
labscript-utils

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labscript suite contributors

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DOCUMENTATION

1	API Reference	3
1.1	Labscript Tools	3
1.2	Communications	9
1.3	GUI	11
1.4	Logging and Profiling	19
1.5	Module and File Tools	20
2	<i>labscript suite</i> components	25
	Python Module Index	27
	Index	29

labscript-utils contains code shared between multiple programs in the labscript suite. This documentation is primarily for developers who might want to use this common code in their own custom features.

1.1 Labscript Tools

1.1.1 labscript_utils

`labscript_utils.dedent` (*s*)

Remove leading spaces from the first line of a string, all common leading indentation (spaces only) from subsequent lines, strip trailing spaces from all lines and replace single newlines prior to lines with the common indentation with spaces. Lines with additional indentation are kept verbatim. Good for unwrapping error messages etc that are in code as multiline triple-quoted strings.

`labscript_utils.import_or_reload` (*modulename*)

Behaves like 'import modulename' would, excepts forces the imported script to be rerun

1.1.2 labscript_utils.connections

class `labscript_utils.connections.Connection` (*raw_row*)

A class to represent a row in the connection table, present the contents as instance attributes after deserialising their contents, and providing default values for backward compatibility with older HDF5 files. Contains links to Connection objects for child devices of each device

`_defaults = {'BLACS_connection': '', 'properties': {}, 'unit conversion class': No`

`_deserialise` (*name, value*)

deserialise one item of the row depending on what it is

`_populate_relatives` (*table*)

Populate child devices based on a list of other connection objects, and set self.parent to our parent device.

`compare_to` (*other_connection*)

`diff` (*other*)

`find_by_name` (*name*)

`find_child` (*parent_name, parent_port*)

`print_details` (*indent*)

`property properties`

`property unit_conversion_params`

class `labscript_utils.connections.ConnectionTable` (*h5file, logging_prefix=None, exceptions_in_thread=False*)

assert_superset (*other*)

compare_to (*other*)

find_by_name (*name*)

find_child (*parent_name, parent_port*)

get_attached_devices ()

Finds out which devices in the connection table are connected to BLACS, based on whether their 'BLACS_connection' attribute is non-empty. Returns a dictionary of them in the form {device_instance_name: labscript_class_name}

print_details ()

remove_device (*device_name*)

Removes a device from the ConnectionTable, but keeps it in the raw_table. This can help make comparisons of connection tables fail for tables with broken devices.

labscript_utils.connections.**_ensure_str** (*s*)
 convert bytestrings and numpy strings to python strings

1.1.3 labscript_utils.dict_diff

labscript_utils.dict_diff.**dict_diff** (*dict1, dict2*)

Return the difference between two dictionaries as a dictionary of key: [val1, val2] pairs. Keys unique to either dictionary are included as key: [val1, '-'] or key: ['- ', val2].

1.1.4 labscript_utils.labconfig

class labscript_utils.labconfig.**EnvInterpolation**

Interpolation which expands environment variables in values, by post-filtering BasicInterpolation.before_get()

before_get (**args*)

class labscript_utils.labconfig.**LabConfig** (*config_path=PosixPath('/home/docs/labscript-suite/labconfig/build-12259364-project-24586-labscript-utils.ini'), required_params=None, defaults=None*)

exception **NoOptionError** (*option, section*)

A requested option was not found.

exception **NoSectionError** (*section*)

Raised when no section matches a requested option.

_abc_impl = **<_abc_data object>**

labscript_utils.labconfig.**load_appconfig** (*filename*)

Load an .ini file and return a dictionary of its contents. All values will be converted to Python objects with ast.literal_eval(). All keys will be lowercase regardless of the written contents on the .ini file.

labscript_utils.labconfig.**save_appconfig** (*filename, data*)

Save a dictionary as an ini file. The keys of the dictionary comprise the section names, and the values must themselves be dictionaries for the names and values within each section. All section values will be converted to strings with pprint.pformat().

1.1.5 labscript_utils.settings

```

class labscript_utils.settings.Settings (storage='hdf5', file=None, parent=None,
                                         page_classes=[])

    add_settings_interface (setting_class)
    close (*args, **kwargs)
    create_dialog (goto_page=None)
    get_value (settings_class, value_name)
    load (name)
    on_cancel (*args, **kwargs)
    on_save (*args, **kwargs)
    register_callback (callback)
    remove_callback (callback)

```

1.1.6 labscript_utils.testing_utils

```

class labscript_utils.testing_utils.Any (types=<class 'object'>)
    A class whose instances equal any object of the given type or tuple of types. For use with
    mock.Mock.assert_called_with when you don't care what some of the arguments are

class labscript_utils.testing_utils.ThreadTestCase (*args, **kwargs)
    Test case that runs tests in a new thread whilst providing a mainloop that allows running scripts in the current
    thread. Those scripts can then be tested from the testing thread.

    _mainloop ()
    _run (*args, **kwargs)
        Called in a thread to run the tests

    quit_mainloop ()
    run (*args, **kwargs)
    run_script_as_main (filepath)

    static wait_for (condition_func, timeout=5, initial_poll_interval=0.005, max_poll_interval=0.5)
        Busy wait for a condition to be true. Uses exponential backoff so it's fast when things are fast and not a
        complete hog when they're not

class labscript_utils.testing_utils.dotdict
    dot.notation access to dictionary attributes

class labscript_utils.testing_utils.monkeypatch (obj, name, mocked_attr)
    Context manager to temporarily monkeypatch an object attribute with some mocked attribute

```

1.1.7 labscript_utils.properties

`labscript_utils.properties._check_dicts` (*o*)
`labscript_utils.properties._decode_bytestrings` (*o*)
 Decode all base64-encoded values (not keys) to bytestrings
`labscript_utils.properties._default` (*o*)
`labscript_utils.properties._encode_bytestrings` (*o*)
 Encode all bytestring values (not keys) to base64 with a prefix
`labscript_utils.properties._get_con_table_properties` (*h5_file, device_name*)
`labscript_utils.properties._get_device_properties` (*h5_file, device_name*)
`labscript_utils.properties._get_unit_conversion_parameters` (*h5_file, device_name*)
`labscript_utils.properties.deserialise` (*value*)
`labscript_utils.properties.get` (*h5_file, device_name, location*)
`labscript_utils.properties.get_attribute` (*group, name*)
 Return the attribute of the given name from the given HDF5 group, deserialising it if it has been encoded as JSON
`labscript_utils.properties.get_attributes` (*group*)
 Return attributes of a HDF5 group as a dict, deserialising any that have been encoded as JSON
`labscript_utils.properties.is_json` (*value*)
`labscript_utils.properties.serialise` (*value*)
`labscript_utils.properties.set_attributes` (*group, attributes*)
 Add attributes to a HDF5 group, serialising them to JSON if they do not map to native HDF5 datatypes
`labscript_utils.properties.set_device_properties` (*h5_file, device_name, properties*)

1.1.8 labscript_utils.unitconversions

`labscript_utils.unitconversions.get_unit_conversion_class` (*fullname*)
 import and return the unit conversion class with the given name. Ideally this is a fully qualified class name with an absolute import path, i.e. `path.to.some.module.ClassName`. But if it is just a single name, we fall back to looking through all classes defined in submodules. This allows backward compatibility with old shot files that do not have the full name saved.

Basic Unit Conversion Classes

```

class labscript_utils.unitconversions.test.test (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion
    A_from_base (volts)
    A_to_base (amps)
    Gauss_from_base (volts)
    Gauss_to_base (gauss)
    base_unit = 'MHz'
    derived_units = ['A', 'Gauss']
  
```

```

class labscript_utils.unitconversions.example.example1 (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    A_from_base (volts)

    A_to_base (amps)

    Gauss_from_base (volts)

    Gauss_to_base (gauss)

    base_unit = 'V'

class labscript_utils.unitconversions.example.example2 (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    base_unit = 'MHz'

    detuned_MHz_from_base (mhz)

    detuned_MHz_to_base (d_mhz)

class labscript_utils.unitconversions.example.example3 (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    W_from_base (vpp)

    W_to_base (watts)

    base_unit = 'Vpp'

class labscript_utils.unitconversions.UnitConversionBase.UnitConversion (params)
    Bases: object

    unit_list = {'G': 1000000000.0, 'M': 1000000.0, 'T': 1000000000000.0, 'k': 1000.0, 'm

labscript_utils.unitconversions.UnitConversionBase.vectorise (method)

```

Unit Conversion Classes

```

class labscript_utils.unitconversions.aom.SineAom (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mAmpConversion

    AOM calibration P(A) is very close to a sine for dipole trap AOM!

    Power_from_base (amp)

    Power_to_base (power)

    base_unit = 'Arb'

    fraction_from_base (amp)

    fraction_to_base (fraction)

class labscript_utils.unitconversions.detuning.detuning (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    MHz_from_base (aom_frequency)

    MHz_to_base (aom_frequency_MHz)

    base_unit = 'Hz'

    d_MHz_from_base (aom_frequency)

```

```

    d_MHz_to_base (detuning_MHz)
    derived_units = ['MHz', 'd_MHz', 'linewidths']
    linewidths_from_base (aom_frequency)
    linewidths_to_base (linewidths)

class labscript_utils.unitconversions.linear_coil_driver.BidirectionalCoilDriver (calibration_pa)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    A_from_base (volts)
    A_to_base (amps)
    base_unit = 'V'
    derived_units = ['A']

class labscript_utils.unitconversions.linear_coil_driver.UnidirectionalCoilDriver (calibration_pa)
    Bases: labscript_utils.unitconversions.linear_coil_driver.BidirectionalCoilDriver

    A_from_base (volts)
    A_to_base (amps)

class labscript_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mAmpConversion (calibration_para)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    base_unit = 'Arb'
    hardware_from_base (arb)
    hardware_to_base (hardware)

class labscript_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mFreqConversion (calibration_pa)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    MHz_from_base (Hz)
    MHz_to_base (MHz)
    base_unit = 'Hz'

class labscript_utils.unitconversions.optotunelens.OptotuneLens (calibration_parameters=None)
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

    I_from_base (volts)
    I_to_base (current)
    base_unit = 'V'
    derived_units = ['distance', 'I']
    distance_from_base (volts)
    distance_to_base (percentage)

class labscript_utils.unitconversions.quad_driver.quad_driver (calibration_parameters={'A_min':
    - 0.09, 'A_offset':
    - 0.642724,
    'A_per_V':
    19.9757,
    'Gcm_per_A':
    1.88679})
    Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion

```

```

A_from_base (volts)
A_to_base (arg)
Gcm_from_base (volts)
Gcm_to_base (gauss_per_cm)
base_unit = 'V'
derived_units = ['A', 'Gcm']
class labscript_utils.unitconversions.quad_monitor.quad_monitor (calibration_parameters={'A_offset':
-
0.043200000000000016,
'A_per_V':
20.032,
'Gcm_per_A':
1.88679})
Bases: labscript_utils.unitconversions.UnitConversionBase.UnitConversion
A_from_base (volts)
A_to_base (amps)
Gcm_from_base (volts)
Gcm_to_base (gauss_per_cm)
base_unit = 'V'
derived_units = ['A', 'Gcm']

```

1.2 Communications

1.2.1 labscript_utils.h5_lock

```

class labscript_utils.h5_lock.File (name, mode=None, driver=None, libver=None, **kwds)
    _abc_impl = <_abc_data object>
    close ()
        Close the file. All open objects become invalid
labscript_utils.h5_lock.hack_locks_onto_h5py ()

```

1.2.2 labscript_utils.ls_zprocess

```

class labscript_utils.ls_zprocess.Context (io_threads=1, shared_secret=None)
    Subclass of zprocess.security.SecureContext configured with settings from labconfig, substitutable for a
    zmq.Context. Can be instantiated to get a unique context, or call the .instance() classmethod to possibly get
    an already-existing one. Only use the latter if you do not intend to terminate the context.
    classmethod instance ()
        Returns a shared instance with the same shared secret, if there is one, otherwise creates it. If an instance
        already exists, io_threads will be ignored, otherwise it will be used in the new instance. Takes into account
        subclasses such that a subclass calling this method will always get back an instance of its own class

```

socket (*args, **kwargs)

Create a Socket associated with this Context.

Parameters

- **socket_type** (*int*) – The socket type, which can be any of the OMQ socket types: REQ, REP, PUB, SUB, PAIR, DEALER, ROUTER, PULL, PUSH, etc.
- **kwargs** – will be passed to the `__init__` method of the socket class.

labscrip-utis.ls_zprocess.**Event** (*args, **kwargs)

labscrip-utis.ls_zprocess.**Handler** (*args, **kwargs)

labscrip-utis.ls_zprocess.**Lock** (*args, **kwargs)

class labscrip-utis.ls_zprocess.**ProcessTree** (*shared_secret=None, al-*
low_insecure=False, zlock_host=None,
zlock_port=7339, zlog_host=None,
zlog_port=7340)

A singleton zprocess.ProcessTree configured with settings from labconfig for security, zlock and zlog. Being a singleton is not enforced - the class can still be instantiated as normal - but calling the `.instance()` classmethod will give the singleton.

`_instance = <labscrip-utis.ls_zprocess.ProcessTree object>`

`classmethod instance ()`

labscrip-utis.ls_zprocess.**RemoteProcessClient** (*host, port=None*)

class labscrip-utis.ls_zprocess.**ZMQClient**

A singleton zprocess.ZMQClient configured with settings from labconfig for security. Being a singleton is not enforced - the class can still be instantiated as normal - but calling the `.instance()` classmethod will give the singleton.

`_instance = None`

`classmethod instance ()`

class labscrip-utis.ls_zprocess.**ZMQServer** (*port=None, dtype='pyobj', pull_only=False,*
bind_address='tcp://0.0.0.0', time-
*out_interval=None, **kwargs*)

A ZMQServer configured with security settings from labconfig

labscrip-utis.ls_zprocess.**connect_to_zlock_server** ()

labscrip-utis.ls_zprocess.**ensure_connected_to_zlog** ()

Ensure we are connected to a zlog server. If one is not running and we are the top-level process, start a zlog server configured according to LabConfig.

labscrip-utis.ls_zprocess.**get_config** ()

Get relevant options from LabConfig, substituting defaults where appropriate and return as a dict

labscrip-utis.ls_zprocess.**zmq_get** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_get_multipart** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_get_raw** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_get_string** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_push** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_push_multipart** (*args, **kwargs)

labscrip-utis.ls_zprocess.**zmq_push_raw** (*args, **kwargs)

```
labscript_utils.ls_zprocess.zmq_push_string(*args, **kwargs)
```

1.2.3 labscript_utils.remote

Script to run a zprocess.remote server configured according to LabConfig. Run with:

```
python -m labscript_utils.remote [--daemon] [--no-tui]
```

If `--daemon` is specified, the server will be started in the background. If `--no-tui` is specified, the server will run with ordinary terminal output instead of with the interactive text-based user interface (TUI).

```
labscript_utils.remote.main()
```

1.2.4 labscript_utils.shared_drive

```
labscript_utils.shared_drive.path_to_agnostic(path)
```

```
labscript_utils.shared_drive.path_to_local(path)
```

1.2.5 labscript_utils.zlock

Script to run a zlock server configured according to LabConfig. Run with:

```
python -m labscript_utils.zlock [--daemon]
```

If `--daemon` is specified, the zlock server will be started in the background.

```
labscript_utils.zlock.main()
```

1.2.6 labscript_utils.zlog

Script to run a zlog server configured according to LabConfig. Run with:

```
python -m labscript_utils.zlog [--daemon]
```

If `--daemon` is specified, the zlog server will be started in the background.

```
labscript_utils.zlog.main()
```

1.3 GUI

1.3.1 labscript_utils.splash

```
class labscript_utils.splash.Splash(imagepath)
```

```
    BG = '#ffffff'
```

```
    alpha = 0.875
```

```
    h = 230
```

```
    icon_frac = 0.65
```

```

imheight = 150
imwidth = 150
paintEvent (self, QPaintEvent)
show (self)
update_text (text)
w = 250

```

1.3.2 labscript_utils.qtwidgets

Helper Widgets

```

class labscript_utils.qtwidgets.dragdroptab.DragDropTabBar (parent, group_id)
    Bases: labscript_utils.qtwidgets.dragdroptab._BaseDragDropTabBar
    FLUSH_GAP = 5
    SCROLL_BUTTON_GAP = 2
    SCROLL_BUTTON_WIDTH = 15
    property drag_in_progress
    property dragged_tab_index
    property dragged_tab_parent
    ensure_visible (index, prefer_left=True)
    insertion_index_at (pos)
        Compute at which index the tab with given upper left corner position in global coordinates should be
        inserted into the tabBar.
    is_dragged_tab (index)
        Return whether the tab at the given index is currently being dragged
    limbo = None
    minimumSizeHint (self) → QSize
    mouseMoveEvent (event)
        Update the parent of the tab to be the DragDropTabWidget under the mouse, if any, otherwise update it to
        the limbo object. Update the position of the tab in the widget it's in.
    mousePressEvent (event)
        Take note of the tab that was clicked so it can be dragged on mouseMoveEvents
    mouseReleaseEvent (event)
        Same as mouseMove event - update the DragDropTabWidget and position of the tab to the current mouse
        position. Unless the mouse position is outside of any widgets at the time of mouse release, in which case
        move the tab to its last known parent and position.
    on_scroll_button_clicked (button)
    paintEvent (self, QPaintEvent)
    paint_tab (index, painter, option)
    setUsesScrollButtons (self, bool)

```


set_tab_parent (*dest, index=None, pos=None*)
 Move the tab to the given parent DragDropTabBar if it's not already there. *index=None* will determined the insertion index from the given mouse position.

sizeHint (*self*) → QSize

tabAt (*self, QPoint*) → int

tabInserted (*self, int*)

tabLayoutChange (*self*)

tabRect (*self, int*) → QRect

tabRemoved (*self, int*)

tab_widgets = {}

update (*self*)

update(*self, QRect*) update(*self, QRegion*) update(*self, int, int, int, int*)

update_dragged_tab_animation_pos (*pos*)

update_scroll_button_state ()

update_tab_index (*index, pos*)

Check if the tab at the given index, being dragged by the mouse at the given position, needs to be moved. Move it and return the new index.

widgetAt (*pos*)

If the given position is over a DragDropTabBar belonging to the current group, return the DragDropTabBar. If it is over a TabWidget in the same group that has no tabs, or the dragged tab as its only tab, return its DragDropTabBar. Otherwise return the limbo object.

class labscript_utils.qtwidgets.dragdroptab.DragDropTabWidget (*group_id=None, ac-cept_drops_bar_only=False*)

Bases: PyQt5.QtWidgets.QTabWidget

A tab widget that supports dragging and dropping of tabs between tab widgets that share a *group_id*. a *group_id* of None indicates that tab dragging is disabled.

setElideMode (*self, Qt.TextElideMode*)

setUsesScrollButtons (*self, bool*)

class labscript_utils.qtwidgets.dragdroptab.Tab (*widget, text, data, text_color, tooltip, whats_this, button_left, button_right, icon*)

Bases: tuple

property button_left

Alias for field number 6

property button_right

Alias for field number 7

property data

Alias for field number 2

property icon

Alias for field number 8

property text

Alias for field number 1

property text_color
Alias for field number 3

property tooltip
Alias for field number 4

property whats_this
Alias for field number 5

property widget
Alias for field number 0

class labscript_utils.qtwidgets.dragdroptab.**TabAnimation** (*parent*)
Bases: `PyQt5.QtCore.QAbstractAnimation`

animate_limbo (*limbo, index*)
If the floating tab in limbo is being sucked back into one of our tabs, then we can animate that by hiding the relevant tab rect off to the side somewhere whilst the floating tab swoops in.

duration (*self*) → `int`

ensure_running ()

on_tab_moved (*source_index, dest_index*)

tabInserted (*index*)

tabRemoved (*index*)

target (*i*)
Return the target position we are animating toward for a tab

tau = 60.0

updateCurrentTime (*self, int*)

class labscript_utils.qtwidgets.dragdroptab.**debug**
Bases: `object`

DEBUG = `False`

depth = 0

classmethod trace (*f*)
decorator to print function entries and exits

class labscript_utils.qtwidgets.elide_label.**ElideScrollArea** (**args, **kwargs*)
Bases: `PyQt5.QtWidgets.QScrollArea`

A ScrollArea for containing a label that we want to elide. The elision is attained by just letting the text we don't want to see be scrolled off to the side with the scrollbars hidden.

event (*self, QEvent*) → `bool`

minimumSizeHint (*self*) → `QSize`

setElideMode (*elideMode*)

setWidget (*self, QWidget*)

sizeHint (*self*) → `QSize`

class labscript_utils.qtwidgets.elide_label.**ElidedLabelContainer** (*label*)
Bases: `PyQt5.QtWidgets.QWidget`

A QWidget to contain a QLabel with a single line of (possibly rich) text that we want to elide. The elision is obtained by putting the QLabel in a QScrollArea and having the QScrollArea only show the part of the text we want to see. An extra label with the elision indication “...” is also inserted next to the QScrollArea.

```

elideMode ()
event (self, QEvent) → bool
minimumSizeHint (self) → QSize
setElideMode (elideMode)
sizeHint (self) → QSize
update_elide_widget ()

```

```
labscript_utils.qtwidgets.elide_label.elide_label (label, layout, elide_mode)
```

Take an existing label that is in a layout, and wrap it in our widgets that elide the text, and insert it back into the layout. This is a hack that allows us to elide a QLabel with a single line of (possibly rich) text, a task that seems pretty much impossible to do in any kosher way.

This function is for modifying an existing label already in a layout, but if you are programatically creating a label, then you can wrap it in `ElidedLabelContainer(label)` before inserting it into a layout or other container widget, which is more flexible than this function which only works if the label is in a `QBoxLayout`

```

class labscript_utils.qtwidgets.fingertab.FingerTabBarWidget (parent=None,
                                                         *args, **kwargs)

```

```
    Bases: PyQt5.QtWidgets.QTabBar
```

```
    paintEvent (self, QPaintEvent)
```

```
    tabSizeHint (self, int) → QSize
```

```

class labscript_utils.qtwidgets.fingertab.FingerTabWidget (parent, *args)

```

```
    Bases: PyQt5.QtWidgets.QTabWidget
```

A QTabWidget equivalent which uses our FingerTabBarWidget

```

class labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWithWidgets (mo

```

par

ent

```
    Bases: PyQt5.QtWidgets.QHeaderView
```

A QHeaderView that supports inserting arbitrary widgets into sections. Use `setWidget(logical_index, widget)` to set and `setWidget(logical_index, None)` to unset. Decorations, checkboxes or anything other than text in the headers containing widgets is unsupported, and may result in garbled output

```
    do_update_widget_positions ()
```

```
    eventFilter (target, event)
```

Ensure we don't leave the cursor set as a resize handle when the mouse moves onto a child widget:

```
    hideSection (self, int)
```

```
    on_columnsInserted (parent, logical_first, logical_last)
```

```
    on_columnsRemoved (parent, logical_first, logical_last)
```

```
    sectionSizeFromContents (self, int) → QSize
```

```
    setSectionHidden (self, int, bool)
```

```
    setStyleSheet (self, str)
```

```
    setWidget (logical_index, widget=None)
```

```
    showEvent (self, QShowEvent)
```

```
    showSection (self, int)
    stylesheet = '\n QHeaderView::section {\n /* Will be set dynamically: */\n padding-to
thinspace = '\u2009'
    update_indents ()
    update_widget_positions ()
    viewportEvent (self, QEvent) → bool
class labscript_utils.qtwidgets.InputPlotWindow.PlotWindow (*args, **kwargs)
    Bases: zprocess.process_tree.Process
    run (connection_name, hardware_name, device_name)
        The method that gets called in the subprocess. To be overridden by subclasses
    setTopLevelWindow ()
    update_plot (new_data)
class labscript_utils.qtwidgets.outputbox.OutputBox (container, scroll-
                                                back_lines=1000)
    Bases: qtutils.outputbox.OutputBox
    A subclass of qtutils.outputbox.OutputBox configured with security from labconfig.
class labscript_utils.qtwidgets.toolpalette.ToolPalette (parent, name, *args,
                                                **kwargs)
    Bases: PyQt5.QtWidgets.QScrollArea
    addWidget (widget, force_relayout=True)
    insertWidget (index, widget, force_relayout=True)
    minimumSize (self) → QSize
    minimumSizeHint (self) → QSize
    resizeEvent (self, QResizeEvent)
    sizeHint (self) → QSize
    updateMinimumSize ()
class labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup (*args, **kwargs)
    Bases: PyQt5.QtWidgets.QVBoxLayout
    add_to_linked_width_group (width_group_name, name)
    append_new_palette (name, *args, **kwargs)
    create_linked_width_group (width_group_name, names)
    get_index_from_name (name)
    get_name_from_index (index)
    get_palette (name)
    get_palette_by_index (index)
    has_palette (name)
    hide_palette (name)
    hide_palette_by_index (index)
    insert_new_palette (index, name, *args, **kwargs)
```

```

remove (name)
remove_by_index (index)
remove_from_linked_width_group (width_group_name, name)
reorder_palette (name, new_index)
reorder_palette_by_index (old_index, new_index)
show_palette (name)
show_palette_by_index (index)
property widths_linked

```

Input/Output Widgets

```

class labscript_utils.qtwidgets.analoginput.AnalogInput (device_name,
                                                         hardware_name,
                                                         connection_name='-',
                                                         display_name=None, horizontal_alignment=False,
                                                         parent=None)

```

Bases: `PyQt5.QtWidgets.QWidget`

```

get_AI ()
open_plot_window ()
set_AI (AI, notify_old_AI=True, notify_new_AI=True)
set_value (value)

```

```

class labscript_utils.qtwidgets.analogoutput.AnalogOutput (hardware_name,
                                                            connection_name='-',
                                                            display_name=None,
                                                            horizontal_alignment=False,
                                                            parent=None)

```

Bases: `PyQt5.QtWidgets.QWidget`

```

block_combobox_signals ()
block_spinbox_signals ()
connect_value_change (func)
disconnect_value_change ()
eventFilter (self, QObject, QEvent) → bool
get_AO ()
lock (notify_ao=True)
property selected_unit
set_AO (AO, notify_old_AO=True, notify_new_AO=True)
set_combobox_model (model)
set_limits (lower, upper)
set_num_decimals (decimals)

```

```

set_selected_unit (unit)
set_spinbox_value (value, unit)
set_step_size (step)
unblock_combobox_signals ()
unblock_spinbox_signals ()
unlock (notify_ao=True)

```

```

class labscript_utils.qtwidgets.analogoutput.NoStealFocusDoubleSpinBox (*args,
                                                                    **kwargs)

```

Bases: `PyQt5.QtWidgets.QDoubleSpinBox`

A QDoubleSpinBox that doesn't steal focus as you scroll over it with a mouse wheel.

```

focusInEvent (self, QFocusEvent)
focusOutEvent (self, QFocusEvent)
wheelEvent (self, QWheelEvent)

```

```

class labscript_utils.qtwidgets.ddsoutput.DDSOutput (hardware_name,
                                                    connection_name='-', parent=None)

```

Bases: `PyQt5.QtWidgets.QWidget`

```

get_sub_widget (subchnl)
hide_sub_widget (subchnl)
show_sub_widget (subchnl)

```

```

class labscript_utils.qtwidgets.digitaloutput.DigitalOutput (*args, **kwargs)

```

Bases: `PyQt5.QtWidgets.QPushButton`

```

eventFilter (self, QObject, QEvent) → bool
get_DO ()
lock (notify_do=True)
set_DO (DO, notify_old_DO=True, notify_new_DO=True)
property state
unlock (notify_do=True)

```

```

class labscript_utils.qtwidgets.digitaloutput.InvertedDigitalOutput (*args,
                                                                    **kwargs)

```

Bases: `labscript_utils.qtwidgets.digitaloutput.DigitalOutput`

```

property state

```

```

class labscript_utils.qtwidgets.enumoutput.EnumOutput (hardware_name,
                                                    connection_name='-', display_name=None,
                                                    horizontal_alignment=False,
                                                    parent=None)

```

Bases: `PyQt5.QtWidgets.QWidget`

```

block_combobox_signals ()
connect_value_change (func)
disconnect_value_change ()

```

```

eventFilter (self, QObject, QEvent) → bool
get_EO ()
lock (notify_eo=True)
property selected_index
property selected_option
set_EO (EO, notify_old_EO=True, notify_new_EO=True)
set_combobox_model (model)
unlock_combobox_signals ()
unlock (notify_eo=True)

class labscript_utils.qtwidgets.imageoutput.BrowseButton (image_output, *args,
**kwargs)
    Bases: PyQt5.QtWidgets.QPushButton
    browse ()
    eventFilter (self, QObject, QEvent) → bool

class labscript_utils.qtwidgets.imageoutput.ImageOutput (name, width, height, *args,
**kwargs)
    Bases: PyQt5.QtWidgets.QWidget
    eventFilter (self, QObject, QEvent) → bool
    get_Image ()
    imageUpdated
    lock (notify_Image=True)
    set_Image (Image, notify_old_Image=True, notify_new_Image=True)
    unlock (notify_Image=True)
    property value

class labscript_utils.qtwidgets.imageoutput.ImageView (*args, **kwargs)
    Bases: PyQt5.QtWidgets.QGraphicsView
    contextMenuEvent (self, QContextMenuEvent)

```

1.4 Logging and Profiling

1.4.1 labscript_utils.impprof

```

class labscript_utils.impprof._ProfilingImporter

    disable ()
    enable (threshold=0.1)
    profiling_import (name, *args, **kwargs)

labscript_utils.impprof.disable ()
labscript_utils.impprof.enable (threshold=0.1)

```

1.4.2 labscript_utils.memprof

class labscript_utils.memprof.**MemoryProfiler**

Class to count number instances of each type in the interpreter in order to detect Python memory leaks

check ()

count_types ()

start (filepath='memprof.txt')

write_to_file (types)

labscript_utils.memprof.**check** ()

labscript_utils.memprof.**start** (filepath='memprof.txt')

1.4.3 labscript_utils.setup_logging

class labscript_utils.setup_logging.**LessThanFilter** (less_than)

filter (record)

Determine if the specified record is to be logged.

Is the specified record to be logged? Returns 0 for no, nonzero for yes. If deemed appropriate, the record may be modified in-place.

labscript_utils.setup_logging.**setup_logging** (program_name, log_level=10, terminal_level=20, maxBytes=52428800, backupCount=1)

1.4.4 labscript_utils.tracelog

labscript_utils.tracelog.**log** (log_path=None, module_names=, sub=False, all=False, mode='w')

Trace and log Python execution.

output includes the time, thread name, containing function name, line number and source line. Indentation before the thread name represents stack depth, indentation before source line is as in the source line itself.

log_path: the path of the desired output file to write to, or None for stdout (default=None) module_names: list of module names that tracing is desired for (default=()) sub: whether submodules of the above modules should be traced (default=False) all: whether all modules should be traced, in which case module_names is ignored (default=False) mode: mode to open the output file in, if log_path is not None (default='w')

1.5 Module and File Tools

1.5.1 labscript_utils.double_import_denier

class labscript_utils.double_import_denier.**DoubleImportDenier**

A module finder that tracks what's been imported and disallows multiple imports of the same module under different names, raising an exception upon detecting that this has occurred

_format_tb (tb)

Take a formatted traceback as returned by traceback.format_stack() and remove lines that are solely about us and the Python machinery, leaving only lines pertaining to the user's code

`_raise_error` (*path, name, tb, other_name, other_tb*)

`_restore_tracebacklimit_after_exception` ()

Record the current value of `sys.tracebacklimit`, if any, and set a temporary `sys.excepthook` to restore it to that value (or delete it) after the next exception.

`find_spec` (*fullname, path=None, target=None*)

`labscript_utils.double_import_denier.disable` ()

`labscript_utils.double_import_denier.enable` ()

1.5.2 labscript_utils.filewatcher

class `labscript_utils.filewatcher.FileWatcher` (*callback, files=None, folders=None, clean_modified_info=None, hashable_types=None, interval=1, **kwargs*)

`_modified_info_of_file` (*name*)

`add_file` (*path*)

`add_files` (*files, clean_modified_info=None*)

`add_folder` (*folder*)

`add_folders` (*folders, clean_modified_info=None*)

`check` (*trigger_callback=True*)

`get_clean_modified_info` ()

`get_modified_info` ()

`get_modified_times` ()

`mainloop` ()

`stop` ()

`update_files` (*folders=None, trigger_callback=True, recursive=True*)

Refresh the watchlist of files (`FileWatcher.files`) by checking the `folders` kwarg or `Filewatcher.folders` if this is not specified.

1.5.3 labscript_utils.modulewatcher

class `labscript_utils.modulewatcher.ModuleWatcher` (*debug=False*)

A watcher that reloads modules that have been modified on disk

Only reloads modules imported after instantiation. Does not reload C extensions.

Parameters `debug` (*bool, optional*) – When `True`, prints debugging information when reloading modules.

`check` ()

`mainloop` ()

`unload` ()

1.5.4 labscript_utils.versions

exception `labscript_utils.versions.BrokenInstall`

class `labscript_utils.versions.NoVersionInfo`

class `labscript_utils.versions.NotFound`

exception `labscript_utils.versions.VersionException`

`labscript_utils.versions._get_literal_version(filename)`

Tokenize a source file and return any `__version__ = <version>` literal defined in it.

Parameters `filename (str)` – The path to the file to tokenize.

Returns Any version literal found matching the above criteria, or None.

`labscript_utils.versions._get_metadata_version(project_name, import_path)`

Gets the package metadata version.

Parameters

- **project_name (str)** – The package name (e.g. the name used when pip installing the package).
- **import_path (str)** – The path to the folder containing the installed package.

Raises `BrokenInstall` – Raised if the package installation is corrupted (multiple packages matching the given arguments were found). May occur if (un)installation for a particular package version only partially completed.

Returns The metadata version for a package with the given project name located at the given import path, or None if there is no such package.

`labscript_utils.versions.check_version(module_name, at_least, less_than, version=None, project_name=None)`

Checks if a module version is within specified bounds.

Checks that the version of the given module is at least and less than the given version strings. This function uses `get_version()` to determine version numbers without importing modules. In order to do this, `project_name` must be provided if it differs from `module_name`. For example, `pyserial` is imported as `'serial'`, but the project name, as passed to a `'pip install'` command, is `'pyserial'`. Therefore to check the version of `pyserial`, pass in `module_name='serial'` and `project_name='pyserial'`. You can also pass in a version string yourself, in which case no inspection of packages will take place.

Parameters

- **module_name (str)** – The name of the module to check.
- **at_least (str)** – The minimum acceptable module version.
- **less_than (str)** – The minimum unacceptable module version. Usually this would be the next major version if the package follows `semver`.
- **version (str, optional)** – The current version of the installed package. Useful when the package version is stored in a non-standard location.
- **project_name (str, optional)** – The package name (e.g. the name used when pip installing the package). This must be specified if it does not match the module name.

Raises `VersionException` – if the module was not found or its version could not be determined.

`labscript_utils.versions.get_import_path(import_name)`

Get which entry in `sys.path` a module would be imported from, without importing it.

Parameters `import_name (str)` – The module name.

Raises

- **ModuleNotFoundError** – Raised if the module is not installed.
- **NotImplementedError** – Raised if the module is a “namespace package”. Support for namespace packages is not currently available.

Returns The path to the folder containing the module.

Return type `str`

```
labscript_utils.versions.get_version(import_name, project_name=None, im-
                                  port_path=None)
```

Try very hard to get the version of a package without importing it.

If `import_path` is not given, first find where it would be imported from, without importing it. Then look for metadata in the same import path with the given project name (note: this is not always the same as the import name, it is the name for example you would ask pip to install). If that is found, return the version info from it. Otherwise look for a `__version__.py` file in the package directory, or a `__version__ = <version>` literal defined in the package source (without executing it).

Parameters

- **import_name** (`str`) – The module name.
- **project_name** (`str`, *optional*) – The package name (e.g. the name used when pip installing the package). This must be specified if it does not match the module name.
- **import_path** (`str`, *optional*) – The path to the folder containing the installed package.

Raises **NotImplementedError** – Raised if the module name contains a period. Only top-level packages are supported at this time.

Returns The version literal of the package. If the package cannot be found, `NotFound` is returned. If the version cannot be obtained in the above way, or if the version was found but was `None`, `NoVersionInfo` is returned.

LABSCRIPT SUITE COMPONENTS

The *labscript suite* is modular by design, and is comprised of:

Table 1: Python libraries

	labscript — Expressive composition of hardware-timed experiments
	labscript-devices — Plugin architecture for controlling experiment hardware
	labscript-utils — Shared modules used by the <i>labscript suite</i>

Table 2: Graphical applications

	runmanager — Graphical and remote interface to parameterized experiments
	blacs — Graphical interface to scientific instruments and experiment supervision
	lyse — Online analysis of live experiment data
	runviewer — Visualize hardware-timed experiment instructions

PYTHON MODULE INDEX

|

- labscript_utils, 3
- labscript_utils.connections, 3
- labscript_utils.dict_diff, 4
- labscript_utils.double_import_denier, 20
- labscript_utils.filewatcher, 21
- labscript_utils.h5_lock, 9
- labscript_utils.impprof, 19
- labscript_utils.labconfig, 4
- labscript_utils.ls_zprocess, 9
- labscript_utils.memprof, 20
- labscript_utils.modulewatcher, 21
- labscript_utils.properties, 6
- labscript_utils.qtwidgets, 12
- labscript_utils.qtwidgets.analoginput, 17
- labscript_utils.qtwidgets.analogoutput, 17
- labscript_utils.qtwidgets.ddsoutput, 18
- labscript_utils.qtwidgets.digitaloutput, 18
- labscript_utils.qtwidgets.dragdroptab, 12
- labscript_utils.qtwidgets.elide_label, 14
- labscript_utils.qtwidgets.enumoutput, 18
- labscript_utils.qtwidgets.fingertab, 15
- labscript_utils.qtwidgets.headerview_with_widgets, 15
- labscript_utils.qtwidgets.imageoutput, 19
- labscript_utils.qtwidgets.InputPlotWindow, 16
- labscript_utils.qtwidgets.outputbox, 16
- labscript_utils.qtwidgets.toolpalette, 16
- labscript_utils.remote, 11
- labscript_utils.settings, 5
- labscript_utils.setup_logging, 20
- labscript_utils.shared_drive, 11
- labscript_utils.splash, 11
- labscript_utils.testing_utils, 5
- labscript_utils.tracelog, 20
- labscript_utils.unitconversions, 6
- labscript_utils.unitconversions.aom, 7
- labscript_utils.unitconversions.detuning, 7
- labscript_utils.unitconversions.example, 6
- labscript_utils.unitconversions.linear_coil_driver, 8
- labscript_utils.unitconversions.NovaTechDDS9m, 8
- labscript_utils.unitconversions.optotunelens, 8
- labscript_utils.unitconversions.quad_driver, 8
- labscript_utils.unitconversions.quad_monitor, 9
- labscript_utils.unitconversions.test, 6
- labscript_utils.unitconversions.UnitConversionBase, 7
- labscript_utils.versions, 22
- labscript_utils.zlock, 11
- labscript_utils.zlog, 11

INDEX

Symbols

- `_ProfilingImporter` (class in `labscript_utils.impprof`), 19
 - `_abc_impl` (`labscript_utils.h5_lock.File` attribute), 9
 - `_abc_impl` (`labscript_utils.labconfig.LabConfig` attribute), 4
 - `_check_dicts()` (in module `labscript_utils.properties`), 6
 - `_decode_bytestrings()` (in module `labscript_utils.properties`), 6
 - `_default()` (in module `labscript_utils.properties`), 6
 - `_defaults` (`labscript_utils.connections.Connection` attribute), 3
 - `_deserialise()` (`labscript_utils.connections.Connection` method), 3
 - `_encode_bytestrings()` (in module `labscript_utils.properties`), 6
 - `_ensure_str()` (in module `labscript_utils.connections`), 4
 - `_format_tb()` (`labscript_utils.double_import_denier.DoubleImportDenier` method), 20
 - `_get_con_table_properties()` (in module `labscript_utils.properties`), 6
 - `_get_device_properties()` (in module `labscript_utils.properties`), 6
 - `_get_literal_version()` (in module `labscript_utils.versions`), 22
 - `_get_metadata_version()` (in module `labscript_utils.versions`), 22
 - `_get_unit_conversion_parameters()` (in module `labscript_utils.properties`), 6
 - `_instance` (`labscript_utils.ls_zprocess.ProcessTree` attribute), 10
 - `_instance` (`labscript_utils.ls_zprocess.ZMQClient` attribute), 10
 - `_mainloop()` (`labscript_utils.testing_utils.ThreadTestCase` method), 5
 - `_modified_info_of_file()` (`labscript_utils.filewatcher.FileWatcher` method), 21
 - `_populate_relatives()` (`labscript_utils.connections.Connection` method), 3
 - `_raise_error()` (`labscript_utils.double_import_denier.DoubleImportDenier` method), 21
 - `_restore_tracebacklimit_after_exception()` (`labscript_utils.double_import_denier.DoubleImportDenier` method), 21
 - `_run()` (`labscript_utils.testing_utils.ThreadTestCase` method), 5
- ### A
- `A_from_base()` (`labscript_utils.unitconversions.example.example1` method), 7
 - `A_from_base()` (`labscript_utils.unitconversions.linear_coil_driver.BidirectionalCoilDriver` method), 8
 - `A_from_base()` (`labscript_utils.unitconversions.linear_coil_driver.UnidirectionalCoilDriver` method), 8
 - `A_from_base()` (`labscript_utils.unitconversions.quad_driver.quad_driver` method), 8
 - `A_from_base()` (`labscript_utils.unitconversions.quad_monitor.quad_monitor` method), 9
 - `A_from_base()` (`labscript_utils.unitconversions.test.test` method), 6
 - `A_to_base()` (`labscript_utils.unitconversions.example.example1` method), 7
 - `A_to_base()` (`labscript_utils.unitconversions.linear_coil_driver.BidirectionalCoilDriver` method), 8
 - `A_to_base()` (`labscript_utils.unitconversions.linear_coil_driver.UnidirectionalCoilDriver` method), 8
 - `A_to_base()` (`labscript_utils.unitconversions.quad_driver.quad_driver` method), 9
 - `A_to_base()` (`labscript_utils.unitconversions.quad_monitor.quad_monitor` method), 9
 - `A_to_base()` (`labscript_utils.unitconversions.test.test` method), 6

method), 6

add_file() (labscript_utils.filewatcher.FileWatcher method), 21

add_files() (labscript_utils.filewatcher.FileWatcher method), 21

add_folder() (labscript_utils.filewatcher.FileWatcher method), 21

add_folders() (labscript_utils.filewatcher.FileWatcher method), 21

add_settings_interface() (labscript_utils.settings.Settings method), 5

add_to_linked_width_group() (labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

addWidget() (labscript_utils.qtwidgets.toolpalette.ToolPalette method), 16

alpha (labscript_utils.splash.Splash attribute), 11

AnalogInput (class in labscript_utils.qtwidgets.analoginput), 17

AnalogOutput (class in labscript_utils.qtwidgets.analogoutput), 17

animate_limbo() (labscript_utils.qtwidgets.dragdroptab.TabAnimation method), 14

Any (class in labscript_utils.testing_utils), 5

append_new_palette() (labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

assert_superset() (labscript_utils.connections.ConnectionTable method), 3

base_unit (labscript_utils.unitconversions.quad_driver.quad_driver attribute), 9

base_unit (labscript_utils.unitconversions.quad_monitor.quad_monitor attribute), 9

base_unit (labscript_utils.unitconversions.test.test_attribute), 6

before_get() (labscript_utils.labconfig.EnvInterpolation method), 4

BG (labscript_utils.splash.Splash attribute), 11

BidirectionalCoilDriver (class in labscript_utils.unitconversions.linear_coil_driver), 8

block_combobox_signals() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 17

block_combobox_signals() (labscript_utils.qtwidgets.enumoutput.EnumOutput method), 18

block_spinbox_signals() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 17

BrokenInstall, 22

browse() (labscript_utils.qtwidgets.imageoutput.BrowseButton method), 19

BrowseButton (class in labscript_utils.qtwidgets.imageoutput), 19

button_left() (labscript_utils.qtwidgets.dragdroptab.Tab property), 13

button_right() (labscript_utils.qtwidgets.dragdroptab.Tab property), 13

B

base_unit (labscript_utils.unitconversions.aom.SineAom attribute), 7

base_unit (labscript_utils.unitconversions.detuning.detuning attribute), 7

base_unit (labscript_utils.unitconversions.example.example1 attribute), 7

base_unit (labscript_utils.unitconversions.example.example2 attribute), 7

base_unit (labscript_utils.unitconversions.example.example3 attribute), 7

base_unit (labscript_utils.unitconversions.linear_coil_driver.BidirectionalCoilDriver attribute), 8

base_unit (labscript_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9m connection attribute), 8

base_unit (labscript_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mFreqConversion attribute), 8

base_unit (labscript_utils.unitconversions.optotunelens.OptotuneLens attribute), 8

C

check() (in module labscript_utils.memprof), 20

check() (labscript_utils.filewatcher.FileWatcher method), 21

check() (labscript_utils.memprof.MemoryProfiler method), 20

check() (labscript_utils.modulewatcher.ModuleWatcher method), 21

check_version() (in module labscript_utils.versions), 22

close() (labscript_utils.h5_lock.File method), 9

compare_to() (labscript_utils.settings.Settings method), 5

compare_to() (labscript_utils.connections.Connection method), 3

connect_to_zlock_server() (in module labscript_utils.ls_zprocess), 10

connect_value_change () (lab-script_utils.qtwidgets.analogoutput.AnalogOutput derived_units (lab-script_utils.unitconversions.test.test attribute), 9 method), 17

connect_value_change () (lab-script_utils.qtwidgets.enumoutput.EnumOutput 6 method), 18

Connection (class in labscript_utils.connections), 3

ConnectionTable (class in lab-script_utils.connections), 3

Context (class in labscript_utils.ls_zprocess), 9

contextMenuEvent () (lab-script_utils.qtwidgets.imageoutput.ImageView method), 19

count_types () (lab-script_utils.memprof.MemoryProfiler method), 20

create_dialog () (labscript_utils.settings.Settings method), 5

create_linked_width_group () (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

D

d_MHz_from_base () (lab-script_utils.unitconversions.detuning.detuning method), 7

d_MHz_to_base () (lab-script_utils.unitconversions.detuning.detuning method), 7

data () (labscript_utils.qtwidgets.dragdroptab.Tab property), 13

DDSOutput (class in lab-script_utils.qtwidgets.ddsoutput), 18

debug (class in labscript_utils.qtwidgets.dragdroptab), 14

DEBUG (labscript_utils.qtwidgets.dragdroptab.debug attribute), 14

dedent () (in module labscript_utils), 3

depth (labscript_utils.qtwidgets.dragdroptab.debug attribute), 14

derived_units (lab-script_utils.unitconversions.detuning.detuning attribute), 8

derived_units (lab-script_utils.unitconversions.linear_coil_driver.BidirectionalDriver attribute), 8

derived_units (lab-script_utils.unitconversions.optotunelens.OptotuneLens attribute), 8

derived_units (lab-script_utils.unitconversions.quad_driver.quad_driver attribute), 9

derived_units (lab-script_utils.unitconversions.quad_monitor.quad_monitor attribute), 9

deserialise () (in module lab-script_utils.properties), 6

detuned_MHz_from_base () (lab-script_utils.unitconversions.example.example2 method), 7

detuned_MHz_to_base () (lab-script_utils.unitconversions.example.example2 method), 7

detuning (class in lab-script_utils.unitconversions.detuning), 7

dict_diff () (in module labscript_utils.dict_diff), 4

diff () (labscript_utils.connections.Connection method), 3

DigitalOutput (class in lab-script_utils.qtwidgets.digitaloutput), 18

disable () (in module lab-script_utils.double_import_denier), 21

disable () (in module labscript_utils.impprof), 19

disable () (labscript_utils.impprof._ProfilingImporter method), 19

disconnect_value_change () (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 17

disconnect_value_change () (lab-script_utils.qtwidgets.enumoutput.EnumOutput method), 18

distance_from_base () (lab-script_utils.unitconversions.optotunelens.OptotuneLens method), 8

distance_to_base () (lab-script_utils.unitconversions.optotunelens.OptotuneLens method), 8

do_update_widget_positions () (lab-script_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

dotdict (class in labscript_utils.testing_utils), 5

DoubleImportDenier (class in lab-script_utils.double_import_denier), 20

drag_in_progress () (lab-script_utils.qtwidgets.dragdroptab.DragDropTabBar method), 12

DragDropTabBar (class in lab-script_utils.qtwidgets.dragdroptab), 12

DragDropTabWidget (class in lab-script_utils.qtwidgets.dragdroptab), 13

dragged_tab_index () (lab-script_utils.qtwidgets.dragdroptab.DragDropTabBar property), 12

dragged_tab_parent () (lab-script_utils.qtwidgets.dragdroptab.DragDropTabBar method), 12

property), 12
 duration() (labscript_utils.qtwidgets.dragdroptab.TabAnimation script_utils.unitconversions.example), 6
 method), 14

E

elide_label() (in module lab- script_utils.qtwidgets.elide_label), 15
 ElidedLabelContainer (class in lab- script_utils.qtwidgets.elide_label), 14
 elideMode() (labscript_utils.qtwidgets.elide_label.ElidedLabelContainer method), 15
 ElideScrollArea (class in lab- script_utils.qtwidgets.elide_label), 14
 enable() (in module lab- script_utils.double_import_denier), 21
 enable() (in module labscript_utils.impprof), 19
 enable() (labscript_utils.impprof._ProfilingImporter method), 19
 ensure_connected_to_zlog() (in module lab- script_utils.ls_zprocess), 10
 ensure_running() (lab- script_utils.qtwidgets.dragdroptab.TabAnimation method), 14
 ensure_visible() (lab- script_utils.qtwidgets.dragdroptab.DragDropTabBar method), 12
 EnumOutput (class in lab- script_utils.qtwidgets.enumoutput), 18
 EnvInterpolation (class in lab- script_utils.labconfig), 4
 Event() (in module labscript_utils.ls_zprocess), 10
 event() (labscript_utils.qtwidgets.elide_label.ElidedLabelContainer method), 15
 event() (labscript_utils.qtwidgets.elide_label.ElideScrollArea method), 14
 eventFilter() (lab- script_utils.qtwidgets.analogoutput.AnalogOutput method), 17
 eventFilter() (lab- script_utils.qtwidgets.digitaloutput.DigitalOutput method), 18
 eventFilter() (lab- script_utils.qtwidgets.enumoutput.EnumOutput method), 18
 eventFilter() (lab- script_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWithWidgets method), 15
 eventFilter() (lab- script_utils.qtwidgets.imageoutput.BrowseButton method), 19
 eventFilter() (lab- script_utils.qtwidgets.imageoutput.ImageOutput method), 19

example1 (class in lab- script_utils.unitconversions.example), 6
 example2 (class in lab- script_utils.unitconversions.example), 7
 example3 (class in lab- script_utils.unitconversions.example), 7

F

File (class in labscript_utils.h5_lock), 9
 FileWatcher (class in labscript_utils.filewatcher), 21
 filter() (labscript_utils.setup_logging.LessThanFilter method), 20
 find_by_name() (lab- script_utils.connections.Connection method), 3
 find_by_name() (lab- script_utils.connections.ConnectionTable method), 4
 find_child() (lab- script_utils.connections.Connection method), 3
 find_child() (lab- script_utils.connections.ConnectionTable method), 4
 find_spec() (labscript_utils.double_import_denier.DoubleImportDenier method), 21
 FingerTabBarWidget (class in lab- script_utils.qtwidgets.fingertab), 15
 FingerTabWidget (class in lab- script_utils.qtwidgets.fingertab), 15
 FLUSH_GAP (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar attribute), 12
 focusInEvent() (lab- script_utils.qtwidgets.analogoutput.NoStealFocusDoubleSpinBox method), 18
 focusOutEvent() (lab- script_utils.qtwidgets.analogoutput.NoStealFocusDoubleSpinBox method), 18
 fraction_from_base() (lab- script_utils.unitconversions.aom.SineAom method), 7
 fraction_to_base() (lab- script_utils.unitconversions.aom.SineAom method), 7
 GaussianHeaderViewWithWidgets (class in lab- script_utils.qtwidgets.gaussianheaderwidget.gaussianheaderwidget), 15
 Gauss_from_base() (lab- script_utils.unitconversions.example.example1 method), 7
 Gauss_from_base() (lab- script_utils.unitconversions.test.test method), 6
 Gauss_to_base() (lab- script_utils.unitconversions.example.example1 method), 7

method), 7

Gauss_to_base() (lab-script_utils.unitconversions.test.test method), 6

Gcm_from_base() (lab-script_utils.unitconversions.quad_driver.quad_driver method), 9

Gcm_from_base() (lab-script_utils.unitconversions.quad_monitor.quad_monitor method), 9

Gcm_to_base() (lab-script_utils.unitconversions.quad_driver.quad_driver method), 9

Gcm_to_base() (lab-script_utils.unitconversions.quad_monitor.quad_monitor method), 9

get() (in module labscript_utils.properties), 6

get_AI() (labscript_utils.qtwidgets.analoginput.AnalogInput method), 17

get_AO() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 17

get_attached_devices() (lab-script_utils.connections.ConnectionTable method), 4

get_attribute() (in module lab-script_utils.properties), 6

get_attributes() (in module lab-script_utils.properties), 6

get_clean_modified_info() (lab-script_utils.filewatcher.FileWatcher method), 21

get_config() (in module lab-script_utils.ls_zprocess), 10

get_DO() (labscript_utils.qtwidgets.digitaloutput.DigitalOutput method), 18

get_EO() (labscript_utils.qtwidgets.enumoutput.EnumOutput method), 19

get_Image() (labscript_utils.qtwidgets.imageoutput.ImageOutput method), 19

get_import_path() (in module lab-script_utils.versions), 22

get_index_from_name() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

get_modified_info() (lab-script_utils.filewatcher.FileWatcher method), 21

get_modified_times() (lab-script_utils.filewatcher.FileWatcher method), 21

get_name_from_index() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

get_palette() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

get_palette_by_index() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

get_sub_widget() (lab-script_utils.qtwidgets.ddsoutput.DDSOutput method), 18

get_unit_conversion_class() (in module lab-script_utils.unitconversions), 6

get_value() (labscript_utils.settings.Settings method), 5

get_version() (in module labscript_utils.versions), 23

H

h (labscript_utils.splash.Splash attribute), 11

hack_locks_onto_h5py() (in module lab-script_utils.h5_lock), 9

Handler() (in module labscript_utils.ls_zprocess), 10

hardware_from_base() (lab-script_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mA method), 8

hardware_to_base() (lab-script_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mA method), 8

has_palette() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

hide_palette() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

hide_palette_by_index() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 16

hide_sub_widget() (lab-script_utils.qtwidgets.ddsoutput.DDSOutput method), 18

hideSection() (lab-script_utils.qtwidgets.headerview_with_widgets.HorizontalHeader method), 15

HeaderViewWithWidgets (class in lab-script_utils.qtwidgets.headerview_with_widgets), 15

I

I_from_base() (lab-script_utils.unitconversions.optotunelens.OptotuneLens method), 8

I_to_base() (labscript_utils.unitconversions.optotunelens.OptotuneLens method), 8

icon() (labscript_utils.qtwidgets.dragdroptab.Tab property), 13

icon_frac (*labscript_utils.splash.Splash* attribute), 11
 ImageOutput (class in *labscript_utils.qtwidgets.imageoutput*), 19
 imageUpdated (*labscript_utils.qtwidgets.imageoutput.ImageOutput* attribute), 19
 ImageView (class in *labscript_utils.qtwidgets.imageoutput*), 19
 imheight (*labscript_utils.splash.Splash* attribute), 11
 import_or_reload() (in module *labscript_utils*), 3
 imwidth (*labscript_utils.splash.Splash* attribute), 12
 insert_new_palette() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 16
 insertion_index_at() (*labscript_utils.qtwidgets.dragdroptab.DragDropTabBar* method), 12
 insertWidget() (*labscript_utils.qtwidgets.toolpalette.ToolPalette* method), 16
 instance() (*labscript_utils.ls_zprocess.Context* class method), 9
 instance() (*labscript_utils.ls_zprocess.ProcessTree* class method), 10
 instance() (*labscript_utils.ls_zprocess.ZMQClient* class method), 10
 InvertedDigitalOutput (class in *labscript_utils.qtwidgets.digitaloutput*), 18
 is_dragged_tab() (*labscript_utils.qtwidgets.dragdroptab.DragDropTabBar* method), 12
 is_json() (in module *labscript_utils.properties*), 6

L

LabConfig (class in *labscript_utils.labconfig*), 4
 LabConfig.NoOptionError, 4
 LabConfig.NoSectionError, 4
 labscript_utils
 module, 3
 labscript_utils.connections
 module, 3
 labscript_utils.dict_diff
 module, 4
 labscript_utils.double_import_denier
 module, 20
 labscript_utils.filewatcher
 module, 21
 labscript_utils.h5_lock
 module, 9
 labscript_utils.impprof
 module, 19
 labscript_utils.labconfig
 module, 4
 labscript_utils.ls_zprocess
 module, 9
 labscript_utils.memprof
 module, 20
 labscript_utils.modulewatcher
 module, 21
 labscript_utils.properties
 module, 6
 labscript_utils.qtwidgets
 module, 12
 labscript_utils.qtwidgets.analoginput
 module, 17
 labscript_utils.qtwidgets.analogoutput
 module, 17
 labscript_utils.qtwidgets.ddsoutput
 module, 18
 labscript_utils.qtwidgets.digitaloutput
 module, 18
 labscript_utils.qtwidgets.dragdroptab
 module, 12
 labscript_utils.qtwidgets.elide_label
 module, 14
 labscript_utils.qtwidgets.enumoutput
 module, 18
 labscript_utils.qtwidgets.fingertab
 module, 15
 labscript_utils.qtwidgets.headerview_with_widgets
 module, 15
 labscript_utils.qtwidgets.imageoutput
 module, 19
 labscript_utils.qtwidgets.InputPlotWindow
 module, 16
 labscript_utils.qtwidgets.outputbox
 module, 16
 labscript_utils.qtwidgets.toolpalette
 module, 16
 labscript_utils.remote
 module, 11
 labscript_utils.settings
 module, 5
 labscript_utils.setup_logging
 module, 20
 labscript_utils.shared_drive
 module, 11
 labscript_utils.splash
 module, 11
 labscript_utils.testing_utils
 module, 5
 labscript_utils.tracelog
 module, 20
 labscript_utils.unitconversions
 module, 6
 labscript_utils.unitconversions.aom
 module, 7
 labscript_utils.unitconversions.detuning

module, 7
 labscript_utils.unitconversions.example
 module, 6
 labscript_utils.unitconversions.linear_coil_driver
 module, 8
 labscript_utils.unitconversions.NovaTechDDS9m
 module, 8
 labscript_utils.unitconversions.optotuneMHzsfrom_base()
 module, 8
 labscript_utils.unitconversions.quad_driver
 module, 8
 labscript_utils.unitconversions.quad_monitor
 module, 9
 labscript_utils.unitconversions.test
 module, 6
 labscript_utils.unitconversions.UnitConversionBase
 module, 7
 labscript_utils.versions
 module, 22
 labscript_utils.zlock
 module, 11
 labscript_utils.zlog
 module, 11
 LessThanFilter (class in lab-
 script_utils.setup_logging), 20
 limbo (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar
 attribute), 12
 linewidths_from_base() (lab-
 script_utils.unitconversions.detuning.detuning
 method), 8
 linewidths_to_base() (lab-
 script_utils.unitconversions.detuning.detuning
 method), 8
 load() (labscript_utils.settings.Settings method), 5
 load_appconfig() (in module lab-
 script_utils.labconfig), 4
 Lock() (in module labscript_utils.ls_zprocess), 10
 lock() (labscript_utils.qtwidgets.analogoutput.AnalogOutput
 method), 17
 lock() (labscript_utils.qtwidgets.digitaloutput.DigitalOutput
 method), 18
 lock() (labscript_utils.qtwidgets.enumoutput.EnumOutput
 method), 19
 lock() (labscript_utils.qtwidgets.imageoutput.ImageOutput
 method), 19
 log() (in module labscript_utils.tracelog), 20
M
 main() (in module labscript_utils.remote), 11
 main() (in module labscript_utils.zlock), 11
 main() (in module labscript_utils.zlog), 11
 mainloop() (labscript_utils.filewatcher.FileWatcher
 method), 21
 mainloop() (labscript_utils.modulewatcher.ModuleWatcher
 method), 21
 MemoryProfiler (class in labscript_utils.memprof),
 20
 MHzsfrom_base() (lab-
 script_utils.unitconversions.detuning.detuning
 method), 7
 MHzsfrom_base() (lab-
 script_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mF
 method), 8
 MHz_to_base() (lab-
 script_utils.unitconversions.detuning.detuning
 method), 7
 MHz_to_base() (lab-
 script_utils.unitconversions.NovaTechDDS9m.NovaTechDDS9mF
 method), 8
 minimumSize() (lab-
 script_utils.qtwidgets.toolpalette.ToolPalette
 method), 16
 minimumSizeHint() (lab-
 script_utils.qtwidgets.dragdroptab.DragDropTabBar
 method), 12
 minimumSizeHint() (lab-
 script_utils.qtwidgets.elide_label.ElidedLabelContainer
 method), 15
 minimumSizeHint() (lab-
 script_utils.qtwidgets.elide_label.ElideScrollArea
 method), 14
 minimumSizeHint() (lab-
 script_utils.qtwidgets.toolpalette.ToolPalette
 method), 16
 module
 labscript_utils, 3
 labscript_utils.connections, 3
 labscript_utils.dict_diff, 4
 labscript_utils.double_import_denier,
 20
 labscript_utils.filewatcher, 21
 labscript_utils.h5_lock, 9
 labscript_utils.impprof, 19
 labscript_utils.labconfig, 4
 labscript_utils.ls_zprocess, 9
 labscript_utils.memprof, 20
 labscript_utils.modulewatcher, 21
 labscript_utils.properties, 6
 labscript_utils.qtwidgets, 12
 labscript_utils.qtwidgets.analoginput,
 17
 labscript_utils.qtwidgets.analogoutput,
 17
 labscript_utils.qtwidgets.ddsoutput,
 18
 labscript_utils.qtwidgets.digitaloutput,
 18

labscript_utils.qtwidgets.dragdroptab,	<i>method</i>), 12
12	mousePressEvent () (lab-
labscript_utils.qtwidgets.elide_label,	<i>script_utils.qtwidgets.dragdroptab.DragDropTabBar</i>
14	<i>method</i>), 12
labscript_utils.qtwidgets.enumoutput,	mouseReleaseEvent () (lab-
18	<i>script_utils.qtwidgets.dragdroptab.DragDropTabBar</i>
labscript_utils.qtwidgets.fingertab,	<i>method</i>), 12
15	
labscript_utils.qtwidgets.headerview_with_widgets,	N
15	NoStealFocusDoubleSpinBox (class in lab-
labscript_utils.qtwidgets.imageoutput,	<i>script_utils.qtwidgets.analogoutput</i>), 18
19	NotFound (class in <i>labscript_utils.versions</i>), 22
labscript_utils.qtwidgets.InputPlotWindow,	NovaTechDDS9mAmpConversion (class in lab-
16	<i>script_utils.unitconversions.NovaTechDDS9m</i>),
labscript_utils.qtwidgets.outputbox,	8
16	NovaTechDDS9mFreqConversion (class in lab-
labscript_utils.qtwidgets.toolpalette,	<i>script_utils.unitconversions.NovaTechDDS9m</i>),
16	8
labscript_utils.remote, 11	NoVersionInfo (class in <i>labscript_utils.versions</i>), 22
labscript_utils.settings, 5	
labscript_utils.setup_logging, 20	O
labscript_utils.shared_drive, 11	on_cancel () (labscript_utils.settings.Settings
labscript_utils.splash, 11	<i>method</i>), 5
labscript_utils.testing_utils, 5	on_columnsInserted () (lab-
labscript_utils.tracelog, 20	<i>script_utils.qtwidgets.headerview_with_widgets.HorizontalHead</i>
labscript_utils.unitconversions, 6	<i>method</i>), 15
labscript_utils.unitconversions.aom,	on_columnsRemoved () (lab-
7	<i>script_utils.qtwidgets.headerview_with_widgets.HorizontalHead</i>
labscript_utils.unitconversions.detuning,	<i>method</i>), 15
7	on_save () (labscript_utils.settings.Settings <i>method</i>), 5
labscript_utils.unitconversions.example,	on_scroll_button_clicked () (lab-
6	<i>script_utils.qtwidgets.dragdroptab.DragDropTabBar</i>
labscript_utils.unitconversions.linear_coil_driver,	<i>method</i>), 12
8	on_tab_moved () (lab-
labscript_utils.unitconversions.NovaTechDDS9m,	<i>script_utils.qtwidgets.dragdroptab.TabAnimation</i>
8	<i>method</i>), 14
labscript_utils.unitconversions.optotunelens,	open_plot_window () (lab-
8	<i>script_utils.qtwidgets.analoginput.AnalogInput</i>
labscript_utils.unitconversions.quad_driver,	<i>method</i>), 17
8	OptotuneLens (class in lab-
labscript_utils.unitconversions.quad_monitor,	<i>script_utils.unitconversions.optotunelens</i>),
9	8
labscript_utils.unitconversions.test,	OutputBox (class in lab-
6	<i>script_utils.qtwidgets.outputbox</i>), 16
labscript_utils.unitconversions.UnitConversionBase,	
7	P
labscript_utils.versions, 22	paint_tab () (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar
labscript_utils.zlock, 11	<i>method</i>), 12
labscript_utils.zlog, 11	paintEvent () (lab-
ModuleWatcher (class in lab-	<i>script_utils.qtwidgets.dragdroptab.DragDropTabBar</i>
<i>script_utils.modulewatcher</i>), 21	<i>method</i>), 12
monkeypatch (class in <i>labscript_utils.testing_utils</i>), 5	paintEvent () (lab-
mouseMoveEvent () (lab-	<i>script_utils.qtwidgets.fingertab.FingerTabBarWidget</i>
<i>script_utils.qtwidgets.dragdroptab.DragDropTabBar</i>	<i>method</i>), 15

paintEvent() (*labscript_utils.splash.Splash* method), 12
 path_to_agnostic() (in module *labscript_utils.shared_drive*), 11
 path_to_local() (in module *labscript_utils.shared_drive*), 11
 PlotWindow (class in *labscript_utils.qtwidgets.InputPlotWindow*), 16
 Power_from_base() (*labscript_utils.unitconversions.aom.SineAom* method), 7
 Power_to_base() (*labscript_utils.unitconversions.aom.SineAom* method), 7
 print_details() (*labscript_utils.connections.Connection* method), 3
 print_details() (*labscript_utils.connections.ConnectionTable* method), 4
 ProcessTree (class in *labscript_utils.ls_zprocess*), 10
 profiling_import() (*labscript_utils.impprof._ProfilingImporter* method), 19
 properties() (*labscript_utils.connections.Connection* property), 3
Q
 quad_driver (class in *labscript_utils.unitconversions.quad_driver*), 8
 quad_monitor (class in *labscript_utils.unitconversions.quad_monitor*), 9
 quit_mainloop() (*labscript_utils.testing_utils.ThreadTestCase* method), 5
R
 register_callback() (*labscript_utils.settings.Settings* method), 5
 RemoteProcessClient() (in module *labscript_utils.ls_zprocess*), 10
 remove() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 16
 remove_by_index() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 17
 remove_callback() (*labscript_utils.settings.Settings* method), 5
 remove_device() (*labscript_utils.connections.ConnectionTable* method), 4
 remove_from_linked_width_group() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 17
 reorder_palette() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 17
 reorder_palette_by_index() (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* method), 17
 resizeEvent() (*labscript_utils.qtwidgets.toolpalette.ToolPalette* method), 16
 run() (*labscript_utils.qtwidgets.InputPlotWindow.PlotWindow* method), 16
 run() (*labscript_utils.testing_utils.ThreadTestCase* method), 5
 run_script_as_main() (*labscript_utils.testing_utils.ThreadTestCase* method), 5
S
 save_appconfig() (in module *labscript_utils.labconfig*), 4
 SCROLL_BUTTON_GAP (*labscript_utils.qtwidgets.dragdroptab.DragDropTabBar* attribute), 12
 SCROLL_BUTTON_WIDTH (*labscript_utils.qtwidgets.dragdroptab.DragDropTabBar* attribute), 12
 sectionSizeFromContents() (*labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeader* method), 15
 selected_index() (*labscript_utils.qtwidgets.enumoutput.EnumOutput* property), 19
 selected_option() (*labscript_utils.qtwidgets.enumoutput.EnumOutput* property), 19
 selected_unit() (*labscript_utils.qtwidgets.analogoutput.AnalogOutput* property), 17
 serialise() (in module *labscript_utils.properties*), 6
 set_AI() (*labscript_utils.qtwidgets.analoginput.AnalogInput* method), 17
 set_AI() (*labscript_utils.qtwidgets.analogoutput.AnalogOutput* method), 17
 set_attributes() (in module *labscript_utils.properties*), 6
 set_combobox_model() (*labscript_utils.qtwidgets.analogoutput.AnalogOutput* method), 17
 set_combobox_model() (*labscript_utils.qtwidgets.enumoutput.EnumOutput* method), 17

method), 19

set_device_properties() (in module lab-script_utils.properties), 6

set_DO() (labscript_utils.qtwidgets.digitaloutput.DigitalOutput method), 18

set_EO() (labscript_utils.qtwidgets.enumoutput.EnumOutput method), 19

set_Image() (labscript_utils.qtwidgets.imageoutput.ImageOutput method), 19

set_limits() (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 17

set_num_decimals() (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 17

set_selected_unit() (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 17

set_spinbox_value() (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 18

set_step_size() (lab-script_utils.qtwidgets.analogoutput.AnalogOutput method), 18

set_tab_parent() (lab-script_utils.qtwidgets.dragdroptab.DragDropTabBar method), 12

set_value() (labscript_utils.qtwidgets.analoginput.AnalogInput method), 17

setElideMode() (lab-script_utils.qtwidgets.dragdroptab.DragDropTabWidget method), 13

setElideMode() (lab-script_utils.qtwidgets.elide_label.ElidedLabelContainer method), 15

setElideMode() (lab-script_utils.qtwidgets.elide_label.ElideScrollArea method), 14

setSectionHidden() (lab-script_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

setStyleSheet() (lab-script_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

Settings (class in labscript_utils.settings), 5

setTopLevelWindow() (lab-script_utils.qtwidgets.InputPlotWindow.PlotWindow method), 16

setup_logging() (in module lab-script_utils.setup_logging), 20

setUsesScrollButtons() (lab-script_utils.qtwidgets.dragdroptab.DragDropTabBar method), 12

setUsesScrollButtons() (lab-script_utils.qtwidgets.dragdroptab.DragDropTabWidget method), 13

script_utils.qtwidgets.dragdroptab.DragDropTabWidget method), 13

addWidget() (labscript_utils.qtwidgets.elide_label.ElideScrollArea method), 14

addWidget() (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

show() (labscript_utils.splash.Splash method), 12

showPalette() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 17

show_palette_by_index() (lab-script_utils.qtwidgets.toolpalette.ToolPaletteGroup method), 17

show_sub_widget() (lab-script_utils.qtwidgets.ddsoutput.DDSOutput method), 18

showEvent() (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

showSection() (lab-script_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView method), 15

SineAom (class in labscript_utils.unitconversions.aom), 7

sizeHint() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13

sizeHint() (labscript_utils.qtwidgets.elide_label.ElidedLabelContainer method), 15

sizeHint() (labscript_utils.qtwidgets.elide_label.ElideScrollArea method), 14

sizeHint() (labscript_utils.qtwidgets.toolpalette.ToolPalette method), 16

socket() (labscript_utils.ls_zprocess.Context method), 9

Splash (class in labscript_utils.splash), 11

start() (in module labscript_utils.memprof), 20

start() (labscript_utils.memprof.MemoryProfiler method), 20

state() (labscript_utils.qtwidgets.digitaloutput.DigitalOutput property), 18

state() (labscript_utils.qtwidgets.digitaloutput.InvertedDigitalOutput property), 18

stop() (labscript_utils.filewatcher.FileWatcher method), 16

stylesheet (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderView attribute), 16

Tab (class in labscript_utils.qtwidgets.dragdroptab), 13

tab_widgets (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar attribute), 13

TabAnimation (class in lab-script_utils.qtwidgets.dragdroptab), 14

tabAt() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13

tabInserted() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 tabInserted() (labscript_utils.qtwidgets.dragdroptab.TabAnimation method), 14
 tabLayoutChange() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 tabRect() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 tabRemoved() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 tabRemoved() (labscript_utils.qtwidgets.dragdroptab.TabAnimation method), 14
 tabSizeHint() (labscript_utils.qtwidgets.fingertab.FingerTabBarWidget method), 15
 target() (labscript_utils.qtwidgets.dragdroptab.TabAnimation method), 14
 tau (labscript_utils.qtwidgets.dragdroptab.TabAnimation attribute), 14
 test (class in labscript_utils.unitconversions.test), 6
 text() (labscript_utils.qtwidgets.dragdroptab.Tab property), 13
 text_color() (labscript_utils.qtwidgets.dragdroptab.Tab property), 13
 thinspace (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWidget attribute), 16
 ThreadTestCase (class in labscript_utils.testing_utils), 5
 ToolPalette (class in labscript_utils.qtwidgets.toolpalette), 16
 ToolPaletteGroup (class in labscript_utils.qtwidgets.toolpalette), 16
 tooltip() (labscript_utils.qtwidgets.dragdroptab.Tab property), 14
 trace() (labscript_utils.qtwidgets.dragdroptab.debug class method), 14

U

unblock_combobox_signals() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 18
 unblock_combobox_signals() (labscript_utils.qtwidgets.enumoutput.EnumOutput method), 19
 unblock_spinbox_signals() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 18

UnidirectionalCoilDriver (class in labscript_utils.unitconversions.linear_coil_driver), 8
 unit_conversion_params() (labscript_utils.connections.Connection property), 3
 unit_list (labscript_utils.unitconversions.UnitConversionBase attribute), 7
 UnitConversion (class in labscript_utils.unitconversions.UnitConversionBase), 7
 unload() (labscript_utils.modulewatcher.ModuleWatcher method), 21
 unlock() (labscript_utils.qtwidgets.analogoutput.AnalogOutput method), 18
 unlock() (labscript_utils.qtwidgets.digitaloutput.DigitalOutput method), 18
 unlock() (labscript_utils.qtwidgets.enumoutput.EnumOutput method), 19
 unlock() (labscript_utils.qtwidgets.imageoutput.ImageOutput method), 19
 update() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 update_dragged_tab_animation_pos() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 update_elide_widget() (labscript_utils.qtwidgets.elide_label.ElidedLabelContainer method), 15
 update_files() (labscript_utils.fileviewer.FileViewer method), 21
 update_indents() (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWidget method), 16
 update_plot() (labscript_utils.qtwidgets.InputPlotWindow.PlotWindow method), 16
 update_scroll_button_state() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 update_tab_index() (labscript_utils.qtwidgets.dragdroptab.DragDropTabBar method), 13
 update_text() (labscript_utils.splash.Splash method), 12
 update_widget_positions() (labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWidget method), 16
 updateTime() (labscript_utils.qtwidgets.dragdroptab.TabAnimation method), 14
 updateMinimumSize() (labscript_utils.qtwidgets.toolpalette.ToolPalette method), 18

method), 16

V

`value()` (*labscript_utils.qtwidgets.imageoutput.ImageOutput* property), 19

`vectorise()` (in module *labscript_utils.unitconversions.UnitConversionBase*), 7

`VersionException`, 22

`viewportEvent()` (*labscript_utils.qtwidgets.headerview_with_widgets.HorizontalHeaderViewWithWidgets* method), 16

W

`w` (*labscript_utils.splash.Splash* attribute), 12

`W_from_base()` (*labscript_utils.unitconversions.example.example3* method), 7

`W_to_base()` (*labscript_utils.unitconversions.example.example3* method), 7

`wait_for()` (*labscript_utils.testing_utils.ThreadTestCase* static method), 5

`whats_this()` (*labscript_utils.qtwidgets.dragdroptab.Tab* property), 14

`wheelEvent()` (*labscript_utils.qtwidgets.analogoutput.NoStealFocusDoubleSpinBox* method), 18

`widget()` (*labscript_utils.qtwidgets.dragdroptab.Tab* property), 14

`widgetAt()` (*labscript_utils.qtwidgets.dragdroptab.DragDropTabBar* method), 13

`widths_linked()` (*labscript_utils.qtwidgets.toolpalette.ToolPaletteGroup* property), 17

`write_to_file()` (*labscript_utils.memprof.MemoryProfiler* method), 20

Z

`zmq_get()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_get_multipart()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_get_raw()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_get_string()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_push()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_push_multipart()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_push_raw()` (in module *labscript_utils.ls_zprocess*), 10

`zmq_push_string()` (in module *labscript_utils.ls_zprocess*), 10

`ZMQClient` (class in *labscript_utils.ls_zprocess*), 10

`ZMQServer` (class in *labscript_utils.ls_zprocess*), 10