

**Automatically Controlled Cable Test Van
HVT-35A**



Larnaca, Cyprus

Technical Brochure

Cable Fault Location Van HVT-35A

The Cable Diagnostic Test Van HVT-35A is designed to determine the location of a failure in power electrical cables rated up to 35 kV by using equipment and devices for preliminary and precise localization.

The cable fault location van HVT-35A performs the following functions:

1. Pre-locating power cable faults by the pulse echo method (TDR), the arc reflection method, and the impulse current method
2. Burning down defective insulation of power cables
3. Insulation Resistance Testing
4. Audio frequency cable route tracing and cable depth evaluation
5. Locating power cable faults by the acoustic and inductive methods
6. Cable identification from a cable bundle
7. Cable sheath fault location



2. Operating conditions

Laboratory HVT-35A is manufactured in accordance with ISO9001-2015 and is designed for operation at temperatures up to + 40 ° C, relative humidity up to 80% and atmospheric pressure 630-800 mm Hg. The lower temperature point is not limited, provided that the temperature inside the laboratory is not lower than plus 1 ° C. According to the safety level, the laboratory completed - the degree of protection against external objects, ingress of solid particles and continuous splashing - IP24- IP 56.

3. Reliability of performance

Laboratory **HVT-35A** is made in accordance to ISO-9001-2015 and is certified by the manufacturer for work in hot and humid climates. Stable operation of the equipment is ensured, provided that the personnel follow the recommendations of the operating manual. The life expectancy of the laboratory equipment is 10 years. Equipment MTBF is not required. The service life between repairs is according to the Laboratory Operation Manual.

The laboratory complies with the electrical safety requirements. The automated security system is equipped with a smartphone with which the operator's assistant can remotely turn off the laboratory in an emergency.

4. Documentation for the laboratory

Documentation listed below is prepared in English.

1. Laboratory operation manual

2. Booklet
3. Album of electrical circuits
4. Program and methodology of periodic laboratory tests
5. Factory test report.
6. The laboratory is provided with a car certificate; paperwork for making changes to the design of the car; registration with the traffic police as a specialized high-voltage laboratory; as well as certificates of verification (calibration) of all measuring instruments, certificates of conformity, certificates of type approval of measuring instruments included in the laboratory package.

A. Main Equipment

5. Central Control Operating Unit

The laboratory equipment is divided into main and optional equipment. A full-featured use of the laboratory is possible only with a complete set of main and additional equipment.

Control Module

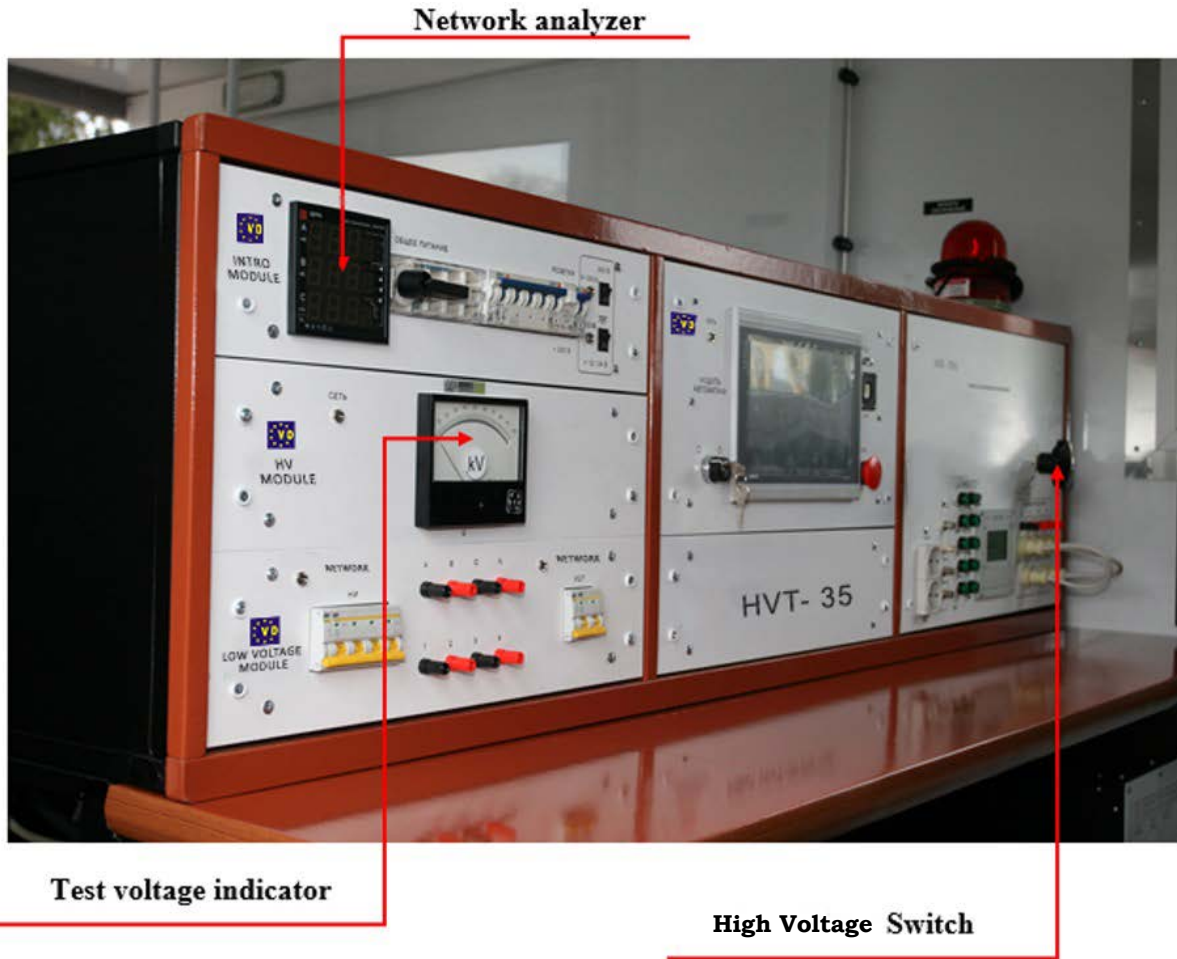
The control module is designed for switching units and blocks of the laboratory. From the control module it is possible to control the interior lighting of the laboratory and control the safety system. A computer, ergonomically installed into the control panel, is also provided. Data and reports can be saved and edited directly in the laboratory or export to any portable support as USB disks.



Visible break switch

Touch screen

TDR connection



View of the Operators Area

The single control panel of the laboratory has a horizontal design, is located across the entire width of the body and is made in 19" designs. The review of all display elements, controls and the implementation of the necessary switches are carried out without difficulty with a comfortable sitting position of the operator. Control and monitoring are carried out from the central module installed in the center of the control panel. The module is a touch-sensitive microprocessor panel that displays all the information and dialog commands that provide an error-free choice of switching schemes in all operating modes of the laboratory.

Additional convenience is provided by the presence of a monolithic Eurodesk countertop made of solid wood material with a glossy surface, rounded corners with a radius of 120 mm and ends with a radius of 300 mm and a thickness of 32 mm, with a depth of at least 300 mm.

The main switch of the console type with a connector for connecting a high-voltage test cable is installed in the right part of the control unit. In the right part of the control unit, on the reverse side, there is a high-voltage part of the main switch of the console type with a socket in an insulated housing for connecting a high-voltage test cable.



Automated Control System (ACS)

The automated control system (ACS) of the laboratory modules is a single hardware and software complex based on an embedded industrial computer, which allows the most efficient control of the measuring, test and search equipment included in its structure. Various measurements, as well as the implementation of diagnostic and service functions.

ACS provides:

- two-way communication of power equipment, integrated into the composition of the Test Van, and an industrial computer using specialized software. At the same time, the possibility of safe and correct shutdown of work in the event of a power failure is provided and, also, the possibility of autonomous operation of the ACS for at least 60 minutes in order to view the test results and train personnel.
- provides all types of measurements and tests in case of failure of the built-in industrial computer due to internal devices without connecting other devices and computers and without the need to reinstall the software.

The Test Van's control module is equipped with a built-in color graphic display with a diagonal of 10.2 "inches for displaying operating parameters and managing work processes.

The software installation of the control system allows you to solve a full range of tasks for diagnostics and search for places of damage to underground cable lines of voltage classes 0.4, 6 -35 kV with any type of insulation;

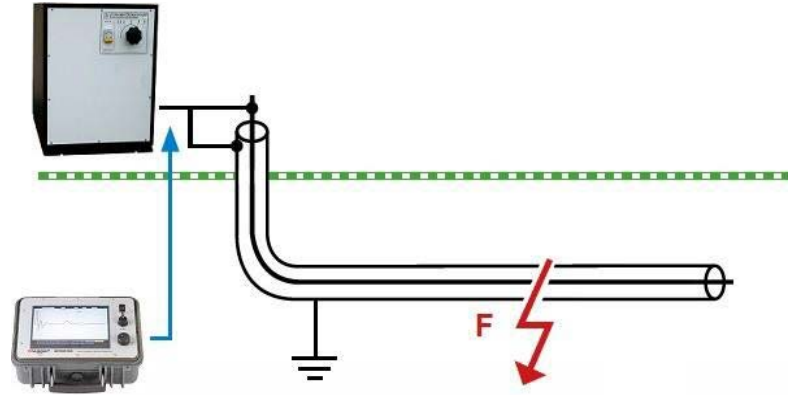
The automated control system solves the following tasks:

- provides control over the operation of the main equipment of the HVT Laboratory;
- the system automatically saves the data obtained from the measurement results;

- provides display of parameters during measurements in analog (in the form of a virtual dial gauge) and digital forms, as well as in the form of graphs:
 - o the dependence of the current and voltage on time and the dependence of the leakage current on the voltage during testing with increased voltage;
 - o dependence of current and voltage on time during the operation of the burn down unit;
 - o the dependence of the charging voltage of the storage capacitors on time during the operation of the shock generator;
- the system allows to form measurement protocols both in manual and automatic modes with the possibility of;
- the system contains a built-in updated library of normative and technical documentation;
- allow the operator to create and maintain a database of serviced power facilities and equipment integrated into the HVT laboratory, with the ability to view the test / measurement history;
- provides intelligent prompts to the operator in accordance with the instruction manual for this type of HVT laboratory
- provides continuous diagnostics and self-monitoring of the state of all HVT laboratory systems with the issuance of messages in real time;
- carries out objective control over the actions of the operator in real time;
- allows you to maintain several accounts / accounts for the possibility of separate use of HVT laboratory by different teams of specialists;
- collects data on all executable processes for the entire service life of the HVT laboratory with the ability to view the history in the database and conduct further analysis;
- performs the function of thermal imaging monitoring
- high-voltage compartment in order to monitor the state of power equipment and other component modules of the HVT laboratory.

6. Surge Generator, SG-2000

A surge generator is used to inject a high voltage DC surge into the faulty cable. By supplying a sufficiently high voltage to the faulty cable, the open-circuit fault will break down creating a high-current arc. This high current arc makes a characteristic thumping sound at the exact location of the fault. To find the location of cable fault using the thumping method, a thumper is set to thump repeatedly and then walking along the cable route to hear the thumping sound. The higher the dc voltage applied, the louder will be the resulting thump.



Surge Generator Fault Pre-Location Principle

To deliver the full joules of energy possible to a fault, the capacitors within a thumper must be charged to the maximum voltage. With the wrong thumper, this often results in thumping a cable at an excessive voltage, causing significant damage to insulation and accessories. Since the applied voltage is a square function ($\frac{1}{2} CV^2$), if the thumper is at $\frac{2}{3}$ voltage, only 45% of the joules are delivered to the fault. At half voltage only 25% energy is delivered, making the fault hard to hear. Either fault locating takes far longer than necessary or the crew gets impatient and turns the voltage all the way up to get the loudest bang. The fault is found but more are made. This practice can and should be avoided.



SG-2000

View of the Surge Generator SG-2000

The SG-2000 is a controlled energy fault locator and fault locating in primary cable systems. It is designed to provide constant energy at each of three different selectable output voltages. This controlled energy feature provides full energy at each output voltage tap, allowing the user to thump at a lower voltage with a higher energy while minimizing further cable damage. The measure of a good thumper is not the maximum voltage it can discharge, but the minimum voltage still capable of delivering the full energy.

Technical Specification

Input:	230±23 V, 50 Hz
Output Voltage:	0-5/10/20kV
Energy:	2000J at full output on all output taps
Repetition Rate:	3 – 15 sec
Duty:	Up to 1 hour
TDR interface	Arc Reflection Method, Current Impulse Method
Dimensions:	520x610x640 mm
Weight:	120 kg

Features:

- Single piece Surge Generator to support Fault Location on power cables
- Constant energy at each output voltage setting
- Adjustable thump (impulse) repetition rate, from 3 to 15 seconds
- Simplified Controls for minimal operator training
- Zero Start high voltage interlock
- Single pulse or continuous discharge modes

7. Digital Cable Radar TDR-1669

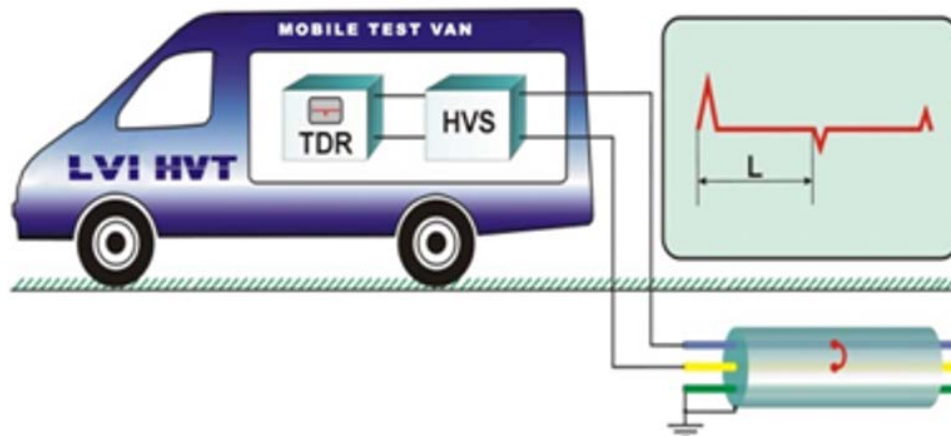
The TDR-1669 is a time domain reflectometer designed to provide quick, effective, accurate and safe prelocation of cable faults in electrical networks. Operation of the instrument is simple with an intuitive menu system. The large color display further enhances operator comfort and aids rapid and accurate fault prelocation. The system is housed in a rugged, robust, field-proven case making it suitable for use in hostile or challenging environments.



Technical Specification

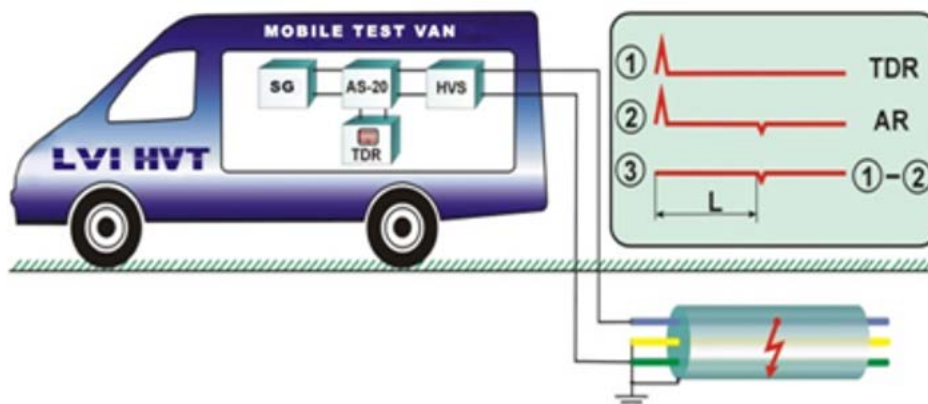
Measuring Range:	Continuously adjustable in 10% increments of displayed range
TDR Range:	150 – 14600 m
CI Range:	455 – 58500 m
Pulse width:	50 ns to 3.0 us
Pulse voltage:	14 Volts into 50 Ohms
Sample rating:	100MHz
Accuracy:	1 Sample (crystal controlled)
Display:	TFT enhanced colour LCD Approximately 10.5" (640x480)pixel
Velocity factor:	25.0 % - 99.9%
Distance measurements:	Adjustable, with two vertical cursors

Power requirements: 115-230V, 50/60Hz input
Dimensions: 406x190x254 mm
Weight: 6.5 kg



Impulse method Connection Diagram

A Time Domain Reflectometer (TDR) sends a short-duration low energy signal at a high repetition rate into the cable. This signal reflects back from the point of change in impedance in the cable (such as a fault). The TDR measures the time taken by the signal to reflect back from the point of change in impedance (or the point of fault). The reflections are traced on a graphical display with amplitude on y-axis and the elapsed time on x-axis. The elapsed time is directly related to the distance to the fault location. If the injected signal encounters an open circuit, it results in high amplitude upward deflection on the trace. While in case of a short-circuit fault, the trace will show a high amplitude negative deflection. This is a low voltage method known as impulse method, a fault pre-location technique suitable for locating short and open circuits as well as other faults below approximately 200 Ohms.



Connection Diagram for Device AR-20 (Arc Stabilization)

The TDR is unable to identify high resistance ground faults or intermittent faults, where its effectiveness in finding underground cable faults is limited. To overcome this limitation the TDR is combined with the surge generator (thumper) and a filter, providing several methods of high voltage (HV) fault pre- location methods such as arc reflection and impulse current.

The **Arc reflection** method uses the effect of reflection of the TDR pulses from the arc ignited at the location of the fault for a short time during the operation of a high-voltage surge generator (SG2000). A reference trace is taken without the arc, then a real-time trace is taken during the arc recorded and compared to the reference trace. The point of divergence indicates the fault position. Arc Reflection is the most widely used high voltage method and is suitable to quickly determine the distance for high resistance and intermittent faults without using a burning down installation.

The **Impulse Current** method is suitable for long or wet cables. In long cables, the natural damping of the cable may cause the TDR impulse to be damped off before returning to the reflectometer. The fault is ignited and the resultant transients are recorded by the reflectometer, which is acting as a transient recorder. The trace displays impulses at both the point of the fault (low impedance) and also where the surge generator (SG2000) is connected to the cable. The distance between the impulses is the distance to fault. The connection of the TDR with the cable is made using a special current connection device (pulse current converter). Structurally, this device is built into the surge generator.

8. Fault Burning Unit, BD-7-05

The Fault Burning Unit BD-7-05 is used to convert high resistance or intermittent faults of power cables to low resistance in order to create conditions for:

- Determine a distance to the defect by the pulse method.
- Pinpoint the exact fault location by the acoustic devices.



View of the Fault Burner 'BD-7-05'



The burning unit BD-7-05

- Powerful high voltage power supply
- 3 stages of burning with rectified voltage and 3 stages of post-combustion (afterburning) with alternating current up to 40 A.
- Increased afterburning efficiency due to low output resistance of the unit (no rectifiers).
- The unit can be used to arc over the cable fault and inject a continuous current stream into the fault for the purpose of reducing the fault impedance, which lowers the arc-over voltage. The operator has the ability to stop the burning process at any selected stage; Convenient and reliable switch with position fixing and feedback sensors.
- Built-in contactor for continuous discharge.
- Robust with the possibility of repair in non-specialized enterprises (there are no elements with complex electronics in the installation scheme). The unit is easily accessible, with semi-automatic fixing at the place of installation.
- Controls and displays are integrated into the Panel Computer of the laboratory.
- Metal casing grounded, enclosed type, without vent port.
- Supply voltage 220 V 50/60 Hz. Duty Cycle in burn down mode – continuous.
- Maximum power used by the unit in network is not more than 4.7 kVA

Technical Specification

Input:		230V, 50Hz
Output Steps:	1-3	0.17, 0.5, 1.4kV AC ±15%
	4-6	5.5, 11, 22kV DC ±15%
Current Steps:	1-3	40, 11, 3.9A AC ±15%
	4-6	1.15, 0.7, 0.35A DC ±15%
Max Power absorbed:		4.8kVA
Duty:		Continuous
Dimensions:		520x640x610 mm
Weight:		164 kg

9. Super Directional Acoustic Detector S.D.A.D II

For pinpointing of faults in buried cables the acoustic method is used to pin-point the exact fault location. The surge generator SG- 2000 is used in repetitive pulsing mode. High energy pulses which are released from the SG-2000 force a voltage pulse to travel along the cable. At the fault the flashover happens. This causes a high acoustic signal that is locally audible. Depending on the pulse energy, the intensity of the acoustic signal varies. These noises are detected on the ground surface with the addition of the S.D.A.D II. The unit conveys more information about the fault location, and faster, with the addition of new microprocessor-controlled electronics that provide bright, easier-to-see-and-read signals - day or night.



Complete Detection System includes:

1. Two earth Probe Microphones W/Wireless Transmitters
2. Two Tripod's (for use on hard surfaces)
3. A-T Ballistic Impulse Detection System
4. Direction to fault indication Color Touch Screen LCD and Super Bright LED
5. Stereo Bluetooth Headphones -High quality and comfortable
6. Audio output limitation: Automatic ear protection for the operator, even if a microphone is dropped.
7. Foam lined carrying case
8. Instruction Manual & Batteries

Features:

- Next generation high voltage fault pinpointing
- Touch screen color display
- Wireless microphone/headphones
- Full automatic operation
- Two earth probe microphones W/Wireless transmitters
- Two tri-pod's (for hard surfaces)
- A-T ballistic impulse detection system
- Direction to fault indication color touch screen LCD and super bright LED
- Stereo Bluetooth headphones
- Audio output limitation: automatic ear protection for operator, even if a microphone is dropped

10. Audio Frequency Cable Tracer Set IFL-1210

The IFL-1210 cable locator set is used for the successful location of the exact track and depth of different underground networks (cables and metallic pipelines). This lightweight user-friendly instrument operates at multiple active frequencies and provides passive 50/60 Hz detection services as an excellent safety feature for identifying live underground utility cables. The IFL-1210 features a digital readout of the depth reading that helps to identify service depths prior to digging.



The generator is included in the laboratory set and is connected to the cable under test by the operator when implementing the inductive method.

Functions and tasks to be solved: troubleshooting cable lines, determining the position of underground utilities, direct digital measurement of the depth of their occurrence, indicating the direction of deviation from the communications axis, measuring the current in communications, determining the type of communications.

Technical Specification

TRANSMITTER

Operating Frequency :	200-10000 Hz
Modes of Generation :	Continuous, Intermittent, tri-band (three frequencies)
Permissible Load Resistance :	0 ... ∞
Specified Output Current:	
- Continuous and tri-band	0,1 ... 10 A
- Intermittent	0,1 ... 15 A
Max Output Power:	120 W (continuous) /
- Battery Operated	180 W (intermittent)
- External Battery Operated	180 W (continuous) / 270 W (intermittent)
Protection :	IP 54
Dimensions:	305 x 270 x 194 mm
Weight:	12 Kg

RECEIVER

Operating Frequency :	Active: 512, 1024, 1450, 8928, 9820 Hz Passive: 50/60 Hz, 100 Hz, 12-24 KHz
Max Depth Measurement :	Up to 10 m
Max Depth of Detection :	Up to 25 m
Max Distance of Detection :	Up to 5 Km
Continuous Operating Time:	Up to 50 h
Operating Temperature:	-40 ... +60 °C
Dimensions :	720 x 110 x 150 mm
Weight :	1,7 Kg



The set includes:

- Receiver IFL-1210R;
- Generator IFL-1210G;
- Induction antenna;
- CR-120 inductive receiving clamp;
- CL-120 inductive transmitting clamp;
- Connecting wires;
- Grounding pin.

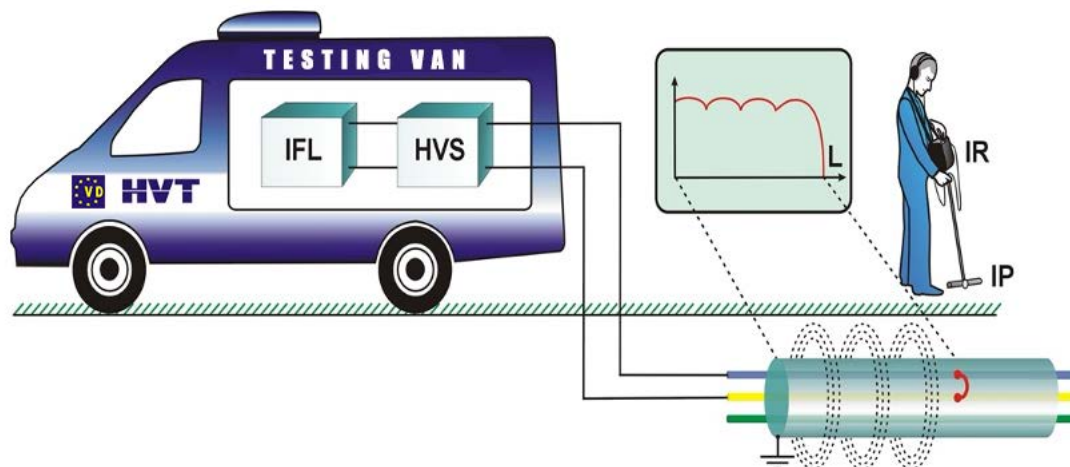


Diagram of work with the IFL-1210

11. Insulation Resistance Tester C.A 6550



The CA6500 insulation tester with its site-proof casing is suitable to check equipment insulation during manufacturing, on-site installation work, periodic inspections and re-commissioning of installations. It complies with the most recent recommended practices while taking into account future developments. The multiple test modes mean that you can both assess the insulation in qualitative terms by non-destructive testing and use samples to investigate insulation ageing problems for preventive maintenance purposes.

Technical Specification

Test Voltages	Ranges	500V: 10 kΩ to 2 TΩ 1000V: 10 kΩ to 4 TΩ 2500V: 10 kΩ to 10 TΩ 5000V: 10 kΩ to 15 TΩ 10000V: 10 kΩ to 25 TΩ
	Fixed Test Voltages	500, 1000, 2500, 5000, 10000
	Variable Test Voltages	40V – 10000V, 3 presettable voltage values
	Adjustment Increment for Variable Voltages	Variable:40-10KV Step: 40V-1KV:10V 1KV-10KV:100V
	Ramp Mode	3 presettable ramps: start voltage/end voltage/duration
	Ramp Configuration Range	40-1100V / 500-10000V
	Step Mode	Up to 10 steps (value and duration configurable for each step)
Voltage Measurement After Test		AC:0-2500V / DC: 0-4000V
Capacitance Measurement		0.001-9.999 μF / 10.00-49.99 μF
Leakage Current Measurement		0 – 8 mA

**Discharge After Test
Additional Test Stop
Modes**

**Burning Mode
Ratio Calculation
Calculation of R at
ref. T°
Measurement Display
Filter
Graphs on Display
Storage
Communication
PC Software
Power Supply**

Battery Charging

**Electrical Safety
EMC, Mechanical
Protection, Altitude
Dimensions
Weight**

**I-limit
Early-Break
Timer
Burning**

Yes / Automatic
Programmable: 0.2-5mA
di/dt
Up to 99 minutes 59 seconds
Constant testing
PI, DAR, DD
Yes

3 filters with 3 possible time-constant

R(t)+u(t);i(t);i(u)
256 recordings, 80000 points: R, U, I and date
Optically isolated port for USB and RS232 links
Dataview
NiMH rechargeable batteries, 8x 1.2 V / 4,000 mAh,
charging by external voltage: 90-260 V 50/60 Hz
Battery charging possible while performing
insulation measurements
1000 V CAT IV – IEC 61010-1 and IEC 61557
EN 61326-1, IP54, 3000m

340x300x200 mm (LxWxH)
6.2 kg

12. Cable Identification Live



Easily identify one cable from another. Whether you are in the trench or out of the trench, transformer to transformer, house to transformer, pole to transformer, or ground rod to ground rod you will be able to diagnose the situation quickly.

- Primary or Secondary
- In or Out of the Trench
- Tx-Former to Tx-Former
- Tx-Former to Meter
- Energized or Grounded
- Secondary, jacketed primary, or street light.
- Simple & Easy to Use

13. Earth Gradient Cable Fault Locator – EG 3000



Underground Cable Fault Locator with Automatic Cable-Saving Voltage Control.

The EG 3000 is used to locate all unshielded cable faults and Sheath-to-Ground faults.

Additionally, it can be used for Cable tracing:

- Direct Mode
- Inductive Mode
- Inductive Coupler Mode

The EG 3000 is a complete system, employing the most effective fault location electronics, plus many features for safety and operational convenience. Most outstanding of these is the system's Automatic Cable-Saving Voltage Control.

When pulsing a line to establish a fault, the EG-3000 applies only the breakdown voltage needed. Just as important, once the breakdown or flash to ground is achieved, the voltage is automatically reduced to the minimum amount needed to keep the fault alive and the fault current is increased. Up to 2.2 amps is available to locate through asphalt and concrete or dry sand and soil. Try that with an AC type fault locator.

14. Digital Multimeter 83V

The digital multimeter 83V has improved measurement functions, trouble-shooting features, resolution, and accuracy to solve more problems on motor drives, in plant automation, power distribution and electro-mechanical equipment. The units are independently tested to comply with the 2nd edition of ANSI/ISA S82.01 and EN61010-1 CAT IV 600V/CAT III 1000V.



Technical Specifications:

Voltage DC:

Maximum Voltage: 1000V

Accuracy: $\pm(0.1\%+1)$

Maximum Resolution: 100 μ V

Voltage AC:

Maximum Voltage: 1000V

Accuracy: $\pm(0.5\%+2)$

AC Bandwidth: 5kHz

Maximum Resolution: 0.1 mV

Current DC:

Maximum Amps: 10A(20 A for 30 seconds maximum)

Amps Accuracy: $\pm(0.4\%+2)$

Maximum Resolution: 0.01 mA

Current AC:

Maximum Amps: 10A(20 A for 30 seconds maximum)

Amps Accuracy: $\pm(1.2\%+2)$

Maximum Resolution: 0.01 mA

Resistance:

Maximum Resistance: 50 M Ω

Capacitance:

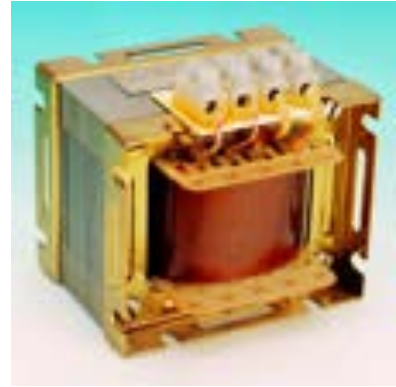
Maximum Capacitance: 9,999 μ F

Frequency:

Maximum Frequency: 200 kHz

15. Isolation Transformer 4kVA or equivalent

- Compliance with BS EN 61558-1: 1998
- There is no electrical connection between input & output windings.
- Suitable for industrial & domestic applications.
- Temperature class E. /Insulation class II.
- Operation in surrounding temperature of 40o C with temperature rise of 80o C.
- May be provided with electrostatic shield between input & output windings.
- Insulation resistance > 5 Megohms between input & output windings and >2 Megohms for other insulation, measurement made at 500V DC.
- Flash test 2000V RMS between core & other parts and 4000V between input & output windings.
- 50/60 Hz frequency operation.



16. Measuring Wheel

Extra rugged construction for use over agricultural land and other rough terrain including sports course management. Handle can be removed and folded away for easy storage

FEATURES

- Robust solid tire fitted to spoke wheel.
- Metric or imperial reading counter available.
- Heavy duty counting head fitted directly to wheel.
- Five figure counting head, 7mm high figures.
- Adds forward, subtracts in reverse.
- Accuracy $\pm 1\%$.



B. CONNECTING DEVICES

17. Main HV Switch HVS-75/1



The main high voltage switch along with the control panel form the heart of the testing process of the cable test van. The unit is air-insulated with a reliable and robust design. The switch once it receives power through the control panel it selects and gets locked to a particular high voltage instrument. Once the test is completed the unit automatically connects to ground making the operation of the test van safe.

Features

- Number of switched equipment outputs - up to 5; no additional switching devices required

- Reliable manual control and air-barrier isolation of the main contacts
- Instrument-type control knobs; one-handed mode operation is enough for switching
- Clear predefined angular positions
- Feedback sensors for monitoring selected equipment
- Built-in visible contacts for automatic discharge of power cable capacitance
- Compact size and light
- Minimum maintenance needed; has an easily removable top cover for routine inspection of the main contacts

18. Cable Drum Racks



External connections for the cable test van are provided with a power feeding cable drum, a grounding cable drum and a high voltage cable drum

- Drum with main power cable, cable length 50 m
- Drum with grounding cable with a cross-section 16 mm² copper transparent plastic sheath with connection every 4 to 5 m, cable length 50 m
- Drum with output HV shielded cable, cable length 50 m
- Drum with auxiliary ground cable, cable length 15 m

19. Electrical safety system

Visualization and control over all organs and safety steps is performed from the touch panel screen. **The security system is equipped with a smartphone, which allows the operator's assistant to monitor the operation of the facility and in case of an emergency, remotely turn off the laboratory.**



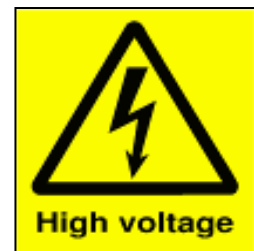
Emergency Shutdown of the laboratory remotely through a Smartphone

System composition:

Safety control module	PC.	1
Position sensors on HV compartment doors	PC.	3
Sound alarm	PC.	1
Light signaling	PC.	1
Emergency stop button	PC.	1
Input release with visible contact break	PC.	1
Automatic contactor kit	SET.	1
Safety isolation transformer	PC.	1
Set of fences and warning posters	SET.	1

Features of the system elements:

- The safety control module monitors the resistance of the "Working earth - protective earth" loop and the potential on the laboratory chassis in relation to earth. With an increase in the grounding resistance over 12 Ohms and / or the potential on the chassis over 24 V, switching on the high voltage is impossible;
- When the doors of the high-voltage compartment are opened at an angle of more than 15°, switching on the high voltage is impossible;
- Gives a sound signal at the moment of switching on the high voltage;
- Turning on the flashing beacon during operation under high voltage;
- Manual emergency shutdown of the laboratory by pressing the emergency shutdown button;
- The design of the input release provides visual control of the presence of an open between its contacts;
- Automatic forced grounding of high-voltage test installations and test objects connected to them using a set of automatic contactors provides forced grounding of laboratory module outputs after completion of work or in emergency situations. When working with objects with a significant capacity, contactors with damping resistors are pre-triggered to ensure a smooth discharge;
- Equipment cases and vehicle chassis are connected to the earthing wire ; laboratories with a wire with a cross section of 10 mm²; for protective grounding of the laboratory, a coil with a highly flexible wire in a transparent sheath with a cross section of 10 mm² is used; in order to reduce the inductance, the wire is equipped with contact bushings every 3 meters along its length.



C. PROTECTIVE EQUIPMENT

20. Voltage Detector

Voltage Detectors are used to verify live or de-energized conductors. These testers may be used with rubber insulating gloves or hot sticks using the splined universal end fitting. Testers indicate the presence of voltage with an extra bright LED light and a distinctive audible signal. It is recommended that the tester be moved closer to conductor until warning is indicated, or it touches conductor, apparatus, or test point. Test the unit on a nearby energized conductor.

1	Ground pole / Insulating stick	1 unit
2	Hot stick	1 unit
3	Dielectric gloves	2 pair
4	Dielectric boots	1 pair
5	Protective helmet	2 units
6	Tool Kit	1 unit
7	Fire extinguisher	2 units
8	Reflecting triangle	1 unit
9	Ground spike / hammer	1 unit

21. Personnel Protective Equipment / Tool Kit



21. TechnoGen H13000ELX or equivalent

TechnoGen generators present a refined design and accurate equipment: a strong sheet steel top with a lifting eye, a 20 liters fuel tank, an electrical control panel safely placed separately from the engine unit and from the alternator, therefore sheltered from all vibrations. Equipped with Honda engines of the latest generator. These generators have in standard package also vibration dampers, exhaust gas silencer, air filter, low oil protection and 12V battery.

Specifications:

KV cont: 10.5

Starting: Electrical

Brand: Honda GX630

Cylinder: 2/688 cm³

HP: 20.8

Tank: 20 liters petrol

Weight: 123 kg

Dimensions: 99x55x67 cm (LxHxW)



22. Chassis: Ford Transit 350 L3/H3 2.0TDCi

Built for hard work. Even smarter. Even more capable. Even more efficient. The new Ford Transit can deliver even greater productivity for your business. Across the new Transit, you will find increased payloads and more fuel-efficient engines with greater torque and towing ability. Plus, a fresh front-end design with 3-bar signature grille, stylish new bonnet and bumper, and distinctive new headlights and LED technology. Inside the cabin, you will find built-in connectivity and advanced driver assistance technologies to help you through the toughest working day. While the redesigned interior, with attractive trim materials, seat fabrics and colours, will reward its occupants with even greater levels of comfort.



Technical Specification

Overall Length	5981 mm
Overall Height	2670 – 2780 mm
Wheelbase	3750 mm
Maximum Loadspace Length	3533 mm
Gross Vehicle Mass	3500 kg
Maximum Gross Payload	2125 kg

The laboratory is mounted in a van in an all-metal Ford Transit Ford Transit 350 L3/H3 2.0TDCi. The steering wheel is left-hand.

The laboratory has two compartments: an operator compartment (front) and a high-voltage equipment compartment.

Body

The body of Ford Transit is all-metal, thermally insulated from the inside and trimmed with white plastic. Due to the modern materials used, the body is not subject to corrosion, maintains the temperature set inside the body, which saves fuel and other resources, as well as provides comfortable conditions when working in hot weather. The body is heated by a roof air conditioner operating in hot-cold mode.

Internal laboratory equipment

The design of the laboratory was created to facilitate operation and service. The body has high quality wall insulation, plastic paneling, and air conditioning. The laboratory salon is separated



by a partition between the high-voltage compartment and the operator compartment. All high-voltage and power equipment is installed in the high-voltage compartment. Safety is one of the most important features of the laboratory, so all equipment is correctly installed and securely fastened. The operator compartment provides a comfortable environment and ample workspace for high efficiency and productivity.

The operator's compartment contains:

- Panel and control units;
- operator's workplace (with reliable transport fastening).
- cabinets and boxes for storing documents and measuring instruments;
- wardrobe for work clothes and protective equipment.

All equipment located in the control compartment has standard stowage points and is fixed to them.

The high-voltage compartment contains:

- high voltage equipment;
- connection of high-voltage connections does not allow corona;
- All devices are located at a safe distance from the high voltage source;
- stands with drums of cables: the drums are securely fixed, their design excludes spontaneous unwinding.

The laboratory has the following main distinctive features:

- The equipment is mounted in a sound and heat-insulated all-metal body. This creates a comfortable working environment for the operator in both cold and hot climates.
- In the operator's compartment there is a Eurodesk-type working table, which creates comfortable conditions for carrying out measurements and their subsequent processing and registration.
- To prevent touching live parts, a special partition separates the operator's compartment from the high-voltage compartment.
- The partition also separates the Eurodesk-type workbench from the high-voltage compartment.
- Cable outlet to the object is carried out through a special cable outlet hatch.
- A roof air conditioner is installed in the operator's compartment, which maintains the operating temperature in hot weather.
- There are also drawers in the operator's compartment for storing accessories.
-

Lighting is installed in the body:

- Internal, 230 VAC;
- Internal, 12V DC
- The laboratory is equipped with retractable tool cases for storing fixer and driver's tools. The culture of production is improved, working conditions are improved and the laboratory maintains favorable conditions for work in general.



View of the back of the Operators area



View of the High Voltage area

23. Training

A training was organized to train the customer's specialists on the rules of work at the supplied electrical laboratory.

- conducting high-voltage tests of electrical equipment
- device, purpose and layout of electrical laboratory units
- high-voltage cable diagnostic
- electrical laboratory connection, switching and power supply modules
- carrying out maintenance of high-voltage equipment of the electrical laboratory
- discussion of questions and suggestions
- presentation of the certificate of participation in the seminar



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By agreement of the customer and with a large group, the training can be organized on the customer's territory.

D. WARRANTY

24. According to the Declaration of Warranty, the laboratory has a warranty period of 24 months. At the end of the warranty period, the manufacturer, at the request of the customer, provides post-warranty service for the supplied equipment.

The vehicle warranty is established in accordance with the manufacturer's service book.

E. CONTACT INFORMATION

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