Series 2650A High Power System SourceMeter® Instrument

Version 1.1.3 Firmware Release Notes

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Contents

General Information

Supported models

CAUTION	Do not install this firmware on Series 2600 (Models 2601, 2602, 2611, 2612, 2635, 2636), Series 2600A (Models 2601A, 2602A, 2611A, 2612A, 2635A, 2636A), or Series 2600B (Models 2601B, 2602B, 2604B, 2611B, 2612B, 2614B, 2634B, 2635B, 2636B) instruments.

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

2651A, 2657A

Installation instructions

For detailed firmware installation instructions, refer to the "Upgrading the firmware" topic in the "Maintenance" section of the reference manual for your instrument. The reference manual is available online at http://www.keithley.com/support. 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 2651A

The following table lists the considerations that should be made when deciding whether or not to upgrade your Model 2651A instrument firmware to version 1.1.3.

Consideration for upgrade	From version 1.0.0	From versions 1.0.1 1.0.2 1.1.2
Recalibration required?	No	No
Backward compatibility concerns?	No	No
Requalification recommended?	Yes[1]	No
Should you upgrade?	Review[2]	Review[2]

Upgrade considerations for the Model 2657A

The following table lists the considerations that should be made when deciding whether or not to upgrade your Model 2657A instrument firmware to version 1.1.3.

Consideration for upgrade	From version 1.1.1 1.1.2
Recalibration required?	No
Backward compatibility concerns?	No
Requalification recommended?	No
Should you upgrade?	Review[2]

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[1] This release introduces fixes that affect range change timing. These fixes may affect tests that are sensitive to settling delays. See the "Compatibility concerns" section for more information.

[2] Review the entire list of changes made in all firmware versions between your current version and version 1.1.3. Upgrade if any of the fixes or enhancements are desired.

Version 1.1.3 Release

Overview

Version 1.1.3 is a maintenance release of the Series 2650A firmware.

Compatibility concerns

Version 1.0.1 introduced a fix that affects the range change timing of the source-measure unit (SMU) current source of the Model 2651A. This fix may affect tests that are sensitive to timing. See PR44354 in the "Critical fixes" section of the Version 1.0.1 Release for more detail.

Enhancements

PR46062
PR49025

Models affected:

2657A

Enhancement:

Bit 10 of the `status.questionable` register now functions as the `HIGHV_NOT_READY` bit. When this bit is set, it indicates that either the interlock is not engaged, or that the interlock was engaged recently and the high voltage supply is still stabilizing. If the interlock is engaged and this bit is set, attempting to turn the output on will result in error 5052, "Interlock engaged; system stabilizing".

PR48795
PR48806

Models affected:

2651A, 2657A

Enhancement:

Keithley has updated its digital signature on all of its Series 2650A Java web applications (TSP Express, TSB Embedded, Flash Upgrade, and Reading Buffers) to a stronger 2048-bit certificate.

Noncritical fixes

PR49407
PR50286

Models affected:

2651A, 2657A

Symptom:

If `smuX.trigger.measure.stimulus` is nonzero, and `smuX.trigger.measure.action` is set to `smuX.ENABLED`, then measurement overruns are not reported.

Resolution:

This issue has been corrected.

PR50616
PR50694

Models affected:

2651A, 2657A

Symptom:

In the `KIPulse` factory script, the step size ratio `b` is calculated incorrectly in functions `ConfigPulseIMeasureVSweepLog` and `ConfigPulseVMeasureISweepLog`.

Resolution:

This issue has been corrected.

Known issues

PR46099 **Models affected:**

2651A, 2657A

Symptom:

For some numeric entry fields after editing a value and then pressing the navigation wheel, the EDIT indicator remains lit until the cursor is moved or the value is accepted.

PR46100 **Models affected:**

2651A, 2657A

Symptom:

When nonprintable control codes are embedded in the text passed as parameters to display functions such as `display.settext()`, the control codes cause the display to malfunction. Some of the possible effects are:

- The displayed text is corrupted.
- The instrument beeps or buzzes.
- The display shuts down and displays a "NO COMM LINK" message.

PR46252 **Models affected:**

2651A, 2657A

Symptom:

Loading the firmware update web application while TSB Embedded is running will cause TSB Embedded to display the error queue dialog box with many "null" errors in it.

PR47323 **Models affected:**

2651A, 2657A

Symptom:

When overwriting an existing script, TSB Embedded does not report any error messages when it fails to save the script (due to errors in the script for example).

Workaround:

Pay attention to the instrument's front panel display when overwriting a script using TSB Embedded. The script will not be saved if there are any errors shown on the front panel display.

PR47350 **Models affected:**

2651A, 2657A

Symptom:

The `tspnet.tsp.runscript()` command does not properly handle errors when an invalid script or invalid script name are provided.

PR47613 **Models affected:**

2651A, 2657A

Symptom:

The `tspnet.tsp.rbtablecopy()` function may return erratic results or make the instrument unresponsive.

PR47614 **Models affected:**

2651A, 2657A

Symptom:

The instrument may fail to operate correctly after an "Out of memory" error. The instrument may ignore commands sent over the command interfaces and may ignore front panel operations.

Workaround:

To avoid out-of-memory issues, leave 1 MB of dynamic memory available for instrument use. The `meminfo()` function can be used to monitor the actual free memory remaining. When the free memory drops below 1000 KB, the instrument may encounter an "Out of memory" error. The user documentation explains how to determine the amount of memory needed for reading buffers and sweeps.

PR47615 **Models affected:**

2651A, 2657A

Symptom:

In prompting mode, if a `tsplink.reset()` command initiated from another command interface is executing when the instrument receives an abort message, a prompt for the abort message may not be generated. The instrument will abort properly, even though the prompt is not generated.

PR47616 **Models affected:**

2651A, 2657A

Symptom:

Aborting a `tsplink.reset()` command or aborting a script executing a `tsplink.reset()` command may take a long time because the `tsplink.reset()` command is allowed to complete before execution is aborted. The `tsplink.reset()` command may take several seconds when a large number of nodes are connected together.

PR47617 **Models affected:**

2651A, 2657A

Symptom:

The instrument may incorrectly generate an "Out of memory" error when allocating a reading buffer. When there is insufficient memory to allocate the reading buffer, the garbage collector should automatically run to reclaim any unused memory before generating the "Out of memory" error. The garbage collector often fails to run, and the instrument issues an "Out of memory" error.

Workaround:

To work around this issue, call the `collectgarbage()` function prior to creating a new reading buffer.

PR47618

Models affected:

2651A, 2657A

Symptom:

TSB Embedded does not generate any errors or warnings when TSP® Express is active. The tool appears to work but will not show any saved scripts, nor will it run new scripts.

PR47619 **Models affected:**

2651A, 2657A

Symptom:

Executing a `tsplink.reset()` while overlapped measurements are in progress causes the instrument to become unresponsive.

PR47620 **Models affected:**

2651A, 2657A

Symptom:

When using TSP-Net, time-outs may occur earlier than programmed. For example, with `tspnet.timeout` set to 5 seconds, the `tspnet.read()` function may actually time out after only 4.7 seconds.

PR47621 **Models affected:**

2651A, 2657A

Symptom:

When loading a script using an invalid script name, the instrument loads the script as the anonymous script and does not generate an error.

PR48901 **Models affected:**

2651A

Symptom:

With open leads, rapidly executed contact check measurements erroneously return a reading of 0 Ω, instead of the expected reading of 9.91E+37.

Version 1.1.2 Release

Overview

Version 1.1.2 is a maintenance release of the Series 2650A firmware.

Compatibility concerns

Version 1.0.1 introduced a fix that affects the range change timing of the source-measure unit (SMU) current source of the Model 2651A. This fix may affect tests that are sensitive to timing. See PR44354 in the "Critical fixes" section of the Version 1.0.1 Release for more detail.

Critical fixes

PR47348 **Models affected:**

2651A, 2657A

Symptom:

When `smuX.source.offmode` = `smuX.OUTPUT_ZERO` and `smuX.source.offfunc` = `smuX.OUTPUT_DCAMPS`, turning the SMU off leaves the hardware in an invalid state. The effective voltage in this state is:

- The value of `smuX.source.levelv` if `smuX.source.func` is set to `smuX.OUTPUT_DCVOLTS`
- The value of `smuX.source.limitv` if `smuX.source.func` is set to `smuX.OUTPUT_DCAMPS`

The effective current limit in this state is unpredictable, but can exceed the standard operating area of the SMU.

Resolution:

This issue has been corrected.

Enhancements

PR47036 **Models affected:**

2651A, 2657A

Enhancement:

A new command to restore the factory defined global variables has been added. The `restoreglobals` command will overwrite all factory defined global variables except `node` with the factory default value. Use `tsplink.reset()` to reset the `node` table.

PR47061 **Models affected:**

2651A, 2657A

Enhancement:

TSP Express now fully supports Series 2600B instruments.

PR47145

Models affected:

2651A, 2657A

Enhancement:

The `tspnet.tsp.rbtablecopy()` command will use the `readings` synchronous table of a reading buffer by default if one isn't specified in the name parameter. For example, `tspnet.tsp.rbtablecopy(myConnection, "myBuffer")` and `tspnet.tsp.rbtablecopy(myConnection, "myBuffer.readings")` are equivalent.

PR47151 **Models affected:**

2651A, 2657A

Enhancement:

The USB interface has been improved and now supports most flash drives now on the market.

PR47154 **Models affected:**

2651A, 2657A

Enhancement:

The QYE, DDE, EXE, and CME bits in the Standard Event Status register of the status model are now set on the master node in addition to the remote node when a remote node generates an error that is logged to the error queue of the master node.

PR47162 **Models affected:**

2651A, 2657A

Enhancement:

When you insert an unrecognized USB device into the USB port, the instrument will now generate an error 1124, "Unrecognized USB device" to indicate that the device is unrecognized.

PR47163 **Models affected:**

2651A, 2657A

Enhancement:

The instrument will now generate an error 1125, "USB overcurrent condition" when the instrument shuts down the USB port because the device inserted into the port is drawing too much current.

PR47325 **Models affected:**

2657A

Enhancement:

High-C mode is now available in TSP Express for Model 2657A instruments with newer hardware (SMU board revision E or later).

Noncritical fixes

PR46156 **Models affected:**

2651A, 2657A

Symptom:

Mounting a USB flash drive during boot operation, or while the instrument is otherwise accessing its nonvolatile memory, can cause the instrument to become unresponsive. Certain flash drives appear to be more susceptible than others.

Resolution:

This issue has been corrected.

PR46307   **Models affected:**

2651A, 2657A

Symptom:

Performing a serial poll using the VXI-11 interface does not clear the status byte's RQS bit as expected.

Resolution:

This issue has been corrected.

PR46476   **Models affected:**

2651A, 2657A

Symptom:

If smu$X$.measure.autozero is set to smu$X$.AUTOZERO_AUTO, then executing smu$X$.trigger.initiate() when smu$X$.trigger.measure.action is not equal to smu$X$.DISABLE will cause smu$X$.measure.autozero to be set to smu$X$.AUTOZERO_OFF at the conclusion of the resulting sweep.

Resolution:

This issue has been corrected.

PR46481   **Models affected:**
(A)
2651A, 2657A

Symptom:

Sending a properly terminated message using the device_write() command causes errors -363, "Input buffer overrun" and -420, "Query UNTERMINATED" when the "end" flag is not set.

Resolution:

This issue has been corrected.

PR46481   **Models affected:**
(B)
2651A, 2657A

Symptom:

Performing a device_read() operation with an I/O timeout parameter value of zero causes the instrument to reply immediately with an error code of 15 (I/O Timeout).

Resolution:

This issue has been corrected.

PR46549 **Models affected:**

2651A, 2657A

Symptom:

If the last known mDNS hostname is 64 characters or longer, the instrument becomes unresponsive when connected to the LAN. A few minutes later it shows "FATAL ERROR e60 v04" on its front-panel display.

Resolution:

This issue has been corrected.

PR46600 **Models affected:**

2651A, 2657A

Symptom:

The maximum length for the instrument's hostname is 15 characters on the LXI IP Configuration page and 255 characters for the `lan.config.dns.hostname` remote command attribute. The maximum length for both should be 63 characters.

Resolution:

This issue has been corrected.

PR46695 **Models affected:**

2651A, 2657A

Symptom:

The file selection filter in the Flash Upgrade, Reading Buffers, TSB Embedded, and TSP Express web applications does not default to the correct selection when running the web applications in Java 7.

Resolution:

This issue has been corrected.

PR46708 **Models affected:**

2651A, 2657A

Symptom:

When you attempt to save data from dedicated reading buffer 2 (SMA_BUFFER2) to non-volatile memory by using the front panel, the instrument will save reading buffer 1 (SMUA_BUFFER1) instead.

Resolution:

This issue has been corrected.

PR46857 **Models affected:**

2651A, 2657A

Symptom:

During a voltage sweep, if source autoranging is enabled, the first source point after a range change is approximately 2% of full-scale higher than intended.

Resolution:

This issue has been corrected.

PR46905 **Models affected:**

2651A, 2657A

Symptom:

In Test Script Builder Embedded, if you attempt to save a script when the nonvolatile memory is full, the instrument generates an error as expected but the unsuccessfully saved script still shows up in the list of user scripts.

Resolution:

This issue has been corrected.

PR47140 **Models affected:**

2651A, 2657A

Symptom:

The `tspnet.termination()` function does not generate an error when you attempt to change the termination sequence of a TSP connection.

Resolution:

The `tspnet.termination()` function now generates an error 2420, "Termination locked while using TSP connection," when you attempt to change the termination sequence of a TSP connection.

PR47141 **Models affected:**

2651A, 2657A

Symptom:

The *start* and *end* parameters to the `tspnet.tsp.rbtablecopy()` function are supposed to be optional but the instrument will generate an error if they are omitted.

Resolution:

This issue has been corrected.

PR47144 **Models affected:**

2651A, 2657A

Symptom:

TSP-Net connections to TSP instruments only work correctly on the first connection. Attempting to open a TSP-Net connection to the same instrument after closing the first connection will fail.

Resolution:

This issue has been corrected.

PR47146   **Models affected:**

2651A, 2657A

Symptom:

TSP-Net connections to some telnet servers may fail to communicate.

Resolution:

This issue has been corrected.

PR47155   **Models affected:**

2651A, 2657A

Symptom:

When certain errors are generated, the bit set in the Standard Event Status register of the status model does match the bit dictated by the SCPI standard. For example, some errors cause the EXE bit to set, but the SCPI standard dictates that the DDE bit is set for that same error.

Resolution:

This issue has been corrected.

PR47164   **Models affected:**

2651A, 2657A

Symptom:

When multiple command messages separated by newline characters are sent in a single VXI-11 write operation, the instrument does not interpret the command messages separately. This can lead to the instrument ignoring the commands and generating inappropriate errors.

Resolution:

This issue has been corrected.

PR47224   **Models affected:**

2651A, 2657A

Symptom:

The `tspnet.tsp.rbtablecopy()` command generates an error 2413, "TSPnet invalid reading buffer table," if the length of the name parameter exceeds 63 characters.

Resolution:

This issue has been corrected.

PR47239   **Models affected:**

2657A

Symptom:

If the overvoltage protection (OVP) limit is set and then the source polarity is changed, the OVP limit becomes less accurate than expected. When this occurs, the OVP limit may be as much as 20 V above or below the configured value.

Workaround:

Set the OVP limit again while the new polarity is active to correct the issue.

Resolution:

This issue has been corrected.

PR47313 **Models affected:**

2651A, 2657A

Symptom:

When setting smu*X*.sense to smu*X*.SENSE_CALA, the effective source range is determined by the smu*X*.measure.range*Y* setting instead of the smu*X*.source.range*Y* setting. To properly calibrate range R, smu*X*.measure.range*Y* must be set to R before setting smu*X*.sense to smu*X*.SENSE_CALA.

Resolution:

This issue has been corrected.

PR47314 **Models affected:**

2651A, 2657A

Symptom:

Attempting to set smu*X*.sense to smu*X*.SENSE_CALA on the 500 V source range should generate error 5004, "Operation conflicts with CALA sense mode." Instead, it appears to succeed without error, but in doing so changes smu*X*.source.rangev to 1500 V.

Resolution:

This issue has been corrected.

PR47378 **Models affected:**

2651A, 2657A

Symptom:

In TSP Express, running tests with high capacitance mode enabled generates error code 5069, "Autorange locked for HighC mode," for the following configurations:

- Source voltage, measure voltage
- Source current, measure current
- Source current, measure current and voltage

Resolution:

This issue has been corrected.

Version 1.1.1 Release

Overview

Version 1.1.1 is the initial release of the Series 2650A firmware for the Model 2657A. This version of the Series 2650A firmware is intended to be used on the Model 2657A only. Do not install this version on a Model 2651A instrument.

Compatibility concerns

This version of the Series 2650A firmware is intended to be used on the Model 2657A only. Do not install this version on a Model 2651A instrument.

Enhancements

PR42774 **Models affected:**

2651A

Enhancement:

In TSP Express, the measure range now follows the source range when the measure function is the same as the source function.

PR43569 **Models affected:**

2651A

Enhancement:

A new remote setting has been added that allows control over which limit value (power or current/voltage) is displayed on the front panel. Please refer to the latest user documentation for details.

PR43805 (A) **Models affected:**

2651A

Enhancement:

TSP Express now supports composite SMUs in series configuration. Please refer to the "Combining SMU outputs" section in the reference manual for details and important safety precautions.

PR43805 (B) **Models affected:**

2651A

Enhancement:

An "Identify" button has been added to the combining SMU dialog window. Pressing this button will flash an identification message on the front panel display of each SMU that makes up the selected composite SMU. At the same time, a corresponding connection diagram is shown to help verify the necessary connections.

PR43805 (C) **Models affected:**

2651A

Enhancement:

For negative-polarity pulsed sweeps, TSP Express will automatically set all zero bias and source levels to a negative number very near zero (-1e-30) to avoid a 100 µs penalty for source polarity changes.

PR43805
(D)

Models affected:

2651A

Enhancement:

TSP Express now rounds calculated composite source and measure values to a maximum of nine decimal places.

PR43889   **Models affected:**

2651A

Enhancement:

TSB Embedded now precedes commands typed in the command console command line with "TSP>" when echoing the command in the response window to clarify what has been typed versus what has been received from the instrument.

PR44450   **Models affected:**

2651A

Enhancement:

The LXI implementation has been updated to comply with version 1.4 of the LXI standard.

PR44460   **Models affected:**

2651A

Enhancement:

TSB Embedded now changes the cursor to an hourglass for lengthy operations.

PR44565   **Models affected:**

2651A

Enhancement:

In TSP Express, project settings information (including sweep/SDM parameters) is now recorded in exported .csv data files.

PR45777   **Models affected:**

2651A

Enhancement:

Errors with a severity of SERIOUS are now displayed on the front panel until you press the EXIT key.

In response to this enhancement, the severity of following errors have been downgraded from FATAL to SERIOUS, in order to more accurately reflect their impact:

1121, "Unreleased firmware; Instrument performance is unqualified."

        1122, "Interlock or power supply failure"
        2000, "Flash download error"
        2004, "Incompatible version"

Noncritical fixes

PR42960
PR43356

Models affected:

2651A

Symptom:

Recalling a saved setup from the front panel display while the limit is in a format for higher range may result in a limit value that has less resolution than its original saved value.

Resolution:

This issue has been corrected.

PR43533   **Models affected:**

2651A

Symptom:

The severity levels of many SMU errors are misleading.

Resolution:

The severity levels of several SMU errors have been reduced. Please refer to the updated user documentation for the complete list of errors and their updated severity levels.

PR43569   **Models affected:**

2651A

Symptom:

The `reset()` function and the `setup.recall()` function do not restore which limit value (power or current/voltage) is being displayed on the front panel.

Resolution:

This issue has been corrected.

PR43862   **Models affected:**

2651A

Symptom:

The web application "Reading Buffers" status details does not show values for status bit 0 (B0), which is used for the Fast ADC status.

Resolution:

A new column has been added to show bit 0 of the reading buffer's status values. The new column is labeled "FastADC" for Series 2650A instruments. It is labeled "Reserved" for Series 2600A and Series 2600B instruments.

PR44020
PR44243

Models affected:

2651A

Symptom:

When smu*X*.source.func = smu*X*.OUTPUT_DCAMPS and smu*X*.source.offfunc = smu*X*.OUTPUT_DCVOLTS, and measurements are stored to a reading buffer with the output off, the buffer indicates current as the source function. A similar issue arises when smu*X*.source.func = smu*X*.OUTPUT_DCVOLTS and smu*X*.source.offfunc = smu*X*.OUTPUT_DCAMPS.

Workaround:

This issue can be avoided by setting smu*X*.source.func to smu*X*.source.offfunc before making measurements with the output off.

Resolution:

This issue has been corrected.

PR44089 **Models affected:**

2651A

Symptom:

TSB Embedded incorrectly applies syntax coloring to commands with embedded quotes. An example of an embedded quote is print('Hello " ').

Resolution:

This issue has been corrected.

PR44361 **Models affected:**

2651A

Symptom:

When using TSB Embedded to delete a script from the instrument, there is no prompt to confirm deletion of the script.

Resolution:

TSB Embedded now presents a confirmation dialog box before deleting a script.

PR44370 **Models affected:**

2651A

Symptom:

Erroneous packets from a DHCP server cause a fatal exception or cause the instrument to become unresponsive. This is known to occur with the DualServer v2.1 DHCP server.

Resolution:

This issue has been corrected.

PR44397 **Models affected:**

2651A

Symptom:

When exporting a script to a USB flash drive using TSB Embedded, if the script already exists it will be overwritten without warning.

Resolution:

Before overwriting a script, TSB Embedded presents a dialog box requesting confirmation that the script should be overwritten.

PR44412 **Models affected:**

2651A

Symptom:

When smu*X*.measure.autorange*Y* is set to smu*X*.AUTORANGE_FOLLOW_LIMIT, explicitly setting the measure range does not properly disable the autorange setting.

Workaround:

To ensure proper behavior after using this setting, explicitly set smu*X*.measure.autorange*Y* to smu*X*.AUTORANGE_OFF.

Resolution:

This issue has been corrected.

PR44414 **Models affected:**

2651A

Symptom:

When smu*X*.measure.autorange*Y* is set to smu*X*.AUTORANGE_FOLLOW_LIMIT, the *Y* measure range follows the *Y* limit range, even when the source function is set to *Y*. In this situation, the *Y* measure range should follow the *Y* source range.

Workaround:

This issue can be avoided by setting smu*X*.measure.autorange*Y* to smu*X*.AUTORANGE_FOLLOW_LIMIT only when the *Y* limit is active (only when sourcing the complementary function).

Resolution:

This issue has been corrected.

PR44416 **Models affected:**

2651A

Symptom:

When the output is off in smu*X*.OUTPUT_HIGH_Z mode and smu*X*.source.offfunc = smu*X*.OUTPUT_DCAMPS, setting smu*X*.source.rangei causes smu*X*.measure.rangev to change.

Resolution:

This issue has been corrected.

PR44417 **Models affected:**

2651A

Symptom:

Enabling source autorange when the output is off does not cause the source range to drop to its low range, as would be expected.

Resolution:

This issue has been corrected.

PR44419 **Models affected:**

2651A

Symptom:

When smu*X*.source.autorange*Y* is set to smu*X*.AUTORANGE_FOLLOW_LIMIT, and the SMU source function is set to the complement of *Y* (for example, *Y* is voltage and the SMU is sourcing current), setting smu*X*.source.range*Y* erroneously changes smu*X*.measure.range*Y*.

Resolution:

This issue has been corrected.

PR44439 **Models affected:**

2651A

Symptom:

When the output is off in smu*X*.OUTPUT_NORMAL mode and the off function is set to current, setting smu*X*.source.offlimitv such that the combination of the I source range and the new V limit range would cause a transition into the Extended Operating Area (EOA) results in error 5007, "Operation would exceed safe operating area of the instrument."

Workaround:

The error can be avoided by lowering the I source range first so that the new V limit range does not cause an EOA transition. Then restore the original, higher I source range.

Resolution:

This issue has been corrected.

PR44449 **Models affected:**

2651A

Symptom:

When configured as a current source with a voltage limit greater than 10 V, the SMU allows the current source range to be set to values that violate the safe operating area of the instrument. Once the error occurs, the SMU may limit the voltage to a lower value than expected; and any attempt to set the current level, voltage limit, or source function results in error 5007, "Operation would exceed safe operating area of the instrument". Resetting the SMU resolves the issue.

Resolution:

The SMU will now generate an error 5007 if you attempt to set the current range to a value that would violate the safe operating area of the SMU.

PR44473 **Models affected:**

2651A

Symptom:

TSP Express does not report instrument errors on its "Script Error" dialog box. The errors display on the "Instrument Output" field, but they are not visible unless you select the "Edit" tab.

Resolution:

Instrument error messages now display on both the "Script Error" dialog box and the "Instrument Output" field.

PR44591 **Models affected:**

2651A

Symptom:

If a power compliance limit has been set, the instrument might not generate an error for exceeding the standard operating area (SOA) when setting ranges or limit values.

Resolution:

This issue has been corrected.

PR44627 **Models affected:**

2651A

Symptom:

The SWEEPING bit in the Operation Status SMU X Summary register (`status.operation.instrument.smuX`) clears before the SMU recognizes that overlapped operation has completed. Consequently, attempting to execute a SMU command immediately after the SWEEPING bit is cleared can result in error code 5042, "Cannot perform requested action while an overlapped operation is in progress."

Resolution:

This issue has been corrected.

PR44629 **Models affected:**

2651A

Symptom:

When clearing a reading buffer, any errors encountered will be repeated nine times.

Resolution:

This issue has been corrected.

PR44651

Models affected:

2651A

Symptom:

If measure autoranging is enabled, attempting to set the measure range to a value below the low range setting causes the measure range to be set to the low range instead.

Resolution:

This issue has been corrected.

PR44653   **Models affected:**

2651A

Symptom:

When the output is off in smu*X*.OUTPUT_NORMAL mode, and smu*X*.source.offfunc = smu*X*.DC_AMPS and smu*X*.source.rangei = 50, attempting to set smu*X*.source.offlimitv to a value that corresponds to the 40 V range results in error 5007, "Operation would exceed safe operating area of the instrument." Afterward, the smu*X*.source.offlimitv attribute indicates that the limit is 40 V, but in reality the limit has not been changed.

Resolution:

This issue has been corrected.

PR44920   **Models affected:**

2651A

Symptom:

The reading buffers web application inappropriately formats some values when displaying reading buffer data. For example, the 20 mV range displays as 0.019999999552965164 instead of 0.02.

Resolution:

This issue has been corrected.

PR44094   **Models affected:**

2651A

Symptom:

Setting the current measure range while high-C mode is enabled has no effect.

Resolution:

When high-C mode is enabled, the last value assigned to the current measure range is retained and then used to restore the current measure range when high-C mode is disabled.

PR45121   **Models affected:**

2651A

Symptom:

You may experience inappropriately degraded performance when using Ethernet raw sockets and telnet sockets. The degradation may occur when a number of small packets are exchanged across the socket. This is caused by the Nagle algorithm which delays Ethernet packets for up to 200 ms waiting to combine small packets for network efficiency.

In most cases packet immediacy is more desirable than network efficiency. The Nagle algorithm should be disabled by default to eliminate this delay.

Resolution:

The Nagle algorithm is now disabled by default. If necessary for Ethernet efficiency, set the `lan.nagle` attribute to `lan.ENABLE` to enable the algorithm.

PR45333   **Models affected:**

2651A

Symptom:

The IDLE event that occurs at the end of a sweep is generated before the SMU hardware has returned to its idle state.

Resolution:

This issue has been corrected.

PR45478   **Models affected:**

2651A

Symptom:

An incorrect source level is displayed if you abort a fixed-source-range sweep by pressing the EXIT key or the OUTPUT ON/OFF button on the front panel. The actual source level is the programmed idle level, but the display indicates the last level active in the sweep before it was aborted.

Resolution:

This issue has been corrected.

PR45479   **Models affected:**

2651A

Symptom:

When a sweep is aborted by a high-priority output off event under certain conditions, the current or voltage source level is incorrectly changed to match the limit value. The paragraphs below describe these conditions and the incorrect outcomes:

Conditions: Sweep source function = Current and Off function = Voltage
Incorrect outcome: The programmed current source value changes to match the current limit value.

Conditions: Sweep source function = Voltage and Off function = Current
Incorrect outcome: The programmed voltage source value changes to match the voltage limit value.

The high-priority output off events that can cause this issue include:

- Pressing the OUTPUT ON/OFF control
- Resetting the TSP-Link
- Detecting a SMU over-temperature condition
- Disengaging the interlock

Resolution:

This issue has been corrected.

PR45539 **Models affected:**

2651A

Symptom:

Setting the LAN configuration using the LXI web interface does not always work. When this happens, the new LAN setting values are ignored by the instrument.

Resolution:

This issue has been corrected.

PR45615 **Models affected:**

2651A

Symptom:

When the instrument is configured as a current source on the 50 A range and the output is on, attempting to set the voltage limit to any value results in error 5007, "Operation would exceed safe operating area of the instrument." The instrument should allow voltage limit values up to 10 V.

Resolution:

This issue has been corrected.

PR45650 **Models affected:**

2651A

Symptom:

In TSP Express, when sweeping current in logarithmic steps, you cannot enter start or stop values smaller than 1 µA.

Resolution:

TSP Express now allows start and stop values as low as 1 pA.

PR45698 **Models affected:**

2651A

Symptom:

Inserting or removing a USB flash drive when the instrument is busy can result in the instrument becoming unresponsive, with the front panel indicating that a "FATAL ERROR" has occurred.

Resolution:

This issue has been corrected.

PR45729 **Models affected:**

2651A

Symptom:

If smu*X*.source.delay is set to smu*X*.DELAY_AUTO, the effective source delay during sweeps is significantly shorter than it should be. The difference is most noticeable on the 100 nA, 1 µA, and 10 µA ranges.

Resolution:

This issue has been corrected.

PR45767 **Models affected:**

2651A

Symptom:

If smu*X*.trigger.autoclear is set to 1 and the smu*X*.trigger.ARMED_EVENT_ID event is used with the smu*X*.source.stimulus, either directly or indirectly through an intermediate trigger object, the source action will not be triggered as expected. If the event is routed through an intermediate trigger object, this only happens when the intermediate trigger object delays the event by less than 1 µs.

Workaround:

Use a timer to add 1 µs of delay between an Armed event and the source stimulus.

Resolution:

This issue has been corrected.

PR45803 **Models affected:**

2651A

Symptom:

After the smu*X*.sense attribute is changed from smu*X*.SENSE_CALA to either smu*X*.SENSE_LOCAL or smu*X*.SENSE_REMOTE, the actual SMU output level cannot be raised above the programmed level that immediately preceded the sense mode change. Turning the output off when smu*X*.source.offmode is set to smu*X*.OUTPUT_HIGH_Z corrects the issue. Additionally, changing the current source range often corrects the issue.

Resolution:

This issue has been corrected.

PR45816 **Models affected:**

2651A

Symptom:

If the SMU output is turned off when smu*X*.source.offmode = smu*X*.OUTPUT_NORMAL and smu*X*.source.offfunc = smu*X*.OUTPUT_DCVOLTS, the effective current limit does not correspond to smu*X*.source.offlimiti as it should. When the output is in this state, setting smu*X*.source.offlimiti or smu*X*.source.limiti corrects the issue.

Resolution:

This issue has been corrected.

PR45980 **Models affected:**

2651A

Symptom:

The VXI-11 interface intermittently terminates response messages too early.

Resolution:

This issue has been corrected.

PR46124 **Models affected:**

2651A

Symptom:

If an End Pulse overrun occurs within 2 μs of a Source overrun, one of the two overruns may not be reported.

Resolution:

This issue has been corrected.

PR46146 **Models affected:**

2651A

Symptom:

If `trigger.timer[`*N*`].delay` is set to a value less than 1 μs, the actual delay that results is approximately 20 μs. Similarly, if `digio.trigger[`*N*`].pulsewidth` or `tsplink.trigger[`*N*`].pulsewidth` is set to a value greater than zero but less than 1 μs, the resulting trigger pulse is approximately 20 μs in width.

Resolution:

This issue has been corrected.

PR46164 **Models affected:**

2651A

Symptom:

Aborting a measurement operation can leave the measurement engine in an invalid state if all of the following conditions are true:

- The measurement operation was initiated by a sweep or by the `smu`*X*`.measure.`*Y*`()` command.
- The measure count is greater than one (1).
- The abort occurs simultaneous to either the measure stimulus event or the expiration of the measure interval timer.

Once in this state, all further readings are erroneous and subsequent SMU commands may cause the instrument to become unresponsive. The instrument power must be turned off and then turned back

on again to recover. Measurements initiated with the `smuX.measure.overlappedY()` command do not cause this issue when aborted.

Resolution:

This issue has been corrected.

PR46186
PR46249

Models affected:

2651A

Symptom:

On rare occasions the instrument boots very slowly, pausing for several minutes with two dots on the front panel display and requiring more than ten minutes total to complete its boot sequence. Afterward, certain commands malfunction, each requiring more than 30 seconds to execute. These commands include:

```
trigger.timer[N].delay
trigger.timer[N].count
digio.trigger[N].pulsewidth
tsplink.trigger[N].pulsewidth
```

When the instrument is in this state, the functionality of any trigger timer, digital I/O, TSP-Link, or SMU measurement operation cannot be relied upon. Turning the instrument off and then on again corrects the issue.

Resolution:

This issue has been corrected.

Version 1.0.2 Release

Overview

Version 1.0.2 is a maintenance release of the Model 2651A firmware.

Compatibility concerns

Version 1.0.1 introduced fixes that affects the range change timing of the source-measure unit (SMU) current source. This may affect tests that are sensitive to timing. See PR44354 in the "Critical fixes" section of the Version 1.0.1 Release for more detail.

Critical fixes

PR45688   **Models affected:**
PR45689   2651A

Symptom:

Loading scripts over the command interface or from a USB flash drive causes a memory leak. If you load several large scripts or many small scripts in this manner, you will eventually encounter an unexpected error -225, "TSP Memory allocation error: not enough memory" or simply "Out of memory." Once the instrument is in this state, you must turn the instrument off and back on to recover.

Resolution:

This issue has been corrected.

Noncritical fixes

PR46544   **Models affected:**
PR46620   2651A

Symptom:

When sourcing between 70 mA and 101 mA on the 1 A range into a low impedance (less than 1 ohm) DUT, lowering the source range to the 100 mA range causes 5 A to flow. Turning the output off stops the excess current.

Workaround:

The issue can be avoided by lowering the current to a level below 70 mA before changing the source range.

Resolution:

This issue has been corrected.

Version 1.0.1 Release

Overview

Version 1.0.1 is a maintenance release of the Model 2651A firmware.

Compatibility concerns

This version of firmware introduced fixes that affect the range change timing of the source-measure unit (SMU) current source. This may affect tests that are sensitive to timing. See PR44354 in the "Critical fixes" section for more details.

Critical fixes

PR44354
PR45594
PR45612
PR45613
PR45620
PR45622
PR45626
PR45627

Models affected:

2651A

Symptom:

Transients induced during current source range changes are larger than the specified range change overshoot for the instrument.

Resolution:

This issue has been corrected. Range change timing for the current source was affected by this fix. The affected range changes now take longer than in version 1.0.0, and tests that depend on the source range change time of the current source should be requalified.

Noncritical fixes

PR43955
PR44143

Models affected:

2651A

Symptom:

Aborting a measurement operation can leave the measurement engine in an invalid state if all of the following conditions are true:

- The measurement operation was initiated by a sweep or by the smu$X$.measure.Y() command.
- The measurements are being stored in a reading buffer.
- Autoranging is enabled.
- The measure delay is nonzero.

Once in this state, all further readings are erroneous and subsequent SMU commands may cause the instrument to become unresponsive. The instrument power must be turned off and then turned back on again to recover. Measurements initiated with the smu$X$.measure.overlapped$Y$() command do not cause this issue when aborted.

Resolution:

This issue has been corrected.

PR44199
PR44200

Models affected:

2651A

Symptom:

Aborting a measurement operation can leave the measurement engine in an invalid state if all of the following conditions are true:

- The measurement operation was initiated by a sweep or by the $smuX.measure.Y()$ command.
- The measure count is greater than one (1).
- The specified measure interval is smaller than the system can achieve.

Once in this state, all further readings are erroneous and subsequent SMU commands may cause the instrument to become unresponsive. The instrument power must be turned off and then turned back on again to recover. Measurements initiated with the $smuX.measure.overlappedY()$ command do not cause this issue when aborted.

Resolution:

This issue has been corrected.

PR45262
PR45584

Models affected:

2651A

Symptom:

Sending a remote command in excess of 1024 characters over a LAN socket interface results in an erroneous error -285, "TSP Syntax error," in addition to the -363, "Input buffer overrun" error that should be generated.

Resolution:

This issue has been corrected.