Model 2461 System SourceMeter®
Version v1.6.5b Firmware Release Notes

Keithley Instruments

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Contents

General Information

Supported models

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

  2461, 2461-NFP, 2461-RACK, 2461-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_2461_v1_6_5b.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. 2461 firmware files end with the file extension .upg. (example: H:\ki_2461_v1_6_5b.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 2461 Interactive SourceMeter® Instrument Reference Manual (document number: 2461-901-01). This manual is available online at http://www.tek.com/support, Search for "2461 Reference Manual" when you get there.

Upgrade considerations for the Model 2461.

Upgrade files are available on the Keithley Instruments website (http://www.tek.com/keithley).
To find firmware files on the Keithley Instruments website:
1. Select the **Support** tab.
2. In the model number box, type **2461**.
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 v1.6.5b Release

Overview

Version 1.6.5b is an audited minor release which fixes one bug listed below.
RELEASED 24-OCT-2017

Critical Fixes

PR61502   From a cold power up, the Model 2461 SMU will sometimes fail with the following error message and will not operate properly.
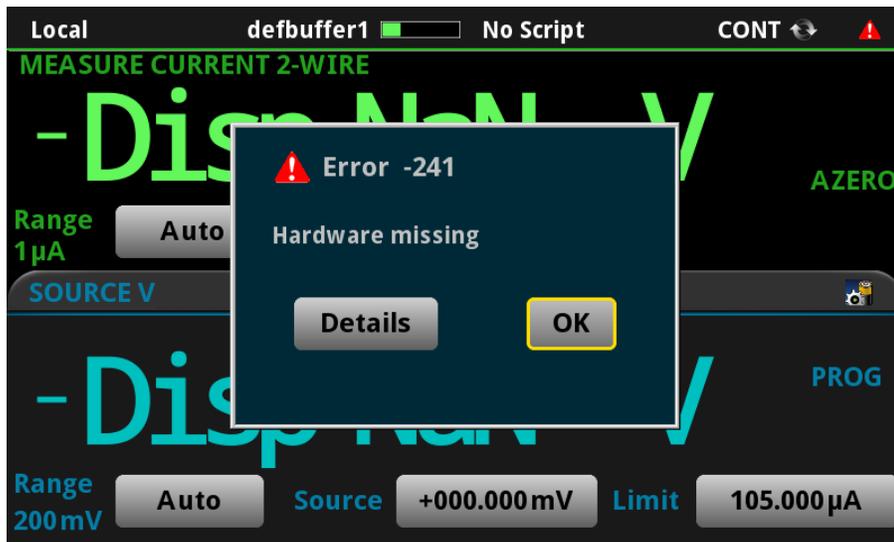
Models affected:

All 2461 models

Symptom:

If this issue occurs, a subsequent power cycle will allow the instrument to power up properly.

Resolution:

This issue has been corrected with firmware revision v.1.6.5.

Version v1.6.4c Release

Overview

Version 1.6.4c is an audited minor release which fixes a number of different bugs all listed below.
RELEASED 23-JUN-2017

Critical Fixes

AR55151   Problem with Abort on Limit. When sweeping voltage, the unit stops prematurely and never reaches
AR55431   the current limit.
AR55767
PR61306   **Models affected:**

All 2450 models, 2460 models, 2461 models

Symptom:

This bug was introduced with firmware revision v1.6.1a and is fixed with firmware revision v1.6.4c.

Resolution:

This issue has been corrected.

AR55671   Problem with Abort on Limit. Fail warning message 2733 "TM path #1 block #12 ended due to source
PR61306   limit exceeded" is displayed even though the true source limit was not reached.

Models affected:

All 2450 models, 2460 models, 2461 models

Symptom:

This bug was introduced with firmware revision v1.6.3d and is fixed with firmware revision v1.6.4c.

Resolution:

This issue has been corrected.

Version v1.6.3d Release

Overview

Version 1.6.3d is an audited minor release which fixes a number of different bugs all listed below.
RELEASED 18-APR-2017

Critical Fixes

AR54361
PR60339

2450 Measure Configuration Lists do not save Auto Range setting.

Models affected:

All 2450 models, 2460 models, 2461 models

Symptom:

The Auto Range attribute was not being saved correctly when Config Lists were created. Auto Range was always set to "Off".

Resolution:

This issue has been corrected.

AR54920
AR60477

Trigger timer does not work correctly for counts > 65535

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

Before this enhancement, the TTI products had a limit of 65,535 points for the trigger timer. This limit has been increased to 1,048,575 to match how the 26xx products behave. The trigger timer will now work up to 1,048,575 points.

Resolution:

This enhancement has been made.

AR55122
AR60647

Under certain conditions, the instrument will lock up in ohm-meter mode.

Models affected:

All 2461 models

Symptom:

A bug with ohm-meter mode was introduced in firmware revision v1.6.1a whereby connecting and disconnecting a device under test (DUT) while measuring in ohm-meter mode, caused the instrument to lock up.

Resolution:

This issue has been corrected.

PR60362   Output button cannot turn off the output without a power cycle.

Models affected:

All 2450 models, 2460 models, 2461 models
Symptom:

Under certain conditions, when in Ohm Meter mode and changing source values, the instrument will display +0.00000GV or !DispNAN!V and the output button cannot turn off the output without a power cycle.

Resolution:

This issue has been corrected.

PR60377   ENHANCEMENT: Add firmware version and program counter to blue screen information.

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models
Symptom:

Whenever a rare system crash occurs and displays a blue screen, valuable information such as firmware revision and program counter (PC) will be displayed to help pinpoint the exact location of the crash.

Resolution:

This enhancement has been made.

PR60504   Trigger model based upon trigger timer sometimes hangs during a long-term test

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models
Symptom:

Under certain conditions, creating a trigger model based upon the trigger timer will hang right in the middle of a test that runs for many minutes or longer. This bug was introduced in firmware revision 1.5.0.

Resolution:

This issue has been corrected.

Version v1.6.1a Release

Overview

Version 1.6.1a is a Hot Fix against Service Pack 6 firmware v1.6.0i. Only one critical fix was made and no other changes were introduced.
RELEASED 25-JUL-2016

Critical Fixes

PR59438   HF1: Cannot graph digitizer with track group

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

When customers enable track groups on the graph, data is either wrong or completely missing. This is especially problematic for graphing digitized data and for Demo mode.

Resolution:

This issue has been corrected.

Version v1.6.0i Release

Overview

Version 1.6.0i is the third official firmware release for the Model 2461. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

Compatibility concerns

N/A

Critical Fixes

PR57048   Instrument not reliably responding to NI VISA "go to local" function
PR57905
AR50675   **Models affected:**

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

Under certain conditions customers are not able to reconnect to the 2461 after remote operation and manually placing the 2461 into local mode.

Resolution:

This issue has been corrected. The instrument will now go into "local mode" after issuing the "logout" command.

PR58210   Buffer file contains extra NULL values.
AR52304   **Models affected:**

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

When saving a databuffer on the DMM7510 form the internal webpage the databuffer will insert NULL values into the CSV file. When saving a buffer from the front panel of the instrument there are no NULL values inserted for the same data set.

Resolution:
This issue has been corrected. Extra NULL characters are no longer generated.

PR58329   There are complaints about swipe screen performance.
AR52702   **Models affected:**

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

Most swipe screens appear to move more slowly than in previous firmware revisions.

Resolution:

This issue has been corrected. Swipe screen action has been restored to previous versions of firmware and has been slightly sped up.

PR58384
AR52713
Downgrading from firmware revision v1.5.0 to v1.3.0 will cause the unit to reboot unnecessarily.

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

When downgrading firmware from v1.5.0 to v1.3.0, a warning message window instructing the user to remove existing scripts will display and then the unit will reboot unconditionally.

Resolution:

This issue has been corrected with version v1.6.0 and later. The unit will only reboot if the user proceeds with the downgrade.

PR58469
AR52717
Pressing the <HOME> button 2 times behavior changes from v1.3.0 to v1.5.0.

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

Feature definition on FW 1.3.0s or earlier is push HOME key once goes to last swipe screen on the home screen. Pushing HOME key a 2nd time takes you back to home swipe on the home screen. FW1.5.0g does not do that 2nd HOME key action.

Resolution:

This issue has been corrected. Previous behavior has been restored.

PR56812
TTI Instruments do not work well when TSP-Linked to a Model 26xx.

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

When hooking up (4) 26xx-X SMUs to each other in series (one of which is the master) and then putting a TTI Instrument on the end, the box will lock up after the 3rd tsplink.reset(). The problem gets worse if you start hooking instruments in parallel.

Resolution:

This issue has been corrected.

PR58964
Timing problem with Autoexec scripts.

Models affected:

All 2450 models, 2460 models, 2461 models, 7510 models

Symptom:

Certain scripts that have been designated as 'default' or Autoexec scripts will start running before the system has completely booted up. This may cause the Autoexec script to get skipped and not executed at all upon first boot up.

Resolution:

This issue has been corrected.

Enhancements

PR56495   **Models affected:**

All 2450 models, 2460 models, 2461 models, 7510 models

Enhancement:

When turning on REL, the units on the graph should not change. This behavior has been implemented.

PR57428   **Models affected:**

All 2461 models

Enhancement:

Enable High-Resolution Source hardware to enhance source resolution spec for the Model 2461.

A software enhancement was made to enable existing hardware in the Model 2461 to improve the source resolution for the product. This enhancement allows for finer control of the source value. Source accuracy and noise specifications are unchanged. Refer to the table below to see the new source resolution specifications.

The new high-resolution source capability relies on the 2461 ACAL for optimizing results. After upgrading to firmware revision v1.6.0, you may receive "Warning 5121 – The high resolution source has not had the initial ACAL adjustment". This is normal. Ensure that the proper ACAL warmup time has elapsed before running ACAL.

For best performance, at least one ACAL should be run after this firmware upgrade to ensure that the high-resolution source calibration is initialized to appropriate values. After this initial run, no further ACAL should be required within the normal 1-year calibration cycle, unless you are using the digitizer function to make readings.

<u>**Auto Calibration Preparation**</u>

To prepare for auto calibration:
1) Disable voltage sources on any test cables that are connected to the front-panel or rear-panel terminals.
2) Place the Model 2461 in a temperature-stable environment.
3) Turn on the instrument power and allow the instrument to warm up for at least 60 minutes. When the instrument has completed the warm-up period, start monitoring the temperature drift if using the digitizer function.

<u>**Auto Calibration Procedure from the front panel of the Model 2461**</u>

1) Press the **MENU** key.
2) Under the System menu, select **Calibration**.
3) Select **Start ACAL**. A prompt is displayed.
4) Select **Yes**. The Start ACAL button turns gray and a spinning activity indicator is displayed while the Auto Calibration executes.
5) After Auto Calibration is complete, the information on the Calibration screen is updated.

To run Auto Calibration using SCPI commands

Send the command: **`ACAL:RUN`**

To run Auto Calibration using TSP commands

Send the command: **`acal.run()`**

If you receive "Error 5120 – The gain acquired during ACAL for the high-resolution DAC is out of range" while running ACAL after this firmware upgrade, you should ensure that you have allowed the proper ACAL warmup time, that the Model 2461 is in a stable environment, and that nothing is connected to the instrument terminals and try to run the ACAL procedure again. If you continue to receive this error, contact Keithley Instruments for service.

Specifications Changes

Source Range:	Old Resolution:	New Resolution:
200mV	5uV	100nV
2V	50uV	1uV
7V	250uV	1uV
10V	250uV	10uV
20V	500uV	10uV
200V	2.5mV	100uV

Source Range:	Old Resolution:	New Resolution:
1uA	50pA	1pA
10uA	500pA	10pA
100uA	5nA	100pA
1mA	50nA	1nA
10mA	500nA	10nA
100mA	5uA	100nA
1A	250uA	1uA
4A	250uA	1uA
5A	250uA	1uA
7A	500uA	1uA
10A	500uA	10uA

PR58734 **Models affected:**

All 2450 models, 2460 models, 2461 models, 7510 models

Enhancement:

The reading tables have been enhanced to visually differentiate between OVERFLOW and LIMITS. Overflow readings will now be set to RED TEXT and Limits will be set to YELLOW

Noncritical Fixes

PR58864 Swipe screen content disappears after pressing the home key on large reading screen.

> **Models affected:**
>
> All 2450 models, 2460 models, 2461 models, 7510 models
>
> **Symptom:**
>
> Under certain sequences of events, after minimizing the default swipe screen and then pressing the HOME button, certain content on the swipe screen will be missing.
>
> **Resolution:**
>
> This issue has been corrected.

Known issues

> **N/A**

Version v1.4.1d Release

Overview

Version 1.4.1d is the second official firmware release for the Model 2461. Known Issues, Usage Notes, and Upcoming Enhancements are listed below in this document.

Compatibility concerns

N/A

Critical Fixes

PR57078 **Models affected:**

All 2461 models

Symptom:

No measurements from analog on power-up; fan ramps to full speed/loud.

Roughly 2 out of every 100 power cycles, no measurements will show up on the front panel and the fan will ramp up to high speed and stay there.

Resolution:

This issue has been resolved. A timing bug in the Analog FPGA was found and corrected.

PR57123 **Models affected:**

All 2461 models

Symptom:

The digitizer performance slider control currently max's out at 70kS/s.

The digitizer actually supports up to 1,000,000 samples per second.

Resolution:

This issue has been resolved. The digitizer slider presets have been set to 1000, 10000, 25000, 50000, 100000, 500000, and 1000000.

PR57272 **Models affected:**

All 2461 models

Symptom:

Digitize sweeps are sometimes digitizing too much.

The trigger flow generated by the `smu.source.pulsesweep()` function set up for the digitizer is running throughout the entire sweep, including the overhead and output off at the end. Instead, the digitize blocks should encapsulate only the pulse itself. Starting the digitizer should also set a start group marker in the buffer.

Resolution:

Changes have been made so that now the SmartScale will automatically select TrackGroup for the pulse sweeps, which will effectively lock the view to the last pulse in the train/sweep. To view the entire pulse train/sweep, select X-Axis method "All" from the scale tab.

PR57293   **Models affected:**

All 2461 models

Symptom:

Digitizer incorrectly reports compliance and output state for sample rates > 100kS/s.

Resolution:

This issue has been resolved..

PR57313   **Models affected:**

All 2461 models

Symptom:

Sweep functions throw an error when used with a digitize function.

When on a digitize function and the instrument is configured for a sweep operation, the instrument errors when trying to initialize the trigger model since it contains measure block instead of digitize blocks.

Resolution:

This issue has been resolved.

PR57327   **Models affected:**

All 2461 models

Symptom:

Pulse list API is not enforcing a minimum pulse width of 150us.

Resolution:

This issue has been resolved. The instrument now checks for small pulses and produces the correct error when they are too small.

PR57328   **Models affected:**

All 2461 models

Symptom:

Sweep List and Pulse List won't run if the Source Config List has only one stored index.

After initiating a trigger model from a pulse or sweep operation with a source config list that contains only 1 index, the user receives `error 2709 Block number 5 cannot be reached` and the trigger model doesn't execute.

Resolution:

This issue has been resolved.

PR57329 **Models affected:**

All 2461 models

Symptom:

Creating a Trigger Model for a Pulse List takes nonlinear time depending on stored indexes..

The unit takes a long time or appears to be locked up when processing a pulse sweep list remote command. For 10K index in source configuration list, it seems to take over 15 seconds or so to complete command and if at 100K indexes, it appears locked up and taking minutes to complete.

Resolution:

This issue has been resolved.

PR57335 **Models affected:**

All 2461 models

Symptom:

Contact Check will fail if preceded by the Measure Resistance Function.

Resolution:

This issue has been resolved.

PR57363 **Models affected:**

All 2461 models

Symptom:

SweepList and PulseSweepList are not appearing in CreateConfigScript file.

Recalling a setup (SCPI) or saved configuration script (TSP) that was generated after creating a custom source configuration list and using it with a sweep list or pulse sweep list command fails to recall the sweep list configuration correctly. Instead it recalls the list or pulse list sweeps as linear step sweeps.

Resolution:

This issue has been resolved.

PR57502 **Models affected:**

All 2461 models

Symptom:

On some units, the digitizer stops after taking a large number of readings.

Some units typically run for about 1,000,000 readings before stopping. Measurements can be restarted by clearing the active buffer.

Resolution:

This issue has been resolved.

Enhancements

PR57317 **Models affected:**

All 2461 models

Short Description:

Measure config lists recall 'active' will not give an error when provided bad values and locks up.

Long Description:

Enhancement commands have been added to the TSP and SCPI command sets to allow setting the measure or digitize function and the source function with a single command instead of needing to use two (2) commands.

You would use these new commands to allow the instrument to intermix the settings of the measure/digitize function with the settings of the source function to avoid warnings or maybe errors if done separately while setting them. This new command eliminates the need for you to be concerned if you should send the measure or source function command first. Use the individual commands to query what measure/digitize function and source function are set.

<u>New SCPI command:</u>

```
SYSTem:CONFigure:FUNCtions "<measure/digitize function>", <source function>
```

valid measure/digitize function parameters for `"<measure/digitize function>"` are:

```
"VOLTage[:DC]"
"CURRent[:DC]"
"DIGitize:VOLTage"
"DIGitize:CURRent"
```

also accepted but will generate errors since invalid options `"NONE"` and `"RESistance"`

valid source function parameters for `<source function>` are:

```
VOLTage
CURRent
```

New TSP command:

```
smu.setfuncs(<measure/digitize function>, <source function>)
```

valid measure/digitize function parameters for `<measure/digitize function>` are:

```
smu.FUNC_DC_VOLTAGE
smu.FUNC_DC_CURRENT
smu.FUNC_DIGITIZE_VOLTAGE
smu.FUNC_DIGITIZE_CURRENT
```

also accepted but will generate errors since invalid options

```
smu.FUNC_NONE
smu.FUNC_RESISTANCE
```

valid source function parameters for `<source function>` are:

```
smu.FUNC_DC_VOLTAGE
smu.FUNC_DC_CURRENT
```

PR57303
PR57360
PR57361

Models affected:

All 2461 models

Short Description:

Overall Pulse performance has been improved.

Long Description:

The performance of the following behaviors has been improved.

a) Trigger Stop Block takes a long time when trigger model is running in firmware.
b) Sometimes, random pulses are not going to their proper bias level.
c) Sometimes, for pulses with low magnitude, digitizer returns incorrect readings.

Problems with each of these use cases have been repaired and improved.

Noncritical Fixes

PR57315 **Models affected:**

All 2461 models

Symptom:

Descenders for letter "p" and "mu" are not long enough for certain screens.

A number of tabbed windows throughout the 2461 GUI would sometimes cut off any text that dropped below the line such as lower-case 'y' and 'p'.

Resolution:

This issue has been resolved. The tab control cut off 4 pixels around the circumference of each tabbed window. This 4 pixel frame has been removed and full characters are now visible in all cases.

Known issues

N/A

Version v1.4.0k Release

Overview

Version 1.4.0k is the initial firmware release for the Model 2461. 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

N/A