Simple Operation
Operation of the TDR500 is simplicity itself. No multi-function keys to confuse the operator. Each button has its own dedicated function.

Just connect the test lead to the de-energised cable to be tested. Switch on the TDR and set the Velocity factor.

Cable route tracing
The TDR500 can inject an oscillating 810 Hz/1.11 kHz tone onto the de-energised transmission line or power line.

The warble tone allows the engineer to trace the faulty cable pair with the use of a commercially available tone tracing probe.

- Simple operation
- Warble tone generator
- Velocity Factor from 0.30 to 0.99
- Range to 3km
- Tough ABS case
- IP54 Environmental protection
- Carry case and test leads included
- 3 year manufacturers warranty
BENEFITS

- Hand held operation
- High contrast monochrome graphic LCD display (122 x 32 pixel).
- Resolution to 1% of range.
- Adjustable display contrast
- Environmental protection to IP54
- Display distance in metres or feet.
- Uses standard AA (6LR61) primary or rechargeable cells
- 3 year warranty reduces long term ownership cost

APPLICATIONS

Non-energised cable testing and tracing including:

- Traditional ‘Transmission Medium Test Equipment’
- Telecommunications
- CATV (Cable TV)
- Aerospace
- Electrical Contractors
- Network Installers
- Utilities
- IT Departments
- Railway signalling

Private networks
- Campus and industrial networks
- Building automation

Stock control
- Cable distribution channels
- Cable manufacturers

Industrial communications
- Fieldbus network installations
- Site maintenance engineers

Except where otherwise stated, this specification applies at an ambient temperature of 20°C.

SPECIFICATION

General
Except where otherwise stated, this specification applies at an ambient temperature of 20°C.

Ranges:
30m, 100m, 300m, 1000m, 3000m (100ft, 300ft, 1000ft, 3000ft, 10000ft)

Accuracy:
±1% of range ± pixel at 0.67 VF

Note - The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct.

Resolution:
1% of range

Input Protection:
For connection to de-energised cable only

Output pulse:
5 volts peak to peak into open circuit from 100 Ω source
Pulse widths determined by range and cable impedance

Gain:
Automatic with gain and range

Velocity Factor:
Variable from 0.30 to 0.99 in steps of 0.01

Refresh Rate:
Three times per second

Power Down:
Automatic after 5 minutes with no key press

Warble:
5 V pk-pk from 100 Ω, alternating between 810 Hz and 1110 Hz

Batteries
Six LR6 (AA) type batteries, Manganese-alkali or nickel-cadmium or nickel-metal-hydride cells

Nominal voltage:
9 V for Alkali or 7.2 V for NiCad.

Battery consumption:
100 mA nominal. (30 hours continuous use)

Safety
This instrument is to be used on de-energised cable only.

EMC
Complies with Electromagnetic Compatibility Specifications (Light industrial) BS EN 61326-1, with a minimum performance of ‘B’ for all immunity tests.

Mechanical
The instrument is designed for use indoors or outdoors and is rated to IP54.
**Case Dimensions**
230 mm (9 inches) x 115 mm (4.5 inches) x 48 mm (2 inches)

**Instrument weight** 0.6kg (1.32lbs)

**Case material**
ABS

**Connectors**
BNC terminal

**Test Lead**
300mm long with croc clips

**Display**
122 X 32 pixel Graphics LCD

**Environmental**

**Operational Temperature:**
-15°C to +50°C (5°F to 122°F)

**Storage Temperature:**
-20°C to 70°C (-4°F to 158°F)

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>Item (Qty)</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Fault Locator</td>
<td>TDR500</td>
</tr>
<tr>
<td>Included Accessories</td>
<td></td>
</tr>
<tr>
<td>Test &amp; Carry case with strap</td>
<td>6420-125</td>
</tr>
<tr>
<td>Test lead set</td>
<td>6231-694</td>
</tr>
<tr>
<td>User Guide</td>
<td>6172-726</td>
</tr>
</tbody>
</table>
ITEM
9
**TDR500/3 Handheld TDR**

**DESCRIPTION**
The TDR500/3 is a hand held, compact Time Domain Reflectometer for locating faults on metallic cables. It has a minimum resolution of 0.1 m/0.3 ft and a 5 km/15 kft maximum range depending on velocity factor selected and cable type.

Four output impedances are available (25, 50, 75, and 100 Ω) and a velocity factor between 0.2 and 0.99 will meet any cable test requirements.

The TDR500/3 has a simple selection option which together with a 4 way control switch offers an intuitive operation for the user.

**FEATURES**
An AUTO selection option ensures that the most effective parameters are selected depending on the range required, aiding rapid diagnosis of the TDR trace. A clear operator controlled cursor allows instant measurement of the distance to the fault.

A trace HOLD feature also allows the operator to hold a trace on the screen, something not seen on most other handheld TDRs. Extra high resolution together with white-light backlight and grey scale tones give the graphical display a vibrancy, aiding the user in identifying key events on the trace.

- Backlit graphics monochrome LCD (256 x 128)
- Adjusted display contrast
- Resolution to 0.1 m
- For use on Telecom TNV-3 circuit, or 150V CAT IV power circuits
SPECIFICATIONS

Except where otherwise stated, this specification applies at an ambient temperature of 20 °C.

General

Ranges
10 m, 25 m, 100 m, 250 m, 1000 m, 2500 m, 5000 m (30 ft, 75 ft, 300 ft, 750 ft, 3000 ft, 7500 ft, 15000 ft)

Accuracy: ±1% of range ± pixel at 0.67 VF
[Note- The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct.]

Resolution: 1% of range

Input protection: This instrument complies with IEC61010-1 for connection to live systems up to 150 V CAT IV when used with the optional fused test lead set.

Output pulse: 5 volts peak to peak into open circuit. Pulse widths determined by range and cable

Gain: Set for each range with three user selectable steps (in manual operating mode)

Velocity factor: Variable from 0.2 to 0.99 in steps of 0.01

TX null: Automatic

Power down: Automatic after 5 minutes with no key press

Backlight: Stays on for 1 minute with no key press

Batteries: Five LR6 (AA) type batteries, Manganese alkali or nickel metal-hydride cells

Battery life: Up to 14 hours (typical)

Mechanical: The instrument is designed for use indoors or outdoors and is rated to IP54.

Case dimensions: 230 mm (9 in) x 115 mm (4.5 inches) x 48 mm (2 inches)

Instrument weight: 0.6 kg (1.32 lbs)

Case material: ABS

Connectors: Two 4 mm-safety terminals

Test leads (TDR500/3): 2 metres long consisting of 2 x 4 mm shrouded connector to miniature crocodile clips

Display: 256 x 128 pixel Graphics LCD

ORDERING INFORMATION

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<th>Item (Qty)</th>
<th>Cat. No.</th>
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<td>Fused test lead set</td>
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ITEM
10
TDR1000/3
Handheld TDR

DESCRIPTION
The TDR1000/3 is a hand held, compact Time Domain Reflectometer for locating faults on metallic cables. It has a minimum resolution of 0.1 m/0.3 ft and a 5 km/15 kft maximum range depending on Velocity factor selected and cable type.

Four output impedances are available (25, 50, 75, and 100 Ω) and a velocity factor between 0.2 and 0.99 will meet any cable test requirements.

The TDR1000 has a simple selection option which together with a 4 way control switch offers an intuitive operation for the user.

FEATURES
An AUTO selection option ensures that the most effective parameters are selected depending on the range required, aiding rapid diagnosis of the TDR trace. Dual cursors allow complete flexibility, giving the operator full control and instant indication of distance between two points.

A trace HOLD feature also allows comparison between conditions, something not seen on most other handheld TDRs. Extra high resolution together with white-light backlight and grey scale tones give the graphical display a vibrancy, aiding the user in identifying key events on the trace.

- Backlit graphics monochrome LCD (256 x 128)
- Adjustable display contrast
- Resolution to 0.1 m
- Power blocking filter not required
- Environmental protection to IP54
- Auto selected output impedance (between 25, 50, 75 and 100 Ω)
- 2ns pulse for near end fault location
- AUTO option selecting gain and pulse for each range
- Display distance in metres or feet
- Uses five AA (LR6) primary cells
- Designed for use on all metallic cable pairs.

For use on Telecom TNV-3 circuit, or 150V CAT IV power circuits
SPECIFICATIONS

Except where otherwise stated, this specification applies at an ambient temperature of 20°C.

General

Ranges: 10 m, 25 m, 100 m, 250 m, 1000 m, 2500 m, 5000 m (30 ft, 75 ft, 300 ft, 750 ft, 3000 ft, 7500 ft, 15000 ft)

Accuracy: ±1% of range ± pixel at 0.67 VF
[Note- The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct.]

Resolution: 1% of range

Input Protection: This instrument complies with IEC61010-1 for connection to live systems up to 150 V CAT IV when used with the optional fused test lead set.

Output pulse: 5 volts peak to peak into open circuit. Pulse widths determined by range and cable

Gain: Set for each range with three user selectable steps (in Manual operating mode)

Velocity Factor: Variable from 0.2 to 0.99 in steps of 0.01

TX Null: Automatic

Power Down: Automatic after 5 minutes with no key press

Backlight: Stays on for 1 minute with no key press

Batteries: Five LR6 (AA) type batteries, Manganese alkali or nickel metal-hydride cells

Battery Life: Up to 14 hours (Typical)

Mechanical: The instrument is designed for use indoors or outdoors and is rated to IP54.

Case Dimensions: 230 mm (9 in) x 115 mm (4.5 inches) x 48 mm (2 inches)

Instrument weight: 0.6 kg (1.32 lbs)

Case material: ABS

Connectors: Two 4 mm-safety terminals

Test Leads (TDR1000/3): 2 metres long consisting of 2 x 4 mm shrouded connector to miniature crocodile clips

Display: 256 x 128 pixel Graphics LCD

Environmental

Operating temperature: 15 ºC to +50 ºC (5 ºF to 122 ºF)

Storage Temperature: -20 ºC to 70 ºC (-4 ºF to 158 ºF)

Safety: When using the optional fused test lead set this instrument complies with IEC61010-1 for connection to live systems with less than 300 V between the terminals and up to 150 V CAT IV to earth

EMC: Complies with Electromagnetic Compatibility Specifications (Light industrial) BS EN 61526-1, with a minimum performance of 'B' for all immunity tests

ORDERING INFORMATION

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<td>Fused Test Lead Set</td>
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CERTIFICATION ISO
Registered to ISO 9001:2008 Cert. no. Q 08250
Registered to ISO 14001-2004 Cert. no. EMS 61597

TDR1000_3_DS_en_V01
Megger is a registered trademark
TDR1000/3P
Handheld TDR

DESCRIPTION
The TDR1000/3P is a hand held, compact Time Domain Reflectometer for locating faults on metallic cables. It has a minimum resolution of 0.1 m/0.3 ft and a 5 km/15 kft maximum range depending on Velocity factor selected and cable type.

Four output impedances are available (25, 50, 75, and 100 Ω) and a velocity factor between 0.2 and 0.99 will meet any cable test requirements.

The TDR1000 has a simple selection option which together with a 4 way control switch offers an intuitive operation for the user.

FEATURES
An AUTO selection option ensures that the most effective parameters are selected depending on the range required, aiding rapid diagnosis of the TDR trace. Dual cursors allow complete flexibility, giving the operator full control and instant indication of distance between two points.

A trace HOLD feature also allows comparison between conditions, something not seen on most other handheld TDRs. Extra high resolution together with white-light backlight and grey scale tones give the graphical display a vibrancy, aiding the user in identifying key events on the trace.

- Backlit graphics monochrome LCD (256 x 128)
- Adjustable display contrast
- Resolution to 0.1 m
- For use on Telecom TNV-3 circuit, or 150V CAT IV power circuits
- Simple operation
- AUTO set up for instant use
- Ultra fast pulse for near end fault identification
- Trace HOLD feature to allow comparison between cables
- IP54 rating offers real life working
- Designed for use on all metallic cable pairs

- Power blocking filter not required
- Environmental protection to IP54
- Auto selected output impedance (between 25, 50, 75 and 100 Ω)
- 2 ns pulse for near end fault location
- AUTO option selecting gain and pulse for each range
- Display distance in metres or feet
- Uses five AA (LR6) primary cells
SPECIFICATIONS

Except where otherwise stated, this specification applies at an ambient temperature of 20ºC.

**General**

**Ranges**
10 m, 25 m, 100 m, 250 m, 1000 m, 2500 m, 5000 m (30 ft, 75 ft, 300 ft, 750 ft, 3000 ft, 7500 ft, 15000 ft)

**Accuracy:** ±1% of range ± pixel at 0.67 VF
[Note: The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct.]

**Resolution:** 1% of range

**Input Protection:** This instrument complies with IEC61010-1 for connection to live systems up to 150 V CAT IV when used with the optional fused test lead set.

**Output pulse:** 5 volts peak to peak into open circuit. Pulse widths determined by range and cable

**Gain:** Set for each range with three user selectable steps (in Manual operating mode)

**Velocity Factor:** Variable from 0.2 to 0.99 in steps of 0.01

**TX Null:** Automatic

**Power Down:** Automatic after 5 minutes with no key press

**Backlight:** Stays on for 1 minute with no key press

**Batteries:** Five LR6 (AA) type batteries, Manganese alkali or nickel metal-hydride cells

**Battery Life:** Up to 14 hours (Typical)

**Mechanical:** The instrument is designed for use indoors or outdoors and is rated to IP54.

**Case Dimensions:** 230 mm (9 in) x 115 mm (4.5 inches) x 48 mm (2 inches)

**Instrument weight:** 0.6 kg (1.32 lbs)

**Case material:** ABS

**Connectors:** Two 4 mm-safety terminals

**Test Leads (TDR1000/3P):** 0.5 metres long fitted with 500 mA FF HBC 1 kV 50 kA Fuse

**Display:** 256 x 128 pixel Graphics LCD

**Environmental**

**Operating temperature:** 15 ºC to +50 ºC (5 ºF to 122 ºF)

**Storage Temperature:** -20 ºC to 70 ºC (-4 ºF to 158 ºF)

**Safety:** When using the optional fused test lead set this instrument complies with IEC61010-1 for connection to live systems with less than 300 V between the terminals and up to 150 V CAT IV to earth

**EMC:** Complies with Electromagnetic Compatibility Specifications (Light industrial) BS EN 61526-1, with a minimum performance of ‘B’ for all immunity tests

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<td>Fused Test Lead Set</td>
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**CERTIFICATION ISO**
Registered to ISO 9001:2008 Cert. no. Q 08250
Registered to ISO 14001-2004 Cert. no. EMS 61597

TDR1000_3P_DS_en_V01
Megger is a registered trademark
ITEM
11
TDR2000/2
Cable Fault Locator

DESCRIPTION

The Megger® TDR2000/2 is a state of the art, monochrome or colour, dual channel Time Domain Reflectometer, capable of identifying and locating a wide range of faults on metallic cables.

The TDR2000/2 has a minimum resolution of 0.1m and a maximum range of 20 km at VF=0.9 and 16 Km at 0.65 VF. The TDR2000/2 can perform single or dual channel measurements on a wide range of metallic cables. Active channels can be compared with each other or with previously stored traces from memory. Differential channel measurements are possible and cross talk between channels can also be identified.

All results are displayed on a high resolution, QVGA colour display. Full contrast adjustment provides optimum display contrast in a variety of ambient light conditions.

3 Configurations Options

The TDR2000/2 comes in three configurations:

TDR2000/2 Monochrome primary cell
A fully featured high resolution TDR with backlit monochrome display and powered by 8 x AA (LR6) batteries.

TDR2000/2RM Monochrome rechargeable
As the TDR2000/2 but with a rechargeable NiMH battery pack and charger in place of the Dry cells.

TDR2000/2R Colour rechargeable
As the TDR2000/2RM but with a colour high resolution display providing excellent trace separation in dual trace modes. The unit is also powered by a rechargeable NiMH and includes battery charger.

Intermittent Mode
An ‘intermittent mode’ continually updates and shows any transient reflections. Any intermittent fault leaves a permanent record on the display, capturing elusive faults.

Dual cursors
The TDR2000/2 can display either single or dual cursors. Single cursor mode displays the distance from the start of the cable to the cursor. In dual cursor mode the distance between faults can be measured.

Fast Find key
One press of the find key automatically adjusts the range and gain and positions the cursor to the major event on the cable.

Tx Null
Tx Null helps eliminate the ‘dead zone’ at the start of the displayed trace, normally obscured by the transmission pulse. By the adjusting the Tx Null the user can see these ‘near end’ faults more clearly.

Output pulse control
Both the amplitude and width of the output pulse can be adjusted to provide the best possible reflection for accurate location of cable faults.
**Interactive Help Screen**
A full graphical help screen is available with keyboard layout and individual key operation. At the press of a button.

**Trace Storage**
15 internal trace memories provide for the storage and recall of test results. The traces can be recalled to the display for analysis or compared with an active display to aid in fault location.

Alternatively the stored results can be downloaded to a computer, over the RS232 port, using the TraceMaster software and RS232 lead provided.

**Trace Master PC Software**
Trace Master provides download and upload facilities between the TDR and a computer. Traces can be individually selected, saved to a PC and annotated by the user. Historical information can be reviewed on the PC or recalled to the TDR for comparison with current measurements. Tracemaster is the ideal tool for cable documentation. Results can be printed from the computer for inclusion in documents.

**Power source**
The TDR2000/2 can be supplied as a standard battery powered unit or in a rechargeable version, as the TDR2000/2RM or TDR2000/R. Fitted with a NiMH rechargeable battery pack the TDR2000/2R and TDR2000/RM are supplied with the charger as standard.

**BENEFITS**
- 11 fault location modes
- For use on Telecom TNV-3 circuit, or 300V CAT III power circuits (415 V phase to phase) with fused leads
- External mains blocking filter not required
- Screen contrast control
- Multi language operation, uploadable using TraceMaster software
- 3 step pulse amplitude control
- Adjustable display contrast
- 15 trace internal memory
- Protected to IP54
- High impact ABS case
- Comes with test and carry case and test leads

**SPECIFICATION**
Except where otherwise stated, this specification applies at an ambient temperature of 20 ºC.

**General**
Ranges:
- 50 m, 100 m, 200 m, 400 m, 1 km, 2 km, 4 km, 8 km, 16 km.
- 150 ft, 300 ft, 600 ft, 1200 ft, 3000 ft, 6000 ft, 12000 ft, 24000 ft, 48000 ft

Resolution:
- 0.1 m (4inches) up to 200 m
- 0.2 m up to 400 m
- 0.1% of range above 400 m

Measurement Accuracy:
0.1% of Range

[Note – The measurement accuracy is for the indicated cursor position only and is conditional on the velocity being correct]

**Input Impedance:**
120 Ω.

**Input Protection:**
300 V CATIII working, 415 V CATIII Phase to Phase

**Output Pulse Amplitude:**
Nominal 3 V, 5 V and 14 Vpk to pk into an opencircuit

**Pulse width user selectable:**
- 50m range: 7 ns, 20 ns, 40 ns, 60 ns, 80 ns
- 100m range: 7 ns, 40 ns, 60 ns, 80 ns, 100 ns
- 200 m ranges: 7 ns, 40 ns, 80 ns, 140 ns, 200 ns
- 400 m range: 40 ns, 80 ns, 160 ns, 200 ns, 400 ns
- 1km range: 80 ns, 160 ns, 260 ns, 500 ns, 1 μs
- 2km range: 160 ns, 260 ns, 500 ns, 1 μs, 2 μs
- 4km range: 240 ns, 500 ns, 1 μs, 2 μs, 4 μs
- 8km range: 500 ns, 1 ms, 2 μs, 4 μs, 8 μs
- 16km range: 1 μs, 2 μs, 4 μs, 8 μs, 16 μs

( Default pulse width for each range underlined)

**Gain:**
0 to 90 dB in steps of 6 dB

**Velocity Factor:**
Variable from 0.30 to 0.99 in steps of 0.001

**TX Null:**
0 Ω to 120 Ω

**Screen Update Rate:**
Once per second or three times per second, (user selectable).

**Power Down:**
Automatic after 5, 10 or 15 minutes with no keys pressed, (user selectable).

**Backlight:**
Stays on for 1, 2 or 5 minutes when activated, (user selectable).

**Communications Port:**
RS-232C compatible 1 start bit, 8 data bits, 1 stop bit and no parity, 19200 baud standard

**Internal Memory:**
Storage capacity of 15 waveforms and data
Batteries

**TDR2000/2**

Eight LR6 (AA) type batteries, manganese-alkali or nickel-cadmium or nickel-metal-hydride cells.

**TDR2000/2RM**

NiMH cell

**TDR2000/2R**

NiMH cell

**Battery Charger**

**Supply voltage:**

UK & European Version: 230 V a.c. ±10% 50 Hz

**Safety**

This instrument complies with IEC61010-1 for connection to live systems up to 300V CAT III with fused leads.

**EMC**

The instrument will comply with EN 61326-1, classified as ‘class B’. If connected to a live domestic power supply, the operation of this instrument could cause interference with other equipment connected to the same supply. To reduce this interference, select the lowest voltage and narrowest width pulse as consistent with accurate measurement. During immunity tests there may be self-recovering loss of function (i.e. Performance criterion B).

**Mechanical**

The instrument is designed for use indoors or outdoors and is rated to IP54.

**Case Dimensions:**

250 mm long x 200 mm wide 110 mm deep

Instrument weight: 1.5 kg (3.3lbs)

**Case material:**

ABS

**Display**

320 x 240 pixel eight colour backlight LCD.

**Environmental**

**TDR2000/2**

**Operational Temperature:**

-15 ºC to +50 ºC (5 ºF to 122 ºF)

**Storage Temperature:**

-20 ºC to +70 ºC (-4 ºF to 158 ºF)

**TDR2000/2R and 2RM**

**Operational Temperature:**

-15 ºC to +45 ºC (5 ºF to 113 ºF)

**Storage Temperature:**

-20 ºC to +45 ºC (-4 ºF to 113 ºF)

Charging should not take place when the ambient temperature is less than 0 ºC (+32 ºF)

**Humidity**

<95% at +40 ºC non-condensing

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<td>TDR2000/2R Colour Rechargeable</td>
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<td>Serial data lead</td>
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<td>2 x Miniature Clip Test Lead Set</td>
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<td>Carry Strap for Pouch</td>
<td>6220-611</td>
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<td>Tracemaster software</td>
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<td>Battery charger European mains</td>
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Registered to ISO 9001:2008 Cert. no. Q 09250
Registered to ISO 14001:2004 Cert. no. EMS 61597

TDR2000_2_DS_en_V12
TDR2000/2P
Dual channel cable fault locator

DESCRIPTION
The Megger® TDR2000/2P is a state of the art, Monochrome dual channel Time Domain Reflectometer, capable of identifying and locating a wide range of faults on metallic cables from a few meters to 20 km depending on cable type. The TDR2000/2P is ideal for engineers with little TDR experience. The TDR2000/2P can perform single or dual channel measurements on a wide range of metallic cables. Cables can be compared with each other or with previously stored traces from memory. Good and bad cores in multi core cables can be compared and just the difference displayed. Either dead or Live cables to CATIII 300 V Phase to earth or 415 V phase to phase can be tested. The TDR2000/2P is supplied complete with pairs of 2 metre long fused test leads, fitted with 30 mm gape crocodile clips for easy connection to large diameter cables. No blocking filter is required.

TDR2000/2P FEATURES

Intermittent Mode
An ‘intermittent mode’ continually updates and shows any transient reflections. Any intermittent fault leaves a permanent record on the display, capturing elusive faults.

Dual cursors
The TDR2000/2P can display either single or dual cursors. Single cursor mode displays the distance from the start of the cable to the cursor. In dual cursor mode the distance between faults can be measured.

Fast Find key
One press of the find key automatically adjusts the range and gain and positions the cursor to the major event on the cable.

Tx Null
Tx Null helps eliminate the ‘dead zone’ at the start of the displayed trace, normally obscured by the transmission pulse. By the adjusting the Tx Null the user can see these ‘near end’ faults more clearly.

Output pulse control
Both the amplitude and width of the output pulse can be adjusted to provide the best possible reflection for accurate location of cable faults.

Interactive Help Screen
A full graphical help screen is available with keyboard layout and individual key operation. At the press of a button.

Trace Storage
15 internal trace memories provide for the storage and recall of test results. The traces can be recalled to the display for analysis or compared with an active display to aid in fault location.

Alternatively the stored results can be downloaded to a computer, over the RS232 port, using the TraceMaster software and RS232 lead provided.

Specifically for the power industry
Fused croc-clip lead set 2 m
300 V CAT III (415 V Phase to Phase)
Intermittent fault location
No blocking filter required
15 memory trace storage
Weather proof to IP54
**Trace Master PC Software**
Trace Master provides download and upload facilities between the TDR and a computer. Traces can be individually selected, saved to a PC and annotated by the user. Historical information can be reviewed on the PC or recalled to the TDR for comparison with current measurements.
Tracemaster is the ideal tool for cable documentation. Results can be printed from the computer for inclusion in documents.

**Power source**
The TDR2000/2P is supplied with a NiMH rechargeable battery pack and charger as standard.

**Further benefits:**
- 11 fault location modes.
- For use 300V CAT III (415V phase to phase) power circuits with fused leads.
- External mains blocking filter not required.
- Screen contrast control.
- Multi language operation, uploadable using TraceMaster software.
- 3 step pulse amplitude control.
- Adjustable display contrast.
- 15 trace internal memory.
- Protected to IP54.
- High impact ABS case.
- Comes with test and carry case and test leads.
- 3 year warranty

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**SPECIFICATION**
Except where otherwise stated, this specification applies at an ambient temperature of 20 °C.

**General**

**Ranges:**
- 50 m, 100 m, 200 m, 400 m, 1 km, 2 km, 4 km, 8 km, 16 km.
- 150 ft, 300 ft, 600 ft, 1200 ft, 3000 ft, 6000 ft, 12000 ft, 24000 ft, 48000 ft

**Resolution:**
- 0.1 mm (4 inches) up to 200 m
- 0.2 m up to 400 m
- 0.1% of range above 400 m

**Measurement Accuracy:** 0.1% of Range

[Note – The measurement accuracy is for the indicated cursor position only and is conditional on the velocity factor being correct].

**Input Impedance:** Automatic 0 to 120 Ω
**Input Protection:** 300 V CATIII phase to ground (440 V phase to phase) working.

**Output Pulse Amplitude:**
Nominal 3 V, 5 V and 14 V pk to pk into an open circuit

**Pulse width user selectable:**

<table>
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<tr>
<th>Range</th>
<th>Pulse Width Options</th>
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<td>7 ns, 20 ns, 40 ns, 60 ns, 80 ns</td>
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<td>200 m</td>
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<td>400 m</td>
<td>40 ns, 80 ns, 160 ns, 200 ns, 400 ns</td>
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<td>1 km</td>
<td>80 ns, 160 ns, 260 ns, 500 ns, 1 μs</td>
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<td>2 km</td>
<td>160 ns, 260 ns, 500 ns, 1 μs, 2 μs</td>
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<td>4 km</td>
<td>240 ns, 500 ns, 1 μs, 2 μs, 4 μs</td>
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<td>8 km</td>
<td>500 ns, 1 μs, 2 μs, 4 μs, 8 μs</td>
</tr>
<tr>
<td>16 km</td>
<td>1 μs, 2 μs, 4 μs, 8 μs, 16 μs</td>
</tr>
</tbody>
</table>

(Default pulse width for each range underlined)

**Gain:**
0 to 90 dB in steps of 6 dB

**TX Null:**
0 Ω to 120 Ω

**Velocity Factor:** Variable from 0.300 to 0.999 in steps of 0.001

**Screen Update Rate:**
Once per second or three times per second, (user selectable).

**Power Down:**
Automatic after 5, 10 or 15 minutes with no keys pressed, (user selectable)

**Backlight:**
Stays on for 1, 2 or 5 minutes when activated, (user selectable).

**Communications Port:**
RS-232C compatible - 1 start bit, 8 data bits, 1 stop bit and no parity, 19200 baud standard

**Internal Memory:** Storage capacity of 15 waveforms and data.

**Batteries:**
- TDR2000/2P 9.6 V NiMH cell
Battery Charger:
Supply voltage
UK and European 230 V a.c. ±10% 50 Hz
North American 115 V a.c. ±10% 60 Hz

SAFETY:
This instrument complies with IEC 61010-1 for connection to live systems up to 300(131,311),(274,361) V CAT III phase to earth and 415 V phase to phase with fused leads.

EMC:
The instrument will comply with EN 61326-1, classified as ‘class B’. If connected to a live domestic power supply, the operation of this instrument could cause interference with other equipment, connected to the same supply.

To reduce this interference, select the lowest voltage and narrowest pulse width as consistent with accurate measurement. During immunity tests there may be self-recovering loss of function (i.e Performance criterion B).

MECHANICAL:
The instrument is designed for use indoors or outdoors and is rated to IP54.

Case Dimensions:
250 mm L x 200 mm W x 110 mm D

Instrument weight: 1.5 kg (3.3 lbs)

Case material: ABS

TEST LEADS:
Two pairs of 2 meter long leads fitted with 30mm gape fused croc clips.
9 way D-type connector for serial communication.

DISPLAY:
320 x 240 pixel backlight LCD.

ENVIRONMENTAL:
TDR2000/2P

Operational Temperature:
-15 ºC to +45 ºC (5 ºF to 113 ºF)

Storage Temperature:
-20 ºC to +45 ºC (-4 ºF to 113 ºF)

NOTE:
Charging should not take place when the ambient temperature is less than 0 ºC (+32 ºF)

Humidity:
<95% at +40 ºC non-condensing

ORDERING INFORMATION

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<thead>
<tr>
<th>Item (Qty)</th>
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<td>Dual Channel cable fault locator</td>
<td>TDR2000/2P</td>
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<tr>
<td>Included Accessories</td>
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<tr>
<td>Battery charger UK</td>
<td>6121-538</td>
</tr>
<tr>
<td>Battery charger European</td>
<td>6121-539</td>
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<tr>
<td>Dual fused test lead set</td>
<td>6231-713</td>
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<tr>
<td>Test and carry pouch</td>
<td>6420-114</td>
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<tr>
<td>Serial data lead</td>
<td>25955-025</td>
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<tr>
<td>Carry strap for pouch</td>
<td>6220-611</td>
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<tr>
<td>Tracemaster software</td>
<td>6111-458</td>
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<tr>
<td>User Guide</td>
<td>6172-662</td>
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</table>

Registered to ISO 9001:2008 Reg no. Q 09250
Registered to ISO 14001:2004 Reg no. EMS 61597
ITEM

12
MTDR300
3-Phase Time Domain Reflectometer

DESCRIPTION
The MTDR300 is a 3-phase Time Domain Reflectometer (TDR) designed to provide quick, effective, accurate and safe prelocation of cable faults in electrical networks.

Operation of the instrument is via a single jog dial and intuitive menu system. The large colour display further enhances operator comfort and aids rapid and accurate fault prelocation.

The MTDR300 can be powered from its internal rechargeable battery or mains power. It’s housed in a rugged, robust, field proven case making it suitable for use in hostile or challenging environments.

By combining the MTDR300 with an impulse generator (thumper) and arc reflection filter, several methods of high voltage fault prelocation are possible.

The CAS-1 stand-alone software package is supplied with all MTDR300’s. This package allows the download (and upload) of saved traces for future analysis. It is also an ideal training package, as it contains all features of the MTDR itself.

FEATURES AND BENEFITS
■ 3-phase TDR operation
■ Single Jog Dial Operation
■ Intuitive “Operator Friendly” Menu system
■ Auto-ranging “find end of cable”
■ Auto-fault find “cursor to fault”
■ TDR range up to 55km/34miles
■ Transient range up to 220km/137miles
■ Multiple Fault Location Techniques
■ 3-phase Pulse Echo
■ Arc Reflection

APPLICATION
After the fault type has been identified, the appropriate fault prelocation method can be determined.

Rule of Thumb
Fault Resistance <300Ω** = LV Fault Location
Fault Resistance >300Ω** = HV Fault Location
**approx.

LV Fault prelocation
TDR also known as Pulse Echo techniques are used to prelocate low resistance faults, in cable networks. The MTDR300 offers 3-phase operation allowing the comparison of up to 3-phases at the same time. This can be especially useful to identify the faulted phase and allows phase comparison.

HV Fault prelocation
(1, 2, 3, 4 require an impulse generator)
(5 requires a DC source)

1. Arc Reflection has become the most widely used method of recent years, with the trace being easy to interpret. In this method the fault is stabilised by creating a temporary “bridge” to earth. During this period a standard pulse echo measurement is taken, into what is effectively a short circuit fault. This trace is then compared with a previously taken low voltage trace. The point of divergence is the fault position.
2. Arc Reflection Plus (ARP). The MTDR300 offers the ability to view up to 1024 traces (range dependent) taken during one arc. This overcomes the problem of misleading traces displayed during unstable periods of the arc.3. Differential Arc Reflection (DART). In this mode unwanted and confusing “common” reflections are removed leaving a clean trace with only the fault position being displayed. This method is especially suited in complex cable networks with several joints/splices or other equipment attached to it.

3. Differential Arc Reflection (DART). In this mode unwanted and confusing “common” reflections are removed leaving a clean trace with only the fault position being displayed. This method is especially suited in complex cable networks with several joints/splices or other equipment attached to it.

4. Impulse Current (ICE). The Impulse Current method is a “transient” fault prelocation technique and is suitable for the location of high resistance faults. A linear coupler, or C.T. integrated into the impulse generator senses the transients emitted from a flashover (fault). These signals are displayed on the MTDR300 which effectively acts as a storage oscilloscope.

5. Voltage Decay. Similar to Impulse Current, except in this instance the flashover is created by charging up the cable with a DC source. The emitted signals are detected by a voltage divider and displayed on the MTDR300 again acting as a storage oscilloscope.

**SPECIFICATIONS**

**Modes:**
- 3-phase Pulse Echo; Arc Reflection; Arc Reflection Plus (ARP);
- Differential Arc Reflection (DART);
- Impulse Current (ICE);
- Voltage Decay

**Range:**
- AUTO & 10-ranges
- 100m - 55km (328ft - 34miles) - TDR
- 100m - 220km (328ft - 37miles) - Transient

**Output pulse width:**
- AUTO with Range
- 50ns, 100ns, 200ns, 500ns, 1μs, 2μs, 5μs, 10μs

**Output pulse amplitude:**
- 25 V into 50 Ω

**Sampling Rate:**
- 100 MHz

**Timbase Accuracy:**
- 200 ppm

**Resolution:**
- (Vp=55%): 2.7 ft (0.82 m)

**Display:**
- 10.4in (26.4 mm), full XGA, 1024 X 768 colour

**Cursors:**
- Dual with independent control

**Gain:**
- 60 dB range in 5 dB Steps

**Input:**
- Impedance 50 Ω
- 3 x TDR
- 1 x Arc Reflection / Transient methods

**Ports:**
- 1 x USB

**Software:**
- CAS-1 (Cable analysis software)

**Supply**
- Mains
- 100 to 240VAC, 45 to 65Hz

**Battery**
- 14.4V NiMh Battery
- Approx. 2hrs operation on full charge
- Approx. 2hrs recharge time

**Dimensions**
- 12in x 7.6in x 14.2in
- 305mm x 194mm x 360mm

**Weight**
- 14.7lbs (6.7kgs)

**Environmental Temperature**
- -4ºF to +122ºF (-20ºC TO +50ºC)

**Humidity**
- < 95% none condensing

**ORDERING INFORMATION**

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<thead>
<tr>
<th>Item (Qty)</th>
<th>Cat. No</th>
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<td>Included Accessories</td>
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<td>Accessory Pouch</td>
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<td>Power Supply Cables</td>
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<td>1 x SCHUKO</td>
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<td>1 x International</td>
<td>17032-5</td>
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<td>Coaxial cable 10ft / 3m (3ea)</td>
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<td>36828</td>
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<td>Earth/Ground Cable (1ea)</td>
<td>2003-022</td>
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<td>User Guide (1)</td>
<td>AVTMMTDR300</td>
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<tr>
<td>Cable Analysis Software</td>
<td>CAS-1</td>
</tr>
</tbody>
</table>
ITEM
13
AC & DC Test Sets

PT 15 - 10 High Voltage DC Cable Test System

Features
• 0 to –15kVdc output voltage
• 10mA output capability
• Both voltage and current metered on HV output
• Automatic earth system for dumping capacitive loads
• HV output plug & socket
• Key operated supply switch to prevent unauthorised operation
• Zero-volt interlock
• Visual indication of test piece failure
• Compact unit with lightweight insulated case

T15-10S – High Voltage DC Cable Test System

Features
• 0 to –15kVdc output voltage
• 10mA output capability
• Both voltage and current metered on HV output
• Automatic earth system for dumping capacitive loads
• HV output plug & socket
• Key operated supply switch to prevent unauthorised operation
• Zero-volt interlock
• Visual indication of test piece failure
• Compact unit with lightweight insulated case

PT18-10 & 30-10 High Voltage DC Cable Test System

Features
• ±18kVdc output voltage (PT18-10)
• ±30kVdc output voltage (PT30-10)
• 10mA output capability
• Both voltage and current metered on HV outputs
• Automatic earth system for dumping capacitive loads
• HV output plug & socket system
• Key operated supply switch to prevent unauthorized operation
• Automatic mains voltage selection
• Visual indication of test piece failure

KV30-40 High Voltage AC Test Systems

Features
• 0-6kV (KV6-200), 0-10kV (KV10-120), 0-15kV (KV15-80), 0-30kV (KV30-40)
• Other voltages available to order
• Automatic mains voltage selection
• Key operated supply switch to prevent unauthorised operation
• Dual overload protection
• Variable electronic trip - 10-110% of rated output
• Voltage and current metering
• Zero-volt interlock
• External 24Vdc interlock circuit
• Visual indication of test piece failure
ITEM 14
The KV50-20D is a low power portable high voltage AC test system designed for insulation testing. This system is equally suited to both development and routine testing of electrical insulation systems and plant.

The equipment consists of a control unit and a separate resin cast high voltage transformer linked by a 5 metre control cable. The control unit is housed in a rugged aluminium case with a hinged, removable lid for protection. The high voltage transformer is mounted on a base with swivel castors for mobility.

The control unit is fitted with a comprehensive range of facilities for control, metering and protection, including an emergency off switch. The output voltage and current are displayed true rms digital instruments. A variable electronic trip is provided, allowing the trip current to be set to 10-110% of rated output.

The unit is designed to be operated with the HV transformer inside an interlocked test enclosure. A connector is supplied on the control unit to connect interlock switches, extra emergency stop switches and external 24V beacons.
KV50-20D Specification

Output
The output of the KV50-20D is via a high voltage bushing. The bushing is designed to be connected to the object under test by an air insulated connection such as copper tubing or tinned copper wire (not supplied with the system). The earthy end of the HV winding is connected to earth via the current metering circuit.

- **Output voltage**: 0-50kVac
- **Output current**: 12mA continuous, 20mA 5 min on/15min off

Metering
The output voltage is metered by a true rms digital instrument.

<table>
<thead>
<tr>
<th>Range</th>
<th>Full scale</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>20kV</td>
<td>19.99kV</td>
<td>0.1kV</td>
</tr>
<tr>
<td>50kV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Accuracy (no load) | ±2% of rdg + 5d | ±2% of rdg + 5d |
| Accuracy (@12mA)   | ±5% of rdg + 5d | ±5% of rdg + 5d |

Load current is metered by a true rms digital instrument.

<table>
<thead>
<tr>
<th>Range</th>
<th>Full scale</th>
<th>Resolution</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>20mA</td>
<td>19.99mA</td>
<td>0.01mA</td>
<td>±2% of rdg + 5d</td>
</tr>
</tbody>
</table>

Control
The output voltage is set by a continuously variable output control with a zero volt interlock - the output may only be switched on with the control in the zero position. The output voltage is switched on and off by illuminated push button switches.

The mains supply switch for the unit is a key operated switch. The key is trapped in the switch in the ‘on’ position.

Supply requirements
115/230V±10% auto-selecting 50/60Hz 1ph 1.5kVA max

Protection and safety
The output of the units are protected by variable electronic trips monitoring the output current, and a fixed over-current trip on the primary of the output transformer. The variable trip is adjustable in 10% steps between 10% and 110% of the rated output current.

The input and control supplies are protected by fuses.

The KV50-20D is designed to meet the requirements of BS EN61010. The unit must be installed in a high voltage test area complying with the requirements of BS EN50191.

Earth terminals are provided on the control unit and HV transformer that must be connected to a low impedance local earth.

Interlock circuits
Two interlock circuits are provided on the KV50-20D. A zero voltage interlock is fitted which prevents the HV output being energised unless the output voltage control is in the zero position. An external interlock circuit is also provided, allowing the fitting of external emergency off buttons and test cage door interlocks.

Beacon output
A beacon output is provided on the control unit to control 24V beacons (max 0.5A). The beacons mimic the state of the HV on and off indicators on the unit—green for HV off and red for HV on.

Temperature Range
- Storage: -20°C to 60°C
- Operating: 0°C to 45°C

Dimensions
- KV50-20 Control Unit: 380x314x221mm, 17kg
- KV50-20 Transformer: 490x520x795mm, 75kg

Accessories
- 1 x 2m power supply lead.
- 1 x 5m interconnecting lead.
- 1 x 3m test object earth lead.
- 1 x 5m earth lead.
- Spare fuse set.
- Operating manual.
ITEM
15
Cable test sets
## Specification

(Subject to changes and alterations without further notice.)

<table>
<thead>
<tr>
<th>KPG 25 kV</th>
<th></th>
</tr>
</thead>
</table>
| **Power supply** (selectable) | • mains 115 V/230 V, 50/60 Hz  
• internal rechargeable battery  
• external battery 11 ... 15 V DC |
| DC output voltage infinitely variable | 0 ... 25 kV  
negative polarity |
| Rated output current at max. output voltage | 1.5 mA |
| Operating time with battery | approx. 45 min. |
| Max. discharge energy | 3 000 J |
| Voltage measuring range | 0 ... 30 kV |
| Current measuring range | 0 ... 0.2 mA and 0 ... 2 mA |
| Operating temperature range | -25 °C ... +55 °C |
| Storage temperature range | -40 °C ... +70 °C |
| Weight (incl. battery) | approx. 13.5 kg |
| Dimensions (W x H x D) | 467 x 168 x 284 mm |

Set comprises:  
• Tester, incl. rechargeable battery and soft case  
• Mains lead  
• Battery lead for external DC battery, approx. 3 m  
• Ground cable, approx. 3 m, for connection to station ground  
• Ground cable, approx. 3 m, for connection to protective ground  
• High-voltage lead, approx. 3 m, with terminal  
• User manual

### KPG 25 kV specifications:

- Power supply: Selectable mains 115 V/230 V, 50/60 Hz or internal rechargeable battery or external battery 11 ... 15 V DC.
- DC output voltage: 0 ... 25 kV, negative polarity.
- Rated output current: 1.5 mA.
- Operating time with battery: Approx. 45 minutes.
- Max. discharge energy: 3 000 J.
- Voltage measuring range: 0 ... 30 kV.
- Current measuring range: 0 ... 0.2 mA and 0 ... 2 mA.
- Operating temperature range: -25 °C ... +55 °C.
- Storage temperature range: -40 °C ... +70 °C.
- Weight (incl. battery): Approx. 13.5 kg.
- Dimensions (W x H x D): 467 x 168 x 284 mm.

### KPG 50 kV

- Power supply: Mains 230 V/50 Hz, 115 V/60 Hz.
- DC output voltage: 0 ... 50 kV, negative polarity.
- Output current: 6 mA at max. output voltage.
- Overcurrent trip: > 8 mA.
- Voltage measuring range: 0 ... 50 kV.
- Current measuring range: 0.1 mA/1 mA/10 mA.
- Power consumption: Max. 0.9 kVA.
- Operating temperature range: -25 °C ... +55 °C.
- Storage temperature range: -40 °C ... +70 °C.
- Weight: Operation unit: approx. 13.0 kg, HV unit: approx. 17.0 kg.
- Dimensions (W x H x D): Operation unit: 400 x 390 x 200 mm, HV unit: 214 x 550 x 305 mm.

### KPG 80 kV

- Power supply: Mains 230 V/50 Hz, 115 V/60 Hz.
- DC output voltage: 0 ... 80 kV, negative polarity.
- Output current: 5 mA at max. output voltage.
- Overcurrent trip: > 7 mA.
- Voltage measuring range: 0 ... 80 kV.
- Current measuring range: 0.1 mA/1 mA/10 mA.
- Power consumption: Max. 0.9 kVA.
- Operating temperature range: -25 °C ... +55 °C.
- Storage temperature range: -40 °C ... +70 °C.
- Weight: Operation unit: approx. 13.0 kg, HV unit: approx. 18.5 kg.
- Dimensions (W x H x D): Operation unit: 400 x 390 x 200 mm, HV unit: 214 x 575 x 305 mm.

### KPG 110 kV

- Power supply: Mains 230 V/50 Hz, 115 V/60 Hz.
- DC output voltage: 0 ... 110 kV, negative polarity.
- Output current: 4 mA at max. output voltage.
- Overcurrent trip: > 6 mA.
- Voltage measuring range: 0 ... 110 kV.
- Current measuring range: 0.1 mA/1 mA/10 mA.
- Power consumption: Max. 0.9 kVA.
- Operating temperature range: -25 °C ... +55 °C.
- Storage temperature range: -40 °C ... +70 °C.
- Weight: Operation unit: approx. 13.0 kg, HV unit: approx. 20.0 kg.
- Dimensions (W x H x D): Operation unit: 400 x 390 x 200 mm, HV unit: 214 x 600 x 305 mm.

### KPG 120 kV

- Power supply: Mains 230 V/50 Hz, 115 V/60 Hz.
- DC output voltage: 0 ... 120 kV, negative polarity.
- Output current: 3.5 mA at max. output voltage.
- Overcurrent trip: > 5.5 mA.
- Voltage measuring range: 0 ... 120 kV.
- Current measuring range: 0.1 mA/1 mA/10 mA.
- Power consumption: Max. 0.9 kVA.
- Operating temperature range: -25 °C ... +55 °C.
- Storage temperature range: -40 °C ... +70 °C.
- Weight: Operation unit: approx. 13.0 kg, HV unit: approx. 20.5 kg.
- Dimensions (W x H x D): Operation unit: 400 x 390 x 200 mm, HV unit: 214 x 600 x 305 mm.

Set comprises:  
• Operation unit with soft case  
• HV unit with HV attachment  
• Connecting lead, operation unit to HV unit  
• High-voltage lead, 2 m  
• Ground cable, 3 m, HV unit to station ground  
• Ground cable, 3 m, operation unit to station ground  
• Ground and discharge rod with ground cable and case  
• User manual
DESCRIPTION
The High Voltage DC Dielectric Test Sets (70, 120 and 160 kV) provide the most dependable, portable dc high-voltage sources for checking the quality of electrical power cables, motors, switchgear, insulators, transformers and capacitors. Each portable set (heaviest is 73 lb, 32.8 kg) is comprised of two separate modules:

Control Module
This module allows the operator to switch-select the appropriate current output range, adjust the output level and monitor both the applied voltage and leakage current at a safe distance from the high voltage being delivered to the load under test. No voltage higher than input ac power is present in the control module.

High-Voltage Module
An air-insulated design receives its instructions from the control unit. It generates the dc high voltage that is delivered to the load under test.

Although a different control module is used with each of the three models, they are all the same size and weight. Each high-voltage module is a different size and weight to accommodate the rated output voltage.

APPLICATIONS
The dc dielectric test sets are used to make proof tests and insulation tests on electrical power cables, motors, switchgear, insulators, transformers and capacitors. Both types of tests are performed by applying controlled high voltages to the unit under test at or above insulation system operating level. Measuring the leakage current helps determine the unit under test’s ability to withstand overvoltages such as lightning strikes and switching surges.

The three models described cover a range of output voltages that meet the most commonly specified ratings in 5-kV to 69-kV class cable. All are suitable for testing power cable, switchgear and rotating machinery in accordance with IEEE, IPCEA, NEMA and ANSI guidelines.

Proof Test
Proof testing is used for acceptance testing of newly installed cable and maintenance testing of aged and/or repaired cable. For the proof test, the unit under test will either withstand the test voltage or it will “break down,” providing the user with a “go/no-go” answer.

Insulation Resistance Tests
To make appropriate tests on healthy insulation, the test instrument must have microampere sensitivity. Insulation resistance can be measured in at least three different ways:

The insulation resistance test is often referred to as a “spot check,” and is performed by applying a predetermined voltage to the unit under test, holding it until the apparent leakage current becomes stable and recording the readings with adjustments for temperature. This test is especially applicable to low-capacitance units under test.
70-, 120- and 160-kV DC
High Voltage DC Dielectric Test Sets

Time-varying tests such as the polarization index test (PI test) are independent of temperature effects and save time. To perform this test, a predetermined test voltage is applied to the unit under test and readings are taken at 1 minute and 10 minutes. The resulting ratio is analyzed to determine insulation quality. This type of test is especially appropriate for high-capacitance samples.

The step-voltage test is independent of temperature effects and saves time. To perform this test, the output voltage is increased in even steps at regular intervals over a fixed period of time. As long as the resistance of the unit under test increases with time, it has high-quality insulation. This type of test is only useful for high-capacitance samples.

**FEATURES AND BENEFITS**

Contains a Full-Wave Rectified Unit (Filtered Half-Wave Rectification)
- Provides the advanced performance equal to a full-wave rectified unit.
- Allows for a simple circuit scheme for long-term reliability.

Lightweight High-Voltage Module
- Air insulated, it is the lightest weight module available for its voltage and power ratings.
- Convenient portability allows a single operator to transport it into the field.

Complete Internal Guard Circuit/Guard Connection on High-Voltage Output Cable
- Intercepts stray surface leakage currents which could interfere with the measurement.
- Eliminates the need for an extra lead to hook up the guard connection.
- Ensures highly accurate measurements.

Choice of Digital or Analog Metering
- The preferred medium may be selected by the user.

Continuously Variable Test Voltage
- User can set test voltage to intermediate values as required.

Fast Charging of High-Capacitance Samples
- Saves the operator test time.

Negative Polarity to Ground
- Applies a worst-case condition to assure reliability.

Strip Chart Recorder (Optionally Available)
- Provides a permanent record of the leakage current for the unit under test.

Standard Safety Features
- Bipolar ammeter that displays the magnitude of the discharge current from the unit under test (digital models only)
- Input-supply-line circuit breaker
- Output current overload relay
- Zero-start interlock for high-voltage output
- Pushbutton controls and indicating lights for high-voltage ON/OFF
- Full circuit-breaker protection against internal damage by overloads, surges or test sample breakdown
- Connection for external permissive and safety interlocks

**Model Capabilities/Applications**
Following are the acceptance and maintenance testing capabilities of each of the dc dielectric test sets.

**70-kV DC Dielectric Test Set**
- Acceptance testing on 15 kV class cable
- Maintenance testing on 28 kV class cable

**120-kV DC Dielectric Test Set**
- Acceptance testing on 35 kV class cable
- Maintenance testing on 46 kV class cable

**160-kV DC Dielectric Test Set**
- Acceptance testing on 46 kV class cable
- Maintenance testing on 115 kV class cable

**SPECIFICATIONS**

**Input Power**
Nominal 120 Vac, 50/60 Hz
For 220/240 Vac, 50/60-Hz operation, add –47 to Cat. No.
Please note that specifications for the –47 models differ as follows:

- Output Current:
  120 kV Models: 5 mA for 5 min; 2 mA continuous
  160 kV Models: 5 mA for 5 min; 1.5 mA continuous

When using external 240/120-volt step-down voltage transformers, the ratings may be used as given for 120 volt input.

- Weight: Add approx. 2 lb (1 kg) for –47 control unit.

**Ammeter (Digital Models)**

Ranges:
- 0 to 19.9 µA
- 0 to 199 µA
- 0 to 1.99 mA
- 0 to 5 mA

Resolution: To 0.1 µA on lowest range
Accuracy: ±2% of reading + 1 digit

**Ammeter (Analog Models)**

Ranges:
- 0 to 5 µA
- 0 to 50 µA
- 0 to 500 mA
- 0 to 5 mA

Resolution: To 0.1 µA on lowest range
Accuracy: ±2% of full scale range

**Voltmeter (Digital Models)**

Resolution: To 100 V over entire range
Accuracy: ±2% of reading + 100 V

**Voltmeter (Analog Models)**

Resolution — Dual Range:
- 35 kV/70 kV: 2.5% full scale
- 60 kV/120 kV: 1.6% full scale
- 80 kV/160 kV: 2.5% full scale

Accuracy: ±2% of full scale range
70-, 120- and 160-kV DC
High Voltage DC Dielectric Test Sets

Ripple
Less than 2% on capacitive samples at continuous rated output

Temperature Range
Operating: -20 to +130° F (-30 to +55° C)
Storage: -40 to +150° F (-40 to +65° C)

Relative Humidity Range
Operating: 0 to 90% noncondensing
Storage: 0 to 95% noncondensing

Dimensions
Control Unit (all models)
20 H x 12 W x 12.5 D in. (510 H x 305 W x 318 D mm)

High Voltage Unit
70 kV: 20 H x 12 W x 12 D in. (510 H x 305 W x 305 D mm)
120 kV: 29 H x 12 W x 12 D in. (740 H x 305 W x 305 D mm)
160 kV: 39 H x 12 W x 12 D in. (1000 H x 305 W x 305 D mm)

Weight
Control Unit (all models)
23 lb (10.5 kg)

High-Voltage Unit
70 kV: 44 lb (20 kg)
120 kV: 65 lb (30 kg)
160 kV: 73 lb (33 kg)

Cables (including carrying bag)
70 kV Models: 7 lb (3 kg)
120 and 160 kV Models: 9 lb (4 kg)

ADDITIONAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>*Test Voltage</th>
<th>Max. Power System Voltage (phase-to-phase)</th>
<th>Output Current (120 Vac Input)</th>
<th>Display</th>
<th>CAT. NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kV</td>
<td>0 to 70 kVdc</td>
<td>15 kVac</td>
<td>5 mA for 30 min; 3.5 mA continuous</td>
<td>Digital</td>
<td>220070</td>
</tr>
<tr>
<td>120 kV</td>
<td>0 to 120 kVdc</td>
<td>35 kVac</td>
<td>5 mA for 20 min; 2.5 mA continuous</td>
<td>Digital</td>
<td>220123</td>
</tr>
<tr>
<td>160 kV</td>
<td>0 to 160 kVdc</td>
<td>69 kVac</td>
<td>5 mA for 20 min; 2 mA continuous</td>
<td>Analog</td>
<td>220163</td>
</tr>
</tbody>
</table>

*Negative polarity with respect to ground.

OPTIONS AND ACCESSORIES

External Voltage Stabilizer
Filters input power to the test set and guards against line voltage fluctuations that may cause inaccurate readings.

Strip Chart Recorder
Document and print test sample leakage current measurements at the test site. This portable analog chart recorder features two ranges (50 and 500 mA), with results printed on pressure-sensitive paper.
Dimensions:
9 H x 7.5 W x 7.4 D in. (230 H x 190 W x 190 D mm)
Weight: 6 lb (2.7 kg)

Special Cable Lengths
For a nominal charge, a custom-length, shielded, high-voltage output cable up to 50 ft (15 m) can be supplied. Specify length when ordering.

Applications Guide
A practical guide, “Lowdown on HV DC Testing,” gives the what, when, how and why of high-voltage dc testing and its applications.

High-Voltage Discharge and Grounding Stick
Applying a suitably rated high-voltage resistance discharge stick following a test is recommended. This is not only a good safety practice, but will hasten discharge of highly capacitive samples.

### High-Voltage Discharge and Grounding Stick Specifications

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Cat. No.</th>
<th>Resistance</th>
<th>Max. Safe Discharge Capacitance*</th>
<th>Length</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>70 kV</td>
<td>222070-62</td>
<td>90 MΩ</td>
<td>10 µF</td>
<td>51 in.</td>
<td>2.0 lb</td>
</tr>
<tr>
<td>120 kV</td>
<td>222120-62</td>
<td>100 MΩ</td>
<td>2.75 µF</td>
<td>51 in.</td>
<td>2.7 lb</td>
</tr>
<tr>
<td>160 kV</td>
<td>222160-62</td>
<td>120 MΩ</td>
<td>2.25 µF</td>
<td>71 in.</td>
<td>3.3 lb</td>
</tr>
</tbody>
</table>

*25°C 15 minute cooling period required after discharge
## 70-, 120- and 160-kV DC

### High Voltage DC Dielectric Test Sets

<table>
<thead>
<tr>
<th>Item (Qty)</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric Test Sets</td>
<td></td>
</tr>
<tr>
<td>70 kVdc, digital</td>
<td>220070</td>
</tr>
<tr>
<td>70 kVdc, analog</td>
<td>220072</td>
</tr>
<tr>
<td>120 kVdc, digital</td>
<td>220123</td>
</tr>
<tr>
<td>120 kVdc, analog</td>
<td>220124</td>
</tr>
<tr>
<td>160 kVdc, digital</td>
<td>220163</td>
</tr>
<tr>
<td>160 kVdc, analog</td>
<td>220164</td>
</tr>
</tbody>
</table>

For 220/240-Vac, 50/60-Hz operation, add –47 to Cat. No.

### Included Accessories

<table>
<thead>
<tr>
<th>Item (Qty)</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input supply cord, three-wire, 8 ft (2.4 m)</td>
<td>17032</td>
</tr>
<tr>
<td>Ground cables, 15 ft (4.5 m) [2]</td>
<td>4702-5</td>
</tr>
<tr>
<td>Interconnection cable, 15 ft (4.5 m)</td>
<td>18320</td>
</tr>
<tr>
<td>Detachable HV output cable, for 70 kV test sets, 15 ft (4.5 m)</td>
<td>18328</td>
</tr>
<tr>
<td>Detachable HV output cable, for 120 and 160 kV test sets, 15 ft (4.5 m)</td>
<td>29590</td>
</tr>
<tr>
<td>Carrying bag for cables</td>
<td>18313</td>
</tr>
<tr>
<td>Kilovolt/megohm test record graph paper (100-sheet pad)</td>
<td>220000</td>
</tr>
</tbody>
</table>

### Optional Accessories

<table>
<thead>
<tr>
<th>Item (Qty)</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>External voltage stabilizer</td>
<td>220004</td>
</tr>
<tr>
<td>Discharge sticks</td>
<td></td>
</tr>
<tr>
<td>70 kV HV</td>
<td>222070-62</td>
</tr>
<tr>
<td>120 kV HV</td>
<td>222120-62</td>
</tr>
<tr>
<td>160 kV HV</td>
<td>222160-62</td>
</tr>
<tr>
<td>Special cable lengths, HV cable</td>
<td>add –56</td>
</tr>
<tr>
<td>“Lowdown on HV DC Testing” manual</td>
<td>AVTM22P-1</td>
</tr>
</tbody>
</table>

---

ORDERING INFORMATION
ITEM
17
Cable Test Sets

KPG 20kV VLF
KPG 36kV VLF

VLF 0.1 Hz

kilovolt PRUEFTECHNIK
Portable VLF cable test sets with 0.1 Hz - technology

The portable cable test sets KPG 20kV VLF and KPG 36kV VLF are used for testing of medium voltage cables with extruded insulation (XLPE-, PE-, EPR-insulation) and nominal voltage up to 6.3/11kV (KPG 20kV VLF) or 12/20kV (KPG 36kV VLF) in accordance to DIN VDE 0276/620 (CENELEC HD 620 S1).

Test is carried out with a low strain practice with very low frequency voltage of 0.1Hz and test voltage level of 3x U_r.m.s. Test enables detection of damages of insulation within shortest test time. The devices are also able to test medium voltage cables with impregnated paper insulation. Cable sheath test with direct voltage is possible as well.

<table>
<thead>
<tr>
<th></th>
<th>KPG 20kV VLF</th>
<th>KPG 36kV VLF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>230 V, 5 A, 50/60 Hz</td>
<td>230 V, 10 A, 50/60 Hz</td>
</tr>
<tr>
<td><strong>Output voltage</strong></td>
<td>5...20 kV_r.m.s., 0.1 Hz VLF (0.05 Hz opt.) ± 0...30 kV DC</td>
<td>5...36 kV_r.m.s., 0.1 Hz VLF (0.05 Hz opt.) ± 0...52 kV DC</td>
</tr>
<tr>
<td><strong>Voltage waveshapes</strong></td>
<td>VLF similar sine-wave (true R.M.S. measurement), Direct voltage</td>
<td></td>
</tr>
<tr>
<td><strong>max. load (VLF)</strong></td>
<td>3.7 µF at 19 kV_r.m.s., 0.1 Hz (app. 10 km XLPE-cable 11kV/150mm²)</td>
<td>3.7 µF at 19 kV_r.m.s., 0.1 Hz (app. 8 km XLPE-cable 20kV/150mm²)</td>
</tr>
<tr>
<td></td>
<td>6.7 µF at 19 kV_r.m.s., 0.05 Hz (app. 18 km XLPE-cable 11kV/150mm²)</td>
<td>6.7 µF at 19 kV_r.m.s., 0.05 Hz (app. 15 km XLPE-cable 20kV/150mm²)</td>
</tr>
<tr>
<td><strong>Overcurrent trip (DC)</strong></td>
<td>10 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Discharge</strong></td>
<td>integrated automatic discharge device</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6250 J (up to 14 µF at 30kV)</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage measuring range</strong></td>
<td>-30 ... 0 ... 30 kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-55 ... 0 ... 55 kV</td>
<td></td>
</tr>
<tr>
<td><strong>Current measuring ranges</strong></td>
<td>± 0 ... 100 µA / 1 mA / 10 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>-20 ... +40°C</td>
<td></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>in two parts, Operation unit and High Voltage unit</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Operation unit</td>
<td>17 kg</td>
</tr>
<tr>
<td></td>
<td>HV unit</td>
<td>38 kg</td>
</tr>
<tr>
<td></td>
<td>Operation unit</td>
<td>17 kg</td>
</tr>
<tr>
<td></td>
<td>HV unit</td>
<td>48 kg</td>
</tr>
<tr>
<td><strong>Dimensions (W x H x D)</strong></td>
<td>Operation unit</td>
<td>37 x 34 x 20 cm</td>
</tr>
<tr>
<td></td>
<td>HV unit</td>
<td>40 x 41 x 24 cm</td>
</tr>
<tr>
<td></td>
<td>Operation unit</td>
<td>37 x 34 x 20 cm</td>
</tr>
<tr>
<td></td>
<td>HV unit</td>
<td>40 x 44 x 24 cm</td>
</tr>
</tbody>
</table>

**Characteristics:**
- Compact portable VLF test devices
- Easily portable from 1-2 person
- Simple operation
- Menu-assisted control
- Fully automatic test sequence
- Integrated timer with automatic tripping
- Integrated breakdown detection
- Integrated fault time detection
- Voltage measurement direct at HV output
- Protective ground circuit
- Protective circuit / indication in accord. with VDE 0104
- Leakage current measurement during VLF test

**Scope of supply:**
- Operation unit with protective bag and cable storage
- High Voltage unit
- HV-connecting cable (shielded), standard length 5m
- Connecting cable, HV unit to Operator unit, length 3m
- Ground cables
- User manual

**Options:**
- Datalogging (USB) for VLF test sets
- Frequency extension: 0.05 Hz
- Transport case

**MADE IN GERMANY** 01/2013
VLF Test Set - KPG 38kV VLF

The portable cable test set KPG 38kV VLF is used for testing of medium voltage cables with extruded insulation (XLPE-, PE-, EPR-insulation).

Test is carried out with a low strain practice with very low frequency voltage of 0.1Hz and test voltage level of 3x U₀ r.m.s., VLF testing enables detection of damages of insulation within shortest test time. The devices are also able to test medium voltage cables with impregnated paper insulation (PILC).

Cable sheath test with direct voltage is possible as well.

Application:

- VLF Testing
- DC Testing
- Sheath Testing
Cable Test Set

KPG 38kV VLF

- VLF Testing
- DC Testing
- Sheath Testing

Group Exporter:
Multi-Tek International
Fax: + 44 207 313 3191
E-Mail: mti@multitekintl.com
Website: www.multitekintl.com
Portable VLF cable test set with 0.1 Hz - technology

The portable cable test set KPG 38kV VLF is used for testing of medium voltage cables with extruded insulation (XLPE-, PE-, EPR-insulation) and nominal voltage up to 12.7/22kV in accordance to DIN VDE 0276/620 (CENELEC HD 620 S1).

Test is carried out with a low strain practice with very low frequency voltage of 0.1Hz and test voltage level of 3x U₀ r.m.s. Test enables detection of damages of insulation within shortest test time. The device is also able to test medium voltage cables with impregnated paper insulation. Cable sheath test with direct voltage is possible as well.

### Specifications:

<table>
<thead>
<tr>
<th>KPG 38kV VLF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>Output voltage</td>
</tr>
<tr>
<td>Voltage waveshapes</td>
</tr>
<tr>
<td>max. load (VLF)</td>
</tr>
<tr>
<td>Overcurrent trip (DC)</td>
</tr>
<tr>
<td>Discharge</td>
</tr>
<tr>
<td>Voltage measuring range</td>
</tr>
<tr>
<td>Current measuring ranges</td>
</tr>
<tr>
<td>Operating temperature</td>
</tr>
<tr>
<td>Construction</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
</tr>
<tr>
<td>HV unit 40 x 44 x 24 cm</td>
</tr>
</tbody>
</table>

### Characteristics:

- Compact portable VLF test device
- Easily portable from 1-2 person
- Simple operation
- Menu-assisted control
- Fully automatic test sequence
- Integrated timer with automatic tripping
- Integrated breakdown detection
- Integrated fault time detection
- Voltage measurement direct at HV output
- Protective ground circuit
- Protective circuit / indication in accord. with VDE 0104
- Leakage current measurement during VLF test

### Scope of supply:

- Operation unit with protective bag and cable storage
- High Voltage unit
- HV-connecting cable (shielded), standard length 5m
- Connecting cable, HV unit to Operator unit, length 3m
- Ground cables
- User manual

### Options:

- Datalogging (USB) for VLF test sets
- Frequency extension: 0.05 Hz
- Transport case
ITEM
18
Measurement Principles

PD Pulse Propagation in HV cables - when a PD event occurs, a PD pulse is generated on both the conductor and earth screen of the cable (these being of opposing polarity). These pulses travel outwards in both directions from the originating site (as shown below).

The first pulse to arrive at the measurement end is the pulse which has travelled directly to that end (the 'Direct Pulse'). The pulse which allows the PD site to be located is the pulse which set off in the opposite direction, and has been reflected from the far end ('Reflected Pulse'). In an ideal situation the pulses measured would look like:

If both of these pulses are identifiable, the location of the site of the PD event is relatively easy to do by measuring the time difference between the direct and reflected pulses, \( \Delta T \). It can be noted that the two pulses will continue to travel up and down the cable, until they become too small to be seen above the noise level. During this time, the pulses are reflected at exactly a 'Cable Return Time = L' away from the previous pulse. It has been found in practice that it is often difficult to carry out the PD mapping locations using the above single-ended method due to the following reasons:

- Signal Attenuation is too large in long cables
- Waveforms are too tricky to interpret
- Teed or jointed cables with multi-reflections
- Cables with many Ring Main Units which cause signal attenuation and (part) reflections of pulses
- Cables with little change in impedance at far end.

It is for the above practical reasons that IPEC HV have developed the Portable Transponder (Type PTT-2000-CT). The Transponder effectively converts the single-ended location into a Double-Ended Location Method (the test set-up for this is shown opposite).
On-Line Partial Discharge HV Cable Mapping Technology

"On-line PD Testing"

Background
The OSM-Longshot™ On-Line Cable PD Mapping Technology from IPEC High Voltage represents the world’s first commercially-available on-line pd mapping technology for locating incipient faults on high voltage cables.

The technology applies the same Time-Of-Flight (TOF) analysis of PD signals as used in the off-line cable pd location methods (ie: VLF, OWTS and resonant test systems) with the key advantage of being able to be done on-line (no outage required).

The core technology applies the portable and flexible OSM-Longshot™ PD Spot Tester, which is combined with the PD Map© Software, PTT-2000-CT Portable Transponder and 3x Shielded HFCT Sensors (2x Measurement CT’s and 1x Pulse Injection CT).

The On-Line Cable Mapping system provides for the accurate location of PD sites (to an accuracy of less than 1% of cable length). The system is suitable for On-Line PD Mapping of high voltage cables of lengths of up to 5km.

Features
- PD mapping measurements are made on-line, with measurements in picoCoulombs (pC’s)
- The Battery-Powered Portable Transponder can be used at any position on a cable feeder with access to the screen of the cable.
- The OSM-Longshot™ Unit can also be used in Monitoring Mode to assess load-related PD.
- Can also be used for Off-Line Testing (OWTS etc)

Benefits
- The cable is tested in its ‘normal’ conditions (working voltage, load and temperature).
- Lower cost when compared with off-line testing.
- The switching out of circuits (as per off-line testing) is not necessary = more flexibility.
- Teed circuits can be tested by adjusting the location of the Transponder.

www.ipechv.co.uk
ITEM 19
The PDS Air™ handheld partial discharge surveying tool from HVPD represents the very latest in handheld PD test technology. Incorporating a digital TEV-dB display and external airborne acoustic probes, the test unit provides the ‘first-line of defence’ for the early detection of PD activity in MV cables and plant from 3.3 kV to 45 kV. Rapid, ‘look-see’ insulation condition testing is possible through the unique combination of three PD measurement technologies: HFCT, TEV and Airborne Acoustic.

The PDS Air™ handheld test unit meets the requirements of both utility and industrial MV plant owners for a simple, portable, and easy-to-use handheld PD screening device for use by all operational staff in the substation. The unit is recommended for use in Phase 1 of the HVPD 4-Phase PD Test and Monitoring Solution which requires PD pre-screening of 100% of the network.

Features include:

- Digital TEV sensor measurement with numerical LED display.
- The only handheld PD test unit in the market to combine 3x PD sensor technologies (TEV, Acoustic and HFCT) in one device.
- Measurement of PD in metal-clad switchgear/plant with airborne acoustic sensors and accurate digital TEV-db measurements.
- Measurement of PD in picocoulombs (pC) in power cables with a split-core HFCT sensor (connected around the cable earth).
- Test times of 3-5 seconds per plant item or cable, enabling large numbers of MV plant items to be scanned for PD quickly and easily, prior to diagnostic PD testing.
- Lightweight & portable device with an easy-to-understand, 7-level, colour-coded PD display.

Standard Scope of Supply

The standard scope of supply of the PDS Air™ is shown below and includes a split-core HFCT sensor, standard headphones, BNC signal cable, mains battery charger, a soft carry case and an inspection test pad with test labels.

| 1x | HVPD PDS Air™          | 1x | HVPD HFCT 100/50 Sensor   |
| 1x | Standard Headphones    | 1x | AC/DC Mains Battery Charger |
| 1x | 100 kHz High Pass Filter | 1x | User Manual                |
| 1x | 1 metre RG223 BNC Signal Cable | 1x | Inspection Test Pad and POA Labels |
| 1x | Soft Carry Case        |

Optional Extras

| 1x | PDSIAP - Indoor Acoustic Probe | 1x | PDSOPR Outdoor Parabolic Receiver and Laser Enhancement Eyewear |
| 1x | PDSPHH - Peltor PPE Headphones (PPE-Suitable) | 1x | PDSACC Accessories Carry Case |
**Application Testing with Accessories**

PDS Air™ with Parabolic Acoustic Receiver measuring PD activity in outdoor sealing ends

PDS Air™ measuring TEV PD activity in metal-clad air-insulated switchgear

**Key Functions**

![Diagram of PDS Air™ unit with labels for LED Display Screen, TEV dB Numerical Display, PD Level Indication Key, BNC Connection for HFCT sensor, Integrated TEV Sensor, Integrated Acoustic Sensor, Headphone Connection, and Charger Connection]

- **LED Display Screen**
- **TEV dB Numerical Display**
- **PD Level Indication Key**
- **BNC Connection for HFCT sensor**
- **Integrated TEV Sensor**
- **Integrated Acoustic Sensor**
- **Headphone Connection**
- **Charger Connection**

**Unit Dimensions**

<table>
<thead>
<tr>
<th>Dimensions:</th>
<th>W: 120 mm</th>
<th>D: 110 mm</th>
<th>H: 220 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight:</td>
<td>1.26 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Supply:</td>
<td>Li-ion Battery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**How it Works**

The PDS Air™ test unit incorporates three individual PD sensors which are designed to pick up different types of PD activity in different types of MV plant, as follows:

**CT - Cable PD Circuit** – Cable PD activity is measured using the external, split-core, High Frequency Current Transformer (HFCT) sensor attached to the cable’s earth straps.

**TEV Circuit** – Transient Earth Voltage (TEV) PD signals are generated by internal PD in metal-clad switchgear and plant. The unit provides **digital TEV-dB sensor measurement** in the form of numerical LED display measured in 1 dB steps from 15 dB to 50 dB.

**AA - Airborne Acoustic Circuit** – Acoustic PD signals are generated by PD in air and can be detected using the unit’s airborne acoustic sensor with sound demodulator and standard headphones. Optional accessories enhance both the flexibility and range of detection of these airborne discharges. These include an **Indoor Acoustic Probe** (PDSIAP), an **Outdoor Parabolic Receiver** (PDSOPR) and **Peltor Headphones** (PDSPHP) which are suitable for use with PPE hard-hats.

The outputs of these PD sensors are displayed on 3x colour-coded universal LED scales. In addition the PDS Air™ unit has a digital TEV-dB numerical display from 15 dB to 50 dB.

The Guideline PD Levels vs. Plant Condition / Action for each LED level are shown opposite and below.

| LED 1 | Green  | (Plant OK) |
| LED 2 & 3 | Yellow | (Moderate PD - Monitor) |
| LED 4 & 5 | Orange | (Moderate to High PD - Investigate Source of PD) |
| LED 6 & 7 | Red    | (High PD – Diagnostic Test, Locate & Restrict Access) |

**On-Line Partial Discharge Surveying System**

**PD Level Guide:**

<table>
<thead>
<tr>
<th>PD Source</th>
<th>CT</th>
<th>AA</th>
<th>TEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 pC</td>
<td>8 dB</td>
<td>15 dB</td>
<td></td>
</tr>
<tr>
<td>600 pC</td>
<td>12 dB</td>
<td>20 dB</td>
<td></td>
</tr>
<tr>
<td>1200 pC</td>
<td>15 dB</td>
<td>25 dB</td>
<td></td>
</tr>
<tr>
<td>3000 pC</td>
<td>19 dB</td>
<td>30 dB</td>
<td></td>
</tr>
<tr>
<td>7800 pC</td>
<td>22 dB</td>
<td>35 dB</td>
<td></td>
</tr>
<tr>
<td>20000 pC</td>
<td>26 dB</td>
<td>40 dB</td>
<td></td>
</tr>
<tr>
<td>30000 pC</td>
<td>30 dB</td>
<td>45 dB</td>
<td></td>
</tr>
</tbody>
</table>

**PD Level Indication Key**

Group Exporter:
Multi-Tek International
Email: mt@multitekinatl.com
Total Solution for Test and Measurement

- Electrical Test and Measurement Equipment
- Power Test Equipment
- Transformer A to Z testing
- High Voltage Test Equipment
- Cable Fault Locating / Testing
- Meter Test Equipment (Portable + Bench Versions)
- Calibration Testing Equipment (Portable + Bench Versions)
- Electronic Test Equipment
- Telecom Test Equipment
- Preventative maintenance / Safety Equipment
- Electrical Workshop
- Technical Training Equipment

Multi-Tek International
Email: mti@multitekintl.com
Fax: +44(0)2073133191
140-144 Freston Road
W10 6TR, London, UK
www.multitekintl.com

MEGGER / PROGRAMMA, TTI, LL, MTE/EMH/EDI... Group Exporter