



# Model 2450 System SourceMeter®

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## Version v1.3.0s Firmware Release Notes

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## General Information

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### Supported models

This firmware is intended for use on the following Keithley Instruments product models:

2450, 2450-NFP, 2450-RACK, 2450-NFP-RACK



### \*\*\* ATTENTION CRITICAL      ATTENTION CRITICAL      ATTENTION CRITICAL \*\*\*

If you are upgrading firmware from v1.0.0i **TO ANY OTHER FIRMWARE REVISION EVER**, it is critical that firmware upgrade be run 2 TIMES in order for all firmware components to be upgraded correctly.

Firmware v1.1.0s fixes an issue with the firmware upgrade code inside the 2450 and this requires that the upgrade be performed 2 TIMES either from the front panel or any remote upgrade process. If you are at firmware revision v1.1.0s or later, then you only need to run firmware upgrade one time.

*NOTE: When using Test Script Builder (TSB) to Flash from v1.0.0i, the same requirement applies and the UPGRADE/DOWNGRADE option needs to be run twice.*

### Firmware Upgrade/Downgrade Instructions

*NOTE: Do not turn off power or remove the USB flash drive until the upgrade process is complete.*

#### **From the front panel:**

1. Copy the firmware upgrade file to a USB flash drive. The file is: `ki_2450_v1_3_0s.upg`.
2. Verify that the upgrade file is in the root subdirectory of the flash drive and that it is the only firmware upgrade file in that location. 2450 firmware files end with the file extension `.upg`. (example: `H:\ki_2450_v1_3_0s.upg`)
3. Disconnect any input and output terminals that are attached to the instrument.
4. Turn on instrument power.
5. Insert the flash drive into the USB port on the front panel of the instrument.
6. From the instrument front panel, press the **MENU** key.
7. Under System, select **Manage**.
8. Select the type of upgrade you want to do:
  - To upgrade to a newer version of firmware: Select **Upgrade to New**.
  - To force downgrading to an older version of firmware: Select **Downgrade to Older**.
9. If the instrument is controlled remotely, a message is displayed. Select **Yes** to continue.
10. When the upgrade is complete, reboot the instrument.
11. If you started with firmware revision v1.0.0i, then GO TO STEP 6 and RUN STEPS 6 THROUGH 10 A SECOND TIME

*NOTE: A message is displayed while the upgrade is in progress.*

For additional information about upgrading the firmware, refer to the “How do I Upgrade Firmware?” topic in the “Frequently Asked Questions (FAQs)” section of the Model 2450 Interactive SourceMeter® Instrument Reference Manual (document number: 2450-901-01). This manual is available online at <http://www.keithley.com/support>, Search for “2450 Reference Manual” when you get there.

## Upgrade considerations for the Model 2450.

ATTENTION: Once the 2450 is upgraded to v1.2.0f, the unit can NEVER be downgraded to an older firmware version. Subsequent versions of firmware will be able to downgrade back to v1.2.0f but no earlier version.

Upgrade files are available on the Keithley Instruments website (<http://www.keithley.com>).

To find firmware files on the Keithley Instruments website:

1. Select the **Support** tab.
2. In the model number box, type **2450**.
3. Select **Firmware**.
4. Click the search button. A list of available firmware updates and any available documentation for the instrument is displayed.
5. Click the file you want to download.

## Version v1.3.0s Release

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### Overview

Version 1.3.0s is the fourth official firmware upgrade release for the Model 2450. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

### Compatibility concerns

Firmware revision v1.3.0s can be installed on any vintage 2450.

**Active Buffer Behavior** Starting with v1.3.0s, the behavior of the Active Buffer has changed. Prior to v1.3.0s, the Active Buffer was always defbuffer1 by default. Now with v1.3.0s, the Active Buffer will be the most recently created or selected buffer. Additionally, while graphing data, when a user creates or selects a new buffer, that data will automatically be graphed. This feature can be disabled by manually selecting another trace and deleting (if desired) the active trace. The user can also just select a different buffer.

### Critical Fixes

PR50999 Need better indication when unit is in continuous trigger mode when set to 10PLC and 100 count  
AR39793 repeat filter

**Models affected:**

All 2450 models

**Symptom:**

During some types of measurements the 2450 will appear to be stuck with no activity. The solution is to add an animated indicator to show that measurements are still taking place and the 2450 is active.

**Resolution:**

This issue has been corrected. There is now an active indicator for continuous readings, even when the reading will be coming in very slowly, the indicator displays that the test is still running.

PR51112 USBTMC: Error returned every other time status byte requested via USB  
AR39909

**Models affected:**

All 2450 models

**Symptom:**

This issue was discovered after writing a Status Byte routine in LabVIEW™ which enables the user to query the status byte in a loop. Every other time STB was requested, an error was returned.

**Resolution:**

This issue has been corrected.

PR51359 Resistor Sorting Trigger Model Example Incorrect  
AR40280

**Models affected:**

All 2450 models

**Symptom:**

The examples which are explained on page 3-78 in 2450 Reference Manual (2450-901-01 Rev. B / September 2013) are wrong.

**Resolution:**

This issue has been corrected. All diagrams and coding examples have been updated and verified.

PR51544 Y-Axis units on the graph do not update properly when changing functions  
AR40577

**Models affected:**

All 2450 models

**Symptom:**

When graphing measurements as a function of time, and then you change functions (say from resistance to current), the units do not update properly on the Y-axis unless you go to one of the tabs on screen and then go back to the Graph or if the unit auto scales.

**Resolution:**

This issue has been corrected.

PR51545 Unit intermittently hangs up when pressing the HOME key from the Graph Page  
AR40578

**Models affected:**

All 2450 models

**Symptom:**

Intermittently when on the Graph page and then pressing the HOME key, the unit will hang up and must be rebooted.

**Resolution:**

This issue has been corrected.

PR55123 Autoexec script cannot be aborted  
AR42424

**Models affected:**

All 2450 models

**Symptom:**

If there is a problem with any script that has been set to run automatically at power up (autoexec), it cannot be aborted.

**Resolution:**

This issue has been corrected.

PR55188 :READ? Query always returns the last reading at the end of the continuous buffer.  
AR42592

**Models affected:**

All 2450 models

**Symptom:**

For example, if a basic measurement is set up to defbuffer1 (size 10000) and then takes 11000 readings, the last 1000 readings will all return the same value. This should act as a circular buffer.

**Resolution:**

This issue has been corrected.

PR55281 Problem with certain trigger block configurations  
AR42407

**Models affected:**

All 2450 models

**Symptom:**

If setting several Notify Blocks with Line#1 as PASS signal trigger, Line#2 as FAIL signal trigger, and Line#4 as EOT signal trigger, for example, in the Trigger Flow, you will find any single Notify Block with Line#X would give out trigger out signals on Line#1,#2,#4 in the same time.

**Resolution:**

This issue has been corrected.

PR55600 \*TRG command trigger source does not work in SCPI mode trigger model.

**Models affected:**

All 2450 models

**Symptom:**

Using a trigger model .wait block with the command event in SCPI does not work when \*TRG is sent. Instead, it generates the following error ==> Error 2713 - "No trigger model engine available".

**Resolution:**

This issue has been resolved. Now, the \*TRG command will satisfy the wait block when sent if waiting for a command event.

PR55867 1uA Current Source error when using Config List  
AR43082

**Models affected:**

All 2450 models

**Symptom:**

Under a very specific sequence of events, setting the Source Config List source value to 1.0uA will revert to 0uA after pressing the Trigger button on the front panel.

**Resolution:**

This issue has been corrected.

PR56135 QuickSet Performance Setting does not work on fastest setting

AR50078

**Models affected:**

All 2450 models

**Symptom:**

On the QuickSet Menu, when editing the Performance Slide bar, if you choose the fastest speed, the dial indicates a speed of ~1700/sec. However, the actual speed is only 10/sec no matter how much the other settings are optimized. The only way to achieve this speed is to create a simple trigger model configuration that sources, measures, and loops back continuously, then manually set NPLC to .01, turn auto ranging for source and measure off, and set source delay to 0.

**Resolution:**

This issue has been corrected and the Performance Slide bar works correctly for all settings.

## Enhancements

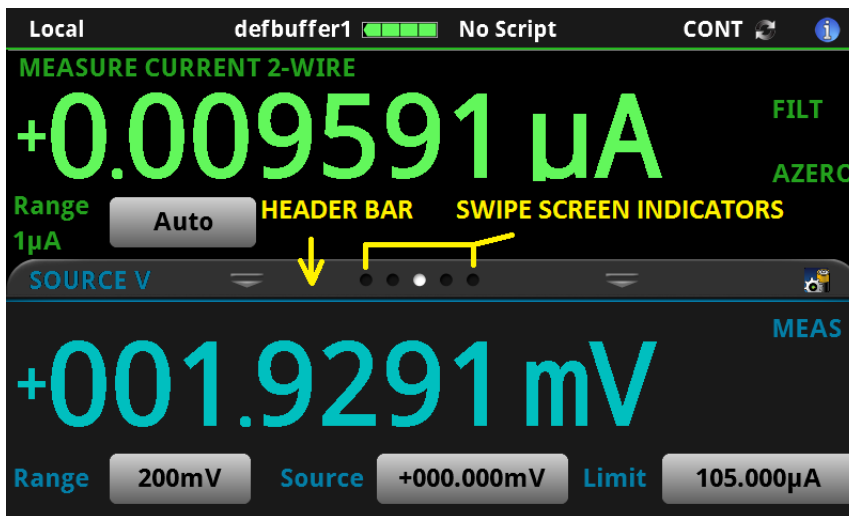
### GENERAL Models affected:

All 2450 models

### Enhancement:

A number of improvements have been made to the overall Graphical User Interface as follows:


1. Screen Colors: All screen colors have been modified for better contrast and easier readability.
2. Pinch-to-Zoom Performance: Throughout the user interface, the “Pinch-to-zoom” touch screen motion has been improved and is more responsive.
3. Improve Swiping:
  - a. The swipe user interface gesturing has been dramatically improved and is more responsive.
  - b. Added Vertical Swiping in various screens in the GUI.
  - c. Horizontal swiping has been made more smooth and is consistent with Vertical Swiping.
  - d. “Fling” swiping has been implemented where faster swiping actions result in rapid scrolling followed by decay based on the velocity of the “fling.”
  - e. Swipe Down on the Home screen will display larger readings.
4. Tabs and Buttons: Throughout the user interface multiple data display options have been made available through tabs (header bars) with swipe screen indicators to show how many options are available and which display tab is active.



5. Graphing:
  - a. New Auto Scale Options (X-Axis) → Track Latest, Track Group
  - b. New Auto Scale Options (Y-Axis) → y-swim lanes, y-shared, y-per trace
  - c. Multi-Trace Line Plots
  - d. Multi-Trace Scatter Plots
  - e. Various refresh and performance improvements



- 6. Histogram:
  - a. New Auto-Scale, Auto-Bin, and Fit
  - b. Smartscale choose best scaling option
  - c. Various refresh and performance improvements
- 7. TTI Synchronization: All Touch, Test, Invent® Keithley Models including the 2450, 2460, and 7510 have been carefully updated so that they are all consistent in look, feel, and general navigation.
- 8. Updated Reading Table: Added new reading table features and a new Reading Preview Graph. Please see the Reference Manual for further details.

READING TABLE			
Buffer	Active (defbuffer1) 		
Buffer Index	Time	Reading	Source
78824	06/10 07:16:22.174568	+0.009484 $\mu$ A	+001.9090 mV
78825	06/10 07:16:22.845109	+0.009590 $\mu$ A	+001.9310 mV
78826	06/10 07:16:23.515734	+0.009564 $\mu$ A	+001.9228 mV
78827	06/10 07:16:24.186322	+0.009647 $\mu$ A	+001.9427 mV
78828	06/10 07:16:24.856892	+0.009639 $\mu$ A	+001.9420 mV
78829	06/10 07:16:25.527470	+0.009541 $\mu$ A	+001.9195 mV
78830	06/10 07:16:26.198087	+0.009517 $\mu$ A	+001.9151 mV
78831	06/10 07:16:26.868617	+0.009631 $\mu$ A	+001.9391 mV
78832	06/10 07:16:27.539214	+0.009617 $\mu$ A	+001.9381 mV
78833	06/10 07:16:28.209799	+0.009630 $\mu$ A	+001.9398 mV

PR50885 **Models affected:**  
 AR39690 All 2450 models

**Enhancement:**

Add a direct shortcut from the HOME view measurement line to the measurement settings menu.

A shortcut icon has been added to the swipe bar on the HOME source/measurement tab.



PR51356 **Models affected:**  
AR40325 All 2450 models

**Enhancement:**

Add a CLEAR or ENTER parameter to the WAIT block of the trigger model.

The CLEAR of ENTER or NEVER was added the WAIT block on the trigger screen.

PR53815 **Models affected:**  
All 2450 models

**Enhancement:**

Add a :TRIGger:LOAD command that takes a template name as a first argument

Old Command

```
:TRIGger:LOAD:EMPTy
:TRIGger:LOAD:CONFIguration:LIST
:TRIGger:LOAD:TRIGger:EXTErnal
:TRIGger:LOAD:LOOP:SIMPlE
:TRIGger:LOAD:LOOP:DURation
<not present>
<not present>
<not present>
```

New Command

```
:TRIGger:LOAD "Empty"
:TRIGger:LOAD "ConfigList", <parameter list as before>
:TRIGger:LOAD "LogicTrigger", <parameter list as before>
:TRIGger:LOAD "SimpleLoop", <parameter list as before>
:TRIGger:LOAD "DurationLoop", <parameter list as before>
:TRIGger:LOAD "LoopUntilEvent", <parameter list as before>
:TRIGger:LOAD "GradeBinning", <parameter list as before>
:TRIGger:LOAD "SortBinning", <parameter list as before>
```

Example:

before:

```
:TRIGger:LOAD:LOOP:DURation <duration>, <delay>, "<reading buffer>"
```

after:

```
:TRIGger:LOAD <duration>. <delay>, "<readingBuffer>"
```

Usage Notes:

- o The template name is not case-sensitive
- o The template name needs to be in quotes
- o This makes the SCPI command more like the TSP equivalent trigger.model.load() command
- o See the Reference Manual for more details

PR55190 **Models affected:**  
AR42567 All 2450 models

**Enhancement:**

Change the Voltmeter default source range from 10uA to 10mA.

In order to speed things up, and to better measure voltages on more inductive loads, the default source range for the Voltmeter QuickSet has been changed from 10uA to 10mA.

**PR56127 Models affected:**

All 2450 models

**Enhancement:**

Add an API command to mark the start of a group for writable buffers.

A status optional parameter has been added to the following TSP and SCPI commands:

**SCPI**

```
TRACe:WRITe:READInG <standard writable reading buffer>, <reading value>,  
[<time sec>, <time nsec>],[<status>]]
```

```
TRACe:WRITe:READInG <full writable reading buffer>, <reading value>,  
<extra value>, [<time sec>, <time nsec>],[<status>]]
```

**TSP**

```
buffer.write.reading(<standard writable reading buffer>, <reading value>,  
[<time sec>, <time nsec>], [<status>])
```

```
buffer.write.reading(<full writable reading buffer>, <reading value>,  
<extra value>, [<time sec>, <time nsec>],[<status>])
```

The optional status parameter indicates if the reading being added is start of group for plotting on the graph. The default is 0. Set this to 0 if not start of group or set to 256 if start of group. This parameter only accepts 0 or 256 - any other value generates an error. For TSP, `buffer.STAT_START_GROUP` can be used to set it. You would set status to 256 to help graph a family of curve traces on the graph.

## Noncritical Fixes

PR50249 **Models affected:**

All 2450 models

**Symptom:**

GPIB: The SRQ annunciator does not get lit for GPIB, works ok for USB and VXI-11.

**Resolution:**

This issue has been corrected.

PR50426 **Models affected:**

All 2450 models

**Symptom:**

Clearing Limit 2 will clear the Limit 1 annunciator on the display instead of the Limit 2 annunciator.

**Resolution:**

This issue has been corrected.

## Known issues

PR56487 Calling `tsplink.initialize()` under specific conditions can cause slave to lockup.

**Models affected:**

All 2450 models

**Symptom:**

Attempting to initialize TSP-Link using `tsplink.initialize()` may result in the following error being reported:

```
TSP-Error 1202: Link initialization failed
```

One or more of the slave instruments may lockup.

**Workaround:**

Workaround #1 → One workaround is to only initialize the TSP-Link connection once. The link state can be checked by querying the `tsplink.state` attribute. If the link state is reported to be "online", then do not initialize the link again.

Workaround #2 → Make sure that the controlling TSP node is NOT a 2450.

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## Version v1.2.0f Release

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### Compatibility concerns

Firmware revision v1.2.0f can be installed on any vintage 2450.

### Critical Fixes

AR40324 **Models affected:**

PR51382 All 2450 models

**Symptom:**

The limit values in trigger.BLOCK\_BRANCH\_LIMIT\_CONSTANT are saved incorrectly in the Create Config operation.

Under certain conditions, limit values are saved as zero.

**Resolution:**

This issue has been corrected.

AR40457 **Models affected:**

PR51440 All 2450 models, SCPI2400 mode only  
PR51987

**Symptom:**

Source Memory Sweep does not work properly when Source Auto Clear is enabled.

**Resolution:**

This issue has been corrected.

AR40488 **Models affected:**

AR40573 All 2450 models  
AR40575  
PR51449

**Symptom:**

Calibration date is set to 03/16/1996 after updating from v1.0.0i to v1.1.0s. This is due to the fact that a new field was added between v1.0.0i and v1.1.0s and the new field was not initialized properly.

**Resolution:**

This issue has been corrected and Calibration Date will be set to the old Calibration Adjust Date if not already initialized.

**AR40579 Models affected:**

PR51546 All 2450 models

**Symptom:**

Black bars appear across the bottom of the screen capture image.

**Resolution:**

This issue has been corrected.

**AR40591 Models affected:**

PR51537 All 2450 models

**Symptom:**

When capturing multiple screen shots in succession, the following error would sometimes occur.

```
2350 Internal: SPLAT! drop packet to input queue
```

**Resolution:**

This issue has been corrected.

**AR41514 Models affected:**

PR52399 All 2450 models

**Symptom:**

VISA Device Clear over USB sometimes causes timeout and data loss.

**Resolution:**

This issue has been corrected.

**AR41552 Models affected:**

PR52941 All 2450 models

**Symptom:**

Under certain test setups, \*RST (and front panel reset) will cause voltage spike at the output.

**Resolution:**

Voltage spikes after \*RST (and front panel reset) have been greatly reduced.

**AR41757 Models affected:**PR53544 All 2450 models  
PR54481**Symptom:**

When sourcing current on the 100mA range or lower, and the instrument ranges up to the 1A range, the source value may be incorrectly rounded.

**Resolution:**

This issue has been corrected.

AR42086 **Models affected:**  
PR54659 All 2450 models

**Symptom:**

When source read-back is turned off, the programmed source values are returned. If the programmed values are less than 1 volt, the returned values are incorrect due to rounding problems.

**Resolution:**

This issue has been corrected.

## Enhancements

PR48621 **Models affected:**  
All 2450 models

**Enhancement:**

Implement and document procedure for Clearing Memory and Data Sterilization for the Model 2450. This document can be requested from the Keithley Instruments Quality team.

PR53367 **Models affected:**  
All 2450 models

**Enhancement:**

Add SCPI equivalent for `trigger.LOG_WARN_ABORT`.

## Overview

Version 1.2.0f is the third official firmware upgrade release for the Model 2450. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

added `ABORT` as the equivalent

```
trig:bloc:log:even 1, abort, "abort message"
```

```
trig:bloc:list?
```

```
1) LOG_EVENT EVENT: # 2733 MESSAGE: "abort message"
```

## Noncritical Fixes

**PR50249 Models affected:**

All 2450 models

**Symptom:**

GPIB: The SRQ annunciator does not get lit for GPIB, works ok for USB and VXI-11.

**Resolution:**

This issue has been corrected.

**PR50426 Models affected:**

All 2450 models

**Symptom:**

Clearing Limit 2 will clear the Limit 1 annunciator on the display instead of the Limit 2 annunciator.

**Resolution:**

This issue has been corrected.

**PR51390 Models affected:**

All 2450 models

**Symptom:**

The command

```
value = display.input.prompt(display.BUTTONS_YESNO, "Do you want to  
continue?")
```

will cause the variable "value" to return nil.

**Resolution:**

This issue has been corrected.

**PR51807 Models affected:**

All 2450 models

**Symptom:**

Some measure attributes are not saved in the Measure Configuration List.

smu.measure.configlist.recall() does not restore the following attributes:

- Display digits
- Limit auto clear
- Math percent
- User delay (1 through 5)



If the filter is not enabled, the following attributes are not restored:

- Filter count
- Filter type

If relative offset is not enabled, the following attribute is not restored:

- Relative offset value

**Resolution:**

This issue has been corrected.

PR54651 **Models affected:**

All 2450 models

**Symptom:**

Changing the measure range low setting (used for auto-range) could result in incorrect operation if the range is higher than the active measure range.

**Resolution:**

This issue has been corrected.

## Known issues

N/A

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## Version v1.1.0s Release

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### Overview

Version 1.1.0s is the second official firmware upgrade release for the Model 2450. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

### Compatibility concerns

This version of firmware cannot be installed on newer 2450 systems. Also, once any system is updated to firmware revision v1.2.0f or later, firmware version v1.0.0s can NEVER be installed again.

### Critical Fixes

PR50333 **Models affected:**  
AR39747 All 2450 models

**Symptom:**

2450 should not measure resistance with output off.  
Because resistance measurements are dependent on the current or voltage source, resistance measurements with the source off are meaningless and will be confusing to the user.

**Resolution:**

This issue has been corrected. Once the output has been turned on/off once, the 2450 will display UNAVL (unavailable) in the upper right corner and the measurement fields will display dashes.

PR50703 **Models affected:**  
AR39206 All 2450 models

**Symptom:**

The graph shows voltage drop as current instead of current when sourcing current and then selecting source as the Y-axis.

**Resolution:**

This issue has been corrected.

PR50704 **Models affected:**  
AR39257 All 2450 models

**Symptom:**

When certain sequences of SCPI commands using the :TRIG:LOAD:LOOP command were sent, the 2450 would throw a Fatal System Error requiring a 2450 power cycle to recover.

**Resolution:**

This issue has been corrected.

PR50750 **Models affected:**  
AR39364 All 2450 models

**Symptom:**

When setting up a source configuration list, in some cases the source configuration list screen on the front panel GUI will show a source limit value of "None" if a config list point is selected.

**Resolution:**

This issue has been corrected.

PR50860 **Models affected:**  
AR39658 All 2450 models

**Symptom:**

When zooming in on the graph, the magnitude of the data changes incorrectly. Sometimes the actual graph area of interest will scroll out of sight.

**Resolution:**

This issue has been corrected. The overall graph zooming capability has been dramatically improved.

PR50998 **Models affected:**  
AR39795 All 2450 models

**Symptom:**

In certain cases, when setting up a Dual Sweep, the last point of the Source Configuration List is incorrect.

**Resolution:**

This issue has been corrected.

PR51005 **Models affected:**  
AR39859 All 2450 models

**Symptom:**

There was an inconsistency in the \*CLS command behavior with SCPI and 2400SCPI modes. In SCPI and 2400SCPI modes, the Output Queue was not always cleared properly. In TSP mode, the command sometimes returned Error Code -410 Query Interrupted or Error Code -420 Query Unterminated.

**Resolution:**

This issue has been corrected.

PR51046 **Models affected:**  
AR39957 All 2450 models

**Symptom:**

When a Source Configuration List is generated in the Trigger Flow Model, everything works OK. When the Source Configuration List is saved and then recalled, the 2450 sometimes returns the Error Code -221 Conflict Error because the Current Range of all of the Source Points is always saved to the 100uA range.

**Resolution:**

This issue has been corrected.

PR51263 **Models affected:**  
AR40267 All 2450 models

**Symptom:**

Sometimes, the Abort on Source Limit setting does not work when the 2450 performs Voltage Sweeping and reaches the Source Limit.

**Resolution:**

This issue has been corrected.

PR51051 **Models affected:**  
AR40159 All 2450 models

**Symptom:**

Extra Current Steps occur between Current Source Range transitions when using the Source Configuration List.

**Resolution:**

This issue has been corrected.

PR51186 **Models affected:**  
AR39968 All 2450 models

**Symptom:**

2450 crashes after long period of time running through LabVIEW™.

**Resolution:**

This issue has been corrected.

## Enhancements

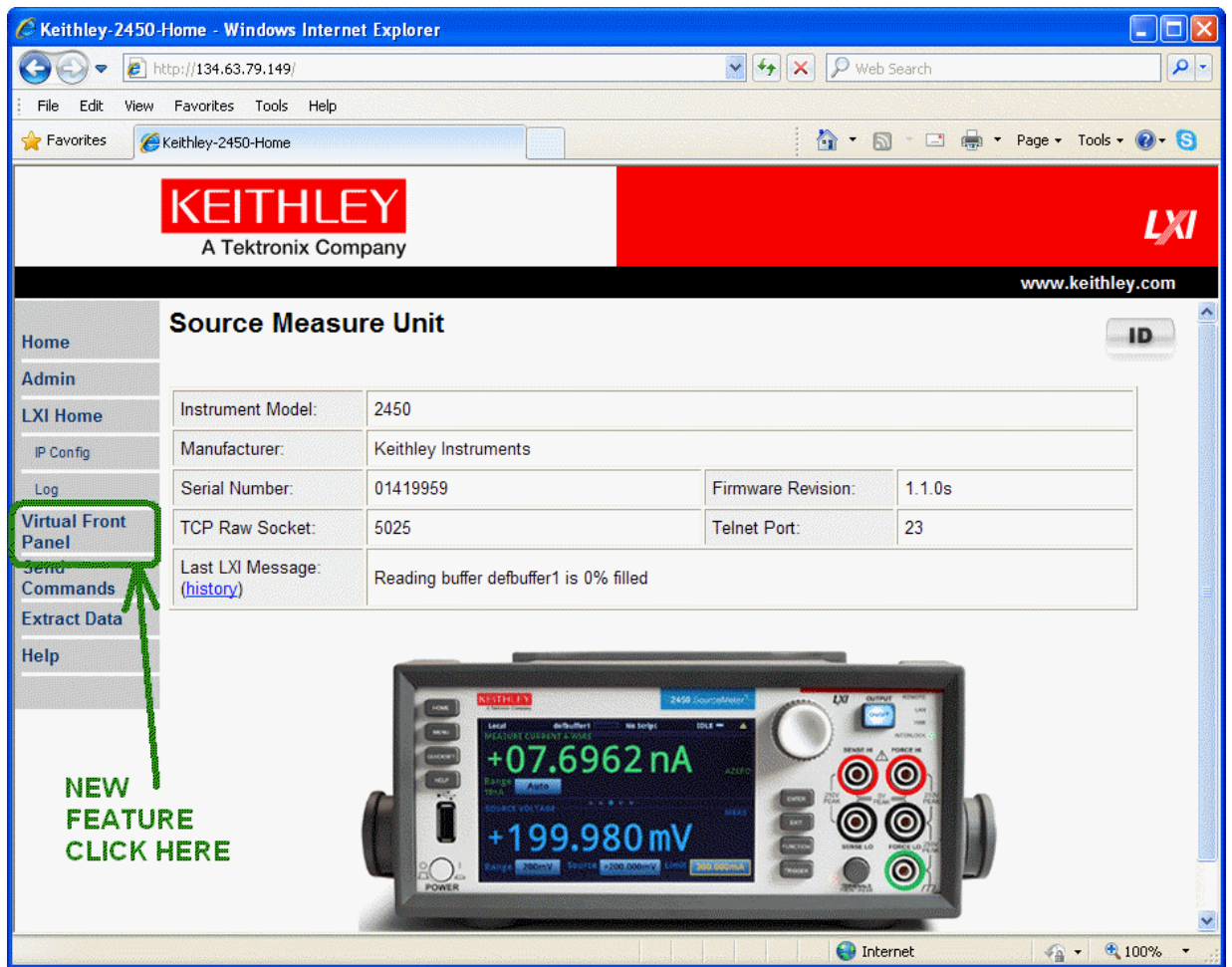
### PR50774 Models affected:

All 2450 models

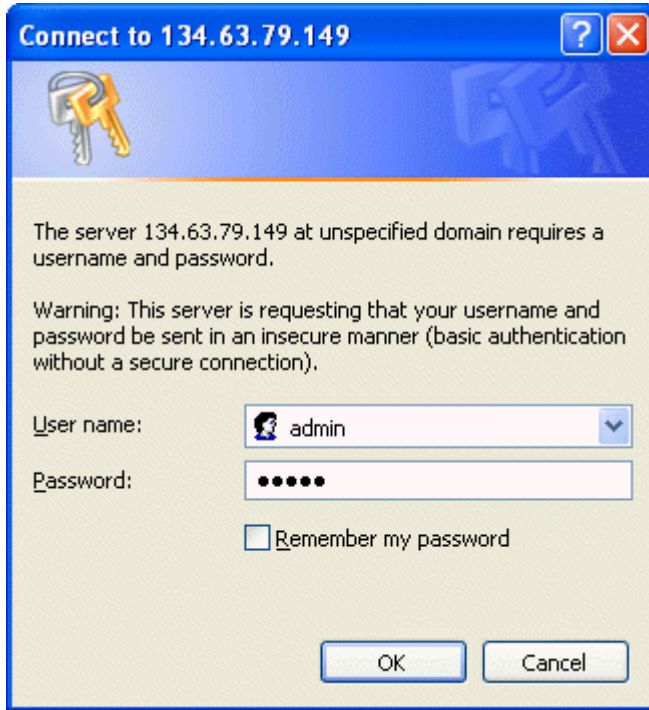
### Enhancement:

Implement new Virtual Front Panel capability.

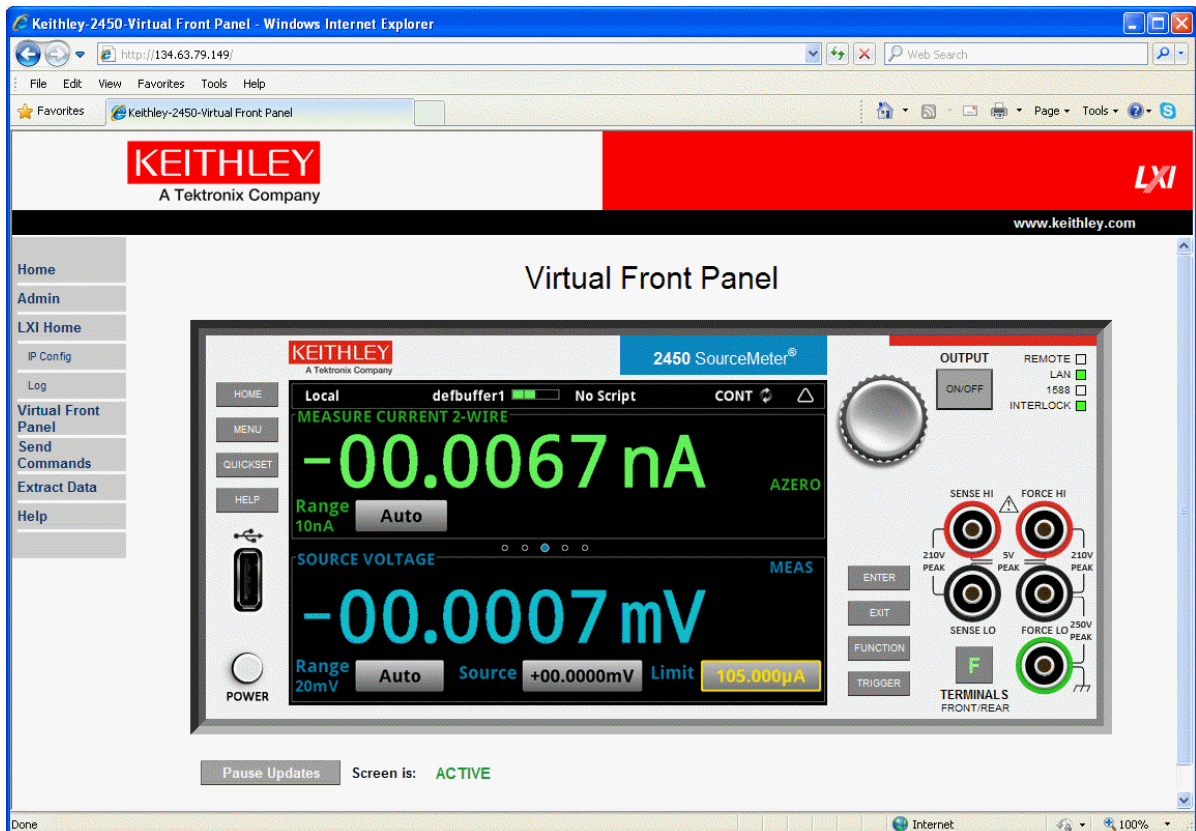
To access the new Virtual Front Panel, access the 2450 through Ethernet using your favorite Internet browser.



When asked for a Username and Password: enter the Username and Password for that particular 2450. The default Username is admin and the default Password is admin.



An example of the 2450 Virtual Front Panel is shown below. Users can use their mouse from a standard PC to control the instrument. Users can also use touch screens from most touch screen devices that can access the 2450 IP address.



**PR50906 Models affected:**

All 2450 models

**Enhancement:**

2450 Quick Start Guide, User Manual, and Reference Manuals have all been updated.

The 2450 Release Notes for Firmware Revision v1.1.0s have also been updated and are available at the Keithley Instruments, Inc. website.

Click Here → <http://www.keithley.com/products/dcac/currentvoltage/2450smu/?path=2450/Documents>

**PR50231 Models affected:**

All 2450 models

**Enhancement:**

Implement and document procedure for Customer onsite Calibration of Model 2450.

This capability is scheduled to be available late Q1'2014. Please check back at [www.keithley.com](http://www.keithley.com) for updates in early April 2014.

**PR48744 Models affected:**

All 2450 models

**Enhancement:**

Provide capability for customers to save screen capture files from the front panel to the USB Flash Drive.

This capability is documented in Rev-C of the 2450 Reference Manual in Section 2 Page 44 (2-44).

In short, with a valid USB Flash Drive inserted into the front USB port of the 2450, press the <HOME> and <ENTER> keys simultaneously and the current screen image will be saved to the USB Flash Drive.

**PR50657 Models affected:**

All 2450 models

**Enhancement:**

The maximum number of characters allowed for naming a Reading Buffer on the front panel GUI was 18 characters. The bus commands allow up to 32 characters. The GUI maximum number of characters has been updated to 32 to match the bus command limit.

**PR50662 Models affected:**

All 2450 models

**Enhancement:**

Add a password verification method to the 2450 GUI.

When changing the 2450 system password, the user will be prompted to enter the password a second time. The second entry will be used to verify that the first and second passwords match and that the intended password has indeed been entered. If the two passwords do not match, an error dialog is displayed and the users is instructed to try again.

**PR50758 Models affected:**

All 2450 models

**Enhancement:**

Scripts can be written in TSB and downloaded to the model 2450. However, scripts do not enable the user to input values from the front panel. The 26xx family of SMUs allows users to input values into their scripts real time.

Starting with firmware revision v1.1.0s, functionality has been added to the 2450 that allows users to input values into the scripts real-time from the front panel.

The new commands are as follows:

```
display.input.number()  
display.input.option()  
display.input.prompt()  
display.input.string()
```

These commands are documented in Rev-C of the 2450 Reference Manual in Section 8 Page 51 (8-51).

**PR50866 Models affected:**

All 2450 models

**Enhancement:**

The 2450 System Information window has been updated to show calibration adjustments vs. calibration without adjustment dates. The System Information window now presents these dates as follows.

Adjust Date	11/19/2013
Adjust Count	1
Calibration Date	4/17/2014

**PR50876 Models affected:**

All 2450 models

**Enhancement:**

The behavior of the \*LANG? command on the 2450 has been changed as follows.

Sending the query \*LANG? over a non-controlling interface will no longer change the interface control of the unit. For example, if the unit is under local control, then sending the \*LANG? over Telnet, USB, or GPIB will leave the unit under local control. This was done in order for KickStart (or any other remote control software) to query connected/accessible instruments without resetting them or changing or disturbing the current trigger model.

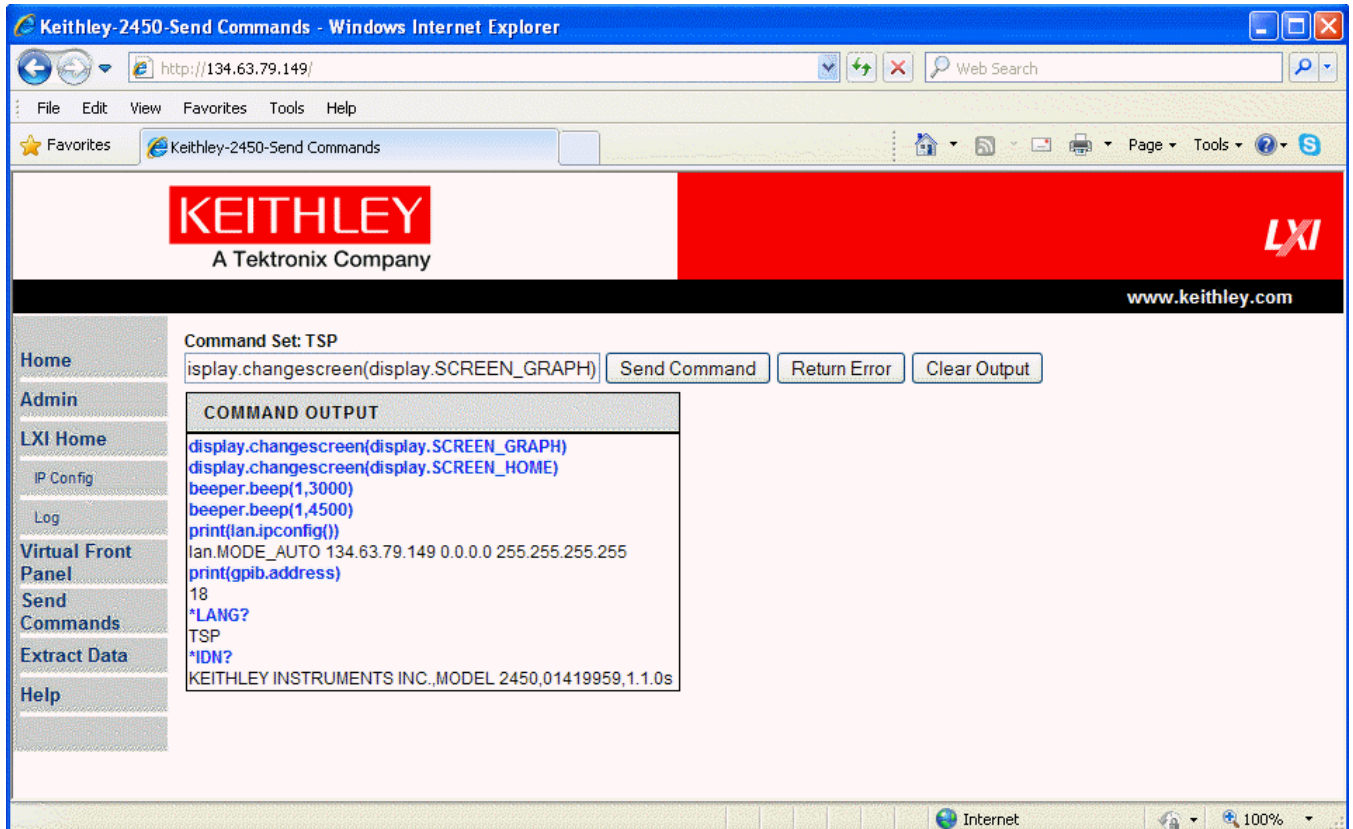


**PR51248 Models affected:**

All 2450 models

**Enhancement:**

The 2450 built-in webpage has been enhanced to show a historical list of commands recently sent to the instrument. This new COMMAND OUTPUT window has been added to the Send Commands section of the webpage.



**PR51249 Models affected:**

All 2450 models

**Enhancement:**

The 2450 built-in webpage has been enhanced. A new button "Return Error" has been added to allow users to easily query the last unread error number and error message. This new functionality works in both TSP and SCPI modes.

## Noncritical Fixes

**PR50285 Models affected:**

All 2450 models

**Symptom:**

On the Manage Scripts window, the Left Arrow and Delete buttons remain enabled and active even after a USB Flash Drive has been removed from the instrument.

**Resolution:**

This issue has been corrected.

**PR50404 Models affected:**

All 2450 models

**Symptom:**

TSP-Link reset or initialization may consistently fail on some 2450 units. The unit being reset may ignore the reset, stop responding to bus commands, and/or display "Slave" in the Communication Status Indicator.

**Resolution:**

This issue has been corrected.

**PR50670 Models affected:**

All 2450 models

**Symptom:**

The LAN Reset button on the back of the 2450 failed to reset the system password.

**Resolution:**

This issue has been corrected and the system password is reset to the default, **admin**.

**PR50772 Models affected:**

All 2450 models

**Symptom:**

Offset Compensation for SVMl (ohms) and Offset Compensation for SIVM (ohms) did not perform the offset measurement correctly.

**Resolution:**

This issue has been corrected.

**PR50785 Models affected:**

All 2450 models

**Symptom:**

On the Trigger Flow Screen, the default Bit Pattern and Bit Mask show 255. Since there are only 6 trigger lines on the 2450, the maximum Bit Pattern should be no more than 63.

**Resolution:**

This issue has been corrected. The maximum value for Bit Pattern is now 63. The maximum value for Bit Mask remains 255.

**PR50786 Models affected:**

All 2450 models

**Symptom:**

Digital I/O Trigger blocks behavior functionality was not correct.

**Resolution:**

For Digital I/O Trigger blocks, as the mask setting changes, any bits that are set to 1 will have the corresponding Digital I/O line set to Digital I/O Output Mode. For bits set to 0, those corresponding Digital I/O line modes remain unchanged.

**PR50899 Models affected:**

All 2450 models

**Symptom:**

The default value for Source Current Range displayed on the front panel does not match the actual Source Current Range value.

**Resolution:**

The default Current Source Range is now 10nA in (2450) SCPI mode.

**PR50903 Models affected:**

All 2450 models

**Symptom:**

Source Current and Source Voltage Levels have incorrect Min and Max Values.  
:SOURce[1]:CURRENT[:LEVel][:IMMediate][:AMPLitude] reports that the minimum acceptable value is -1.00 and maximum is 1.00 when they should be -1.05 and 1.05, respectively.

**Resolution:**

This issue has been corrected.

**PR50979 Models affected:**

All 2450 models

**Symptom:**

If a Sweep Function encounters a Source Limit Value Event, the Source will not turn off.

**Resolution:**

This issue has been corrected. The 2450 will now automatically turn off the Source Output if a Source Limit Event occurs.

**PR51033 Models affected:**

All 2450 models

**Symptom:**

Sending `*IDN?` over USB TMC causes the unit to switch into USBTMC control instead of staying with the current active interface. It also puts the trigger model back into IDLE mode.

**Resolution:**

This issue has been corrected.

**PR51205 Models affected:**

All 2450 models

**Symptom:**

ICL command "display.changescreen()" can lock up after the command "reset()" is called over and over again.

**Resolution:**

This issue has been corrected.

## Known issues

PR48636 Model 2450 does not respect a USB Flash drive file that is read only.

**Models affected:**

2450

**Symptom:**

The 2450 will write over read-only files on flash drives. For example, if the 2450 attempts to write to file aaa.txt and aaa.txt is marked read-only, the 2450 will rewrite file aaa.txt without warning. This problem does NOT suggest the 2450 randomly overwrites arbitrary files on a flash drive.

**Workaround:**

There is no known workaround for this issue at this time.

PR49308 `trigger.BLOCK_BRANCH_COUNTER` loop without a measure or delay block appears to hang.

SCPI: `:TRIGger:BLOCK:BRANch:COUNter`

TSP: `trigger.model.setblock()` with `trigger.BLOCK_BRANCH_COUNTER`

**Models affected:**

2450

**Symptom:**

When running a tight trigger loop without a measurement or delay in the sequence, the 2450 will be unresponsive until the loop ends.

**Workaround:**

Add any measurement or short delay in the trigger loop and the 2450 will perform normally. A future firmware release will work around this problem automatically.

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## Version v1.0.0i Release

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### Overview

Version 1.0.0i is the initial firmware release for the Model 2450. No fixes are listed since this is the very first firmware release. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

### Compatibility concerns

This version of firmware cannot be installed on newer 2450 systems. Also, once any system is updated to firmware revision v1.2.0f or later, firmware version v1.0.0i can NEVER be installed again.

### Critical fixes

N/A

### Enhancements

N/A

### Noncritical fixes

N/A

### Known issues

PR48636 Model 2450 does not respect a USB Flash drive that is read only.

**Models affected:**

2450

**Symptom:**

The 2450 will write over read-only files on flash drives. Specifically, if the 2450 attempts to write to file aaa.txt and aaa.txt is marked read-only, the 2450 will rewrite file aaa.txt without warning. This problem does NOT suggest the 2450 randomly overwrites arbitrary files on a flash drive.

**Workaround:**

There is no known workaround for this issue at this time.

PR49308 `Trigger.BLOCK_BRANCH_COUNTER` loop without a measure or delay block causes hang.

SCPI: `:TRIGger:BLOCK:BRANch:COUNter`

TSP: `trigger.model.setblock()` with `trigger.BLOCK_BRANCH_COUNTER`

**Models affected:**

2450

**Symptom:**

When running a tight trigger loop without a measurement or delay in the sequence, the 2450 will be unresponsive until the loop ends.

**Workaround:**

Simply add any measurement or short delay in the trigger loop and the 2450 will perform normally. A future firmware release will work around this problem automatically.

PR49812 MANUAL: Better explanation of sweep delay needed.

**Models affected:**

All 2450

**Symptom:**

Recent changes to the sweep commands did not get added to the 2450 Reference Manual in time for first release.

**Workaround:**

The sweep commands accept a delay setting of 0 for no delay, -1 for auto delay (excluding the list command), or constant value between 50 us and 10000 s.

The TSP sweep commands are:

```
smu.source.sweeplinear()  
smu.source.sweeplinearstep()  
smu.source.sweeplist()  
smu.source.sweeplog().
```

The SCPI sweep commands are :

```
:SOURce[1]:SWEep:<function>:LINear  
:SOURce[1]:SWEep:<function>:LINear:STEP  
:SOURce[1]:SWEep:<function>:LIST  
:SOURce[1]:SWEep:<function>:LOG
```

For `smu.source.sweeplist()` and `:SOURce[1]:SWEep:<function>:LIST`, the delay setting configures a constant delay trigger block in the trigger model.

A delay of zero omits the trigger block.

The configuration list delay settings act independently of the delay specified in the command. Therefore, a double delay may result by utilizing both.

The next version of the 2450 Reference Manual will be updated.

PR49835 Recalling measure configuration list causes error 823.

**Models affected:**

All 2450

**Symptom:**

When recalling the measure configuration list before the source configuration list, the error code 823 may be displayed.

**Workaround:**

When recalling both source and measure configuration lists, always recall the source configuration list before the measure. This order ensures that dependencies between source and measure settings will be properly handled.

PR49885 MANUAL: Source delay is incorrect for default settings and resistance measure function.

SCPI: :SOURce[1]:<function>:DELay

TSP: smu.source.delay

**Models affected:**

All 2450

**Symptom:**

In the 2450 Reference Manual, the documentation for the command `smu.source.delay` claims the default setting is `.001`. This is NOT TRUE. There is no default value for the command `smu.source.delay` and if queried without being set, will return the last auto delay setting.

The manual also states "If you turn auto delay back on, the programmed source delay value is added to the auto delay time." This is also incorrect.

**Workaround:**

Make sure to set an initial value for `smu.source.delay`.

The next version of the 2450 Reference Manual will be corrected.

PR49892 Changes to the Reference Manual.

**Models affected:**

All 2450

**Symptom:**

A number of miscellaneous late changes were not added in time to Rev-A revision of the 2450 Reference Manual. Some of the key issues have been documented here.

A) The following commands have been removed from the product:

SCPI: `SYSTem:BEEPer:STATe`

TSP: `beeper.enable`

These commands have been used in various places in the manual and in documented examples. These references will be removed in the next revision of the manual. No substitute commands have been provided.

B) Digital I/O behavior:

- a. For digital I/O lines, changing the line mode to input will set the line state high.
- b. For digital I/O lines, changing the line mode to output will set the line state low.
- c. When configuring digital I/O, the output side of the line should be configured before the input side to avoid a false input trigger detection



## C) Using the reset() command:

- a. On page 3-125 in the Reference Manual, the following NOTE is INCORRECT. The command `tsplink.initialize()` DOES change the states of the individual nodes in the system.

## NOTE

Using the `reset()` command in a TSP-Link network differs from using the `tsplink.reset()` or `tsplink.initialize()` command. The `tsplink.reset()` or `tsplink.initialize()` command reinitializes the TSP-Link network, but does not change the state of the individual nodes in the system.

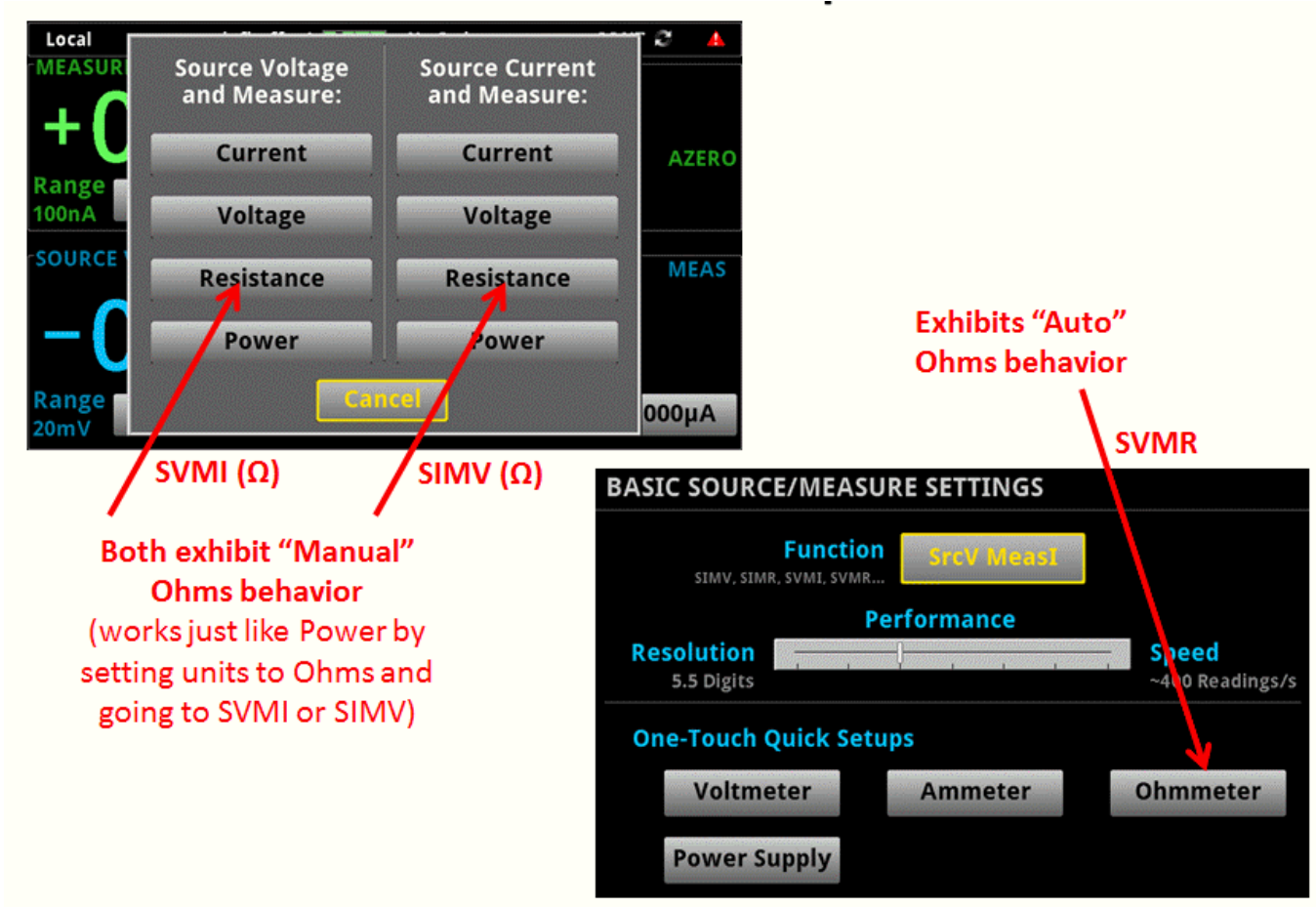
## D) Resistance Mode Changes: Auto Ohms vs. Manual Ohms:

- a. Significant changes were made to the way resistance mode was documented in Revision A of the 2450 Reference Manual. Below is a summary of differences in the Reference Manual vs. the actual implementation. The Reference Manual will be updated to reflect these changes in Revision B of the 2450 Reference Manual. Sections affected are 2-91, 6-46, 8-116, and 9-14.
- b. The term “Auto Ohms” has been removed from the user interface. The user interface now presents “Ohmmeter” as a One-Touch Quick Setup (see diagram below).
- c. The term “Manual Ohms” has been removed from the user interface. The user interface now presents “Resistance” as a Measure function vs. Voltage or Current Source (see diagram below).
- d. The following commands have been eliminated
  - i. `[SENSe[1]]:RESistance:MODE AUTO | MANual` (SCPI, section 6-46)
  - ii. `smu.measure.resistancemode = smu.RESISTANCE_AUTO` or `smu.RESISTANCE_MANUAL` (TSP, section 8-116)
- e. The following existing commands have a new argument as follows
  - i. `[SENSe[1]]:<function>:UNIT WATT | OHM | VOLT | AMP` (section 6)
  - ii. `smu.measure.unit = <WATT> <OHM> <VOLT> <AMP>`
- f. New TSP Command Usage:
  - i. “Manual Ohms” → Measures resistance by sourcing voltage, measuring current, and calculating the resistance reading.
    - `smu.source.func = smu.FUNC_DC_VOLTAGE`
    - `smu.measure.func = smu.FUNC_DC_CURRENT`
    - `smu.measure.unit = smu.UNIT_OHM`

OR

    - `smu.source.func = smu.FUNC_DC_CURRENT`
    - `smu.voltage.func = smu.FUNC_DC_VOLTAGE`
    - `smu.measure.unit = smu.UNIT_OHM`
  - ii. “Auto Ohms” → Measures resistance by sourcing current, measuring voltage, and calculating the resistance reading. In this case, the source current and source limit are automatically calculated and set.

- `smu.measure.func = smu.FUNC_RESISTANCE`
- g. New SCPI Command Usage:
- i. "Manual Ohms" (see definition above)
    - `SOURCE:FUNC VOLTage`
    - `[SENSE[1]]:FUNC "CURRENT"`
    - `[SENSE[1]]:CURRENT:UNIT OHM`OR
    - `SOURCE:FUNC CURRENT`
    - `[SENSE[1]]:FUNC "VOLTage"`
    - `[SENSE[1]]:VOLTage:UNIT OHM`
  - ii. "Auto Ohms" (see definition above)
    - `[SENSE[1]]:FUNC "RESistance"`
- h. Front panel user interface setting of Manual vs. Auto Ohms measurements
- <see the following figure for details>



PR49955 Cannot repeatedly reconnect with LAN triggers.

**Models affected:**

All 2450

**Symptom:**

Certain scripts (where LAN connections are quickly and repeatedly disconnected and reconnected in rapid succession) may cause a failed connection.

**Workaround:**

Due to limited socket resources, the safest rate of making LAN connections is 1 connection per second. If there is need for more than one LAN connection per second, the total number of socket resources available is approximately 180, and after a socket is closed, it will take 2 minutes to become available again.

PR50042 MANUAL: TSP-Link mode command only supports open drain.

**Models affected:**

All 2450

**Symptom:**

In the 2450 Reference Manual, the documentation erroneously states that the TSP command `tsplink.line[N].mode` accepts the following parameters:

```
tsplink.MODE_DIGITAL_IN  
tsplink.MODE_DIGITAL_OUT  
tsplink.MODE_TRIGGER_IN  
tsplink.MODE_TRIGGER_OUT
```

**Workaround:**

Do not use the parameters listed above in the command `tsplink.line[N].`

The next version of the 2450 Reference Manual will be corrected.

PR50188 MANUAL: The source sweep list function does not support `smu.DELAY_AUTO`.

**Models affected:**

All 2450

**Symptom:**

In the 2450 Reference Manual, the documentation incorrectly states that the source sweep list function supports the setting `smu.DELAY_AUTO`.

**Workaround:**

Do not use the setting -1 for delay in the following command:

```
:SOURCE[1]:SWEEP:<function>:LIST
```

Do not use the setting `smu.DELAY_AUTO` in the following command:  
`smu.source.sweeplist()`

The next version of the 2450 Reference Manual will be corrected.

PR50228 The `display.screen` command has been changed.

**Models affected:**

All 2450

**Symptom:**

The TSP attribute command, `display.screen`, has been replaced with a TSP function, `display.changescreen()`. The parameters to the new function are the same that `display.screen` previously took as a set attribute.

The SCPI query command `DISPlay:SCReen?` does not exist.

The `DISPlay:SCReen` command is only intended to change the screen view NOT to query which view is active

**Workaround:**

N/A

PR50231 Need to Add Customer Calibration.

**Models affected:**

All 2450

**Symptom:**

Because the 2450 added two lower current ranges and one lower voltage range, existing 2400 customer calibration hardware will not work on the 2450. Keithley is working on a recommended customer calibration equipment list, but for now, customer calibration of the 2450 is not supported.

**Workaround:**

Keithley plans to support customer calibration within six months after shipping the initial Model 2450. Please see [www.keithley.com](http://www.keithley.com) for updates.

PR50350 Trying to print beyond buffer dimensions causes timeout for new buffer.

**Models affected:**

All 2450

**Symptom:**

Attempting to print buffer elements that are outside the range of `[1, bufferVar.n]` may cause a script to hang or a bus command to timeout.

**Workaround:**

Prior to using `print()` command with a buffer or `printbuffer()`, the elements or bounds provided should be checked to ensure that they are between 1 and `bufferVar.n`, inclusively.

PR50378 Config lists generated by the sweep API don't get saved to the config script.

**Models affected:**

All 2450

**Symptom:**

Changes made to source config lists generated using the sweep API are not retained when saving the configuration.

**Workaround:**

Move all points in the config list generated using the sweep API to a new config list. This can be accomplished by first, creating a new config list. Next, iteratively recall each point from the sweep config list and store it to the new config list. Then delete the config list generated by the sweep API. Finally, build a custom trigger model that uses the new config list.

PR50379 Customer trigger model is overwritten when restoring pre-boxed sweep.

**Models affected:**

All 2450

**Symptom:**

Changes made to trigger models generated using the sweep API are not retained when saving the configuration.

**Workaround:**

Move all points in the config list generated using the sweep API to a new config list. This can be accomplished by first, creating a new config list. Next, iteratively recall each point from the sweep config list and store it to the new config list. Then delete the config list generated by the sweep API. Finally, build a custom trigger model that uses the new config list.

PR50404 TSP-Link does not reset properly on some units.

**Models affected:**

All 2450

**Symptom:**

TSP-Link reset or initialization may consistently fail on certain units. The unit being reset or initialized may ignore the reset or initialization command, stop responding to bus commands, and/or display "Slave" in the communications status indicator.

**Workaround:**

If the reset or initialization command is ignored, try calling it again. It may necessary to repeat this action up to ten times. If the command causes a time-out for bus communications and/or "Slave" is

displayed in the communications status indicator for the unit being reset or initialized, then it is necessary to choose a different unit to be the TSP-Link master.

PR50497 SCPI command syntax checking: Error is not generated if parameter is not valid long or short form of the specified command.

**Models affected:**

All 2450

**Symptom:**

The 2450 fails to generate an error when the parameter to a SCPI command does not match either the short or long form of the parameter being specified. Instead, the unit will accept any number of characters between the short and long form as being valid. For example, in the following list, only the first two examples should be allowed, however, the additional four examples are being accepted as valid. In a future firmware release, the additional four examples will generate an error message.

COMMAND	v1.0.0 Firmware	Future Firmware
:SYSTem:EVENTlog:COUNT? INF	OK	OK
:SYSTem:EVENTlog:COUNT? INFORMATIONAL	OK	OK
:SYSTem:EVENTlog:COUNT? INFO	OK	SYNTAX ERROR
:SYSTem:EVENTlog:COUNT? INFORM	OK	SYNTAX ERROR
:SYSTem:EVENTlog:COUNT? INFORMAT	OK	SYNTAX ERROR
:SYSTem:EVENTlog:COUNT? INFORMATION	OK	SYNTAX ERROR

**Workaround:**

Only send a valid short or long form of the SCPI command parameter. Based on the example listed, send either INF or INFORMATIONAL for the related command. This will avoid new syntax errors when upgrading to new 2450 firmware in the future.

PR51449 Calibration Date is set to 03/16/1996 after updating 1.0.0i to 1.1.0s.

**Models affected:**

All 2450

**Symptom:**

After upgrading the 2450 firmware from version v1.0.0i to v1.1.0s, the Calibration Date is 03/16/1996. Do NOT be alarmed. This issue has NO IMPACT on calibration and calibration values. The issue is that from v1.0.0i to v1.1.0s, a new date field was added and it has not been initialized properly. Also, the date headings have also changed to differentiate between Adjust Date and Calibration Date (e.g. Verification Date). See the diagrams below.

v1.0.0i firmware

v1.1.0s firmware

SYSTEM INFORMATION	
Serial Number	01419971
Version	1.0.0i
Detected Line Frequency	60 Hz
Calibration Adjust Date	08/14/2014
Calibration Adjust Count	1

SYSTEM INFORMATION	
Serial Number	01419971
Version	1.1.0s
Detected Line Frequency	60 Hz
Adjust Date	08/14/2014
Adjust Count	1
Calibration Date	03/16/1996

Before, there was only one date field named “Calibration Adjust Date.” This was the date that the 2450 was last calibrated WITH adjustment. Starting with the v1.1.0s firmware, a new date named “Calibration Date” was added to display and differentiate between the Adjust Date and Calibration (without adjust) Date. The new “Adjust Date” is the same field as the old “Calibration Adjust Date.” The new “Calibration Date” is brand new field and this will be the date the 2450 was last calibrated WITHOUT adjustment. Since the new “Calibration Date” field did not exist with v1.0.0i firmware, this new date is un-initialized and has defaulted to 03/16/1996. Again, this has zero impact on the original factory calibration and does not impact the factory stored calibration constants in any way.

**Workaround:**

This date will be properly set the next time the 2450 is returned to Keithley or a designated field service office for recalibration. If you insist on updating the “Calibration Date” to equal the “Adjust Date”, please refer to the “Model 2450 Interactive SourceMeter Calibration Manual.” This manual can be found at [www.keithley.com](http://www.keithley.com). The document is 2450-905-01.