KEITHLEY

Series 2600 System SourceMeter® Instruments
v1.4.2 Firmware Release Notes

Contents

General Information

Supported Models

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

2601, 2602,
2611, 2612,
2635, 2636

Installation Instructions

Firmware installation instructions are given in the "Flash firmware upgrade" topic of the Series 2600 System SourceMeter® Instruments Reference Manual (document number: 2600S-901-01). This manual is available online at http://www.keithley.com/support. If you decide to upgrade the firmware on your instrument, follow the instructions in the manual. Alternatively, Keithley Instruments factory upgrades can be arranged by calling your local Keithley Instruments support office.

Upgrade Considerations for Models 2601/2602

The following table outlines the considerations that should be made when deciding whether or not to upgrade your Model 2601/2602 firmware to v1.4.2.

Consideration	From v1.1.3 v1.1.4	From v1.3.3	From v1.4.0	From v1.4.1
Recalibration required?	No[1]	No	No	No
Backward compatibility concerns?	Yes[2]	Yes[2]	No	No
Should you upgrade?	Review[3]	Review[3]	Yes	Review[3]

For information about upgrading from a firmware version older than v1.1.3, contact Keithley Instruments customer support or consult the release notes for earlier releases.

Upgrade Considerations for Models 2611/2612

The following table outlines the considerations that should be made when deciding whether or not to upgrade your Model 2611/2612 firmware to v1.4.2.

Consideration	From v1.2.0	From v1.3.3	From v1.4.0	From v1.4.1
Recalibration required?	No[1]	No	No	No
Backward compatibility concerns?	Yes[2]	Yes[2]	No	No
Should you upgrade?	Yes	Review[3]	Yes	Review[3]

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[1] Recalibration is not necessary when upgrading to v1.4.2 firmware. However, if the unit is recalibrated after performing the upgrade, a recalibration will be required if the firmware is later downgraded to v1.2.0 or any earlier version.

[2] This version of firmware introduces some changes in behavior compared to older firmware. See the Compatibility Concerns section for more details.

[3] Review the entire list of changes made in all firmware versions between your current version and v1.4.2. Upgrade if any of the fixes or enhancements are desired.

Upgrade Considerations for Models 2635/2636

The following table outlines the considerations that should be made when deciding whether or not to upgrade your Model 2635/2636 firmware to v1.4.2.

Consideration	From v1.3.0 v1.3.3	From v1.4.0	From v1.4.1
Recalibration required?	Partial[4]	No	No
Backward compatibility concerns?	Yes[5]	No	No
Should you upgrade?	Review[6]	Yes	Review[6]

When upgrading an instrument to this version of firmware from version 1.3, the instrument may exhibit a few-hundred fA shift in current measurements. The KIOffsetAdjust script should be run after upgrading the instrument to adjust the offset and remove the offset shift. A full calibration is not needed and the instrument does not need to be returned to the factory. The script will take approximately one hour to run. It only needs to be run once after upgrading.

To perform the offset adjustment:

1. Short the outputs of each of the SMUs. On a Model 2636, short the outputs independently; do not connect SMU A to SMU B. Shorting the output terminals with a two-wire short is sufficient. Four-wire shorts are not needed.
2. Run the KIOffsetAdjust script. Test Script Builder (TSB) can be used to load and run the script on the instrument.
3. Remove the output shorts.
4. The instrument will need one additional hour for temperature stabilization before it meets its rated specifications.

If the instrument's firmware is later downgraded to version 1.3 after the KIOffsetAdjust script has been run, the instrument will show a shift in the opposite direction. The script must be run on the instrument again after downgrading the firmware to remove the offset shift.

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[4] Differences between this version of firmware and version 1.3 firmware may cause a few-hundred fA shift in current measurements. A script included with the firmware should be run one time on the instrument after upgrading the unit. This will adjust the offset calibration to remove this shift. Once this script is run on an instrument, if the instrument is later downgraded to version 1.3 firmware, the script must be run on the instrument again after downgrading the firmware. A full recalibration is not necessary and the instrument does not need to be returned to the factory.

[5] This version of firmware introduces some changes in behavior compared to older firmware. See the Compatibility Concerns section for more details.

[6] Review the entire list of changes made in all firmware versions between your current version and v1.4.2. Upgrade if any of the fixes or enhancements are desired.

v1.4.2 Release

Overview

Version 1.4.2 firmware is a maintenance release of the Series 2600 firmware. This version introduces one critical fix, one enhancement, and one non-critical fix.

Compatibility Concerns

Version 1.4.0 firmware was an enhancement release that introduced changes that may affect compatibility with older firmware. If upgrading from firmware version 1.3.3 or earlier, review the v1.4.0 Release section for more details.

Version 1.3.0 firmware also introduced changes that may affect compatibility with older firmware. If upgrading from firmware version 1.2.0 or earlier, review the v1.3.0 Release section for more details.

Critical Fixes

PR37082   **Models Affected:**

      2611, 2612, 2635, 2636

      Symptom:

      When between 11 and 13 µA of current is flowing into or out of the device under test, current measurements made on the 100 nA range and below may return erroneous values instead of the expected overflow indication. If the SMU is set to autorange, the erroneous values confuse the autoranging logic and the instrument will not uprange to the proper range.

      Resolution:

      This issue has been corrected.

Enhancements

PR36582   **Models Affected:**

      2601, 2602, 2611, 2612, 2635, 2636

      Enhancement:

      The `reset()` function was modified to accept an optional parameter. If the value `true` is specified, the reset function will reset the whole system as it used to. If the value `false` is specified, the reset function will only reset the local group. The default value for the parameter is `true`. Only the master node may reset the whole system.

Non-critical Fixes

PR36583   **Models Affected:**

      2601, 2602, 2611, 2612, 2635, 2636

      Symptom:

      The `execute()` function allows a `tsplink.reset()` call to reset the system.

      Resolution:

      The `tsplink.reset()` function will generate an error (error code 1218) when it is being executed on a group leader that is not the master node.

Known Issues

PR26390
PR26444
PR26451
PR33257

Models Affected:

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

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

Workaround:

To avoid out of memory issues, you should not exceed 3MB of memory consumption for the TSP runtime environment and reading buffers combined. The Series 2600 documentation outlines how to determine the amount of memory consumed for these. The `meminfo()` function can also be used to monitor the actual free memory remaining. When the free memory drops below 500 kilobytes, there is a danger of the unit encountering an out of memory error.

PR26902   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The display will briefly change to the source/measure screen during execution of a TSP-Link reset operation that has been initiated by front panel operation.

PR26990   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

In prompting mode, a prompt is not always generated for an abort message if a `tsplink.reset()` command that was initiated from another command interface is executing when the abort message is received. The unit will abort properly even though the prompt is not generated.

PR26991   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Aborting a `tsplink.reset()` command or aborting a script executing a `tsplink.reset()` 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.

PR29994   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The pulse script will execute a `smuX.reset()` when aborted. This will reset all the SMU settings to their defaults.

PR32196   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The unit 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. In most cases, the garbage collector fails to run and an out of memory error is issued.

Workaround:

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

PR34273 **Models Affected:**

2635, 2636

Symptom:

Changing the state of the analog filter causes a measurement offset shift of approximately 50fA to 100fA.

PR35510 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

When running a script from the front panel, any errors generated by the script may not be completely displayed. The error message may be removed from the display prematurely.

PR36092 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Adding an entry to the display **LOAD** menu with a name longer than 32 characters will cause the unit to display menu items erratically when the **LOAD** button is pressed. The unit may fail to display some items or may display them incorrectly.

v1.4.1 Release

Overview

Version 1.4.1 firmware is a maintenance release of the Series 2600 firmware. This version was released to support hardware changes in production. This firmware also introduces some non-critical fixes. Version 1.4.0 was not released to the general public and this version supersedes v1.4.0.

Compatibility Concerns

Version 1.4.0 firmware was an enhancement release that introduced changes that may affect compatibility with older firmware. If upgrading from firmware version 1.3.3 or earlier, review the v1.4.0 Release section for more details.

Version 1.3.0 firmware also introduced changes that may affect compatibility with older firmware. If upgrading from firmware version 1.2.0 or earlier, review the v1.3.0 Release section for more details.

Critical Fixes

There were no critical fixes included in this release. See the Non-critical Fixes section for more information about release content.

Enhancements

There were no enhancements included in this release. See the Non-critical Fixes section for more information about release content.

Non-critical Fixes

PR35853
PR35854

Models Affected:

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Setting the source or measure delay of a SMU to a value less than one second disables the delay.

Resolution:

This issue has been corrected.

PR36079
PR36091

Models Affected:

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Aborting a `smuX.cal.restore` operation may cause the instrument to become unresponsive.

Resolution:

This issue has been corrected.

PR36084

Models Affected:

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The instrument may generate an "UNKNOWN FATAL ERROR" if command messages (any message sent over the active command interface) are sent to the instrument while it is busy executing a display command. Any display command, including setting display attributes, is vulnerable.

Workaround:

Wait for any display commands or scripts that execute display commands to complete before sending subsequent command messages.

Resolution:

This issue has been corrected.

v1.4.0 Release

Overview

Version 1.4.0 firmware is a feature enhancement release of the Series 2600 firmware. This firmware introduces some new features and includes several non-critical fixes.

Compatibility Concerns

This version of firmware restricts interoperation of direct digital I/O line control (`digio.writebit` and `digio.writeport` commands) and digital I/O triggering. This may introduce compatibility issues with test sequences that intermix direct digital I/O and trigger control on the same digital I/O line. See enhancement PR26312 for more details.

Version 1.3.0 firmware also introduced changes that may affect compatibility with older firmware. If upgrading from firmware earlier than v1.3.0, review the v1.3.0 Release section for more details.

Critical Fixes

There were no critical fixes included in this release. See the Enhancements and Non-critical Fixes sections for more information about release content.

Enhancements

PR26312   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

Digital I/O trigger support has been enhanced to provide better performance and additional trigger modes. When generating output triggers on the digital I/O lines, the unit no longer waits for the trigger pulse to complete. The unit will continue to execute a running script or process additional commands while the pulse is generated in the background. Also, the pulse widths are much more tightly controlled. The generated pulse width is still guaranteed to be at least the requested pulse width, but can now be expected to be no more than 1µS longer than the requested pulse width.

Several new trigger modes have been added to the digital I/O triggers. For complete details, refer to the updated Series 2600 documentation.

This enhancement introduces a concern over compatibility with older firmware. Version 1.4.0 firmware requires that the trigger mode of a digital I/O line be set to `digio.TRIG_BYPASS` in order to control its signal state directly as a digital I/O line with the `digio.writebit` and `digio.writeport` commands. When the trigger mode is not `digio.TRIG_BYPASS`, only the digital I/O trigger commands may be used to control the line state. Older firmware allows a digital I/O line to be controlled directly, regardless of the trigger mode setting on that digital I/O line.

PR26758   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

A catalog function has been added to provide access to the display's load-menu contents. The catalog function returns an iterator that can be used with a `for` loop to iterate over all the entries in the load-menu. The example below serves to explain its use. For more details, see the updated Series 2600 documentation.

Example:

```
for name, code in display.loadmenu.catalog() do
    print("The "..name.." entry will run the following code:")
    print(code)
end
```

PR27182   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

Storing readings to a reading buffer from the front panel will now allow the measurements to be appended to reading buffers instead of always overwriting them. Append operation can be configured by selecting **CONFIG** > **STORE** > **TRIG-MODE** from the front panel. Append mode is global and will affect all front panel store operations to any reading buffer.

Wrap-around operation is not available from the front panel. When using append mode from the front panel, if any reading buffer involved in the store operation fills to capacity, the store operation will terminate.

The **COUNT** option from the **CONFIG** > **STORE** menu has been removed. The unit will now prompt for the store count when a store operation is initiated by pressing the **STORE** button.

PR28476   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

The `printbuffer` command has been enhanced to accept ordinary tables in addition to reading buffers. When using ordinary tables, table values are expected to be indexed with sequential integer values starting at index 1.

PR34773   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

This firmware adds several functions and attributes that allow scripting code to be executed on slave nodes in parallel with code executing on the master node or other slave nodes. Functions and attributes have been added that also allow the communication of data between nodes running code in parallel.

For complete details, refer to the updated Series 2600 documentation for more information on advanced TSP-Link® features.

PR34774   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

The command interface handling has been enhanced in the following ways:

- There are no longer any restrictions on the size of an output message.
- The MAV bit in the status model now reflects the state of the output queue, regardless of which command interface is being used (rather than just for the GPIB interface).

- When switching between command interface sessions, the output queue will be automatically cleared. A new session is started each time the unit transitions from local to remote operation.

PR34775   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

This version of firmware provides access to the three TSP-Link synchronization lines. These lines behave identically to the digital I/O synchronization lines, and similar commands can be used by using `tsplink` instead of `digio` in the command name.

PR34776   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

The name of a script can now be changed after the script is loaded. The name of the script is changed by assigning its name attribute a new value. When the name of a script is changed, the `script.user.scripts` table will be updated to reflect the change. A script can be unnamed by setting the name of the script to an empty string. When a script is unnamed, its entry in the `script.user.scripts` table will be removed. If a script is renamed to the name of another script, the previous script with that name will be unnamed.

Note: Changing the name of a script does not rename any variables that are a reference to that script. When a script is first loaded as a named script, a global variable with that name is also created that is a reference to the script. The name of that variable will never change regardless of any changes to the script's name.

PR34777   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

The **LOAD** menu on the front panel now includes a new option. The **SCRIPT** option allows you to select any script loaded on the instrument. Unnamed scripts will not appear in the menu.

PR34778   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

The front panel menus have been reorganized for easier access to instrument features. For complete details, refer to the updated Series 2600 documentation.

Non-critical Fixes

PR26845   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The instrument does not properly detect "Query Unterminated" errors. If the instrument is addressed to talk and there are no pending commands that might generate output, the instrument will fail to detect and generate an error in this situation.

Workaround:

This situation can be detected by the user when a GPIB read operation times out.

Resolution:

This issue has been corrected.

PR27460 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Performing a `tsplink.reset()` for the first time after power-up of a system does not abort scripts running on nodes other than the one that initiated the reset. This might allow multiple scripts to be running simultaneously.

Resolution:

The unit will now abort a script if a `tsplink.reset()` is initiated from another node while the script is running.

PR28889 **Models Affected:**
PR32470
2601, 2602, 2611, 2612, 2635, 2636

Symptom:

`*CLS` does not clear the output queue.

Resolution:

This issue has been corrected.

PR29055 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The digital output port value displayed on the front panel may be incorrect after power-on. If any of the digital I/O lines are externally driven low during power-on, the value displayed in the "**GENERAL** > **DIGOUT** > **DIG-IO-OUTPUT**" menu will reflect the state of the lines at power-up rather than their programmed output value. After writing a value to the port via the front panel or a remote command, the correct value is displayed.

Resolution:

This issue has been corrected.

PR29079 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Sending several thousand abort messages to the unit over the RS-232 interface while the unit is powering up can cause the unit to halt with an "UNKNOWN FATAL ERROR" message on the display.

Resolution:

This issue has been corrected.

PR29249 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Using certain commands from a coroutine will cause the unit to become unresponsive, generate improper error messages, or fail to execute. In addition to saving a script or listing a script, the following commands will cause one or more of these problems when executed from a coroutine: `delay()`, `makegetter()`, `makesetter()`, `print()`, `printbuffer()`, `printnumber()`, `script.delete()`, `script.new()`, `script.newautorun()`, `script.restore()`, `timer.clear()`, and `timer.wait()`.

Resolution:

This issue has been corrected.

PR29951 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

While the unit is rebooting after performing a flash upgrade, any GPIB activity will cause the unit to halt with an "UNKNOWN FATAL EXCEPTION" error. The firmware is updated correctly. Cycling power on the unit corrects the problem.

Resolution:

This issue has been corrected.

PR32856 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The `display.prompt()` function may display some erratic (very small) values instead of zero. For example, you might see "-7.9409e-23" instead of "+0.0000e+00". This problem also affects factory script input routines because they use this function.

Resolution:

This issue has been corrected.

PR32947 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Prior to performing a `tsplink.reset()`, the node table does not contain an entry for the local node under the local node index. It only appears under the index "self." This also happens when the `tsplink.reset()` command fails with an error.

For example, consider a node with a node number of 5. After a successful `tsplink.reset()`, the index 5 will refer to the local node. Prior to executing the first `tsplink.reset()` or after a `tsplink.reset()` fails, the entry at index 5 in the node table is nil.

Resolution:

This issue has been corrected.

PR32961 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

If you create a dynamic reading buffer on a remote node with the `smuX.makebuffer()` command and later perform a `tsplink.reset()` command, the reading buffer will be locked into memory with no way to access it or to delete it until the remote node is powered off.

Workaround:

This problem can be avoided by setting all dynamic reading buffer references to nil and calling `collectgarbage()` prior to executing `tsplink.reset()`.

Resolution:

This issue has been corrected.

PR33182 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Passing a line number other than 1 or 2 to the `display.gettext()` function will cause the instrument to become unresponsive.

Resolution:

This issue has been corrected.

PR33183 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The error message for error 1103 reads "Max greater than min" but it should read "Min greater than max."

Resolution:

This issue has been corrected.

PR33303 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

ICL attributes that are integers can be assigned extremely large values without error. The actual value assigned will be a truncated version of the large value the user is attempting to assign.

Resolution:

The Test Script Processor (TSP™) now ensures that numbers do not exceed the maximum value allowed for the internal representation of integer values when they are used in ICL commands. If they are outside the range of representable values, a "Data out of range" error will be generated.

PR33510 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

If hardware flow control is enabled on the RS-232 interface and the instrument is being controlled over that interface, unplugging the serial cable while a script is generating output will cause the instrument to hang when the output buffers fill up. The **EXIT** button will not fully terminate the script until the cable is reconnected. The instrument will recover if the cable is reconnected.

Resolution:

This issue has been corrected.

PR33587 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

When the instrument is running factory scripts at power-up, pressing the **EXIT** button or sending an `abort` message over the RS-232 interface will abort the factory scripts. This prevents the factory scripts from creating some of the functions defined in them and prevents them from populating the front panel load menu.

Resolution:

Factory scripts can no longer be aborted when the unit is powering up.

PR34254 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The display annunciators can get out of synchronization with the state of the instrument and may fail to represent the true state of the instrument. The instance of this problem most likely to be observed affects the REM indicator and can often be induced by sending a command message very quickly after sending an abort message. This problem was introduced in firmware version 1.2.0.

Resolution:

This issue has been corrected.

PR34493
PR34494 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

Sending an abort message to the instrument when it is in local mode with the output on may cause the unit to stop updating the display with new measurements. It may also generate a "Script Aborted by User" error.

Resolution:

This issue has been corrected.

PR35424   **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Symptom:

The buffer store annunciator does not turn off after storing readings with the `smuX.measure.overlappedX` command.

Resolution:

This issue has been corrected.

PR35482   **Models Affected:**
PR35521
PR36059   2601, 2602, 2611, 2612, 2635, 2636
PR36060
Symptom:

Aborting a script that is waiting for data to become available in a reading buffer will cause the instrument to stop responding.

Resolution:

This issue has been corrected.

v1.3.3 Release

Overview

Version 1.3.3 firmware is a maintenance release of the Series 2600 firmware. This firmware includes some non-critical fixes. Note that versions 1.3.1 and 1.3.2 of the Series 2600 firmware were never released.

This version of firmware introduces support for the KIPulse script on the Model 2601 and Model 2602. The KIPulse script was originally supported in v1.2.0 for the Model 2611 and Model 2612, but v1.2.0 was never approved for use on the Model 2601 or Model 2602. See the updated Series 2600 documentation for details on the KIPulse factory script.

Compatibility Concerns

Version 1.3.0 firmware introduced changes that may affect compatibility with automated calibration software used to calibrate a Series 2600 instrument. This firmware includes these changes and may be of concern when upgrading from a version of firmware earlier than v1.3.0. See enhancement PR31753 in the Enhancements portion of the v1.3.0 release section for more details.

Critical Fixes

There were no critical fixes included in this release. See the Non-critical Fixes section for more information about release content.

Enhancements

There were no enhancements included in this release. See the Non-critical Fixes section for more information about release content.

Non-critical Fixes

PR34445 **Models Affected:**
PR34446
PR34447 2601, 2602, 2611, 2612, 2635, 2636

Symptom:

A SMU will return erroneous overflow indications when making filtered measurements under the following conditions: A measurement is made on one function, I or V. Then the measure range for that function is changed such that the measurement just made would overflow the new range. Then a measurement is made on the complementary function.

Resolution:

This issue has been corrected.

PR34480 **Models Affected:**

2611, 2612, 2635, 2636

Symptom:

The KIPulse script will generate an error about operating outside the Standard Operating Area (SOA) even though the pulse is within the SOA if the SMU is configured to source more than 20V and it is configured to source a low voltage pulse with a current limit greater than 1A. The unit may then hang when attempting to turn the output off.

Resolution:

This issue has been corrected.

PR34693
PR34728
PR34729

Models Affected:

2611, 2612, 2635, 2636

Symptom:

When using the KIPulse script, if the specified pulse level or the compliance level exceeds a range boundary by 1% or less, the script will not choose the appropriate range. Additionally, if the levels specified are outside of the Standard Operating Area (SOA) of the instrument, the script may not detect the outside of SOA condition. If the script does not detect the outside of SOA condition, the script will may not output a pulse at the correct output level and may also generate various error messages.

Resolution:

This issue has been corrected.

v1.3.0 Release

Overview

Version 1.3.0 firmware was released to support the Model 2635 and Model 2636. This is the initial firmware release for those models. For the other models supported by this firmware, this release introduces three critical fixes, several enhancements, and several minor fixes.

Compatibility Concerns

Version 1.3.0 firmware introduces changes that may affect compatibility with automated calibration software used to calibrate a Series 2600 instrument. See enhancement PR31753 in the Enhancements section for more details.

Critical Fixes

PR31664   **Models Affected:**

2611, 2612

Symptom:

After generating a current pulse greater than 1.5A using the KIPulse script, the SMU may output a large current after the pulse. The magnitude of the current is proportional to (but larger than) the bias current specified for the pulse, but even bias levels of zero may cause some current to be output. When this happens, the SMU is capable of outputting currents in excess of 5A. If the SMU is configured as a current source prior to initiating the pulse, the SMU will continue to output this current after the pulse script completes. Large sustained currents caused by this issue may cause the unit to become unresponsive and could damage the SMU.

Resolution:

This issue has been corrected.

PR32195   **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

An "Out of memory" error while trying to allocate a reading buffer with the `smuX.makebuffer` command will crash the unit. The unit must be power-cycled to recover.

Resolution:

This issue has been corrected.

PR32445
PR32956   **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

Autoranged measurements may return a bad measurement if the SMU needs to change ranges to make the measurement. This can happen in the following scenarios: It may return a bad measurement if it needs to downrange to the 100nA measure range while making the measurement. It may return a bad measurement if it needs to downrange to or uprange from the lowest voltage measure range while making the measurement. It may return a measurement made on a suboptimal range if it needs to uprange while making the measurement.

Resolution:

This issue has been corrected.

Enhancements

PR29810 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The amount of time it takes to perform a TSP-Link reset operation with three or more nodes has been substantially improved. The execution time is now approximately one second per node.

PR30211
PR30879 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

Two parameters were added to the `ConfigPulseXMeasureY` function in the KIPulse factory script immediately after the `sync_out` parameter.

The parameter `sync_in_timeout` was added to allow the time-out period to wait for the `sync_in` trigger to be specified. The time-out value is in seconds. The `sync_in_timeout` parameter is optional and defaults to 10 seconds.

The `sync_in_abort` parameter was added to allow the user to specify if the pulse should be aborted when the input trigger is not received within the time-out period. If this parameter is `true`, the pulse will be aborted when no input trigger is detected within the time-out period. The default value for this parameter is `true`.

PR30789
PR30793 **Models Affected:**

2611, 2612

Enhancement:

A new measurement autorange algorithm has been added that sets the measurement range to the range used for the source limit function. This autorange algorithm is selected by setting the `smuX.measure.autorangeY` to the value `smuX.AUTORANGE_FOLLOW_LIMIT`. Note: Setting a fixed range will still set this attribute to `smuX.AUTORANGE_OFF` regardless of which autorange algorithm is being used.

PR30791
PR30844 **Models Affected:**

2611, 2612

Enhancement:

Logic was added that is able to detect unstable output conditions that could damage the instrument. When detected, the SMU will disable all low-current measurement ranges to protect itself. Although the SMU will continue to make measurements with an unstable output, the measurements may not be meaningful.

New status model bits were added for the unstable output condition. The table below outlines the status model bits that have been added. Note that the entire `status.questionable.unstable_output` register set has been added.

Register Set	Bit
status.questionable	UNSTABLE_OUTPUT (OU)
status.questionable.instrument.smua	UNSTABLE_OUTPUT (OU)
status.questionable.instrument.smub	UNSTABLE_OUTPUT (OU)
status.questionable.unstable_output	SMUA (SMUA)
status.questionable.unstable_output	SMUB (SMUB)

This enhancement was originally released in firmware version 1.1.4 for the Model 2601 and Model 2602, but it was not included in version 1.2.0 for the Model 2611 and Model 2612. This release includes this enhancement for all products supported by this firmware.

PR31753 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

A new attribute has been added to assist calibration labs in tracking calibration adjustments, as well as calibration dates. The smuX.cal.adjustdate attribute has been added; its usage is similar to the smuX.cal.date and smuX.cal.due attributes.

The smuX.cal.adjustdate attribute cannot be changed without first changing the calibration constants. If the calibration constants are changed, they cannot be saved without first setting the smuX.cal.adjustdate attribute. Setting the smuX.cal.date and smuX.cal.due are no longer required to be changed before saving the calibration data. The smuX.cal.date and smuX.cal.due attributes have no affect on the calibration constants, so they may be changed and saved without making any changes to the calibration constants.

PR32166 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The KIPulse script functions have been enhanced to accept a table of values for the off_time parameter. When a table of values is used to specify the pulse off times, each pulse will use the appropriate off time from the table. The first pulse will use the value at index 1, the second pulse will use the value from index 2, and so on. If a single value is given instead of a table, or a table with a single value is given, that value will be used for all the pulses. If there is more than one entry in the table, the number of entries must match the number of pulses. When performing dual-channel pulsing, the times for both channels must match.

PR32167 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The source level may now be changed during overlapped measurements as long as the source autorange setting is off.

PR32577 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The KIPulse script has been enhanced to allow simultaneous I and V measurements during pulsing. To measure I and V simultaneously, pass a table of reading buffers to the

`ConfigPulseXMeasureY()` function for the reading buffer parameter. When building the table, store the reading buffer to hold the I measurements at index "`i`" and the reading buffer to hold the V measurements at index "`v`". For example:

```
status, msg = ConfigPulseVMeasureI(smua, 0, 10, 1e-3, 1e-3,
        1e-3, 2, {i = smua.nvbuffer1, v = smua.nvbuffer2}, 1)
```

PR33361 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

Two new attributes have been added that control measurement delays. The `smuX.measure.delay` attribute can be set to a value in seconds that will cause the SMU to automatically wait that amount of time each time either `smuX.measure.Y()` or `smuX.measure.overlappedY()` is called. If the measurement count is greater than one, the measurement delay will only be imposed before the first measurement.

The `smuX.measure.delay` attribute may also be set to the value `smuX.DELAY_AUTO`. When set to this value, the SMU will automatically choose a delay value based on the measurement range. These automatic delay values can be systematically increased or decreased by setting the `smuX.measure.delayfactor` to a scaling factor. The automatic delay values are multiplied by this scaling factor. The default value for this scaling factor is 1.0. Set the scaling factor to a value greater than one to increase the delays. Set it to a value less than one to decrease the delays. The `smuX.measure.delayfactor` attribute is ignored when the `smuX.measure.delay` attribute is not set to the value `smuX.DELAY_AUTO`.

PR33362 **Models Affected:**

2635, 2636

Enhancement:

The `smuX.measure.analogfilter` attribute can be set to the value 1 to enable an analog filter on the 1nA and 100pA ranges. The analog filter will not be used on all other measurement ranges. Set this attribute to zero to disable the analog filter.

PR33543 **Models Affected:**

2601, 2602, 2611, 2612, 2635, 2636

Enhancement:

A median filter can now be selected as a digital measurement filter. From the remote interface, the median filter is selected by setting the `smuX.measure.filter.type` attribute to `smuX.FILTER_MEDIAN`.

When the median filter is enabled, measurements returned will be the median of the last `smuX.measure.filter.count` unfiltered measurement samples (sliding window). If the sliding window is empty when a measurement is requested, the filter window will be pre-filled to capacity with copies of the first sample.

To accommodate selection of the median filter, the front panel filter configuration menus have changed slightly. From the filter configuration menu, one may select **TYPE** or **COUNT**. **COUNT** has the same meaning as the older **AVERAGE-COUNT** entry, but the count now applies to both the average filter as well as the median filter. Under **TYPE**, one may select **AVERAGE** or **MEDIAN**. If

AVERAGE is selected, the specific type of average filter is chosen by selecting either **MOVING** or **REPEAT**.

Non-critical Fixes

PR27088 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

The `tsplink.reset()` command may cause one or more units on the TSP-Link network to become unresponsive. This problem happens very infrequently. The symptoms of this problem are identical to those of PR34098. The likelihood of PR34098 occurring is very low compared to this problem.

Resolution:

This issue has been corrected.

PR30054 **Models Affected:**

2611, 2612

Symptom:

Front panel display updates cause timing jitter. This is most apparent when making measurements that are stored in a reading buffer.

Workaround:

Turning off the display with the `display.clear()` command avoids these timing anomalies.

Resolution:

This issue has been corrected.

PR30094 **Models Affected:**

2611, 2612

Symptom:

When attempting to initiate a single channel pulse that does not make a measurement, the pulse script will abort with a run-time error.

Resolution:

This issue has been corrected.

PR30129 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

The buffer recall key will not cycle between all available reading buffers when the numeric keypad feature is enabled. The buffer recall operation works properly when the numeric keypad feature is disabled.

Resolution:

This issue has been corrected.

PR30247
PR30308

Models Affected:

2601, 2602, 2611, 2612

Symptom:

The star annunciator on the front panel does not light when storing readings to a reading buffer when initiated when initiated via a remote command.

Resolution:

The star annunciator will light when a SMU is acquiring reading buffer data regardless of how the store operation was initiated.

PR30248
PR30309

Models Affected:

2601, 2602, 2611, 2612

Symptom:

Setting the `display.smuX.digits` attribute does not behave as documented in the manual. The following table details the actual behavior when setting the attribute to the value X. This behavior is incorrect. Note that a value of 5.0 will select 4.5 digits, and so on.

Value of X	Number of digits
X <= 3.5	Error
3.5 < X < 5.5	4.5
5.5 <= X < 6.5	5.5
6.5 <= X < 7.5	6.5
7.5 <= X	Error

Resolution:

This issue has been corrected. The following table details the new and correct behavior.

Value of X	Number of digits
X <= 3.0	Error
3.0 < X < 5.0	4.5
5.0 <= X < 6.0	5.5
6.0 <= X < 7.0	6.5
7.0 <= X	Error

PR30788
PR30792

Models Affected:

2611, 2612

Symptom:

Passing parameters of the wrong data type or with unexpected values to the `ConfigXXX()` function in the KIPulse script may cause the `InitiatePulseTest()` or `InitiatePulseTestDual()` function to generate errors when it is executed. If this happens and the script is aborted, the SMU may not reset properly.

Resolution:

The `ConfigXXX()` functions now perform more thorough parameter checking and will return a failure indication and error message for problematic parameter values.

PR31172 **Models Affected:**
PR31182
2601, 2602, 2611, 2612

Symptom:

Attempting to set a fixed source range will turn the source-autorange setting off, even if there is an error generated while processing the command. When source-autorange is turned on, setting a new source range will automatically turn source-autorange off. If there is an error generated for this operation, such as trying to set the new range lower than the source level, the command should not take any action.

Resolution:

This issue has been corrected.

PR31483 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

When a digital I/O line is configured for synchronous mode triggers, it will properly detect and latch a falling edge trigger. Once latched, however, it cannot be released.

Resolution:

This issue has been corrected.

PR31536 **Models Affected:**

2611, 2612

Symptom:

Specifying a non-zero bias level with the KIPulse script does not work properly and causes the script to generate error messages when the pulse is generated. If the bias is a positive value, the pulse will complete normally, but the source range will not be restored. If the bias is a negative value, the pulse will be generated properly, but the bias level before the pulse will not be set.

Resolution:

This issue has been corrected.

PR31749 **Models Affected:**

2611, 2612

Symptom:

Sweeping from a negative value to zero using the KIPulse script generates a polarity error.

Resolution:

This issue has been corrected.

PR31749 **Models Affected:**

2611, 2612

Symptom:

The KIPulse script allows logarithmic sweeps to start or end at zero.

Resolution:

This issue has been corrected.

PR31775 **Models Affected:**

2611, 2612

Symptom:

When using the KIPulse script, specifying a bias level higher than the pulse level will cause the `InitiatePulseTest` function to generate an error.

Resolution:

This issue has been corrected.

PR31843 **Models Affected:**

2611, 2612

Symptom:

The SMU may briefly output 0V when changing range to the 20V range (either manually or during autoranging) while the source is outputting a negative voltage.

Resolution:

This issue has been corrected.

PR32510 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

When the TSP-Link system is in the Local Control State (LCS), sending a command to the TSP-Link master node that will execute a SMU command on a remote TSP-Link node immediately after the LCS to Remote Control State (RCS) transition may cause the system to hang if any script or command is later aborted at any time. This problem is more likely to be seen if the output on the remote SMU is on during the LCS to RCS transition.

Workaround:

This problem can be avoided by executing a 50 millisecond delay as the first command in a command message that causes an LCS to RCS transition. For example, if the system is in the LCS state, send the message "`delay(0.05)`" as the first command to the master. After this, all subsequent commands are safe until the system is again put in the LCS state. As long as the system remains in the RCS state (no aborts are sent and the **EXIT** or **ON/OFF** buttons are not pressed), no further delays need be sent.

Resolution:

This issue has been corrected.

PR32534 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

Aborting a `waitcomplete` operation while a remote node is executing an overlapped operation will cause the TSP-Link system to hang.

Resolution:

This issue has been corrected.

PR33493 **Models Affected:**
PR34008
2601, 2602, 2611, 2612

Symptom:

If the display screen setting is changed from the front panel, the `display.screen` attribute accessible from the remote interface is not updated to reflect the new screen selection.

Resolution:

This issue has been corrected.

PR33553 **Models Affected:**

2611, 2612

Symptom:

Changing the source range from the 20V range to the 100V range while sourcing more than 20V will cause the output to glitch while changing range.

Resolution:

This issue has been corrected.

PR33559 **Models Affected:**

2611, 2612

Symptom:

The `ConfigPulseIMeasureVSweepLin` function from the KIPulse factory script will generate an error when configuring a negative sweep with a start value of 0.

Resolution:

This issue has been corrected.

PR33670 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

Changing source function from a 0A current source to a voltage source with the voltage source level lower than the voltage limit that was in effect as a current source may cause a large voltage spike on the output.

Resolution:

This issue has been corrected.

PR33754 **Models Affected:**

2601, 2602, 2611, 2612

Symptom:

If the output of a SMU is turned on and back off from the front panel and then the output is later turned on via a remote command interface, the display will display a stale measurement. It will display the last measurement displayed when the output was on while in local rather than a stale measurement indication.

Resolution:

This issue has been corrected.

v1.2.0 Release

Overview

Version 1.2.0 firmware was released to support the Models 2611 and 2612. This version is the initial firmware release for the Model 2611 and 2612. This version was never approved for use on the Models 2601 and 2602. All fixes and enhancements listed here are of interest for all models because they are included in all subsequent releases.

This release does not include the unstable output detection enhancement released under PR30149/PR30794 in version 1.1.4.

Critical Fixes

There were no critical fixes included in this release. See the Enhancements and Non-critical Fixes sections for more information about release content.

Enhancements

PR27601 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

Added the Contact Check feature. For detailed information about the new commands and specifications for this feature, refer to the Series 2600 documentation.

PR28493
PR29980 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

Added the Line Frequency Auto-detect feature. In addition to 50Hz or 60Hz options for the line frequency, **AUTO** can now be selected from the front panel. From the remote interface, `localnode.autolinefreq` can be set to the value `true` to enable automatic line frequency detection.

When automatic line frequency detection is enabled, the unit will analyze environmental noise at power up and automatically select the best line frequency setting based on the noise measured.

PR28643
PR29983 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The default calibration password for all models has been changed to KI0026XX. This avoids the confusion created by the Model 2601 SMUs having different calibration passwords than the Model 2602 SMUs.

PR28862
PR28863 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

By default, the unit does not impose any measurement settling delays. Changes in the output may cause transients in the measure circuit that are not settled out before making measurements.

A new attribute, `smuX.source.delay`, has been added to the command set. The default value for this attribute is `smuX.DELAY_OFF`, which preserves the functionality of prior firmware versions. If this attribute is set to `smuX.DELAY_AUTO`, the SMU will impose a settling delay based on the i-measure range. Setting this attribute to any positive value will cause the SMU to always impose a delay equal to that value, regardless of range.

PR29228 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

A new command has been introduced to read the state of the Models 2611/2612 interlock signal. The `smuX.readinterlock()` function will return `true` if the interlock signal is asserted, and `false` if it is not.

This function is present on the Models 2601/2602 but will return the state of the output enable signal.

PR29479
PR29901 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

Numeric keypad entry can now be disabled. When the display is in numeric entry mode, some buttons such as Channel A **SRC**, **DIGITS**, and so on. have a different meaning. Disabling the numeric keypad entry feature prevents this from causing confusion.

The numeric keypad feature can be controlled with the `display.numpad` attribute. Set this attribute to `display.ENABLE` to enable the numeric keypad feature. Set it to `display.DISABLE` to disable it. For example, send the `display.numpad = display.DISABLE` command to disable the numeric keypad feature.

The numeric keypad feature can also be enabled or disabled from the front panel by selecting **MENU** > **GENERAL** > **DISPLAY** menu.

PR29684
PR29695 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

All ASCII characters below 0x20 (space) are treated as space characters except for the following, which are handled the same as they were in earlier versions of firmware:

0x08 (BS)	The backspace character will remove the previous character of a message. This is useful for typing messages directly from an RS-232 terminal or terminal application.
0x09 (TAB)	The tab character will retain its value because it has meaning for formatting output.
0x0A (LF)	The linefeed character is used as a message terminator as it is in IEEE-488.2. It is also used to separate lines in a multi-line script.

This change provides more compatibility with the IEEE-488.2 standard and avoids syntax errors caused by ASCII control characters being embedded in messages sent to the unit.

PR29803 **Models Affected:**

2601, 2602, 2611, 2612

Enhancement:

The unit will display the saved setup number being loaded at power up if a saved setup other than the default factory setup is being loaded.

Non-critical Fixes

PR27835
PR29991

Models Affected:

2601, 2602

Symptom:

Fatal errors may not display on the front panel while the unit is running a CPU intensive script. The errors will eventually display when the script performs a delay or some other action that yields the CPU.

Resolution:

This issue has been corrected.

PR27939
PR29367

Models Affected:

2601, 2602

Symptom:

The unit will allow values other than 1 or 0 to be used to set the `collectsourcevalues` and `collecttimestamps` attributes of a reading buffer.

Resolution:

The unit will now generate an illegal parameter error when trying to set these reading buffer attributes to a value other than 0 or 1.

PR28176
PR29982

Models Affected:

2601, 2602

Symptom:

When turning the output off while sourcing voltage with a compliance limit above 100mA, the unit may occasionally use a fast shutdown sequence that causes glitches on the output.

Resolution:

This issue has been corrected.

PR28720
PR29984

Models Affected:

2601, 2602

Symptom:

Fatal errors generated when the unit is booting are not always displayed. When this happens, they will appear after pressing a key.

Resolution:

This issue has been corrected.

PR29058

Models Affected:

2601

Symptom:

Resetting the calibration password on a Model 2601 by shorting the "cal" pads causes an error about "smub" to be generated. The error can be safely ignored. This issue does not affect the Model 2602.

Resolution:

This issue has been corrected.

PR29286
PR29291
PR29366

Models Affected:

2601, 2602

Symptom:

The attributes of a nonvolatile reading buffer are set to their defaults after a power cycle when the reading buffer is empty.

Resolution:

Nonvolatile reading buffers now retain their attribute settings across power cycles even when a buffer is empty.

PR29289
PR29290

Models Affected:

2601, 2602

Symptom:

The beeper enable/disable setting is not saved or restored with saved setups.

Resolution:

This issue has been corrected.

PR29318
PR29319

Models Affected:

2601, 2602

Symptom:

When changing the source `lowrange` setting of a SMU to a value above the range being used while the source is configured for autoranging, the range may not be changed until the source level of the SMU is changed.

Resolution:

This issue has been corrected.

PR29320
PR29321

Models Affected:

2601, 2602

Symptom:

When using the **CONFIG** button on the front panel, the unit intermittently ignores all configuration sequence button presses and stays on the configuration menu.

Resolution:

This issue has been corrected.

PR29774
PR29778
PR29985

Models Affected:

2601, 2602

Symptom:

The RQS bit in the serial poll byte reported during a GPIB spoll operation is not set when the unit is asserting the SRQ line. The unit will properly assert the SRQ line but will not report this in the RQS bit during a GPIB spoll operation. This problem was introduced in firmware version 1.1.1.

Resolution:

This issue has been corrected.

PR29786

Models Affected:

2601, 2602

Symptom:

When sourcing current, the unit displays the wrong source range and level after the current source low range setting is changed. The values are displayed correctly again after setting a new output level or selecting a new source range.

Resolution:

This issue has been corrected.

PR29827
PR29867

Models Affected:

2601, 2602

Symptom:

When trying to access an element at index zero in a reading buffer, the error message will refer to an index of "(null)."

Resolution:

This issue has been corrected.

v1.1.4 Release

Overview

Version 1.1.4 firmware was a maintenance version of the Model 2601/2602 firmware that was never released.

Critical Fixes

PR30439
PR30855
PR30856

Symptom:

When the unit encounters a GPIB error, a 5046 "SMU too hot" error, or an 802 "OUTPUT blocked by interlock" error, the unit may become unstable or unresponsive. This problem was introduced in version 1.1.0 of the firmware.

Resolution:

This issue has been corrected.

Enhancements

PR30149
PR30794

Enhancement:

Logic was added that is able to detect unstable output conditions that could damage the instrument. When detected, the SMU will disable all low current measurement ranges to protect itself. Although the SMU will continue to make measurements with an unstable output, the measurements may not be meaningful.

New status model bits were added for the unstable output condition. The table below outlines the status model bits that have been added. Note that the entire
`status.questionable.unstable_output` register set has been added.

Register Set	Bit
`status.questionable`	`UNSTABLE_OUTPUT` (OU)
`status.questionable.instrument.smua`	`UNSTABLE_OUTPUT` (OU)
`status.questionable.instrument.smub`	`UNSTABLE_OUTPUT` (OU)
`status.questionable.unstable_output`	SMUA (SMUA)
`status.questionable.unstable_output`	SMUB (SMUB)

Non-critical Fixes

PR30455

Symptom:

Some error messages are missing words when they are displayed on the front panel. Only error messages that are split between multiple display pages are affected. The message text in the error queue is unaffected by this problem.

Resolution:

This issue has been corrected.

Older Releases

The history of releases prior to 1.1.4 is not included in this release notes document. Please see the release notes from previous releases for more information about these earlier releases.