

Aim-TTi SMU4000 Series Bridge SMU Source Measure Unit Instruction Manual

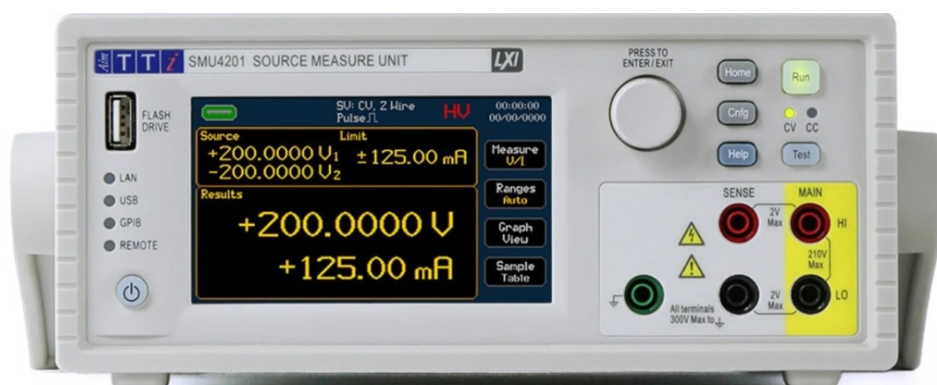
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Aim-TTi SMU4000 Series Bridge SMU Source Measure Unit



Product Information: TEST BRIDGE SMU

The TEST BRIDGE SMU is a device that provides full control of up to 2 SMUs (Source Measure Units) from the SMU4000 series. It comes with advanced graphing of data and is compatible with USB and LAN connections. The device also includes a sequence builder to create custom measurement sequences. It is intended to be used with the SMU4001 and SMU4201 models.

Features:

- Control 1 or 2 SMUs
- Full control of SMU
- Sequence builder
- Advanced graphing of data
- USB and LAN compatible

Intended Use:

The TEST BRIDGE SMU is intended to be used with the SMU4001 and SMU4201 models. Firmware updates may be required for compatibility with other instruments.
List of compatible instruments: (Firmware updates may be required for compatibility)

SMU	
Series	Models
SMU4000	SMU4001, SMU4201

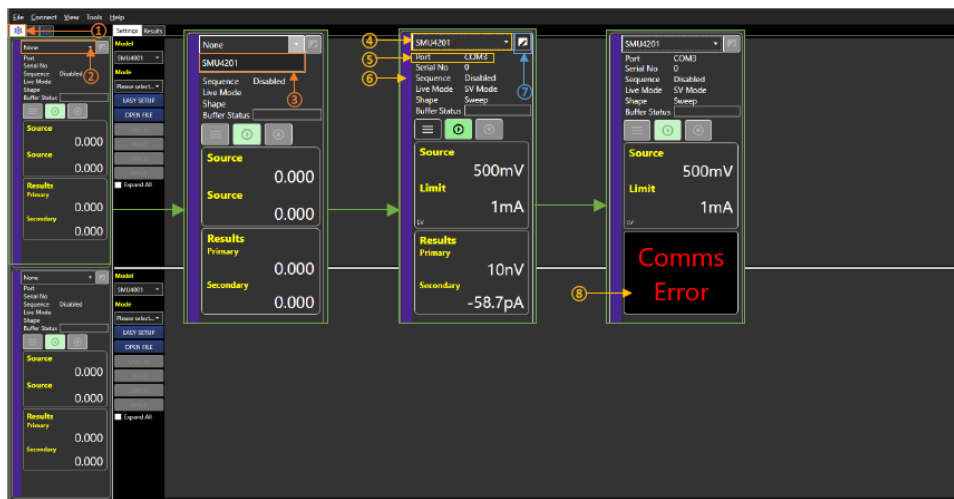
Instrument Setup:

To use the TEST BRIDGE SMU, first ensure that Instrument Control is selected. Select the drop-down box in the Instrument Control Panel to show all instruments available. If a connected instrument is not shown, see Connect. The available instruments will be listed under the instrument name e.g. `SMU4001` for the SMU4001 source measure unit.
Select the instrument to activate the Instrument Control Panel. The instrument name will now be shown, in addition to following additional information:

- The channel output state will match the instrument when connected, this may be on or off depending on the setup.
- To disconnect an instrument, select the connected instrument from the drop-down box. This will reset the Instrument Control Panel back to the default state. If an instrument is connected and communication is lost, a `Comms Error` will show. Check connections and reconnect as shown above.
- The mode or sequence in the editor will stay. This allows you to edit a mode or sequence offline before reconnection (or connecting to another instrument) and applying it.

Select an Instrument

Firstly, ensure Instrument Control is selected ①.



Select the drop-down box in the Instrument Control Panel ② to show all instruments available. If a connected instrument is not shown, see Connect. The available instruments will be listed under the instrument name e.g. 'SMU4001' for the SMU4001 source measure unit. If there is a mode or a sequence in the editor, you will be asked if you want to keep it or load the current mode/sequence from the instrument. Select the instrument ③ to activate the Instrument Control Panel. The instrument name will now be shown ④, in addition following additional information will be shown:

- COM port details or IP address
- Serial number
- Sequence mode status
- Active mode
- Active shape
- Buffer status (the status will show green unless it is > 90% full when it will turn red)

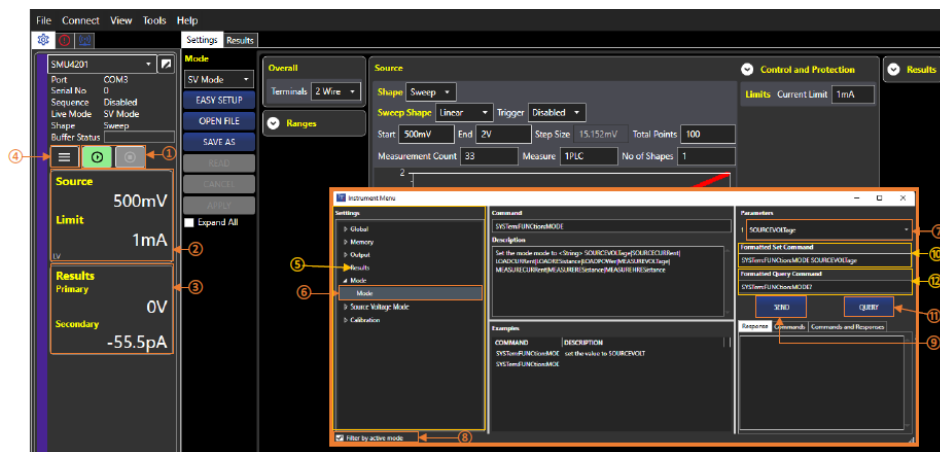
A coloured strip will be allocated ⑥ on the left, indicating the product category. The instrument can be given a unique name, using the edit box ⑦. The meter digits show live readings when they are available (if off measurements are turned off, they will not be shown).

NOTE

The channel output state will match the instrument when connected, this may be on or off depending on the setup. To disconnect an instrument, select the connected instrument from the drop-down box. This will reset the Instrument Control Panel back to the default state. If an instrument is connected and communication is lost, a 'Comms Error' will show ⑧. Check connections and reconnect as shown above. The mode or sequence in the editor will stay. This allows you to edit a mode or sequence off-line before reconnection (or connecting to another instrument) and applying it.

Instrument Control:

To run the setup, use the Run and Stop buttons. If the instrument is in a mode that uses the source, the source level and limit are shown. The live primary and secondary results are shown unless the output is off, and off measurements are disabled.



To run the setup, use the Run and Stop ① buttons. If the instrument is in a mode that uses the source, the source level and limit are shown in ②. The live primary and secondary results are shown in ③ unless the output is off, and off measurements are disabled.

Instrument menu

To access the Instrument Menu, select the Menu button ④. This menu contains settings and functions such as OVP, limits, ranges etc. These are instrument specific and will vary depending on the instrument connected. Each block of settings is contained within a tree view ⑤, the selected setting on the left ⑥ defines the available parameters ⑦ on the right. If no parameter is available, the action has no numeric value option.

NOTE

By default, only the commands for the active mode are visible, to access the commands for all the other modes un-tick ⑧. If the command to change the mode is sent and the “Filter by active mode” is ticked the tree will refresh to show the commands for the new mode.

Selecting a command will display the description and an example (referenced from the Programming Manual). Commands that have string parameters with fixed options, will be shown in a dropdown list. Commands with numeric parameters will allow the user to enter a value in a text box. Commands where the numeric parameter has units will also have a dropdown list of the allowed units. Units are optional, where they are omitted, the base units will be used e.g. V, A, W, Ω or s. Press Send ⑨ to send the formatted set command ⑩. Alternatively, right-click to execute the example. Press Query to send the formatted query command . The response will be shown in the “Response” box.

NOTE

All commands are in the tree for reference. However, some cannot be executed, these commands would be used to either to send / receive files to / from the SMU or would return large amounts of binary or ASCII data.

Instrument Menu:

To access the Instrument Menu, select the Menu button. This menu contains settings and functions such as OVP, limits, ranges etc. These are instrument specific and will vary depending on the instrument connected. Each block of settings is contained within a tree view, the selected setting on the left defines the available parameters on the right. If no parameter is available, the action has no numeric value option. By default, only the commands for the active mode are visible, to access the commands for all the other modes un-tick. If the command to change the mode is sent and the Filter by active mode is ticked the tree will refresh to show the commands for the new mode.

INTRODUCTION

Using this manual

Colour coding:

Green = Larger view / selected area

- ① Orange = Instruction to select

- ① Blue = Optional instruction to select
- ① Yellow = Description of item

Symbols

The following symbols are displayed throughout the manual:



Indicates a hazard that could damage the product that may result in loss of important data or invalidation of the warranty.

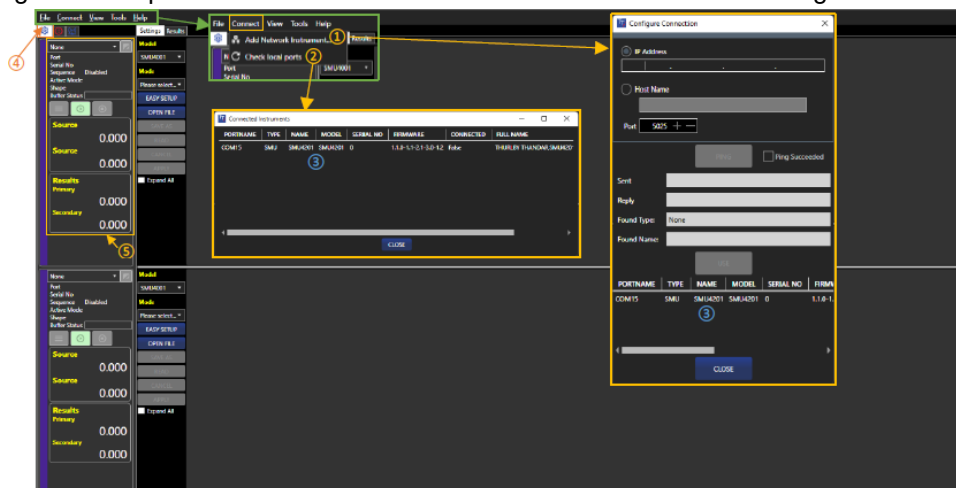


Indicates a helpful tip

GETTING STARTED

File

Open/Save Configuration: Open or save the Instrument Control Panel and Recording Channel configurations.



Exit: Close the application.

Connect

Add Network Instrument: ① Specify the IP address or host name and enter the port number (5025) – see the instrument's Instruction Manual for more details. Click the Ping button to test the connection – if successful the Use button will activate. Click the Close button to continue.

Check Local Ports (USB): ② Display and refresh the list of available instruments.

The Instrument can be renamed from the connect window, double click on the name ③ to edit.

NOTE

Following a power cycle, checking ports can take up to 10 seconds if not connected via LAN.

View

Show/Hide the SMU control panel or graph.

Tools

Arb Generator: Offline arbitrary waveform generator.

Help

Help: This PDF guide to using the software.

About: Application details and a 'report generator' function to provide feedback.

Instrument Control Panel

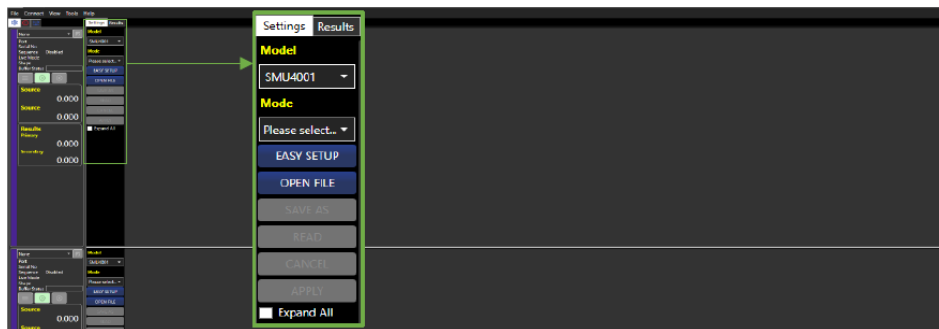
The Instrument Control Panel is selected using the icon ④. 1 or 2 SMUs can be connected to the Control Panel. Each Instrument will populate one control box ⑤. For details on how to use the Instrument control box, see Instrument control.

Entering Values

Values entered validate after 1s. This is to allow users to enter a decimal point.

SETTINGS

The settings tab provides an interactive display of the settings for an SMU, it also allows setups to be created without an SMU connected.



The following options are available:

Model: Select the model that the setup will be created for e.g. SMU4001. This is only available when an instrument is not connected.

NOTE

Setups are model specific, e.g. A setup created for an SMU4001 will not run on an SMU4201. However, Setups and Sequences can be converted from one model to another using Test Bridge whilst the instrument is not connected.

Mode: Select the mode of the setup. This can be any of the following: SV Mode, SC Mode, LC Mode, LR Mode, LP Mode, MV Mode, MC Mode, MR Mode, MHR Mode or Sequence. Selecting a mode will show the editor for the mode.

Easy Setup: Open the Easy Setup window, see Easy Setup Window for more details.

Open File: Load a setup (.stp) or sequence (.seq) from a file into the editor.

Save As: Save the setup or a sequence to a file.

NOTE

Save As and Apply will not be available if the setup or sequence have errors.

When a setup or sequence that contains list is saved, a folder containing the file with the same name as the setup or sequence (for the list .CSV files) will also be saved to the chosen location.

Expand All: Show (expand) or hide all hidden sections of a setup or sequence in the editor

The following options are available once an instrument is connected, data has been collected or parameters have been changed:

Read: Manually read the buffer for the connected SMU, only if it contains data.

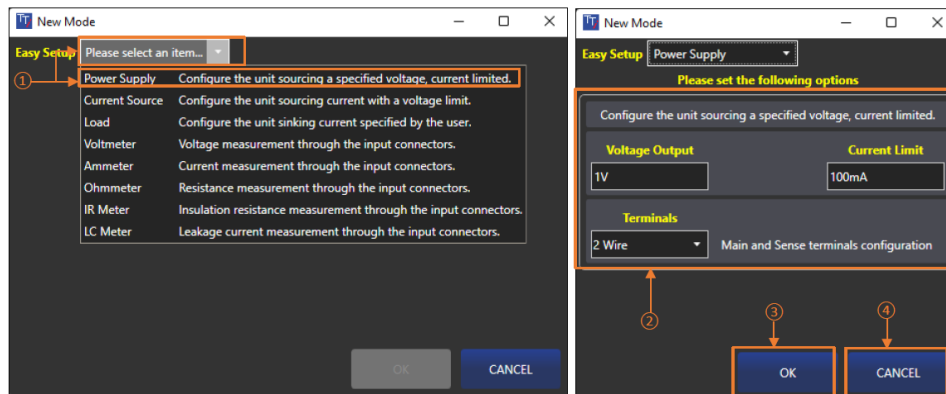
Cancel: Cancel all changes and reload the active setup or sequence from the instrument.

NOTE

If the setup or sequence contains a list and is then cancelled, lists will not be loaded.

Apply: Send the setup or sequence to the instrument.

Easy Setup Window



The Easy Setup menu contains a number of pre-configured setups, providing instant configuration for basic operational use of the SMU. Select the setup from the dropdown list ①. A brief description of the selected mode and mode specific options will become available ②, if no options are available only the description will appear. Enter the required values and select OK ③ to activate the mode with the set options, selecting Cancel ④ will close the window and no changes will be applied.

Mode Editor (Manual Setup)

The Mode Editor contains options for the source and measurement operating functionality. Once a mode has been selected, mode specific options will become available. For sequence mode See Sequence Mode Editor.



The Mode Editor is grouped into sections (as appear on the SMU GUI – Manual Setup):

Overall: General settings for the selected mode.

Source/Sink/Measure: The shape, control, limits and protection.

Results: Post processing (Math and sorting functions).

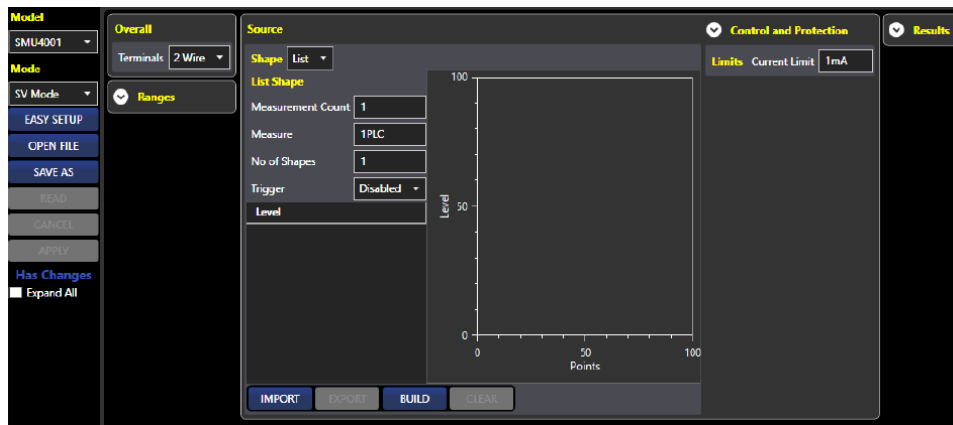
Ranges: Set the current and voltage range.

Invalid values will have a red outline ①. A summary of all the current errors will be shown at the bottom of the editor ②. While there are invalid values it will not be possible to save the setup to file or apply the setup to the SMU ③.

NOTE

Changes will be shown in the Mode Editor. To apply the latest changes to the SMU, press the Apply button in the Settings section.

List Source Shape



The list source shape editor has the following additional options:

Import: Import a list of levels from a CSV file. If the CSV file contains multiple columns, a pop-up will appear with the option to select the column to import.

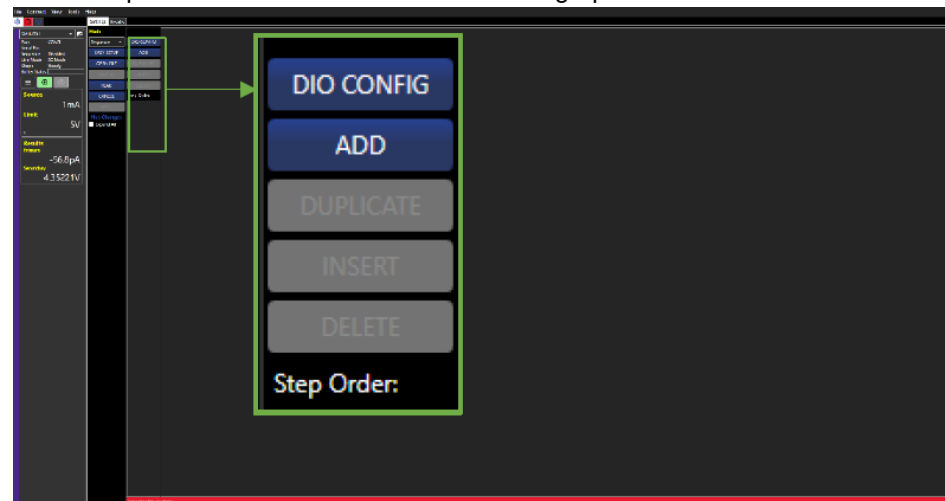
Export: Export the present list of levels to a CSV file.

Build: Open the Arb generator, this allows a custom list to be created, see Arb Generator .

Clear: Remove all points from the list.

Sequence Mode Editor

The Sequence Mode Editor allows for the setup and configuration of multiple steps to form a sequence. This is created using user stored configuration setups that are loaded into the sequence model to create a base for the additional actions. The Sequence Mode Editor has the following options:



DIO Config: Open the DIO Config window, used to configure the DIO pins.

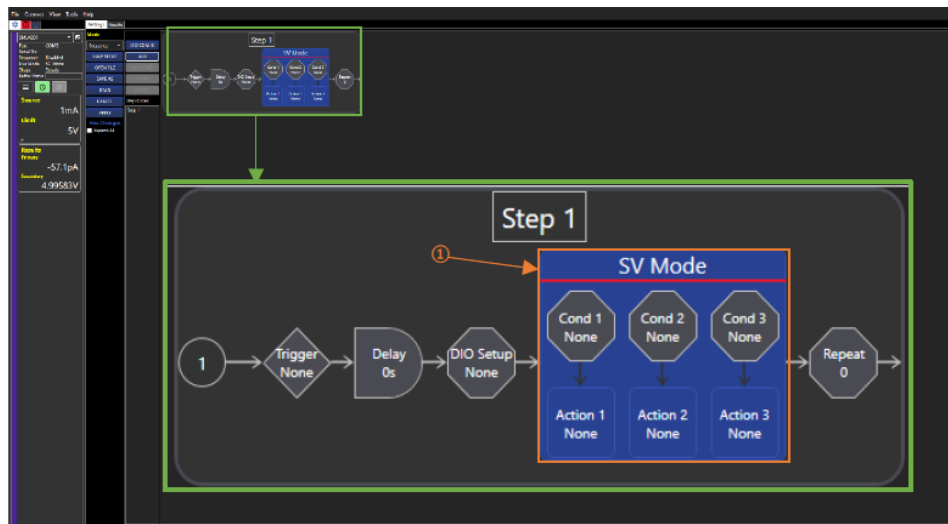
Add: Add a new step to the end of the sequence, up to a maximum of 25. **Duplicate:** Duplicates the selected step, adds the step to the end of the sequence. **Insert:** Insert a new step before the selected step.

Delete: Delete the selected step

Step Order: Drag and drop the steps in the list box to re-order them.

To start building a sequence, Add a step. The steps are shown in order going across the window from left to right. See Sequence Step Editor for details of how to edit a step.

Sequence Step Editor



The sequence step editor allows the following:

- Build/load a setup
- Set delays
- Repeat and jump to and from steps
- Create multiple triggered events
- Set output statuses

The Sequence Step Editor provides the options to edit the step of a sequence. Each step must have a setup added, a default setup has been added to get started. only one configuration setup can be added to each step. The top of the sequence shows an overview of the step and what order things will happen. Selecting an item in the overview will show more settings for that item below. See the SMU4000 Series Instruction Manual details on what can be set, this can be found at: www.aimtti.co.uk/support

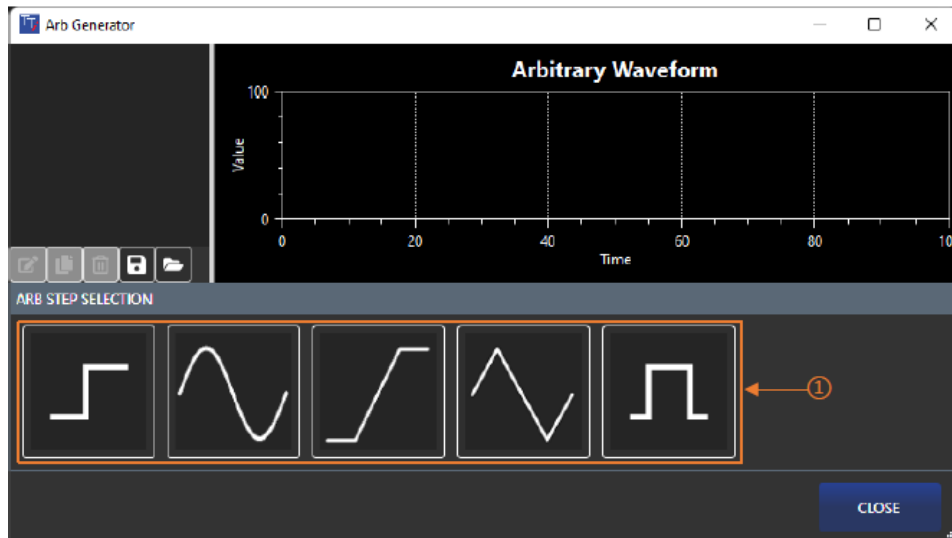
Selecting the mode box ① will show the mode editor ②. It is possible to set the name of the mode and the step using Overall > Name ③ .

Easy Setup: Open the Easy Setup window, see Easy Setup Window for more details.

Load: Load a setup (.stp) from a file into the editor. The first 8 characters of the selected file name will replace the mode name.

Save As: Save the setup to a file.

Arb Generator



The Arb generator provides the tools to create a custom list of points that can be loaded as a list into a setup. A range of built-in step options are available, including: sine wave, square wave, triangle wave, ramp, and step. To add a step to the arb, select a shape from the options in the step selection ①.



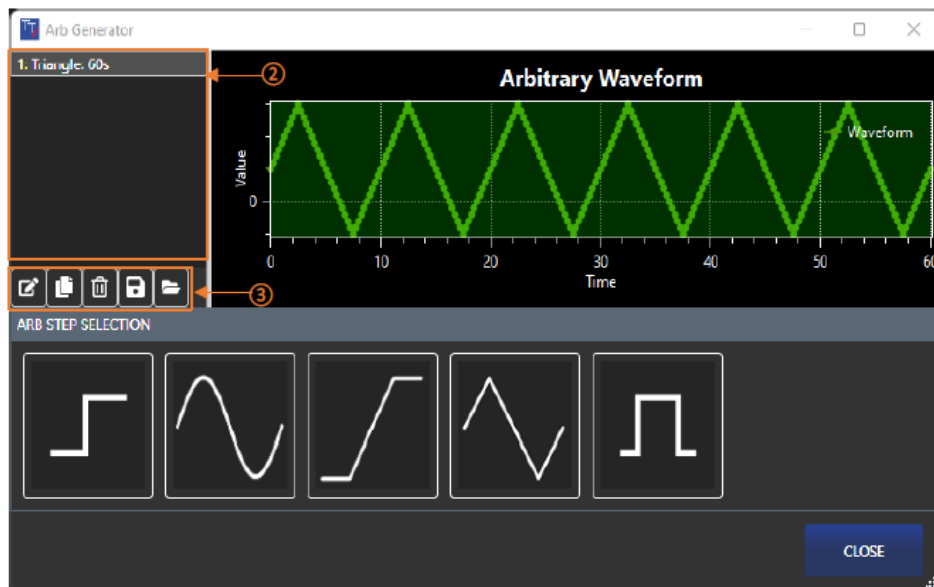
Each shape has a unique pop-up window that gives the editable parameters for that shape: Each step has the option to Insert, Add or Cancel:

Insert- Place the step BEFORE the selected step.

Add- Place the step AFTER the last step.

Cancel- Return to the sequence without making any changes.

There is also an option to name the step.



Steps are listed on the left-hand side ②, these can be selected and the following actions can be applied using the tools ③:

Edit: Edit the selected step. Opens the edit window.

Duplicate: Duplicates the selected step and opens the edit window.

Delete: Delete the selected step.

Save: Save an arb as a .CSV or .ARB file.

NOTE

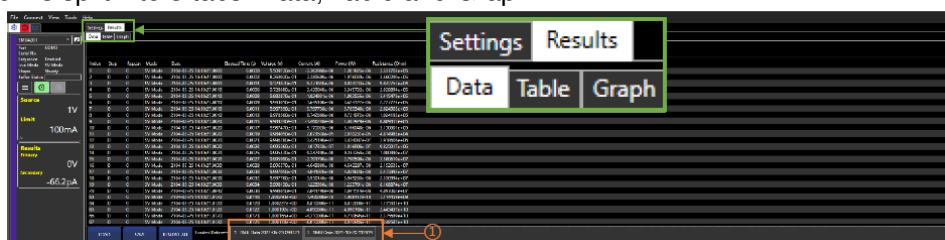
Arb files allow you to edit the arb steps later. Saving as a CSV file will not allow you to edit the arb, you will only be able to load the points into a list.

Load: Load an .ARB file.

If the Arb Generator was opened from the list editor clicking OK will return the arb as a list of points to the list editor. You will be asked if you want to replace the current list or append the new points to the current list.

RESULTS

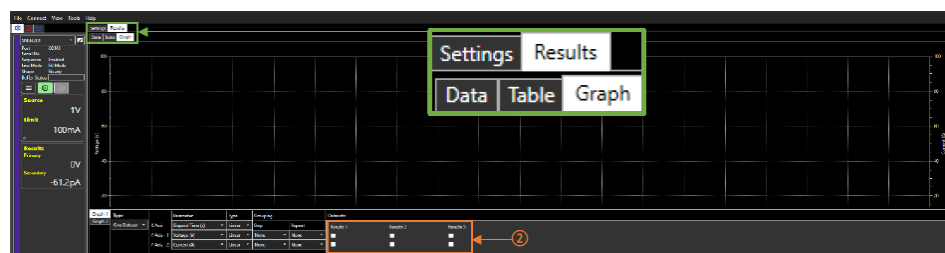
The results section is split into 3 tabs: Data, Table and Graph



Data

The Data tab shows the values in a dataset that have been loaded from the instrument or a file, these are loaded from the Loaded Datasets ① panel, click to select the required dataset or right click to rename or remove it.

Table / Graph



The data shown in the table tab shows the data selected in the Datasets section ② of the graph configuration panel, this is the data used to configure the graph.

Graph Configuration

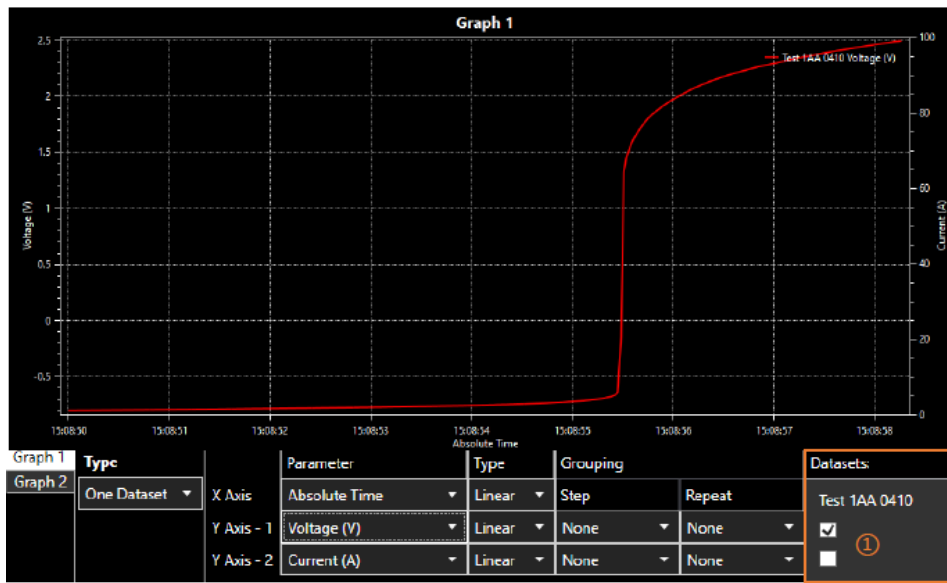
There are two types of graph: One Dataset and Two Datasets, each with their own settings.

One Dataset

Graph 1	Type	Parameter	Type	Grouping	Repeat	Datasets:
Graph 2	One Dataset	X Axis	Elapsed Time (s)	Linear	Step	Results 1
		Y Axis - 1	Voltage (V)	Linear	None	Results 2
		Y Axis - 2	Current (A)	Linear	None	Results 3

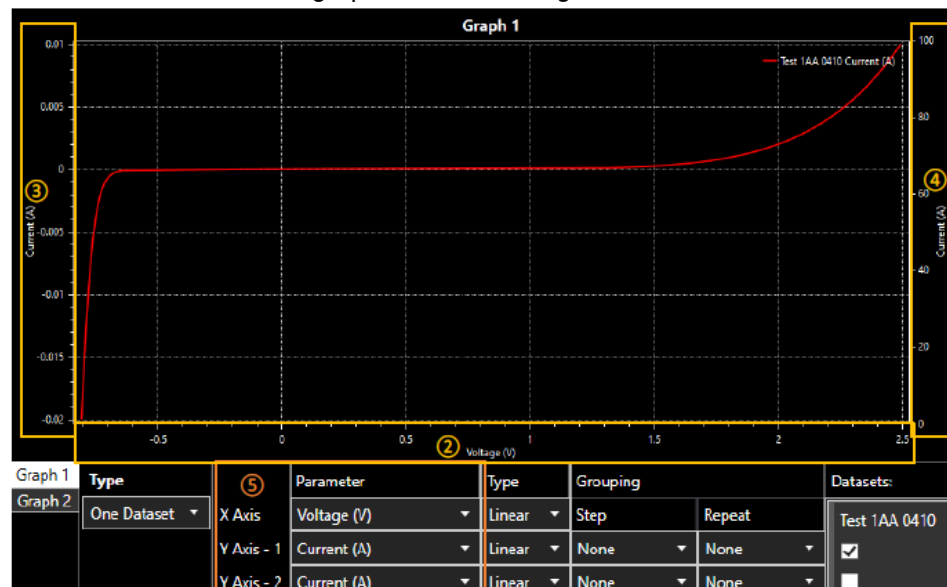
Allows the plotting of data from multiple datasets. Choose the X and Y parameters, axis type (linear or log) and any grouping ③. For each dataset tick to show on the primary and/or secondary y axis ④. Grouping is for use with results from a sequence ⑤. Grouping can be done on change of step or change of repeat. Split will insert a break in the data but leave the data in the same series. New Series will create a new series for each group.

Graph Features- One Dataset

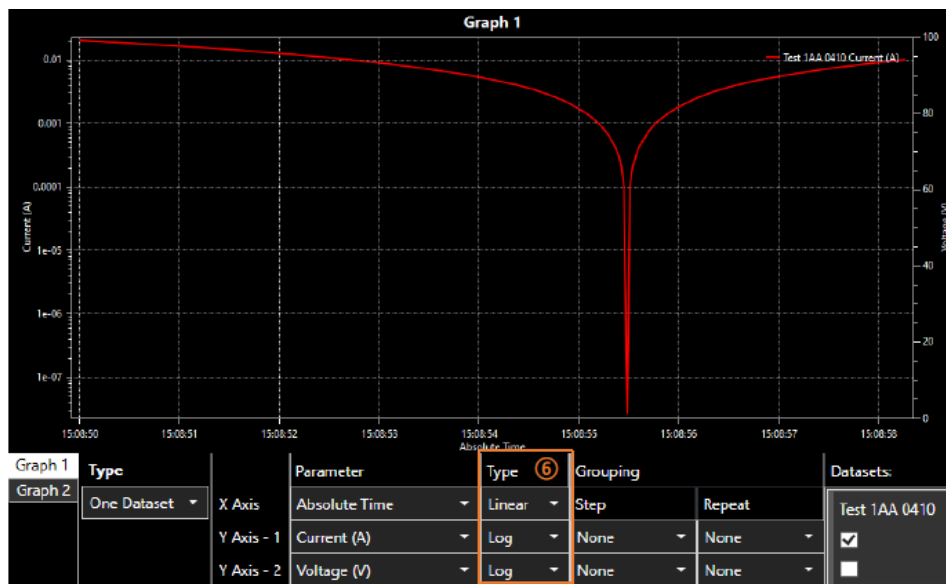


Datasets, Parameters and Graph Types

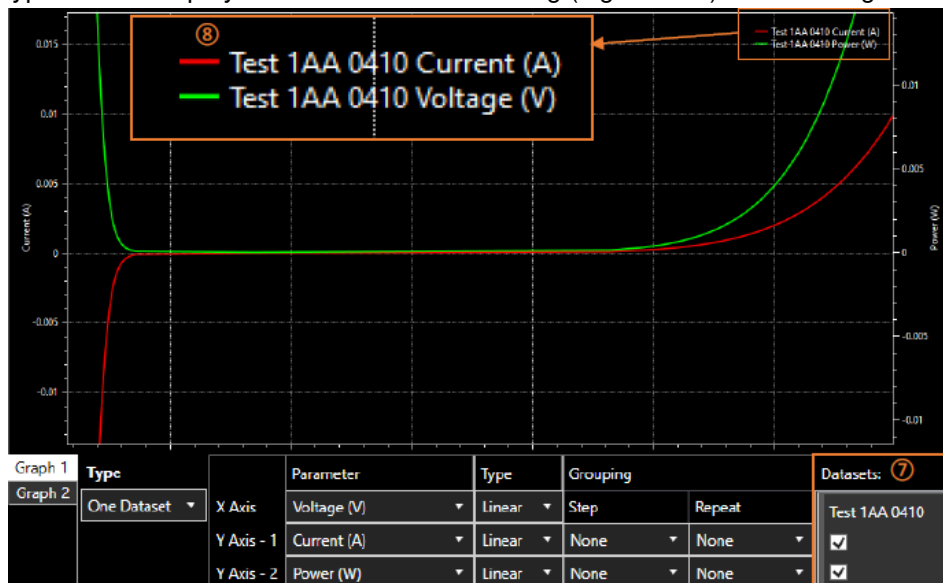
To show data on the graph, select the tick box of the required dataset ①. A graphical representation of the selected data will be shown, based on the graphs default settings.



The X ②, Y1 ③ & Y2 ④ graph axes types can be changed using the Parameter settings ⑤. To show alternative parameter types from the loaded data, select an option from the drop-down box. The options are Voltage, Current, Power or Resistance, the X axis also include the options of Elapsed Time and Absolute Time.



Each graph axis type can be displayed in either a Linear or Log (logarithmic) format using the Type settings ⑥.



There are two Y Axis options:

Y Axis-1 (Right)

Y Axis-2 (Left)

When both are selected for a single dataset ⑦ the data will be shown on one graph. Each variation of data shown is assigned a colour ⑧.

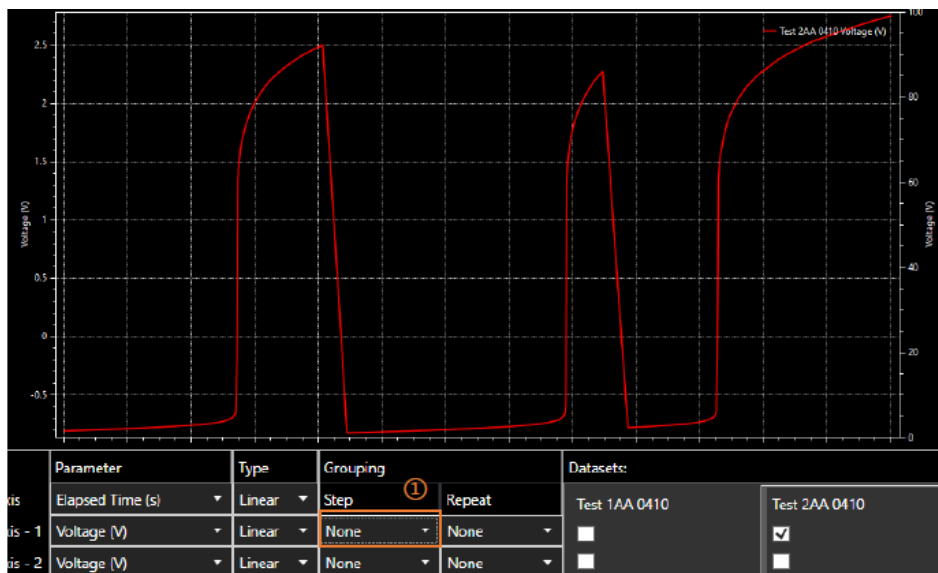
Grouping

Grouping is designed to be used with measurement data collected from the SMU when in Sequence Mode, the recorded measurement data must contain steps and/or repeats for grouping to work. Grouping allows you to split a dataset when a step repeats or changes. Steps and/or repeat grouping can be viewed as None, Split or New Series.

NOTE

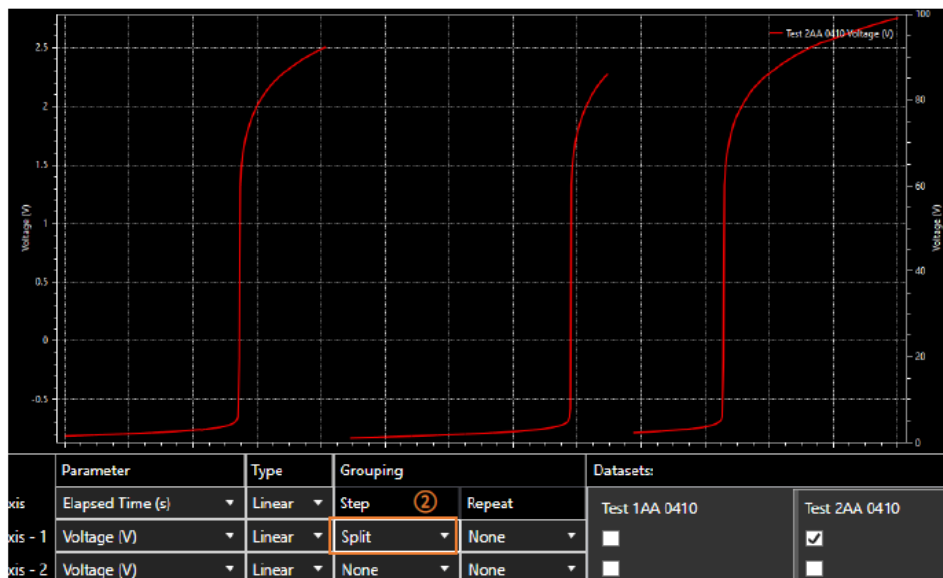
If X axis is set to Elapsed time, the time will reset at the start of each series. See example ③ (below).

Step grouping must be set before repeat grouping settings are available.

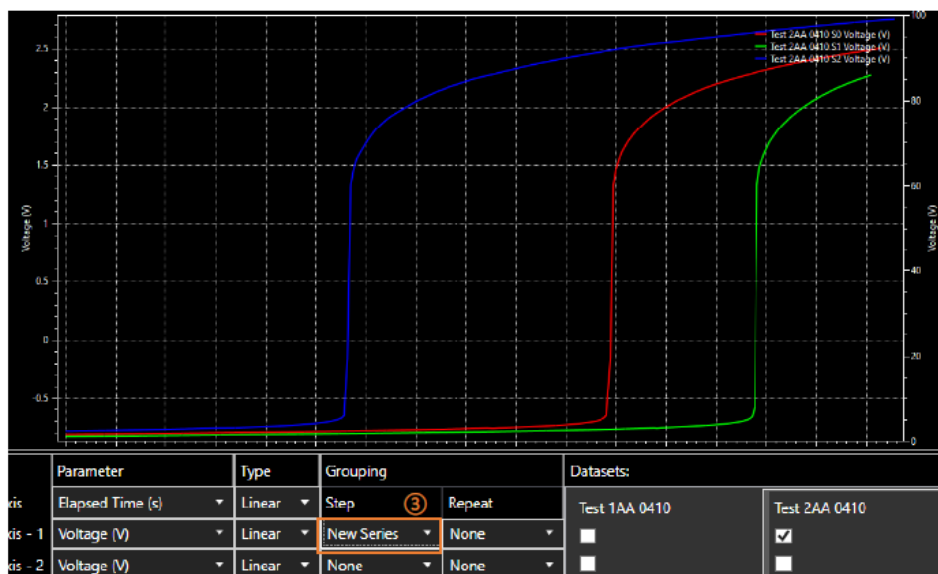


Grouping by Step- These examples show a sequence with 3 steps and no repeats:

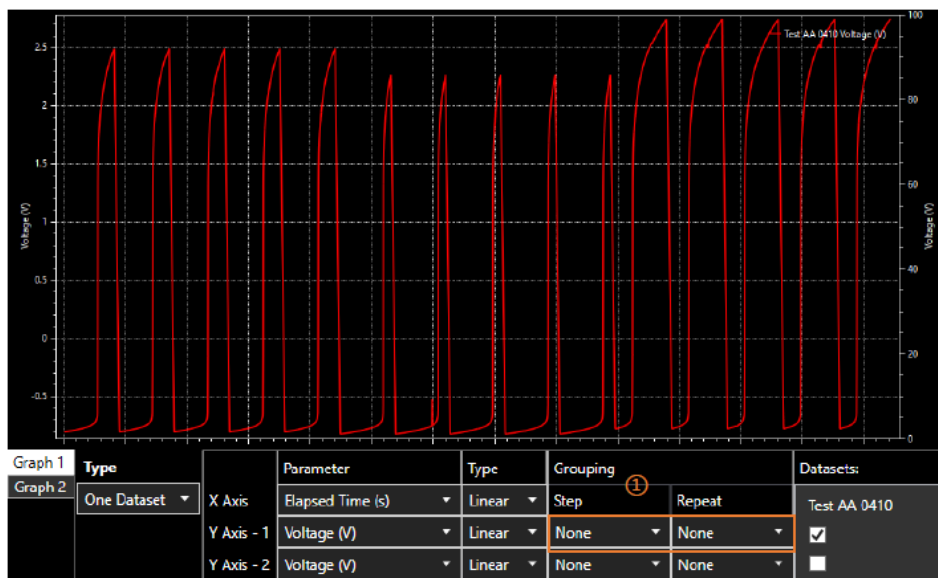
1. None – Entire dataset is shown as a continuous line of data.



2. Split – Each step within the dataset is split into individual steps on the X Axis.

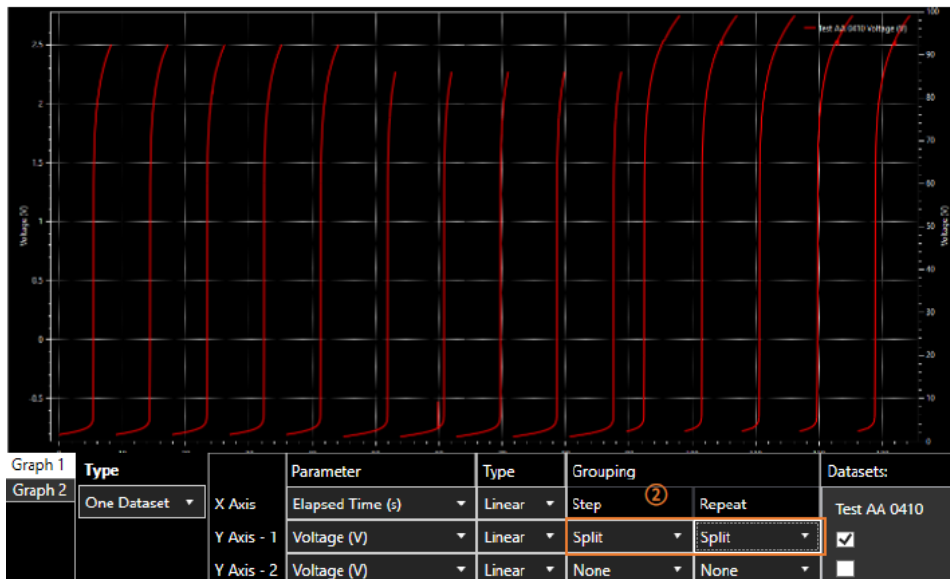


3. New Series – Each step within the dataset is shown as a new series on the X Axis.

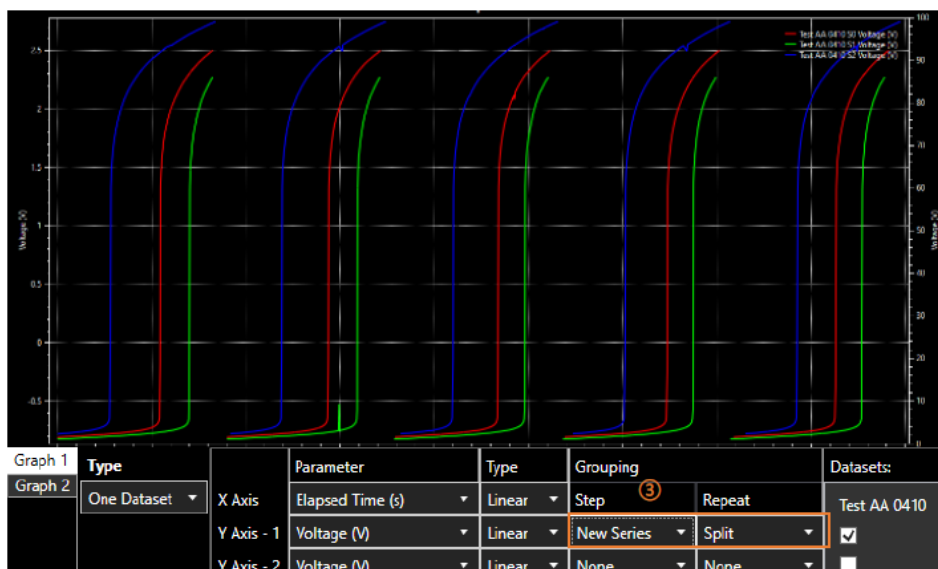


Grouping by Repeat- These examples show a sequence with 3 steps and 4 repeats:

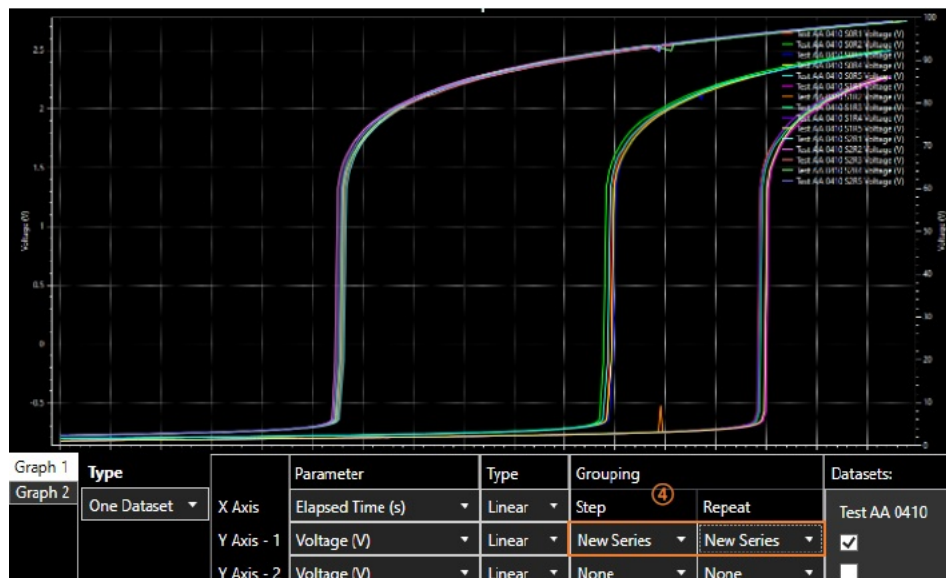
1. None – Entire dataset is shown as a continuous line of data.



2. Split / Split- Each step and repeat within the dataset is split into individual steps and repeats on the X Axis.



3. New Series / Split- Each step within the dataset is shown as a new series on the X Axis. Each repeat within the dataset is split within the series.



4. New Series / New Series- Each step and repeat within the dataset is shown as a new series on the X Axis.

Two Datasets

Graph 1	Type	DataSet	Parameter	Type	Joining	Tolerance (+/-)	Step	Repeat	Axis
Graph 2	Two Datasets	X Axis	Elapsed Time (s)	Linear	Type	0	None	None	<input type="checkbox"/> Use X Axis
		Y Axis - 1	None	Linear	Index	0	None	None	<input type="checkbox"/> Use X Axis
		Y Axis - 2	None	Linear	Index	0	None	None	<input type="checkbox"/> Use X Axis

This graph allows you to plot data from one dataset against data from a second. To allow the application to match the data you need to select the parameter on which the datasets should be joined and any tolerance in the joining ①.

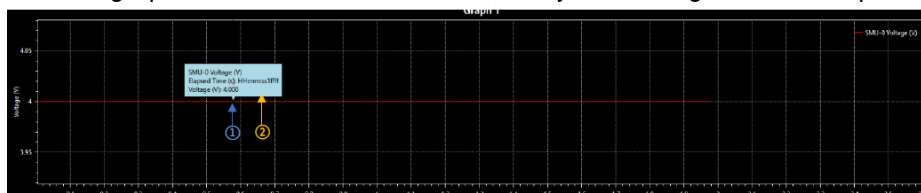
NOTE

Take care when joining datasets together that contain multiple steps or repeats, such that parameters with the same value are matched correctly. E.g. data from a sequence with multiple steps and / or repeats with similar data may not join as expected.

When joining two datasets you need to select which parameters should be used, they can be any of the following: Index, Absolute Time, Relative Time, Voltage (V), Current (A), Power (W) or Resistance (Ohms). A tolerance can also be set, this is the range of values that can be matched between the two datasets. For example, if you were measuring currents on two SMUs where the set voltage is being swept in the same sweep and you want to compare the values, the voltages being measured would be very similar but not exactly the same, setting the tolerance to half the step size would allow the two datasets to be connected and allow you to plot current 1 against current 2. Once the datasets are joined you can plot and group parameters in the same way as you can in the “One Dataset” graph with one addition, when grouping the y axis dataset is used unless you tick the “Use X Axis” tick box ②.







Graph View

The View menu can be used to show or hide graph 1 or 2, if one graph is hidden the remaining one will fill the graph display area. If both graphs are visible, the size can be adjusted using the central splitter bar.

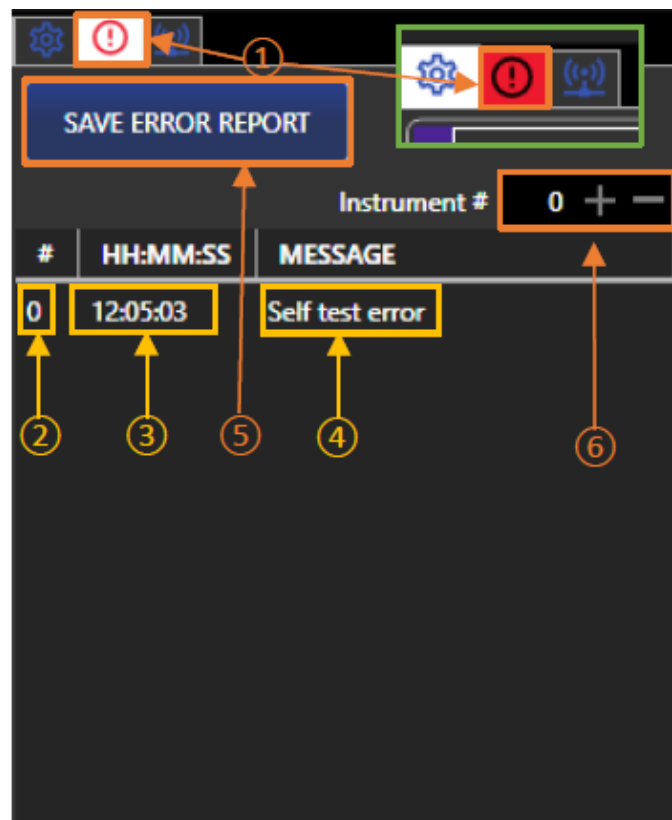


Show Values – Click and drag the mouse across the graph ① to show the details ② of that specific point in the logged data. This can be dragged along the entire data line to show any point within the log.

The following actions are available for graph navigation. To begin, click on the graph area:

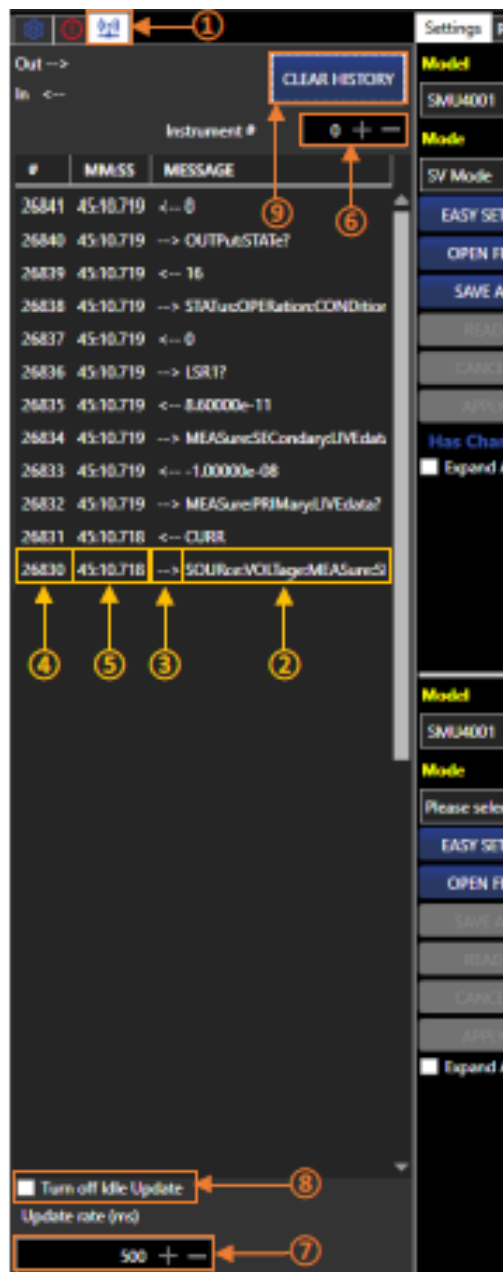
 Pan	Right click and drag	Alt + left click and drag	Arrow keys	 fine pan	Ctrl + Right click and drag	Ctrl + Alt + left click and drag	Ctrl + Arrow keys
 Zoom	Mouse wheel (Will zoom X/Y1 Axes)	Numeric keypad +/-	Page Up / Page Down	 Fine zoom	Ctrl + mouse wheel	Ctrl + numeric keypad +/-	Ctrl + Page Up / Page down
 Zoom a rectangle	Ctrl + right-click and drag	Middle mouse button	Ctrl + Alt + left click and drag	 Reset zoom	A on the keyboard,	Right click select Reset Zoom	Alt + Ctrl + left double click
Note: To zoom in one axis only, place the cursor over the axis, then use the mouse wheel to zoom							

ERROR LOG AND COMMUNICATIONS



Error Log

The Error Log panel is selected using the tab ① and will present any errors that have been logged. The icon background will turn red if there are new errors and the tab isn't selected. Each error message ④ has an index number ② and time allocated ③ as a reference point. The Error Log can be saved using the Save Error Report button ⑤. To change the instrument, select the number reference ⑥ using the +/- keys. Numbers run from 0-1 starting with the first instrument at 0.



Communications

The communications panel is selected using the tab ①. The communications panel shows the commands used to communicate between Test Bridge and the connected instruments. Messages ② are either a sent or received command this is indicated with the Out/In arrows ③. Each message has an index number ④ and time allocated ⑤ as a reference point. To change the instrument, select the number reference ⑥ using the +/- keys. Numbers run from 0-1 starting with the first instrument at 0. Messages are recorded at the selected interval update rate ⑦ – the minimum is 100ms. Messages are recorded even when the instrument is idle. To stop communications recording idle data, select the Turn Off Idle update ⑧. The history can be cleared using the Clear History button ⑨.

EXCELLENCE THROUGH EXPERIENCE

Aim-TTi is the trading name of Thurlby Thandar Instruments Ltd. (TTi), one of Europe's leading manufacturers of test and measurement instruments. The company has wide experience in the design and manufacture of advanced test instruments and power supplies built up over more than thirty years. The company is based in the United Kingdom, and all products are built at the main facility in Huntingdon, close to the famous university city of Cambridge.

TRACEABLE QUALITY SYSTEMS

TTi is an ISO9001 registered company operating fully traceable quality systems for all processes from design through to final calibration.

ISO9001:2015

Certificate number FM 20695

WHERE TO BUY AIM-TTI PRODUCTS

Aim-TTi products are widely available from a network of distributors and agents in more than sixty countries across the world. To find your local distributor, please visit our website which provides full contact details.



Designed and built in Europe by:
TTilt

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Documents / Resources

	<p>Aim-TTi SMU4000 Series Bridge SMU Source Measure Unit [pdf] Instruction Manual SMU4000 Series Bidge SMU Source Measure Unit, SMU4000 Series, Bidge SMU Source Measure Unit, Source Measure Unit, Measure Unit</p>
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References

-  [Aim-TTi - Test & Measurement Instruments and Power Supplies](#)
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