HV Diagnostics

ENGLISH

Rev 9.0

HVA 34

User Manual

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Portable Universal High Voltage VLF/DC Test Instrument

Table of Contents

1 Forward

Purpose

This operating manual serves to ensure the proper and safe use of the HVA test instrument.

1.1 Regarding this Document

Target User

This operating manual is designed to inform various user groups. The scope and depth of the information provided may not be appropriate for all users. However, it is important that all users familiarize themselves with this document in full. The following is a guideline indicating the most significant information as a function of the user's responsibilities.

User	Responsibilities	Focus
HVA Operator	• To connect the equipment • To carry out manual or pre-programmed test sequence • To verify validity of HVA application • To adjust instrument settings • To program automatic test sequences in accordance with particular testing standards	**All** Sections Particular focus on all **safety** messages
Procurement, Management	• To assure that the workplace is safe and has all required equipment • To assure that HVA operators are qualified technicians • To assure that operators fulfil their responsibilities	Particular focus on **safety** messages and information regarding **general** product description.

Safekeeping

NOTICE

This manual should always be on hand when using the HVA test instrument

1.2 Documentation Conventions

The following explain the **symbols**, and **safety messages** found in this document. The employment of safety symbols and signal words are according to the American National Standards Institute standard ANSI Z535.6 "Product Safety Signs and Labels".

Danger

DANGER

Indicates a hazardous situation which if not avoided will result in death or serious injury

Warning

WARNING

Indicates a hazardous situation which if not avoided could result in death or serious injury.

Caution

CAUTION

Indicates a hazardous situation which if not avoided could result in minor or moderate injury.

Notice

NOTICE

Indicates suggested practices to protect equipment and property.

Safety Messages

Symbols

Yellow triangle, framed in black: Used to indicate a potential hazard.
Only used in conjunction with description of the possible hazard!
Detailed symbol may correspond to this specific hazard.

Red outlined circle with red diagonal line: Used to indicate forbidden practices.
The described handling practice must not be carried out!

Blue circle with white exclamation mark: Used to indicate recommended precautionary measures or a situation that can lead to property damage.

1.3 Legal Considerations

Warranty

HV Diagnostics provides a one-year warranty from the original purchase date of instrument for all necessary parts and labor. This warranty is void in the event of abuse, incorrect operation or use, unauthorized modification or repairs, or failure to perform the specified maintenance as indicated in this operation manual. This warranty does not include normal consumable items such as lamps, paper rolls, printer ribbons, batteries or other auxiliary items.

This warranty and our liability are limited to replacing or repairing defective equipment, at our discretion. Equipment that is returned to HV Diagnostics must be packed in original packaging. All shipped items must be prepaid and insured. No other warranties are expressed or implied.

Contact Information

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Your opinion matters!

Your comments and suggestions are of value. We are dedicated to supporting your needs. Offering you optimal documentation is part of our promise of quality.

Improvement suggestions regarding this manual may be sent to:

sales@hvdiagnostics.com

Thank you for your feedback!

2 Safety

Safety is a **priority**! Observe and adhere to all **safety information and regulations**; only use the HVA34 for **appropriate applications** and ensure that operators possess the required **operator qualifications and training.**

2.1 General Safety

NOTICE

Operation Manual

Before carrying out any high voltage test with this instrument, read this Operating Manual in its entirety.

2.2 Work Safety

DANGER

Electric Shock Hazard

Never assume that equipment is safe to handle without using the necessary safety equipment and grounding procedures.

- All procedures must comply with local safety regulations
- Always treat exposed connectors and conductors as potential electric shock hazards.
- DUT (Device Under Test) must be grounded, de-energized and isolated from all power sources.
- All auxiliary electrical apparatus such as switchgear, surge arresters etc. must be isolated from the test power source and the DUT.
- All cables and connectors must be inspected for damage before use. Damaged equipment must not be used.
- Earth connections must be made first and removed last!
- DUT must be discharged and earthed before disconnecting the test lead.
- Avoid testing alone. In the event of an emergency another person's presence may be essential.

DANGER

Authorized Personnel Only

The test area must be secured to keep non-qualified personnel off the premises!

- Signs must warn all persons of the high voltage test area.
- Only qualified electrical technicians should have access to the test area.
- Other persons must be accompanied by qualified electrical technicians and must be informed of the risks involved.

WARNING

Radiation Hazard

Testing vacuum bottles, above their voltage rating, with DC can produce dangerous X-rays.

NOTICE

Equipment Handling

DUT must have clean connections.

Test instruments must only be repaired or modified by authorized HV Diagnostics' personnel.

NOTICE

If required according to local safety regulations

Wear high voltage gloves when handling high voltage cables and equipment.

2.3 Appropriate Applications

The HVA test instrument is designed to perform high voltage insulation testing of various types of highly capacitive loads.

Appropriate DUTs

DUT Type	Examples
Cables	• Extruded cables (e.g. XLPE) • Laminated cables (e.g. PILC) • Insulated cables • Cable jacket / sheath
Other highly capacitive loads	• Generators • Switchgear • Transformers • Rotating machines • Insulators • Bushings

Appropriate Measurements

Measurement	Examples
Test	• Capacitance • Resistance • Dielectric breakdown voltage • RMS current • Applied RMS voltage

NOTICE

Other Applications

Before proceeding, contact HV Diagnostics to validate appropriate use!

2.4 Operator Qualifications

HVA operators must be **qualified electrical technicians!** Proof of necessary qualifications for working in high voltage domain is mandatory. It is highly recommended that operators have completed an emergency rescue training program.

3 General Description

3.1 Technical Specifications

Characteristic	HVA34[1]	
Input Supply Voltage	110-240V; 50/60 Hz ; ±10%	
Input Supply Power	400VA	
Output Voltage [Max.]	VLF Sinewave: 24kV rms , 34kV Peak VLF Squarewave: 34kV DC: ±34 kV	
Output Current [Max.]	Sinewave: 10mA rms Squarewave / DC [+/-]: 15mA	
Output Frequency	0.01 Hz -0.1Hz in 0.01 Hz increments	
Sheath Test	max. Test Voltage: 10 kV, Duration: 1 min – 15 min Trip Current: 0.1 mA – 5.0 mA	
Sheath Fault Location Mode[2]	max. Test Voltage: 10 kV, Duration: 1 min – 60 min Pulse/Period: 1:3 / 4 s, 1:5 / 4 s, 1:5 / 6 s, 1:9 / 6 s	
Frequency optimization	Yes	
Output Load Capacity	At Full rated voltage at 0.1Hz: 0.5µF Max. at reduced frequency and or reduced voltages: 12µF	
Metering	Current Resolution: 1µA, Accuracy: ±1% Voltage: Resolution: 0.1kV, Accuracy: ±1% Capacitance: 0.1nF - 20µF Resistance: 0.1 MΩ -20GΩ	
Output Duty	Continuous! No thermal limitation for operating time.	
Test Modes	Manual Automatic	
Output Modes [Load independent, symmetrical]	VLF AC Sinewave VLF AC Squarewave DC [+ or – polarity]	Vacuum Bottle Testing Sheath Sheath Fault Location Mode
Arc Management Modes	Fault Conditioning Mode: Burn on Arc Fault Trip Mode: Trip Out on Arc	
Computer Interface	RS232 and USB Flash Memory Module	
Record Storage	Built in Memory: up to 50 reports , 40 Test sequences USB Memory Flash drive: Unlimited	
PC Software [included]	HVA Control Center for Windows XP / 7 / Vista	
Weight	43lbs / 19.5kg	
Dimensions [excluding handles]	17” x 14” x 10” / 430mm x 360mm x 250mm	
Environment	Storage Temperature: -25°C to 70°C (-13°F to 158°F) Operation Temperature: -5°C to 45°C (23°F to 113°F) Humidity: 5-85% non-condensing	

[1] Technical Specifications are subject to change. HV Diagnostics reserves the right to modify values in accordance with future HVA development.
[2] in combination with locator set (not in scope of supply)

3.2 Design Features

To assure that the workplace is safe and that operators can fulfil their responsibilities with ease, the HVA provides the following features.

Feature	Purpose / Application	Advantage
Optimized Frequency Selection / Automatic load measurement	• To test capacitive loads • No instrument restart necessary	• Facilitates testing • Limits number of connections to the DUT
Fully Automatic Test Sequences	• To test according to IEEE or other standards	• Facilitates complex testing • Facilitates test repetition
Real Time Display	• To indicate instantaneous output voltage display.	• Facilitates testing
Load independent output	• To indicate true symmetrical sinusoidal and square wave waveforms output	• Facilitates testing
Built in Memory	• To save test sequences • To save test reports	• Facilitates test repetition • Facilitates documentation
Arc Management	• To provide short-circuit protection • To allow for fault conditioning	• Limits test interruptions commonly encountered when using conventional HV test instruments that immediately trip on arc detection.
Automatic load measurement	• To limit connections to the DUT	• Facilitates testing
Intelligent Design	• Minimum moving parts and no need for lubrication	• Reduces maintenance • Improves instrument durability and reliability
Instrument Lock-Key switch (7)	• To prevent against unauthorized use	• Improves safety
Local and remote emergency off switches	• To shut down operations in an emergency situation	• Improves safety
Fully integrated discharge and transient circuit	• To ground the DUT after testing • To protect the unit from transient over voltages	• Improves safety • Protects instrument
Initial load clearance test at reduced voltages	• To check automatically for shorts or grounds, during load measurement, before test initiation	• Improves safety
Return Voltage Indication	• To monitor external high voltage greater than 100V (AC)	• Improves safety
Discharge Status Indication	• To indicate when DUT is not fully discharged. LED Red (3) lights when residual voltage greater than 100V	• Improves safety during normal disconnection procedures

3.3 Materials

Shipment Content

Items included upon delivery of the HVA are listed below. The * marking specifies items that are country specific. For inquiries, please contact HV Diagnostics.

Part. No.	Item	Description	Qty
734 001	HVA34		1
700 501	HVA 34 HV Test Lead + Alligator Clamps 50kV / 4m		1
700 505	Grounding Cable Transparent 6mm^2 (10 AWG) / 4m (13ft); with 400A alligator clamp		1
	Grounding Cable Green		1
700 048	HV External Remote Interlock Adapter		1
700 907	Power On Key Spare key for Key switch (7)		1
700 902	Cable RS232 Serial Communication Cable		1
	Mains / AC Power Cable*		1*
700 909	USB-RS232 Adapter FTDI USB Adapter UC232R-10		1
700 199	USB Flash Drive HV Diagnostics		1
	HVA Control Center Software		1
	HVA 34 Operation Manual		1

4 Accessories

Accessories that are not included with the standard delivery of the HVA and are available for order through HV Diagnostics.

Part No.	Item	Description
700 006	USB Flash Adapter	
700 005	Transport Case	
700 086	HV Protective Cap	
700 003	TD30 Tan-Delta System 24 kVrms	
700 220	PD30 Partial Discharge Fault location System 30 kV	
706 050	Discharge Stick 60 kV	
700 502	HVA34 HV Test Lead + Alligator Clamps 50 kV / 15 m	
700 011	Vise Grips	
700 004	Heavy Duty Cable 4.5m / 15 ft (Does require suitable Clamp / Visegrip – see Part #700 011 for example)	
700 004LL	Heavy Duty Cable 50ft	

NOTICE

Equipment Not included

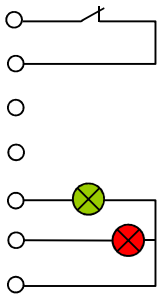
Cables for remote control and external lamps are not included with the standard issue of the HVA by HV Diagnostics! See options.

External Lamp requirements:

- Rating: Max 1.2 W
- Recommended colors: Red, Green

PINOUT Connection

PIN 1: Interlock	1
PIN 2: Interlock	2
PIN 3: Not in use	3
PIN 4: Not in use	4
PIN 5: Lamp HV ON	5
PIN 6: Lamp HV OFF	6
PIN 7: Ground (GND)	7



5 Design and Construction

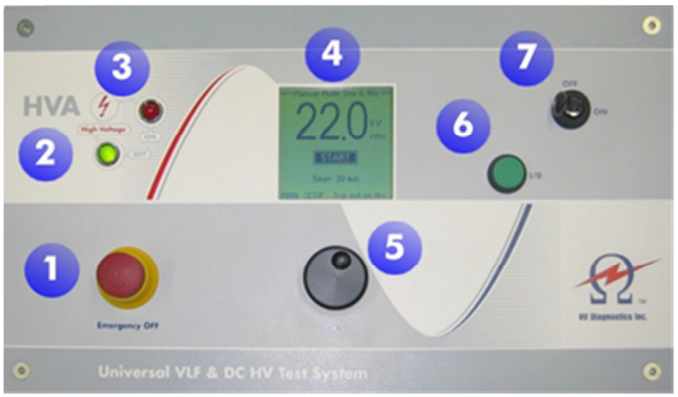
5.1 Control Elements

HVA control and connection components are located on 3 panels

Panel- Orientation

Orientation	Description
Front	• Test controls and emergency shutdown • HV status information
Left Side	• Cable and power source connections • External connections • Air Vent
Right Side	• RS232 port / USB Flash Adapter • Air Vent

Switches and Controls

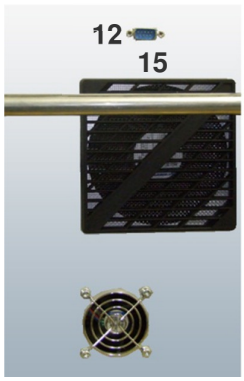


Pos.	Name	Description
1	Emergency OFF	Activates emergency shutdown. Operation is only possible when Emergency OFF is deactivated. • To Activate Emergency Off→ Press in • To Deactivate Emergency Off→ Rotate and Release latch
2	LED green	Indicates HV status. ✸Green light indicates → High Voltage is OFF
3	LED red	Indicates HV status. ✸Red light indicates→ High Voltage is ON (possible DANGER) → DUT not discharged (residual voltage >100V)
4	Display screen	Displays menu, options and status information.
5	Navigation knob	Enables user to select options and functions shown on display. See 4.2 User Interface • To scroll selection up or down→ Rotate • To enter selection→ Click (push in)
6	HV switch [on/off]	Activates high voltage. • To activate HV output→Press within 10 seconds after START See 5.2 Manual Test Procedure: Step MR 2; See 5.3 Automatic Test Procedure: Step AR 6
7	Key switch [on/off]	Locks the unit to prevent against unauthorized use. • To disable unit→Remove key from the OFF Position • To reactivate unit →Replace key and turn to ON Position.

Switches and Controls, continued

Left side

Right side



Detail Pos. 12

RS232

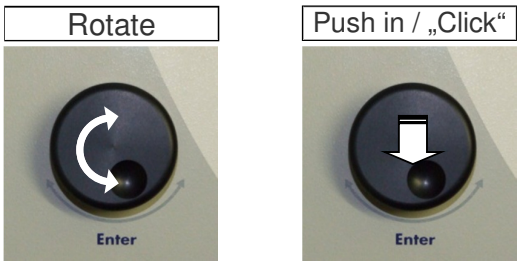
USB Adapter

Pos.	Name	Description
8	Main switch [on/off]	Activates the HVA. This switch is a fuse with integrated magnetic auto-reset 10A • To reset→ Turn the main switch OFF and then ON again
9	Power supply plug	Serves as connection point from the HVA to the 110V – 240V, 50/60 Hz power source.
10	Grounding connector	Serves as connection point from HVA to earth.
11	HV output connector	Serves as connection point from the HVA to the HV test lead. To connect→Screw the HV test lead into the HV output connector and tighten
12	Communication port	Serves as connection point from the HVA to PC (via RS232) or to a USB device (via USB Flash adapter).
13	Remote control interlock plug	Provides interlock for the remote switch (i.e. door interlock). Can be connected to a remote emergency off switch, a gate, foot pedal or dead man switch
14	Air Vent	Air inlet with filter, for cooling of electronic elements.
15	Air Vent	Air outlet, for cooling of electronic elements.

5.2 User Interface

Display Navigation

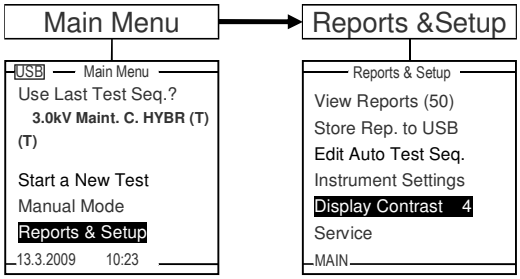
The navigation knob (5) enables the user to select or change options shown on the HVA display screen (4).



- To move to another item in a menu list or to any other field possible on the screen → Rotate the knob.
- To scroll through options or to change value displayed of an active field→ Rotate the knob.
- To select marked option or to accept set value → Push in / “click”

Display Contrast

The contrast of the HVA display screen (4) can be adjusted. The “Display Contrast” setting is found in the “Reports & Setup” menu.

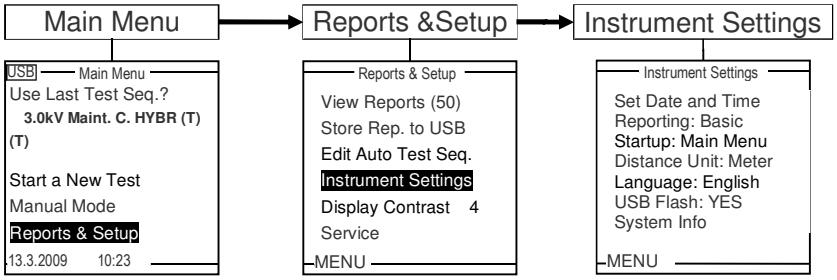


- The lowest value is “1”, refers to the lightest background.
- The greatest value “10” refers to the darkest background.

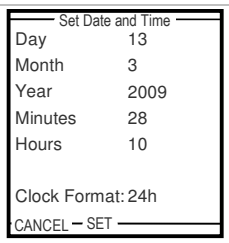
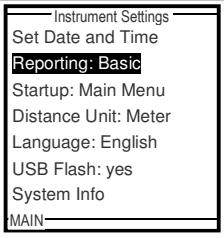
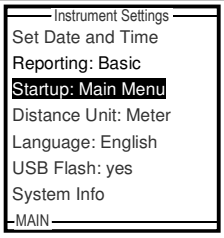
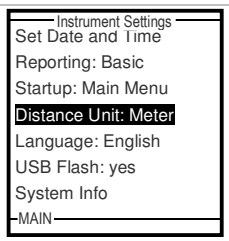
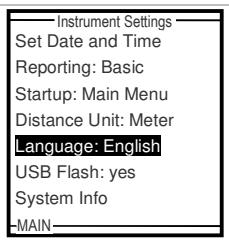
To select, Push in / “click” the navigation knob (5) until “Display Contrast” is highlighted. Rotate the knob to change the value. Push in / “click” in to enter the new value.

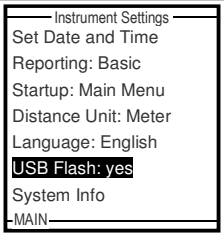
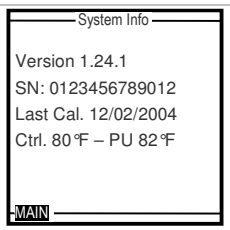
5.3 Instrument Set-up

The HVA instrument settings should be established prior to first utilization and can be modified at any time thereafter. “Instrument Settings” is found in the “Reports & Setup” menu.



Description

Setting	Options	Example
Set Date and Time	Select “Set Date and Time“ from “Instrument Settings “ menu to arrive at appropriate screen. “Clock Format” selected here appears in reports and on the Main Menu display hereafter: • 24h • am/pm	
Reporting	“Reporting” type selected here is generated when report mode is active in testing hereafter. • Extended (detailed report information can be entered) • Basic (only Report Title is entered prior to test start)	
Startup	“Startup” default screen selected here appears as 1st screen when HVA is turned ON hereafter. • Main Menu • Manual Mode	
Distance Unit	“Distance Unit” selected here sets the units for entering cable length when creating test parameters and reporting information hereafter. • Feet • Meter	
Language	“Language” selected here appears as display hereafter. • English	

Setting	Options	Example
USB Flash	"USB Flash" defines the status of communication port (12). • USB Flash :Yes (for USB Flash Adapter) • USB Flash: No (for RS232) ➔ Note: Set USB Flash Selection to "no" prior to firmware upgrades or RS232 communication to a PC	
System Info	"System Info" displays HVA characteristics. This information cannot be modified by the operator: • Version: Installed HVA Firmware • SN: HVA unit serial number • Last Cal: Date of last calibration • Ctrl.: Temperature	

5.4 Operation Modes

The following describes the scope of each HVA operation modes: **Test Modes, Output Modes** (Waveform), **Arc Management Modes,** and **Data Transfer Modes**.

Test Modes

The HVA can be operated in “Manual” or “Automatic” mode. For detailed procedure, see 5.2- Manual Test Mode, and 5.3 - Automatic Test Mode.

Test Mode	Characteristics
Manual	Designed to facilitate rapid testing. Test Parameters of the last manual test appear as the default setting. • Test parameters can be changed immediately before activating a test. • Basic reporting most appropriate setting. (Extended reporting will generate a report with most fields left blank)
Automatic	Designed for testing with predefined configuration in order to satisfy specific requirements (e.g. IEEE, IEC standards). • Test sequence must be configured and saved at any time before testing. • Extended reporting most appropriate setting.

Output Modes

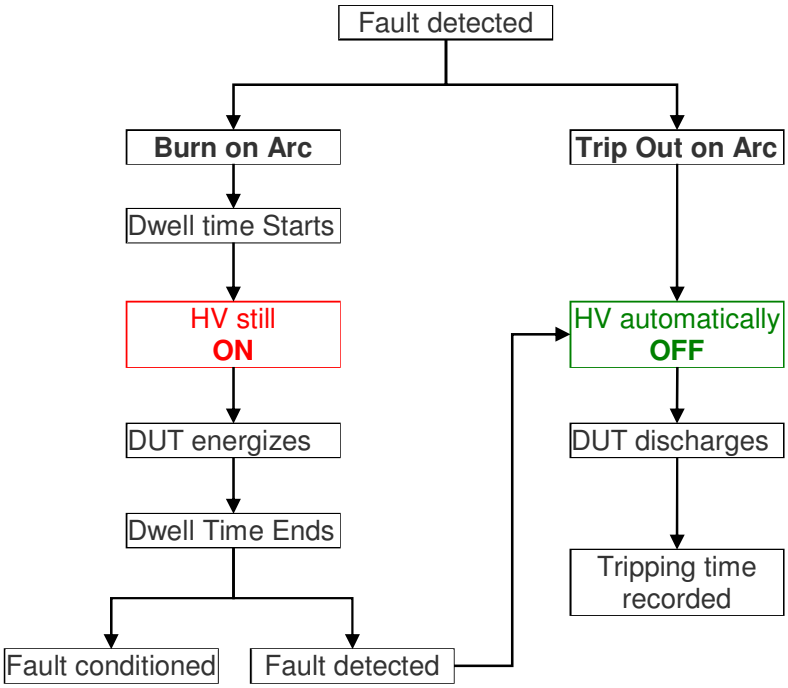
The HVA can carry out HV test in the following output modes:

Output Mode	Characteristics
DC [- /+]	Single polarity output. DUT is polarized (negative / positive) with respect to ground. • **Not** recommended for testing extruded cables (e.g. XLPE cables). • Measured valued: Dielectric loss of the DUT (including leakage current across terminations) • DC - : Most commonly used DC output mode
VLF Sinewave	Default waveform • Suitable for testing extruded cables (e.g. XLPE cables). • Measured valued: RMS
VLF Squarewave	• Suitable for testing extruded cables (e.g. XLPE cables).
Vacuum Bottle Testing	• Not suitable for testing with DC above DUT voltage rating (X-ray Hazard) • Possible in Manual and Automatic test modes

Output Mode	Characteristics
	• Trip current, duration and rise rate are user defined • Measured valued: Peak Voltage
Sheath Test	• Suitable for Sheath Test • Duration and Test voltage are user defined • max Test Voltage: 10 kV
Sheath Fault Location Mode	• Suitable for Sheath Fault Location • Duration is user defined • Pulse user defined (1:3 / 4 s, 1:5 / 4 s, 1:5 / 6 s, 1:9 / 6 s)

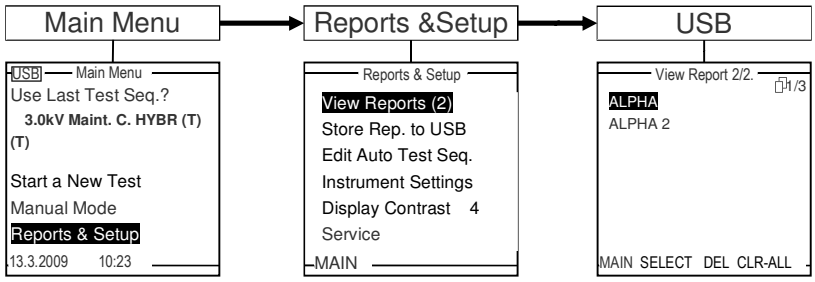
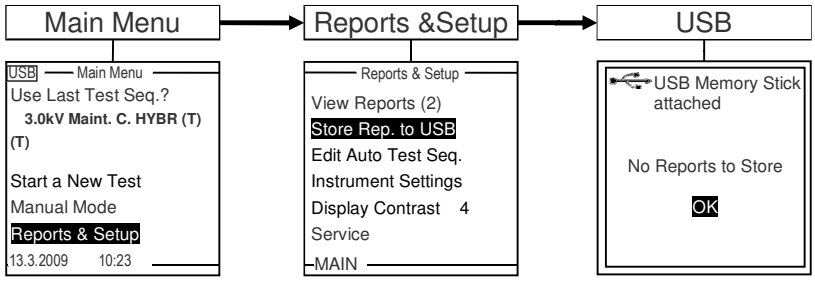
Arc Management Modes

If a fault is detected during a HV test, the arc management mode determines how the failure is managed. The “Burn on Arc” mode will condition the fault whereas the “Trip out on Arc” mode will immediately switch HV off.



Data Transfer Modes

The HVA built in memory can save up to 50 reports and 40 test sequences. Data storage location and transfer capability depends on the configuration of the communication port (12).

Configuration	Characteristics
RS232	• During testing, RS232 cables are **not** connected to communication port (12) • Test sequences are directly saved to HVA memory • New reports are directly saved to HVA memory • All test sequences and reports saved in HVA memory can be transferred to the linked PC, once the HVA Control Center Software has been installed
USB Flash Adapter	• During testing, USB adapter and stick are connected to communication port (12) • When connected, left hand corner of main menu displays “USB”. • Test sequences are directly saved to HVA memory • Reports saved on the USB stick can be retrieved and viewed on the HVA display:  • All reports saved in HVA memory, can be transferred to the linked USB stick: 

6 Test Procedure

DANGER

Electric Shock Hazard!

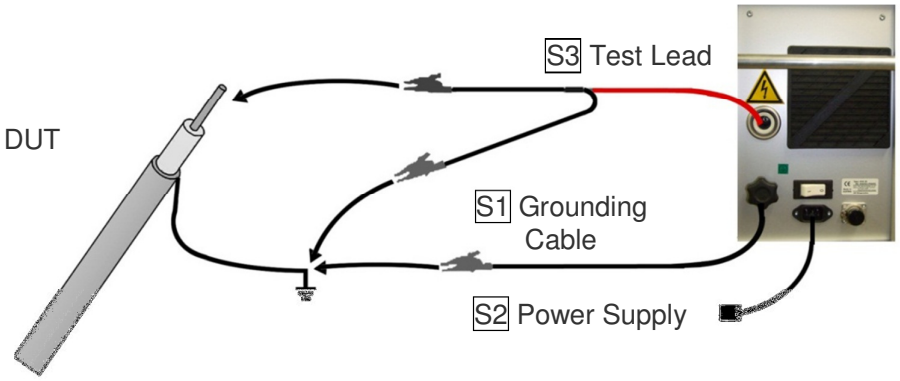
All procedures must comply with local safety regulations.

- Before operating the HVA, equipment set-up procedure must be completed!
- Cables must be connected in the proper sequence!
- Before turning on the power supply and before activating the HVA, verify that all system elements are properly grounded!
  See 5.1 Equipment Set-up: Steps S 1 –S 7

6.1 Equipment Set-up

Steps **S1-S9** describe the **Equipment Set-up** procedure. When carrying out multiple tests, the ground and power supply connections must always remain intact. The HV test lead must be reconnected before each subsequent test (i.e. repeat procedure as of step S3).

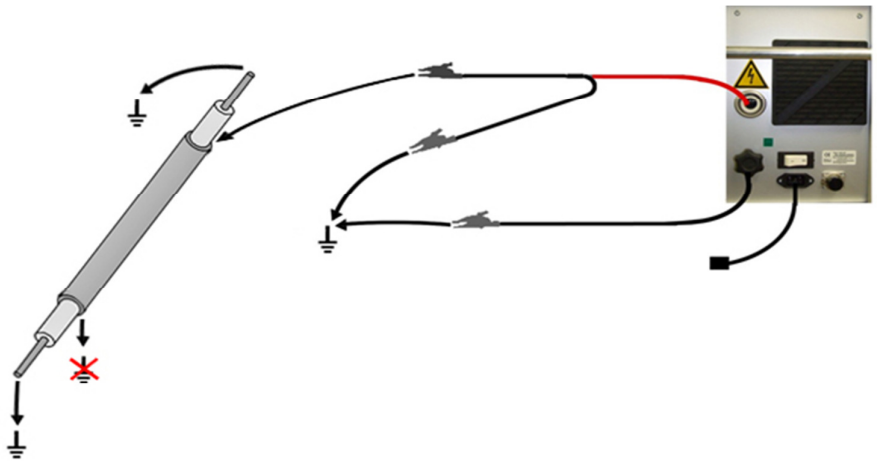
Connection Diagram: Cable Testing



Step	Procedure
S1	Connect Grounding Cable • Connect grounding cable to the HVA grounding connector (10) • Connect grounding cable to the DUT ground
S2	Connect Power Supply Cable • Connect the power supply cable to the HVA power supply plug (9)
S3	Connect HV Test Lead • Screw the HV test lead into the HVA HV output connector (11) • Connect the HV cable shield to ground. • Connect other end of HV test lead (clamp including screen protector) to the DUT.
S4	Verify Connections • Check that all cables are attached securely.

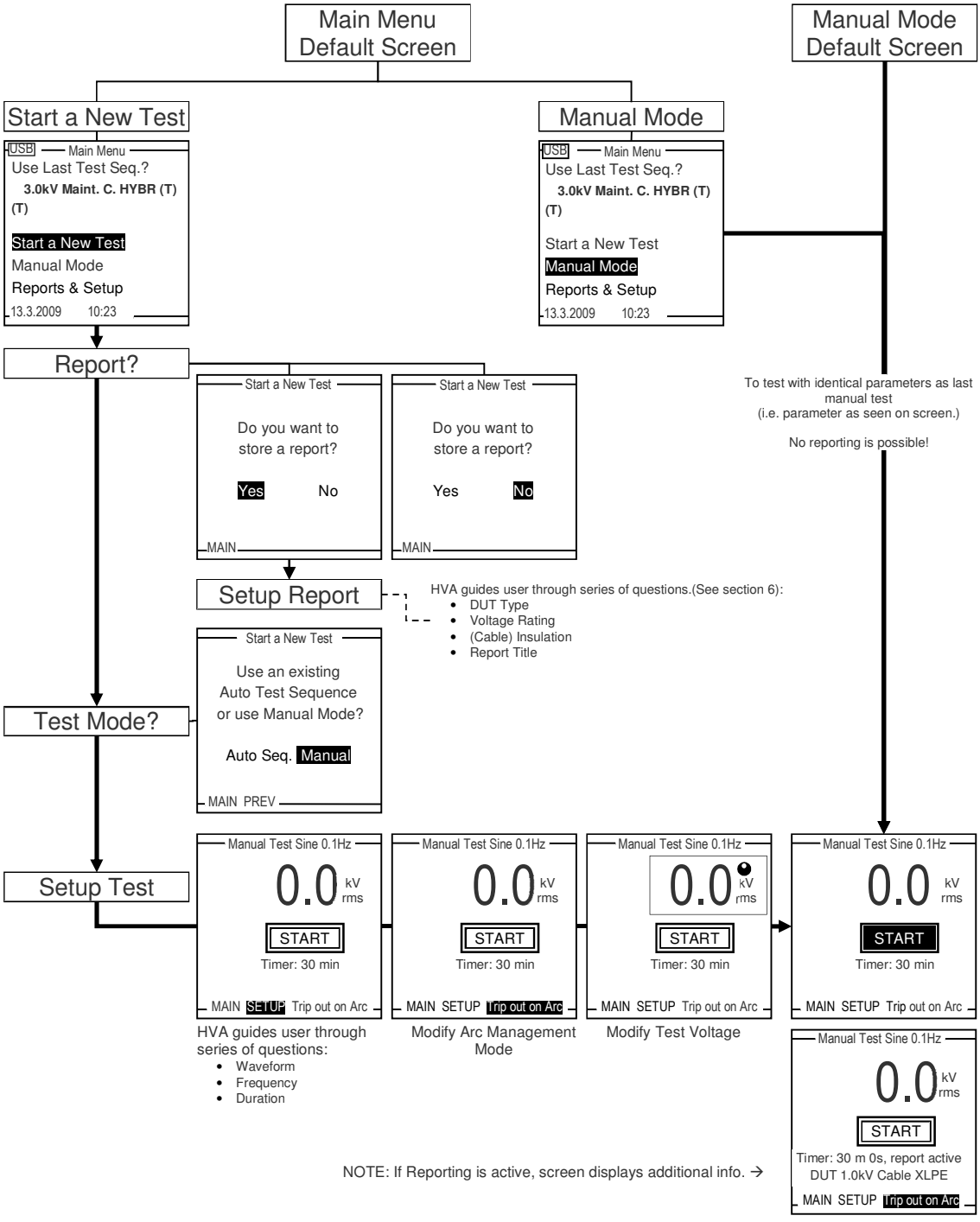
Step	Procedure
S5	Configure interlock plug (13) • Verify that the HV Interlock Adapter is connected If operating with remote controls (Optional): • Connect external lamps or remote switches • Refer to 3.3 –Materials, for connection schema and material requirements
S6	Configure communication port (12) For USB Data Transfer Mode: • Connect the USB Flash adapter Otherwise: Verify that RS232 cable is NOT connected to the HVA!
S7	Turn “ON” HVA main switch (8)
S8	Turn key switch (7) to the “ON” position
S9	The HVA system automatically boots. • Start-up default screen appears ”Main Menu” or “Manual Mode” screen See 4.3 Instrument Set-up Select appropriate option from default screen and proceed to appropriate section for further instructions: • See 5.2 Manual Test Mode or See 5.3 Automatic Test Mode

Connection Diagram: Sheath/Jacket Test and Sheath Fault Location



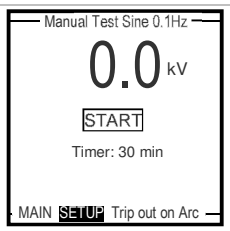
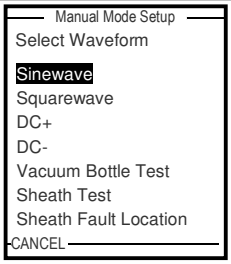
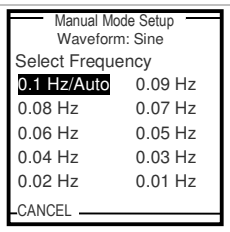
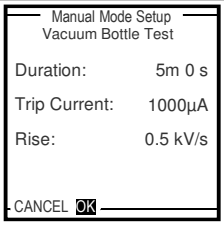
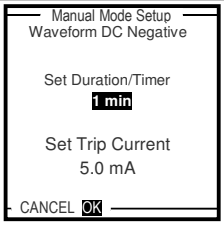
6.2 Manual Test Mode

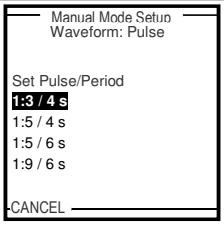
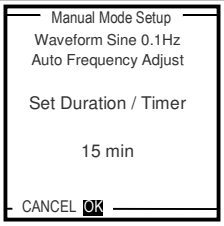
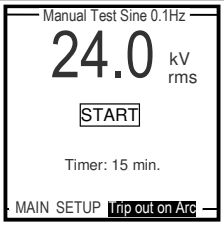
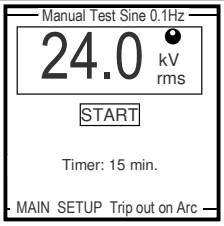
This HVA test mode facilitates rapid testing. If the default is the “Manual Mode Screen”, a test with the same settings as the previous test can be started directly after activating the system. Similarly, if the “Main Menu” is set as the 1st screen, select “Manual Mode”. Otherwise, select “Start a New Test” to change test parameters or to activate reporting.



Setting Manual Test Parameters

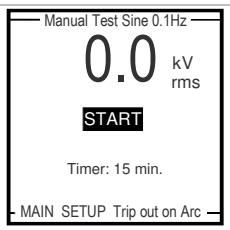
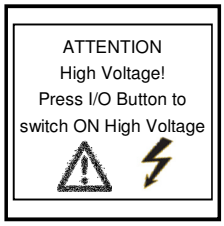
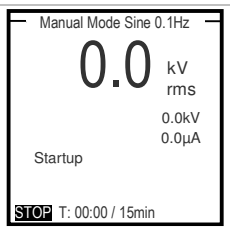
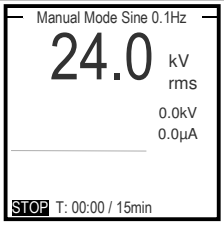
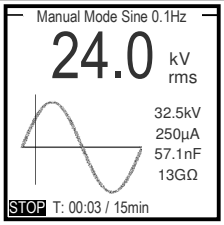
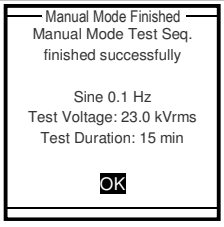
Steps **MS 1-MS 8** describe how to **set manual mode test parameters**.

Step	**Procedure** (Set Manual Test Parameters)	**Example**
MS 1: SETUP	To set the waveform, frequency, or test duration, select “SETUP” on bottom of “Manual Test” screen	
MS 2: SETUP: Waveform	Select one of the following output modes: • Sine wave • Square wave • DC+ • DC- • Vacuum Bottle Test • Sheath Test • Sheath Fault Location	
MS 3: Sinewave; Squarewave: SETUP: Frequency	Set the frequency to as close to 0.1 Hz as possible. • 0.1 Hz/Auto: Recommended setting that automatically maintains the frequency as close to 0.1 Hz as possible To correct entry select “CANCEL” at bottom of display.	
MS 4: Vacuum Bottle Test: SETUP: Trip Current Rise Rate	Set the test “Duration”: • Min. = 5 seconds; Max. = 15 minutes Set the test “Trip Current”: • Min. = 200 µA, Max. = 1000 µA Set the test “Rise” rate: • Min. = 0.5 kV/s, Max. = 5.0 kV/s	
MS 5 Sheath Test	Set the test “Duration/Timer”: • Min. = 1 minute; Max. = 15 minutes Set the test “Trip Current”: • Min. = 0.1 mA, Max. = 5.0 mA	

Step	**Procedure** (Set Manual Test Parameters)	Example
MS 6: Sheath Fault Location	Select one of the following Pulse/Periods: • 1:3 / 4 s • 1:5 / 4 s • 1:5 / 6 s • 1:9 / 6 s For example: 1 second on and 3 seconds off, every 4 seconds.	
MS 7: SETUP: Duration (Not applicable Vacuum Bottle Test)	To modify the duration, rotate navigation knob (5). To accept value, push in knob. • Min. test duration = 1 minute • Max. test duration = 24 hours To return to “Manual Mode” screen, select “OK”	
MS 8: Arc Management Mode	Rotate navigation knob (5) until the field on bottom of the screen is highlighted. To change the mode, push in the knob. One of the following modes will be displayed: • Trip out on Arc • Burn on Arc	
MS 8: Preset Test Voltage: (optional-voltage can be set once test has been initiated!)	Entering the test voltage before activating the manual mode test “START” is **optional**. In manual mode, voltage can be set once test has been initiated! To set the test voltage before activating the manual mode test “START”: Rotate navigation knob (5) until voltage field is framed. The dot in upper right hand corner indicates that the test voltage is in preset mode. To modify the value, rotate navigation knob (5). • Min. test voltage = 0.0 kV • Max. voltage = 24.0 kV rms (VLF), 34.0 kV (DC) To accept the value, push in knob (5).The dot in upper right hand disappears indicating that the test voltage is set.	

Running a Manual Test

Steps **MR 1-MR 6** describe how to **run a test in the manual mode**.

Step	**Procedure** (Run Manual Test)	**Example**
MR 1: START	Start the test when test parameters displayed on the “Manual Test” screen are correct. Rotate navigation knob (5) until the “START” field is highlighted. • To run the test, push in knob (5)	
MR 2: HV Activation	Once the activation screen appears, • Press the HV switch (6) within 10 seconds. If the HV switch is not activated within the 10 second window, the “Manual Mode” screen will reappear.	
MR 3: Test Start up	“Startup” appears on the screen to indicate that the HVA is initializing the test	
MR 4: Set Test Voltage (if not preset in step MS 8)	Rotate navigation knob (5) to modify the voltage value. • Min. test voltage = 0.0 kV • Max. voltage = 24.0 kVrms (VLF), 34.0 kV (DC)	
MR 5: Test	Test begins automatically The bottom of the screen indicates the lapsed time • T: lapsed time / total test duration	
MR 6: Test End	Display indicates end of Manual Test	

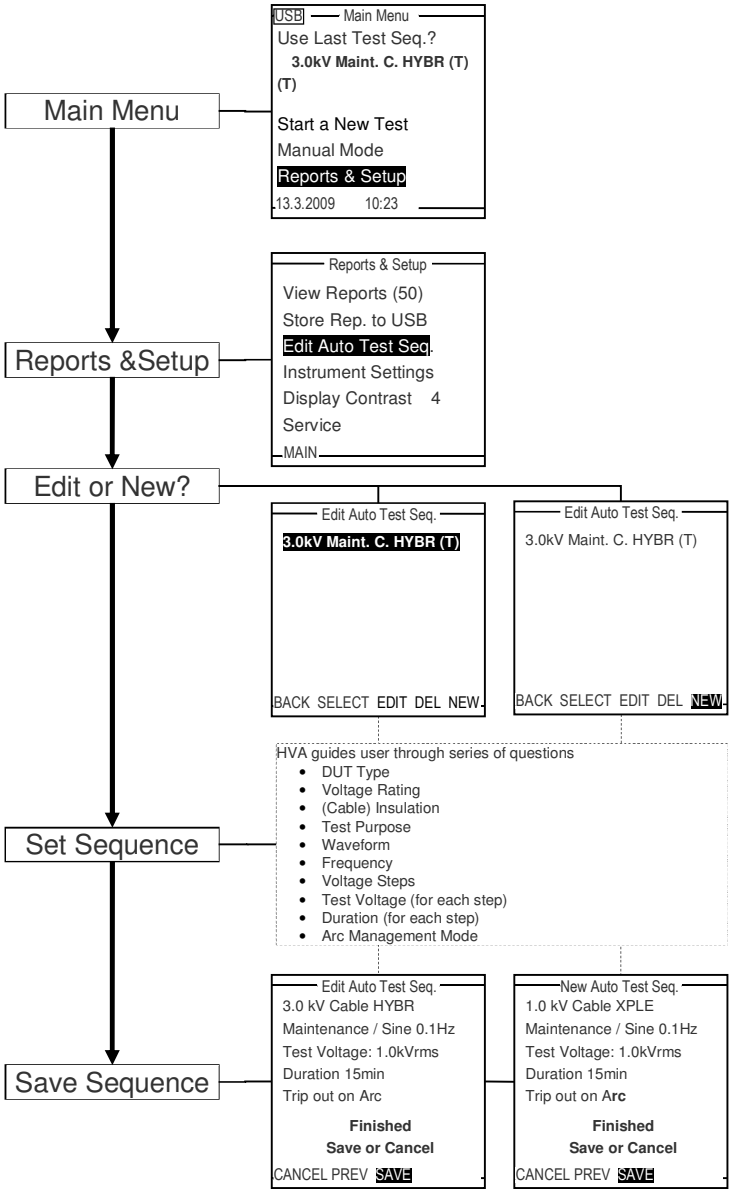
6.3 Automatic Test Mode

This HVA test mode allows automatic testing of a DUT according to a specific sequence in order to satisfy specific requirements (e.g. IEEE, IEC standards). The test sequence can be configured, modified and saved at any time before testing.

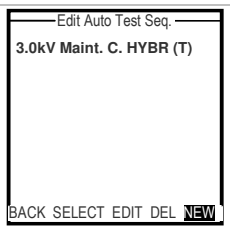
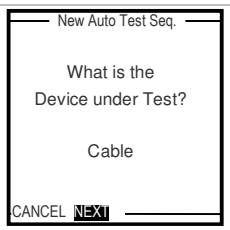
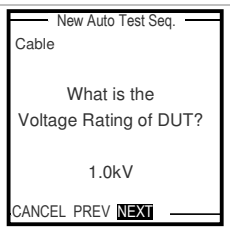
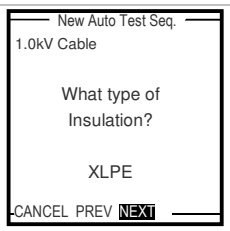
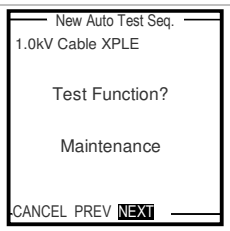
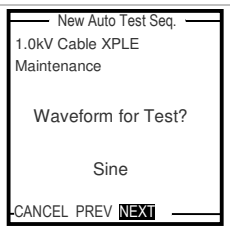
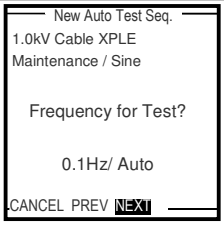
NOTICE

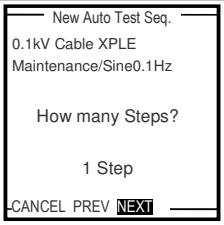
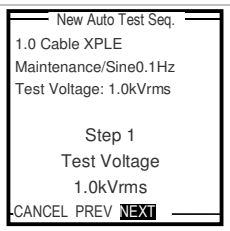
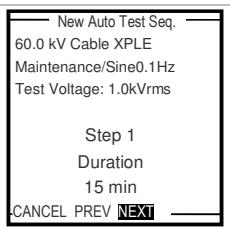
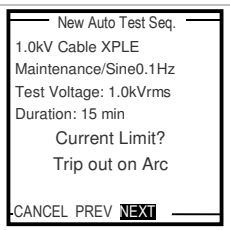
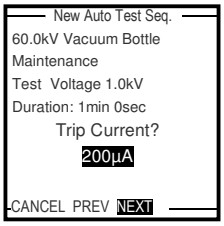
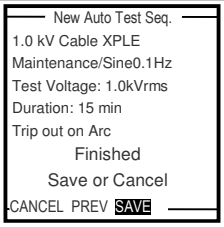
No Automatic Test Sequence programmable for Sheath/Jacket Test and Sheath Fault Location.
Already programmed in Manual Mode!

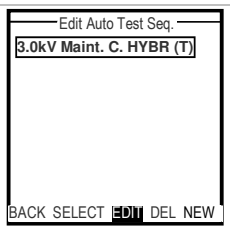
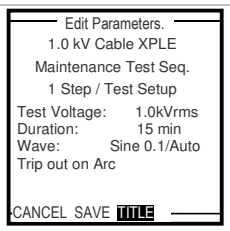
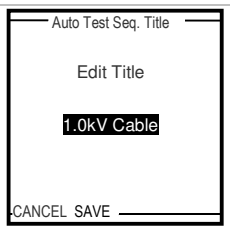
Configuring Auto Test. Sequence- Detailed Steps



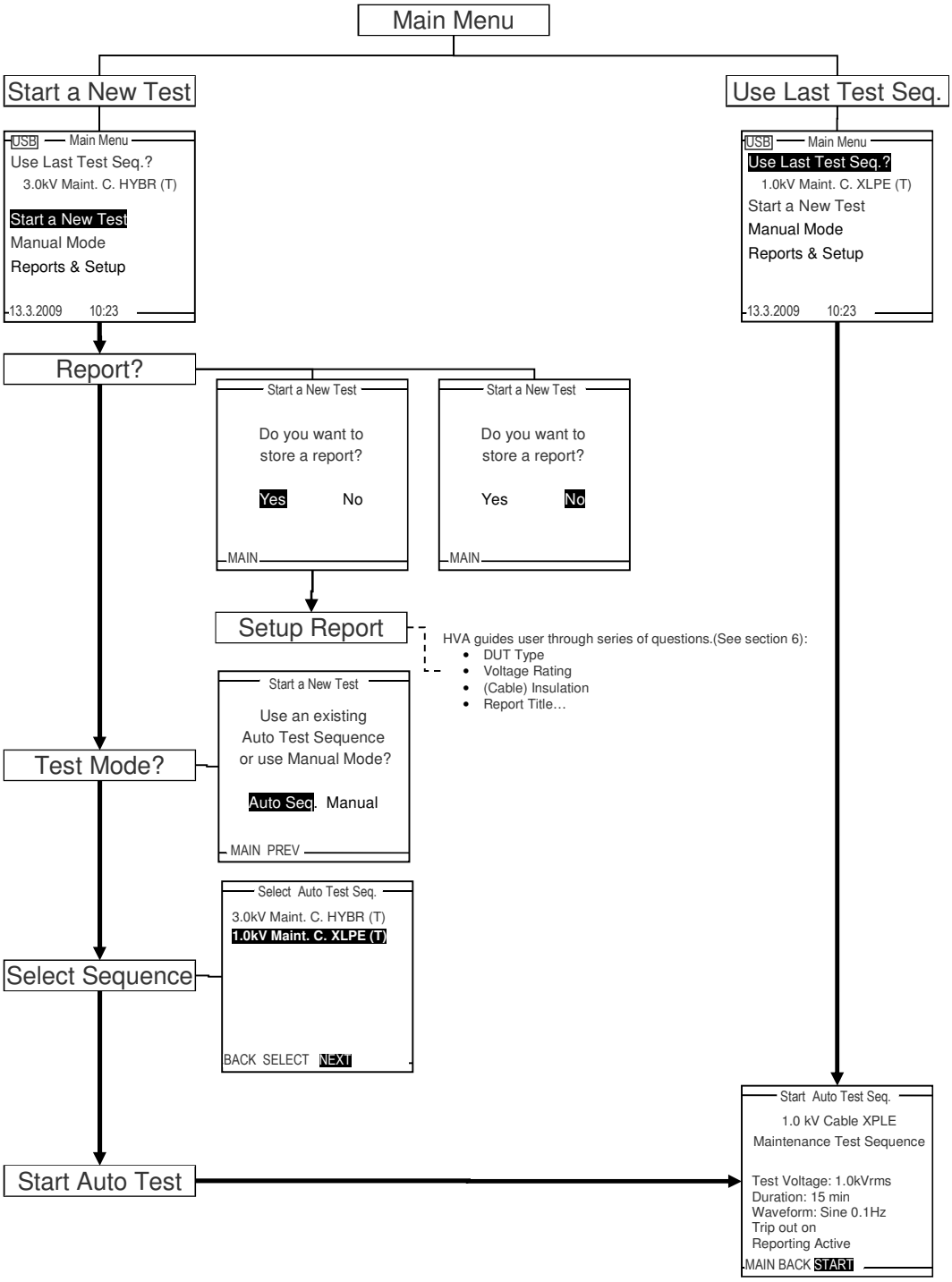
Steps **AS 1-AS 15** describe how to **configure a test sequence**.

Step	**Procedure** (Configure Automatic Sequence)	Example
AS 1: EDIT or NEW?	The “Edit Auto Test Seq”. Menu displays the sequences already stored in memory. • To **modify** an existing program, highlight the corresponding program from the list and select the “EDIT” option, on the bottom of the screen • To **create** a new program, select the “NEW” option, on the bottom of the screen	
AS 2: DUT	Select one of the following DUT types: • Cable • Motor • Generator • Transformer • Switchgear • Other • Vacuum Bottle	
AS 3: Voltage Rating	Specify the voltage rating of the DUT. **This is a characteristic of the DUT and does NOT refer to the test voltage!** To increase / decrease the voltage rating, rotate navigation knob (5). To accept value, push in knob. • Min. rating = 0.1 kV, Max. rating = 50.0 kV	
AS 4: (Cables Only) Insulation	Select one of the following cable insulation types: • XLPE • PILC • EPR • PE • PVC • HYBRID (combination of types) • OTH. (other)	
AS 5: Test Purpose	Select aim of test from one the following: • Acceptance • Maintenance • Diagnostic	
AS 6: Waveform	Select one of the following output modes: • Sine wave • Square wave • DC+ • DC- • Vacuum Bottle Test	
AS 7: Frequency (Sinewave or Squarewave only)	Set the frequency to as close to 0.1Hz as possible. • 0.1 Hz/Auto: Recommended setting that automatically maintains the frequency as close to 0.1 Hz as possible • Permitted values: 0.01 - 0.1 Hz in 0.01 Hz increments	

Step	**Procedure** (Configure Automatic Sequence)	Example
AS 8: Voltage Steps	Specify the number of voltage steps to be applied to the DUT. • Min. voltage levels: 1 Step • Max. voltage levels: 4 Steps	
AS 9: Test Voltage	Specify test voltage for each step: • Min. voltage = 0.1 kV • Max. voltage = 24.0 kV rms (for VLF) = 34.0 kV (for DC) For multiple voltage steps: HVA automatically advances to next step. Values are displayed in a table.	
AS 10: Duration	Specify test duration for each step: • Min. test duration / step = 1 minute • Max. test duration / step = 120 minutes For multiple voltage steps: HVA automatically advances to next step. Values are displayed in a table.	
AS 11: Arc Management Mode	Select one of the following arc management modes: • Trip out on Arc • Burn on Arc	
AS 12 (Vacuum Bottle Only) Trip Current	Set the test “Trip Current”: • Min. = 200 µA, • Max. = 1000 µA	
AS 13 (Vacuum Bottle Only) Rise Rate	Set the test “Rise” rate: • Min. = 0.5 kV/s • Max. = 5.0 kV/s	
AS 14: Save Sequence	Test sequence setup is complete. • To save the program select “SAVE”. The program will be stored under a name referring to its test parameters.(To modify name, see AS15) The sequence is found in the “Edit Auto Test Seq.” Menu display. See Step AS 1.	

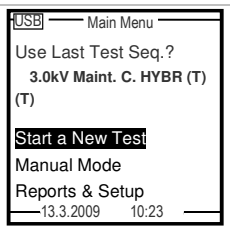
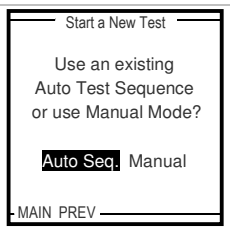
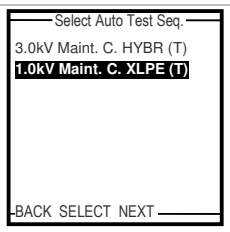
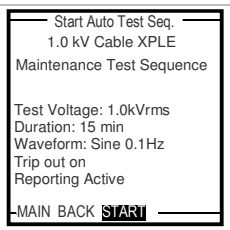
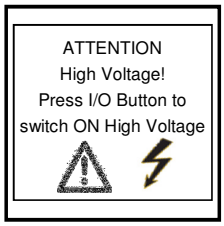
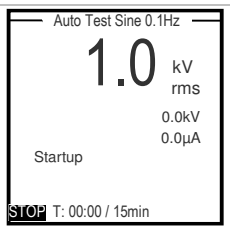
Step	**Procedure** (Configure Automatic Sequence)	**Example**
AS 15: (optional) Edit Sequence Title	To modify the sequence title from program already saved in HVA memory, highlight the corresponding sequence from the “Edit Auto Test Seq.”. Menu display. • select the “EDIT” option, on the bottom of the screen	
	• select the “TITLE” option, on the bottom of the screen	
	For naming directions, see 6-Reporting Procedure-Report Naming Instructions	

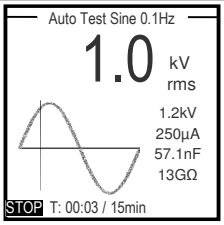
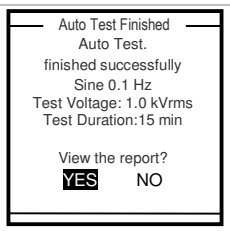
Running an Automatic Test - Overview



Running an Automatic Test - Detailed Steps

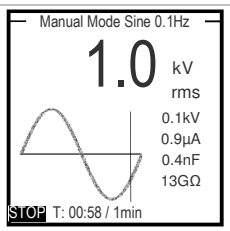
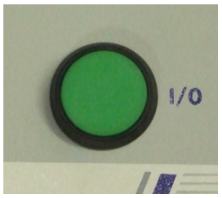
Steps **AR 1-AR 9** describe how to **run a test in the Automatic Mode**.

Step	**Procedure** (Run Automatic Test)	Example
AR 1: Use Last Seq. or Start New Test	To repeat the previous test sequence: • Select “Use Last Test Sequence” from “Main Menu” • Proceed to Step AR 5 Otherwise, select: • “Start a new Test”	
AR 2: De / activate Reporting	To activate reporting: • Select “YES”, See 6 Reporting To conduct a test without generating a report: • Select “NO”	
AR 3: **(If reporting active: this step follows report setup completion)**	To run an test sequence: • Select “Auto Seq”	
AR 4: Select Sequence	• Select the appropriate test sequence • To continue, select “NEXT”	
AR 5: Parameter Verification	• Verify that the selected sequence defines the correct test parameters To run the auto test sequence: • Select “START” from the bottom of the screen	
AR 6: HV Activation	Once the activation screen appears, • Press the HV switch (6) within 10 seconds. If the HV switch is not activated within the 10 second window, the “Start Auto Test Seq. “screen will reappear.	
AR 7: Test Start up	“Startup” appears on the screen to indicate that the HVA is initializing test	

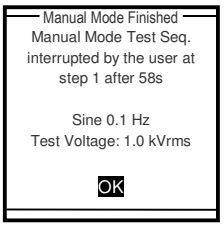
Step	**Procedure** (Run Automatic Test)	**Example**
AR 8: Test	Test begins automatically The bottom of the screen indicates the lapsed time • T: lapsed time / total test duration	
AR 9: Test End	Display indicates end of Auto Test If reporting is active, the user can immediately view the report.	

6.4 Interrupting a Test

Once a test has started, it can be interrupted at any time. It is recommended to select the appropriate method corresponding to the situation

Situation	Procedure	Example
Routine STOP (No emergency)	When a test is in progress, “STOP” on the display screen is highlighted. To interrupt the test, push in / click the navigation knob (5) • HVA **software** deactivates HV • Test stops	
Alternative	When a test is in progress, press the HV switch (6) to deactivate high voltage. • HVA **hardware** deactivates HV • Test stops	
Emergency Stop	In an emergency situation, press the Emergency Off (1) to shutdown the system. • HVA **hardware** deactivates HV • Test stops	

After test interruption, a message is displayed indicating that the test has been terminated by the user:



7 Reporting Procedure

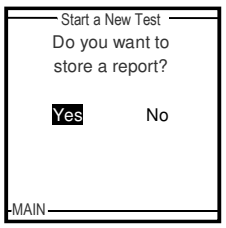
Report Type

The HVA can generate 2 report types: A “Basic” report with limited information, or a more complete “Extended” report. The type of report generated corresponds to the entry selected in “Instrument Settings”. Before testing, verify that the desired type is set!
See 4.3: Instrument Set-up

Report Info.	Basic	Extended
DUT Type	✓	✓
Voltage Rating	✓	✓
(Cable) Insulation Type	✓	✓
Report Title	✓	✓
Phase name		✓
Company name		✓
Region name		✓
Station name		✓
Line Length		✓
Size of DUT		✓
Manufacturer		✓
Work order		✓
Operator name		✓

Report Activation

Reporting is possible in both the test modes. To generate a report in the manual mode, the procedure must begin with “Start a New Test” from the main menu. See 5.2-Manual Test Mode

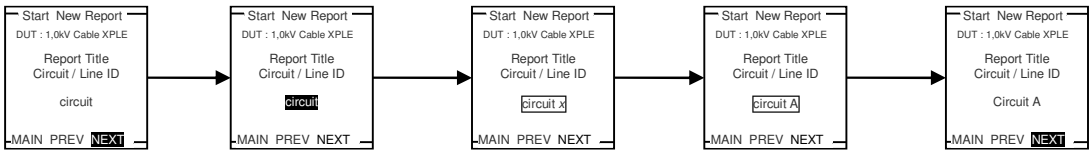


Report Naming Instructions

To enter the report information, some steps (i.e. steps R4-R13) require the operator to enter a user selected name. If no name is entered, the corresponding category appears blank in the report.

Possible entries include:

- A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
- . , ; : " # - + /
- 0 1 2 3 4 5 6 7 8 9



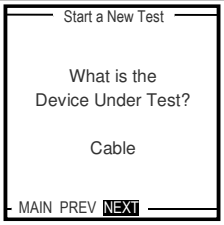
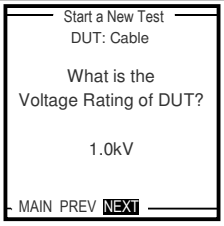
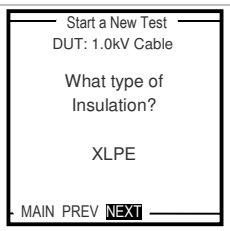
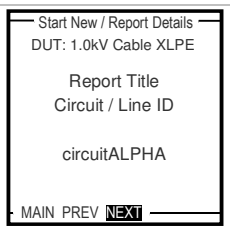
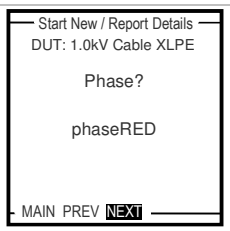
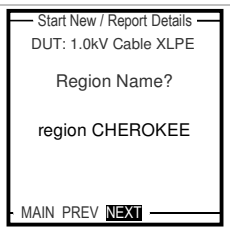
- To activate naming: Rotate Navigation Knob (5), then Push in/click.
- To select characters: Rotate Knob (5) clockwise
- To DELETE: Rotate Knob (5) counter clockwise until < symbol appears
- To SPACE: Rotate Knob (5) counter clockwise until _ symbol appears
- To confirm: double click Knob (5)

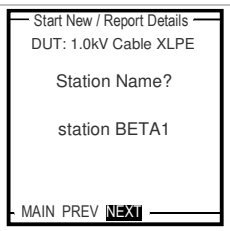
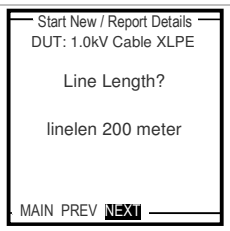
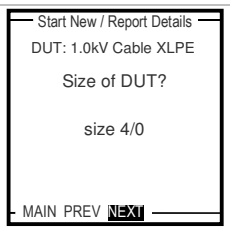
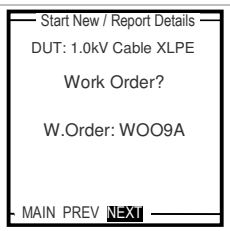
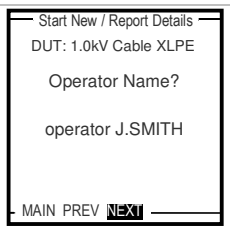
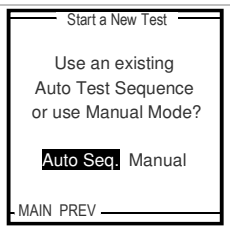
Entering Report Information

The HVA guides the user through a series of questions dependent on the report type already set in "Instrument Settings". These steps are independent of the test mode, as the user has not yet selected "Manual" or "Automatic". Note that although some of the following steps (i.e. R1 – R3) require entry of identical information as in "Configuring Auto Test. Sequence" (i.e. steps AS 2, AS 3 and AS 4), these steps are not identical!

Steps **R 1-R 13** lists the **report information** that the HVA asks the user to enter when the "Extended" reporting mode is active.

Step	**Procedure** (Reporting)	**Example**

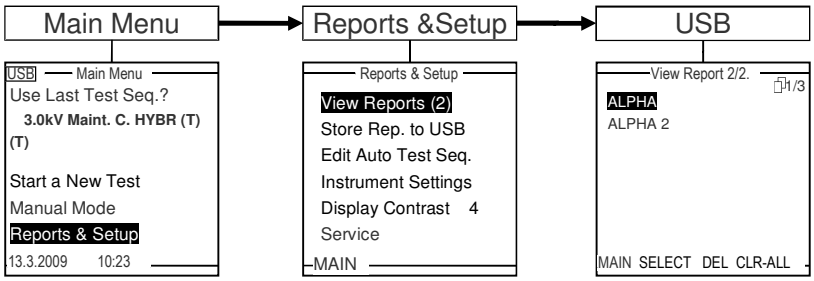
Step	**Procedure** (Reporting)	Example
R 1: DUT	Specify the type of DUT. Select one of the following options: • Cable • Motor • Generator • Transformer • Switchgear • Other • Vacuum Bottle	
R 2: Voltage Rating	Specify the voltage rating of the DUT. **This is the nameplate rating of the DUT and does NOT refer to the test voltage!** Rotate navigation knob (5) to increase or decrease voltage rating value: • Min rating. = 0.1 kV; Max rating= 50.0 kV	
R 3: Insulation (only applicable for Cables)	Specify one of the following cable insulation types: • XLPE • PILC • EPR • PE • PVC • HYBRID (combination of types) • OTH. (other)	
R 4: Report Title	Set report name • User defined entry, typically the cable number or ID for cable testing	
R 5: Phase (Extended only)	Specify circuit phase • User can define up to 3 phases if required	
R 6: Company (Extended only)	Specify company name	
R 7: Region (Extended only)	Specify region name	

Step	**Procedure** (Reporting)	Example
R 8: Station (Extended only)	Specify station name	
R 9: Line Length (Extended only)	Specify line length • Units correspond to “Distance Unit” set in “Instrument Settings” (see 4.3-Instrument Set-up)	
R 10: DUT size (Extended only)	Specify DUT size Typical entries include: • Conductor size for cable test • Horsepower or kW for motor test	
R 11: Manufacturer (Extended only)	Specify manufacturer name	
R 12: Work Order (Extended only)	Specify work order name	
R 13: Operator (Extended only)	Specify operator name	
End of reporting procedure Select Test Mode	• To continue in **Manual Test Mode** : See 5.2 Steps MS 1-MS 5 - set test parameters Steps MR 1-MR 6 - run test • To continue in **Automatic Test Mode**: See 5.3 Steps AS 1-AS 15 - configure sequence Steps AR 1-AR 9 - run test	

Viewing Report

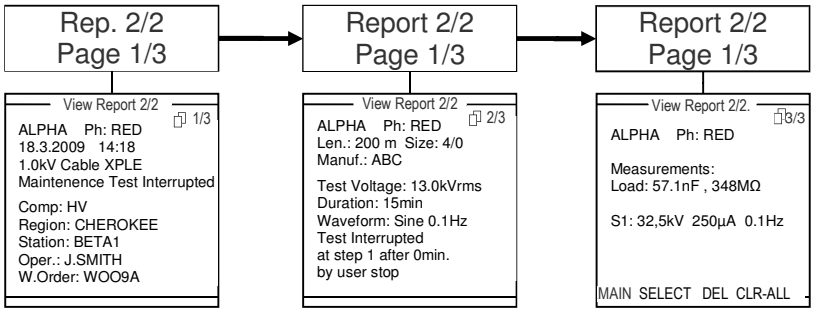
Reports can be viewed directly on the HVA display screen. In “Reports & Setup” the number of reports saved appears in parentheses following

"View Reports". Reports are listed according to date, with the first entry corresponding to the latest report saved.



When a report is selected, the screen header indicates:
"Reference # of report in view / Total number of reports saved".

The upper right-hand corner displays:
"Page # in view / Total number of report pages".



DANGER

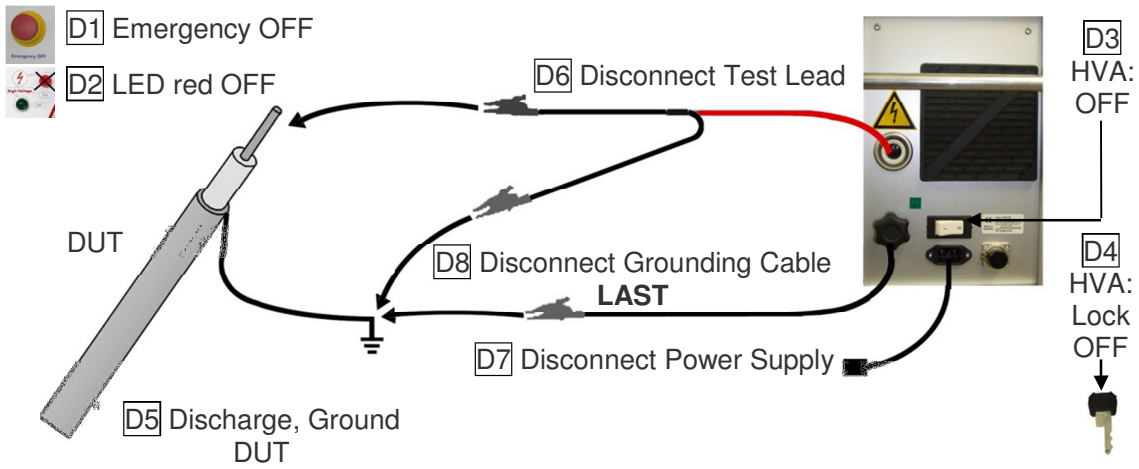
Electric Shock Hazard

Never assume that equipment is safe to handle without using the necessary safety equipment and grounding procedures.
Disconnection procedures must comply with local safety regulations.

- Before disconnecting test lead, DUT must be discharged and grounded.
- Grounding connections must be removed last!

8 Disconnection Procedure

Disconnection



Steps **D 1- D 8** describe the **normal disconnection** procedure.

Step	**Procedure** (Normal Disconnection)
D1	Press Emergency OFF (1)
D2	Verify HV status • Wait until LED red (3) light deactivates (indicates residual voltage < 100V)
D3	Turn OFF HVA • Turn the HVA main switch (8) off
D4	Lock HVA in disabled state to prevent against unauthorized use: • Turn Key switch (7) to OFF Position and remove Key
D5	Discharge and ground the DUT complying with local safety regulations
D6	Disconnect the Test Lead • Disconnect the test lead from the DUT • Unscrew the test lead from the HV output connector (11)
D7	Disconnect power supply cable from power supply plug (9)
D8	Disconnect Ground • Disconnect the grounding cable from the HVA grounding connector (10) • Disconnect the grounding cable from the DUT.

System Failure

In case of errors or failure due to a loss of power during testing, additional precaution is required. The HVA red LED (3) light cannot indicate when residual voltage is less than 100V. To guarantee that the residual voltage has dissipated before removing the test lead, the DUT must be de-energized using a discharge stick.

Steps **D 1*-D 7*** describe the **disconnection** procedure in case of **system failure.**

Step	**Procedure** (System Failure Disconnection)
D1*	Switch HVA OFF • Press Emergency OFF (1) • Turn the HVA main switch (8) off • Lock HVA in disabled state to prevent against unauthorized use: Turn Key switch (7) to OFF Position and remove Key
D2*	• Verify correct functioning of discharge stick
D3*	Discharge and ground the DUT complying with local safety regulations • Discharge DUT using a discharge stick
D4*	Before disconnecting test lead, **wait** until residual voltage has dissipated. • Required wait time depends on the resistance of the discharge stick and capacitance of the load.
D5*	Disconnect the Test Lead • Disconnect the test lead from the DUT • Unscrew the test lead from the HV output connector (11)
D6*	Disconnect power supply cable from power supply plug (9)
D7*	Disconnect Ground • Disconnect the grounding cable from the HVA grounding connector (10) • Disconnect the grounding cable from the DUT.

9 Instrument Care

DANGER

Electric Shock Hazard!

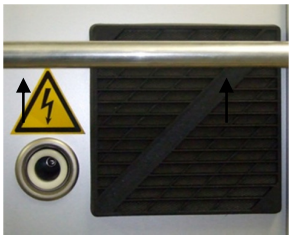
Only clean the instrument when turned off!

HV Cable

Clean the HV Cable high voltage plug before use.

Air Filter

Clean the filter of the Air Vent (14) annually:



- Unclip plastic protective guard and remove the filter
- Using pressurized-air, blow the filter clean
- Reinstall the cleaned filter
- Replace the protective guard.

If a replacement filter is required, contact HV Diagnostics

Storage

CAUTION

Instrument Damage

Do not store the HVA outdoors!

Keep the HVA away from liquids!

HVA should be stored indoors in the following environmental conditions:

- Temperature: -25°C to 70°C (-13°F to 158°F)
- Humidity: 5-85 % non-condensing

Maintenance and Repairs

NOTICE

Authorized personnel only!

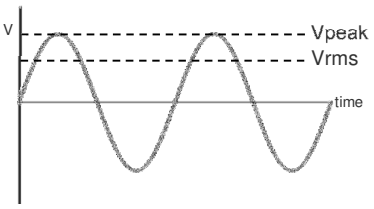
Repairs and maintenance should only be performed by authorized HV Diagnostics personnel.

Annual inspection and calibration by authorized HV Diagnostics' personnel is recommended.

10 Glossary and Abbreviations

The following explains abbreviations and selected terms used in this document in alphabetical order.

Term	Explanation
Arc	Self-maintained gas conduction for which most of the charge carriers are electrons supplied by primary‑electron emission (source: IEC)
Auto Adjust Frequency “0.1 Hz/Auto”	Mode that maximizes output frequency to highest allowable value • Greatest allowable frequency depends on the test load and test voltage applied • For loads greater than nominal load, the instrument automatically reduces the frequency
DUT	Device Under Test
Duty (continuous)	Load state in which the unit operates for a long period. Continuous means: no limitation in operating time based on temperature limits
Fault	An unplanned occurrence or defect in an item which may result in one or more failures of the item itself or of other associated equipment (source: IEC)
Frequency[Hz]	Number of cycles per unit of time ; f=1/ Period (Time), units=Hz 1 Hz = 1cycle / 1 second 0.1 Hz = 1cycle / 10 second , etc.
Hipot	High potential (voltage)
HV	High Voltage: Voltage levels used in power distribution: • Medium Voltage: up to 36 kV • High Voltage: up to 110 kV • Extremely High Voltage: 220 kV, 380 kV or higher According to VDE0105 / EN50110
IEC	International Electrotechnical Commission
Peak value	Maximum Voltage = V_{max}
RMS value	Root Mean Square voltage • $V_{rms} = V_{peak} / \sqrt{2}$ for Sinusoidal wave forms



To Short	Forcing the electric potential differences between two or more conductive parts to be equal to or close to zero (Infinite current flows in a short circuit)
To Trip	Opening the circuit (no current flows in open circuit)
VLF	Very Low Frequency • Typically between 0.01 - 0.1 Hz

11 Declaration of Conformity

The HVA 34 is CE certified and has met the following requirements of the European Council:

Category	Standard
EMC	IEC61004-2 , ESD Level 4 (8/15kV) IEC61004-4 , Burst 4kV 5kHz EN55011
Safety	EN60950 EN50191 EN61010-1