



USER'S MANUAL

AC DIELECTRIC TEST SET TYPE 6CB

MODEL NUMBER
6CB120/60-7.5

PHENIX TECHNOLOGIES A Division of Doble Engineering

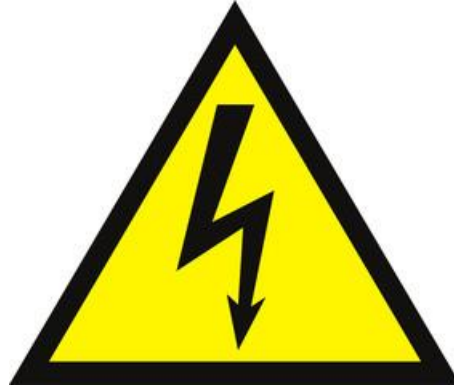
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WARNING!!!



DANGER

Complete Grounding of this unit is necessary for the safe operation of this equipment. Disconnect inputs before ungrounding this equipment

GENERAL SAFETY PRECAUTIONS



This equipment is capable of providing POTENTIALLY LETHAL VOLTAGES! Improper operation or test practices may result in injury or death to the operator or surrounding personnel.

The operation of High Voltage test equipment should only be performed by personnel familiar with HIGH VOLTAGE testing and safety procedures. The operator of this equipment must be aware of all hazards associated with High Voltage testing. The operator is responsible for himself and others in close proximity of the testing area.

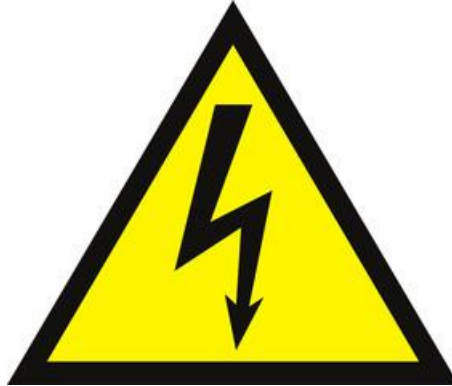
Some General Safety Practices for working with High Voltage Test Equipment have been listed below for your reference.

- Become familiar with your instrument before performing an actual test.
- Know your work area, check that all circuits are de-energized and locked out.
- Never work alone; always work with another qualified worker.
- Mark off entire work area with barriers and warning tape.
- Make all personnel aware of your testing activities.
- Be aware of dangerous conditions that may arise from energizing a test specimen.
- Never modify test equipment; modifications to equipment could introduce an unknown hazard or hinder a designed-in safety feature.
- DO NOT operate damaged equipment. Remove power, and do not use the equipment until safe operation can be verified by service-trained personnel.

Phenix Technologies, Inc. assumes no liability for unsafe or improper use of test equipment.

MODEL: 6CB100/50-7.5

Dielectric Test Sets are designed to measure the dielectric strength that an insulating material can withstand before an insulation breakdown occurs at rated power frequencies.



INPUT (Refer to Unit Serial Tag)

110-120	Volts AC	30	Amps AC	50/60	Hz	1	Phase
			OR				
220-240	Volts AC	15	Amps AC	50/60	Hz	1	Phase

OUTPUT

Tap #1:	Side Polished Ball						
	60.0 kVAC			125	mA (Max)		
Tap #2:	Top High Voltage Spinning						
	120.0 kVAC			62.5	mA (Max)		

DUTY

5 min ON/15 min OFF	@ 7.50kVA
15 min ON/1 hr OFF	@ 5kVA
1 hr ON/1 hr OFF	@ 3kVA

DISTORTION

Less than 5% at full load

IMPEDANCE

Less than 15% at rated current

PD RATING

<10 pC

ENVIRONMENTAL OPERATING CONDITIONS:

TEMPERATURE:	10 – 40°C indoor/outdoor in fair weather
HUMIDITY:	<95% non-condensing
ALTITUDE:	<1000m (3300 ft.)

COOLING TYPE

ONAN (Oil-Natural/Air-Natural Convection)

REMOTE CONNECTION TYPE (IF PURCHASED)

Wi-Fi via Wireless Access Point

METERING

Output Voltmeter:

Instrument Type: HMI
Meter Type: Peak/(Square root of 2)
Accuracy: \pm (0.8% of Reading + 0.2% of Range) + LSD (10-100% of range)
Range: 0-60kV, 120kV

Total Currentmeter:

Instrument Type: HMI
Meter Type: True RMS
Accuracy: \pm (0.8% of Reading + 0.2% of Range) + LSD (10-100% of range)
Range: 0-25mA, 125mA

Specimen Currentmeter:

Instrument Type: HMI
Meter Type: True RMS
Accuracy: \pm (0.8% of Reading + 0.2% of Range) + LSD (10-100% of range)
Range: 0-200uA, 2mA, 25mA, 125mA

DIMENSIONS

CONTROLS/REGULATOR:

22"L x 21"W x 16"H x 67lbs.
533mmL x 508mmW x 406mmH x 30kg

HIGH VOLTAGE CYLINDER:

19"L x 19"W x 30"H x 255lbs.
483mmL x 483mmW x 762mmH x 116kg

CART:

22.5"L x 29.25"W x 50"H x 61lbs.
572mmL x 743mmW x 1270mmH x 28kg

GENERAL PROCEDURE

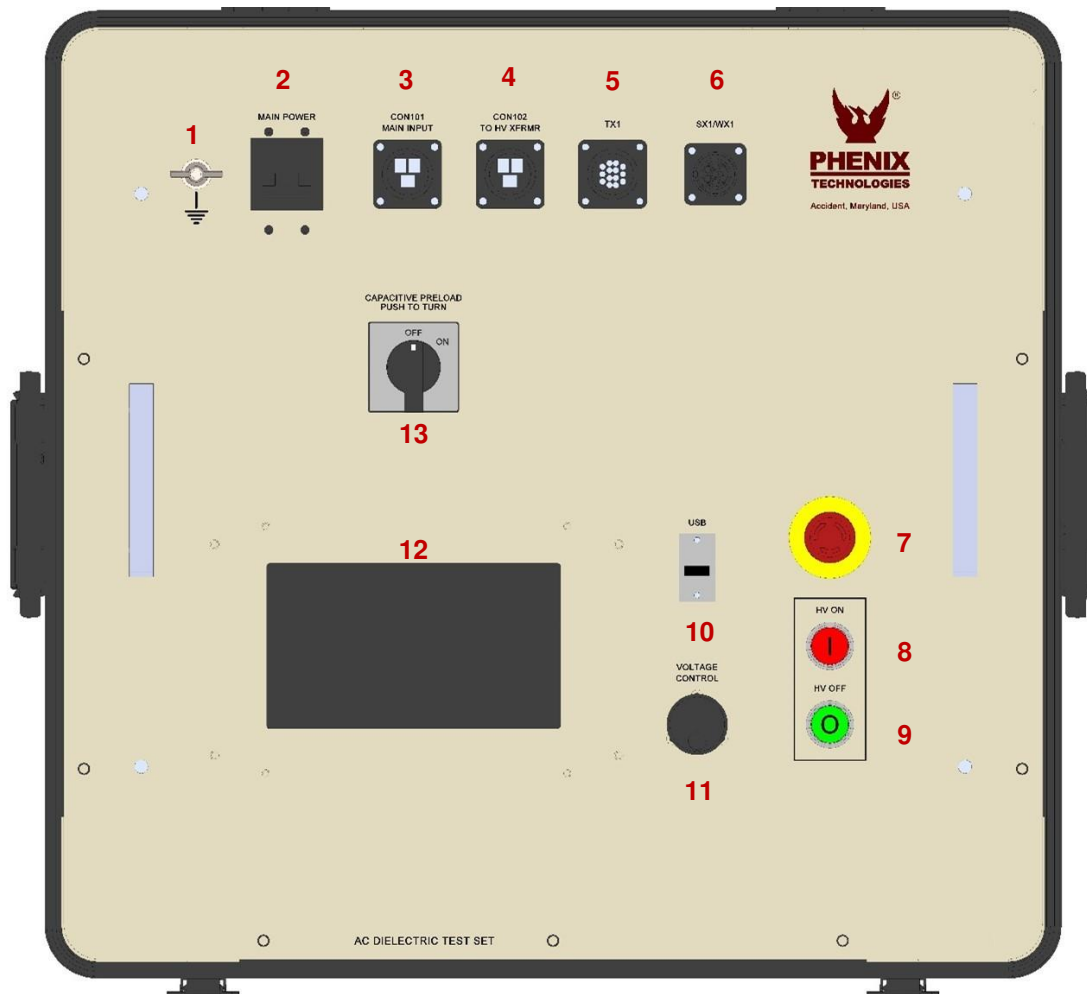
1. Exercise care in removing shipping materials to avoid injury to personnel or damage to the unit. Items in this shipment are large and heavy. Phenix Technologies recommends that 2 persons be assigned to this task.
2. Perform visual inspection to determine if unit was damaged during shipment. If there are any signs of physical damage (such as dents, scratches, oil leaks), contact the factory before proceeding.

For questions or information regarding operation of the Test Set, please refer to the appropriate sections of this manual. Further information is also available from:

**Phenix Technologies' Service Department
75 Speicher Drive
Accident, Maryland 21520**

**Phone 1 (301) 746-8118
Fax 1 (301) 895-5570
E-mail: info@phenixtech.com**

CONTROL PANEL



1. **Ground Stud**
Ground connection point for tying to high voltage cylinder ground.
2. **Main Power Circuit Breaker**
This is the main circuit breaker for the system. It provides a input overload protection for the system and functions as the main on/off switch for the unit.
3. **CON101 Main Input Power Connection**
This connector is used to provide power to the system. Connect the provided input power cable to test facility power.
4. **CON102 TO HV TRANSFORMER**
Power output connection to high voltage transformer. The power interconnect cable connects here.

5. TX1

Connection for metering interconnect cable. This is the metering and return connection. *Do not attempt to operate high voltage unit without this cable connected at both ends.*

6. Security/Warning Circuit

Security Circuit - Provided for user connection of external interlock or auxiliary safety control device such as emergency off switch, gate switch, foot switch, dead man switch, etc. Included plug has shorting jumper installed to complete circuit. Jumper must be removed, and cable connected to user supplied device by user if desired to use this provision. Only non-energized switch or dry relay contact devices may be used. This is a series circuit that must remain closed for high voltage to be activated.

Warning Circuit – Provides power to external warning light circuits. Voltage is provided to different pins depending if HV is no or not. Reference included schematic to see what pins are powered. Unit can be operated without use of this feature.

Security circuit and warning light accessories are available from Phenix Technologies that use this connector. The accessories are able to be “daisy chained” together so that multiple accessories can be used at once. The available accessories include flashing lights, foot switches, and Green\Red-light pole with E-Stop switch.

7. Emergency Stop switch

Press under emergency conditions. Output will turn off. Button will stay down when pressed, twist to release.

8. HV ON switch/lamp

Momentary switch turns high voltage on when pressed. **HV ON** lamp illuminates red when high voltage is on.

9. HV OFF switch/lamp

Momentary switch turns high voltage off when pressed. **HV Off** lamp illuminates green when all pre-conditions required for high voltage activation are met.

Conditions required for **HV Off** lamp illumination are:

- Power applied to unit and **Main Power Breaker** on, **HMI** illuminated.
- **External Interlock** circuit series loop must not be open.
- **Emergency Off** must not be pressed.
- Regulator position must be at zero. (Zero Start.)
- Overloads (if any) must be reset.

10. External USB Port

This standard female USB port allows for (optional) external data logging via USB drive. A device must first be connected before data logging can be enabled. CAUTION: This port is not isolated and requires the use of an external isolator if connection is made to a device with an earth ground.

11. Infinity Dial

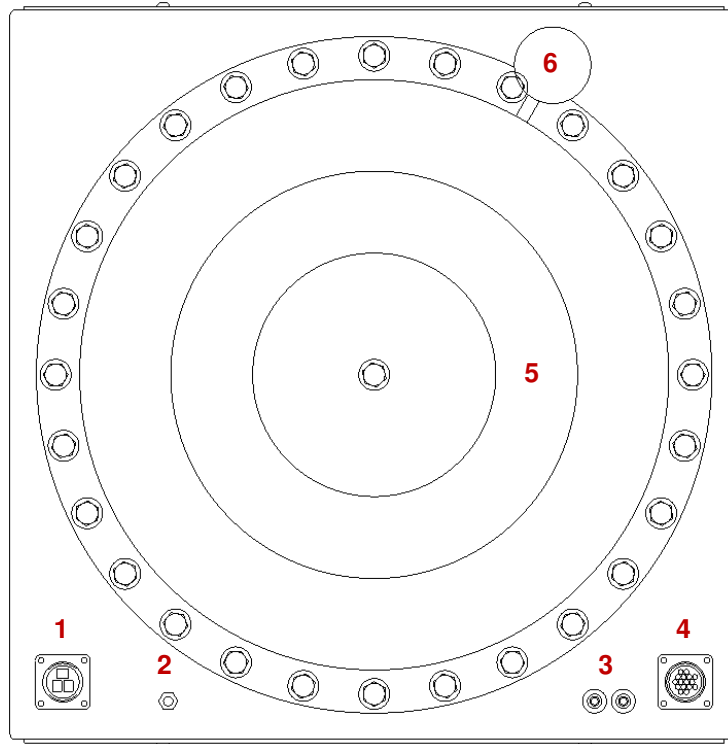
This dial is used to manually control the regulator voltage by controlling the regulator swing arm when the manual test mode is selected. It is speed sensitive and has no physical stop-limit. Rotate counterclockwise to decrease the voltage output, and clockwise to increase the voltage output.

12. Human Machine Interface (HMI)

This touchscreen display controls status and test parameter information.

13. **Capacitive Preload Switch**

Used to allow full voltage when HV transformer is lightly loaded (<3kVAR). This cannot be switched with high voltage on. Push-to-Turn feature will open the main contactor and turn HV off if switching is attempted while HV is on.



High Voltage Tank

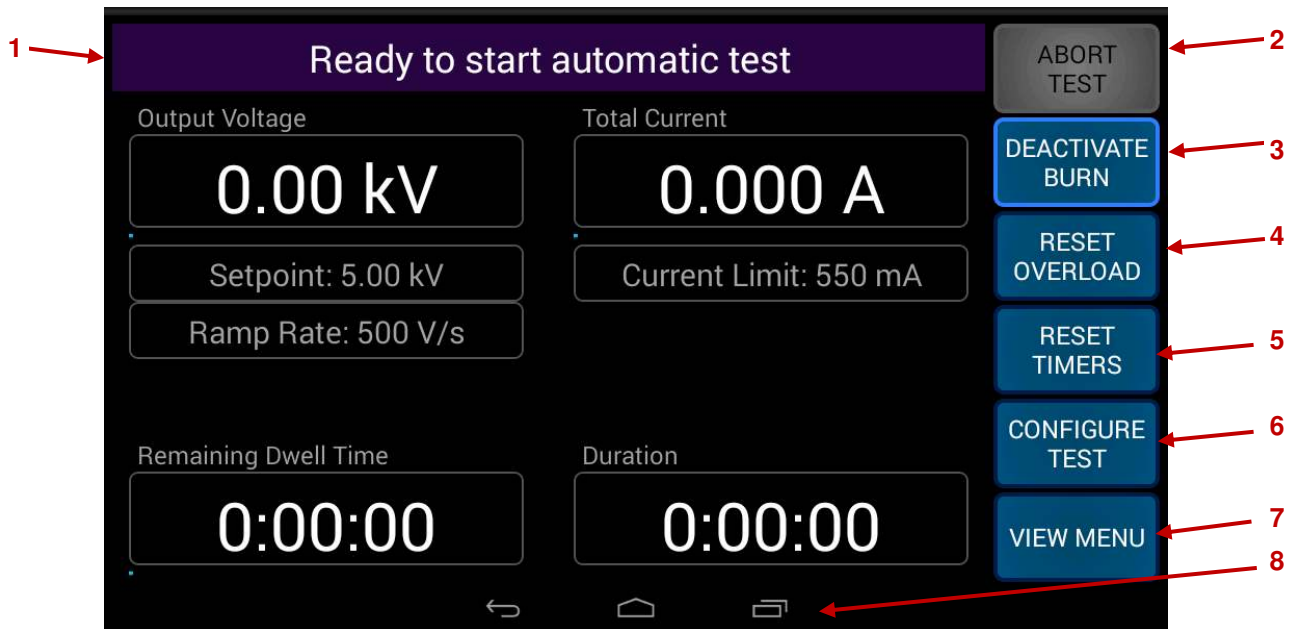
1. **XFRM Input**
Input power connection to high voltage cylinders from control/regulator box.
2. **Ground Stud**
Main ground point for unit. Connection to facility ground. Ground all other unit pieces to this point. This must be grounded at all times.
3. **CM Connections**
Connection points for current metering. See INITIAL SETUP section for connection details.
4. **TX1**
Metering connection between high voltage cylinder and control/regulator box.
5. **Tap #2 (Top Spinning)**
100kV output connection.
6. **Tap #1 (Side Tap)**
50kV output connection.

HMI CONTROLS

This system is equipped with an embedded controller and resistive touch screen that functions as the HMI (Human-Machine Interface). The touch screen is used mainly to set up test parameters and display test readings. It is also used for calibration and troubleshooting. A menu style interface with touch buttons is used to navigate the HMI. This manual section will describe each of the screens of the HMI.

HMI CONTROLS: MAIN SCREEN

The main screen displays voltage and current reading, unit status, and dwell timer values. This is the main operating screen of the device.



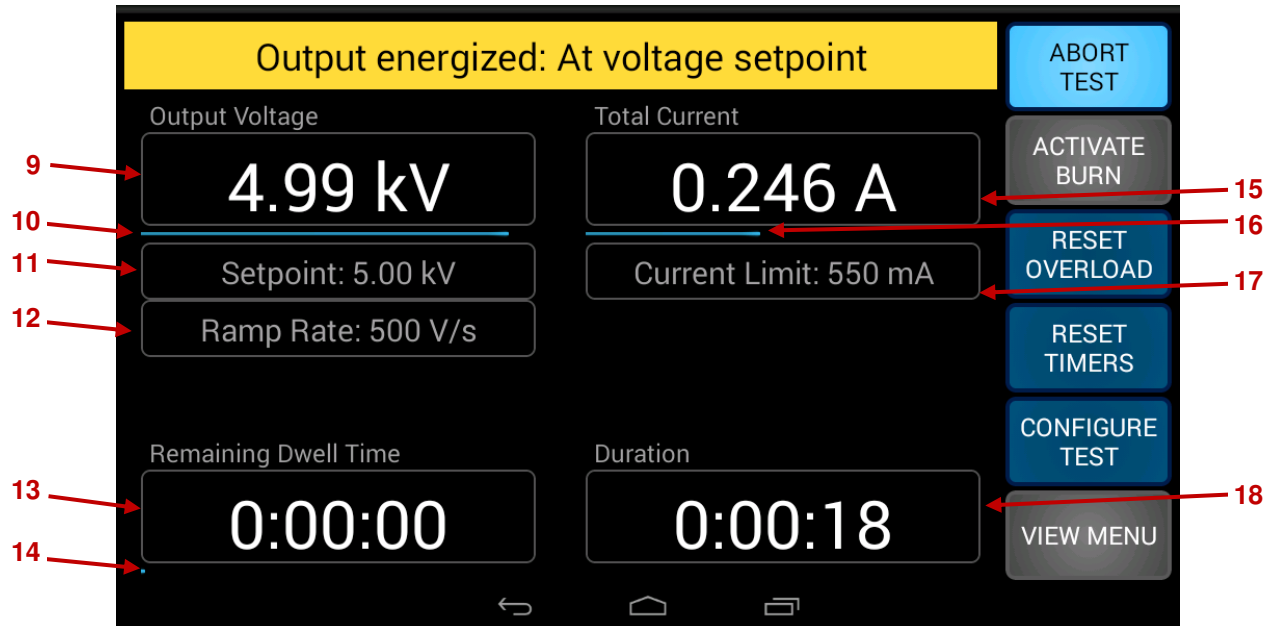
MAIN SCREEN (STANDBY STATE)

1. **Status Bar**
Indicates the main status message of the unit. There are three types of states that the unit can be in. These are state Standby, Fault, Energized. Refer to the HMI CONTROLS: STATUS BAR subsection for detailed message information.
2. **ABORT TEST button**
When pressed during test, unit automatically returns regulator to zero position and then shuts off high-voltage. HV off button will illuminate and test results will display on screen when high-voltage is off. The ABORT TEST button is blue when unit is energized and is greyed out when unit is off.
3. **BURN MODE button**
The burn mode button label text displays the action that will occur if the button is pressed. The button can only be pressed if the button is blue, if it is greyed out, the button is presently not available to switch states. The button state can only be switched when the output is de-energized. The illuminating rim indicates the present status of the burn mode (Presently shown "ACTIVE"). Burn mode is a purchased option.
4. **RESET OVERLOAD button**
Resets overloads after an instantaneous voltage overload, instantaneous current overload, long-term current overload, or thermal overload.
5. **RESET TIMERS button**
When press will resets only Remaining Dwell Timer while unit is energized. Resets all timers while unit is off.
6. **CONFIGURE TEST button**
Press to enter the Configuration Screen.

HMI CONTROLS: MAIN SCREEN (Cont'd)

7. **VIEW MENU button**
Press to enter the Menu Screen.
8. **OS Menu buttons**

HMI CONTROLS: MAIN SCREEN (Cont'd)



MAIN SCREEN (ENERGIZED STATE)

9. **Output Voltmeter**
Displays voltage of selected tap when unit is Energized.
10. **Regulator Bar Graph**
Displays current regulator output voltage relative to maximum regulator output voltage.
11. **Dwell Voltage**
Displays the target dwell voltage for the test (Setpoint).
12. **Ramp Rate**
For automatic tests, the output voltage will rise by the Ramp Rate every second until target Dwell Voltage is reached. For manual tests, the output voltage will rise at this rate if the knob is turned once per second. The rate will vary in proportion to the knob speed.
13. **Remaining Dwell Time**
Displays the time remaining for the test at Dwell Voltage.
14. **Dwell Time Bar Graph**
Displays the time remaining for the test at Dwell Voltage relative to the total dwell time.
15. **Main Currentmeter**
Displays the total current when in Total Current mode or return terminal current when in Return Current mode.
16. **Main Currentmeter Bar Graph**
Displays the main current relative to the configured overcurrent trip-point. Unit will trip off when the bar is full.

HMI CONTROLS: MAIN SCREEN (Cont'd)

17. Main Current Limit

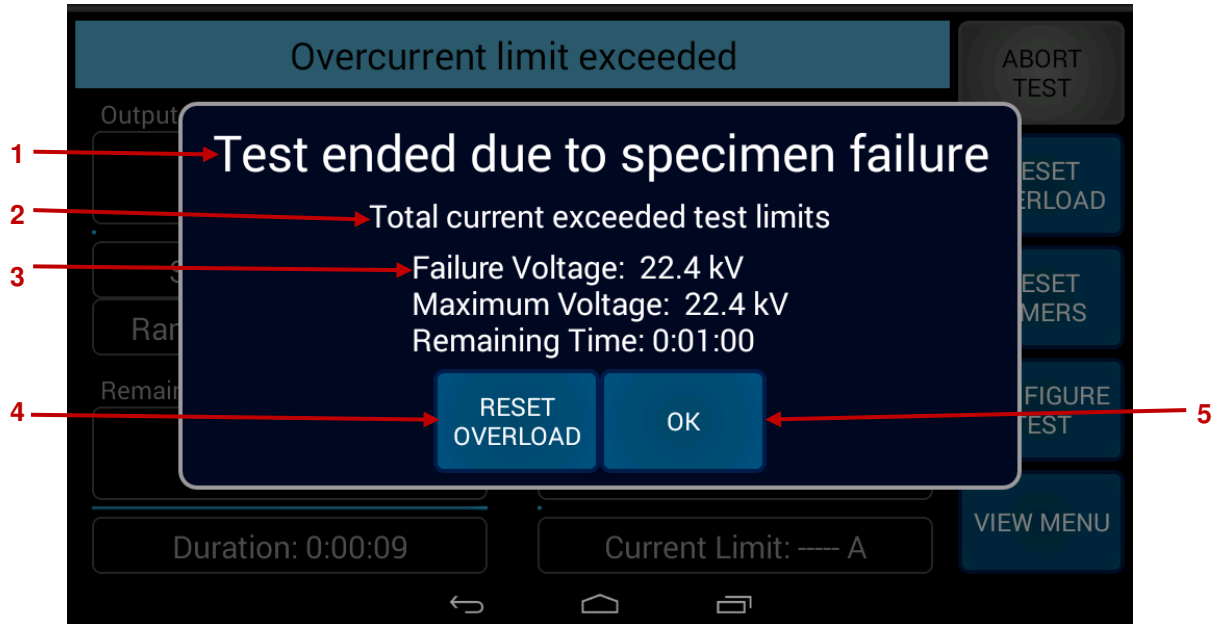
Displays the configured overcurrent trip-point. Unit will trip off if this value is exceeded.

18. Duration

Displays the amount of time since high-voltage was turned on.

HMI CONTROLS: TEST RESULTS MESSAGE

When the unit has been energized, and then it de-energized and regulator has returned to the zero position, a Test Results Screen will show over the Main Control Screen. The Test Results Screen will display if test was completed successfully or if there was a fault.



TEST RESULTS MESSAGE

1. End Test State

Displays reason or state for test ending.

- A. "Test completed successfully" displays when all test parameter were met in either automatic or manual mode.
- B. "Test ended manually by operator" displays when test has been manually ended when either the HV-Off button or the ABORT TEST button has been pressed.
- C. "Test ended due to specimen failure" displays when test configuration current limits are met.
- D. "Test ended due to unit fault" displays when E-Stop, SX Circuit, or Main Circuit Breaker open, or if unit Activation Key expires.
- E. "Test ended due to unit overload" displays when the voltage, current, or thermal limits of the unit have been exceeded.

HMI CONTROLS: TEST RESULTS SCREEN (Cont'd)

2. Test End Cause

Displays the specific reason the test was ended. If test ended due to fault, specific fault error will show. See Status Bar Fault states.

- A. If test was completed successful, will show "All test parameters met".
- B. If test was ended manually, no fault was detected, and test parameters were not met, will show: "No fault detected"

3. Relevant test values

Displays different values depending on the reason the test was ended.

- A. If test ended due to fault, displays failure voltage, maximum voltage and Dwell time remaining when failure occurred.
- B. If test completed successfully, displays maximum voltage and current measured.
- C. If test ended due to manual stoppage, displays the maximum voltage and current, as well as Dwell time remaining when the test was ended.

4. Reset Overload button

Press to reset any overloads and return to Main Screen. (Only shown if test ended due to overload).

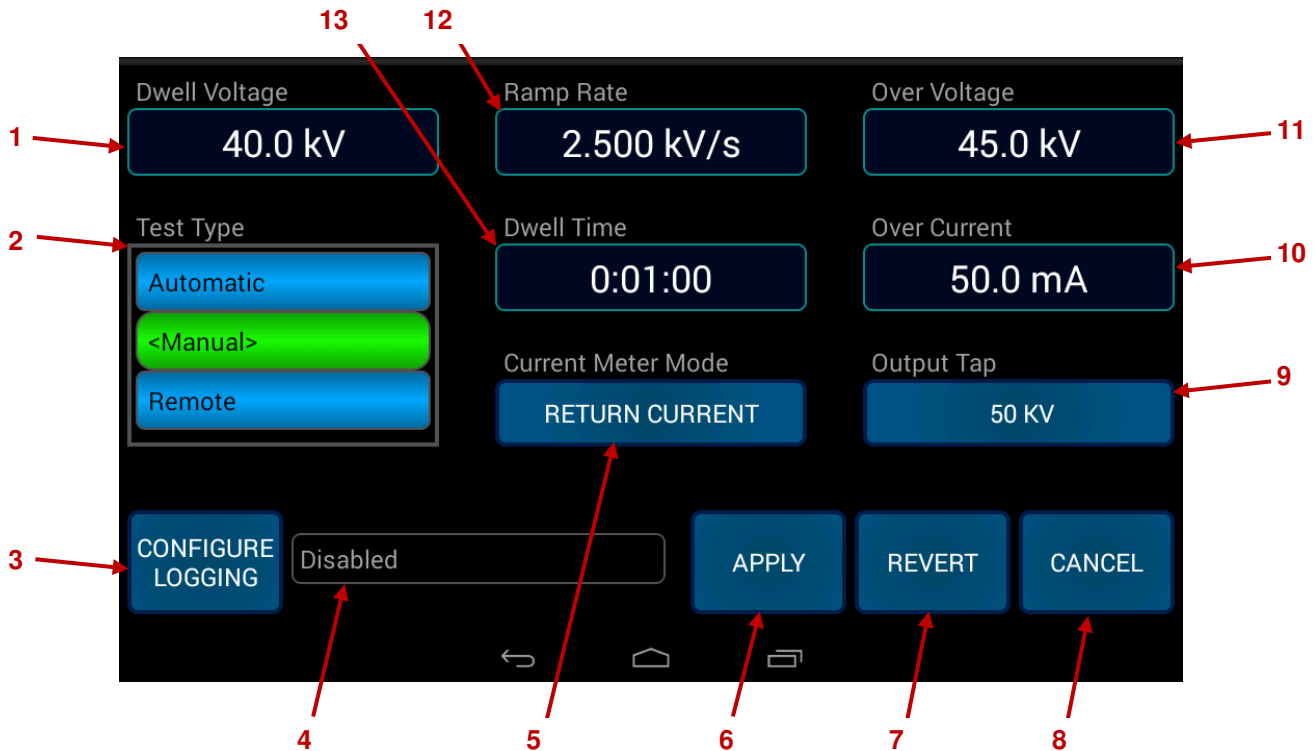
5. OK button

Press to return to Main Screen.

HMI CONTROL: CONFIGURATION SCREEN

To run a test, test parameters must first be set up. Setting these parameters allows the unit to automatically run the entire test cycle or have some functions automated when test is done manually. Value ranges are based off the selected output tap.

NOTICE: Make sure the correct Output Tap is selected before entering parameters.



CONFIG TEST SCREEN

- 1. Dwell Voltage**
Press to set the output voltage Dwell Voltage. In Automatic mode, this is the value the unit will automatically ramp to. In Manual mode, this is the level that will cause the dwell timer to begin counting down. Dwell Voltage can be set between 10% and 100% of Output Tap rating.
- 2. Test Type**
Select Automatic, Manual, or Remote (IF PURCHASED) test mode. Selected option displays in green.
- 3. Configure Logging Button**
Press to enter the Data Logging Screen for external logging of test data via USB. See Data Logging Screen.
- 4. Data Logging Info**
Indicates if data logging is enabled or disabled. If enabled will display chosen file name.
- 5. Current Meter Mode**
Press to switch between Total Current mode and Return Current mode. The selected mode is displayed on the button. If the unit is not equipped with Return Current Mode, this button will be grayed out.

HMI CONTROL: CONFIGURATION SCREEN (Cont'd)

6. Apply button

Press to save entered settings and return to the Main Screen.

***NOTICE:** Settings WILL NOT be saved unless applied.*

7. Revert button

Press to restore most recently applied settings.

8. Cancel button

Press to return to Main Screen without saving changes.

9. Output Tap

Press to select the HV transformer tap being used.

10. Over Current

Press to set the main current trip level. Adjustable from 10% to 105% of tap rating.

11. Over Voltage

Press to set the output voltage trip level. Adjustable from Dwell Voltage to 105% of tap rating.

12. Ramp Rate

Press to select output voltage ramp rate in Volt/Second. Adjustable in a range that will cause the regulator to go from 0% to 100% in 15 to 150 seconds.

13. Dwell Time

Press to set the dwell time at dwell voltage. If in Automatic mode, output will automatically ramp to zero and shut off when dwell time expires.

HMI CONTROL: CONFIGURE LOGGING SCREEN

This unit is capable of logging readings from a test onto a USB storage device. Tap voltage, return current, total current, unit status, and time of reading are all logged into a .csv file. Periodic readings will be taken based on the Sample Interval. A reading will also automatically be taken any time when there is a unit Status Bar change, regardless of the Sample Interval.

AutoSave Off TEST001.csv - Read-Only Mike Stenson MS

File Home Insert Page Layout Formulas Data Review View Add-ins Help Share

Clipboard Font Alignment Number Styles Cells Editing Ideas Sensitivity

POSSIBLE DATA LOSS Some features might be lost if you save this workbook in the comma-delimited (.csv) format. To preserve these features, save it in an Excel file format. Don't show again Save As...

C8 0.015814079

	A	B	C	D	E	F	G	H
1	Test began at: 2020-06-03 10:29:31							
2								
3	Time	Output Voltage	Total Current	Status				
4	1.15E-04	0	0	Output energized: Ramping to setpoint				
5	1.2059689	165.9060534	0	Output energized: Ramping to setpoint				
6	2.3392746	577.306165	0	Output energized: Ramping to setpoint				
7	3.4618888	865.7274703	0.010911725	Output energized: Ramping to setpoint				
8	4.5543945	1133.349759	0.015814079	Output energized: Ramping to setpoint				
9	5.6805842	1413.147333	0.019374936	Output energized: Ramping to setpoint				
10	6.6866046	1669.047316	0.022671326	Output energized: Ramping to setpoint				
11	7.6935615	1912.675771	0.02604248	Output energized: Ramping to setpoint				
12	8.7064922	2169.988483	0.029034453	Output energized: Ramping to setpoint				
13	9.7122919	2424.805256	0.032621133	Output energized: Ramping to setpoint				
14	10.71524	2687.464377	0.035214977	Output energized: Ramping to setpoint				
15	11.964154	2989.7708	0.039259649	Output energized: Ramping to setpoint				
16	13.057944	3276.46013	0.043986111	Output energized: Ramping to setpoint				
17	14.064881	3526.141099	0.047692735	Output energized: Ramping to setpoint				
18	15.072389	3782.645595	0.05065909	Output energized: Ramping to setpoint				
19	16.198419	4062.162554	0.054038058	Output energized: Ramping to setpoint				
20	17.297954	4343.165466	0.057750375	Output energized: Ramping to setpoint				
21	18.379266	4487.872963	0.059510271	Output energized: Ramping to setpoint				

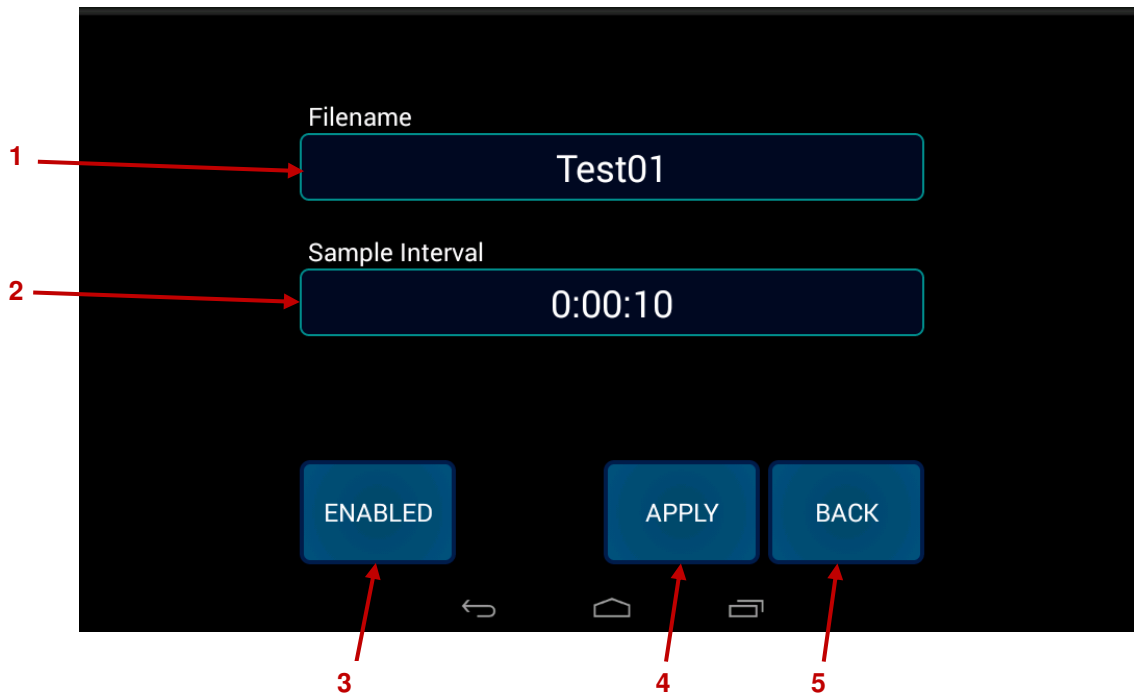
TEST 001 100%

EXAMPLE OF CSV FILE FORMAT

HMI CONTROL: CONFIGURE LOGGING SCREEN (Cont'd)

To configure logging:

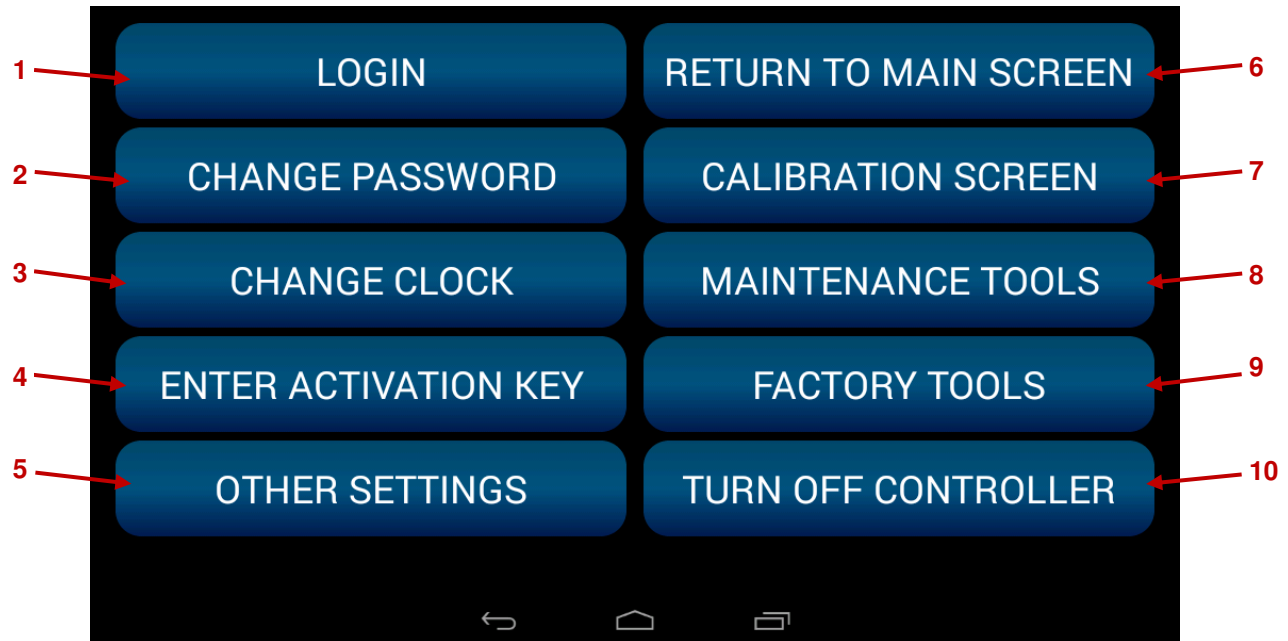
- A. Insert USB storage device into USB port.
- B. Press ENABLE/DISABLE to enable data logging.
- C. Enter Filename
- D. Enter Sample Interval
- E. Press APPLY

**CONFIGURE LOGGING SCREEN**

- 1. Filename**
Press to enter the desired file name for the data log. If file of same name already exists on the USB storage device, following test will be saved at "Filename_1", "Filename_2", ect.
- 2. Sample Interval**
Press to enter the time interval between data loggings. The valid range is between 500mS and 1.1415 years. The default setting is 500mS.
- 3. ENABLED/DISABLED button**
Press to toggle data logging on/off (Note: By default, this function is disabled. In order to enable data collection, you must first insert a memory stick into the USB slot on the front panel, then toggle this button and apply the change).
- 4. APPLY button**
Press to apply the entered settings and return to the Configuration screen.
- 5. BACK button**
Press to return to the Configuration screen without applying changes.

HMI CONTROL: MENU SCREEN

From this menu, users can access logins, settings, and calibration and maintenance tools. Some options will not be available depending on what user is logged in. See Login Screen for more information about users.

**MENU SCREEN**

- 1. LOGIN button**
Press to enter Login Screen.
- 2. CHANGE PASSWORD button**
Press to enter Change Password Screen. Only available with Admin login.
- 3. CHANGE CLOCK button**
Press to enter Set Clock Screen. Only available with Admin login.
- 4. ENTER ACTIVATION KEY button**
Press to enter Activation Code Screen (includes serial number and unit information). Only available with Admin login.
- 5. OTHER SETTINGS SCREEN button**
Press to enter the Other Setting Screen.
- 6. RETURN TO MAIN SCREEN button**
Press to return to the Main Screen.
- 7. CALIBRATION SCREEN button**
Press to enter Calibration Screen. Only available with Admin login.

HMI CONTROL: MENU SCREEN (Cont'd)

8. MAINTENANCE TOOLS button

Press to enter Maintenance Tools Screen. Only available with Admin login.

9. FACTORY TOOLS button

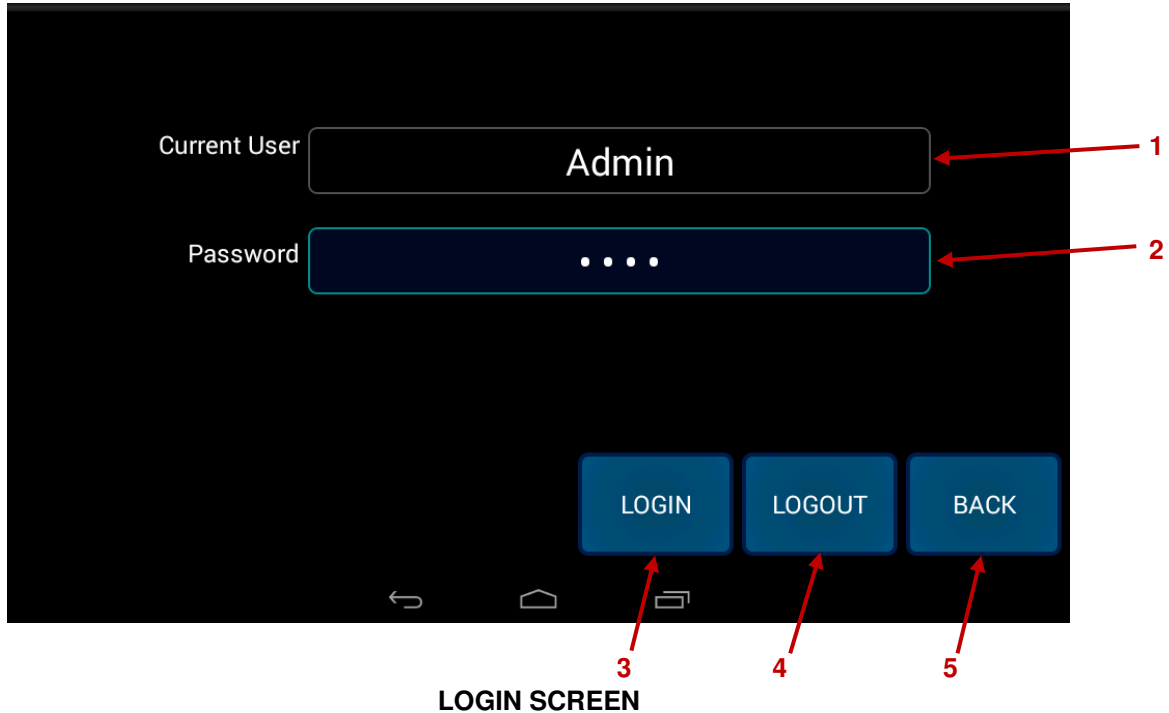
The Factory Tools Screen is for Phenix use only. It cannot be accessed by users.

10. TURN OFF CONTROLLER button

Press to shut down controller safely. Do this before opening main circuit breaker if possible. Controller will automatically wake up when circuit breaker is closed again.

HMI CONTROL: LOGIN SCREEN

There are two different logins available. These are Guest and Admin. By default, when the unit is turned on, the Guest user will be signed in. The Guest user is able to run tests and do only the essential things needed for unit operation. The Admin user is able to access and change unit settings, and calibration maintenance tools. To login to the Admin user the Admin Password needs to be entered in the Password field. By default the Admin password is: 1234.



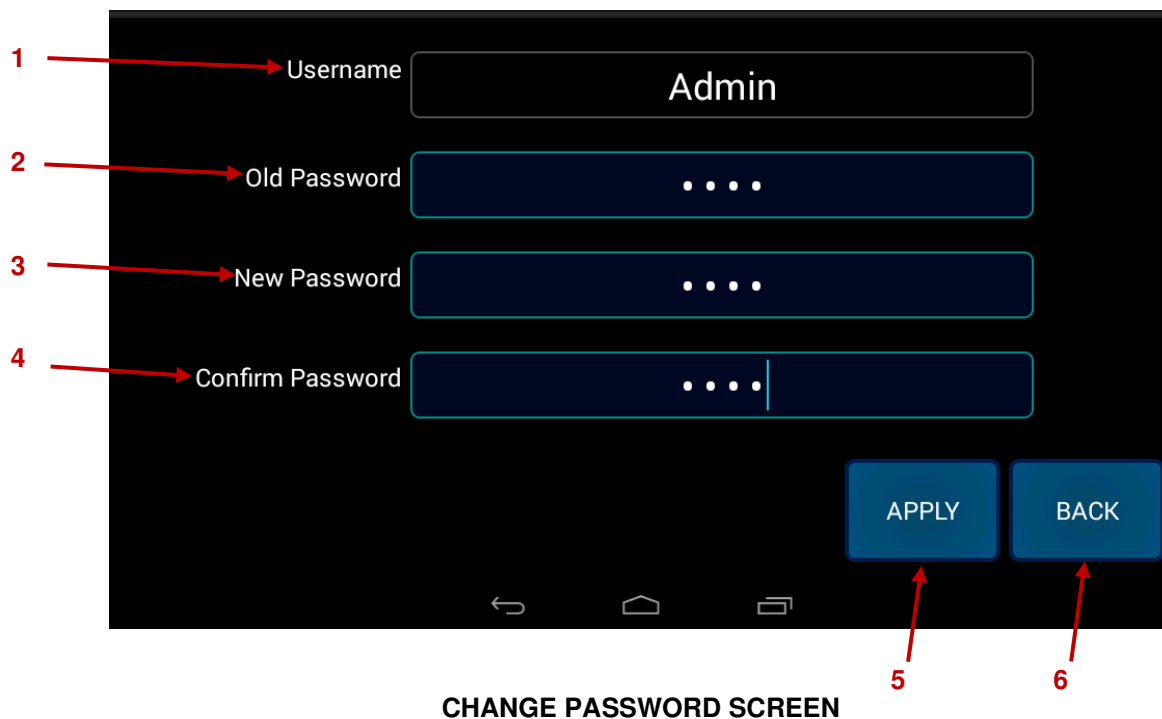
- 1. Current User**
Displays currently logged in user.
- 2. Password**
Press to enter password.
- 3. LOGIN button**
Press to login with given credentials.
- 4. LOGOUT button**
Press to logout current user.
- 5. BACK button**
Press to return to the Menu screen.

HMI CONTROL: CHANGE PASSWORD SCREEN

This screen is used to change the password of the currently logged in user.

To change the password:

- A. Enter current user password in Old Password
- B. Enter new user password in New Password
- C. Enter new user password in Confirm Password
- D. Press APPLY

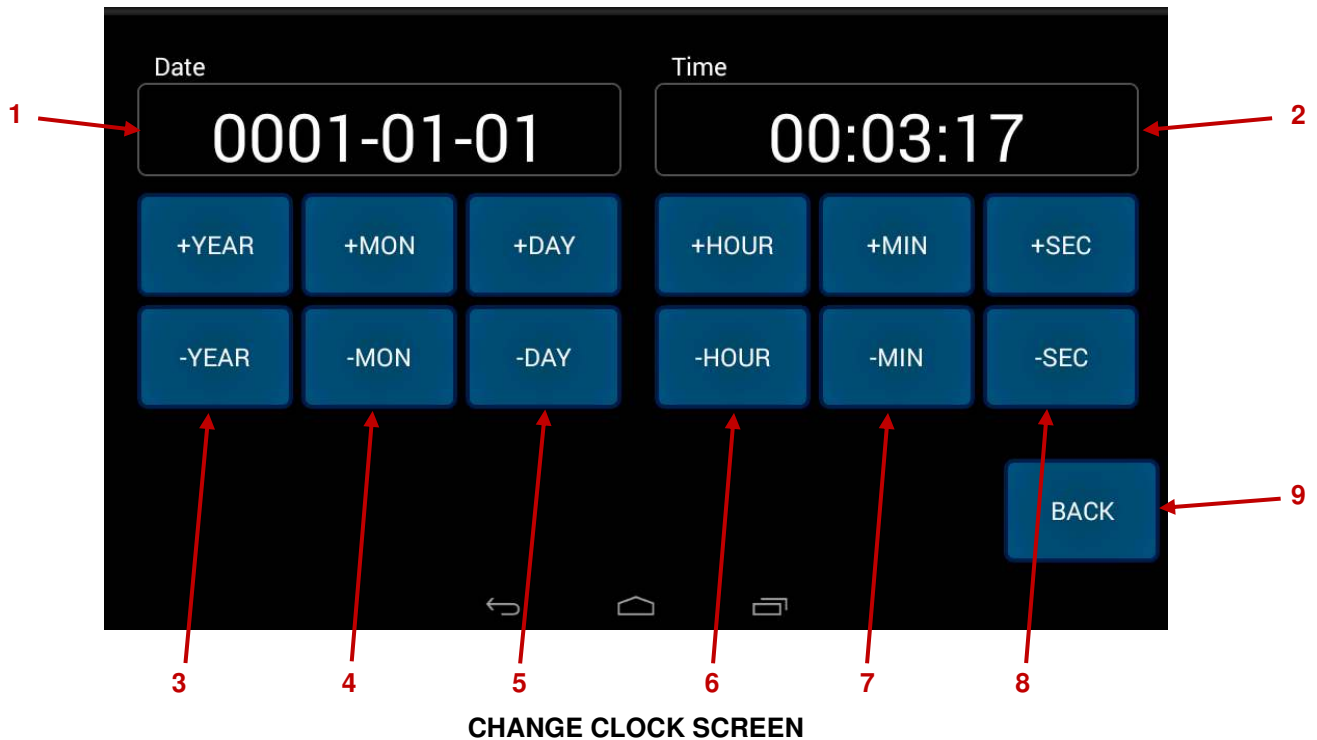


CHANGE PASSWORD SCREEN

- 1. Username**
Displays currently logged in user.
- 2. Old Password**
Press to enter current password.
- 3. New Password**
Press to enter new password.
- 4. Confirm Password**
Press to confirm new password.
- 5. APPLY button**
Press to apply changed password.
- 6. BACK button**
Press to return to the Menu screen.

HMI CONTROL: CHANGE CLOCK SCREEN

The date and time that is recorded in the data logging file can be changed by modifying this date and time.

**1. Date:**

Displays the current calendar date in ISO8601 format (YYYY-MM-DD).

2. Time:

Displays the current time.

3-8. +/- buttons

Press +/- to increase/decrease value. Hold to increment by values of 10.

9. BACK button

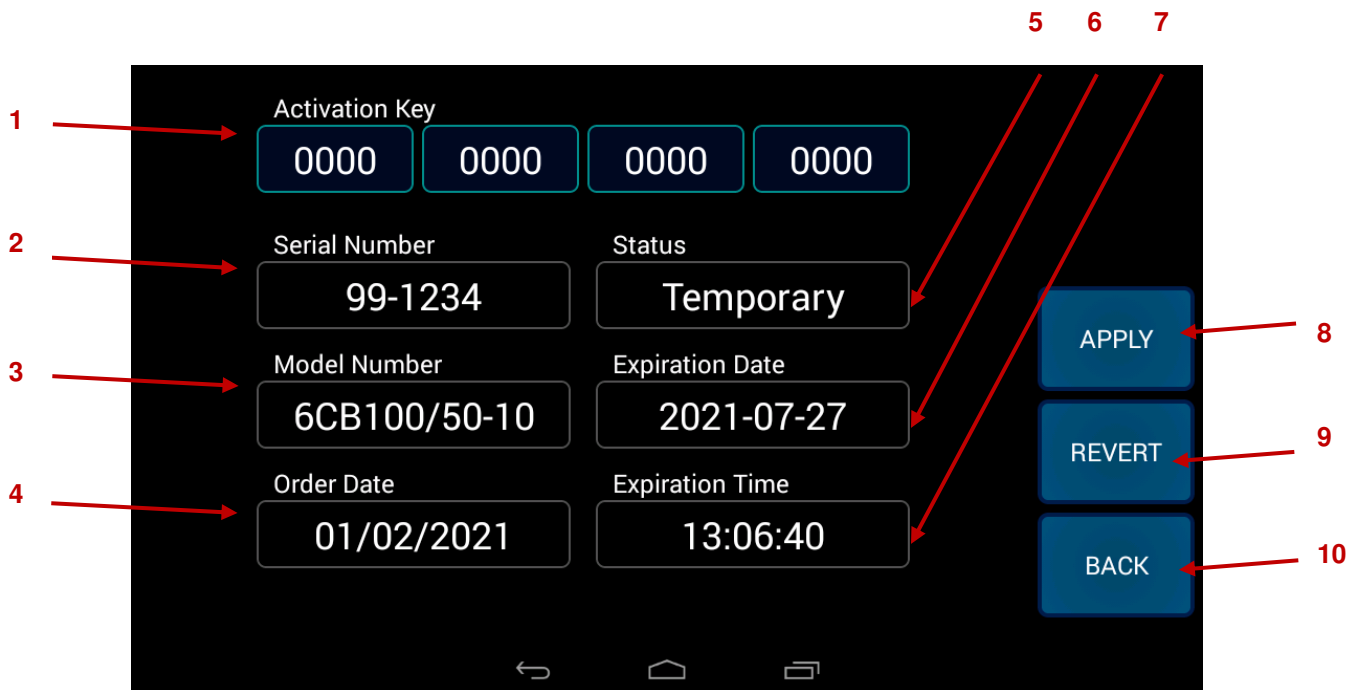
Press to return to the Menu screen.

HMI CONTROL: ACTIVATION KEY SCREEN

This screen is used to enter product Activation Key and view unit information. A valid Activation Key must be entered for the unit to perform testing. There are two different types of Activation Key. These are Permanent, and Temporary.

To enter an Activation Key:

- A. Select each Activation Key field and enter the corresponding four digits of the Activation Key.
- B. After all fields have been entered correctly, press APPLY.
- C. Status will update to show Activation Key type. If Activation Key is Temporary, Expiration Date and Time will show.

**ACTIVATION KEY SCREEN**

- 1. Activation Key**
Press to enter unit's activation key.
- 2. Serial Number**
Displays the unit serial number.
- 3. Model Number**
Displays the unit model number.
- 4. Order Date**
Displays the date the unit was ordered.

HMI CONTROL: ACTIVATION KEY SCREEN (Cont'd)

5. Status

Displays the status of the activation key.

- **Permanent**
The permanent key has been entered. No additional temporary keys are required.
- **Temporary**
The unit is operation with a temporary key. If this key expires the unit will not be able to energize without contacting Phenix Technologies for a new key.
- **Expired**
The existing key has expired. A new key is required to operate the system.
- **Invalid Key**
The key entered is not valid, please carefully confirm the key entered matches exactly. Re-enter to correct any type-o's

6. Expiration Date

Displays the date that the activation key expires in YYYY-MM-DD. (If applicable).

7. Expiration Time

Displays the time (UTC) that the activation expires on the expiration date.

8. APPLY button

Press to apply the entered activation key.

9. REVERT button

Press to revert to the most recently applied activation key.

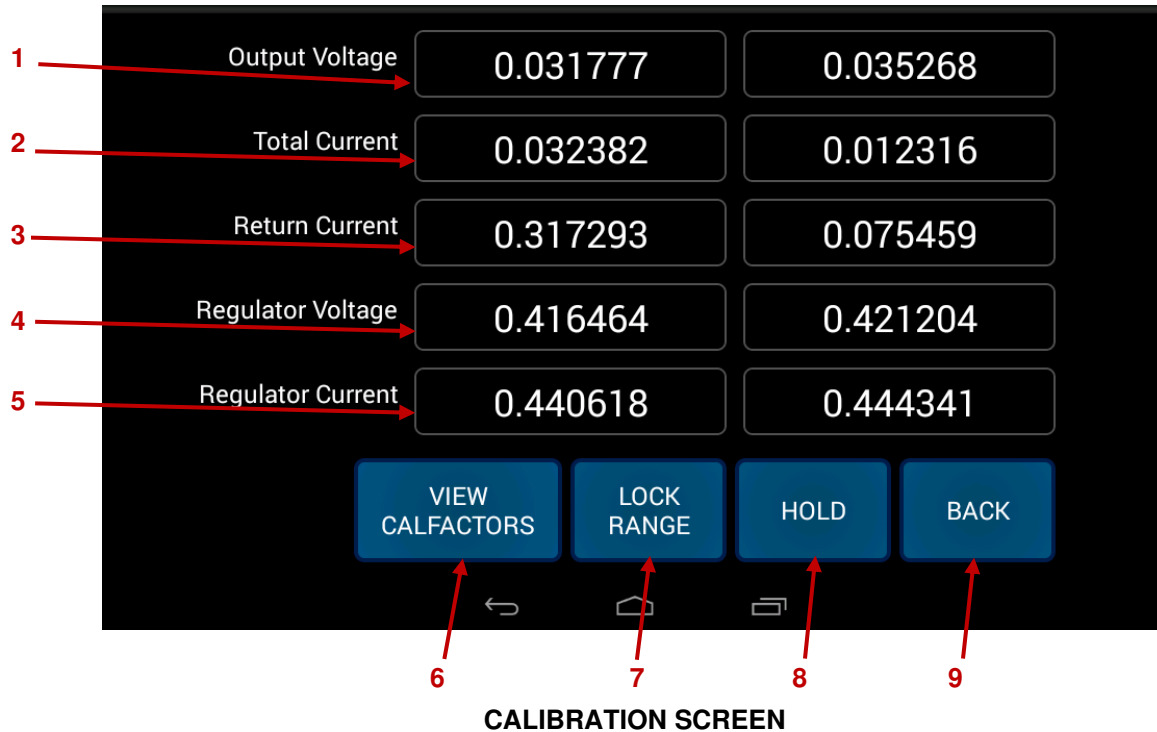
10. BACK button

Press to return to the Menu Screen without applying changes.

HMI CONTROL: CALIBRATION SCREEN

NOTICE: If calibration is required, contact Phenix Technologies for instructions and procedure.

The Calibration Screen shows the raw analog reading value going into the controller. These values will be in the range of 0-1.



1. **Output Voltage**
Displays the raw voltmeter input value.
2. **Total Current**
Displays the raw total currentmeter input.
3. **Return Current**
Displays the raw return currentmeter input. (If equipped)
4. **Regulator Voltage**
Displays the raw regulator voltmeter input. (If equipped)
5. **Regulator Current**
Displays the raw return currentmeter input. (If equipped)
6. **VIEW CALFACTORS button**
Press to enter Calibration Factor Browser screen.
7. **LOCK RANGE button**
Press to disable currentmeter auto-ranging and select a fixed range for calibration.

HMI CONTROL: CALIBRATION SCREEN (Cont'd)

8. HOLD button

Press to obtain an instantaneous sample of the raw inputs (will displayed in the right column)

***NOTICE:** Displayed values require approximately 7 seconds to fully settle. Users must wait at least this long after changing voltage, before collecting calibration data.*

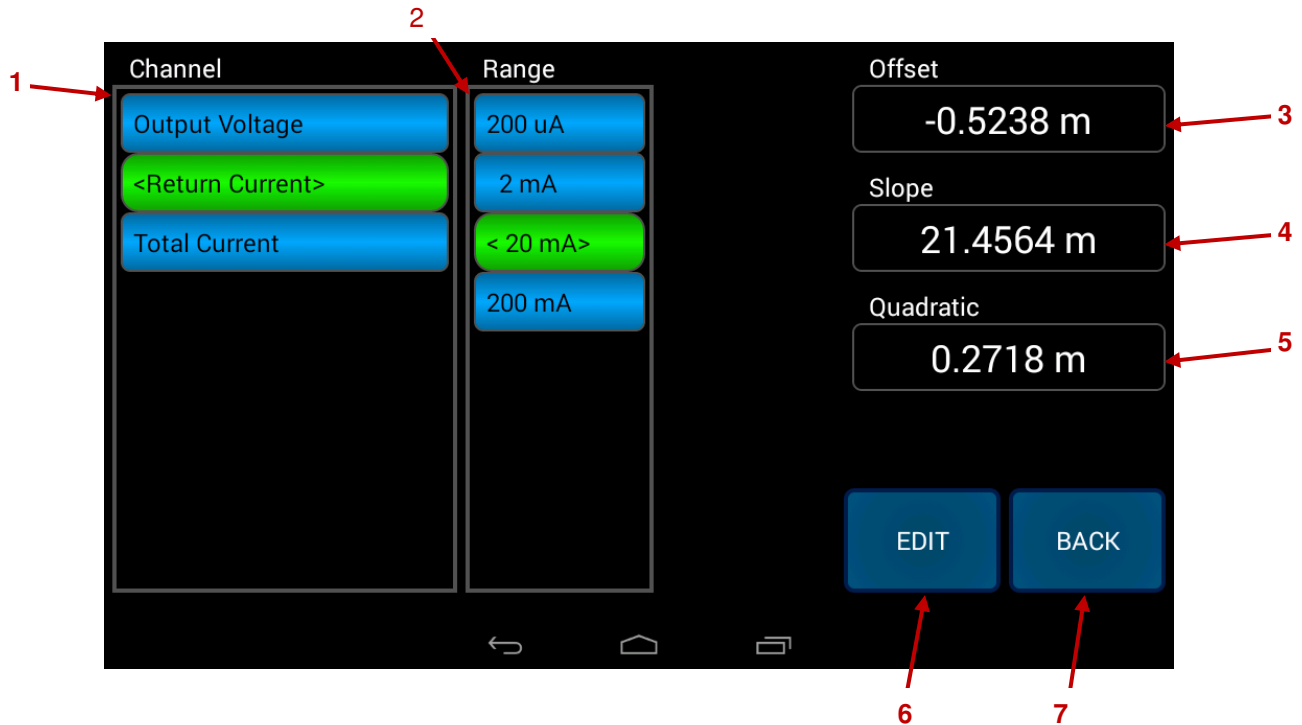
9. BACK button

Press to return to the Menu screen.

HMI CONTROL: CALIBRATION FACTOR BROWSER SCREEN

NOTICES: If calibration is required, contact Phenix Technologies for instructions and procedure.

This screen is used to view calibration factors for the unit. Each voltage and current channel will have at least one range associated with it. Each range has its own set of calibration factors associated with it.



CALIBRATION FACTOR BROWSER SCREEN

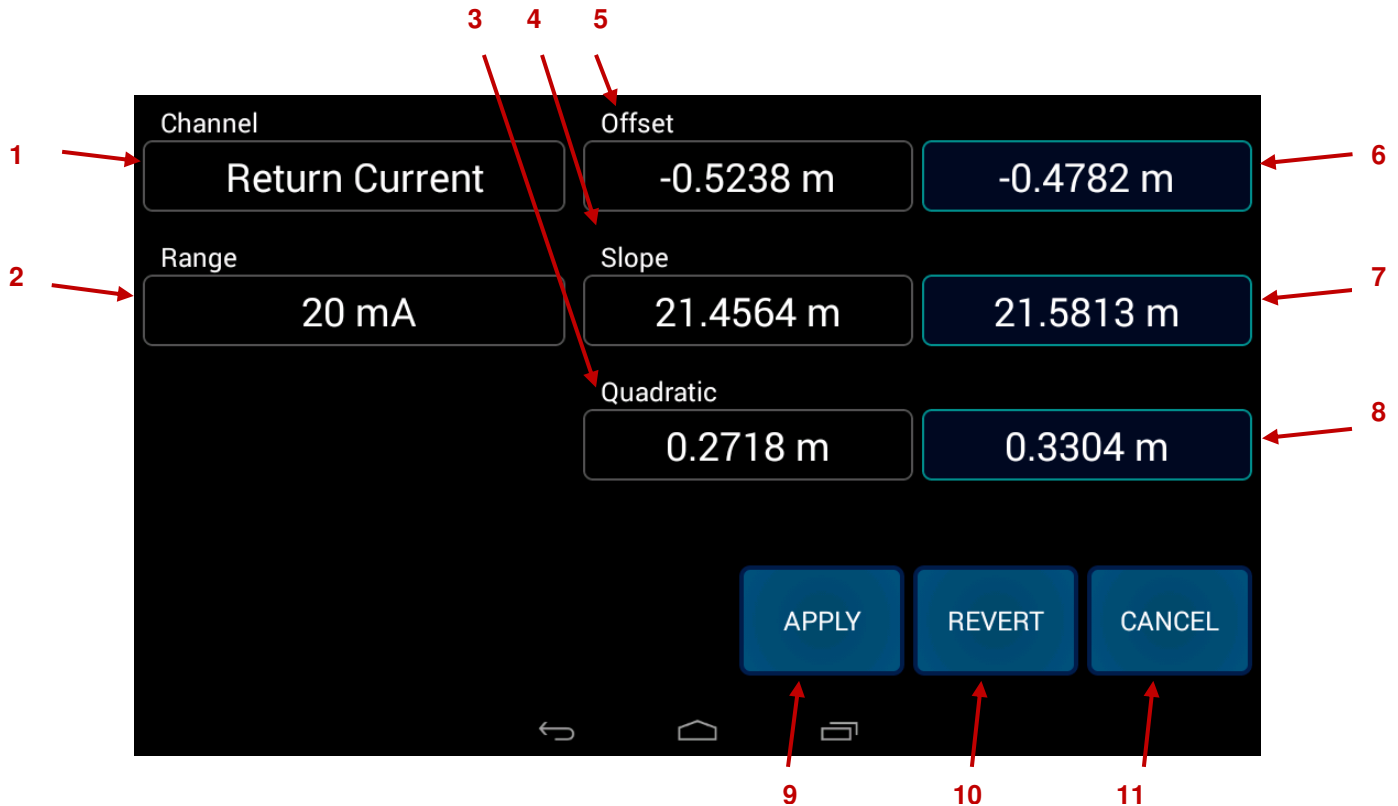
- 1. Channel Field**
Press to select which meter channel to view.
- 2. Range Field**
Press to select the desired metering range. (If applicable)
- 3. Offset**
Displays the offset correction factor for the given channel, and range.
- 4. Slope**
Displays the slope for the given channel, and range.
- 5. Quadratic**
Displays the quadratic correction factors for the selected range.
- 6. EDIT button**
Press to enter the **Calibration Factor Editor Screen**.
- 7. BACK button**
Press to return to **Calibration**.

HMI CONTROL: CALIBRATION FACTOR EDITOR SCREEN

NOTICES:

- If calibration is required, contact Phenix Technologies for test instructions and test procedure.
- Settings WILL NOT be saved unless applied.

This screen is used to edit calibration factors of the Channel, and Range that was selected in the Calibration Factor Browser Screen.



CALIBRATION FACTOR EDITOR SCREEN

- 1. Channel**
Displays which meter channel is being modified.
- 2. Range**
Displays the selected metering range. (If applicable).
- 3. Quadratic**
Displays the active quadratic correction factor.
- 4. Slope**
Displays the active slope coefficient.
- 5. Offset**
Displays the active offset correction factor.

HMI CONTROL: CALIBRATION FACTOR EDITOR SCREEN (Cont'd)

6. Offset Edit button

Press to enter a new offset value.

7. Slope Edit button

Press to enter a new slope value.

8. Quadratic Edit button

Press to enter a new quadratic value.

9. APPLY button

Press to apply new calibration factors.

10. REVERT button

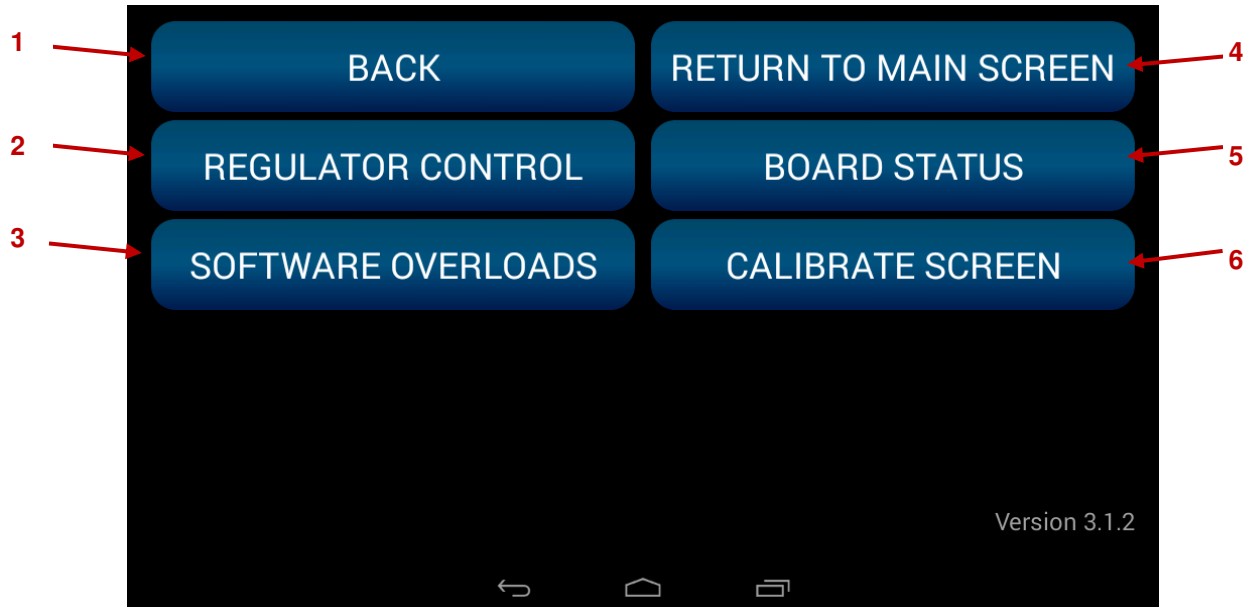
Press to cancel any changes and revert to the currently active calibration factors.

11. CANCEL button

Press to cancel any changes and return to the Calibration Factor Browser screen.

HMI CONTROL: MAINTENANCE TOOL SCREEN

This screen allows users to access troubleshooting and maintenance tools.

**MAINTENANCE TOOL SCREEN**

- 1. BACK button**
Press to return to Menu Screen.
- 2. REGULATOR CONTROL button**
Press to enter Regulator Control Screen.
- 3. SOFTWARE OVERLOADS**
Press to enter Software Overloads Screen.
- 4. RETURN TO MAIN SCREEN button**
Press to return to Main Screen.
- 5. BOARD STATUS button**
Press to view Board Status Screen.
- 6. CALIBRATE SCREEN button**
Press to launch the touch screen calibrator.

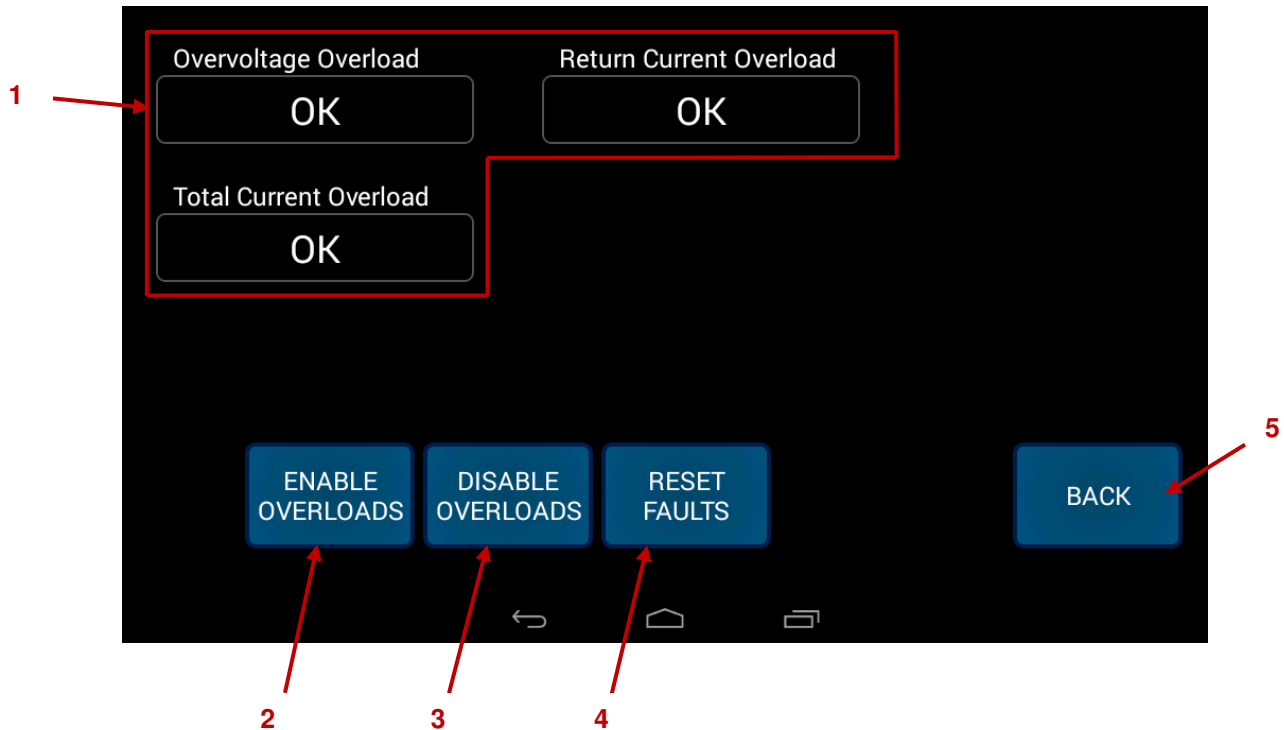
HMI CONTROL: REGULATOR CONTROL SCREEN

This screen is used to control the regulator motor. This should be used for maintenance and troubleshooting only.

**REGULATOR CONTROL SCREEN**

- 1. Regulator Angle**
Displays approximate regulator swing arm position (0 at lower limit, 1 at upper limit).
- 2. Regulator Voltage**
Displays the present regulator voltage value (V). (If applicable)
- 3. Regulator Current**
Displays the present regulator amperage value (A). (If applicable)
- 4. Slow Speed Adjustment**
Move the slider to adjust the magnitude of the slow raise / lower regulator speeds.
- 5. RAISE FAST button**
Hold to quickly raise the regulator position.
- 6. RAISE SLOW button**
Hold to slowly raise the regulator position.
- 7. LOWER SLOW button**
Hold to slowly lower the regulator position.
- 8. LOWER FAST button**
Hold to quickly lower the regulator position.
- 9. BACK button**
Press to return to the Maintenance Tools screen.

HMI CONTROL: SOFTWARE OVERLOAD SCREEN



MAINTENANCE TOOL SCREEN

1. OVERLOAD STATUS

Indicates the status of Overvoltage Overload, Total Current Overload, and Return Current Overload.

- OK – The overload is not tripped and enabled.
- Tripped – The overload is tripped.
- Disabled – The overload had been disabled.

2. ENABLE OVERLOADS button

Pressing enables all software overloads.

3. DISABLE OVERLOADS button

Pressing disables all software overloads.

4. RESET FAULTS button

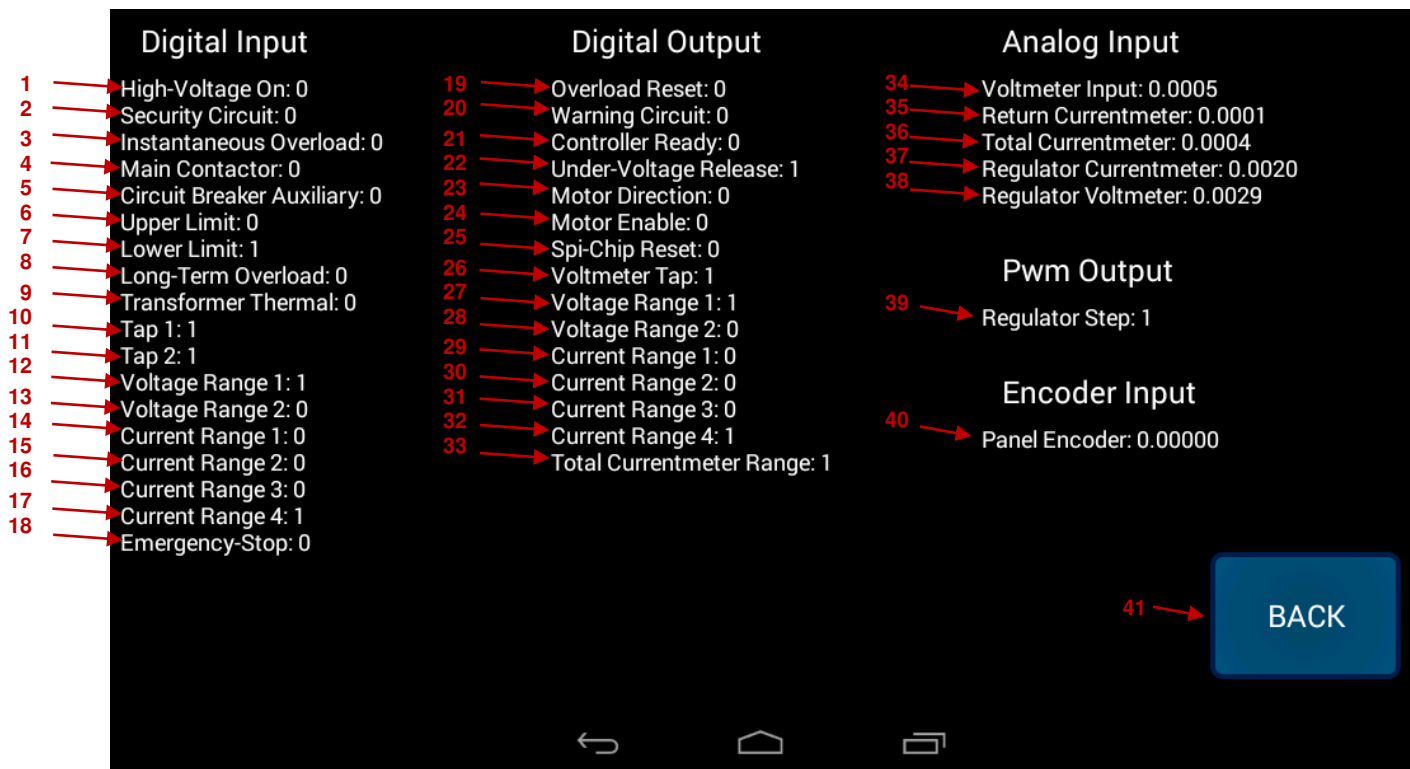
Press to reset all overloads.

5. BACK button

Press to return to the Maintenance Tools screen.

HMI CONTROL: BOARD STATUS SCREEN

This screen shows the status of various inputs and outputs of the controller.

**BOARD STATUS SCREEN**

1. **High-Voltage On**
Indicates status of HV output.
2. **Security Circuit:**
Indicates status of Security circuit.
3. **Instantaneous Overload:**
Indicates status of Instantaneous Overload circuit.
4. **Main Contactor**
Indicates status of Main Regulator Contact.
5. **Circuit Breaker Auxiliary**
Indicates status of Main Circuit Breaker.
6. **Upper Limit**
Indicates status of Upper Limit switch on regulator.
7. **Lower Limit**
Indicates status of Lower Limit switch on regulator.

HMI CONTROL: BOARD STATUS SCREEN (Cont'd)

- 8. Long-Term Overload**
Indicates status of Long-Term Overload circuit.
- 9. Transformer Thermal**
Indicates status of Thermal Overload circuit.
- 10. Index**
Indicates the state of the Motor Position Encoder Index Channel.
- 11. Tap1**
Indicates the unit is in Tap 1.
- 12. Tap2**
Indicates the unit is in Tap 2.
- 13-14. Voltage Range 1-2**
Indicates the state of External Voltage Range Selector.
- 14-17. Current Range 1-4**
Indicates the state of External Current Range Selector (if equipped)
- 18. Emergency-Stop:**
Indicates status of Emergency-Stop button.
- 19. Overload Reset**
Indicates status of Overload Reset circuit.
- 20. Warning Circuit**
Indicates status of Warning circuit.
- 21. Controller Ready**
Indicates ready status of the controller's circuit board.
- 22. Under-Voltage Release**
Indicates if controller will allow the Main Circuit Breaker to be closed.
- 23. Motor Direction**
Indicates motor direction.
- 24. Motor Enable**
Indicates current state of the motor.
- 25. Spi-Chip Reset**
Indicates status of Auto-Ranging circuit (if equipped).
- 26. Voltmeter Tap**
Indicates if the voltmeter tap is active.
- 27-28. Voltmeter Range 1-2**
Indicates state of Voltmeter Auto-Ranging for the given range.
- 29-32. Current Range 1-4**
Indicates state of Currentmeter Auto-Ranging for the given range.

HMI CONTROL: BOARD STATUS SCREEN (Cont'd)

- 33. Total Currentmeter Range.**
Indicates state of Currentmeter Auto-Ranging
- 34. Voltmeter Input**
Displays the raw Voltmeter Input value.
- 35. Return Currentmeter**
Displays the raw Return Currentmeter Input value.
- 36. Total Currentmeter**
Displays the raw Total Currentmeter Input value.
- 37. Regulator Currentmeter**
Displays the raw Regulator Currentmeter Input value.
- 38. Regulator Voltmeter**
Displays the raw Regulator Voltmeter Input value.
- 39. Regulator Steps**
Displays Speed signal going to regulator motor – [frequency].
- 40. Panel Encoder**
Displays relative angle of the Infinity Dial.
- 41. Back button**
Press to return to the Maintenance Tools screen.

HMI CONTROLS: STATUS BAR

The HMI can display three types of status message, Standby, Fault, and Energized. This section describes the three types and detailed information about each message.

- **Standby** states are shown with a violet background. The standby states indicated that the unit output is ready to be energized.
- **Fault** states are shown with a blue background. The Fault state indicates that was a fault or error while testing, or that the unit is in a state that required operator action. The unit can not be energized while in a fault state.
- **Energized** states are shown with a yellow background. The Energized state indicates that the output in energized.

WARNING: EXERCISE EXTREME CAUTION WHEN UNIT IS ENERGIZED!

HMI CONTROLS: STATUS BAR: STANDBY MESSAGES

The unit has the following standby messages:

Ready to start automatic test:

Unit ready to start automatic test

Ready to start manual test:

Unit ready to start manual test.

Press OUTPUT ON to begin remote test.

The unit is in remote control and requires the operator to press the HV ON physical button to start the test.

HMI CONTROLS: STATUS BAR: FAULT MESSAGES

The unit has the following Fault messages:

Configure test to continue

No test configuration active. Press CONFIGURE TEST to continue.

Regulator is off zero position

Output is de-energized, but regulator is not in zero position. Wait until regulator automatically returns to zero position to continue.

Short term regulator overload detected

Regulator current has exceeded the short-term hardware limit. Press RESET OVERLOAD to continue.

Long-term regulator overload detected

Regulator has exceeded the long-term hardware current limit. Press RESET OVERLOAD to continue.

Thermal overload detected

Regulator or transformer temperature has exceeded hardware limit. Wait at least 15 minutes for the unit to cooldown. Press RESET OVERLOAD to continue.

Overvoltage limit exceeded

Output voltage has exceeded user programmed limit. Press RESET OVERLOAD to continue.

Main circuit breaker is open

If ready to test, close main circuit breaker to continue.

Activation Key has expired

Invalid or expired Activation Key entered. Reenter or renew Activation Key to continue.

Security circuit is open

External security circuit has been opened. Verify environment is safe, then close security circuit to continue.

Emergency stop switch pressed

Emergency stop button is activated. Verify environment is safe, then release button to continue.

Waiting for test parameters.

The unit is in remote control, waiting for the controller to send test configuration parameter prior to starting the test.

Rated Duty Cycle Exceeded

The rated duty cycle has been exceeded. The unit should remain off for its duty cycle amount of time. Refer to the specification page for the unit's duty cycle information.

HMI CONTROLS: STATUS BAR: FAULT MESSAGES

The unit has the following Fault messages:

Total Overcurrent Limit Exceeded

Total current has exceeded the software limit. Press RESET OVERLOAD to continue.

Return Overcurrent Limit Exceeded

Return current has exceeded the software limit. Press RESET OVERLOAD to continue.

Waiting For Remote Heartbeat

The controller is not communicating with the remote PC.

Waiting For Remote Test Parameters

The controller is getting the remote PC heartbeat but has not received test parameters.

HMI CONTROLS: STATUS BAR: ENERGIZED MESSAGES

The unit has the following Energized messages:

Output energized

High-voltage output is Energized.

Output energized: At voltage setpoint

High-voltage output is Energized and unit is at voltage set point. Dwell timer will countdown if set.

Output energized: Aborting test:

High-voltage output is Energized. Abort test button has been pressed. Unit will ramp to zero and shut off.

Output energized: Dwell complete

High-voltage output is Energized. Dwell timer has expired. Push ABORT TEST button or manually lower voltage to zero and shut off.

Output energized: Test complete

High-voltage output is Energized. Automatic test has completed. Unit will ramp to zero and shut off.

Output energized: Ramping to setpoint

High-voltage output is Energized. Automatic test is running. Voltage will automatically increase to setpoint.

Output Energized: Regulation Paused

High-Voltage output is energized. Regulation has been temporarily disabled by the remote control computer.

Output Energized: Remote Heartbeat Lost

Heartbeat from remote controlling computer has been lost. Unit will ramp to zero and shut off.

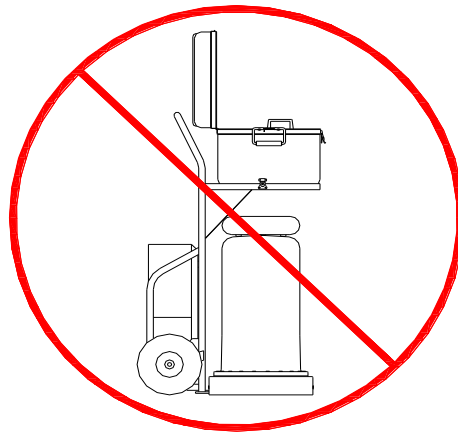
MECHANICAL SETUP

- A. Designate an area suitable for electrical testing. The area must provide sufficient mechanical and electrical clearances to perform the test.
- B. The test site surface must be strong enough to support the weight of the unit. The approximate weight of each module is available from the respective nameplate. The surface must also be level to prevent the unit from excessively tilting.

NOTICE: *If the unit is being used for PD testing a shielded room and/or grounded floor may be necessary to achieve desired background noise levels. The shielding solution must be installed prior to installing the test set.*

- C. Place the test set into position.

WARNING !



DO NOT OPERATE THE TEST SET
WITHOUT REMOVING HIGH-VOLTAGE
TRANSFORMER FROM THE CART.

THE HIGH-VOLTAGE TRANSFORMER
MUST BE POSITIONED A SAFE DISTANCE
FROM PERSONNEL AND OTHER OBJECTS.

NOTICE: *If lifting by a crane; always use all lift points provided for proper load distribution.*

- D. Clean all high voltage components to remove contamination from the component surface. This cleaning must include the high voltage cables.

GENERAL ELECTRICAL SETUP

- A.** Use low inductance braid or copper foil for grounding the unit. Use conductors of sufficient size (amperage equal to or larger than the rated input current) for making all ground connections. Connect the facility ground and control box to the high voltage transformer ground stud. If this is a single piece unit, connect the facility ground to the unit's ground stud. For units with multiple modules ground in a "star" configuration, making the high voltage transformer ground stud the center point of the star. DO NOT "daisy chain" the grounding from one module to the next!
- B.** Connect external security interlock circuit (SX1). The security circuit can be used with footswitches, dead man switches, etc. If integrating into an existing security interlock circuit, the jumpers on the provided plug must be disconnected. The external security circuit then connects to the jumpers. The external interlock circuit must consist of a closed loop of dry contacts; an open circuit prevents the high voltage output from being energized. The voltage on the external interlock circuit may vary depending on the model of unit. Reference unit schematics to see what voltage is used.

Security circuit accessories are available from Phenix Technologies. Contact Phenix Technologies for more information.

- C.** Connect external warning circuit (WX1) (If equipped). The external warning circuit is an optional circuit that can be used to power alarms, flashing lights, etc. The circuit will be powered depending on unit state. The warning circuit options and connection type may vary depending on unit model. Reference unit schematics to see warning circuit connection configuration.

Warning circuit accessories are available from Phenix Technologies. Contact Phenix Technologies for more information.

- D.** If two-piece unit, connect power and metering interconnect cables between controls/regulator and the HV tank.
- E.** Connect the test specimen's "low side" to the return, guard, or ground connection. Depending on unit type, the connections may vary. See the Current Meter Set Up part of this section for more details on connections.
- F.** Connect the test specimen to the output termination or cable of the high voltage transformer. Ensure that connection is applicable for test level and type, and that the connection has sufficient safety clearances for the voltage rating.
- G.** Connect the main input power cable from the facility power connection to the control/regulator. Ensure that facility circuit is rated for the unit power requirements.

CURRENT METER SETUP

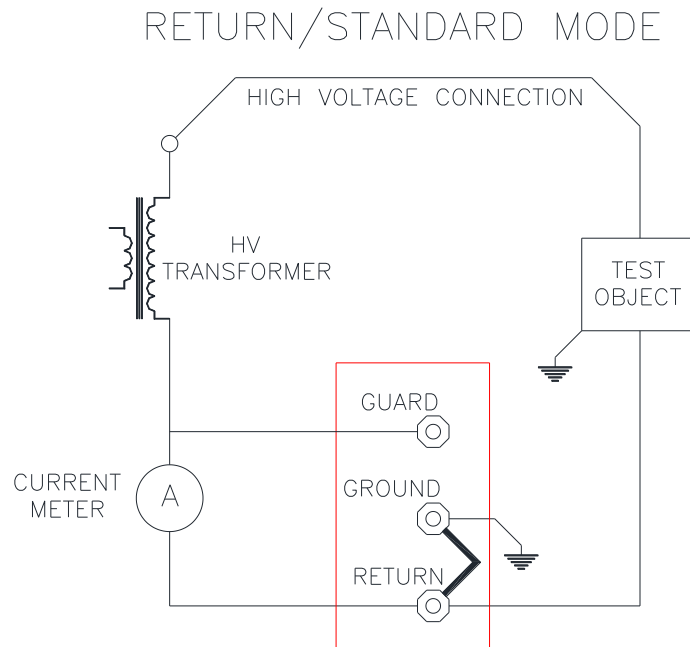
For all configurations, the ground stud must always be connected to a suitable earth ground. If the test set does not have a separate high voltage tank, the stud on the cabinet that houses the high voltage transformer must be connected to earth ground. Unit will have one of two types of current metering connection. One type will have three separate terminals: white guard, green ground, and red return. The other will only have two separate terminals: green ground, and a red return. Reference unit schematic to determine what metering is used.

UNITS WITH RETURN, GUARD, AND GROUND CONNECTIONS

Test sets equipped with a guard circuit have three terminals: white guard, green ground, and a red return. There is a metal jumper that must always be connected between either the guard and ground terminals, or the ground and return terminals.

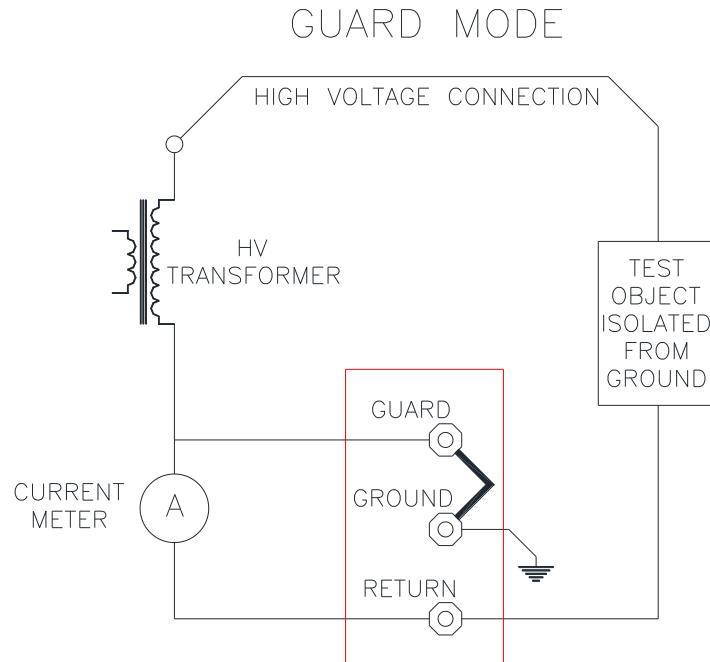
Return/Standard Mode

For normal or standard current measurement, connect the jumper between the ground and return terminals, and connect the test specimen return (low voltage side) to the return terminal. In this mode all test current, including leakage current, will be measured by the meter. Reference figure below. Leakage current to ground can come from several sources. The high voltage transformer could have capacitive leakage to ground. The high voltage connection might have some leakage due to partial discharge (corona). The test specimen might have some leakage current to ground.



Guard Mode

For guarded current measurement, connect the jumper between the ground and guard terminals and connect the test specimen return (low voltage side) to the return terminal. In this mode, stray leakage current to ground is guarded out (bypasses the meter) and is not measured. Reference figure below. If the test object is isolated from ground, then this current mode reading can be used accurately.

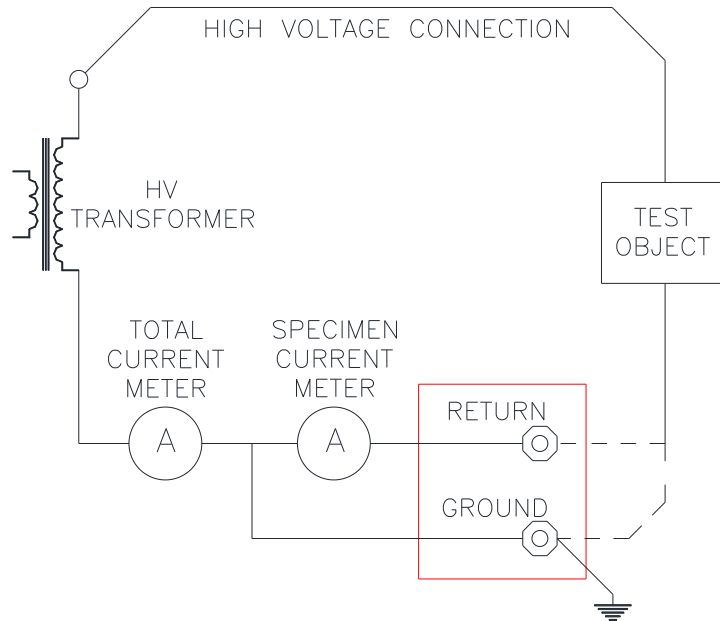


UNITS WITH RETURN AND GROUND CONNECTIONS

Units with only a return and ground connection are equipped with two separate current meters. These are known as the Specimen Current Meter and the Total Current Meter. The appropriate connection to use is dependent on the object being tested. See descriptions and figure below.

The **Specimen Current Meter** only measures current that goes through the return connection. This will NOT measure stray leakage current to ground. If the test object is isolated from ground, then the specimen current meter can be used accurately. The Specimen Current meter measures the same current that a unit with return, guard, and ground terminals would measure in guard mode.

The **Total Current Meter** will measure specimen return current and any leakage current to ground. Leakage current to ground can be from several sources. The high voltage transformer could have capacitive leakage to ground. The high voltage connection might have some leakage due to partial discharge (corona). The test specimen might have some leakage current to ground. The Total Current Meter measures the same current that a unit with return, guard, and ground terminals would measure in return or standard mode.



SPECIAL CONSIDERATION FOR AC/DC TEST SETS

If the test set has both AC and DC voltage outputs, the guard circuit may be intended for use with the DC output only (see specifications). If so, connect the test specimen return to the high voltage tank's ground stud for AC tests.

TEST PROCEDURE

This subsection describes the test procedure for operating the test set.

WARNING: *This unit should only be operated by personnel knowledgeable in High Voltage testing and safety procedures. Improper or careless operation of unit can result in serious injury or death.*

TEST PROCEDURE: GENERAL

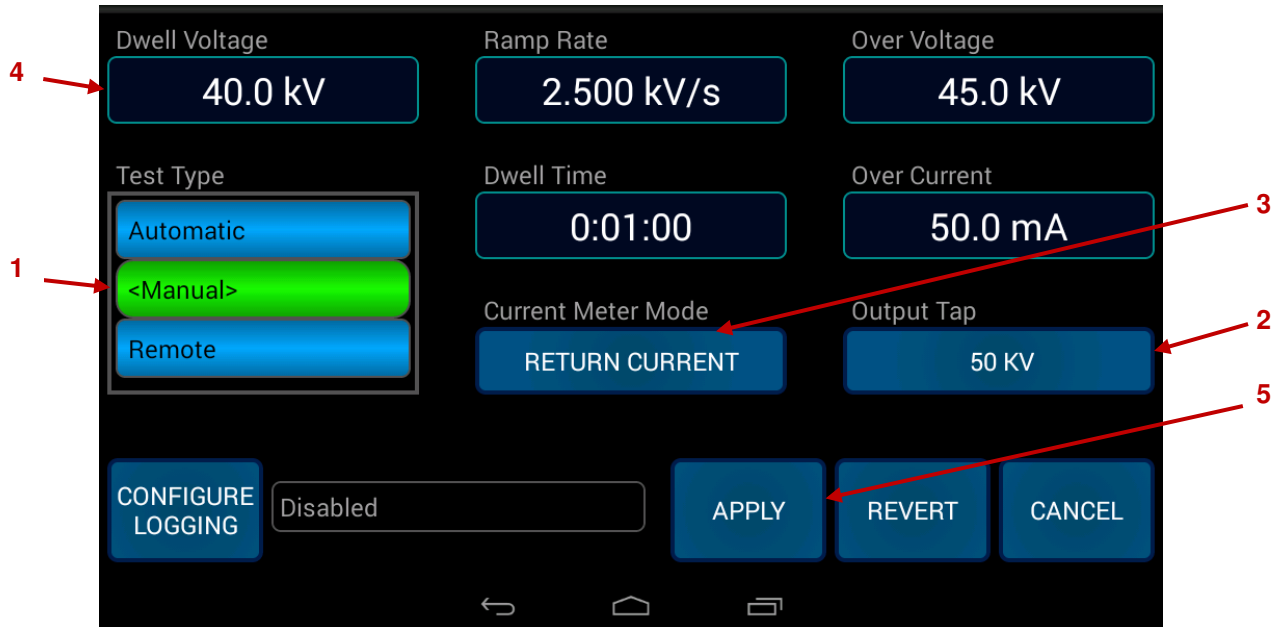
The general test procedure is as follows:

- A. Before powering on unit, ensure that the all steps of the ELECTRICAL SET-UP section have been followed.
- B. Power unit on with the main circuit breaker. After being powered on, the HMI take approximately 1 minutes to boot up. For the first 10-15 seconds, the HMI will show a black screen.
- C. Select high voltage transformer output tap (If equipped). When booting is complete, a tap section screen will display. Select the tap to be used to continue (the selected tap can be changed later). After tap is selected the main screen for operation will display.
- D. Set-up test configuration. Before a test can be done, the user must configure the test parameters. This is done by selecting the CONFIGURE TEST button on the right side of the Main Screen. See Configuration Screen section of manual for specific information about the parameters to be set.

TEST PROCEDURE: MANUAL TEST

The manual test procedure is as follows:

- A. Follow the General test up procedure.
- B. In the Configuration screen select Manual (1) under the Test Type, the desired Output Tap (if applicable) by pressing the Output Tap button (2), the meter return mode (3) and setting the desired test parameters (4). Then press the APPLY button (5) to return to the main operating screen.

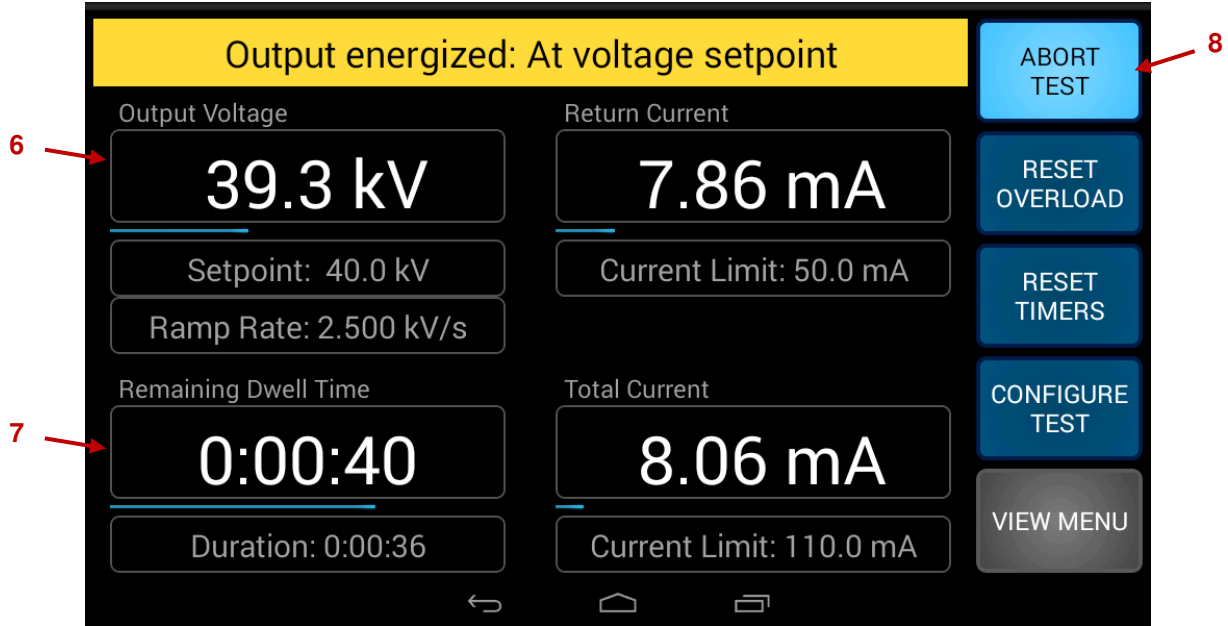
**CONFIG TEST: MANUAL**

- C. Start test by pressing the red HV-ON button on front panel.

CAUTION: The system is now energized; high voltage is now enabled to the output!

TEST PROCEDURE: MANUAL TEST (Cont'd)

- D. Increase voltage with Infinity Dial on front panel to run the Output Voltage (6) up to the desired test voltage. Dwell timer (7) will automatically count down when voltage is within $\pm 2\%$ of target voltage.



MANUAL MODE: OPERATING

- E. When test is complete or needs to be stopped, press the ABORT TEST button (8) on the MAIN SCREEN. This will cause the regulator to automatically run down to zero output. The main contractor will then be open. This causes less stress on unit. This method should be used in possible.

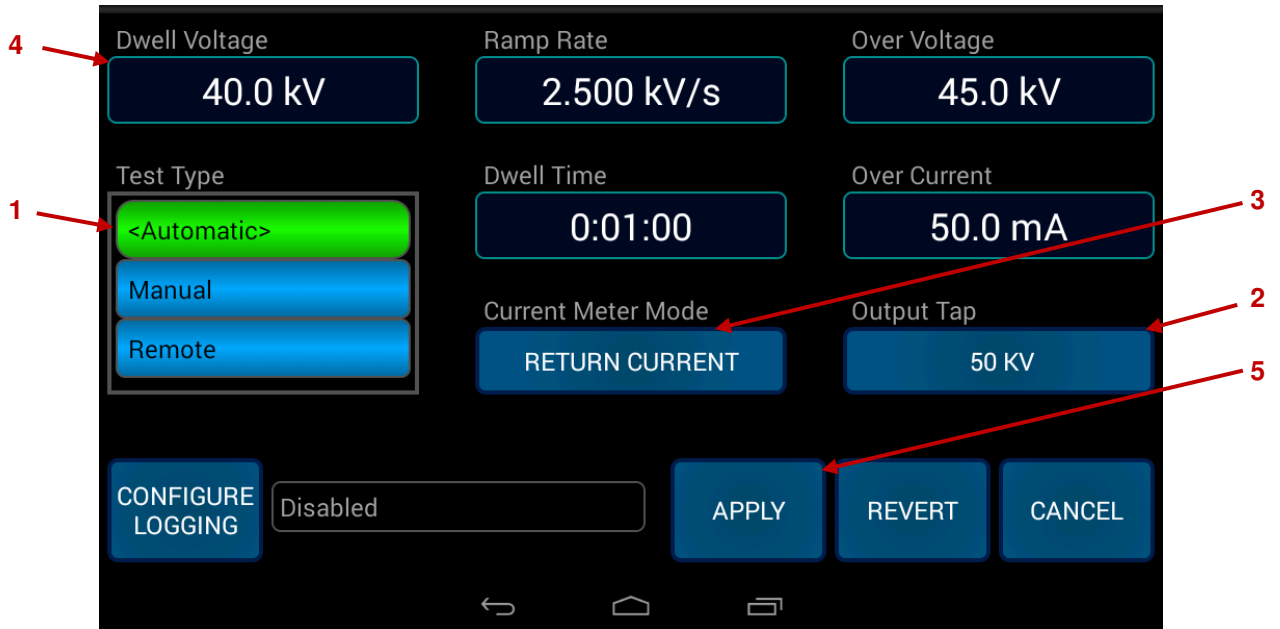
NOTICES:

- If high voltage needs to be turned off immediately, the green HV-OFF button on the front panel can be pressed.
- In an emergency, press the Emergency Off (E-STOP) button on the front panel. This is in series with the main contractor and will ensure output in de-energized.
- If during the test a failure should occur or if the OVER CURRENT or OVER VOLTAGE setting is exceeded, the high voltage will automatically shut off, the failure voltage will be stored, and the regulator will automatically return to zero. To regain high voltage, press RESET OVERLOAD button.

TEST PROCEDURE: AUTOMATIC TEST

The automatic test procedure is as follows:

- A. Follow the General test up procedure.
- B. In the Configuration screen select Automatic (1) under the Test Type, the desired Output Tap (if applicable) by pressing the Output Tap button (2), the meter mode (3) and setting the desired test parameters (4). Then press the APPLY button (5) to return to the main operating screen.

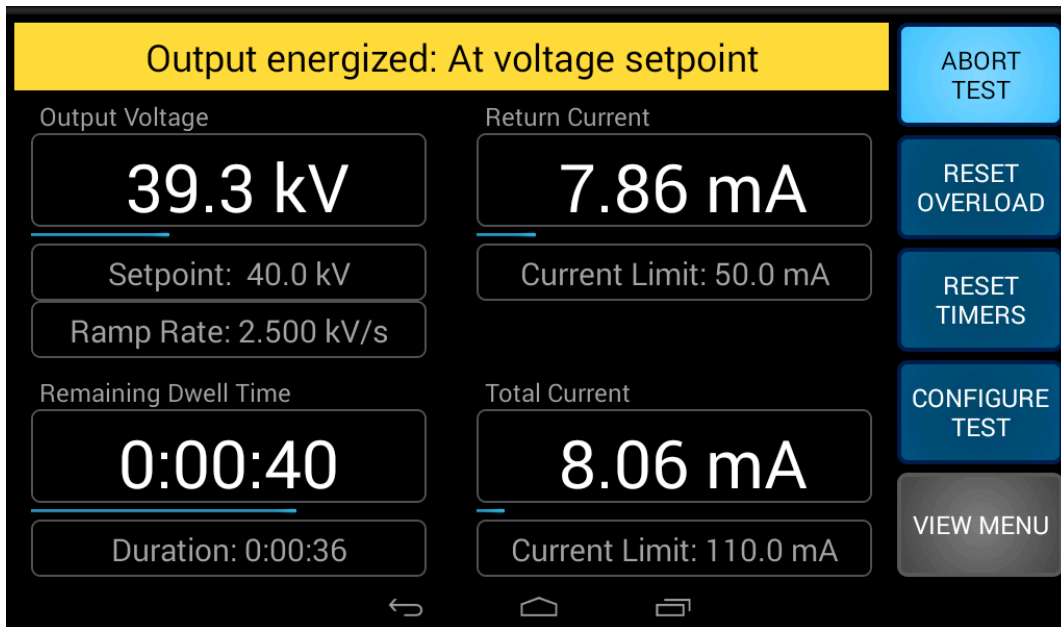
**CONFIG TEST: AUTOMATIC**

- C. Start test by pressing the red HV-ON button on front panel.

CAUTION: The system is now energized; high voltage is now enabled to the output!

TEST PROCEDURE: AUTOMATIC TEST (Cont'd)

- D. The unit will:
- I. Automatically start running the output to the desired Dwell Voltage.
 - II. Stay at Dwell Voltage for time specified on Dwell Timer.
 - III. Automatically run down the regulator to the zero position and open main contactor.

**AUTOMATIC MODE: OPERATING****NOTICES:**

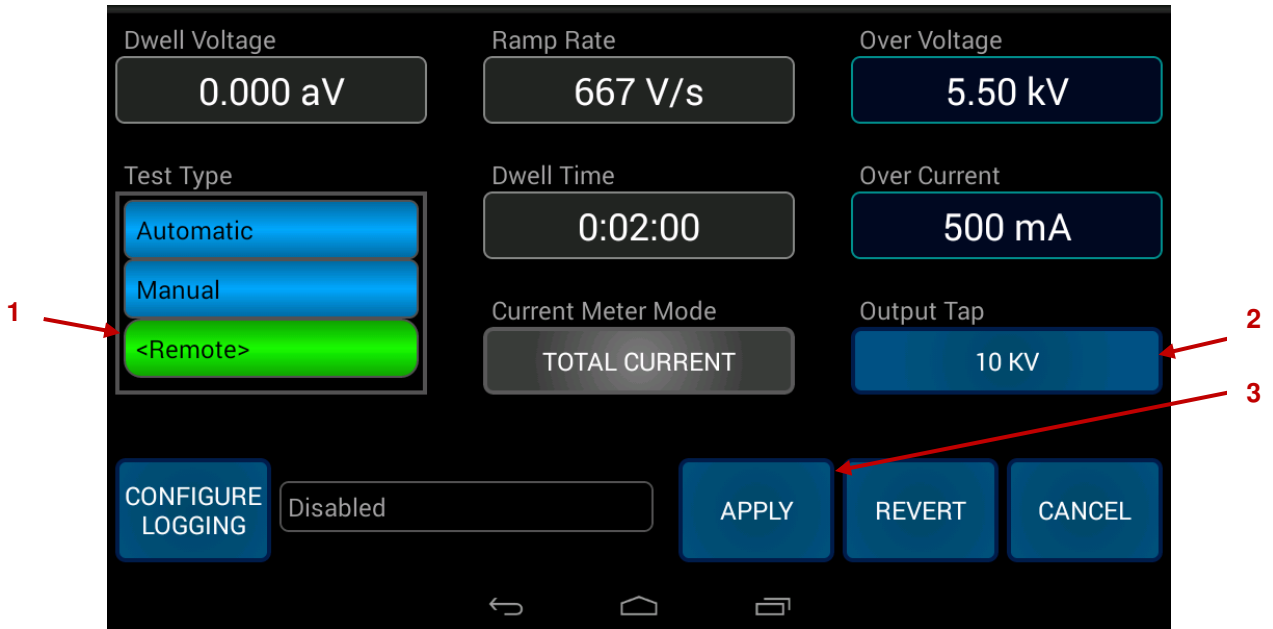
- At any point, the test can be stopped by pressing the ABORT TEST Button. The ABORT TEST Button will cause the regulator to automatically run down to zero output. The main contractor will then be opened. This causes much less stress on unit. This method should be used in possible.
- If high voltage needs to be turned off immediately, the green HV-OFF button on the front panel can be pressed.
- In an emergency, press the red Emergency Off (E-STOP) button on the front panel. This is in series with the main contractor and will ensure output in de-energized.
- If during the test a failure should occur or if the OVER CURRENT or OVER VOLTAGE setting is exceeded, the high voltage will automatically shut off, the failure voltage will be stored, and the regulator will automatically return to zero. To regain high voltage, press RESET OVERLOAD Button.

- E. The test is complete.

TEST PROCEDURE: REMOTE TEST

The remote test procedure is as follows:

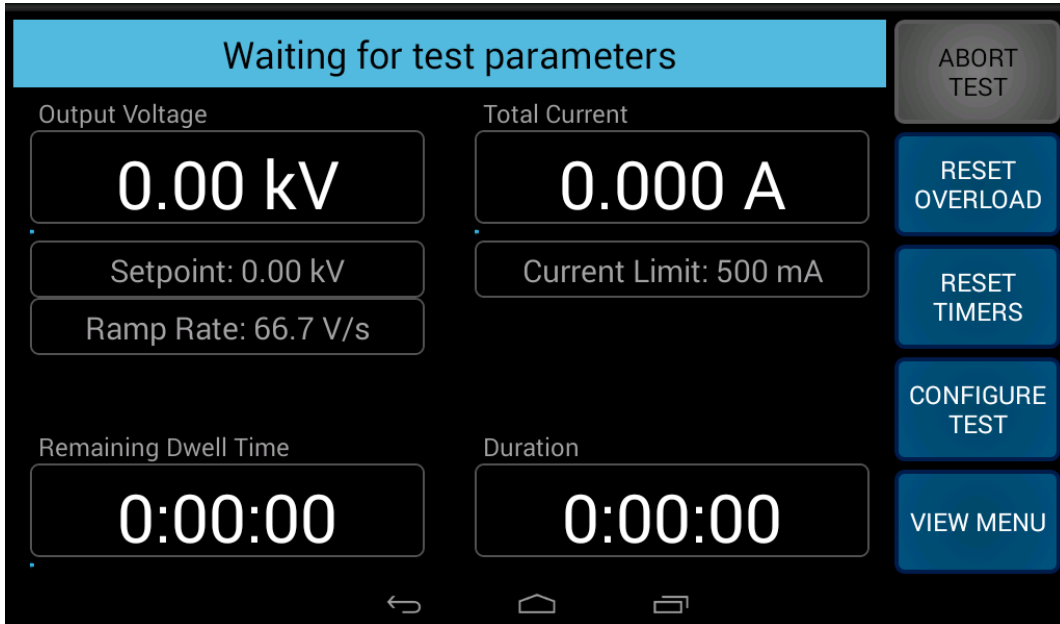
- A. Follow the General test up procedure.
- B. In the Configuration screen select Remote (1) under the Test Type, the desired Output Tap (if applicable) by pressing the Output Tap button (2). Then press the APPLY button (3) to return to the main operating screen.



CONFIG TEST: REMOTE

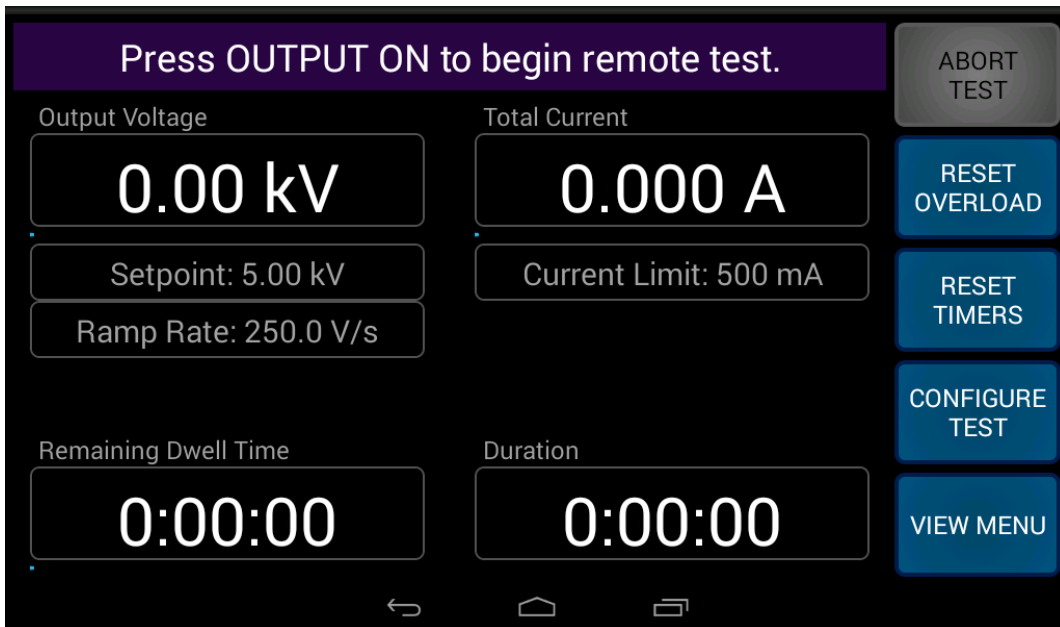
TEST PROCEDURE: REMOTE TEST (Cont'd)

- C. Operate the remote system to send test parameters to the test set. The test set will display "Waiting for test parameters". During this time, the unit cannot be enabled.



REMOTE CONTROL: WAITING FOR TEST PARAMETERS

- D. Once test parameters are received and the remote system sends the output enable command. The test set will prompt the operator to press the OUTPUT ON button to energize the system.



REMOTE CONTROL: READY TO ENERGIZE

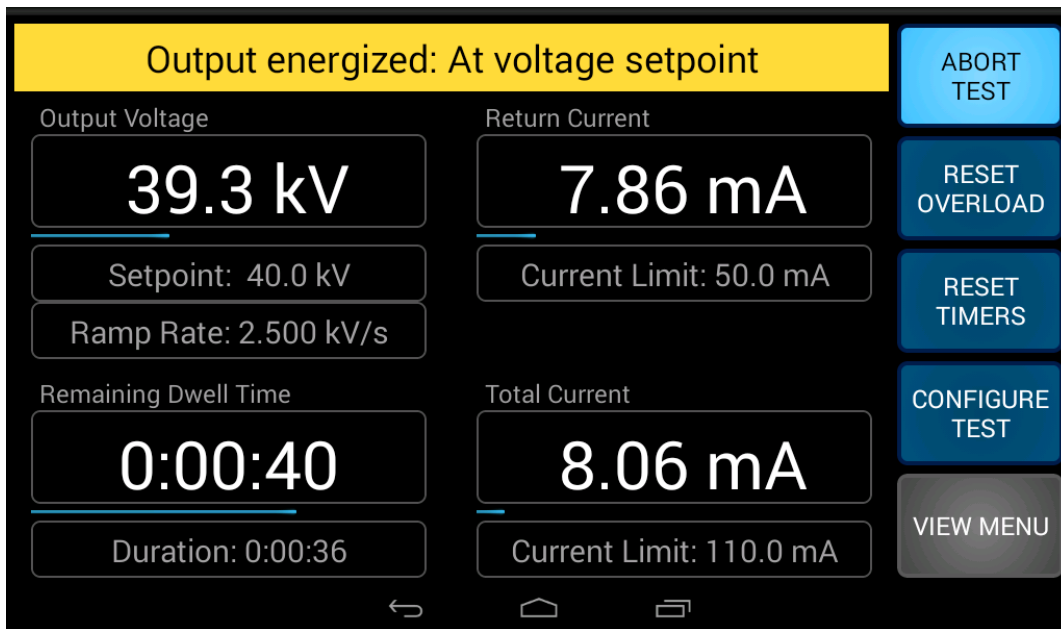
TEST PROCEDURE: REMOTE TEST (Cont'd)

- E. Start the test by pressing the red HV-ON button on front panel.

CAUTION: *The system is now energized; high voltage is now enabled to the output!*

- F. The unit will:

- I. Automatically start running the output to the desired Dwell Voltage.
- II. Stay at Dwell Voltage for time specified on Dwell Timer.
- III. Automatically run down the regulator to the zero position and open main contactor.



REMOTE CONTROL: OPERATING

NOTICES:

- *At any point, the test can be stopped by pressing the ABORT TEST Button. The ABORT TEST Button will cause the regulator to automatically run down to zero output. The main contractor will then be opened. This causes much less stress on unit. This method should be used in possible.*
- *If high voltage needs to be turned off immediately, the green HV-OFF button on the front panel can be pressed.*
- *In an emergency, press the red Emergency Off (E-STOP) button on the front panel. This is in series with the main contractor and will ensure output in de-energized.*
- *The remote system can also send a command to abort the test.*
- *If during the test a failure should occur or if the OVER CURRENT or OVER VOLTAGE setting is exceeded, the high voltage will automatically shut off, the failure voltage will be stored, and the regulator will automatically return to zero. To regain high voltage, press RESET OVERLOAD Button.*

TEST PROCEDURE: REMOTE TEST (Cont'd)

- G. The test is complete. The test set remains in remote control mode, waiting for the next command from the remote system.

The system is designed to operate with Phenix's Dielectric Test System (DTS) Windows software. DTS provides data acquisition, database, and report generation capabilities that enables you to save your dielectric test results in a historical database for future recall and report generation. DTS also gives you remote control capabilities, via Test Recipes, allowing you to monitor tests from your computer.

INSTALLATION

DTS is a MS-Windows application designed for use on the Windows 7 / 10 operating systems. Before you install DTS, make sure that you have a computer system that is capable of running the software effectively. The DTS computer system requirements are shown below.

Minimum System Requirements:

- Intel Pentium 1.0 GHz compatible computer greater
- 512 MB of system RAM or more
- 50 MB available hard disk space or more
- Microsoft Windows 7 / 10

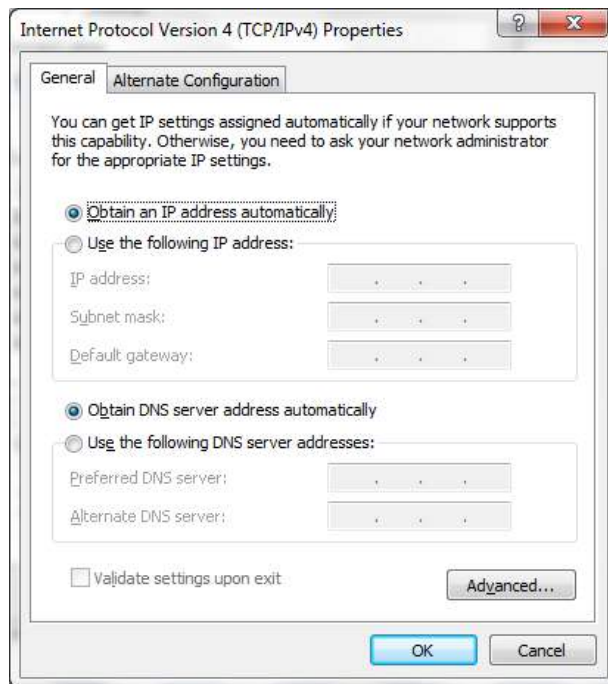
To Install DTS:

1. Insert the Dielectric Test System CD or USB device.
2. Run the setup file on the drive.
3. Follow the installation instructions as they appear on the screen.
4. When the installation is complete, double-click on the "Dielectric Test System" icon to launch the software.

CONNECTING TO TEST SET

Connection to the test set is made possible via a wired ethernet cable, or wirelessly via Wi-Fi. If test set is equipped with an ethernet jack, then an ethernet cable must be used. If there is no ethernet jack, then the test set is equipped with Wi-Fi.

1. Connect your PC to the test system.
 - a. For units with an ethernet jack, use a standard straight-through RJ-45 ethernet cable to connect between the test set and the PC. The cable must be connected before the test set is powered on.
 - b. For units with Wi-Fi, connect to the test sets 2.4GHz network from your PC. The networks SSID will include the test sets serial number. Use the given password to connect to the network.
2. The test system has a built-in DHCP server that will automatically assign an IP address to your PC. This requires that your PC is configured for DHCP, but all Windows PC's are configured this way by default. If your Ethernet port is configured with a fixed IP, then you will need to reconfigure it for DHCP like below:



DEFAULT DHCP CONFIGURATION

3. After you connect the cable, you may see a warning indicator on the system tray icon like below. Ignore this warning as it is only indicating that there is no internet connectivity available.



SYSTEM TRAY ICONS

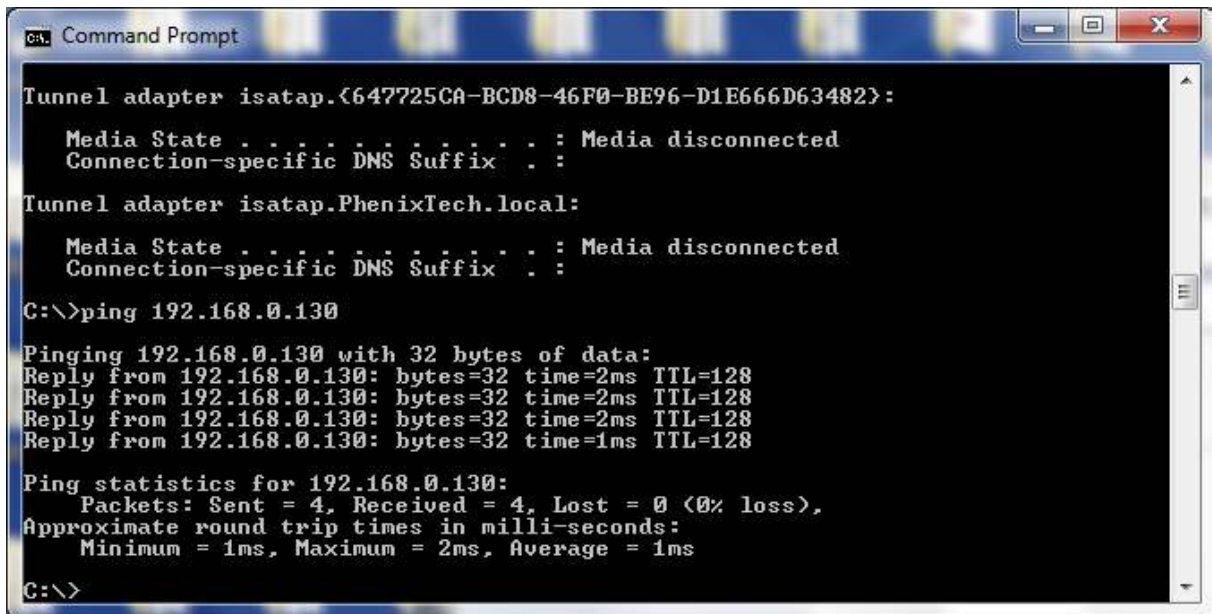
CONNECTING TO TEST SET (Cont'd)

4. The first time you launch DTS, you may see the Windows Firewall message below. Check the domain and private allow checkboxes and click "Allow access."

**WINDOWS SECURITY ALERT**

5. Launch the DTS software. When first launching DTS, it attempts to establish communication with the test set. If communication cannot be established, then DTS switches to LOCAL MODE. This mode allows you to view the test history and to maintain the test recipes. You can force DTS into this mode by clicking *Cancel* while DTS is attempting to establish communication.
6. If the software is unable to connect to the test set, then check the Controller Type setting in the DTS via Tools/General/Controller Type. For Phenix 600C products, select "PLC". For 600B select "Android". Close and relaunch the DTS software.
7. If the software is still unable to connect, use the ping utility in the command prompt window to test the connection. The command is: ping 192.168.0.130. See the figure below. If you are unable to successfully ping the test set, then there is a configuration or hardware problem in the connection.

CONNECTING TO TEST SET (Cont'd)



```
cs. Command Prompt
Tunnel adapter isatap.{647725CA-BCD8-46F0-BE96-D1E666D63482}:
    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :
Tunnel adapter isatap.PhenixTech.local:
    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :
C:\>ping 192.168.0.130
Pinging 192.168.0.130 with 32 bytes of data:
Reply from 192.168.0.130: bytes=32 time=2ms TTL=128
Reply from 192.168.0.130: bytes=32 time=2ms TTL=128
Reply from 192.168.0.130: bytes=32 time=2ms TTL=128
Reply from 192.168.0.130: bytes=32 time=1ms TTL=128

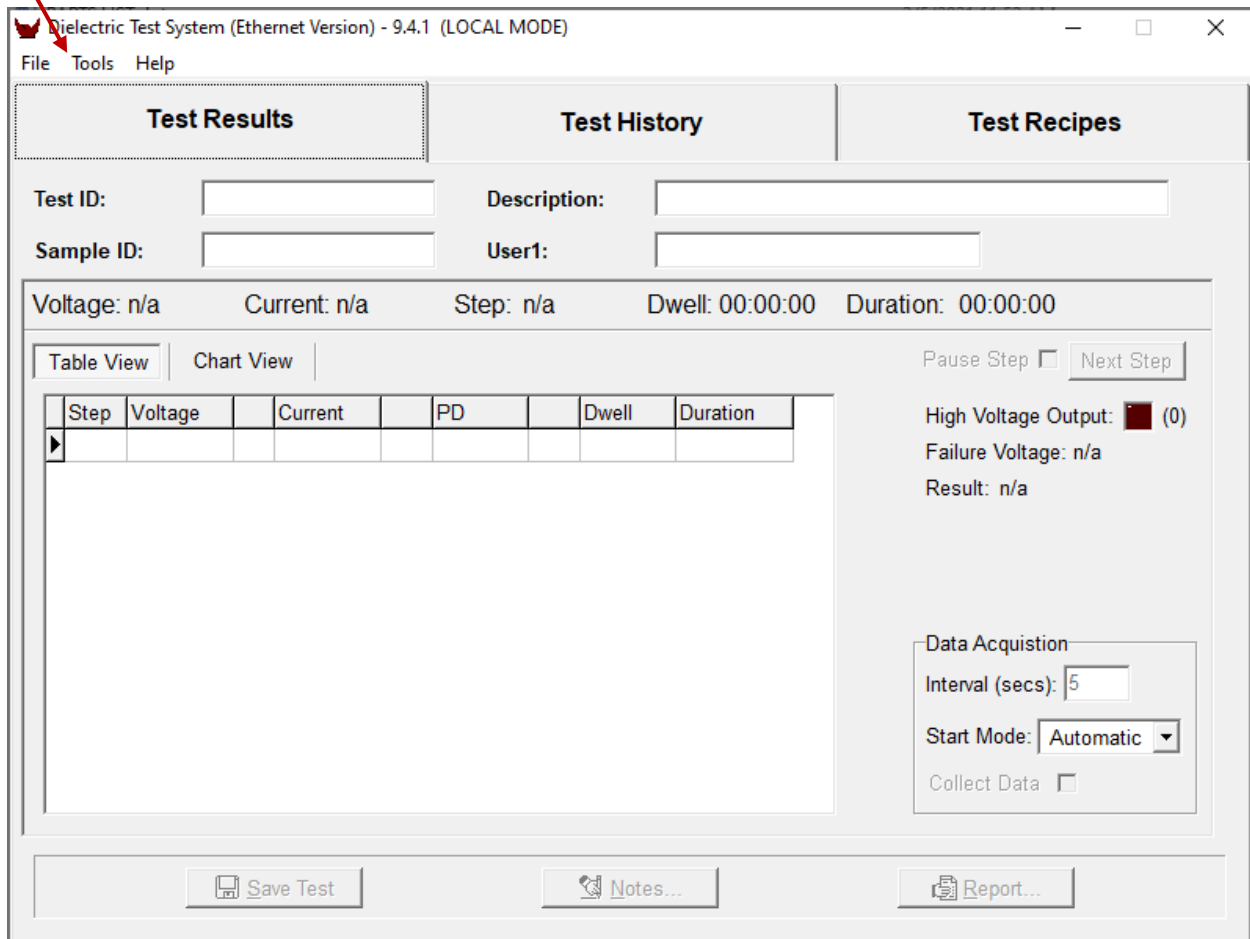
Ping statistics for 192.168.0.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms
C:\>
```

COMMAND PROMPT: PING

SETUP

Once the DTS software is installed, open the application up and select the Tools menu option to display the Setup menu. The setup screen allows the operator to set static information that configures how the application operates. Information such as, the type of controller, controller IP address, report header information, and report options are all configurable and saved for future operations.

1



DTS MAIN APPLICATION WINDOW

1. Tools menu option

SETUP: GENERAL

The screenshot shows the 'Setup: General' dialog box. It has four tabs: 'General', 'Labels', 'Data Logger', and 'Custom'. The 'General' tab is selected. The fields and options are as follows:

- Company:** Phenix Technologies
- Header 1:** Industrial Drive
- Header 2:** Accident, MD. 21520
- Header 3:** (301) 746-8118
- Data Path:** C:\ProgramData\Phenix\DieNet\
- Controller IP Address:** 192.168.0.130
- Controller Type:** PLC
- PD Scope Serial Port:** None
- PD2U Device Code:** (empty field)
- Report Options:**
 - Print Address in Header
 - Print Plot
 - Print Test Notes
 - Print Sign Off
 - Print PD Results
 - Send Directly To Printer
- Automatically Save Test Results:**
- Logo File Name (.BMP):** (empty field) with a 'Browse...' button.
- Buttons:** OK and Cancel.

Numbered callouts (2-12) point to the following elements:

- 2: Setup tabs
- 3: Company and Header information fields
- 4: Data Path field
- 5: Controller IP Address field
- 6: Controller Type dropdown
- 7: PD Scope Serial Port dropdown
- 8: PD2U Device Code field
- 9: OK and Cancel buttons
- 10: Browse... button
- 11: PD2U Device Code field
- 12: Report Options section

SETUP SCREEN: GENERAL

2. Setup tabs

The Setup screen has the follow tabs; General, Labels, Data logger, Custom. Click on the tab to display parameters stored under each category.

3. Header information

Enter Company and Header information to be displayed as part of the report. The Company field is the primary field that appears at the top of each report. Header 1 is the secondary field, and so on.

4. Data Path

Selects the directory to store report files.

5. Controller IP Address

Enter the AC Dielectric controller IP address. The default Phenix IP controller address is "192.168.0.130", but this may change based upon the requirements of the application.

6. Controller Type

Determines the controller communication protocol. For Phenix 600C products, select "PLC". For 600B select "Android".

7. PD Scope Serial Port

For units paired with a PD meter, select the serial port that the PC assigns to the PD meter. Refer to Windows Device Manager to help determine the serial number.

SETUP: GENERAL (Cont'd)

8. Automatically Save Test Results

Select the checkbox to automatically save test results after a test.

9. OK/Cancel Buttons

Press OK to save all parameters and return to the main application screen. Press Cancel to discard all changes and return to the main application screen.

10. Logo File Name

Press the Browse... button to select a .BMP image file as a logo for in the report header.

11. PD2U Device Code

Each Power Diagnostix PD meter requires a device code to enable communications. The device code must be correctly entered to receive data from the PD meter.

12. Report Options

Sets customized report options.

SETUP: LABELS

The labels options screen contains the field labels for the test result info fields. You may change any of these to suit your needs. These labels appear on the test results screen and on the test reports.

The screenshot shows a software window titled "Setup" with four tabs: "General", "Labels", "Data Logger", and "Custom". The "Labels" tab is selected. The window contains the following fields and controls:

- 1. Test ID: A text input field containing "Test ID".
- 2. Sample ID: A text input field containing "Sample ID".
- 3. Description: A text input field containing "Description".
- 4. User 1: A text input field containing "User1".
- 5. Reset Labels To Default: A button.
- 6. Language: A dropdown menu currently set to "English".
- 7. OK and Cancel buttons at the bottom right.

Red arrows point from numbers 1 through 7 on the left side of the image to the corresponding fields and controls in the screenshot.

SETUP SCREEN: LABELS

- 1. Test ID**
To add a test ID to identify a specific type of test in the report, enter the ID into the control box.
- 2. Sample ID**
To add a unique ID, like a serial number to the report, enter the ID to the control box.
- 3. Description**
To add a detailed description to the report, enter the description into the control box.
- 4. User 1**
To associate a specific operator that performed the test, enter the username into the control box.
- 5. Reset Labels To Default**
To reset the labels to the default settings, press the reset button.

SETUP: LABELS (Cont'd)**6. Language**

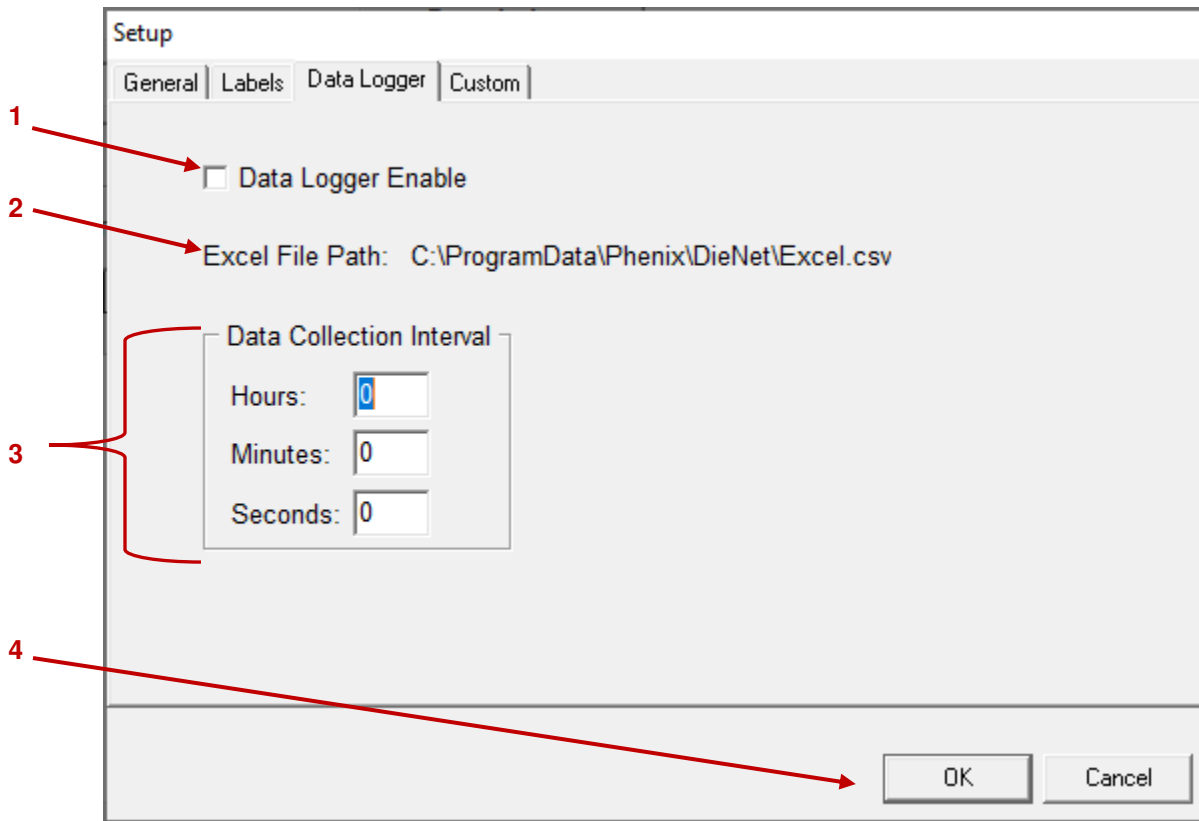
If the report needs to be converted to a different language select the language from the pull down box.

7. OK/Cancel

To save changes and return to the main operating screen press the OK button. Pressing the Cancel button discards any changes and returns to the main operating screen.

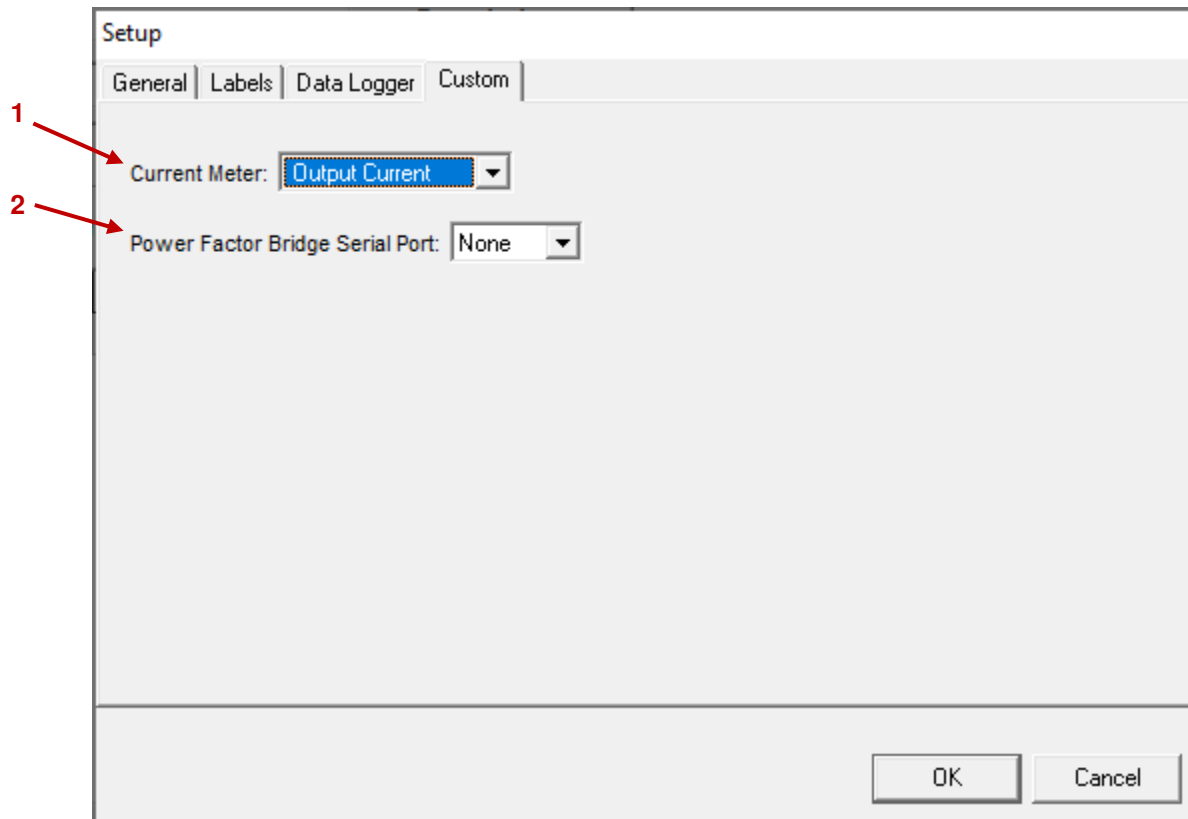
SETUP: DATA LOGGER

To log data at a specific interval during a test select the data logger tab of the setup screen.

**SETUP SCREEN: DATA LOGGER**

- 1. Data Logger Enable**
Select the Data Logger Enable checkbox to enable data logging for the application.
- 2. Excel File Path**
Displays the data logging file directory. Refer to the General Tab to set the data logging directory.
- 3. Data Collection Interval**
Set the interval that data is captured and logged in the terms of hour, minutes, and seconds.
- 4. OK/Cancel**
Press the OK button to save changes and return to the main application screen. Press Cancel button to discard changes and return to the main application screen.

SETUP: CUSTOM



SETUP SCREEN: CUSTOM

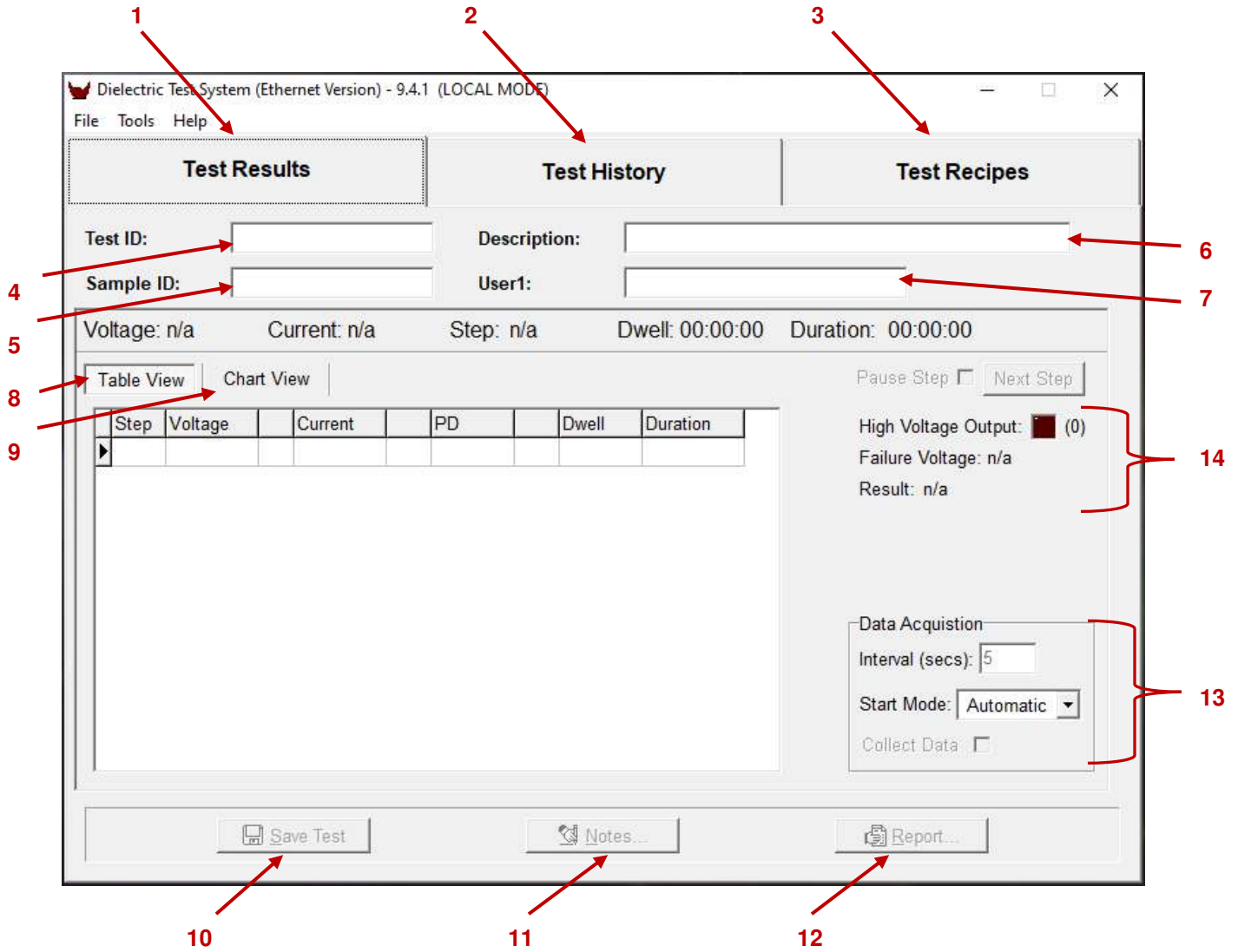
- 1. Current Meter**
Selects which current meter is logged.
- 2. Power Factor Bridge Serial Port:**
Used to select Power Factor Bridge device port.

OPERATIONS

Navigating DTS is made easy by the three large tabs. These tabs are always accessible and located at the top of every screen. These tabs provide access to the major areas of DTS: Test Results, Test History, and Test Recipes.

OPERATIONS: TEST RESULTS

The data acquisition screen displays the data collected by DTS in both a tabular and graphic form. This is also where you identify the test results and control the mode of acquisition. DTS continuously monitors the test set, displaying real-time meter data and the result of the current test.



DTS MAIN SCREEN

1. Test Results

The data acquisition screen. Shows the test identification fields and the current test results.

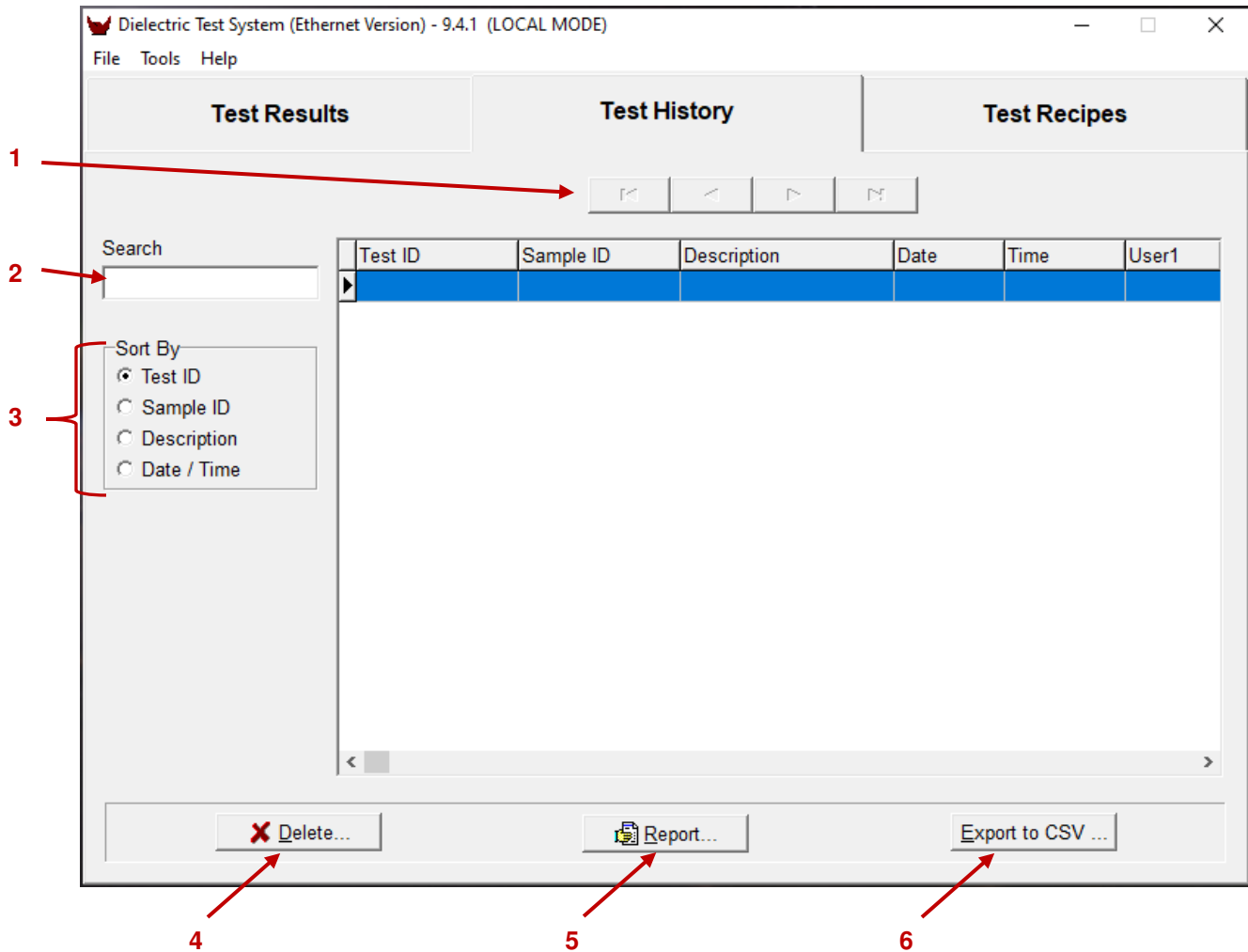
OPERATIONS: TEST RESULTS (Cont'd)

- 2. Test History**
Shows a list of the test history. From here you can generate test reports and sort or search your history of tests.
- 3. Test Recipes**
Contains the test recipe table. Here you can add delete or modify test recipes that may be used to initiate or download tests.
- 4. Test ID**
This field contains the unique label that will identify the test when it is saved to the test history.
- 5. Description**
This field contains a description of the test that will be saved with the test history.
- 6. Sample ID**
An additional ID field that will be saved with the test history.
- 7. User1**
An additional user definable field that will be saved with the test history.
- 8. Table View**
Click to view the data collected in a tabular form.
- 9. Chart View**
Click to view the data collected as a graph: plotted as voltage and current vs. time.
- 10. Save Test**
After the test is complete, enter data in the ID fields then click this button to save the test data to the test history.

***NOTICE:** This button is only enabled when there are new test results present that have not yet been saved to the test history. This button has no purpose when the Automatically Save Test Results option is checked.*
- 11. Notes**
Click to enter any additional test notes. Enter as many lines of notes as needed.
- 12. Report**
Click to generate a test report from the current test data.
- 13. Data Acquisition**
Determines the method of data acquisition. The *Each Step* mode will direct DTS to record a data point at the beginning and the end of a voltage level change. The *Time Interval* mode will direct DTS to record data points on a user definable time interval. To set the interval, enter the number of seconds between readings in the *Time Interval* field.
- 14. Test Status**
Displays information about the test, such as, whether the output is energized and the voltage if a fault occurred.

OPERATIONS: TEST HISTORY

The DTS keeps a history of all dielectric tests that have been performed.

**DTS TEST HISTORY**

- 1. Navigation Bar**
Use the navigation bar to highlight a specific test.
- 2. Search Field**
Use the search field to search for a specific item based upon the Sort By selector.
- 3. Sort By Selector**
Select the option to sort the results by; Test ID, Sample ID, Description, or Date/Time.
- 4. Delete Button**
Press to permanently delete the highlighted test results.
- 5. Report Button**
Press to generate a report of the highlighted test.

OPERATIONS: TEST HISTORY (Cont'd)

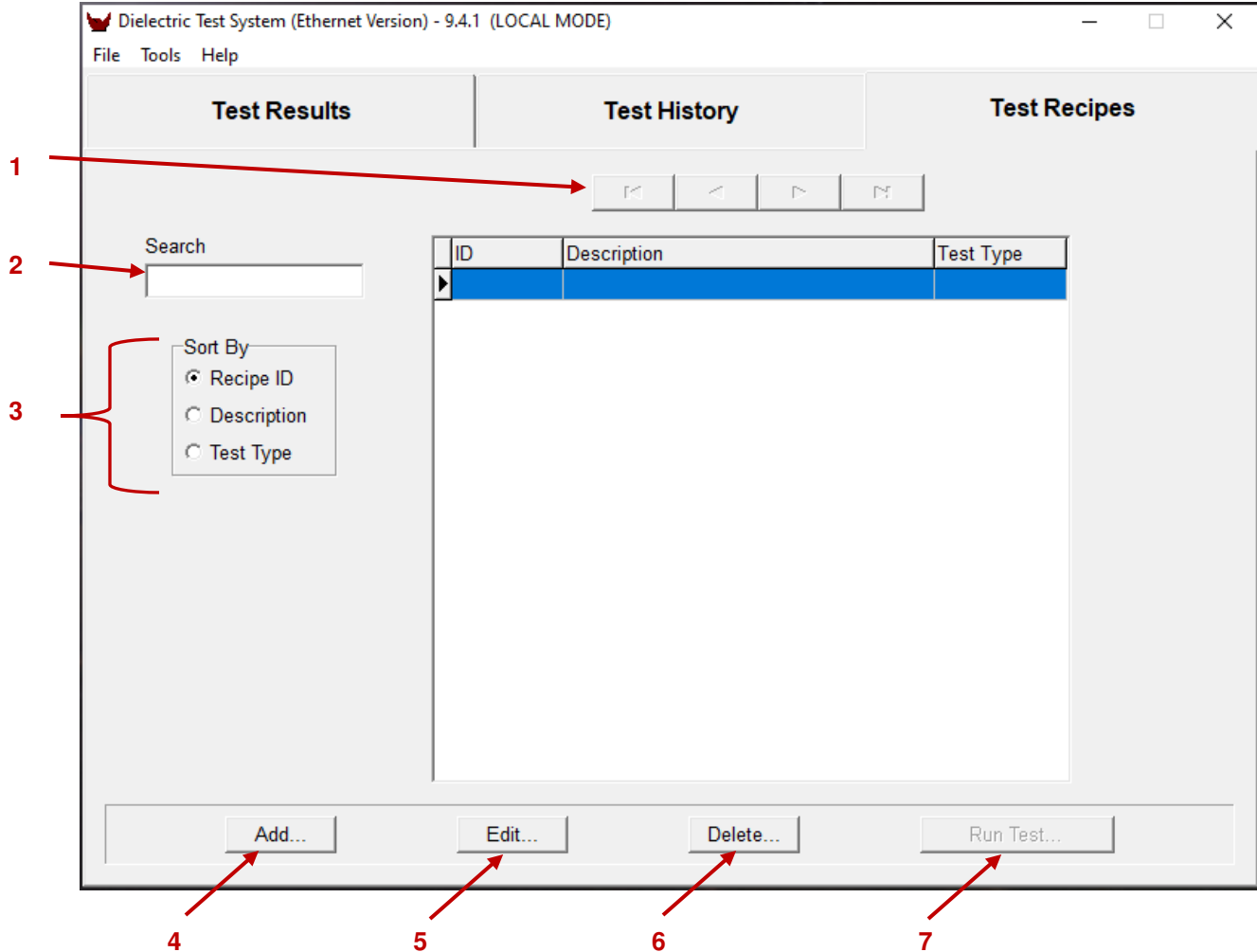
6. Export to CSV

Press to export the highlighted test to a separate file (CSV).

NOTICE: *The D149 report is a special report that is used when performing a dielectric strength test according to the ASTM D149 standard. This report requires that 5 or more tests are recorded for a given test specimen, then you select the tests that should be compiled into the report.*

OPERATIONS: TEST RECIPES

Test Recipes are a powerful feature of the DTS software. They allow you to predefine test sequences and then download these sequences into the test set. The Test Recipe screen contains the test recipe table. Here you can add, delete and modify test recipes.



DTS TEST RECIPES

1. **Navigation Bar**
Use the navigation bar to highlight a specific test recipe.
2. **Search Field**
Use the search field to search for a specific item based upon the Sort By selector.
3. **Sort By Selector**
Select the option to sort the recipes by; Recipe ID, Description, or Test Type.
4. **Add Button**
Click to add a new recipe. Select the Test Type and the tap that you wish to use during the test. Possible test types are: Step, Cycle, and Custom.

OPERATIONS: TEST RECIPES (Cont'd)**5. Edit Button**

Click to modify the selected recipe.

6. Delete Button

Click to delete the selected recipe.

7. Run Test

Click to run the selected recipe. The test sequence will be downloaded into the test set. You will then be prompted to press the ON button to begin the test.

OPERATION: TEST RECIPES: STEP TEST TYPE

The step test begins at a predefined voltage level then steps the voltage up at a fixed level, for a fixed dwell duration and for a fixed number of steps.

STEP TEST TYPE SCREEN

1. **Recipe ID**
Unique Identifier field that identifies the recipe in the table.
2. **Description**
Text field that can be used to describe the purpose of the recipe.
3. **Start Voltage**
The voltage level at the beginning of the test.
4. **Step Voltage**
The level of voltage increase at the beginning of each new step.
5. **Last Step**
The number of steps in the test sequence.
6. **Ramp Rate**
The rate of rise of the voltage increase at the beginning of each new step.

OPERATION: TEST RECIPES: STEP TEST TYPE (Cont'd)**7. Dwell Fields**

The amount of time (in hours, minutes and seconds) that the voltage remains at the new step level before increasing to the next level.

8. Last Dwell Fields

(optional fields): At times, you may want the final dwell in a test sequence to be different from the standard dwell time.

9. SAVE / Cancel Buttons

To save the new recipe the operator must press the SAVE button. Pressing the Cancel button will discard changes and return to the Test Recipe screen.

NOTICE: Items such as selected Tap, Overvoltage, and Overcurrent, are read from the Test Set at the time of the test.

OPERATION: TEST RECIPES: CYCLE TEST TYPE

The cycle test type begins at a predefined voltage level then alternately adjusts the voltage up (or down) to a second level for a fixed dwell duration and for a fixed number of cycles.

Recipes

Recipe ID: Description:

Cycle Test

	<u>First Dwell</u>	<u>Second Dwell</u>	<u>Max. Duration</u>
First Voltage (kV): <input type="text"/>	Hr.: <input type="text"/>	Hr.: <input type="text"/>	Hr.: <input type="text"/>
Second Voltage (kV): <input type="text"/>	Min.: <input type="text"/>	Min.: <input type="text"/>	Min.: <input type="text"/>
Number Of Cycles: <input type="text"/>	Sec.: <input type="text"/>	Sec.: <input type="text"/>	Sec.: <input type="text"/>
Ramp Rate: <input type="text"/> V / Second			

Save Cancel

CYCLE TEST TYPE SCREEN

1. **First Voltage**
The voltage level at the beginning of the test.
2. **Second Voltage**
The voltage level that the test cycles to after the first dwell.
3. **Number Of Cycles**
The number of cycles in the test sequence.
4. **Rate**
The rate of rise of the voltage increase or decrease at the beginning of each new cycle.
5. **First Dwell Fields**
The amount of time (in hours, minutes and seconds) that the voltage remains at the start voltage level before moving to the second level.

OPERATION: TEST RECIPES: CYCLE TEST TYPE (Cont'd)**6. Second Dwell Fields**

The amount of time (in hours, minutes and seconds) that the voltage remains at the second voltage level before moving back to the start level.

7. Max. Duration Fields

(optional field): Allows setting a time limit on total test duration. Test is aborted if limit is exceeded.

OPERATION: TEST RECIPES: CUSTOM TEST TYPE

The custom test type allows you to define the voltage level, dwell, and ramp rate for every step in the test sequence.

Recipes

Recipe ID: Description:

Custom Test

Navigation Bar: [Left Arrow] [Right Arrow] [Home] [Refresh] [Delete] [Insert...]

Step	Voltage (kV)	Dwell Hr.	Min.	Sec.	Rate (V/S)
▶					

Save Cancel

CUSTOM TEST TYPE SCREEN**1. Insert**

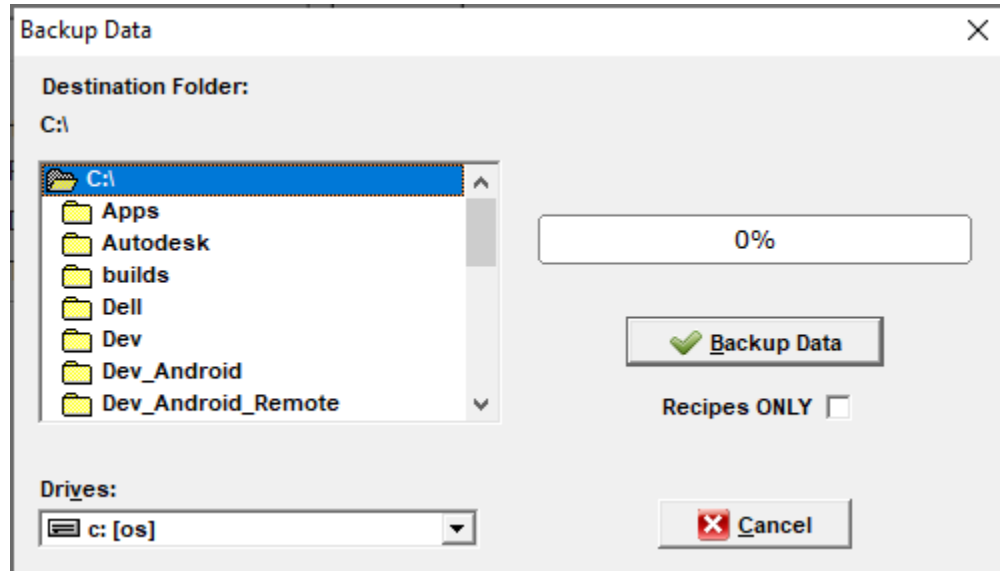
Use the Insert button to add a custom sequence of test steps with unique voltage set points, dwell time, and ramp rates. Pressing the insert button will prompt the operator to select the number of the step to insert. Once the operator presses the OK button to insert the step, then they can enter in the Voltage, Dwell (Hours, Minutes, and Seconds), and ramp rate of the test step in the step fields.

2. Navigation Bar

The Navigation Bar gives the operator the ability to select an available step. The operator is able to delete a selected step by pressing the "-" button.

TOOLS: BACKUP DATA

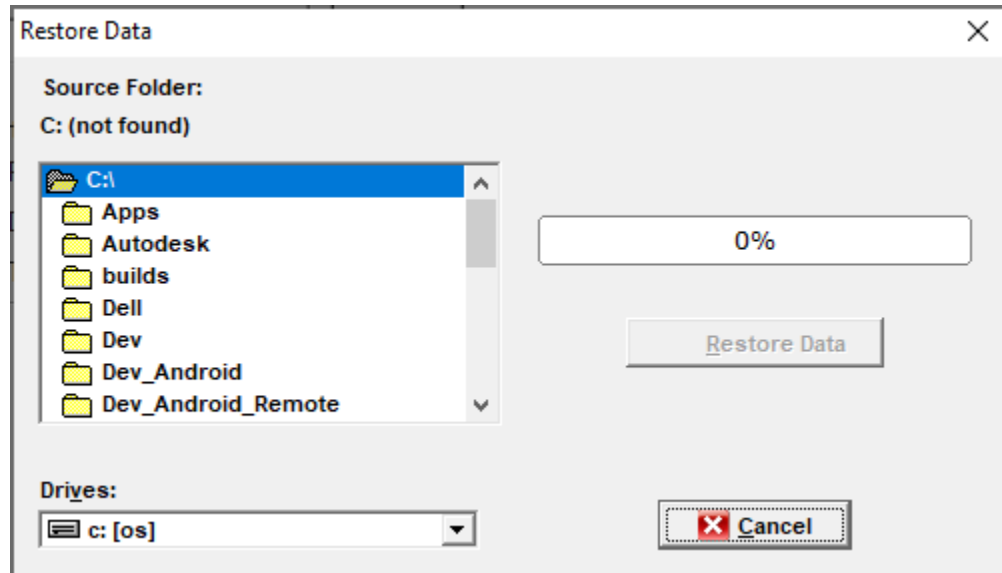
DTS data should be backed up on a regular basis. Hard disks do fail; you don't want to lose years of valuable data. We recommend that you maintain at least two separate backup disks (floppy disks or USB memory sticks). DTS has backup and restore functions that make this an easy task.

**BACKUP DATA SCREEN**

The backup data screen allows you to select a drive/directory as a destination for your data backup. Access this screen by selecting *Tools* and then *Backup Data*. Select the drive/directory and Click *Backup Data* to begin the backup.

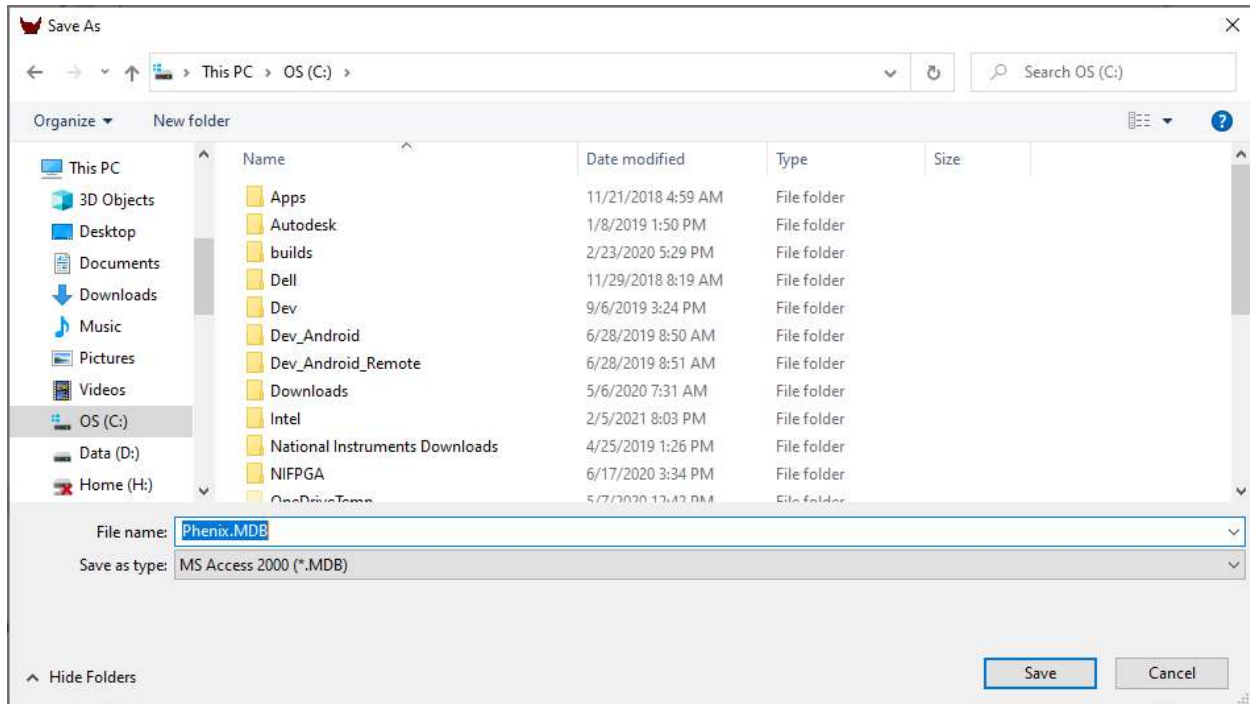
TOOLS: DATA RECOVERY

Should something happen and you need to restore data from a backup, DTS provides a similar function for restoring data. The Restore Data screen allows you to easily select a drive/directory as a source for data recovery. Access this form by selecting *Tools* and then *Restore Data*. Select the drive/directory and Click *Restore Data* to begin the data recovery.

**RESTORE DATA SCREEN**

EXPORT DATA

The data export function allows exporting all test results data from DTS to a Microsoft Access 2000 database and more recent versions. It is also operational in Excel.



DATA EXPORT SCREEN

The Data Export procedure is as follows:

1. Select the drive and directory where you would like the Access database file to be created. You may change the file name if desired.
2. Click Save to export the data.

REBUILD DATABASE TABLES

Occasionally, a database table or index file may become corrupt and unusable. DTS has a function that will rebuild all database files. If a database error occurs during software operation, this function should be executed. To rebuild the tables, select *Tools* and then *Rebuild Database Tables*.

WARNING!!!

Lethal voltages may be encountered when calibrating this equipment. Calibration should be performed by a qualified person.

It is strongly recommended that you read the entire calibration procedure before performing any steps, even if you are only performing one section of the calibration procedure.

CALIBRATION: GENERAL

All meters have been calibrated at the factory. Periodic check of calibration (validation) should be done at least annually. When performing calibration validations, it is recommended to check the following meters:

- AC Output Voltmeter
- AC Total Current Meter
- AC Return Current Meter (if applicable)

The general validation method is to compare the system’s display meter to a standard (reference) meter. Typically, a validation is done by connecting the reference meter to the system and operating the unit in manual mode; although, signal injection from a different power supply can be accomplished. Each meter should be validated at several points over the range of the meter. System’s with multiple meter ranges must validate several points over each meter range. It is recommended that validation and calibration points differ from each other. Recommended validation and calibration points are as follows:

POINT	VALIDATION (% of Range)	CALIBRATION (% of Range)
1	10%	5%
2	30%	25%
3	50%	45%
4	70%	65%
5	90%	85%
6	100%	105%

The general equation for calculating percent error of a meter is to subtract the system meter value from the standard meter value and divide the difference by the standard meter value. Multiply the result by 100 to convert the result into a percentage. The equation is as follows:

$$\frac{\text{SYSTEM} - \text{STANDARD}}{\text{STANDARD}} \times 100 = \text{PERCENT ERROR}$$

NOTICES:

- *It is imperative that the standard meter have a better metering accuracy than the system meter.*
- *The standard meter itself must have a valid calibration.*
- *Refer to the technical specifications section of this document for information about meter accuracy.*

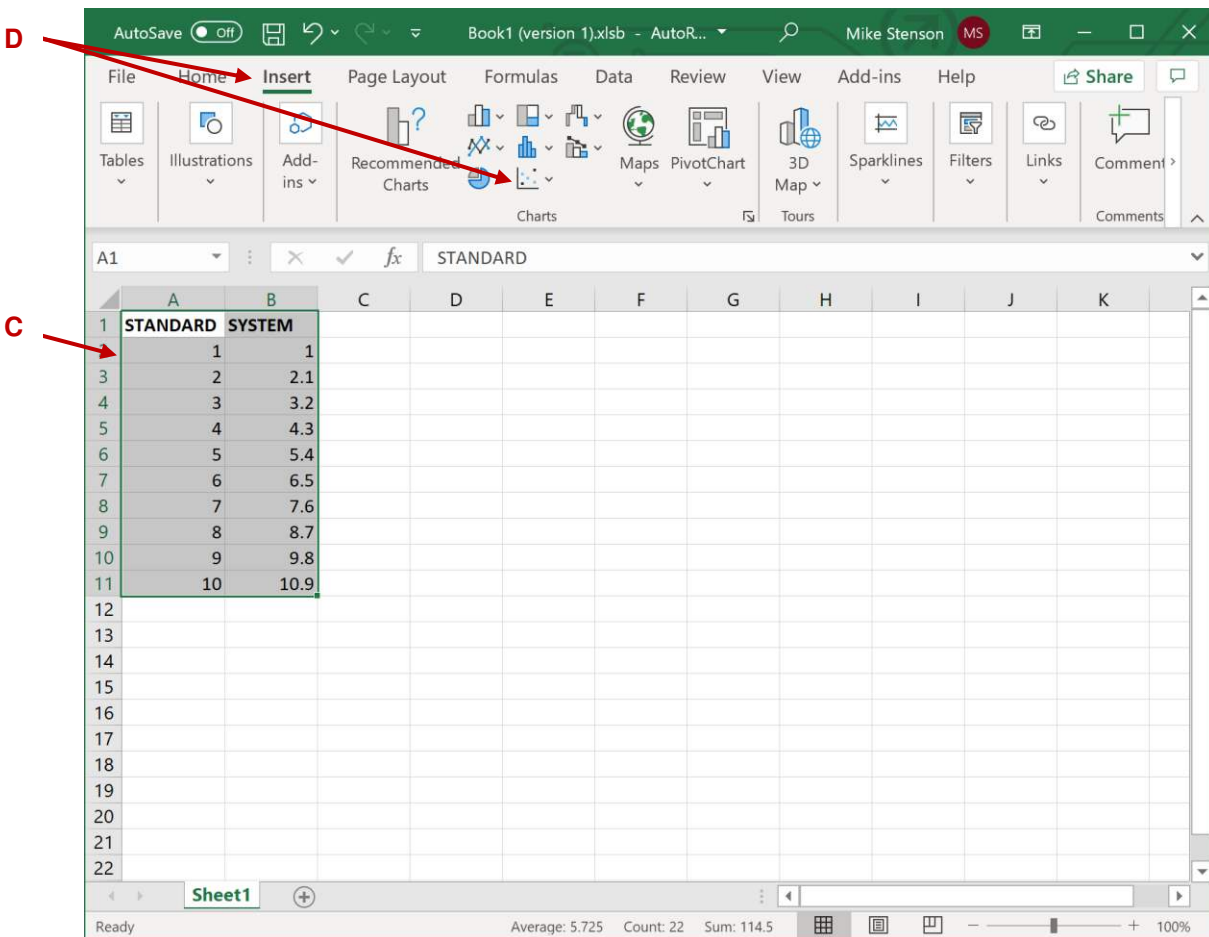
CALIBRATION: GENERAL (Cont'd)

It is recommended that the system is only recalibrated if the validation fails or is close to failing to meet the meter specifications. If the estimated drift percentage indicates that the meter will fall outside of specification before the next scheduled validation, then it is recommended to recalibrate. If an adjustment is required, follow this general procedure to calculate a new calibration factor.

- A. Record the standard and system meter values for each of the following points.

POINT (% of Range)	STANDARD READING	SYSTEM METER
5%		
25%		
45%		
65%		
85%		
105%		

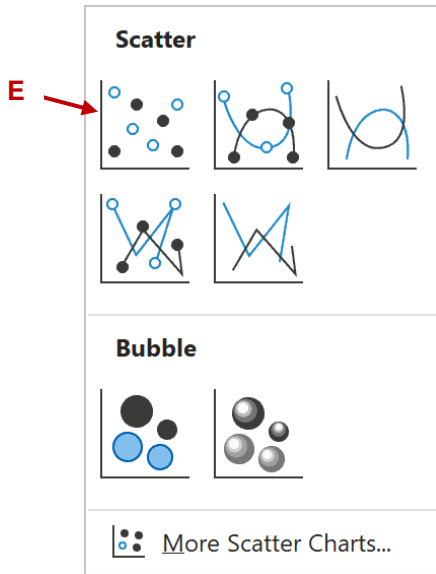
- B. Enter the points into a Microsoft Excel worksheet.
- C. Highlight the data by clicking and dragging the mouse over all the data.



- D. Insert a chart by selecting the Insert Tab and then click Charts.

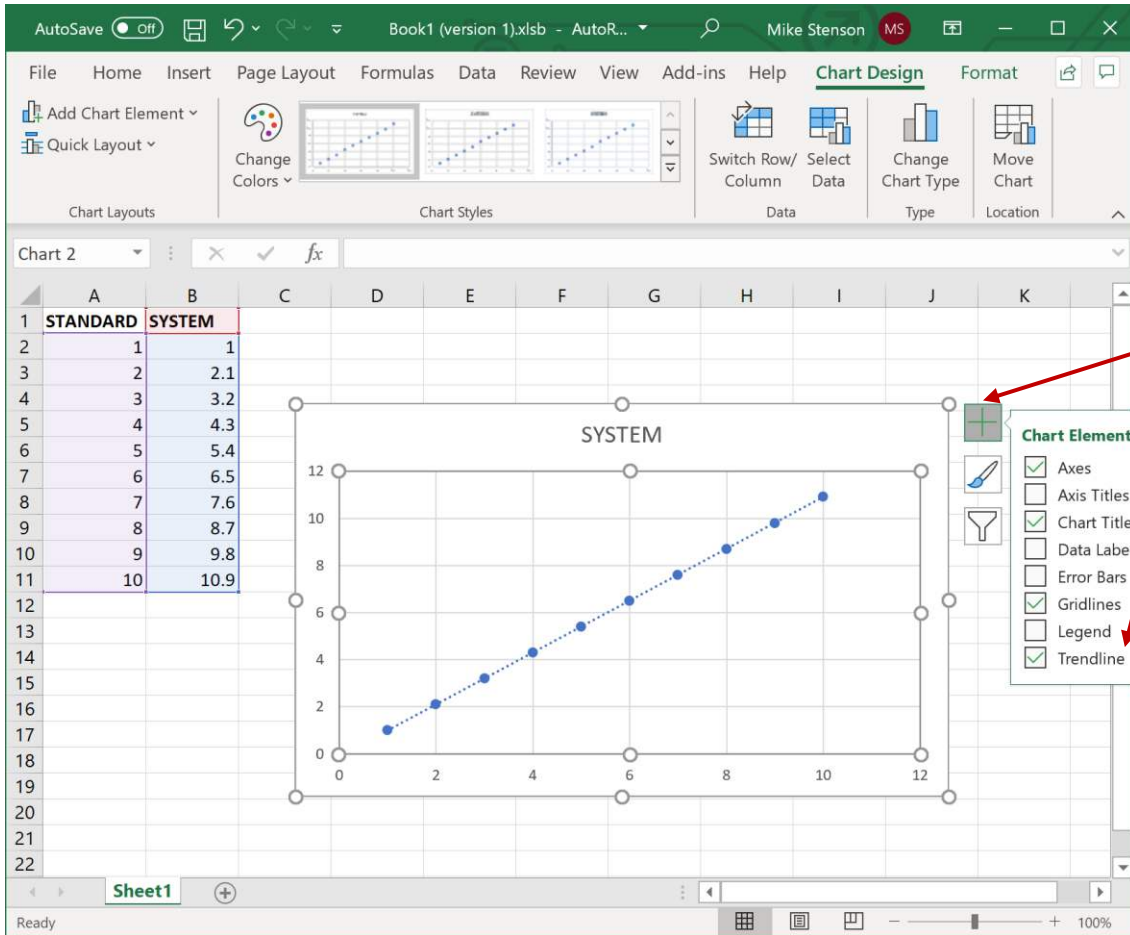
CALIBRATION: GENERAL (Cont'd)

E. Select a scattered chart from the pulldown list of charts.



CALIBRATION: GENERAL (Cont'd)

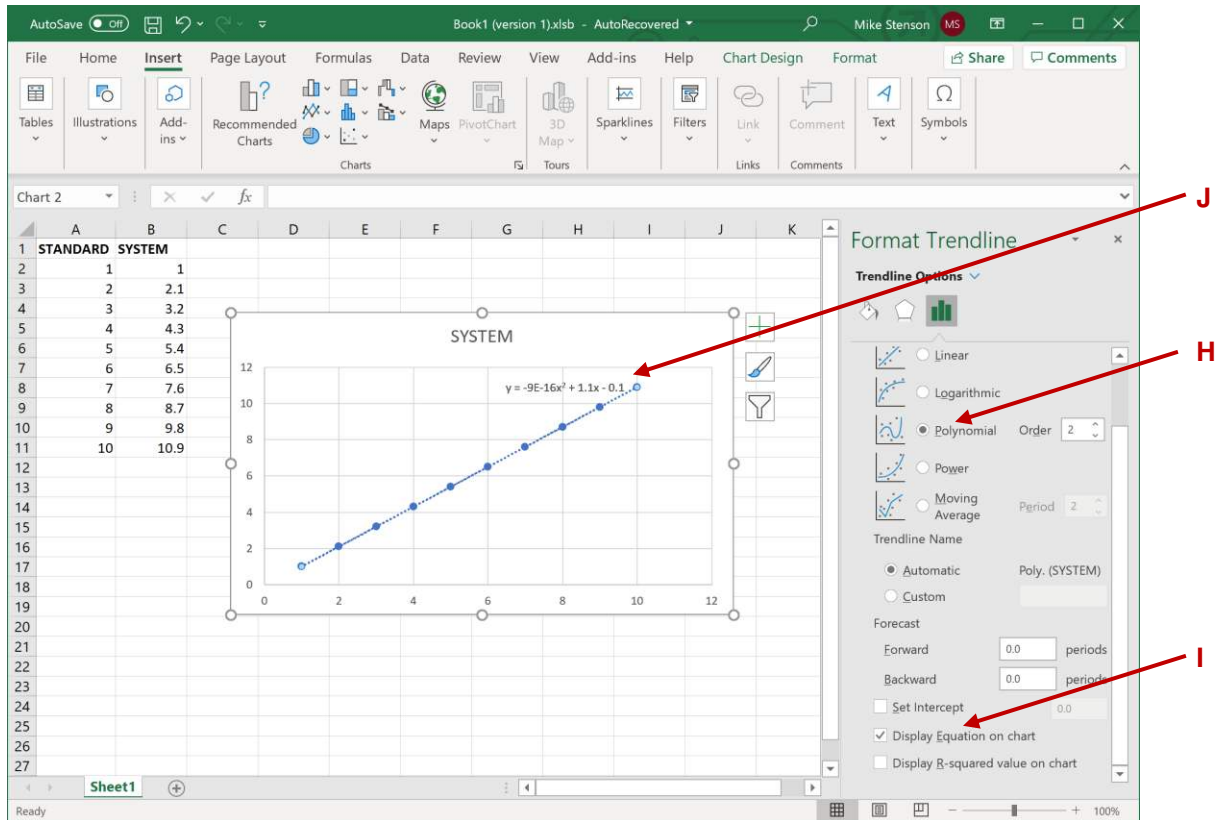
- F. A chart will appear on the worksheet with the data that was highlighted. Click on the chart elements button and select Trendline.



- G. Mouse over Trendline and Select more Trendline options (not shown)

CALIBRATION: GENERAL (Cont'd)

- H. Select Polynomial on the Format Trendline options.
- I. Select Display Equation on Chart.



- J. Enter the Calibration screen on the system and enter the new equation information into the system. Refer to the Operating Instructions section for additional information on how to enter the new calibration factor into the system.

NOTICE: The system must be revalidated after new calibration data is entered!

CALIBRATION: AC OUTPUT VOLTMETER

AC Hipots are configured to measure the AC peak and divide it by the square root of 2, which is common in insulation-based systems to nominalize the measurement to an RMS value. This is often called “peak responding, calibrated to RMS” or “peak responding square root of 2”. Peak responding square root of 2, is not equivalent to RMS, care must be taken to ensure the meter is calibrated properly. The system’s AC voltmeter reads a metering card that measures the analog signal and calculates a metered value to pass into the controller’s analog input. The metering board itself is calibrated at the factory and should not need validated or recalibrated as part of the normal maintenance calibration schedule. Refer to the metering board subsection for additional information about calibrating its meters.

To validate and calibrate the system’s AC voltmeter, perform the following procedure:

1. Ground the output terminal of the test set.
2. Connect a calibrated standard meter to the output terminal of the test set. Confirm that the standard meter input is rated for the meter range that is to be tested. If necessary, add an appropriate divider to the front end of the standard meter.
3. Set the standard meter to measure peak responding square root of 2. It may be necessary to select peak and perform a calculation of the standard meter’s value to determine the peak responding, calibrated to RMS value.

V(peak)STANDARD

$\sqrt{2}$

4. Remove the ground from the output terminal.
5. Operate the test set in manual mode, recording five or more points of both the standard meter and the system meter over the range of the meter.
6. Follow the procedure in the General Calibration section to recalibrate the system.

CALIBRATION: AC TOTAL CURRENT METER

The system's Total Current meter measures the total output current of the system. This measurement includes losses in the system's transformer in addition to the load of the specimen under test. The Total Current meter is calibrated to True RMS. The system receives an analog signal representing the AC True RMS value of the current from the metering board. Refer to the Metering Board subsection for additional information about calibrating its meters.

To validate and calibrate the system's AC current meter perform the following procedure:

1. Ground the output terminal of the test set.
2. Disconnect the output transformer's return from ground. Connect a calibrated standard meter to the transformer's return to ground. Confirm that the standard meter input is rated for the meter range that is to be tested. If necessary, add an appropriate CT divider to the front end of the standard meter.
3. Set the standard meter to measure RMS.
4. Remove the ground from the output terminal.
5. Operate the test set in manual mode, recording five or more points of both the standard meter and the system meter over the range of the meter.
6. Follow the procedure in the General Calibration section to recalibrate the system.

CALIBRATION: AC SPECIMEN CURRENT METER (IF APPLICABLE)

If the system is configured with a specimen current meter, the meter is designed to measure the return current from a device under test, prior to returning to the output transformer's ground, thus eliminating metering the losses in the system's transformer. The system receives an analog value of the current from the metering board, PCB1387. Refer to the Metering Board subsection for additional information about calibrating its meters.

To validate and calibrate the system's AC current meter perform the following procedure:

1. Ground the output terminal of the test set.
2. Connect a calibrated standard meter to the output terminal of the test set to ground. Confirm that the standard meter input is rated for the meter range that is to be tested. If necessary, add an appropriate CT divider to the front end of the standard meter.
3. Set the standard meter to measure RMS.
4. Remove the ground from the output terminal.
5. Operate the test set in manual mode, recording five or more points of both the standard meter and the system meter over the full range of the meter. It is recommended to select a point slightly below and above the rated range to calculate the most accurate polynomial equation.
6. Follow the procedure in the General Calibration section to recalibrate the system.

CALIBRATION: METERING BOARD (PCB1387)

PCB1387 contains the following meters:

- Primary Overload
- AC Output voltmeter (Peak Responding Square root of 2)
- AC Total Current meter (True RMS)
- AC Specimen Current meter (If applicable)

CALIBRATION: METERING BOARD PCB1387: PRIMARY OVERLOAD

The system is designed with an independent AC overload current meter for additional safety. The overload meter is designed to fault the system if the HV transformer's primary current exceeds the absolute maximum. This meter is independent of the specimen and total current meter used to measure the HV transformer current output. This meter is calibrated at the factory and should not need to be recalibrated as part of the normal maintenance calibration schedule. Refer to the Electrical Schematic section of this document to review the system's overload metering and trip point.

WARNING: *Inaccurately calibrating this meter can result in permanent damage to the system!*

1. With the test set off, place a CT with meter on the regulator output line.
2. Short the output of the high voltage transformer to ground.
3. Operate the test set in manual mode and slowly raise the regulator output while watching the regulator output current.
4. The overload should trip at 110% of the rated current.
5. If it does not, adjust the potentiometer R72 on PCB1387 until the system's output trips and "Short-term regulator overload detected" is displayed as a status message. Repeat this process until R72 does not need adjusted.

CALIBRATION: METERING BOARD PCB1387: AC OUTPUT VOLTAGE METER

The AC Output Voltmeter does not require any board level calibration. If board level adjustments are made, the system level meter will need recalibrated.

CALIBRATION: METERING BOARD PCB1387: AC TOTAL CURRENT METER

The AC Total Current meter does not require any board level calibration. If board level adjustments are made, the system level meter will need recalibrated.

GENERAL

If the controls do not operate properly after having been used according to the instructions, the following should be checked.

- Check main facility input power to the test set.
- Check indicating lamps. (Spare lamps are available through Phenix Technologies.)
- Check operation of the circuit breakers. Display should be on when the circuit breaker is on.
- Check fuses.
- Check all plug connections on the test set, internal and external.

SPECIFIC PROBLEMS

This section identifies specific problems that may arise with the test set and lists items to check as part of the troubleshooting process for each problem.

SPECIFIC PROBLEM: HIGH VOLTAGE CANNOT BE TURNED ON

- A. External interlock is open.
- B. Regulator is not in lower limit position.
- C. Protection circuit (Overcurrent) is not reset.
- D. Faulty relay contacts.
- E. Faulty HV On switch.
- F. Faulty Reset relay.

SPECIFIC PROBLEM: VOLTAGE CONTROL INOPERABLE

- A. High voltage is not on (Main contactor not energized or see above).
- B. Faulty motor assembly.
- C. Faulty variable auto-transformer.
- D. Faulty high voltage transformer.

SPECIFIC PROBLEM: NO HIGH VOLTAGE OUTPUT

- A. Defective metering circuit.
- B. No input to voltage regulator section, possible problems with main contacts, variable transformer, or regulator circuit breaker.
- C. Shorted high voltage output.
- D. Defective high voltage output transformer.
- E. Defective TX1 cable or connector.

SPECIFIC PROBLEM: VOLTMETER INOPERABLE

- A. High voltage output shorted to ground.
- B. Damaged or inoperative Measurement Divider Switch (If equipped).
- C. Meter defective.
- D. Faulty TX1 interconnect cable (if equipped)
- E. Faulty circuit on PCB1387.

SPECIFIC PROBLEM: PRIMARY OVERLOAD INOPERABLE

- A. Improper sensitivity (adjust Overcurrent Trip, R1, on front panel).
- B. Defective U13 on PCB 1387.
- C. Check the +15 volts DC and -15 volts DC regulator (U16, U17).
- D. Check Overcurrent lamp and relay K7 on PCB 1387.

SPECIFIC PROBLEM: CURRENTMETER INOPERABLE

- A. Connections between the test set and the test specimen are open.
- B. Faulty, TX1 interconnect cable.(if equipped)
- C. Meter defective.
- D. Faulty Circuit on PCB1387.

CONTROLS/REGULATOR

The only mechanical maintenance needed on the control panel is that it be kept clean. No solution or chemical stronger than an ordinary household cleaner such as Formula 409 or denatured alcohol should be applied to the control panel. Care must be used when cleaning the meter faces and panel. Abrasives may remove printing and descriptive titles and scratch meter faces. When cleaning, always have unit disconnected from power source.

CAUTION: *Never attempt to clean inside the unit as the cleaning solution may damage electronic components.*

HIGH VOLTAGE TRANSFORMER

All surfaces are finished with heavy duty polyurethane paints and will provide adequate protection against the elements in normal use. It is recommended that the painted steel surfaces be wiped down with a light cleaner such as Formula 409 or denatured alcohol for longer life and for proper electrical operation of the unit. Also inspect any vessel containing oil for leakage. If an oil leak is found, consult the Phenix Technologies' Service Department.

CAUTION: *Denatured alcohol must be used carefully. It is extremely flammable in either liquid or vapor. It is poisonous. Refer to MSDS for more information.*

Under normal conditions, transformer oil level and purity will remain acceptable. At timed intervals depending on use, the oil purity should be checked in the high voltage sections to verify its reliability.

With units designed with an oil filled transformer tank, an oil level check should be part of a routine inspection. Oil filling requires a specific oil type and a vacuum be placed on the transformer tank. Follow the procedure below for filling the transformer tank.

NOTICE: *Some tanks are not designed for self-vacuum and must be vacuumed in a chamber. If in doubt as to design, consult Phenix Technologies Service Department.*

1. Close all valves on the tank (cooling system, breather/dryer, oil drain, etc.) to assure the ability to vacuum.
2. Remove the oil fill plug on the header and connect the vacuum line at this location.
3. Vacuum the tank until 100 microns has been obtained.
4. Remove the NPT plug for the oil drain valve at the bottom of the tank and connect the oil fill line from the vacuum filter system at this location.
5. Once a vacuum of 100 microns has been obtained, open the oil drain valve and begin filling the tank with transformer oil at a rate of 1.0 to 1.4 GPM. The oil shall be passed through the vacuum filter system before entering the tank. Continue to vacuum the tank during the oil fill.

The dielectric strength of the oil entering the tank after passing through the vacuum filter system shall be verified per ASTM D877 using a gap of 0.1 inch. If the value is less than 35 KV, the oil shall be recycled through the vacuum filter system until 35 kV has been obtained.

6. Once the tank has been filled to the proper level, stop the oil fill process and close the oil drain valve.
7. Disconnect the oil fill line and the vacuum line.

The most reliable means of determining the purity of the oil in the field is to test the dielectric strength. Available test sets for this purpose differ in design, particularly in the shape of the electrodes and the test container. Tests on samples from the same oil carried out with electrodes of different types give different breakdown values for the same distance between the electrodes. Oil test values should therefore always be accompanied by information about the type of test gap used. The most common types of test gaps are:

- Type A., Spheres, 12.5 mm in diameter (JIS C2101)
- Type B, Flat discs, 25 mm in diameter (ASTM D877)
- Type C, Segments of spheres (mushroom), 35 mm in diameter, with face radius 25 mm (IEC 156, ASTM D816).

For field testing, Phenix employs Type B, flat discs, which is per ASTM specification D877. Irrespective of which type of test gap is used, it is important that container and electrodes be well cleaned and dried before oil filling. Cleaning should be done per the instructions with the oil testing equipment. Sample the oil both at the top and the bottom of the transformer if possible. Phenix Technologies recommends a minimum test level of 30 kV when using the ASTM D877 test procedure. If the oil tests lower than this, consult the Phenix Service Department for recommendations. If re-filtering is recommended, proceed as follows:

1. The purification of contaminated oil in a transformer is carried out by circulating the oil between the transformer and the purification plant, drawing off the oil at the base and returning it at the top of the transformer. If the oil is heated in the purification plant, a stratification of heated and unheated oil will take place in the transformer. As the different oil layers mix very little, the circulation of the oil quantity will be more effective, thus reducing the time needed for treatment of the oil.
2. Circulation of the oil is carried on until oil tests indicate that the desired oil quality is obtained.
3. After circulation, the oil level is adjusted in accordance with the instruction plate on the transformer to the correct level at the prevailing oil temperature. When making or changing connections, always fill the feed hose completely with oil before opening the bottom valve on the transformer. If this precaution is not taken, the air in the hose, which may have considerable volume, will be forced into the transformer with the oil stream.

NOTICE: *If air has been injected into the oil, it is recommended that a period of two days be allowed after completion of oil filling until energizing to allow the oil to absorb any occluded air or gas in the insulation.*

SPECIFICATION

Transformer oil is a high-quality insulating oil specially refined and formulated to meet the exacting requirements of major electrical equipment manufacturers and users.

Transformer oil is used as the insulating and cooling medium for oil-immersed transformers where a high quality straight mineral oil is desired. It is also recommended for arc-forming apparatus such as switches, circuit breakers, tap changers, reclosers, and fuses. A typical oil used is Superfine™ Transformer Oil.

GENERAL CHARACTERISTICS

Characteristics of oil with good insulating properties are as follows:

1. **High Dielectric Strength:**
High electrical insulating values as shown by their dielectric strengths of over 30,000 volts.
2. **Excellent Oxidation Stability:**
Excellent oxidation stability and high resistance to sludging provide protection, particularly where high temperatures are likely to be encountered. These products are specially refined to ensure long time service with minimal maintenance.
3. **Freedom of Contaminants:**
Absence of organic acids, corrosive sulfur, and other foreign materials, which might affect metals or insulation, ensures long life for the oil as well as the electrical units.
4. **High Interfacial Tension:**
High interfacial tension shows the absence of soluble polar contaminants. Refinery sealed containers assure maintenance of purity in transit.
5. **Good Heat Transfer Properties:**
Good circulation and rapid transfer of heat from the coils to the cooling fins are assured by low viscosities at all operating temperatures.

METHODS AND CRITERIA

Below are test methods and pass criteria specifications for testing Hydrodec Superfine™ transformer oil. Refer to oil manufacturer's specification sheet for detailed information.

TEST	METHOD	UNITS	SPECIFICATION
Moisture	ASTM D1533	mg/kg	35 max
Color	ASTM D1500	ASTM	0.5 max
DDF (Power Factor) @100°C	ASTM D924	Units	0.3 max
Breakdown voltage (2mm gap)	ASTM D1816	kV	35 min
Inhibitor Content	ASTM D2668	%w/w	0.30 max
Interfacial tension	ASTM D971	dynes/cm	40 min
Density @15°C	ASTM D1298	g/ml	0.91 max
Viscosity @ 100°C	ASTM D445	cSt	3.0 max
Viscosity @ 40°C	ASTM D445	cSt	12.0 max
Viscosity @ 0°C	ASTM D445	cSt	76.0 max
Refractive Index	ASTM 1218	Units	
Carbon N%	ASTM D2140	%	
Carbon A%	ASTM D2140	%	
Carbon P%	ASTM D2140	%	
Corrosive Sulfur	ASTM D1275B		Noncorrosive
PCBs – Detection Unit 1 mg/kg	ASTM D4059	mg/kg	Not Detected
Flash Point	ASTM D92	0°C	145 min

TYPICAL TEST DATA SPECIFICATIONS (SUPERFINE™ TRANSFORMER OIL)

SECTION 14: MAINTENANCE SCHEDULE

Below is a general guide schedule for maintaining the test set. Refer to the appropriate sections in this manual for maintenance instructions.

NOTICE: *This schedule is intended as a general guide. Preventive maintenance frequency checks will depend on the duty cycle and the environmental conditions for the Test Set. If questions, consult the Phenix Technologies' Service Department.*

SCHEDULE				
	At Setup	As Needed	Every 6 months	Every Year
Clean surfaces	X	X		
Check regulator drive chains and sprockets	X		X	
Check regulator filters and fans	X		X	
Check transformer oil level	X			X
Check oil purity (only required if oil leaks)	X	X		
Transformer silica gel (if present)			X	
Check regulator brushes			X	
Calibration:				
Primary Overload	X			X
Voltmeter	X			X
Current Meter(s)	X			X

MAINTENANCE SCHEDULE

In some instances, there is a requirement for transporting the equipment from one location to another for on-site field testing. In such cases, the following precautions should be followed:

CONTROL /REGULATOR SECTION

Disconnect and rap all cabling securing them with cable ties. Store the cabling in the appropriate bin or bag. Close all covers and secure latches. Use an appropriate number of personal to lift and move heavier units. If transporting in vehicle secure with straps to prevent unit from tipping, sliding, or rattling/vibrating. After transportation, upload unit and visually inspect for any damage that may have occurred.

TRANSFORMER

If unit has a separate transformer check for oil leaks and cracks. If none are present, secure all covers and secure latches. If unit is equipped with hand card, load transformer onto it. If there no hand card, use and appropriate number of personals and lift and move the transformer. If transporting in vehicle secure with straps to prevent transformer from tipping, sliding, or rattling/vibrating. After transportation, upload transformer and visually inspect for any damage that may have occurred. Check for oil leaks and cracks.

If the equipment will be stored for a prolonged period, the following precautions are recommended.

1. The equipment should be protected from the elements and kept in a warm, dry environment (95% maximum humidity, 5 to 50 degrees C).
2. If the high voltage transformer is not a dedicated outdoor unit and is to be stored outdoors, it should be completely covered to prevent damage from environmental conditions.
3. In no case should the control console or regulator sections be stored outdoors (unless previously specified in the original purchase agreement).
4. Prior to placing the equipment back into operation, all aspects of the maintenance schedule should be strictly adhered to.

SECTION 17: CIRCUIT DIAGRAM SYMBOLS

17-1

CIRCUIT DIAGRAM SYMBOLS
SYMBOLS POUR SCHEMA DE CIRCUIT
SYMBOLE ZU SCHEMA

REF	SYMBOL	DESCRIPTION	DESCRIPTION	BEMENKUNG
A		Amplifier	Unite d'amplificateur	Verstärker
ARSR		Surge Arrestor	Parafoudre	Ueberspannungsableiter
C		Capacitor	Condensateur	Kondensator
BSHG		Bushing	Traversée	Durchfuehung
C		Electrolytic Capacitor	Condensateur électrol	Eleckrolytik kondensator
F		Fuse	Fusible	Sicherung
CT		Current Transformer	Transformateur de Courant	Stromtransformer
CB		Circuit Breaker	Intérupteur	Unterbrecher
K		Relay, Contactor	Relais, Contacteur	Relais, Schütz
L		Inductor	Self	Drossel, Spule
MOT		Motor	Moteur	Motor
MOV		Movistor	Parafoudre	Movistor
NE		Neon	Parafoudre	Ueberspannungsableiter
LP		Lamp, Indicator	Lampe	Meldeleuchte
R		Resistor	Resistance	Widerstand
R		Variable Resistor	Resistance Variable	Widerstand
T		Transformer	Transformateur	Transformer
TB		Terminal Block	Borne	Lösbare Klemme
X		Connector	Prise de Courant	Steckverbindung
K		Relay Contact Normally Open	Contact Normalement Ouvert	Schlierskontakt
K		Relay Contact Normally Closed	Contact Normalement Fermé	Oeffnungskontakt
K		Changeover Contact	Contact de Changement	Umschaltkontakt
		Shielded Wire	Cable blindé	Abgeschirmetes Kabel
TR		Transistor	Transisteur	Transistor
M		Analog Meter	Instrument Analogue	Analog Meter
D		Diode	Diode	Diode
Z		Zener	Diode Zener	Zener
SCR		Thyristor	Thyristor	Thyristor
SW		Normally Open Maintained Switch	Interrupteur Normalement Maintenu Ouvert	Schrittschalter (Schliesser)
SW		Normally Closed Maintained Switch	Interrupteur Normalement Maintenu Fermé	Schrittschalter (Oeffner)
SW		Normally Closed Momentary Switch	Interrupteur Normalement Fermé Momentanement	Druckschalter (Oeffner)
SW		Normally Open Momentary Switch	Interrupteur Normalement Ouvert Momentanement	Druckschalter (Schliesser)
DP		Current Overload Device	Dispositif De Sûr Intensité	UeberstromschutzEinheit

SCHEMATIC DRAWING NUMBERS

This section lists the Phenix drawing numbers and drawing descriptions that are contained in the system.

<u>DRAWING NUMBER</u>	<u>DESCRIPTION</u>
	(110-120V)
9602168	SYSTEM OVERVIEW DIAGRAM
7612168	CONTROL SCHEMATIC
7632168	HIGH VOLTAGE CYLINDER

Replacement parts are available from Phenix Technologies, Inc.

Changes to Phenix Technologies' products are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest technical improvements developed in our Engineering Department.

NOTICE: *It is important when ordering parts to include the SERIAL NUMBER of the unit as well as the PART NUMBER of the replacement part.*

When your purchase order is received at our office, a representative of Phenix Technologies will contact you to confirm the current price of the part being ordered. If a part you order has been replaced with a new or improved part, an Applications Engineer will contact you concerning any change in part number.

Send orders for replacement parts to:

**Service Department
Phenix Technologies, Inc.
75 Speicher Drive
Accident, Maryland 21520**

**Phone 1 (301) 746-8118
Fax 1 (301) 895-5570
E-mail: info@phenixtech.com**

SECTION 20: PARTS LIST

20-1

CONTROLS

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>QTY</u>
CAT5 CBL	1001489	ETHERNET CABLE	1
D101-2	1780025	DIODE	2
ENCDR101	1004000	ENCODER	1
ENCDR101	1355325	KNOB	1
HDMI CBL	1001419	HDMI CABLE	1
MP101	1001238	MICRO CONTROLLER	1
MP102	1001291	WIFI MODULE	1
PS101	1590136	POWER SUPPLY	1
R101	1722100	RESISTOR	1
SW101	1860795	CONTACTOR	1
SW101	1860796	SWITCH	1
SW102	1861427	RED LENS	1
SW102	1420162	RED LED	1
SW102-3	1861426	CONTACT	2
SW102-3	1861429	MOUNT	2
SW103	1420161	GREEN LED	1
SW103	1861428	GREEN LENS	1
TS101	1001237	TOUCH DISPLAY	1
TS101 CBL	1001242	CABLE	1
TS101 DB	1001240	DRIVER BOARD	1
TS101DBCBL	1001241	CABLE	1
USB101	1001393	USB JACK	1
USB101CBL	1001414	USB CABLE	1
USBHUB101	1001500	USB HUB	1
PCB1387	31138716	PCB 1387 METERING	1
PCB1425	31142502	PCB 1425 INTERFACE	1

SECTION 20: PARTS LIST

20-2

REGULATOR SECTION

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>QTY</u>
BRDG101	1789205	BRIDGE	1
C101	1098940	CAPACITOR	1
C102	1093070	CAPACITOR	1
C103-6	1098100	CAPACITOR	4
CB101	1601330	CIRCUIT BREAKER	1
CB102	1601415	CIRCUIT BREAKER	1
CBL INPUT	30110008	POWER CABLE	1
CBL TX1	30160001	TX1 CABLE	1
CON101	1151178	RECEPTACLE	1
CON101	1151182	PINS	3
CON102	1151102	RECEPTACLE	1
CON102	1151107	PINS	1
CON103	1153910	MOLEX PLUG	1
CON103	1153915	MOLEX PIN	2
CT101	1892003	CURRENT TRANSFORMER	1
FLT201	1300080	FILTER	1
K101	1705465	CONTACTOR	1
K101AUX1-2	1701500	AUXILIARY CONTACTOR	2
K102	1157420	CONTACTOR	1
K102	1700713	SOCKET	1
K103	1157345	SOCKET	1
K103	1700500	CONTACTOR	1
MD101	1564000	MOTOR DRIVE	1
MOV101-3	31107000	MOVISTOR BOARD (130V)	1
MOV104	1606100	MOVISTOR (130V)	1
R102	1741020	RESISTOR	1
R103	1156050	RESISTOR	1
R104	1742190	RESISTOR	1
SW104-6	1866015	SWITCH	3
SW107	1861200	SWITCH	1
SX1/WX1	1151147	MALE RECEPTACLE 7 PIN	1
SX1/WX1	1151174	FEMALE PINS	6
SX1/WX1	50100018	PLUG	1
T102	1894410	TRANSFORMER	1
T103	1894430	TRANSFORMER	1
TERMINALS	1154360	TERMINAL STRIP	1
TERMINALS	1154956	MARKER STRIP	1
TX1	1151158	RECEPTACLE	1
TX1	1151170	MALE PINS	10

SECTION 20: PARTS LIST

20-3

HIGH VOLTAGE SECTION

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>QTY</u>
BP301	1351103	BINDING POST GREEN	1
BP302	1351102	BINDING POST RED	1
CON301	1151178	RECEPTACLE	1
CON301	1151183	PINS	2
CON301, TX1	1151196	CAP	2
MOV301-3	31107000	MOVISTOR BOARD (130V)	1
PCB 1223	31122319	RESISTOR BOARD	1
R301A-C	1748351	RESISTOR	3
R302A-B	1748311	RESISTOR	2
SPG303	1605110	SPARK GAP	1
TX1	1151158	RECEPTACLE	1
TX1	1151170	PIN	10
T301	38342774	GO1-2774 HV TRANSFORMER	1

ACCESSORIES

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>QTY</u>
CBL INPUT	30110008	POWER INPUT CABLE	1
CBL POWER INTER	30110046	INTERCONNECT POWER CABLE	1
CBL TX1	30160001	INTERCONNECT METERING CABLE	1
CBL GND	30080018	GROUND CABLE	2
RTN CBL	30080010	RETURN CABLE	1

SECTION 21: RECOMMENDED SPARE PARTS

21-1

Phenix Technologies recommends that the customer purchase and stock the following parts for normal maintenance of the unit. The recommended quantity should be sufficient to support the unit during normal operation.

If the unit will be operated at an isolated site for an extended period or will be subjected to unusual stresses or severe environmental conditions, a larger quantity of parts should be stocked as spares. In such cases, contact your Phenix Technologies' sales representative for a recommendation.

Current prices may be obtained by contacting the Service Department at Phenix Technologies.

CONTROLS/REGULATOR SECTION

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>RECOMMENDED QUANTITY</u>
SW102	1420162	RED LED	1
SW103	1420161	GREEN LED	1
D101-2	1780025	DIODE	2
MOV101-3 (120V)	31107000	MOVISTOR BOARD (130V)	1
MOV101-3 (220V)	31107001	MOVISTOR BOARD (275V)	1
MOV104 (220V)	1606100	MOVISTOR (130V)	1

HIGH VOLTAGE TRANSFORMER SECTION

<u>ITEM</u>	<u>P/N</u>	<u>DESCRIPTION</u>	<u>RECOMMENDED QUANTITY</u>
D301-4	1780066	TRANSORB	4
MOV301-3 (120V)	31107000	MOVISTOR BOARD (130V)	1
MOV301-3 (220V)	31107001	MOVISTOR BOARD (275V)	1
SPG301-3	1605110	SPARK GAP	3

SECTION 22: RETURNED MATERIAL

22-1

If for any reason it becomes necessary to return this equipment to the factory, contact the Service Department of Phenix Technologies, Inc. The following information must be given:

Name Plate Information
Model Number
Serial Number
Reason for Return
Cause of Defect

If Phenix Technologies, Inc. deems return of the part appropriate, it will then issue a "Return Authorization Number."

If return is not deemed appropriate, other inspection arrangements will be made.

NOTICE: *Material received at the Phenix plant without the proper authorization shall be held as "Customer's Property" with no service until such time as the proper steps have been taken.*

Your cooperation is requested in order to ensure prompt service.

**Service Department
Phenix Technologies, Inc.
75 Speicher Drive
Accident, Maryland 21520**

**Phone 1 (301) 746-8118
Fax 1 (301) 895-5570
E-mail: info@phenixtech.com**

