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## GENERAL INFORMATION

### SUPPORTED MODELS

This firmware is used on the following Keithley Instruments product models:

- Model 2461 High-Current SourceMeter® Instrument
- 2461-NFP
- 2461-RACK
- 2461-NFP-RACK

### INSTALLATION INSTRUCTIONS

#### Firmware upgrade and downgrade instructions

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## CAUTION

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

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#### *From the front panel:*

1. Copy the firmware upgrade file (.upg file) to a USB flash drive.
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.
3. Disconnect any terminals that are attached to the instrument.
4. Turn the instrument power off. Wait a few seconds.
5. Turn the instrument power on.
6. Insert the flash drive into the USB port on the front panel of the instrument.
7. From the instrument front panel, press the **MENU** key.
8. Under System, select **Info/Manage**.
9. Choose an upgrade option:
  - To upgrade to a newer version of firmware: Select **Upgrade to New**.
  - To return to a previous version of firmware: Select **Downgrade to Older**.
10. When the upgrade is complete, reboot the instrument.

A message is displayed while the upgrade is in progress.

For additional firmware installation instructions, refer to the “Upgrading the firmware” topic in the “Maintenance” section of the *Model 2461 High-Current SourceMeter Instrument Reference Manual* (document number 2461-901-01). This manual is available online at [tek.com/keithley](http://tek.com/keithley).

## VERSION 1.7.3 RELEASE

### OVERVIEW

Version 1.7.3 provides fixes and enhancements.

### CRITICAL FIXES

<b>Reference number:</b>	NS-1923
<b>Symptom:</b>	When measuring resistance in local mode, the SMU does not switch from <code>INACTive</code> to <code>CONTinuous</code> measurement when output is turned on.
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	NS-1927
<b>Symptom:</b>	The LXI identification web page shows the incorrect LXI version and web page links.
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	NS-1941
<b>Symptom:</b>	Infinite pulse train trigger models with high speed digitizing might be affected when viewing the digitizing readings on the graph. While trigger model is running, it might generate undesired large idle gaps between pulses.
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	NS-1944
<b>Symptom:</b>	Source and Limit values do not update correctly when exiting the quick edit method (not live edit) with the navigation control.
<b>Resolution:</b>	This issue has been corrected.

### KNOWN ISSUES

<b>Reference number:</b>	NS-1959
<b>Symptom:</b>	When graphing infinite high-speed (above 100,000 samples) digitize readings, the graph may show gaps in data when a popup dialog appears indicating "Processing reading backlog."
<b>Workaround:</b>	Once the processing reading backlog dialog clears and more readings are graphed, the artifacts will clear.

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**ENHANCEMENTS**

<b>Category</b>  <b>Reference number:</b>	<b>Remote commands</b>  NS-1931: Added a TLS (transport layer security) option when using the <code>tspnet.connect()</code> command.  <pre>connectionID = tspnet.connect(ipAddress, portNumber,                              initString, useTLS)</pre> <p><i>ipAddress</i>: A string that indicates the IP address or host name to connect to.  <i>portNumber</i>: Default 5025.  <i>initString</i>: Sends a string to <i>ipAddress</i>.  <i>useTLS</i>: 0 or 1;  0: Do not use TLS with the connection (default)  1: Use TLS with the connection.</p> <p>When <i>useTLS</i> is set to 1, the instrument negotiates the security protocol when connecting to the host or IP address that is used. This security protocol is used when using <code>tspnet.write()</code> to send data or <code>tspnet.read()</code> to receive data.</p> <p>The following is an example of how to use a host name with the TLS option:  <pre>connectionID = tspnet.connect("hostname.domain.com",                              443, "", 1)</pre></p>
<b>Category</b>  <b>Reference number:</b>	<b>Remote commands</b>  NS-1960: The <code>localnode.gettimewithfractional()</code> TSP command is available to retrieve the number of seconds elapsed since January 1, 1970, with fractional seconds appended to the returned response.

## VERSION 1.7.2 RELEASE

### OVERVIEW

Version 1.7.2 provides fixes and required support.

### CRITICAL FIXES

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<b>Reference number:</b>	NS-1902
<b>Symptom:</b>	After using a pulse or sweep command that specifies a user-created buffer instead of a default buffer, the configuration of the instrument is saved in a setup or configuration script. Recalling this setup or running this script causes an error that says a parameter expecting a certain reading buffer type but instead finding an unknown type.
<b>Resolution:</b>	This issue has been corrected.

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### NONCRITICAL FIXES

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<b>Reference number:</b>	NS-1915
<b>Symptom:</b>	When running a Test Script Processor® (TSP) script application with a custom user interface that has an End App button, the custom user interface may not close properly when “End App” is selected.
<b>Resolution:</b>	This issue has been corrected. This fix also introduces a behavior change from previous firmware versions. If you are running a nested script (scripts running within a script), the user interface only displays the first running script. Previously, the user interface displayed name changes between nested scripts.

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## VERSION 1.7.1 RELEASE

### OVERVIEW

Version 1.7.1 provides minor fixes and required support for the I-V Tracer TSP™ Application. You must install the new firmware to use the Application, available from:

[https://www.tek.com/keithley-i-v\\_tracer](https://www.tek.com/keithley-i-v_tracer).

The support changes for the Application do not impact normal instrument operation.

### CRITICAL FIXES

<b>Reference number:</b>	NS-1846
<b>Symptom:</b>	Pressing the Function key repeatedly while running a script or trigger model generates several messages stating that the key is disabled. This may cause the instrument to stop functioning, depending on the number of messages generated.
<b>Resolution:</b>	This issue has been corrected.

### NONCRITICAL FIXES

<b>Reference number:</b>	NS-1869
<b>Symptom:</b>	Setting a digitize range value when the digitize function matches the source function (such as when digitizing voltage and sourcing voltage) can result in the following error that references digitize autozero instead of digitize range: 1128, Parameter, digitize auto zero, conflicts because digitize and source functions are the same.
<b>Resolution:</b>	This issue has been corrected.

### ENHANCEMENTS

Category	Applications
	<ul style="list-style-type: none"> <li>Changes have been made to the Apps Manager view to state whether or not an Application is supported on an instrument and the required firmware version.</li> </ul>

## VERSION 1.7.0 RELEASE

### OVERVIEW

Version 1.7.0 is a significant maintenance firmware release for the 2461 that brings numerous updates along with stability and reliability improvements. See the *Model 2461 High-Current SourceMeter Reference Manual* (document number 2461-901-01) for more information.

### CRITICAL FIXES

<b>Reference number:</b>	AR41304, NS-460
<b>Symptom:</b>	Unable to set continuous measurement with a remote command.
<b>Resolution:</b>	Remote commands added.
<b>Reference number:</b>	AR41750, AR41769, AR42131, AR42243, AR42807, AR50058, AR50059, NS-422
<b>Symptom:</b>	<p>The effective source limit of the SMU is the lesser of either the programmed source limit or 105% of the active measure range. If you use fixed measure ranges, the instrument prevents you from selecting different limit and measure ranges.</p> <p>However, if measure autorange is selected, it is possible for the autorange process to cause the ranges to differ because the instrument may go down to a range that is lower than the one on which the source limit is programmed. This causes the effective source limit to drop to 105% of the newly selected measure range. The source limit will remain at this value until either you make another measurement that causes a range change or you explicitly select another range.</p> <p>If you take no action to change the measure range before you change the source level, or perhaps test a new device, you may find that the output voltage or current level is less than expected due to the reduced source limit. This may prevent your device from properly turning on or otherwise operating as expected.</p>
<b>Resolution:</b>	These issues have been addressed. The front panel display now indicates if the SMU output is limited by the programmed source limit or by the active measure range. A new autorange mode was also added to automatically set the measure range equal to the source limit range after a measurement is completed (see "Enhancements").
<b>Reference number:</b>	AR55036, AR62150, NS-339
<b>Symptom:</b>	Repeated creation and deletion of user-defined buffers may cause out-of-memory errors. Error messages indicating the maximum size for buffers being created are wrong and provide misleading guidance.
<b>Resolution:</b>	Reading buffer memory management now allows users to easily allocate the largest size available when creating a reading buffer. Documentation has been clarified to explain the creation process. Improved buffer memory management also greatly reduces the possibility of getting out-of-memory errors.

<b>Reference number:</b>	AR56349, AR60259, NS-929
<b>Symptom:</b>	USB communication issues.
<b>Resolution:</b>	To better accommodate the variety of VISA installation options available to users, the STALLing USBTMC is not active as it had been before.
<b>Reference number:</b>	AR61116, AR62660, NS-529, NS-1558
<b>Symptom:</b>	Repeatedly saving a buffer to a file on a USB flash drive using the <code>buffer.saveappend</code> command eventually causes Error 2203, "Cannot open file."
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	AR62310
<b>Symptom:</b>	Exercising various combinations of front panel settings for the Event Log may cause the front panel to lock up.
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	AR62342, NS-1483
<b>Symptom:</b>	Pulse train generation is inconsistent when configuring the SMU to Source Voltage and Digitize Voltage, and then creating a Trigger Model to generate an Infinite Pulse Train (10 ms ON and 1 ms OFF) more than once.
<b>Resolution:</b>	This issue has been corrected.
<b>Reference number:</b>	AR62390, AR62391, AR62392, NS-1382
<b>Symptom:</b>	Executing a Configuration List sweep that changes the source level, function, limit, range, and measure function and range may not be repeatable. The following issues may be observed: <ul style="list-style-type: none"> <li>• The duration of a step in the sweep alternates between two values in consecutive cycles of the sweep.</li> <li>• The first step in the sweep is not reproduced in subsequent consecutive cycles of the sweep.</li> <li>• The first step in a sweep is missing in alternating consecutive cycles of the sweep.</li> </ul>
<b>Resolution:</b>	This issue has been resolved.
<b>Reference number:</b>	AR63013, NS-1738
<b>Symptom:</b>	The trigger model may cause the instrument to become unresponsive when you configure the SMU to perform a pulsed voltage sweep using the Trigger Model. The current measure range is initially set to 1 uA and measure autorange is enabled. You connect a 1 ohm load to the SMU and you initiate the Trigger Model. You observe that if the first step in the sweep does not produce at least 700mA of current, then the Trigger Model will hang up.
<b>Resolution:</b>	This issue has been resolved.

<b>Reference number:</b>	AR63231
<b>Symptom:</b>	If you change the source function while you are at the Pulse Settings screen, the change will not go into effect unless you go to the Main Menu and then re-select Pulse.
<b>Resolution:</b>	This issue has been resolved.

## KNOWN ISSUES

<b>Reference number:</b>	AR62218, NS-1241
<b>Symptom:</b>	Rapidly changing the Quickset performance slider between medium and fast settings can result in the slider becoming unresponsive.
<b>Workaround:</b>	Switch to another screen and back to Quickset.

## ENHANCEMENTS

<b>Category</b>	<b>Reading buffers</b> <ul style="list-style-type: none"> <li>Reading buffer memory management now allows users to easily allocate the largest size available when creating a reading buffer.</li> <li>Additional options are now available when saving data to a USB flash drive.</li> <li>Buffer statistics and options for accessing data from reading buffers have been added.</li> <li>Added reading buffer math and unit support.</li> <li>Added formatting options for writable buffers.</li> <li>Added a method to clear the active buffer by pressing the MENU + EXIT keys.</li> <li>When selecting the active buffer, an option now exists to create a new user buffer.</li> <li>Added the <code>display.activebuffer</code> TSP command and <code>DISPlay:BUFFer:ACTive</code> SCPI command to specify the active buffer for the instrument using remote commands.</li> </ul>
<b>Category</b>	<b>Measurement speed</b> <ul style="list-style-type: none"> <li>A priority voltage option has been added which allows you to select the power supply rail to prevent excessive switching between rails (<code>smu.priorityvoltage</code> and <code>:SYSTEM:PRIority:VOLTage</code>).</li> <li>A fast range change option has been added which allows you to suppress checks for transients and overshoots that are normally done before range changes (<code>smu.fastrangechange</code> and <code>:SYSTEM:FAST:RANGE:CHANGe</code>).</li> <li>These options are only supported in instrument serial numbers 4400794 and above.</li> </ul>

<b>Category</b>	<b>Configuration lists</b> <ul style="list-style-type: none"> <li>• Enhanced user interface screen for accessing configuration list settings.</li> <li>• Added the ability to use remote commands to store inactive source and measure function settings in a configuration list index.</li> <li>• Added the ability to use remote commands to query or configure inactive source and measure function attributes.</li> </ul>
<b>Category</b>	<b>Trigger model</b> <ul style="list-style-type: none"> <li>• The Measure and Digitize trigger blocks have been combined into a single Measure and Digitize block. The new trigger block either measures or digitizes based on the active function. When used with a Measure Configuration list, this trigger block lets you make sequential measurements with the analog-to-digital converter and the digitizer (when available) in the same trigger model. <ul style="list-style-type: none"> <li>• The SCPI command is <code>:TRIGger:BLOCK:MDIGitize</code>. The TSP command is <code>trigger.BLOCK_MEASURE_DIGITIZE</code>.</li> <li>• The remote commands for the original Measure and Digitize trigger blocks are still accepted to provide compatibility with existing test programs and scripts. However, the trigger models generated with the original commands automatically use the new, combined Measure and Digitize block.</li> </ul> </li> </ul>
<b>Category</b>	<b>LXI</b> <ul style="list-style-type: none"> <li>• The instrument is now compliant with LXI version 1.5.</li> <li>• An LXI/LAN ID indicator has been added to the System Communications screen.</li> <li>• To discover the instrument, use the LXI Discovery Tool.</li> </ul>
<b>Category</b>	<b>Apps</b> <ul style="list-style-type: none"> <li>• When applications are available, the APPS Manager screen displays the apps for the instrument.</li> </ul>

<b>Category</b>	<p><b>New commands and options</b></p> <ul style="list-style-type: none"> <li>• Added an interlock on and off setting to the user interface and remote commands, <code>:OUTPut[1]:INTErlock:STATe</code> (SCPI) and <code>smu.interlock.enable</code> (TSP). When enabled, the SMU will not allow the output to be turned on when the interlock is not engaged.</li> <li>• The interlock base behavior has also changed. The SMU output will turn off whenever the interlock is engaged or disengaged.</li> <li>• Added an autorange rebound setting to the user interface and the remote commands <code>[ :SENSE[1] ] :&lt;function&gt; :RANGe:AUTO:REBounD</code> (SCPI) and <code>smu.measure.autorangerebound</code> (TSP). If autorange rebound is enabled, then after an autoranged measurement is completed, the measure range is restored to match the limit range.</li> <li>• Added a method to automatically install any scripts to internal storage memory that reside in an autoinstall directory on the USB drive when inserted into the instrument.</li> <li>• Added <code>fs.*</code> TSP commands for accessing and managing file system settings.</li> <li>• Added an option to show a Processing screen in the user interface to increase test execution speeds when screen updates are not required.</li> <li>• Added remote commands to set continuous measurement.</li> <li>• Added the <code>smu.digitize.sense</code> commands for TSP and <code>[ :SENSE[1] ] :&lt;function&gt; :RSENse</code> for SCPI when the digitize function is set to voltage or current.</li> </ul>
<b>Category</b>	<p><b>Ease of use</b></p> <ul style="list-style-type: none"> <li>• Numerical entries on the user interface now support Minimum, Maximum, and Infinite options when applicable to the setting.</li> <li>• Option to display the virtual front panel in low resolution to improve communication speed with the instrument. The default screen display resolution of 800 x 480 is reduced to 400 x 240 resolution.</li> <li>• Graph and histogram settings are now shared for ease of viewing data between the two screens. Also added other graphing enhancements.</li> </ul>
<b>Category</b>	<p><b>General changes</b></p> <ul style="list-style-type: none"> <li>• The maximum TSP node ID is now 63. The previous maximum was 64.</li> <li>• The Access Mode option on the front panel has been changed to Interface Access.</li> <li>• The user swipe screen is only displayed if user text is defined.</li> <li>• The home screen indication of source limiting has been enhanced to show whether the source limit setting or the measure range is limiting the instrument output.</li> </ul>
<b>Category</b>	<p><b>Emulation</b></p> <p>Four new instrument command set options have been added: SCPI 2420, SCPI 2425, SCPI 2430 and SCPI 2440. When selected, these settings enable the 2461 to recognize the SCPI commands for the corresponding SourceMeter models to facilitate the re-use of software written for those instruments. The 2461 also emulates the ranges and power envelope appropriate for the selected model.</p> <p>These emulation modes are described in the document <i>Model 2461 in a Series 2400 Application Emulation and Migration Guide</i>, Keithley document number 0771621XX, available at <a href="http://tek.com">tek.com</a>.</p>

## VERSION V1.6.8B RELEASE

### OVERVIEW

The Version 1.6.8b release was not released to the general public. Version 1.6.8b is a minor release that provides one enhancement and one noncritical fix to the function of the safety interlock control.

### ENHANCEMENT

AR62555 **Models affected:**

NS1470 All 2450 models, 2460 models, 2461 models

#### Enhancement:

A new command has been added to control the output when the interlock is not engaged. When enabled, the SMU will not allow the output to be turned on when the interlock is not engaged.

This setting is not affected by a power cycle or a reset.

#### New TSP command:

The attribute is set to a Boolean value (`smu.ON` or `smu.OFF` or 1 or 0).

```
smu.interlock.enable
```

#### New SCPI command:

```
:OUTPut[1]:INTerlock:STATe <b>
```

```
:OUTPut[1]:INTerlock:STATe?
```

### NONCRITICAL FIX

AR62555 **Models affected:**

NS1470 All 2450 models, 2460 models, 2461 models

#### Symptom:

If the output is on when the interlock is engaged there may be transient voltages on the output.

#### Resolution:

The instrument will turn the output off when the interlock is engaged or disengaged.

## VERSION V1.6.7C RELEASE

### Overview

Version 1.6.7c is an audited minor release which fixes several different bugs all listed below.  
[RELEASED 12-NOV-2018](#)

### Critical Fixes

PR61513 Better timer accuracy for times greater than 65 ms.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Using a constant delay block in a TriggerFlow™ takes slightly more time than specified when the delay is greater than 65.5 ms.

**Resolution:**

The delay time before the extra time is seen has been increased to 1.024 seconds.

PR61508 Restore SmartScale™ button on graph screen after pan/zoom.  
AR60539

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Steps to reproduce:

1. View the graph screen.
2. Pan or zoom the graph.
3. The SmartScale button no longer appears.

**Resolution:**

This issue has been corrected.

NIHK6042 Trigger models hangs with fast NPLC setting.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Setting up a TriggerFlow™ model using the TSP-Link™ trigger lines for synchronization with a fast measurement in a loop can hang waiting for the trigger.

**Resolution:**

This issue has been corrected.

NIHK4274 TSP-Link performance improvements.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

TSP-Link connection can generate errors if the unit is performing high sample rate or low NPLC measurements.

**Resolution:**

This issue has been corrected.

NIHK6106 TSP-Link initialization memory leak.

NIHK6239

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Performing a `tsplink.initialize()` command would reduce the amount of available memory slightly each time it executed. This occurred because the firmware was not correctly clearing the group leaders, which led to extra memory allocation. Eventually this problem can result in an out of memory condition.

**Resolution:**

This issue has been corrected.

NIHK6320 TSP-Link node number 64 is no longer selectable.

NIHK6306

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Using TSP-Link node number 64 could cause compatibility issues with older TSP-Link products.

**Resolution:**

The maximum TSP-Link node number has been limited to 63.

SYS42 Creating a script on a remote TSP-Link node causes a "Node inaccessible" error.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Steps to reproduce:

1. Use `tsplink.initialize()` to create the TSP-Link network.

2. Send the script source to the remote node via the dataqueue  
`node[remoteNode].dataqueue.add(myScript.source)`
3. Create the script on the remote node  
`node[remoteNode].execute(myScript.name ..  
"= script.new(dataqueue.next(), [{" .. myScript.name .."}]))"`
4. The remote node becomes unresponsive and a node inaccessible error is generated.

**Resolution:**

This issue has been corrected.

SYS535 Using a 2600S, 2600AS, 2600BS, 3706, or a 3706A product as the TSP-Link master results in errors for some commands.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Using a 2600S, 2600AS, 2600BS, 3706, or a 3706A product as the TSP-Link master will generate errors when attempting to use functions or attributes that accept enumeration types

**Resolution:**

This issue has been corrected.

NS1131 Sending data to TCP/IP socket is too slow.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

The TCP/IP socket interface can experience long delays before the acknowledge packet is sent from the instrument for large data packets.

**Resolution:**

This issue has been corrected.

NS1115 Trigger timer does not generate the event at the correct time for long delay settings.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Steps to reproduce:

```
trigger.timer[1].reset()  
trigger.timer[1].delay = delay_time  
trigger.timer[1].start.generate = trigger.ON
```

The event should be generated immediately but will not be generated if `delay_time` is greater than 65.5 ms.

**Resolution:**

This issue has been corrected.

NS284 Source range limit checking should generate error on invalid value.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Setting the source range to a value greater than the maximum value would select the highest range but would not generate an error. For 2461 models, the voltage range maximum value is 105 V and for current it is 10.5 A.

**Resolution:**

This issue has been corrected.

NS967 Output is still ON after turning it OFF and output light is off.

**Models affected:**

All 2450 models, 2460 models, 2461 models

**Symptom:**

Under certain conditions, creating a configuration list with the output OFF and then recalling it during the execution of a TriggerFlow™ can result in the output state showing as OFF even when the output is still ON.

Steps to reproduce:

```
reset()
smu.measure.func = smu.FUNC_DC_CURRENT
smu.measure.configlist.create('mList')
smu.source.configlist.create('sList')
smu.measure.configlist.store('mList')
smu.source.configlist.store('sList')
smu.source.func = smu.FUNC_DC_CURRENT
smu.source.output = smu.ON
trigger.model.load('ConfigList', 'mList', 'sList', 0.1)
trigger.model.initiate()
waitcomplete()
smu.measure.func = smu.FUNC_RESISTANCE
print("Expect OFF, found: "..smu.source.output)
smu.source.output = smu.OFF
print("Expect OFF, found: "..smu.source.output)
```

**Resolution:**

This issue has been corrected.

PR61514 Aborting TriggerFlow™ causes error 5072.

AR60505

**Models affected:**

All 2461 models

**Symptom:**

Steps to reproduce:

1. Use the Pulse menu to configure an infinite pulse train and press Generate.
2. Press HOME to return to the home screen.
3. Press TRIGGER to start the pulse train. The pulse sequence will start and continue looping.
4. Press OUTPUT to turn the output off and abort the TriggerFlow. Error 5072 is displayed and the unit is unresponsive.

**Resolution:**

This issue has been corrected.

NS525 2461 allows settings outside of power limits.

**Models affected:**

All 2461 models

**Symptom:**

Using TSP commands, it is possible to configure the settings to exceed the power limits supported by the instrument.

Example steps to reproduce:

```
reset()  
smu.measure.range = 7  
smu.source.ilimit.level = 7  
smu.source.func = smu.FUNC_DC_VOLTAGE  
smu.source.level = 105.
```

This attempts to configure the instrument for source 105 V with a 7 A source limit. This is outside the power limits, but does not generate an error.

**Resolution:**

This issue has been corrected.

NS560 SCPI voltage pulse sweep commands use incorrect default values.

**Models affected:**

All 2461 models

**Symptom:**

The default values *xBiasLimit* and *xPulseLimit* are incorrect for the following SCPI commands:

:SOURce[1]:PULSe:SWEep:VOLT:LINear.

:SOURce[1]:PULSe:SWEep:VOLT:LINear:STEP.

:SOURce[1]:PULSe:SWEep:VOLT:LOG.

This problem can result in unexpected errors being generated.

**Resolution:**

This issue has been corrected.

## VERSION V1.6.5B RELEASE

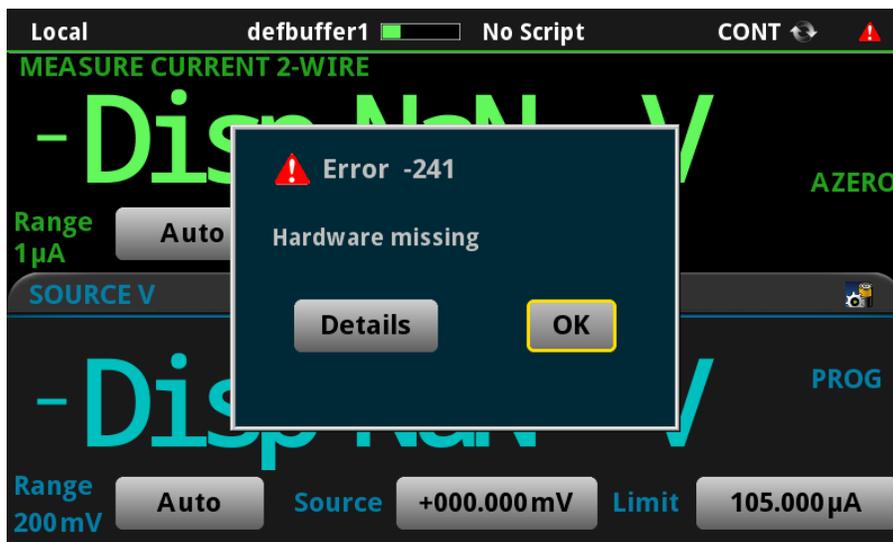
### Overview

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 the current limit.

AR55431

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 limit exceeded" is displayed even though the true source limit was not reached.

PR61306

**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 2450 Measure Configuration Lists do not save Auto Range setting.  
PR60339

**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 Trigger timer does not work correctly for counts > 65535  
AR60477

**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 Under certain conditions, the instrument will lock up in ohm-meter mode.  
AR60647

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

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

**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 2<sup>nd</sup> 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.

**Auto Calibration Preparation**

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.

**Auto Calibration Procedure from the front panel of the Model 2461**

- 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**

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

<b>Source Range:</b>	<b>Old Resolution:</b>	<b>New Resolution:</b>
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 TriggerFlow 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.

**New SCPI command:**

```
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 **Models affected:**

PR57360 All 2461 models  
PR57361

#### **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