KEITHLEY

# Model 2450 System SourceMeter®

## Version v1.0.0 Firmware Release Notes

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## Contents

# General Information

## Supported models

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

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

## 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_0_0i.upg`.
2. Verify that the upgrade file is in the root subdirectory of the flash drive and that it is the only firmware file in that location. 2450 firmware files end with the file extension .upg. (example: H:\ki_2450_v1_0_0i.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.

*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. If you decide to upgrade the firmware in your instrument, follow the instructions in the manual. Alternatively, you can arrange to have Keithley Instruments upgrade your firmware at the factory by calling your local Keithley Instruments support office.

## Upgrade considerations for the Model 2450.

Firmware Version 1.0.0 is the initial release of firmware for the Model 2450 product.

# Version v1.0.0 Release

## 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

**N/A**

## 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

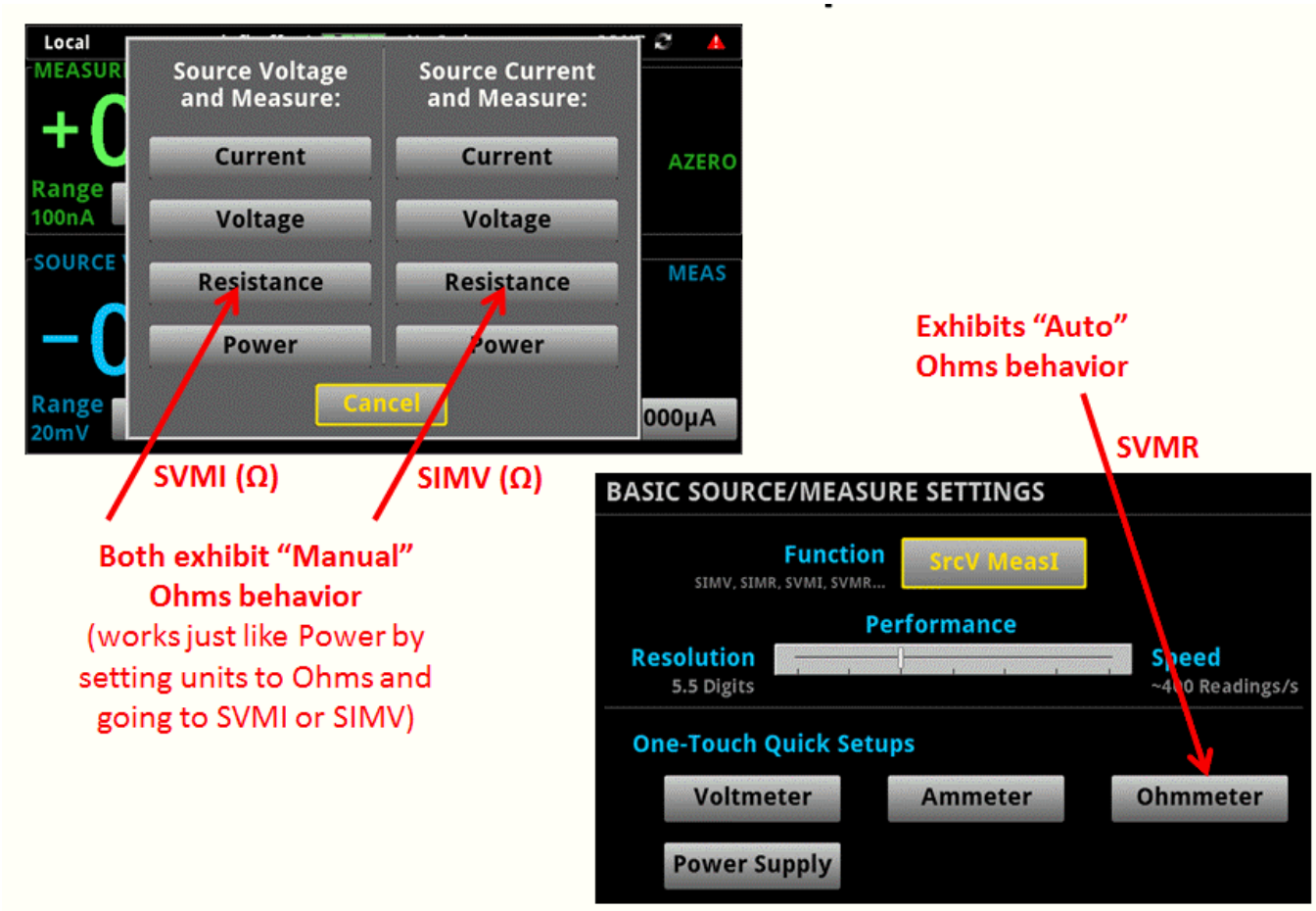
- `SOURce:FUNC CURRent`
- `[SENSe[1]]:FUNC "VOLTage"`
- `[SENSe[1]]:VOLTage:UNIT OHM`

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 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.