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# **Flex GUI**

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## **FLEX GUI DESCRIPTION**

Flex GUI is a flexible GUI that can be customized to suit your needs.

- Uses stock Qt Designer 5 or 6
- Widget names are used to connect controls to the correct code
- Widgets are auto-discovered at startup
- Special widgets only need Dynamic Properties to be discovered and created
- Your GUI can have exactly the controls and labels you want
- You can create and use your own style sheet, changing fonts, colors, etc.
- All Flex GUI configuration is done in the .ini file
- Flex GUI remembers the size and position of your GUI

For more information on Dynamic Properties see *Dynamic Properties*

### **1.1 Features**

- Status Labels
- Menu Actions
- Button Actions
- Button Controls
- Plotter
- MDI Input and Buttons
- Spindle Controls
- Probing with Spindle Safety
- Tool Change Controls
- Coordinate System Controls
- HAL Buttons, Spinboxes, Sliders, Labels and LCDs
- Touch Screen Controls and Popups

## 1.2 Acronyms

The following acronyms will be found in this document

- NC = *Numerical Control* code includes G, M and O codes
- G = *Geometric* code is used for geometric movements
- M = *Miscellaneous* code is used for non-movement functions
- O = *Organizing* code is used in CNC programs to control flow

---

CHAPTER  
TWO

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## GETTING STARTED

1. Install options for Flex GUI
  - Install using Debian Apt - See [Install with Apt](#)
  - Install the prebuilt .deb file - See [Install the Deb](#)
  - Clone and build a .deb file and install - See [Build and Install](#)
2. Install Qt Designer - See [Installing the Qt Designer](#)
3. Copy Flex GUI Examples - See [Copy Example Files](#)
4. Building Your GUI
  - Copy an Example GUI and modify it to suit
  - Build your GUI from scratch - See [Building a GUI](#)
5. Running Your GUI
  - Add Flex GUI to the INI file Display - See [Using Flex GUI](#)
  - Optionally pick a built in Theme - See [Themes](#)



## INSTALLING

### 3.1 Install with Apt

The advantage of using apt to install Flex GUI is when a new version of Flex GUI is released apt will know a new version is available when you run `sudo apt update`. This will allow you to install the new version of Flex GUI along with other Debian software.

---

**Note:** on a brand-new RPi5 using the linuxcnc.iso, use `apt --fix-broken install` to install several qt6 sub-dependencies

---

The first command will ask for your password. Neither command will print anything in the terminal.

For a PC to create an apt sources file for Flex GUI copy and paste this command in a terminal

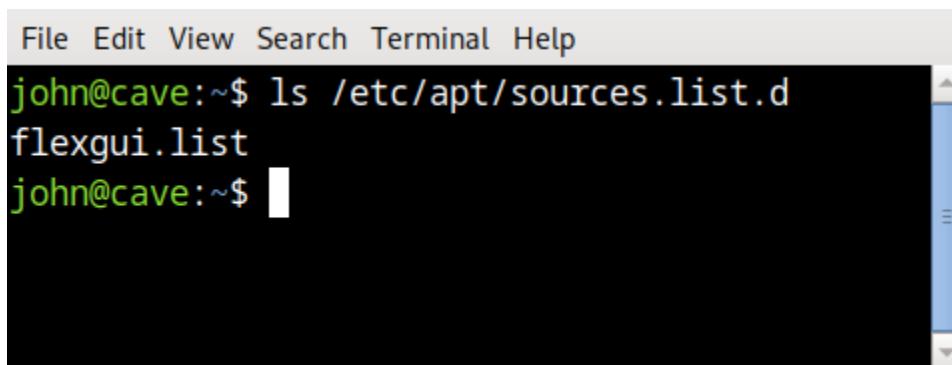
```
echo 'deb [arch=amd64] https://gnipsel.com/flexgui/apt-repo stable main' | sudo tee /etc/
↪apt/sources.list.d/flexgui.list
```

For a Raspberry Pi create an apt sources file for Flex GUI copy and paste this command in a terminal

```
echo 'deb [arch=arm64] https://gnipsel.com/flexgui/apt-repo stable main' | sudo tee /etc/
↪apt/sources.list.d/flexgui.list
```

To check the above command worked you can list the file with this command

```
ls /etc/apt/sources.list.d
```



```
File Edit View Search Terminal Help
john@cave:~$ ls /etc/apt/sources.list.d
flexgui.list
john@cave:~$
```

Next get the public key for Flex GUI and copy it to trusted.gpg.d

```
sudo curl --silent --show-error https://gnipsel.com/flexgui/apt-repo/pgp-key.public -o /
↪etc/apt/trusted.gpg.d/flexgui.asc
```

If curl is not installed you can install it with the following command

```
sudo apt install curl
```

Next update apt

```
sudo apt update
```

If you have Flex GUI installed you can see what packages can be upgraded with the following command

```
apt list --upgradable
```

If Flex GUI is not installed you can install it with the following command

```
sudo apt install flexgui
```

## 3.2 Install the Deb

You can still download the deb from github and install with gdebi if that works better for you. If you don't have an internet connection this is the best way to install Flex GUI

---

**Note:** Between releases the deb will have the latest bug fixes

---

### Installing Flex GUI Tutorial

Download the latest deb file from >[HERE](#)<.

If the link is not clickable, copy and paste the following URL into your browser

```
https://github.com/jethornton/flexgui/releases
```

~amd64.deb is for PC's and ~arm64.deb is for Raspberri Pi.

Select the latest release and click on the .deb to start a download.

Right click on the deb file and select *Open with GDebi Package Installer*. If that option is not there then GDebi is not installed, open a terminal and run this command to install it:

```
sudo apt install gdebi
```

An alternative is to install from the terminal outright using *dpkg*. Make sure the version number is correct for the deb you have the following command may be an older version.

```
sudo dpkg -i flexgui_1.1.0_amd64.deb
```

### 3.3 Build and Install

If you plan on changing code in Flex GUI you can clone the repository and build the deb after making changes. The target directory is optional.

```
git clone https://github.com/jethornton/flexgui.git (target/directory)
```

Before building the deb you will need to install some programs that do the building. Open a terminal and run the following to install devscripts

```
sudo apt install devscripts
```

Open a terminal in the top most flexgui directory and use this command to build a deb file.

```
debuild -us -uc
```

### 3.4 Copy Example Files

After installing Flex GUI, a menu item *Copy Flex Examples* is added to the *CNC* menu. This will copy the Flex GUI example files to *~/linuxcnc/configs/flex\_examples*.

---

**Note:** After updating the Flex GUI some examples may have changed. To get a fresh copy of the examples delete the *linuxcnc/configs/flex\_examples* or rename it.

---



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CHAPTER  
FOUR

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## QT DESIGNER

### 4.1 Installing the Qt Designer

In a terminal, install Qt Designer 5 with

```
sudo apt install qttools5-dev-tools
```

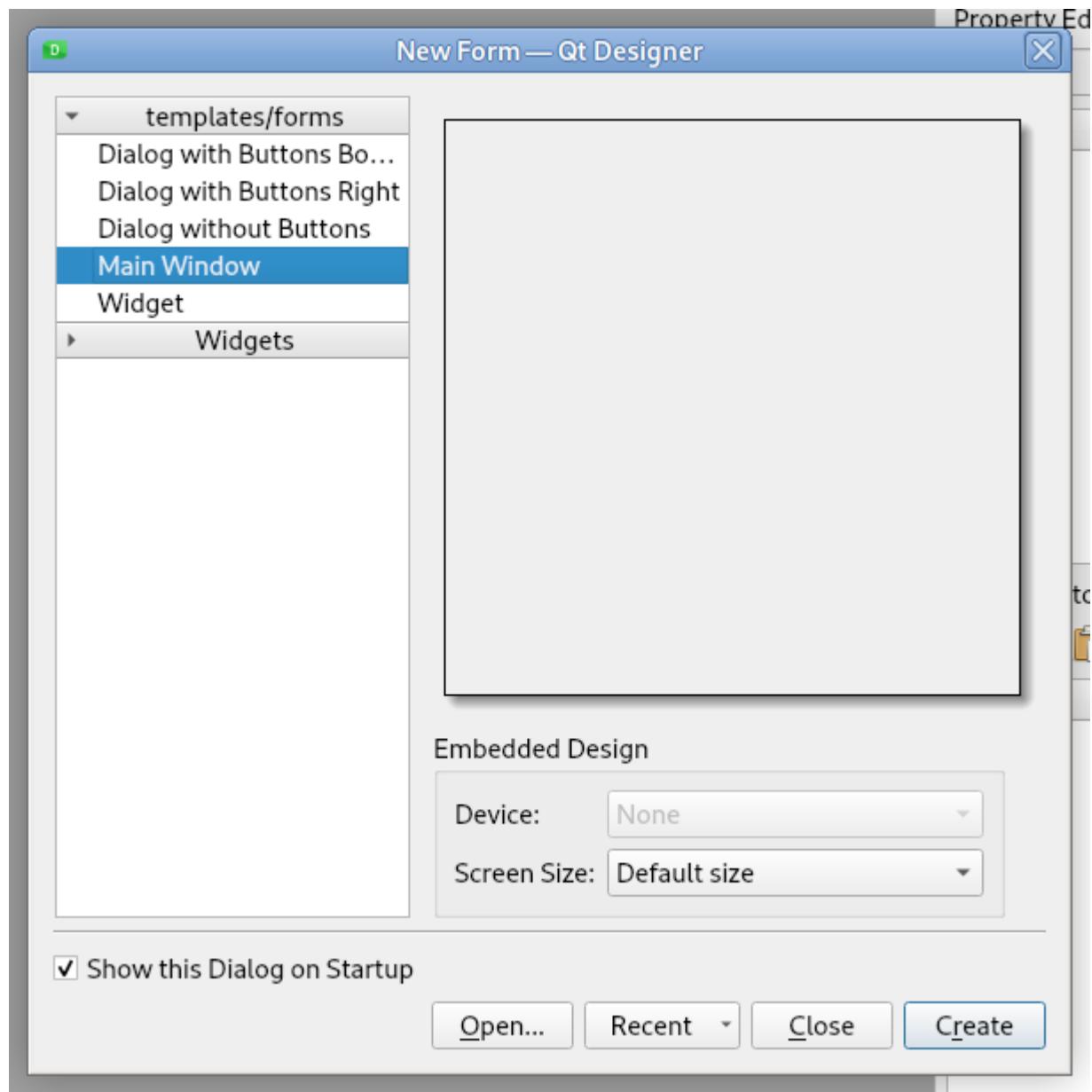
---

**Note:** The Qt6 Designer is not required nor better; Qt5 Designer is fine.

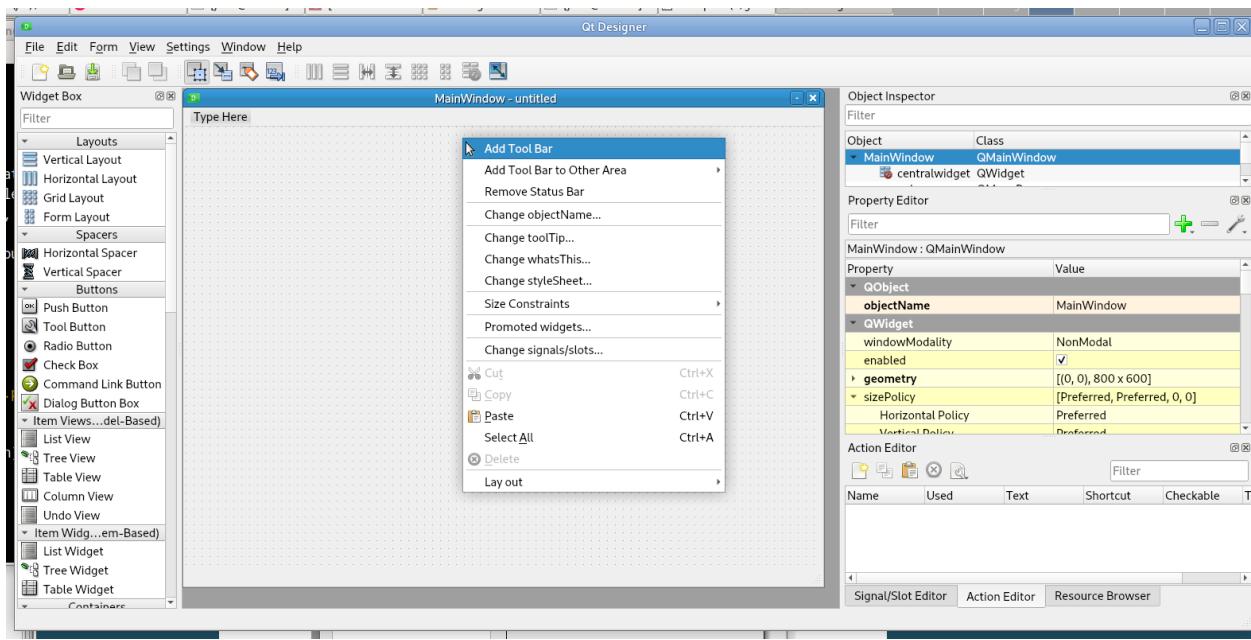
---

### 4.2 Building a GUI

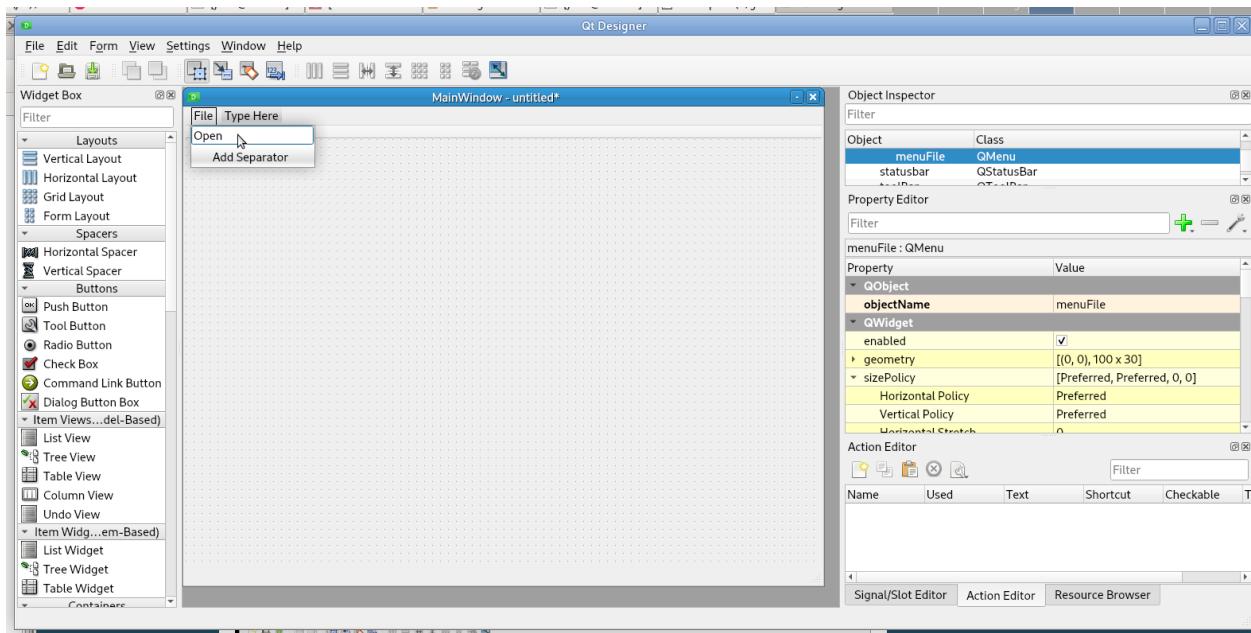
Run the Qt Designer from the Applications > Programming menu and create a new *Main Window*



To add a Tool Bar, right click on the main window and select *Add Tool Bar*

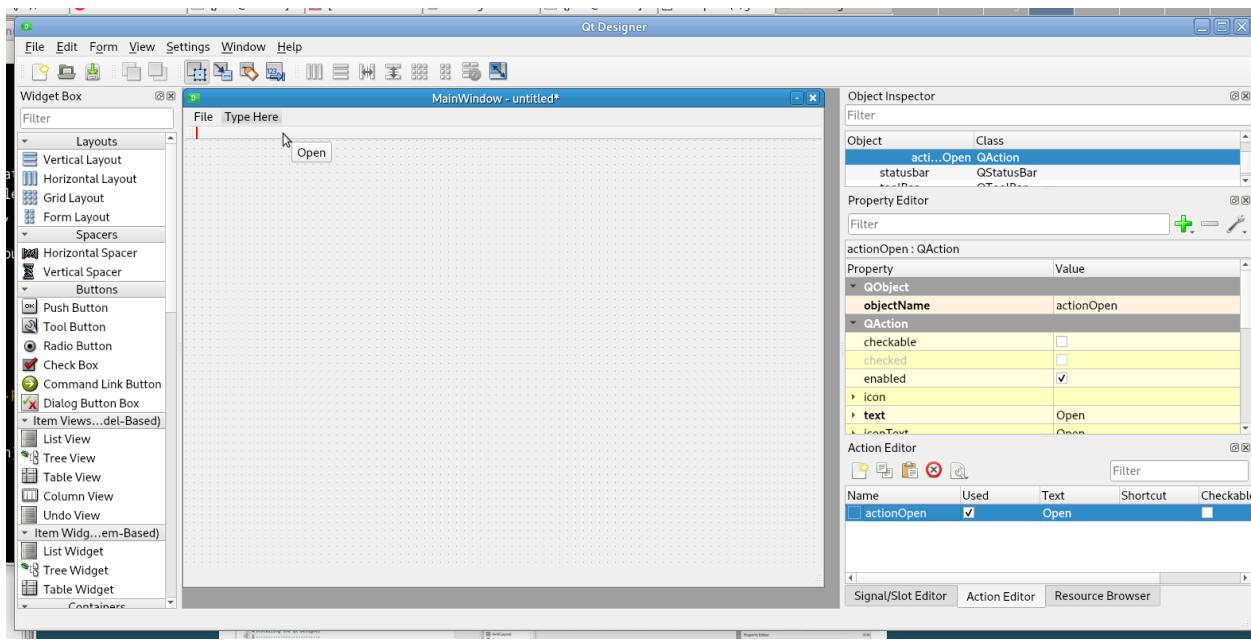


To add a Menu, type in the menu area and press enter

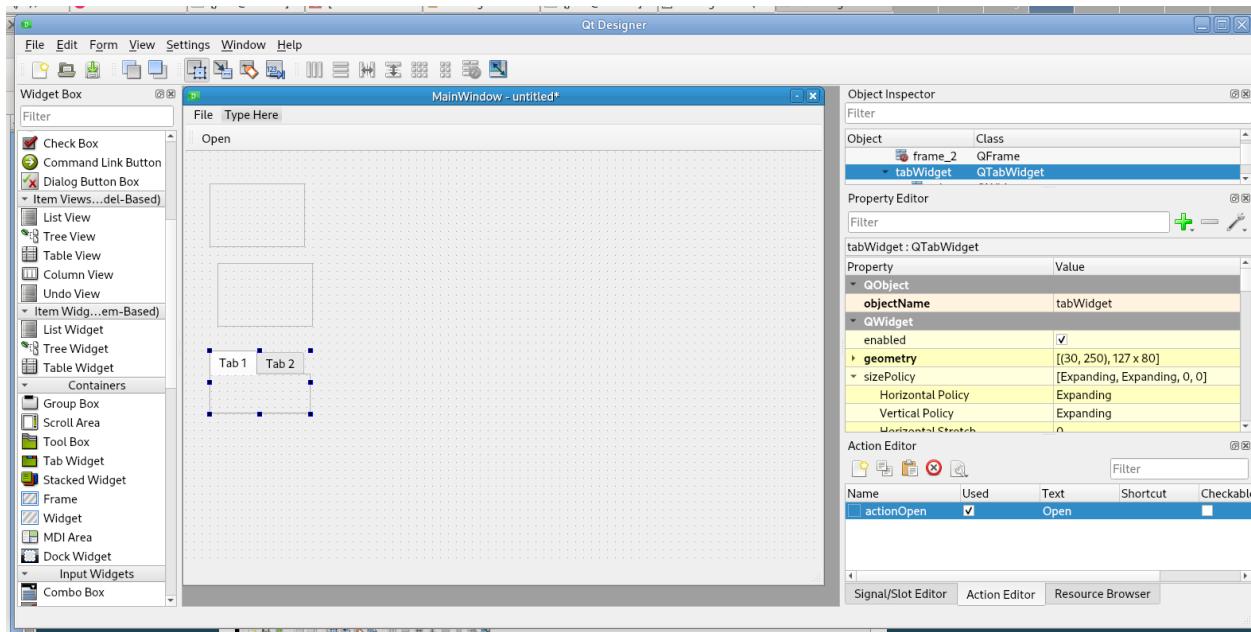


When you create a Menu item it creates an action; this action can be dragged to the Tool Bar to create a tool bar button

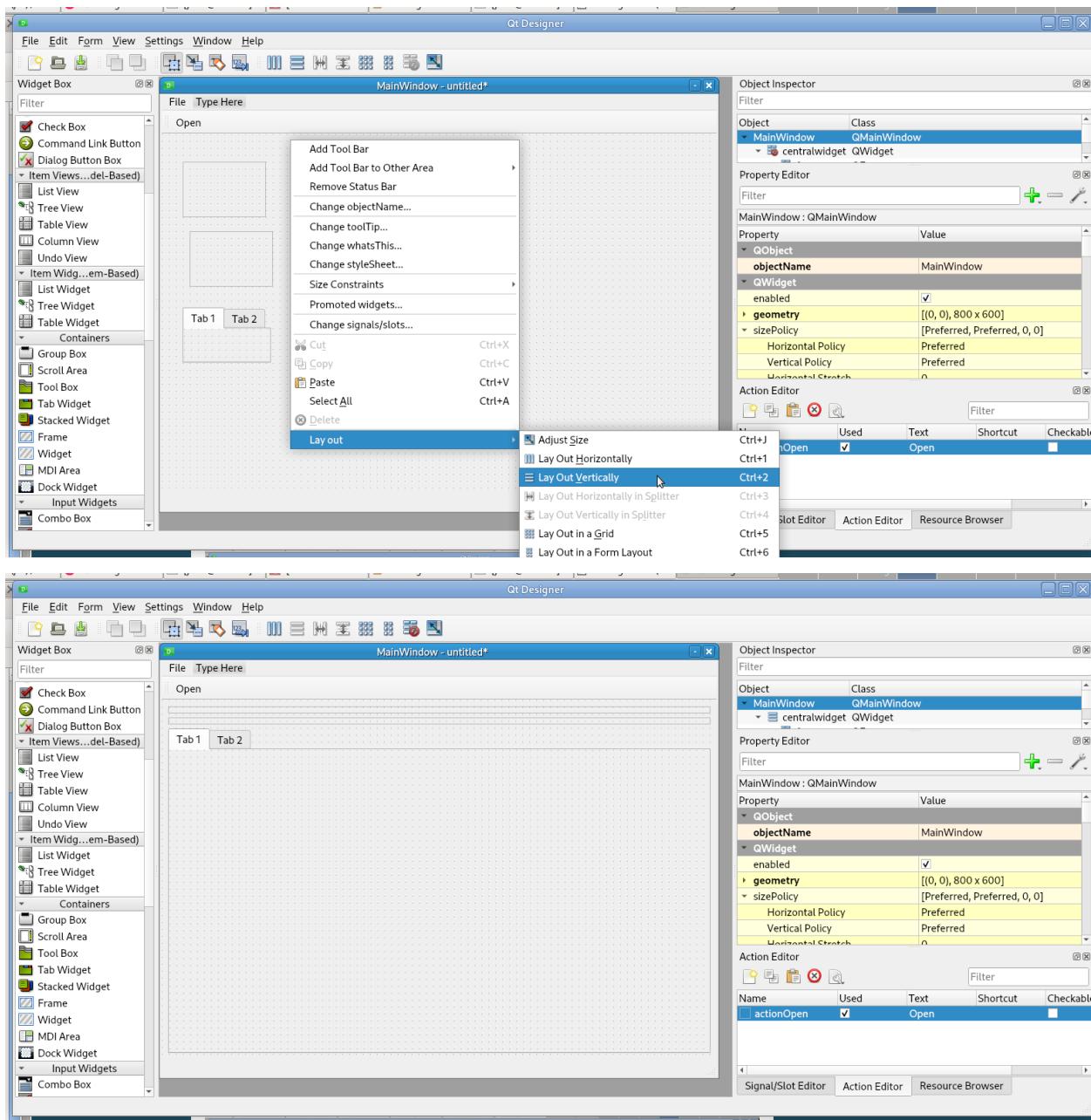
## Flex GUI



Adding items from the Widget Box is drag-and-drop. To create a basic layout from Containers, add two Frames and a Tab Widget

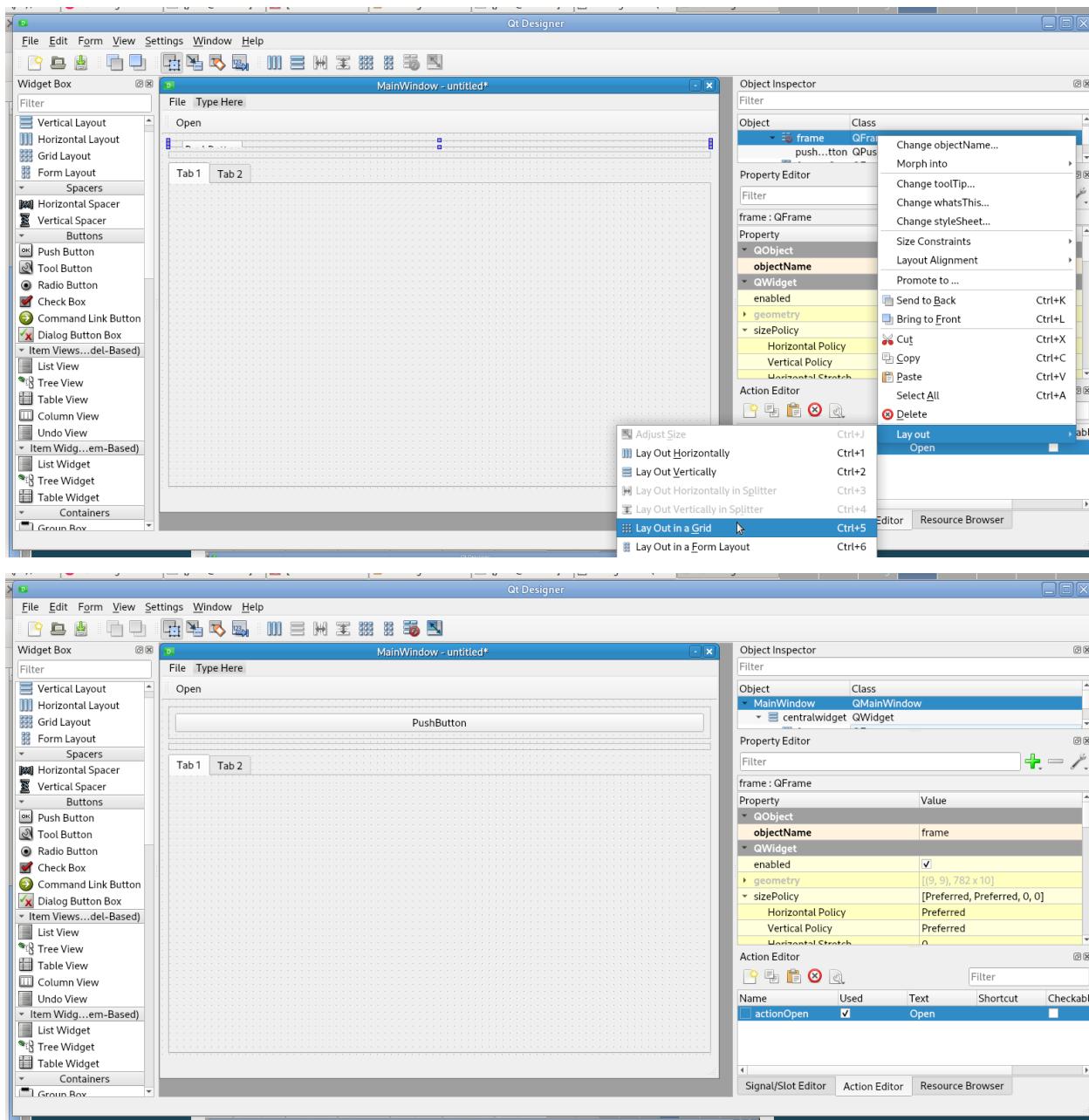


Right click in the QMainWindow and select Lay out → Lay out Vertically



Add a Push Button to the QFrame, then right click on the frame or the QFrame in the Object Inspector and set the lay out to grid

## Flex GUI



After dragging a widget into the window, make sure you use the correct objectName for that widget. For example the E-Stop button is called estop\_pb.

**Note:** Each object name must be unique; designer will not allow duplicate names.

Save the GUI in the configuration directory alongside your .ini file.

You can start Qt5 Designer from a terminal with `designer` & which spawns a new process (gives you back the terminal prompt.)

**Note:** There is an documented issue with Qt5 Designer and bold fonts not appearing properly.

## 4.3 Qt6 Designer

Qt6 Designer can be installed from a terminal with

```
sudo apt install designer-qt6
```

To run Qt6 Designer you must use the full path to the executable

```
/usr/lib/qt6/bin/designer
```



## DYNAMIC PROPERTIES

Flex GUI uses a lot Dynamic Properties to cusomize widget behaviour and add more functionality to a widget.

To Create a Dynamic Property the first thing you do is select the widget.



Next left click on the green plus sign in the Property Editor.



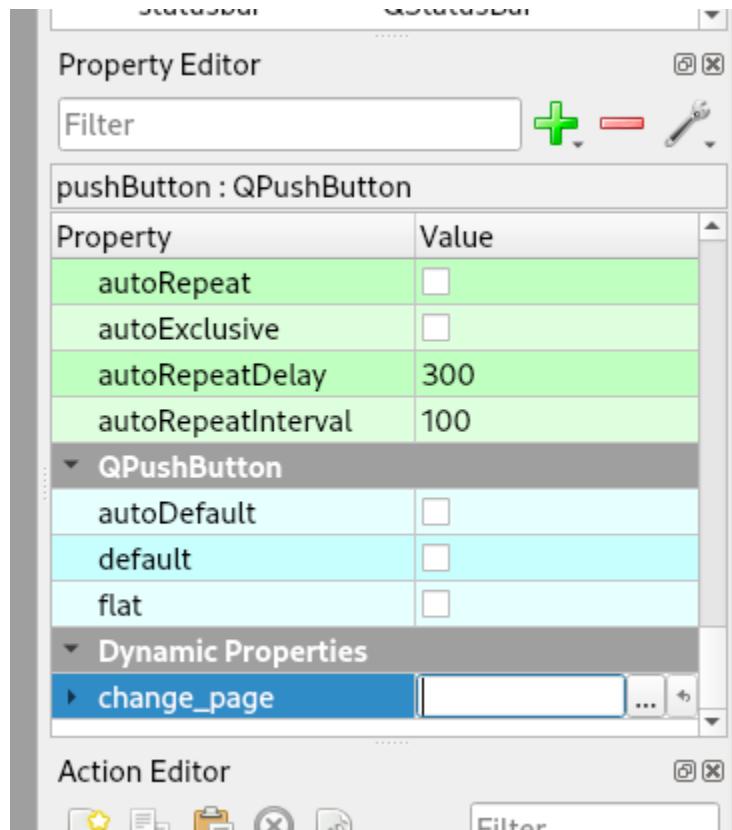
Select a string type as Flex GUI always uses a string type Dynamic Property.

|   |                      |
|---|----------------------|
| Property Name   | <input type="text"/> |
| Property Type   | String               |
| <input type="button" value="Cancel"/> <input type="button" value="OK"/> |                      |

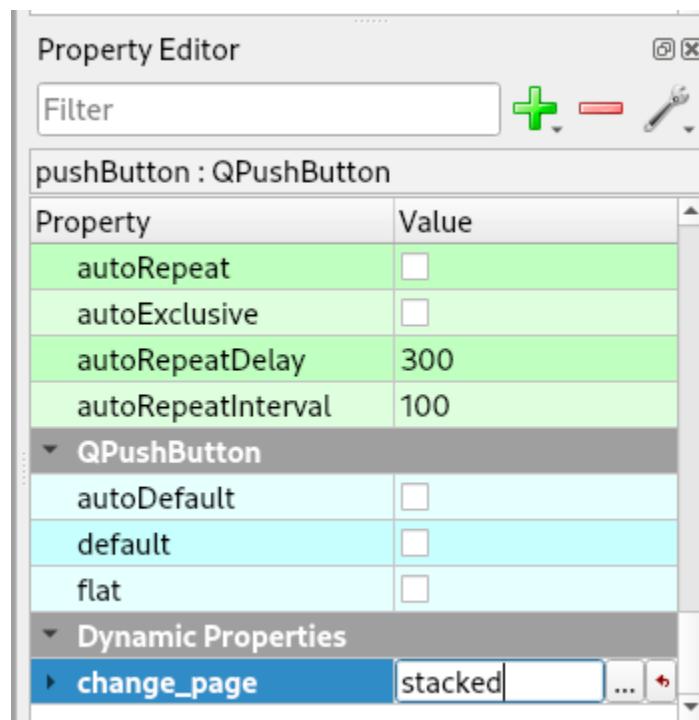
Next enter the Dynamic Property Name, which must be exactly like shown in the documents.



Press OK then the Dynamic Property will show up in the Property Editor.



Now you can enter the Value for that Dynamic Property.



---

**Note:** The Dynamic Properties section does not show up in the Property Editor until you create a Dynamic Property.

---

## INI SETTINGS

Video Tutorial

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**Note:** The following Flex GUI settings are all located in the [DISPLAY] section of your LinuxCNC .ini file.

---

### 6.1 Using Flex GUI

To use the Flex GUI (as opposed to Axis or others), change the DISPLAY value to

```
DISPLAY = flexgui
```

If no GUI is specified then the default GUI will be used.

---

**Note:** Any Flex GUI .ui and .qss files must be in the same LinuxCNC configuration directory as the .ini file.

---

To use your .ui file (created with Qt Designer), add a GUI key to the .ini with its *filename*:

```
GUI = my-file-name.ui
```

### 6.2 Themes

Themes are just style sheets that get applied to the widgets. The theme files are in the themes directory of the example files if you want to copy and customize one of the themes.

```
blue.qss
blue-touch.qss
dark.qss
dark-touch.qss
keyboard.qss
touch.qss
```

To use a built-in theme with no color changes choose one of the following

```
THEME = touch
THEME = keyboard
```

To use a built in theme with coloring choose one of the following

```
THEME = blue
THEME = blue-touch
THEME = dark
THEME = dark-touch
```

---

**Note:** Touch themes use tabs set to South for rounding and non touch use tabs set to North.

---

**Note:** THEME is checked first then QSS so the first entry found is used.

---

To use a custom .qss style sheet you created named *lightflex.qss*

```
QSS = lightflex.qss
```

For more information on style sheets see [StyleSheet](#)

## 6.3 Jog Increments

The following settings can be used in the [DISPLAY] section of the ini file to preset jog items

```
INCREMENTS = 0.100, 0.010, 0.001
or
INCREMENTS = 1 inch, 0.5 in, 1 cm, 1 mm
MIN_LINEAR_VELOCITY = 0.1
MAX_LINEAR_VELOCITY = 1.0
DEFAULT_LINEAR_VELOCITY = 0.2
```

**Warning:** [DISPLAY] INCREMENTS must be a comma seperated list or it will be ignored.

---

**Note:** Jog increments can have unit labels, the following are valid unit labels cm, mm, um, inch, in or mil. If no unit labels are found the the configuration units are used.

---

## 6.4 Startup File

To automatically open a NC file on startup, add the OPEN\_FILE key with any valid path. Use ~/ as a shortcut to the users home directory. Use ./ to indicate that the file is in the configuration directory

```
Full Path to the file
OPEN_FILE = /home/john/linuxcnc/configs/myconfig/welcome.ngc
or use the ~ for the users home directory
OPEN_FILE = ~/linuxcnc/configs/flex_examples/probe_sim/square.ngc
or use the ./ to use the current configuration directory
OPEN_FILE = ./welcome.ngc
```

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```
or ust the ../ to use the parent directory of the configuration
OPEN_FILE = ../welcome.ngc
```

## 6.5 File Location

Likewise, to specify a default location for NC files, add the PROGRAM\_PREFIX item.

```
PROGRAM_PREFIX = /home/john/linuxcnc/configs/myconfig
or
PROGRAM_PREFIX = ~/linuxcnc/configs/flex_examples/probe_sim
or
PROGRAM_PREFIX = ./
or
PROGRAM_PREFIX = ../
```

## 6.6 Tool Table Editor

To specify a different tool table editor add an entry to the [DISPLAY] section. If no entry is found then the default tool editor is used

```
TOOL_EDITOR = tooledit
```

To control the columns displayed by the default tool editor add any of the valid column specifiers separated by a space.

```
TOOL_EDITOR = tooledit x y z a b c u v w diam front back orien
```

If no entry is found then the axes in the configuration and diameter are shown. Tool, Pocket and Comment are always shown.

## 6.7 Resource File

To use a .py resource file (to add images to buttons with your qss stylesheet) place the .py resource file in the configuration directory and add the following line to the .ini file

```
RESOURCES = resources.py
```

See the section on Resources for more info.

## 6.8 File Extensions

The keyboard file dialog defaults to \*.ngc and this ignores case. To specify the file extensions you want the file dialog to show, add an EXTENSIONS key with the desired extensions separated by a comma. The extensions must be in the format \*.ext with the asterisk and dot

```
EXTENSIONS = `*.nc` , `*.G-code` , `*.ngc` , `*.txt`
```

## 6.9 Screen Size

To control the initial size of the screen, add either:

```
SIZE = minimized  
SIZE = normal  
SIZE = maximized  
SIZE = full
```

**Warning:** Full size screen does not have any window controls. Make sure there is a way to close the GUI like an Exit button or you may not be able to close the application. As a last-resort, pressing ALT-F4 will close it.

## 6.10 Plotter

The plotter background color can be set in the [FLEXGUI] section of the ini. The value is the Red,Green,Blue color numbers from 0 to 1 with no space. So an entry of 0.0,0.0,0.0 is black and 1.0,1.0,1.0 is white. Use a RGB 0-1 Color Picker to select the RGB values.

```
[FLEXGUI]  
PLOT_BACKGROUND_COLOR = 0.0,0.0,0.0
```

The plotter orientation can be set to one of the following x, x2, y, y2, z, or p.

```
[DISPLAY]  
VIEW = x
```

## 6.11 Colors

The E-Stop can have a static color for Open and Closed.

The Power Button can have a static color for Off and On.

Create a key in the ini file called FLEXGUI and use the following to control the static color of these items. The value can be any valid color specification; it's suggested to use RGB or Hex colors:

```
[FLEXGUI]  
ESTOP_OPEN_COLOR = 128, 255, 128  
ESTOP_CLOSED_COLOR = 255, 77, 77
```

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```
POWER_OFF_COLOR = 255, 128, 128
POWER_ON_COLOR = #00FF00
```

Another way to achieve this is via adding and editing a .qss stylesheet file. See the [StyleSheet](#) section for more info.

## 6.12 LED Defaults

LED buttons can have defaults set in the ini file. This makes it easier to have consistant LED size, position and colors. These options go in the [FLEXGUI] section.

The color options can be specified using HEX, RGB or RGBA.

Valid RGB(A) Red, Green, Blue (Alpha) values are 0 to 255.

Valid HEX values are #000000 to #ffffff

In PyQt6 the Alpha channel is 0 to 255. 0 represents a fully transparent color, while 255 represents a fully opaque color. If Alpha is omitted then it's set to fully opaque or 255.

The Diameter and Offset values are whole numbers only.

```
[FLEXGUI]
LED_DIAMETER = 15
LED_RIGHT_OFFSET = 5
LED_TOP_OFFSET = 5
LED_ON_COLOR = 0, 255, 0
LED_OFF_COLOR= 125, 0, 0, 255
```

For more information on LED buttons see [LED Buttons](#)

## 6.13 Touch Screens

Options for touch screen users.

Set the touch screen file chooser to automatically adjust the width by adding the following to the FLEXGUI section.

```
[FLEXGUI]
TOUCH_FILE_WIDTH = True
```



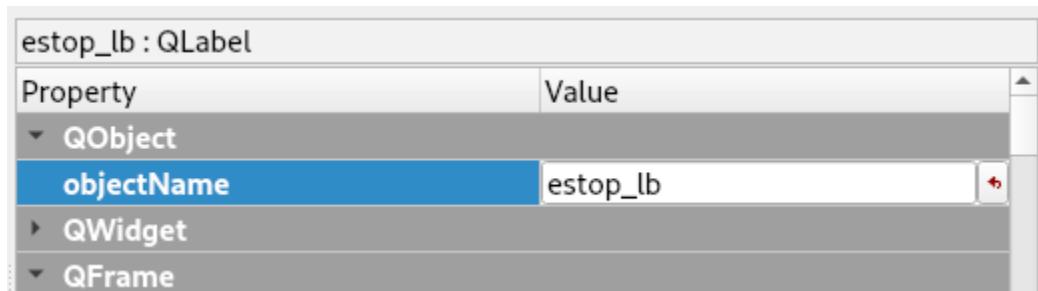
## STATUS LABELS

### Status Labels Tutorial

Status labels are created using a QLabel and setting the *Object Name*. Status labels come in two forms. A single-status-label like *Machine Status* only contains one piece of information, such as *OFF*, *RUN*, etc.

A multiple-status-label like the *axis* or *joint* dictionaries have multiple items and displays for all joints. Multiple-status-labels use a number identifier to select the axis, joint, or spindle information wanted.

When creating a status label, set the *objectName* to the status you want to display



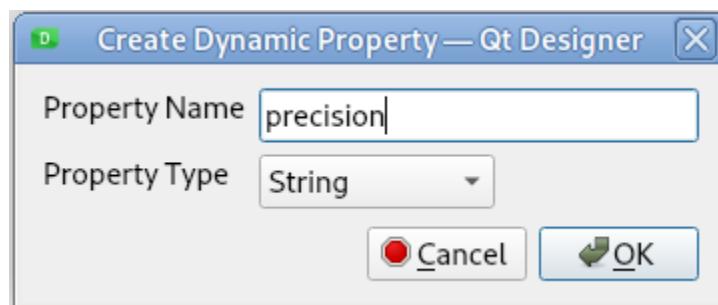
### 7.1 Precision

Labels that return float values default to 3 decimal places for metric and 4 for inch.

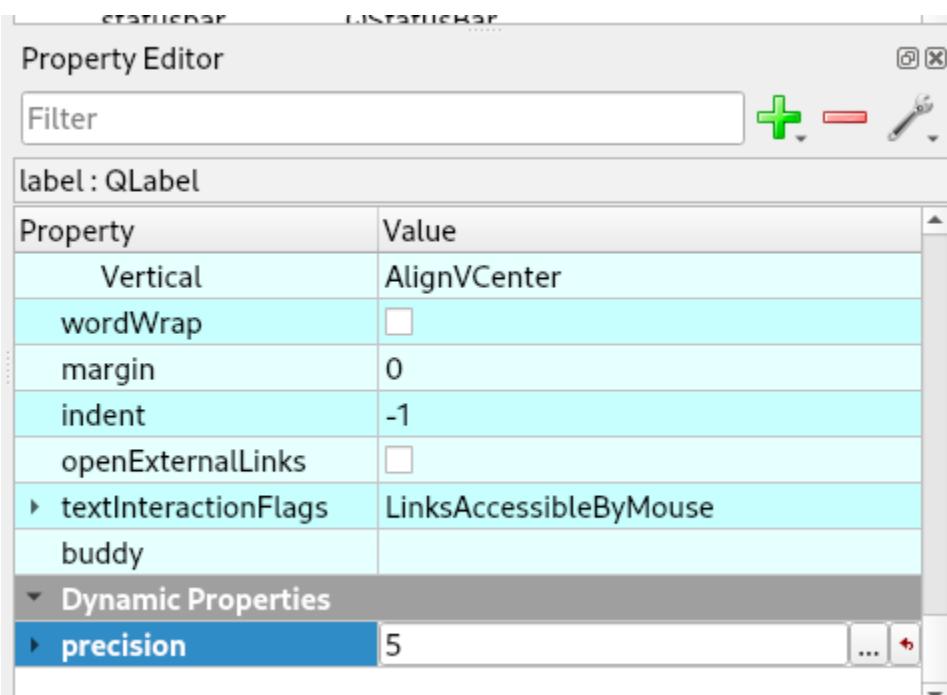
To override the default, select the label then click on the Green Plus sign in the Property Editor to add a Dynamic Property and select String. See *Dynamic Properties*



Set the Property Name to *precision*:



Set the Value to how many decimal places you want for that status label



For more information about status labels read the [LinuxCNC Python Interface Status Attributes](#)

## 7.2 Status Labels

Table 1: Single Status Label Object Names

|                          |                        |                     |
|--------------------------|------------------------|---------------------|
| acceleration_lb          | flood_lb               | pocket_prepended_lb |
| active_queue_lb          | gcodes_lb              | probe_trippped_lb   |
| adaptive_feed_enabled_lb | g5x_index_lb           | probe_val_lb        |
| angular_units_lb         | ini_filename_lb        | probed_position_lb  |
| axis_mask_lb             | inpos_lb               | probing_lb          |
| block_delete_lb          | input_timeout_lb       | program_units_lb    |
| call_level_lb            | interp_state_lb        | queue_lb            |
| command_lb               | interpreter_errcode_lb | queue_full_lb       |
| current_line_lb          | joints_lb              | rapid_override_lb   |
| current_vel_lb           | kinematics_type_lb     | read_line_lb        |
| cycle_time_lb            | linear_units_lb        | rotation_xy_lb      |
| debug_lb                 | lube_lb                | settings_lb         |
| delay_left_lb            | lube_level_lb          | spindles_lb         |
| distance_to_go_lb        | max_acceleration_lb    | state_lb            |
| echo_serial_number_lb    | max_velocity_lb        | task_mode_lb        |
| enabled_lb               | mcodes_lb              | task_paused_lb      |
| estop_lb                 | mist_lb                | task_state_lb       |
| exec_state_lb            | motion_line_lb         | tool_in_spindle_lb  |
| feed_hold_enabled_lb     | motion_mode_lb         | tool_from_pocket_lb |
| motion_type_lb           | tool_offset_lb         | feed_override_lb    |
| optional_stop_lb         | file_lb                | paused_lb           |

---

**Note:** You don't have to use all the labels; use only as many as you need.

---

## 7.3 Axis Status

The Axis status contains status items for all 9 axes. Replace the *n* with the number of the axis. Axis numbers start at 0 and go through 8. Returns a float

Table 2: Axis Status Labels

|                              |                              |
|------------------------------|------------------------------|
| axis_n_max_position_limit_lb | axis_n_min_position_limit_lb |
| axis_n_velocity_lb           | axis_n_vel_per_min_lb        |

---

**Note:** The Axis velocity label only reports back *jogging* speed; use the joint velocity label for *linear* speed.

---

## 7.4 Joint Status

The Joint status contains status items for 16 joints. Replace the  $n$  with the number of the joint. Joint numbers start at 0 and go through 15

Table 3: Joint Status Labels

|                               |                               |
|-------------------------------|-------------------------------|
| joint_backlash_n_lb           | joint_input_n_lb              |
| joint_min_position_limit_n_lb | joint_enabled_n_lb            |
| joint_jointType_n_lb          | joint_in_soft_limit_n_lb      |
| joint_fault_n_lb              | joint_max_ferror_n_lb         |
| joint_output_n_lb             | joint_ferror_current_n_lb     |
| joint_max_hard_limit_n_lb     | joint_override_limits_n_lb    |
| joint_ferror_highmark_n_lb    | joint_max_position_limit_n_lb |
| joint_units_n_lb              | joint_homed_n_lb              |
| joint_max_soft_limit_n_lb     | joint_vel_sec_n_lb            |
| joint_vel_min_n_lb            | joint_homing_n_lb             |
| joint_min_ferror_n_lb         | joint_inpos_n_lb              |
| joint_min_hard_limit_n_lb     |                               |

## 7.5 Special Labels

Run from line label *start\_line\_lb*

Axis machine position labels (no offsets.) Returns a float

Table 4: Machine Absolute Position Status Labels

|             |             |             |
|-------------|-------------|-------------|
| actual_lb_x | actual_lb_y | actual_lb_z |
| actual_lb_a | actual_lb_b | actual_lb_c |
| actual_lb_u | actual_lb_v | actual_lb_w |

Axis position labels *including* all offsets. Returns a float

Table 5: DRO Relative Status Labels

|          |          |          |
|----------|----------|----------|
| dro_lb_x | dro_lb_y | dro_lb_z |
| dro_lb_a | dro_lb_b | dro_lb_c |
| dro_lb_u | dro_lb_v | dro_lb_w |

Axis-is-homed labels

Table 6: Axis Homed Labels

|           |           |           |
|-----------|-----------|-----------|
| home_lb_0 | home_lb_1 | home_lb_2 |
| home_lb_3 | home_lb_4 | home_lb_5 |
| home_lb_6 | home_lb_7 | home_lb_8 |

Offsets for the currently active G5x coordinate system. Returns a float

Table 7: G5x Status Labels

|          |          |          |
|----------|----------|----------|
| g5x_lb_x | g5x_lb_y | g5x_lb_z |
| g5x_lb_a | g5x_lb_b | g5x_lb_c |
| g5x_lb_u | g5x_lb_v | g5x_lb_w |

Offsets for G92. Returns a float

Table 8: G92 Status Labels

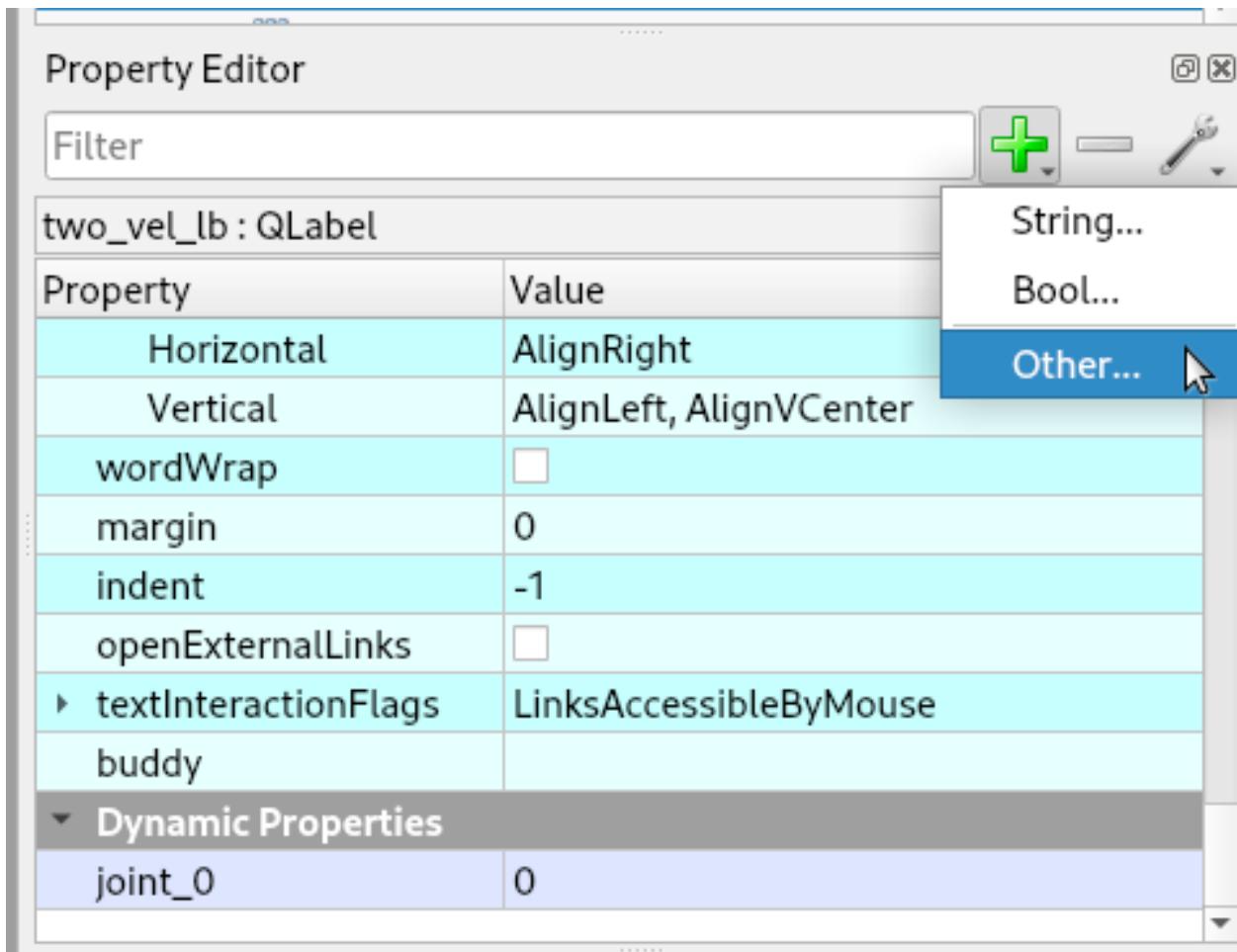
|          |          |          |
|----------|----------|----------|
| g92_lb_x | g92_lb_y | g92_lb_z |
| g92_lb_a | g92_lb_b | g92_lb_c |
| g92_lb_u | g92_lb_v | g92_lb_w |

## 7.6 Velocity Labels

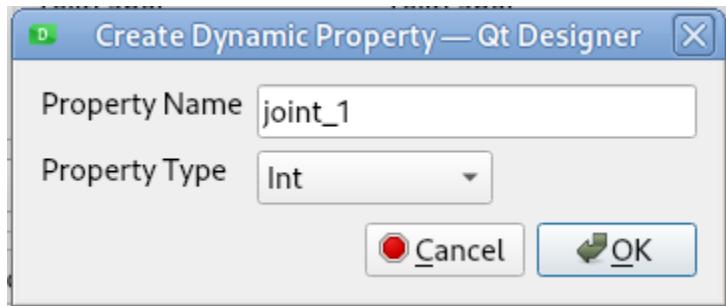
Tool velocity using two perpendicular joint velocities.

Name the label *two\_vel\_lb* and add two int type Dynamic Properties called *joint\_0* and *joint\_1* and set the values to the perpendicular joint numbers you want to calculate. Typically this would be for the X and Y axes.

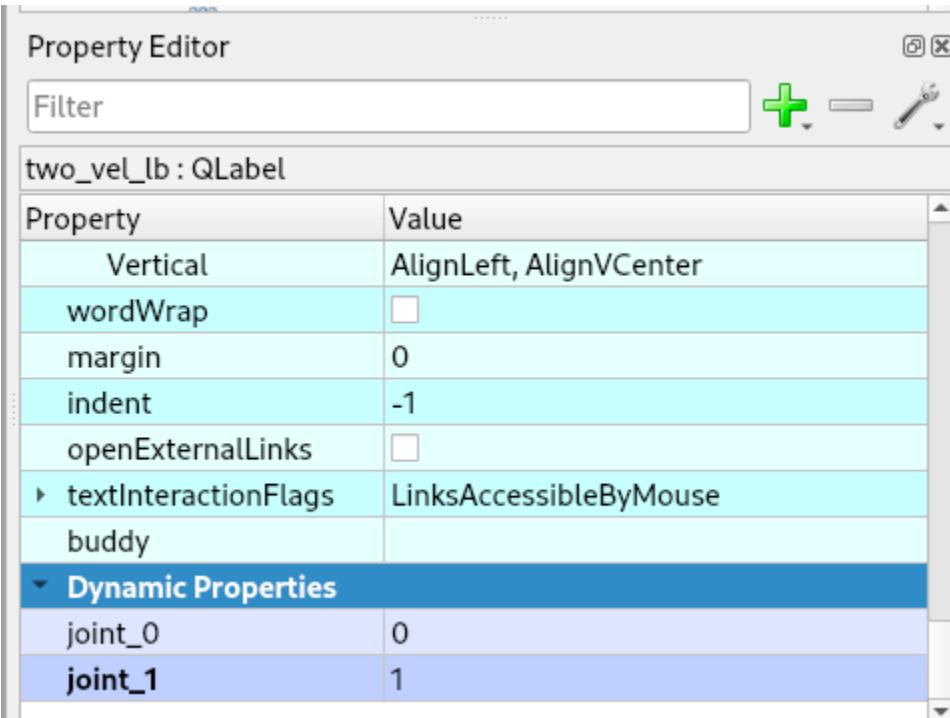
To select an int type of Dynamic Property, select *Other* after clicking on the green plus sign



Then select the Property Type of *int*



The two Dynamic Properties should look like this



Tool velocity using *three* perpendicular joint velocities.

Name the label *three\_vel\_lb* and add three int type Dynamic Properties called *joint\_0*, *joint\_1* and *joint\_2* and set the values to the perpendicular joint numbers you want to calculate. Typically this would be for the X, Y and Z axes.

## 7.7 I/O Status

The I/O status contains status items for 64 I/O's. Replace the *n* with the number of the I/O. I/O numbers start at 0 and go through 63. Analog I/O returns a float. For example a QLabel with an object name of *din\_5\_lb* will show the status of the *motion.digital-in-05* HAL pin

Table 9: I/O Status Labels

| HAL Pin               | Label Name |
|-----------------------|------------|
| motion.analog-in-nn   | ain_n_lb   |
| motion.analog-out-nn  | aout_n_lb  |
| motion.digital-in-nn  | din_n_lb   |
| motion.digital-out-nn | dout_n_lb  |



---

## CHAPTER EIGHT

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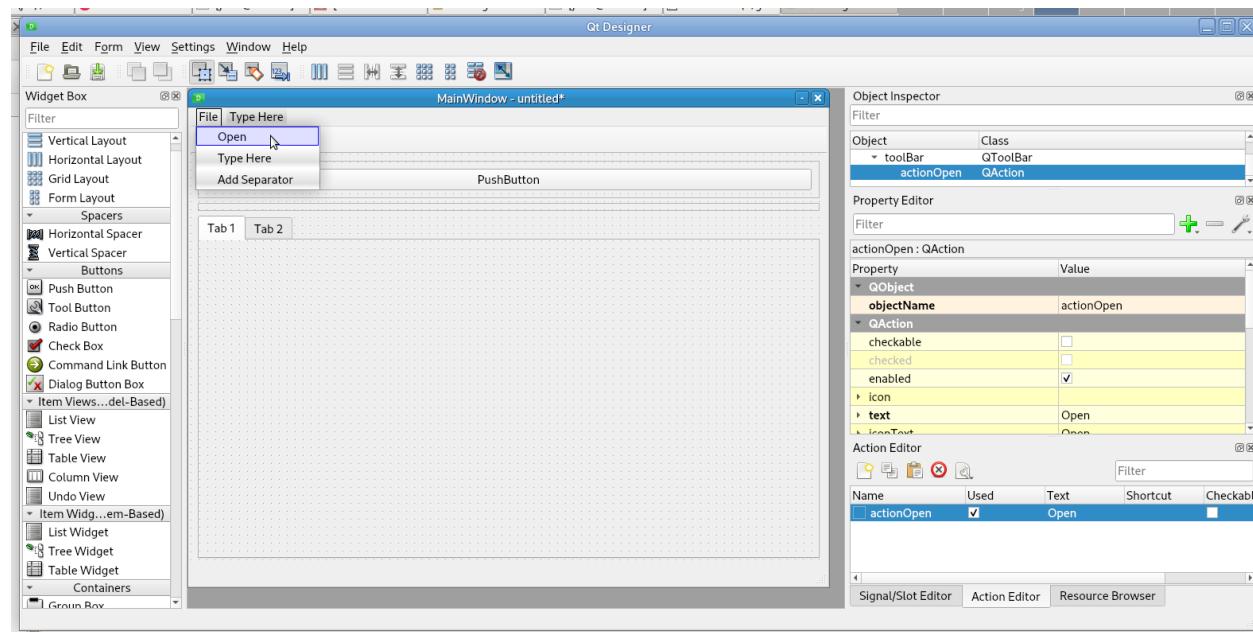
### MENU

#### Adding Menu Items Tutorial Tool Bar Buttons Tutorial

**Note:** Every menu item has a command button, so you don't need to use any menu items if you don't want to.

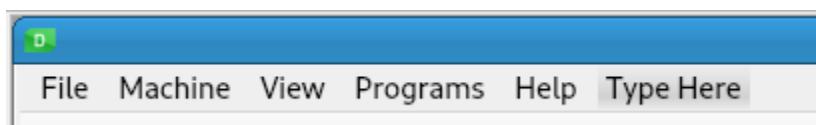
---

Adding a menu item creates an action. When you create File > Open menu, the *actionOpen* action is created.



**Warning:** If you use the full-screen option, you will not be able to exit the application if you don't have the Exit action or an Exit Push Button or Press ALT-F4 to close the GUI.

This shows the typical menu categories which are the first items in each menu. The image is from the Qt Designer.



The following table shows the menu name you type into Qt Designer and the action name that is created by the Qt Designer. Menu categories like *File* don't create an action name.

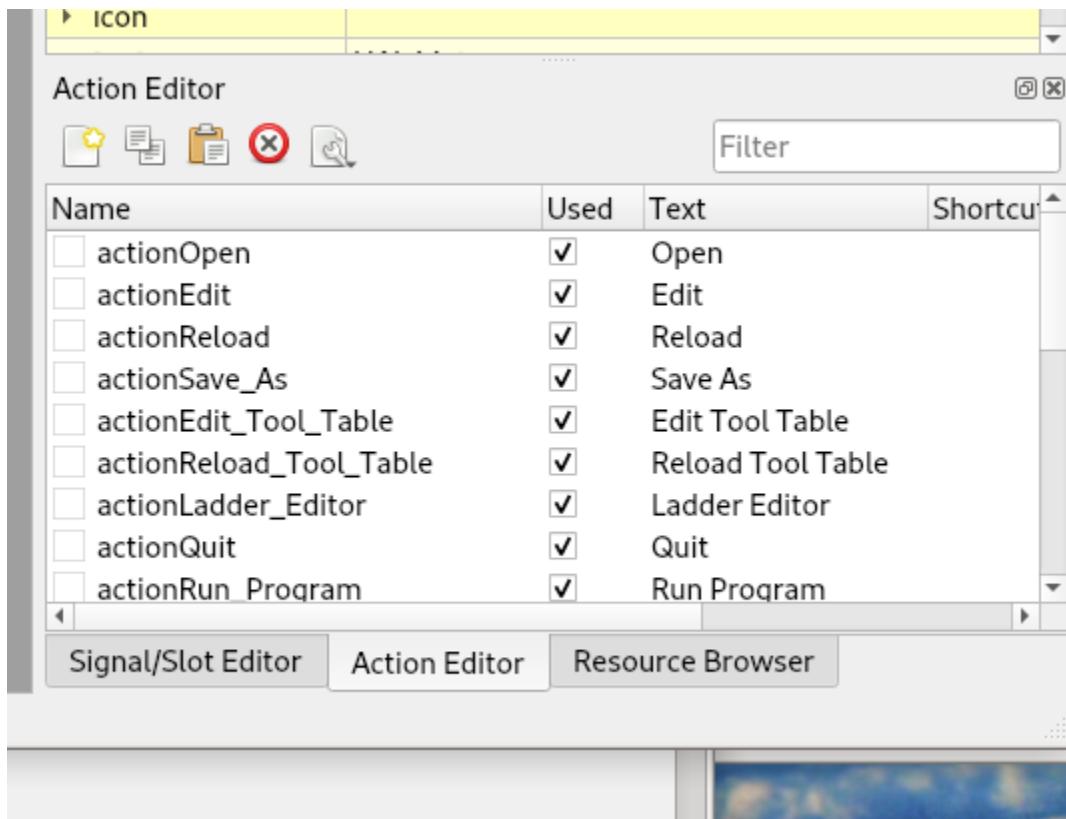
Table 1: Menu Items

| <b>File</b>       | <b>Action Name</b>                                      |
|-------------------|---|
| Open              | actionOpen  |
| Edit              | actionEdit  |
| Reload            | actionReload  |
| Save As           | actionSave_As   |
| Edit Tool Table   | actionEdit_Tool_Table                                   |
| Reload Tool Table | actionReload_Tool_Table                                 |
| Ladder Editor     | actionLadder_Editor                                     |
| Quit              | actionQuit  |
|                   |   |
| <b>Machine</b>    | <b>Action Name</b>                                      |
| E Stop            | actionE_Stop  |
| Power             | action_Power  |
| Run               | actionRun   |
| Run From Line     | actionRun_From_Line                                     |
| Step              | actionStep  |
| Pause             | actionPause   |
| Resume            | actionResume  |
| Stop              | actionStop  |
| Clear MDI History | actionClear_MDI_History                                 |
| Copy MDI History  | actionCopy_MDI_History                                  |
| Homing            | this creates a home menu item for each axis             |
| Unhomming         | this creates a unhome menu item for each axis           |
| Clear Offsets     | this creates a clear offsets for each coordinate system |
|                   |   |
| <b>Programs</b>   | <b>Action Name</b>                                      |
| Show HAL          | actionShow_HAL  |
| HAL Meter         | actionHAL_Meter   |
| HAL Scope         | actionHAL_Scope   |
|                   |   |
| <b>View</b>       | <b>Action Name</b>                                      |
| DRO               | actionDRO   |
| Limits            | actionLimits  |
| Extents Option    | actionExtents_Option                                    |
| Live Plot         | actionLive_Plot   |
| Velocity          | actionVelocity  |
| Metric Units      | actionMetric_Units                                      |
| Program           | actionProgram   |
| Rapids            | actionRapids  |
| Tool              | actionTool  |
| Lathe Radius      | actionLathe_Radius                                      |
| DTG               | actionDTG   |
| Offsets           | actionOffsets   |
| Overlay           | actionOverlay   |
| Clear Live Plot   | actionClear_Live_Plot                                   |
|                   |   |
| <b>Help</b>       | <b>Action Name</b>                                      |
| About             | actionAbout   |
| Quick Reference   | actionQuick_Reference                                   |

## 8.1 Action Names

When you add a menu item, it creates an action and the Object Name is created from the menu name automatically.

The Object Name must match the above items *exactly* in order to be discovered by Flex GUI:



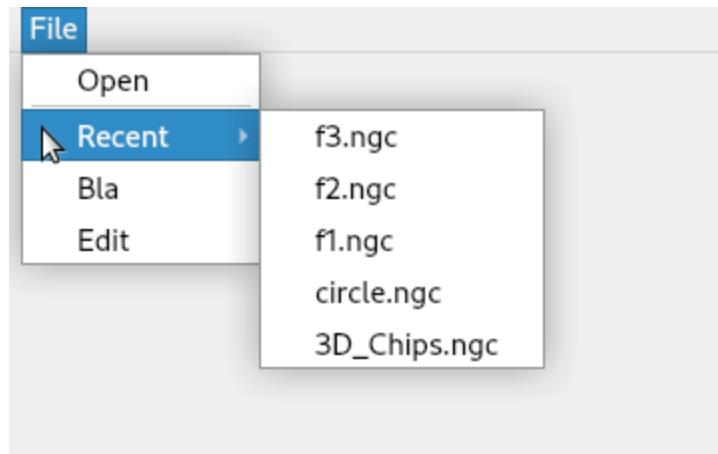
## 8.2 Recent Files

---

**Note:** The Recent menu item is added after the Open menu. There must be at least one menu item after Open for the Recent menu to be added.

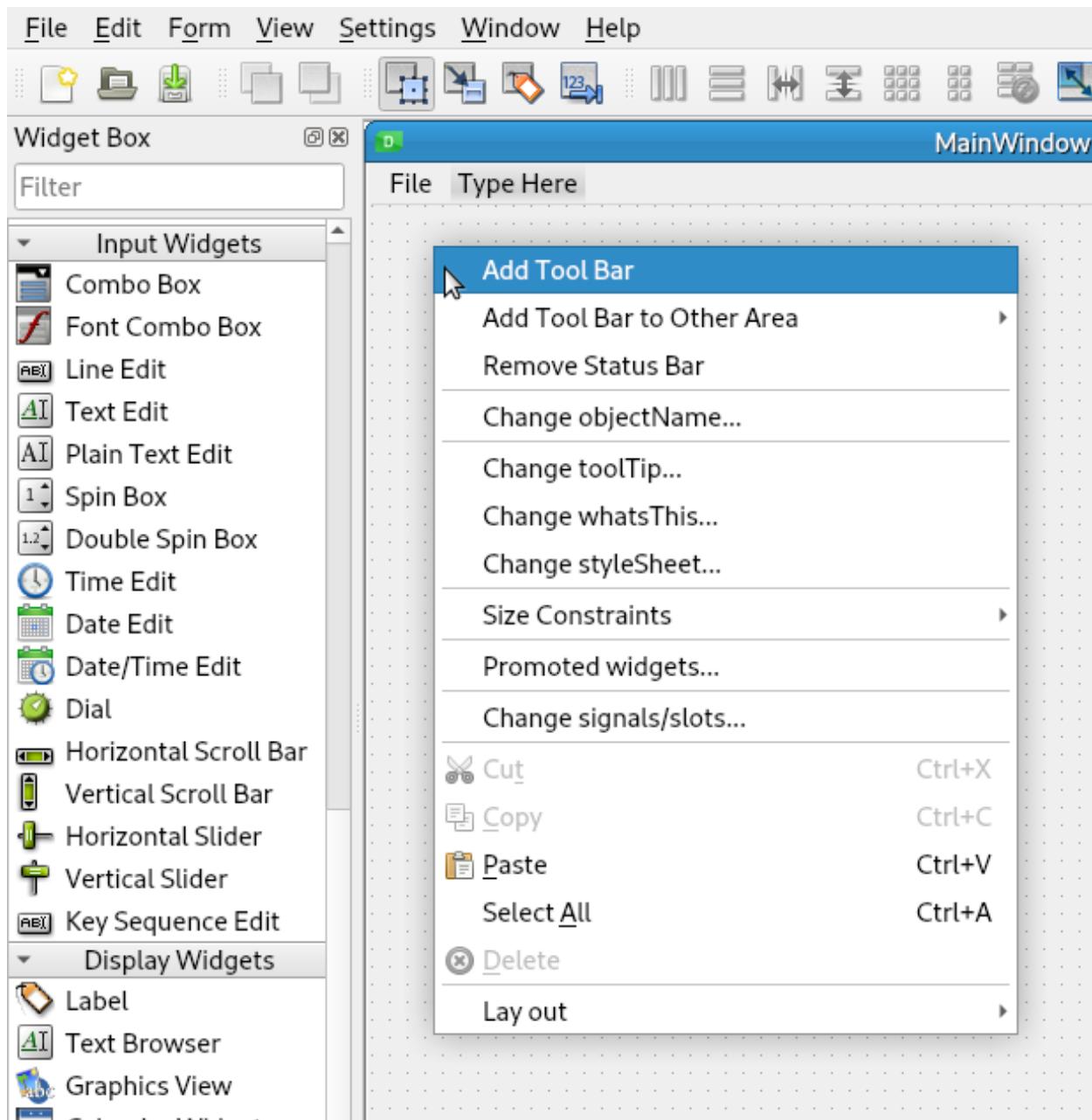
---

Location of the Recent menu after the Open menu:

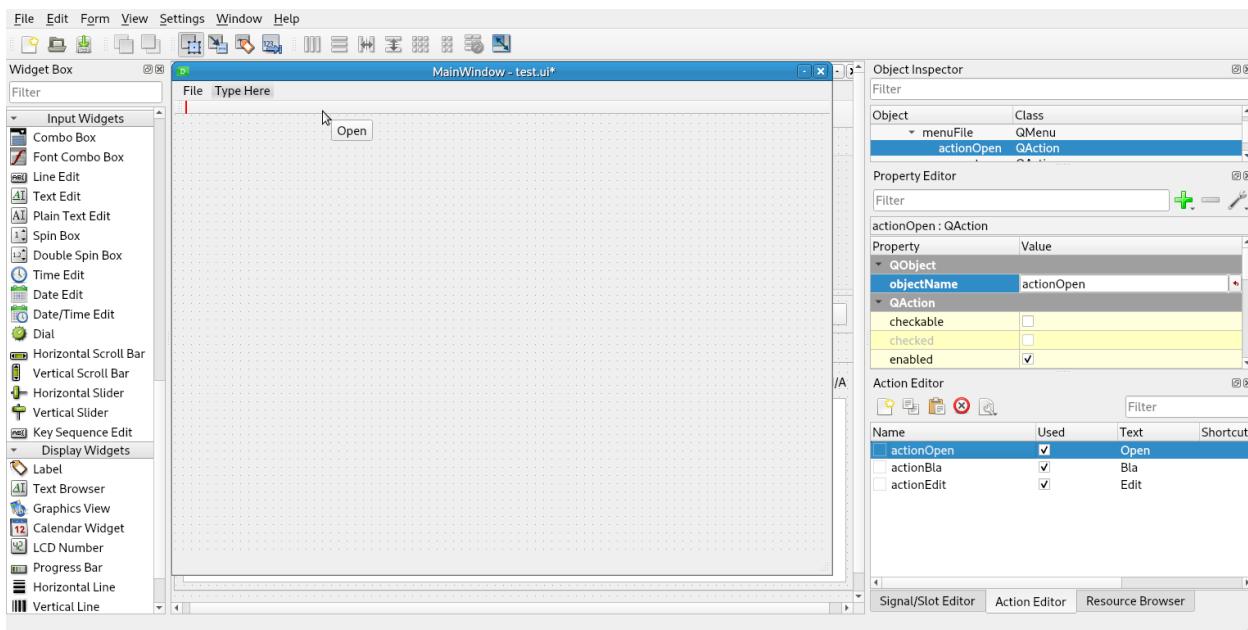


### 8.3 Tool Bars

If you right-click on the main window, you can add a Tool Bar:



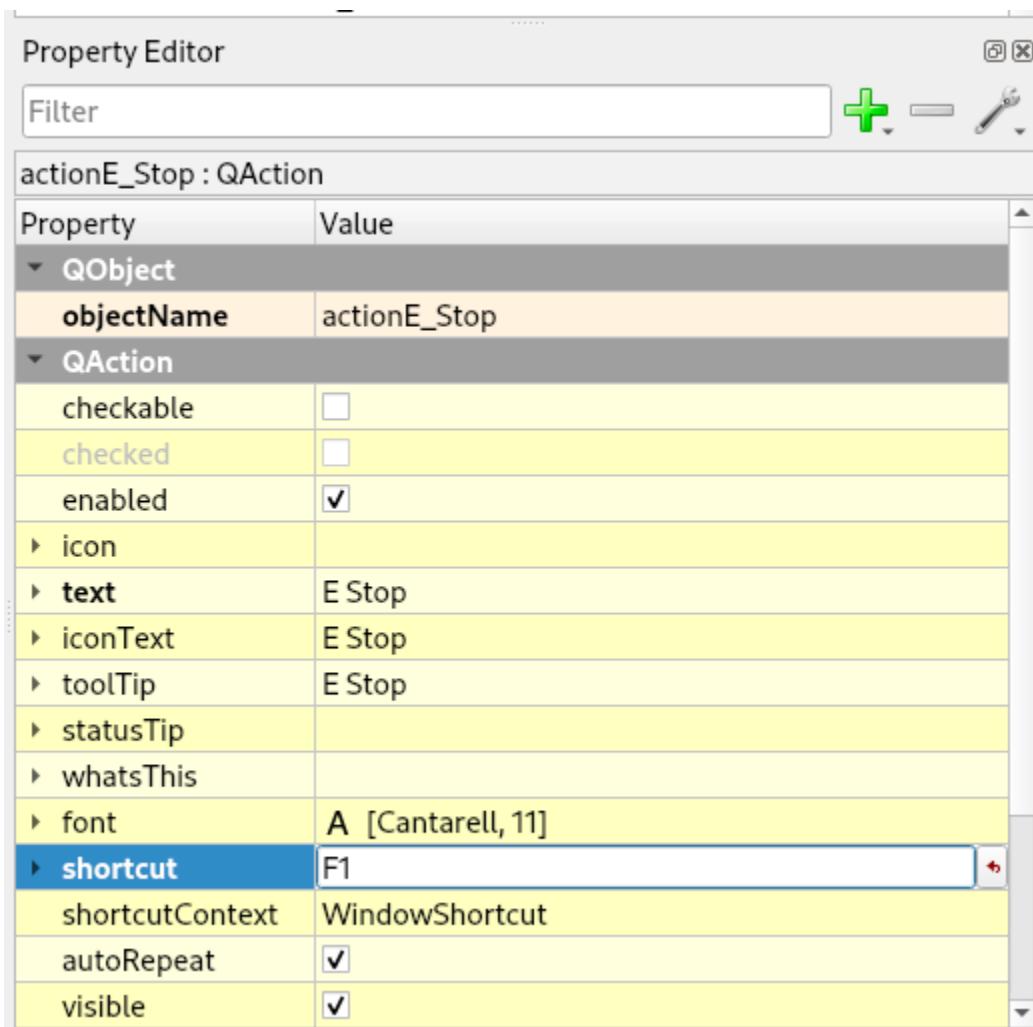
To add actions to the Tool Bar, drag them from the Action Editor and drop them in the Tool Bar:



To set the style of a Tool Bar Button, use the action name and replace action with *flex\_* for example the actionQuit would be *flex\_Quit*. See *Tool Bar Buttons* in the stylesheet examples.

## 8.4 Shortcut Keys

Shortcut keys can be added in the Property Editor by clicking in the shortcut Value box and pressing the key or key combination you want to use. You can change text, icon Text, or tool Tip also.



**Note:** A toolTip can be handy, however they might not work on touchscreens.



## CONTROLS

Command Buttons Tutorial Home Controls Tutorial

### 9.1 Push Buttons

Controls are QPushButtons that can be placed anywhere you like. Use the Name from the list below for each control widget objectName. Replace the (0-8) with the joint number or axis index. More controls are in [Tools](#).

Table 1: Control Push Buttons

| Control Function          | Object Name           |
|---------------------------|-----------------------|
| Open a G-code File        | open_pb               |
| Edit a G-code File        | edit_pb               |
| Reload a G-code File      | reload_pb             |
| Edit Tool Table           | edit_tool_table_pb    |
| Edit Ladder               | edit_ladder_pb        |
| Reload Tool Table         | reload_tool_table_pb  |
| Save                      | save_pb               |
| Save As a New Name        | save_as_pb            |
| Quit the Program          | quit_pb               |
| E-Stop Toggle             | estop_pb              |
| Power Toggle              | power_pb              |
| Run a Loaded G-code File  | run_pb                |
| Run From Line             | run_from_line_pb      |
| Step one Logical Line     | step_pb               |
| Pause a Running Program   | pause_pb              |
| Resume a Paused Program   | resume_pb             |
| Stop a Running Program    | stop_pb               |
| Home All Joints           | home_all_pb           |
| Home a Joint (0-8)        | home_pb_(0-8)         |
| Unhome All Joints         | unhome_all_pb         |
| Unhome a Joint (0-8)      | unhome_pb_(0-8)       |
| Zero an Axis              | zero_(axis letter)_pb |
| Manual Mode               | manual_mode_pb        |
| Flood Toggle              | flood_pb              |
| Mist Toggle               | mist_pb               |
| Clear Error History       | clear_errors_pb       |
| Copy Error History        | copy_errors_pb        |
| Clear Information History | clear_info_pb         |

continues on next page

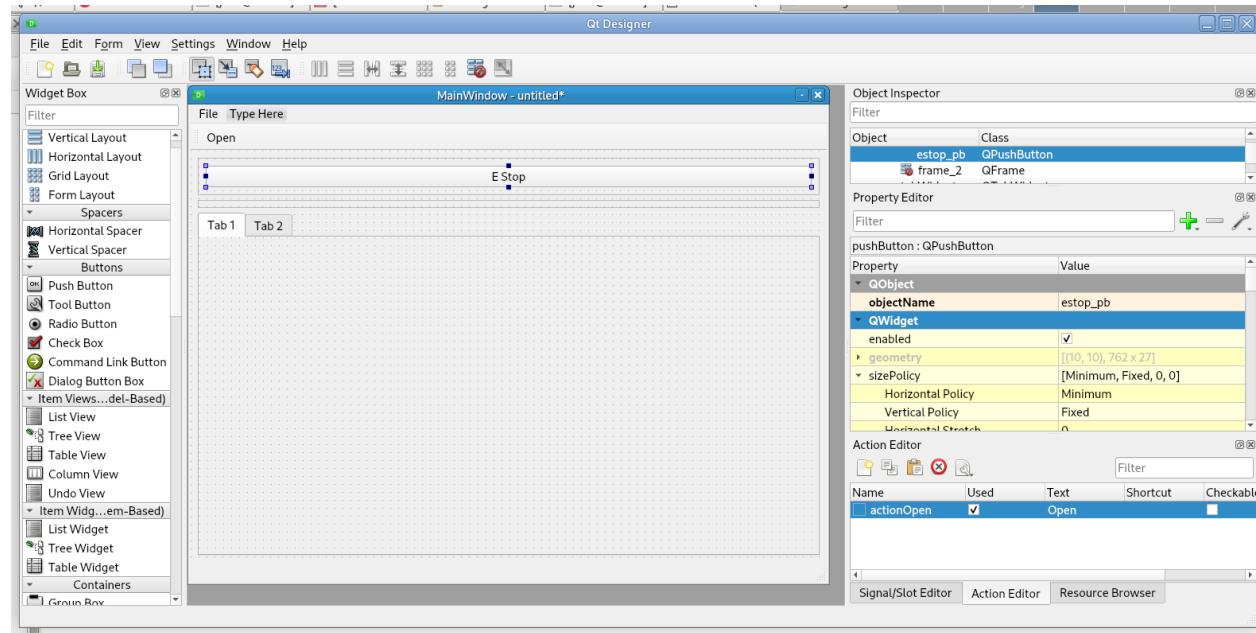
Table 1 – continued from previous page

|                 |                    |
|-----------------|--------------------|
| Show HAL        | show_hal_pb        |
| HAL Meter       | hal_meter_pb       |
| HAL Scope       | hal_scope_pb       |
| Help About      | about_pb           |
| Quick Reference | quick_reference_pb |

---

**Note:** You don't have to use any of these controls; Flex GUI is flexible.

---



---

**Note:** Touch-Off buttons require a Double Spin Box named *touchoff\_dsb*

---

---

**Note:** Tool-Touch-Off buttons require a Double Spin Box named *tool\_touchoff\_dsb*

---

## 9.2 Touch-Off Spin Boxes

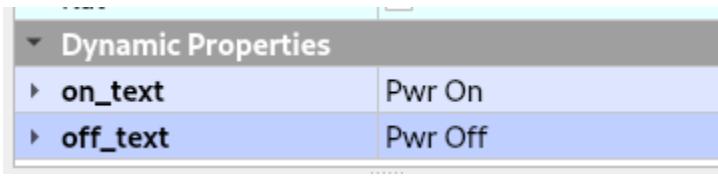
|                      |                   |
|----------------------|-------------------|
| Touch Off Value      | touchoff_dsb      |
| Tool Touch Off Value | tool_touchoff_dsb |

## 9.3 E Stop and Power

The E Stop push button Open/Closed state text can be set by adding two string type Dynamic Properties *open\_text* and *closed\_text*. The text in those two properties will be used if found. See *Dynamic Properties*



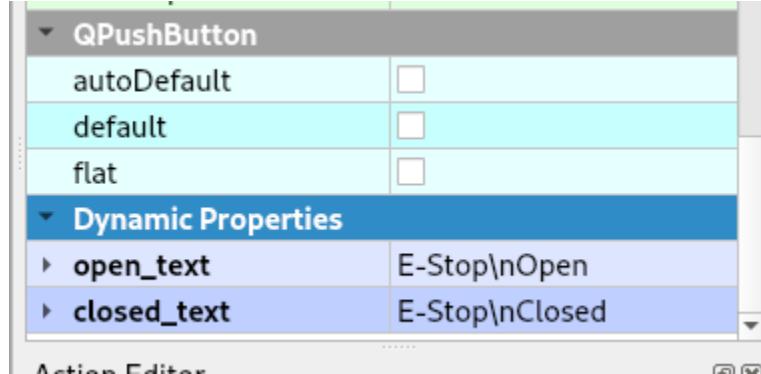
The Power push button On/Off state text can be set by adding two string type Dynamic Properties *on\_text* and *off\_text*. The text in those two properties will be used if found. The default text is *Power Off* and *Power On*.



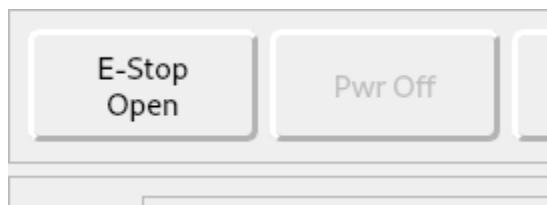

---

**Note:** To have two words be above and below insert a \n between the words.

---



This is how the above looks in the GUI



## 9.4 LED Buttons

---

**Important:** This is implemented in version 1.2.0.

---

Some push buttons can have a LED to indicate on and off states. The LED is added to the push button with a Bool type Dynamic Property called *led\_indicator*.

Table 2: LED Buttons

| Control Name | Object Name       | Function                                    |
|--------------|-------------------|---|
| Save         | save_pb           | NC Code Save Button                         |
| Reload       | reload_pb         | Reload NC Code from current file            |
| E Stop       | estop_pb          | E Stop Toggle Button                        |
| Power        | power_pb          | Power Toggle Button                         |
| Run          | run_pb            | Runs a loaded NC file                       |
| Pause        | pause_pb          | Pauses a running NC file                    |
| Manual Mode  | manual_mode_pb    | Puts the control into Manual Mode           |
| MDI Mode     | mdi_mode_pb       | Puts the control into MDI Mode              |
| Flood        | flood_pb          | Turns on the flood coolant                  |
| Mist         | mist_pb           | Turns on the mist coolant                   |
| Probe Enable | probing_enable_pb | Enables Probing and disables other controls |

Adding the Bool type Dynamic Property *led\_indicator* to one of the above control buttons will add the default LED to that button. Each control button can have different options.

Table 3: LED Button Dynamic Properties

| Property Name    | Type  | Function                                      |
|------------------|-------|---|
| led_indicator    | Bool  | Creates a LED                                 |
| led_diameter     | Int   | Sets the Diameter of the LED in pixels        |
| led_right_offset | Int   | Sets the offset from the right edge in pixels |
| led_top_offset   | Int   | Sets the offset from the top edge in pixels   |
| led_on_color     | Color | Sets the color of the LED when on             |
| led_off_color    | Color | Sets the color of the LED when off            |

To change the LED default options they can be set in the INI file. See [LED Defaults](#)

---

**Tip:** A space after the button text gives more room for the LED

---

## 9.5 Coordinate System Controls

A QPushButton can be used to clear the current coordinate system by using 0 as the index or any one of the 9 coordinate systems with (1-9).

To clear the G92 coordinate system use 10 as the index.

Table 4: Coordinate System Buttons

| Control Function            | Object Name       |
|-----------------------------|-------------------|
| Clear Current G5x           | clear_coord_0     |
| Clear G5x Coordinate System | clear_coord_(1-9) |
| Clear G92 Coordinate System | clear_coord_10    |

## 9.6 Options

The QPushButton options are toggle-type buttons; press to turn on, press again to turn off. They are normal push buttons but Flex automatically makes them *checkboxable*.

Table 5: Options

| Function                             | Widget      | Name             |
|--------------------------------------|-------------|------------------|
| Flood Toggle                         | QPushButton | flood_pb         |
| Mist Toggle                          | QPushButton | mist_pb          |
| Optional Stop at M1                  | QPushButton | optional_stop_pb |
| Block Delete line that starts with / | QPushButton | block_delete_pb  |
| Feed Override Enable/Disable         | QPushButton | feed_override_pb |

## 9.7 Axis Index

```
X 0
Y 1
Z 2
A 3
B 4
C 5
U 6
V 7
W 8
```

## 9.8 Jog Controls

### Jog Controls Tutorial

Jogging requires a *Jog Velocity Slider* and *Jog Mode Selector*. If either is not found, Jog Buttons will be disabled.

Table 6: Jog Widgets

| Function             | Widget      | Name               |
|----------------------|-------------|--------------------|
| Jog Plus Axis (0-8)  | QPushButton | jog_plus_pb_(0-8)  |
| Jog Minus Axis (0-8) | QPushButton | jog_minus_pb_(0-8) |
| Jog Velocity Slider  | QSlider     | jog_vel_sl         |
| Jog Velocity Label   | QLabel      | jog_vel_lb         |
| Jog Mode Selector    | QComboBox   | jog_modes_cb       |

---

**Note:** Jog Plus/Minus buttons use the *Axis Index*. So *Jog Y Plus* is *jog\_plus\_pb\_1*.

---

---

**Note:** *Jog Mode Selector* reads the ini entry [DISPLAY] INCREMENTS and if not found, only *Continuous* will be an option.

---

## 9.9 Jog Selected Controls

To add Axis style jog controls where you select an axis then the plus/minus buttons jog the selected axis add a QRadioButton for each axis and a QPushButton for Plus and Minus. Axes are 0-8 for X, Y, Z, A, B, C, U, V, W.

Table 7: Jog Selected Widgets

| Function          | Widget       | Name               |
|-------------------|--------------|--------------------|
| Axis Select (0-8) | QRadioButton | axis_select_(0-8)  |
| Jog Plus          | QPushButton  | jog_selected_plus  |
| Jog Minus         | QPushButton  | jog_selected_minus |

## 9.10 Overrides

### Overrides Tutorial

A QSlider is used to control the following functions and the corresponding label shows the value of the slider:

Table 8: Overrides

| Function                 | Widget    | Object Name           |
|--------------------------|-----------|-----------------------|
| Feed Override Slider     | QSlider   | feed_override_sl      |
| Feed Override Percent    | QLabel    | feed_override_lb      |
| Rapid Override Slider    | QSlider   | rapid_override_sl     |
| Rapid Override Percent   | QLabel    | rapid_override_lb     |
| Spindle Override Slider  | QSlider   | spindle_override_sl   |
| Spindle Override Percent | QLabel    | spindle_override_0_lb |
| Maximum Velocity         | QSlider   | max_vel_sl            |
| Override Limits          | QCheckBox | override_limits_cb    |

The following settings can be used in the DISPLAY section of the ini file:

|                          |                      |
|--------------------------|----------------------|
| Feed Override maximum    | MAX_FEED_OVERRIDE    |
| Spindle Override maximum | MAX_SPINDLE_OVERRIDE |

## 9.11 Override Presets

Feed, Rapid and Spindle overrides can have a preset button(s) for different preset amounts. Replace the nnn with the percent of override you want that button to use.

Table 9: Override Presets

| Function                | Widget      | Object Name         |
|-------------------------|-------------|---------------------|
| Feed Override Preset    | QPushButton | feed_percent_nnn    |
| Rapid Override Preset   | QPushButton | rapid_percent_nnn   |
| Spindle Override Preset | QPushButton | spindle_percent_nnn |

---

**Note:** The maximum override for Rapid is 100

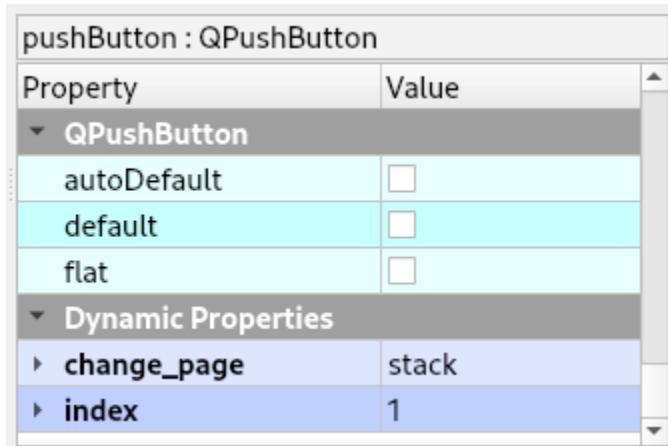
---

## 9.12 Stacked Widget

To change to a specific page on a QStackedWidget add a QPushButton on each page and set a couple of Dynamic Properties. See [Dynamic Properties](#)

Table 10: Stacked Widget Change Page

| Dynamic Property Name | Value                      |
|-----------------------|----------------------------|
| change_page           | QStackedWidget Object Name |
| index                 | index of page to change to |



To create a Next Page and Previous Page buttons for a QStackedWidget add two QPushButtons with the following Dynamic Properties. See [Dynamic Properties](#)

Table 11: Stacked Widget Next/Previous Page

| Button Function | Dynamic Property Name | Value                      |
|-----------------|-----------------------|----------------------------|
| Next Page       | next_page             | QStackedWidget Object Name |
| Previous Page   | previous_page         | QStackedWidget Object Name |

---

**Note:** The Forward and Backward Buttons should not be in the QStackedWidget

---

## Plotter Tutorial

To add a live G-code plotter, add a QWidget or QFrame and name it *plot\_widget*.

### 10.1 Controls

If you're using a touch-screen, add pan, zoom, and rotate controls for the plotter

Table 1: Display Controls

| Control           | Widget      | Object Name          |
|-------------------|-------------|----------------------|
| Rotate View Up    | QPushButton | view_rotate_up_pb    |
| Rotate View Down  | QPushButton | view_rotate_down_pb  |
| Rotate View Left  | QPushButton | view_rotate_left_pb  |
| Rotate View Right | QPushButton | view_rotate_right_pb |
| Pan View Up       | QPushButton | view_pan_up_pb       |
| Pan View Down     | QPushButton | view_pan_down_pb     |
| Pan View Left     | QPushButton | view_pan_left_pb     |
| Pan View Right    | QPushButton | view_pan_right_pb    |
| Zoom View In      | QPushButton | view_zoom_in_pb      |
| Zoom View Out     | QPushButton | view_zoom_out_pb     |

The following controls set-predefined views

Table 2: Display Views

| Control          | Widget      | Object Name |
|------------------|-------------|-------------|
| View Perspective | QPushButton | view_p_pb   |
| View X           | QPushButton | view_x_pb   |
| View Y           | QPushButton | view_y_pb   |
| View Y2          | QPushButton | view_y2_pb  |
| View Z           | QPushButton | view_z_pb   |
| View Z2          | QPushButton | view_z2_pb  |

To clear the Live plot

Table 3: Display Functions

| Control         | Widget      | Name          |
|-----------------|-------------|---------------|
| Clear Live Plot | QPushButton | view_clear_pb |

## 10.2 Display

The DRO overlaid onto the plotter can be customized by turning on or off various features. Use either a QCheckbox or a QPushButton to toggle these

Table 4: Display Checkbox Options

| Function            | Widget    | Object Name            |
|---------------------|-----------|------------------------|
| View DRO            | QCheckBox | view_dro_cb            |
| View Machine Limits | QCheckBox | view_limits_cb         |
| View Extents Option | QCheckBox | view_extents_option_cb |
| View Live Plot      | QCheckBox | view_live_plot_cb      |
| View Velocity       | QCheckBox | view_velocity_cb       |
| Use Metric Units    | QCheckBox | view_metric_units_cb   |
| View Program        | QCheckBox | view_program_cb        |
| View Rapids         | QCheckBox | view_rapids_cb         |
| View Tool           | QCheckBox | view_tool_cb           |
| View Lathe Radius   | QCheckBox | view_lathe_radius_cb   |
| View Distance to Go | QCheckBox | view_dtg_cb            |
| View Offsets        | QCheckBox | view_offsets_cb        |
| View Overlay        | QCheckBox | view_overlay_cb        |

Table 5: Display PushButton Options

| Function            | Widget      | Object Name            |
|---------------------|-------------|------------------------|
| View DRO            | QPushButton | view_dro_pb            |
| View Machine Limits | QPushButton | view_limits_pb         |
| View Extents Option | QPushButton | view_extents_option_pb |
| View Live Plot      | QPushButton | view_live_plot_pb      |
| View Velocity       | QPushButton | view_velocity_pb       |
| Use Metric Units    | QPushButton | view_metric_units_pb   |
| View Program        | QPushButton | view_program_pb        |
| View Rapids         | QPushButton | view_rapids_pb         |
| View Tool           | QPushButton | view_tool_pb           |
| View Lathe Radius   | QPushButton | view_lathe_radius_pb   |
| View Distance to Go | QPushButton | view_dtg_pb            |
| View Offsets        | QPushButton | view_offsets_pb        |
| View Overlay        | QPushButton | view_overlay_pb        |

---

**Note:** Don't set the checked property to checked in Qt Designer as this is already handled in the code. Once you check an option it is remembered.

---

## 10.3 Menu

The following menu items can set display options. *Menu Name* is what you type when creating the Menu, then press enter. All the items are checkbox type menu items that stay coordinated with the checkbox of the same option.

Table 6: Plot Menu Options

| Function            | Menu Name      | Object Name          |
|---------------------|----------------|----------------------|
| View DRO            | DRO            | actionDRO            |
| View Machine Limits | Limits         | actionLimits         |
| View Extents Option | Extents Option | actionExtents_Option |
| View Live Plot      | Live Plot      | actionLive_Plot      |
| View Velocity       | Velocity       | actionVelocity       |
| Use Metric Units    | Metric Units   | actionMetric_Units   |
| View Program        | Program        | actionProgram        |
| View Rapids         | Rapids         | actionRapids         |
| View Tool           | Tool           | actionTool           |
| View Lathe Radius   | Lathe Radius   | actionLathe_Radius   |
| View Distance to Go | DTG            | actionDTG            |
| View Offsets        | Offsets        | actionOffsets        |
| View Overlay        | Overlay        | actionOverlay        |

---

**Note:** Once a view selection has been set, Flex GUI remembers it.

---

The live plot can be cleared from the menu with this menu item.

Table 7: Plot Menu

| Function        | Menu Name       | Object Name           |
|-----------------|-----------------|-----------------------|
| Clear Live Plot | Clear Live Plot | actionClear_Live_Plot |

## 10.4 DRO

The font size can be set in the ini file by adding in the [DISPLAY] section DRO\_FONT\_SIZE = n where n is an integer. The default size is 12.



## MANUAL DATA INPUT (MDI)

MDI Tutorial

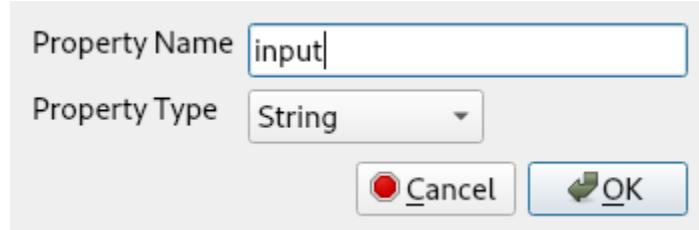
### 11.1 MDI Interface

The MDI Interface uses a QLineEdit named *mdi\_command\_le* to enter commands.

For touch screens there are two options a *NC Popup* is a touch screen that has G and M words and a number keypad or a *Keyboard Popup* has a full keyboard.

To enable a popup add a Dynamic string type Property to the *mdi\_command\_le* QLineEdit and name it *input* and set the value to either *nccode* or *keyboard*.

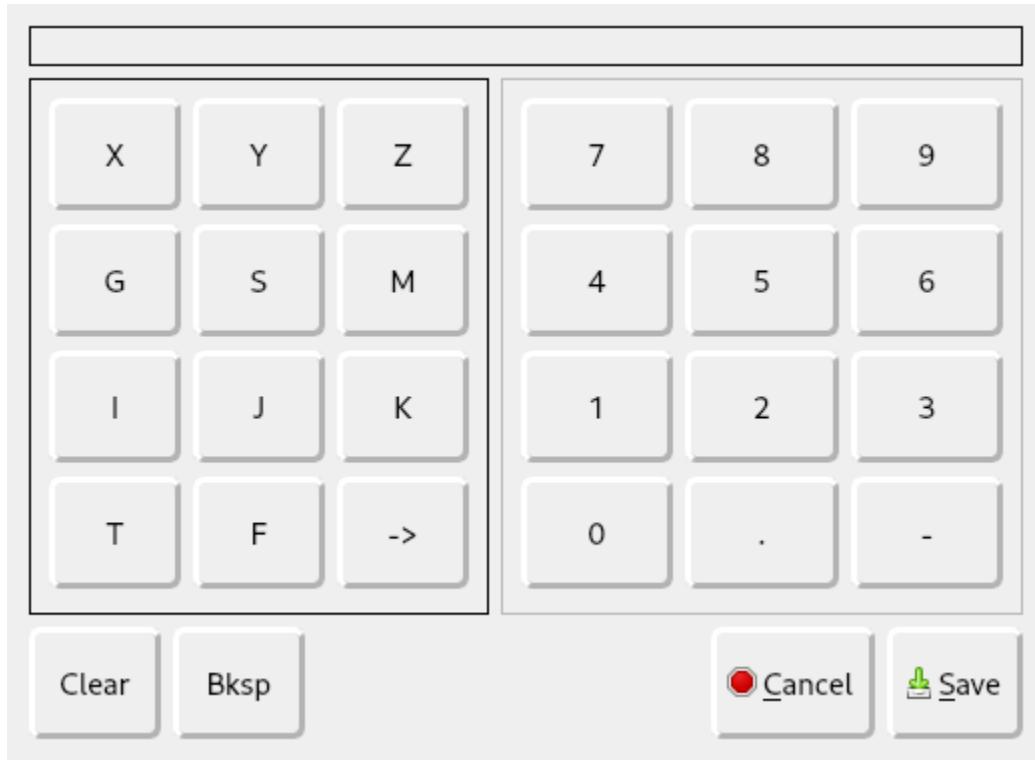
Dynamic Property



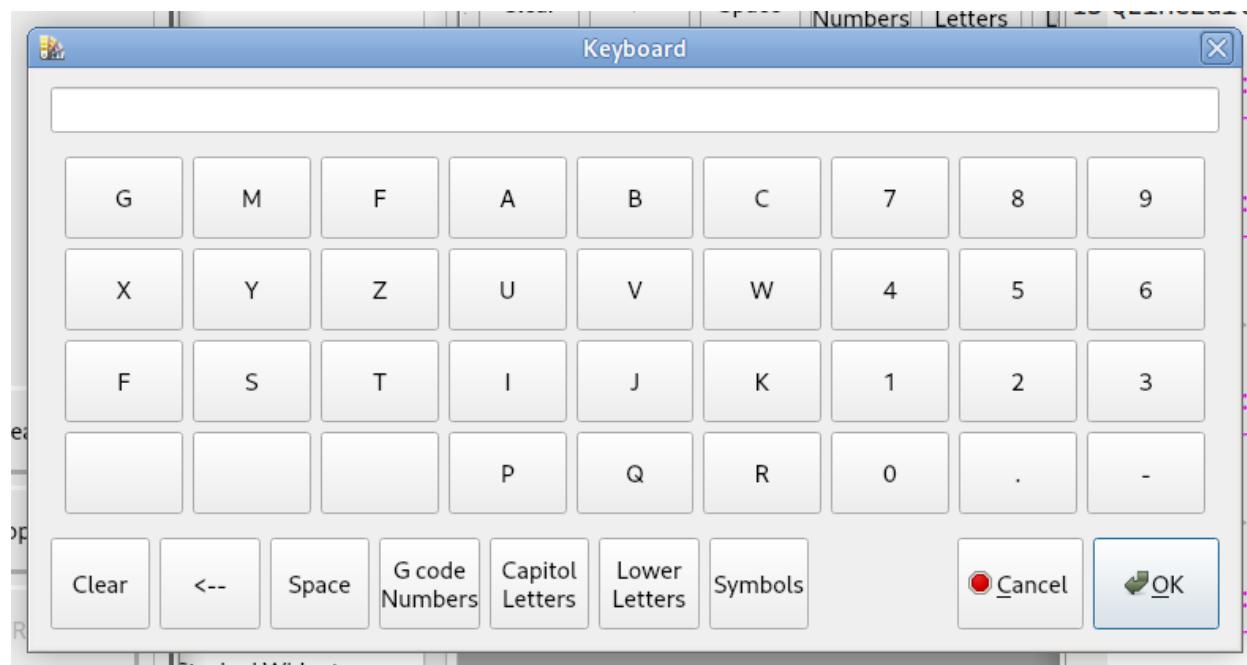
Setting the value

| mdi_command_le : QLineEdit |                          |
|----------------------------|--------------------------|
| Property                   | Value                    |
| Horizontal                 | AlignLeft                |
| Vertical                   | AlignVCenter             |
| dragEnabled                | <input type="checkbox"/> |
| readOnly                   | <input type="checkbox"/> |
| placeholderText            |                          |
| cursorMoveStyle            | LogicalMoveStyle         |
| clearButtonEnabled         | <input type="checkbox"/> |
| Dynamic Properties         |                          |
| input                      | gcode                    |

NC code popup window



Keyboard popup window



## 11.2 MDI History

MDI history uses a QListWidget named *mdi\_history\_lw* to display the MDI history. You can click on a line in the history display to copy the command to the MDI Interface, ready for running.



The MDI history is kept in a file named *mdi\_history.txt* in the configuration directory.

## 11.3 MDI Controls

The following QPushButtons can be used to execute, copy, and clear MDI command history

Table 1: MDI Push Buttons

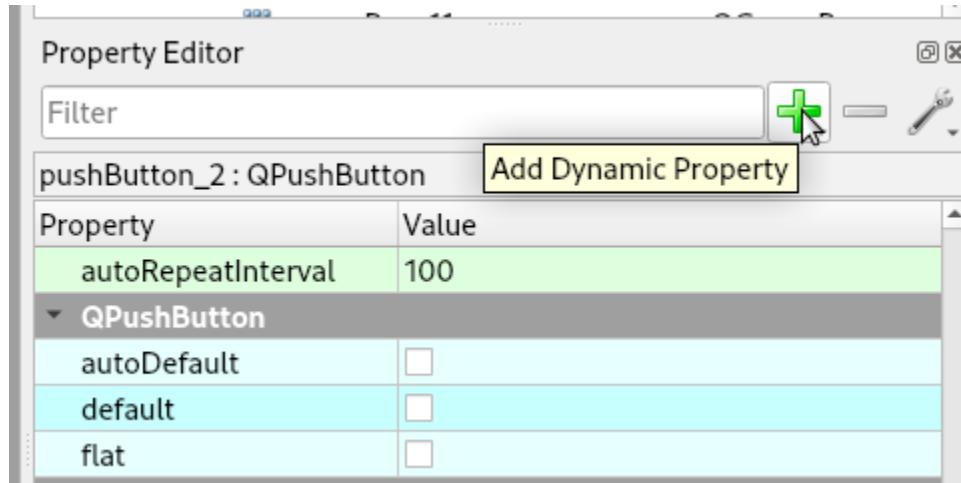
| Function                              | Widget      | Object Name          |
|---------------------------------------|-------------|----------------------|
| Run MDI Command                       | QPushButton | run_mdi_pb           |
| Copy the MDI History to the Clipboard | QPushButton | copy_mdi_history_pb  |
| Save the MDI History to a file        | QPushButton | save_mdi_history_pb  |
| Clear the MDI History                 | QPushButton | clear_mdi_history_pb |

## 11.4 MDI Button

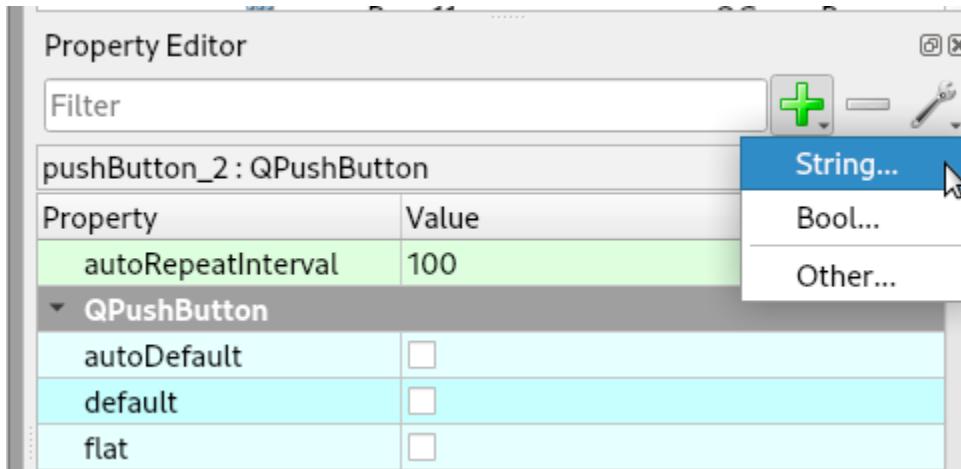
MDI buttons execute a MDI command when the button is pressed. These are created by adding two dynamic properties called *function* and *command* to a QPushButton.

**Note:** If the *command* property is not found, the button will not be enabled!

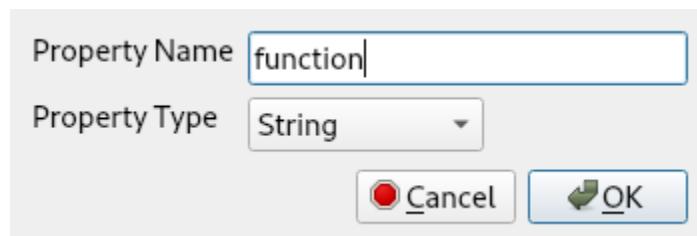
Select the button then create a dynamic property by pressing the green plus sign in the Property Editor



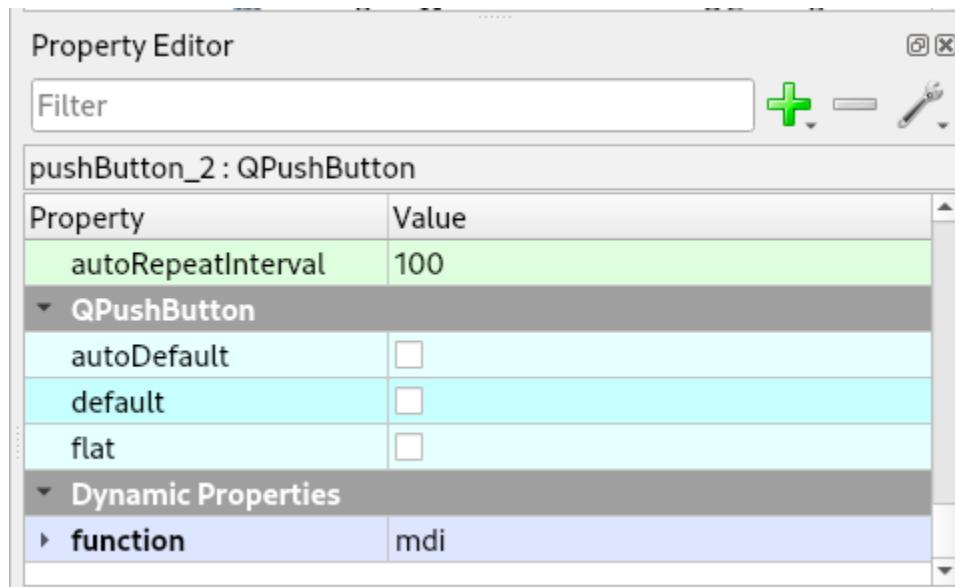
Then select *string*:



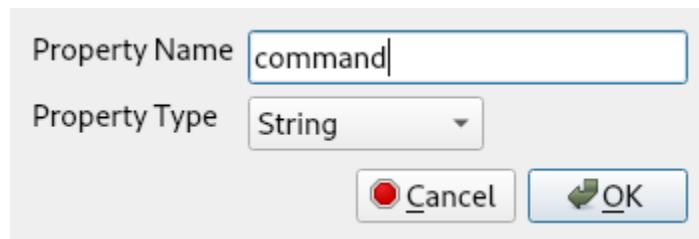
Name the property *function* and click OK



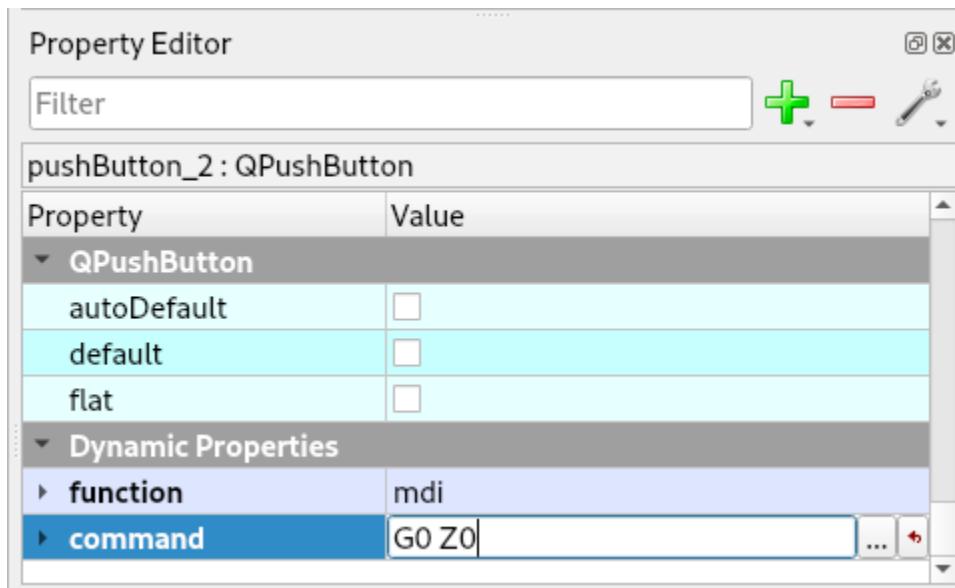
Set the value of the property to *mdi*



Add a property called *command*



Set the value of the property to your valid MDI command





---

CHAPTER  
TWELVE

---

SPINDLE

Video Tutorial

## 12.1 Spindle Status

Spindle status labels show the current status of the item.

Table 1: Spindle Status Labels

| Control Function         | Object Type | Object Name                   |
|--------------------------|-------------|-------------------------------|
| Spindle Brake            | QLabel      | spindle_brake_0_lb            |
| Spindle Direction        | QLabel      | spindle_direction_0_lb        |
| Spindle Enabled          | QLabel      | spindle_enabled_0_lb          |
| Spindle Override Enabled | QLabel      | spindle_override_enabled_0_lb |
| Spindle Commanded Speed  | QLabel      | spindle_speed_0_lb            |
| Spindle Speed LCD        | QLCDNumber  | spindle_speed_0_lcd           |
| Spindle Override Percent | QLabel      | spindle_override_0_lb         |
| Spindle Homed            | QLabel      | spindle_homed_0_lb            |
| Spindle Orient State     | QLabel      | spindle_orient_state_0_lb     |
| Spindle Orient Fault     | QLabel      | spindle_orient_fault_0_lb     |
| Current S word Setting   | QLabel      | settings_speed_lb             |
| Spindle Actual Speed     | QLabel      | spindle_actual_speed_lb       |

---

**Note:** Spindle Commanded Speed does not show override. Spindle Actual Speed is actual speed including override.

---

---

**Note:** The digitCount property of the LCD must be large enough to display the whole number.

---

On start-up, Flex will check for the following items in the [SPINDLE\_0] section of the .ini file

If *INCREMENT* is not found, Flex will look in the .ini [DISPLAY] section for *SPINDLE\_INCREMENT* and if not there will default the increment to 10 for spindle faster/slower control buttons and sindle step for the QSpinBox.

If *MIN\_FORWARD\_VELOCITY* is found, it will be used to set the QSpinBox minimum setting. If not found, the minimum setting will be 0.

If *MAX\_FORWARD\_VELOCITY* is found, it will set the QSpinBox maximum setting. If not found, the maximum setting will be 1000.

*INCREMENT* will also set the QSpinBox single step when using the up/down arrows.

## 12.2 Spindle Controls

The following items control the spindle on/off direction and speed

Table 2: Spindle Status Labels

| Control Function | Object Type | Object Name      |
|------------------|-------------|------------------|
| Spindle Forward  | QPushButton | spindle_fwd_pb   |
| Spindle Reverse  | QPushButton | spindle_rev_pb   |
| Spindle Stop     | QPushButton | spindle_stop_pb  |
| Spindle Faster   | QPushButton | spindle_plus_pb  |
| Spindle Slower   | QPushButton | spindle_minus_pb |
| Spindle Speed    | QSpinBox    | spindle_speed_sb |

---

**Note:** The spindle can not be started with a spindle speed of zero.

---

## 12.3 Spindle Overrides

The spindle speed override is set using a QSlider. See the Status Labels above for spindle override status labels.

Table 3: Spindle Override

| Control Function | Object Type | Object Name         |
|------------------|-------------|---------------------|
| Spindle Override | QSlider     | spindle_override_sl |

## PARAMETERS

Parameter values in the var file can be set and watched for changes.

### 13.1 Setting Parameters

To set a user parameter value in the var file with a QDoubleSpinBox add a couple of string type Dynamic Properties. See *Dynamic Properties* The parameters 31 - 5000 are available for use in NC code programs. Replace *nnnn* with the variable number.

```
function set_var
variable `nnnn`
```

| doubleSpinBox : QDoubleSpinBox |                 |
|--------------------------------|-----------------|
| Property                       | Value           |
| suffix                         |                 |
| decimals                       | 2               |
| minimum                        | 0.000000        |
| maximum                        | 99.990000       |
| singleStep                     | 1.000000        |
| stepType                       | DefaultStepType |
| value                          | 0.000000        |
| ▼ Dynamic Properties           |                 |
| ▶ function                     | set_var         |
| ▶ variable                     | 1000            |

The user parameter must be in the var file. On startup Flex reads the var file and sets the value of the QDoubleSpinBox to that value. When you change the value of the QDoubleSpinBox the var file is updated with the new value. There is a 0.5 second timeout before the var file is updated to give time to type in a number.

The configuration must be out of E-Stop, Power On and Homed before the QDoubleSpinBox is enabled.

## 13.2 Watching Parameters

To watch the value of a user parameter a QLabel can be used with the following string type Dynamic Properties. See *Dynamic Properties*

```
function watch_var
variable `nnnn`
```

| label_45 : QLabel      |                                     |
|------------------------|-------------------------------------|
| Property               | Value                               |
| Vertical               | AlignVCenter                        |
| wordWrap               | <input checked="" type="checkbox"/> |
| margin                 | 0                                   |
| indent                 | -1                                  |
| openExternalLinks      | <input checked="" type="checkbox"/> |
| ▶ textInteractionFlags | LinksAccessibleBy...                |
| buddy                  |                                     |
| ▼ Dynamic Properties   |                                     |
| ▶ function             | watch_var                           |
| ▶ variable             | 1000                                |

The value is updated at startup and any time the var file is updated.

The default precision for a parameter value is 6, to change the precision add a Dynamic Property called *precision* and set the value to the number of digits after the dot.

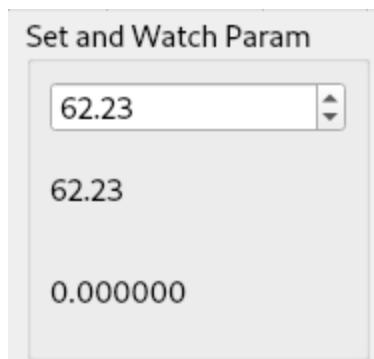
| label_45 : QLabel      |                                     |
|------------------------|-------------------------------------|
| Property               | Value                               |
| wordWrap               | <input checked="" type="checkbox"/> |
| margin                 | 0                                   |
| indent                 | -1                                  |
| openExternalLinks      | <input checked="" type="checkbox"/> |
| ▶ textInteractionFlags | LinksAccessibleBy...                |
| buddy                  |                                     |
| ▼ Dynamic Properties   |                                     |
| ▶ function             | watch_var                           |
| ▶ variable             | 1000                                |
| ▶ precision            | 2                                   |

---

**Note:** The var file is not updated until the end of a NC file.

---

Example of setting and watching parameters





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CHAPTER  
FOURTEEN

---

## PYTHON MODULE

### Python Import Tutorial

To import a python module add the following to the INI [FLEXGUI] section using the name of the python file without the.py extension. The file name must be unique and can not be any python module name. You can have as many imports as you need to simplify your code.

```
[FLEXGUI]
IMPORT_PYTHON = testpy
```

---

**Note:** The module requires the .py extension to be able to import so the above module would be named testpy.py.

---

In each python file you import you must have a *startup* function where you make any connections from objects in the ui file to code in your module. The parent is passed to the startup function to give you access to all the objects in the GUI.

```
from functools import partial

def startup(parent):
    # connect a pushbutton without passing parent
    parent.my_test_pb.clicked.connect(test_1)
    parent.get_names_pb.clicked.connect(partial(get_names, parent))

    # connect a pushbutton and pass parent to the function
    parent.another_test_pb.clicked.connect(partial(test_2, parent))

def test_1():
    print('test 1')

def test_2(parent):
    # in this function you have access to all the objects in parent
    print(f'test 2 {parent.another_test_pb.text()}')

def get_names(parent):
    # get all the object names from the parent
    print(dir(parent))
```

## 14.1 Timer

A user timer is provided for use in the user python module.

```
from functools import partial

def startup(parent):
    parent.user_timer.timeout.connect(testit)
    parent.conn_pb.setEnabled(False) # prevent another connection
    parent.disc_pb.clicked.connect(partial(disc, parent))
    parent.conn_pb.clicked.connect(partial(conn, parent))
    parent.start_pb.clicked.connect(partial(start, parent))
    parent.stop_pb.clicked.connect(partial(stop, parent))

def testit():
    print('testing')

def disc(parent):
    parent.user_timer.timeout.disconnect(testit)
    parent.conn_pb.setEnabled(True) # allow a connection
    parent.disc_pb.setEnabled(False) # prevent trying to disconnect

def conn(parent):
    parent.user_timer.timeout.connect(testit)
    parent.conn_pb.setEnabled(False) # prevent trying to connect
    parent.disc_pb.setEnabled(True) # allow a disconnect

def start(parent):
    parent.user_timer.start(1000) # milliseconds

def stop(parent):
    parent.user_timer.stop()
```

## PROBING

### 15.1 Probe Enable

Add a QPushButton named *probing\_enable\_pb* and if it is found it will be set as a toggle button. The button will only be enabled when the machine is homed and not running a program. The button is set to checkable in code so it can be styled with :checked and :enabled pseudo-states among others.

---

**Note:** The *probing\_enable\_pb* requires at least one object that starts with *probe\_* to be enabled.

---

```
QPushButton#probing_enable_pb:enabled:checked {  
    color: white;  
    background-color: red;  
}  
  
QPushButton#probing_enable_pb:enabled {  
    color: green;  
    background-color: yellow;  
}
```

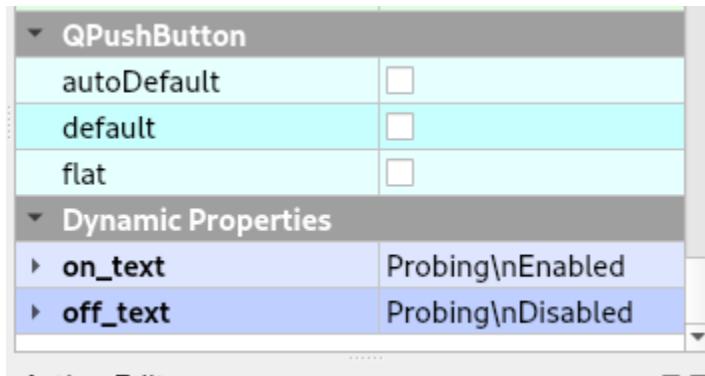
---

**Note:** A QPushButton with checkable set to true does not have an unchecked pseudo-state

---

For more style sheet options see the *StyleSheet* section

The text on the Probe Enable button can be set by adding two Dynamic Properties named *on\_text* and *off\_text*. Both must be present or no change will take place as there is no default text for the Probe Enable button. See *Dynamic Properties*



This is what the button would look like with the above settings.



## 15.2 Function

When the `probing_enable_pb` is toggled *OFF*, any widget with an object name that starts with `probe_` will be disabled.

When the `probing_enable_pb` is toggled *ON* the widgets that start with `probe_` will be enabled. In addition, spindle controls will be disabled, spindle speed set to 0, run controls will be disabled, and MDI controls will be disabled.

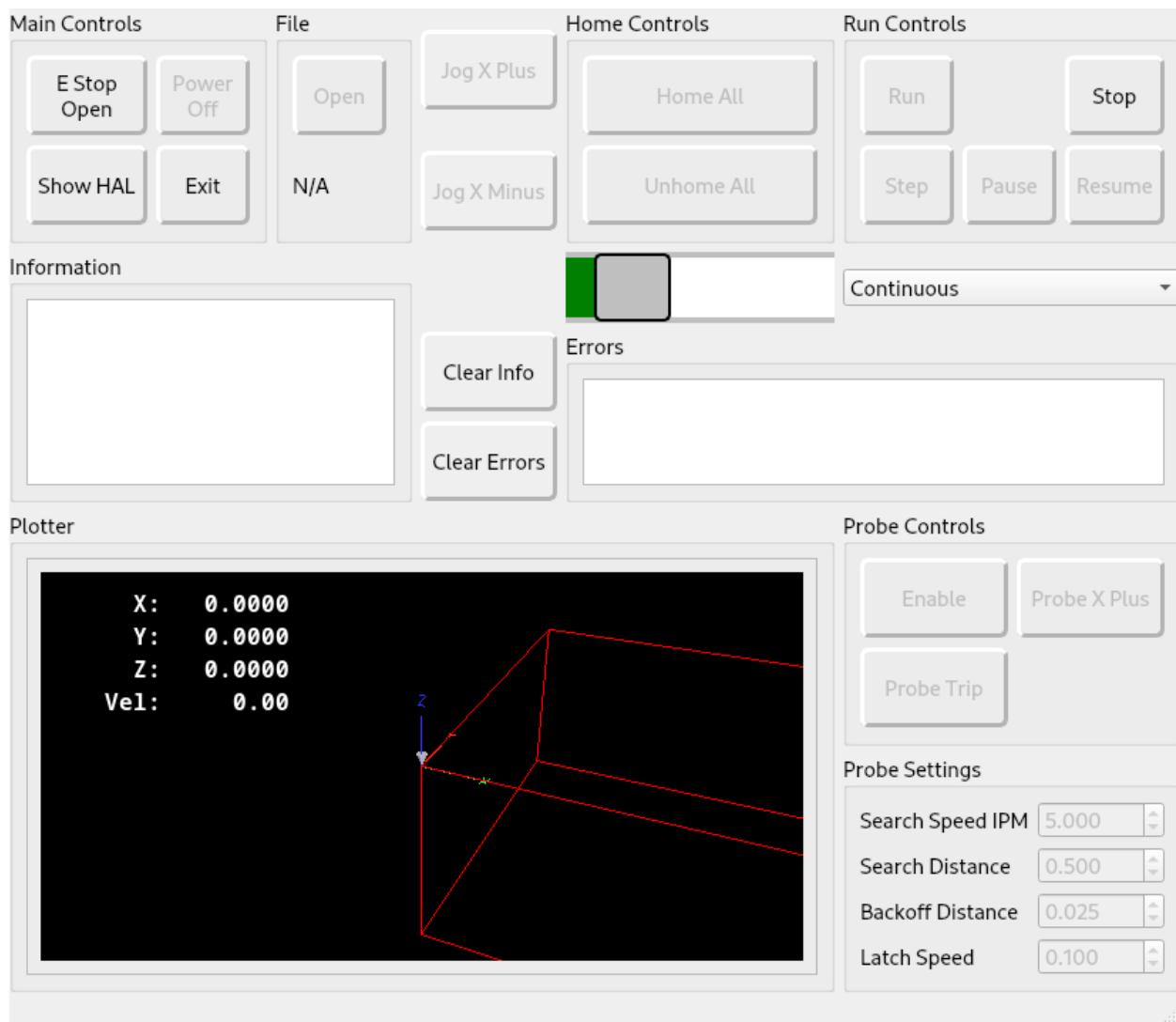
QPushButtons with an `objectName` that start with `probe_` and configured as a *MDI Button* (to launch the probing subroutines) will be enabled when probing is enabled and disabled when probing is disabled.

You can create a HAL *Spinbox* to use in your probing subroutine. Set the `objectName` to start with `probe_` and it will be enabled and disabled with the probe buttons.

If you're using a touch-screen, add a Dynamic Property named `input` and set the value to `touch`.

## 15.3 Example

A minimal example is in the Flex Examples in the Features directory



To run the example, close the E Stop, turn Power on, Home all, then toggle the Enable button. When probing is enabled many other controls are disabled including the spindle.

To test the probe routine press the Probe X Plus button and the X axis will start to move in the positive direction. If you do nothing when the Search Distance is reached you will get an error that the G38.2 move finished without making contact, which is expected.

Press the Probe X Plus button again and after it starts to move, press the Probe Trip button, the X axis will back off the Backoff Distance and start to move in the positive direction again. Pressing the Probe Trip button again will end the probe simulation. The debug information will show up in the Information window.

## 15.4 Subroutine

The probe subroutines use the values from the Probe Settings spin boxes. To use these values, you need to make the spin box a HAL pin. See the [Spinbox](#) example in the HAL section.

The subroutine is located in a directory called *subroutines* that is in the configuration directory. The ini's [RS274NGC] SUBROUTINE\_PATH sets the path that LinuxCNC looks for subroutines. Notice the leading ./ specifies that the path to the current directory is where the subroutine directory is.

```
SUBROUTINE_PATH = ./subroutines
```

The example files used are the following; notice that the xplus.ngc is in the ./subroutines directory

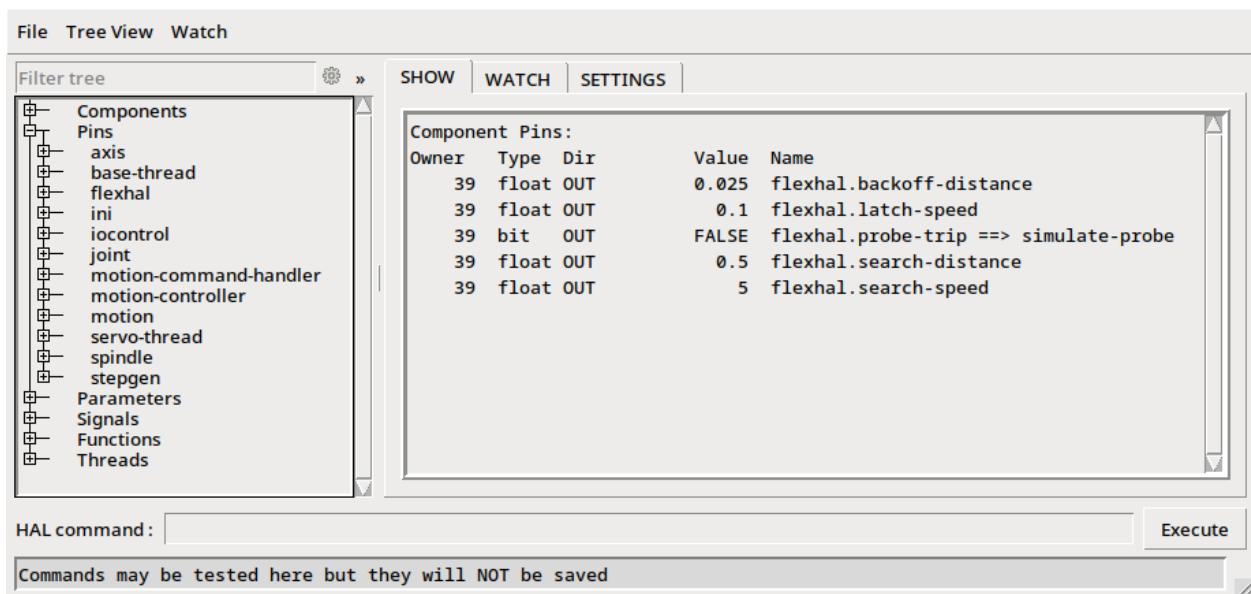
```
└── main.hal
└── parameters.var
└── parameters.var.bak
└── postgui.hal
└── probe.ini
└── probe.ui
└── README
└── sim_axis_probe.ini
└── subroutines
    └── xplus.ngc
└── tool.tbl
```

In your subroutine you can use user parameters instead of using HAL pins. See the [Parameters](#) section.

The subroutine is a normal LinuxCNC subroutine. The magic is how you get the values from HAL pins with #<*\_hal[pin\_name]*> where pin\_name is the actual pin name in HAL.

```
(filename xplus.ngc)
(HAL pins #<_hal[pin_name]>)
(G90 absolute distance mode G91 incremental distance mode)
o<xplus> sub
    (msg, xplus subroutine)
    G20
    ; initial search
    G91 G38.2 F#<_hal[flexhal.search-speed]> X#<_hal[flexhal.search-distance]>
    ;5061-5069 - Coordinates of a G38 probe result (X, Y, Z, A, B, C, U, V & W)
    (debug, Probe Contact at #5061)
    ; back off using #5061 to compensate for over travel on the probe
    G90 G0 X[#5061-#<_hal[flexhal.backoff-distance]>]
    ; final probe at latch speed
    G91 G38.2 F#<_hal[flexhal.latch-speed]> X[#<_hal[flexhal.backoff-distance]> + 0.
    ↵02]
        (debug, Probe Contact at #5061)
o<xplus> endsub
M2
```

Looking at the Halshow window which pops up when you press the Show HAL button, you can see the flexhal pin names for each spin box and for the Probe Trip button. Also notice that the Probe Trip button is connected to a signal which is connected to motion.probe-input in the postgui.hal file





---

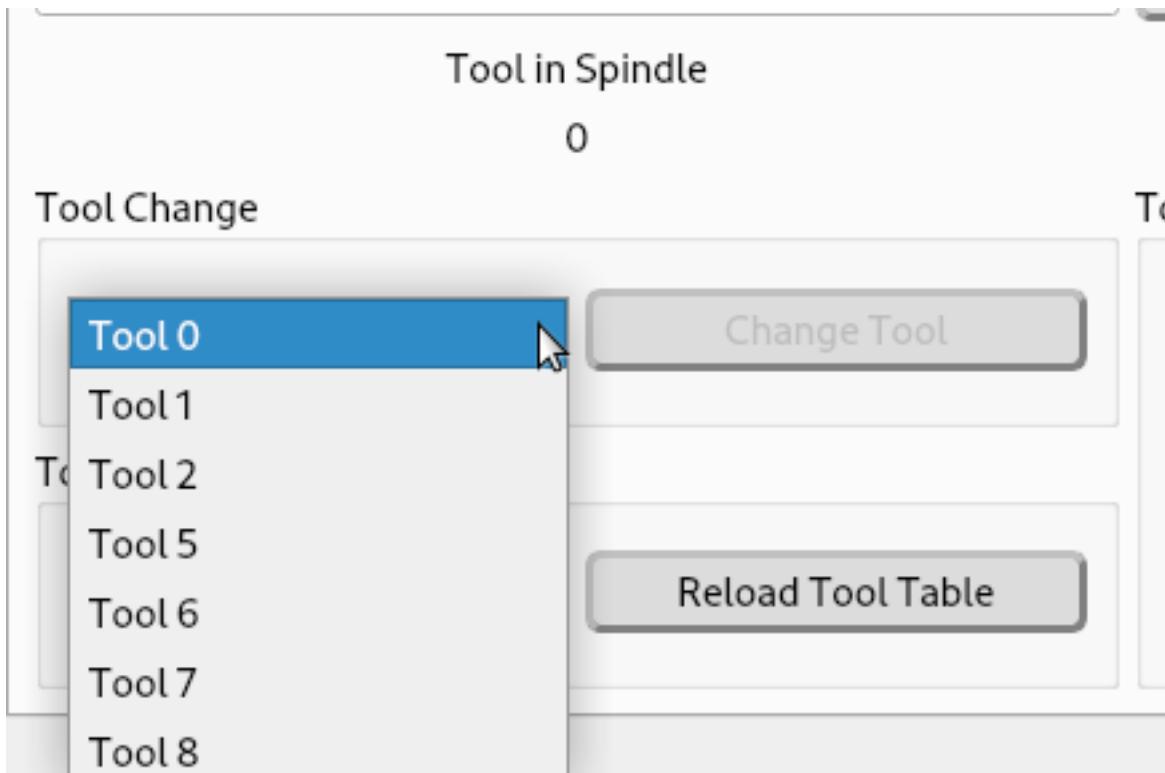
CHAPTER  
SIXTEEN

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TOOLS

Tools Tutorial

## 16.1 Tool Change



A tool change QPushButton, with a QComboBox to select the tool number to change to, is done with QPushButton named `tool_change_pb` and a QComboBox named `tool_change_cb`. The tool change combobox will automatically be populated with all the tools found in the tool table.

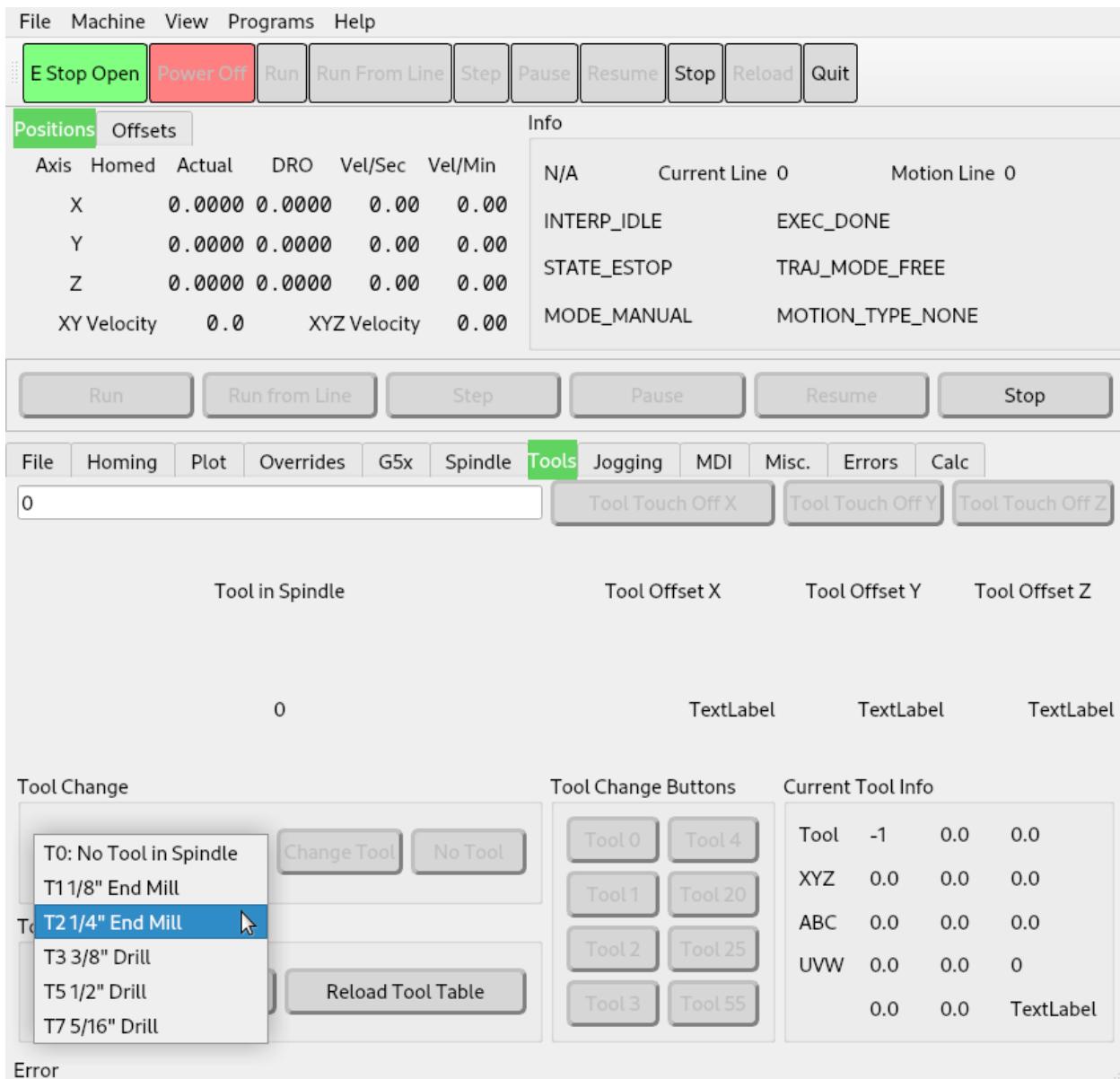
Table 1: Tool Change Controls

| Control Function | Object Type | Object Name                 |
|------------------|-------------|-----------------------------|
| Tool Change      | QPushButton | <code>tool_change_pb</code> |
| Tool Selector    | QComboBox   | <code>tool_change_cb</code> |

To add the description of the tools to the tool change combo box add a Dynamic Property named *option* and set the value to *description*. See *Dynamic Properties*

| tool_change_cb : QComboBox |                                     |
|----------------------------|-------------------------------------|
| Property                   | Value                               |
| sizeAdjustPolicy           | AdjustToContents...                 |
| minimumContentsLe...       | 0                                   |
| iconSize                   | 16 x 16                             |
| placeholderText            |                                     |
| duplicatesEnabled          | <input type="checkbox"/>            |
| frame                      | <input checked="" type="checkbox"/> |
| modelColumn                | 0                                   |
| ▼ Dynamic Properties       |                                     |
| option                     | description                         |

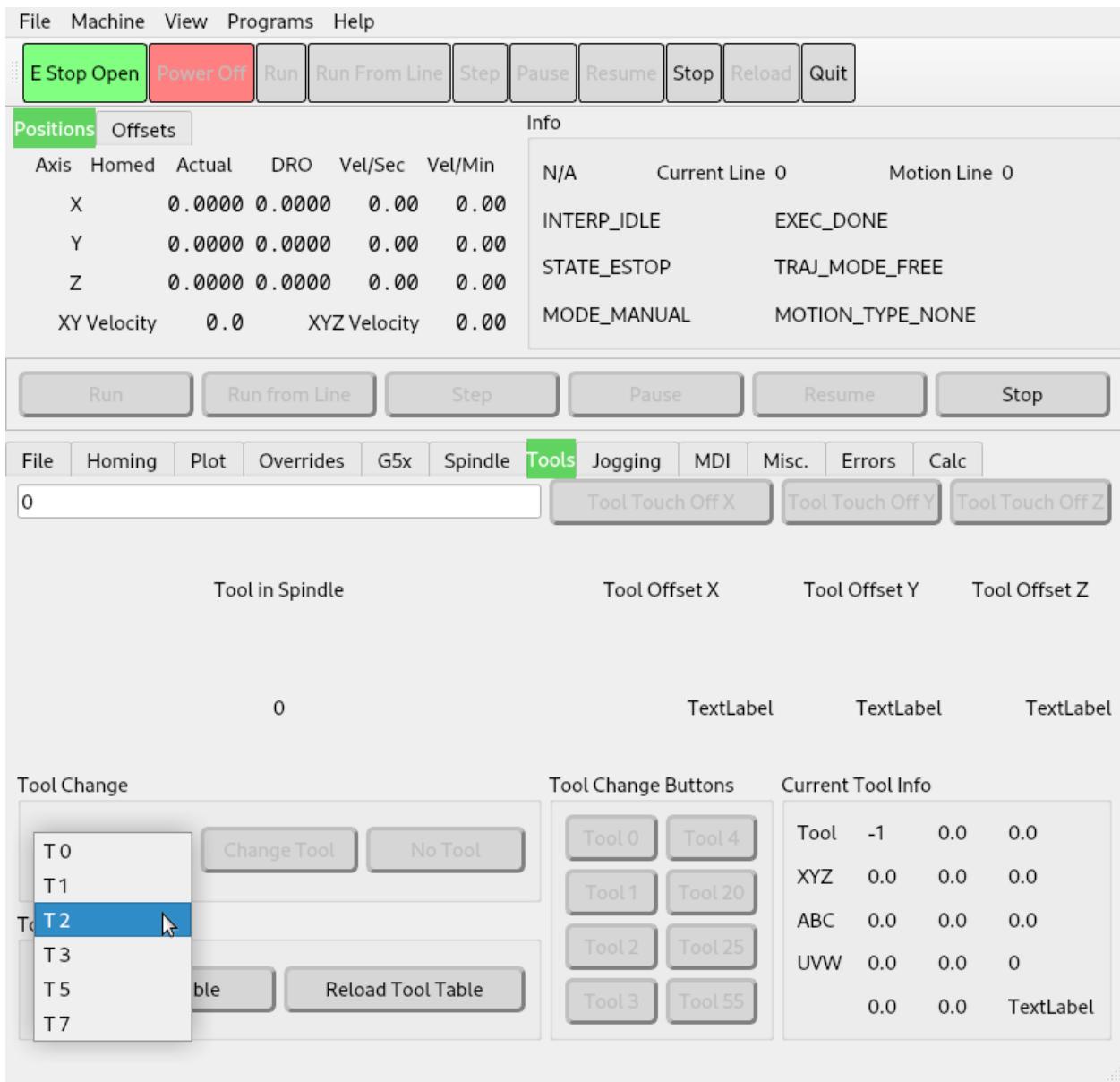
The description from the tool table will be appended to the tool number.



If you have limited space you can define the tool prefix by adding a Dynamic Property named *prefix* and set the value to the prefix you want.

| tool_change_cb : QComboBox |  |
|----------------------------|--|
| Property                   | Value  |
| sizeAdjustPolicy           | AdjustToContents...  |
| minimumContentsLe...       | 0  |
| iconSize                   | 16 x 16  |
| placeholderText            |  |
| duplicatesEnabled          | <input type="checkbox"/>   |
| frame                      | <input checked="" type="checkbox"/>  |
| modelColumn                | 0  |
| Dynamic Properties         |  |
| prefix                     | T <input type="text"/> ...  |

The tool number will follow the prefix.



**Note:** Only one option can be used, if option is found it is used and prefix will be ignored.

## 16.2 Manual Tool Change

All that is needed to add a manual tool change is to add the following to the ini file in the [FLEXGUI] section.

```
[FLEXGUI]
MANUAL_TOOL_CHANGE = True
```

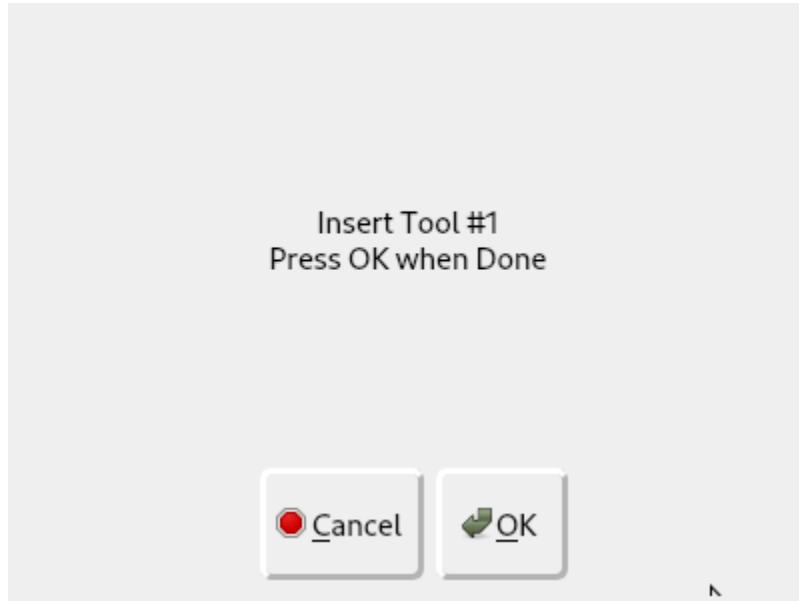


Fig. 1: This is without using a theme.



Fig. 2: This is the blue-touch theme.



Fig. 3: This is the dark-touch theme.

**Warning:** You can't use the hal\_manualtoolchange at the same time as the built in Flex Manual Tool Change, you must comment out all the hal\_manualtoolchange lines or remove them.

## 16.3 Manual Tool Change Error

If you get an error that hal\_manualtoolchange component exists look in your hal files for the hal\_manualtoolchange lines in the Manual Tool Change Option below.

If you're using a copy of one of the Axis sims the hal\_manualtoolchange component can be hard to find. It's recommended that you start with a simple configuration like the Flex example simple-sim.

## 16.4 Manual Tool Change Option

The HAL Manual Tool Change requires at least the following HAL code in the main hal file if not using the builtin Flex Manual Tool Change above.

```
# manual tool change
loadusr -W hal_manualtoolchange
net tool-change iocontrol.0.tool-change => hal_manualtoolchange.change
net tool-changed iocontrol.0.tool-changed <= hal_manualtoolchange.changed
net tool-number iocontrol.0.tool-prep-number => hal_manualtoolchange.number
net tool-prepare-loopback iocontrol.0.tool-prepare => iocontrol.0.tool-prepared
```

## 16.5 Tool Change Button

Tool change QPushButtons can be used to change tools without a spinbox by adding up to 99 QPushButtons named *tool\_change\_pb\_n*. With *n* being the number of the tool you wish to change to using that button

Table 2: Tool Change Buttons

| Control Function   | Object Type | Object Name        |
|--------------------|-------------|--------------------|
| Tool Change Button | QPushButton | tool_change_pb_(n) |

## 16.6 Tool Touchoff

To touch-off a tool to an axis, use a tool-touch-off QPushButton and a QLineEdit to enter the value of the touch off.

Table 3: Tool Touchoff Controls

| Control Function     | Object Type | Object Name                 |
|----------------------|-------------|-----------------------------|
| Tool Touch Off Value | QLineEdit   | tool_touchoff_le            |
| Tool Touch Off       | QPushButton | tool_touchoff_(axis letter) |

Optionally you can have a QLineEdit for each axis for tool touch off. Add a Dynamic Property named *source* to the tool touch off button and set the value to the name of the QLineEdit that is the source for that touch off button. See *Dynamic Properties*



Tool touch off QLineEdit for each axis.

| tool_touchoff_z : QPushButton |                          |
|-------------------------------|--------------------------|
| Property                      | Value                    |
| autoExclusive                 | <input type="checkbox"/> |
| autoRepeatDelay               | 300                      |
| autoRepeatInterval            | 100                      |
| ▼ QPushButton                 |                          |
| autoDefault                   | <input type="checkbox"/> |
| default                       | <input type="checkbox"/> |
| flat                          | <input type="checkbox"/> |
| ▼ Dynamic Properties          |                          |
| ▶ source                      | tt_z_value_le            |

## 16.7 Current Tool Status

Current Tool status of the tool loaded in the spindle. All the labels can have a Dynamic Property called *precision* with the number of digits you wish to show. The *tool\_id\_lb* and the *tool\_orientation\_lb* are integers.

Table 4: Tool Table Status Labels

|                   |                     |                    |
|-------------------|---------------------|--------------------|
| tool_id_lb        | tool_xoffset_lb     | tool_yoffset_lb    |
| tool_zoffset_lb   | tool_aoffset_lb     | tool_boffset_lb    |
| tool_coffset_lb   | tool_uoffset_lb     | tool_voffset_lb    |
| tool_woffset_lb   | tool_diameter_lb    | tool_frontangle_lb |
| tool_backangle_lb | tool_orientation_lb |                    |



---

CHAPTER  
SEVENTEEN

---

## COORDINATE SYSTEMS

Coordinate System Tutorial

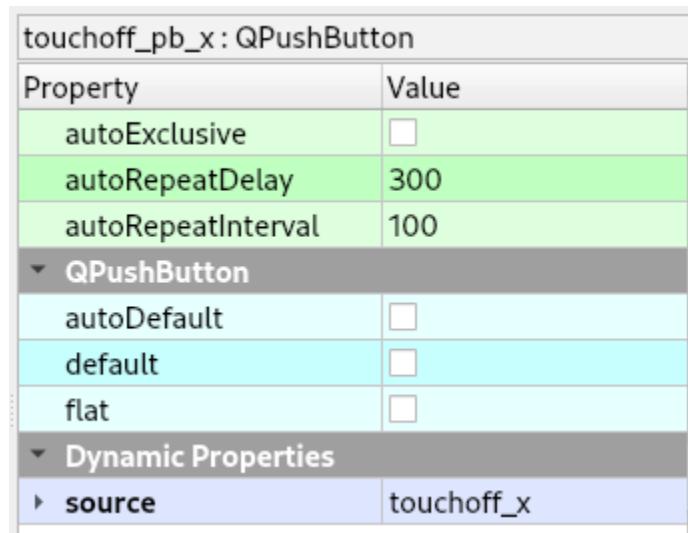
### 17.1 Coordinate System Touchoff

To touch-off an axis, use a QPushButton and QLineEdit to set the touch-off value

Table 1: Coordinate System Touch Off Controls

| Control Function | Object Type | Object Name               |
|------------------|-------------|---------------------------|
| Touch Off Axis   | QPushButton | touchoff_pb_(axis letter) |
| Touch Off Value  | QLineEdit   | touchoff_le               |

Optionally you can have a QLineEdit for any axis by adding a string type Dynamic Property named *source* and the value contains the object name of the QLineEdit that you want to use. See [Dynamic Properties](#)



As you can see you can have a QLineEdit for each axis.



## 17.2 Change Coordinate System

To change the coordinate system via a button, use a `change_cs_`n`` QPushButton where *n* is 1-9 for G54 through G59.3

Table 2: Coordinate System Change Buttons

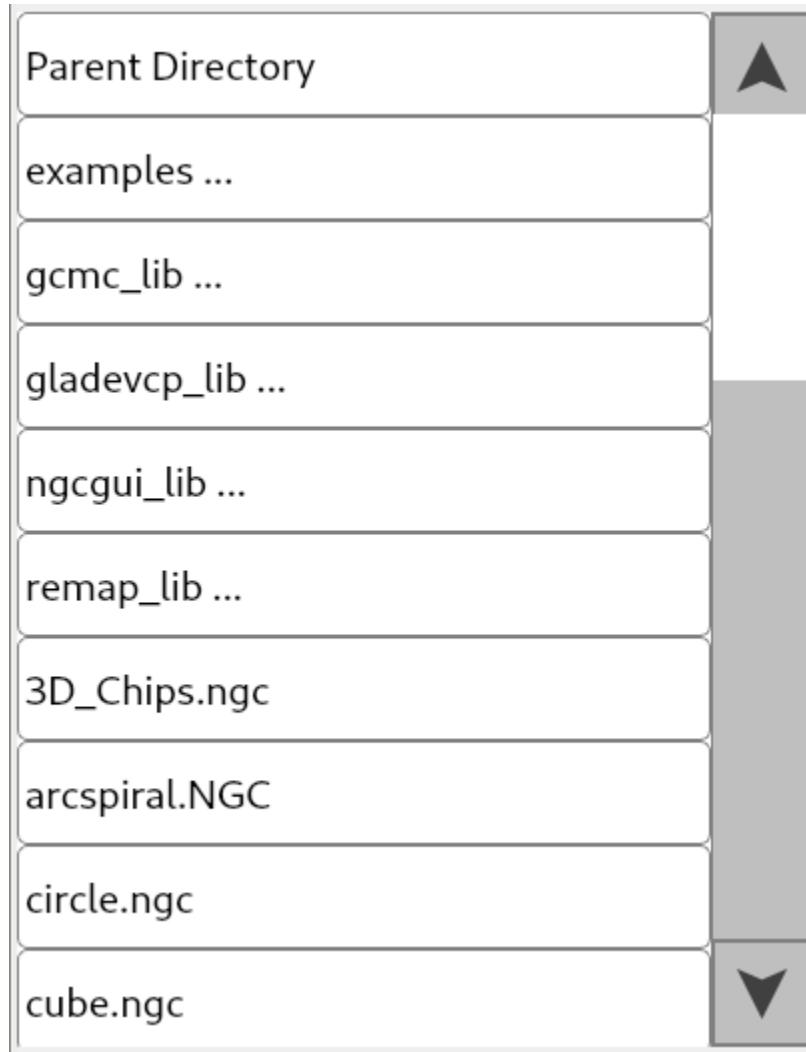
| Control Function         | Object Type | Object Name                |
|--------------------------|-------------|----------------------------|
| Change Coordinate System | QPushButton | <code>change_cs_(n)</code> |

## MISCELLANEOUS ITEMS

### 18.1 File Selector

Add a QListWidget and name it *file\_lw*, this can be used with a touch screen by specifying the touch input. A single left-click or touch is all that's needed to use the *File Selector*. A left-click or touch on a directory will change to that directory. A left-click or touch on the up or down arrow will move the list by one. A left-click or touch inbetween an arrow and the slider will move the list by one page. Touch-and-hold to move the slider.

If you use the touch input, the selector looks like this



---

**Note:** Make sure you use a QListWidget and not a QListView for the file selector.

---

File, Error and Information Tutorial

## 18.2 Code Viewer

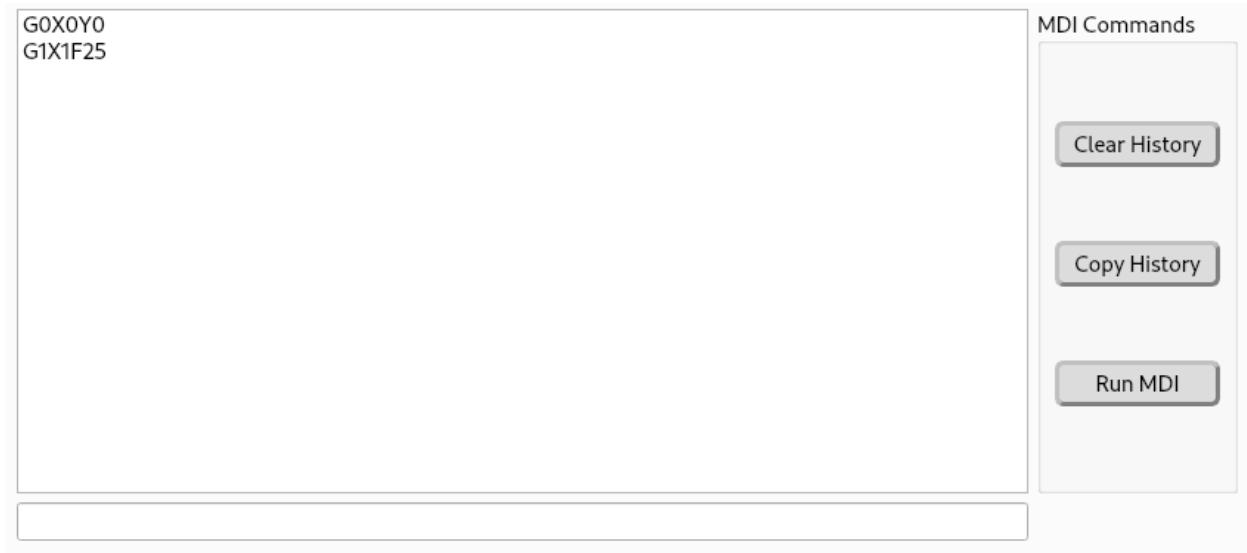
To add a code viewer, add a *QPlainTextEdit* from Input Widgets and name it *gcode\_pte*

```
( AXIS "splash G-code" Not intended for actual milling )
( To run this code anyway you might have to Touch Off the Z axis)
( depending on your setup. As if you had some material in your mill... )
( Hint jog the Z axis down a bit then touch off )
( Also press the Toggle Skip Lines with "/" to see that part )
( If the program is too big or small for your machine, change the scale below )
( LinuxCNC 19/1/2012 2:13:51 PM )

#<depth>=2.0
#<scale>=1.0
G21 G90 G64 G40
G0 Z3.0
( engraving )
```

## 18.3 MDI Viewer

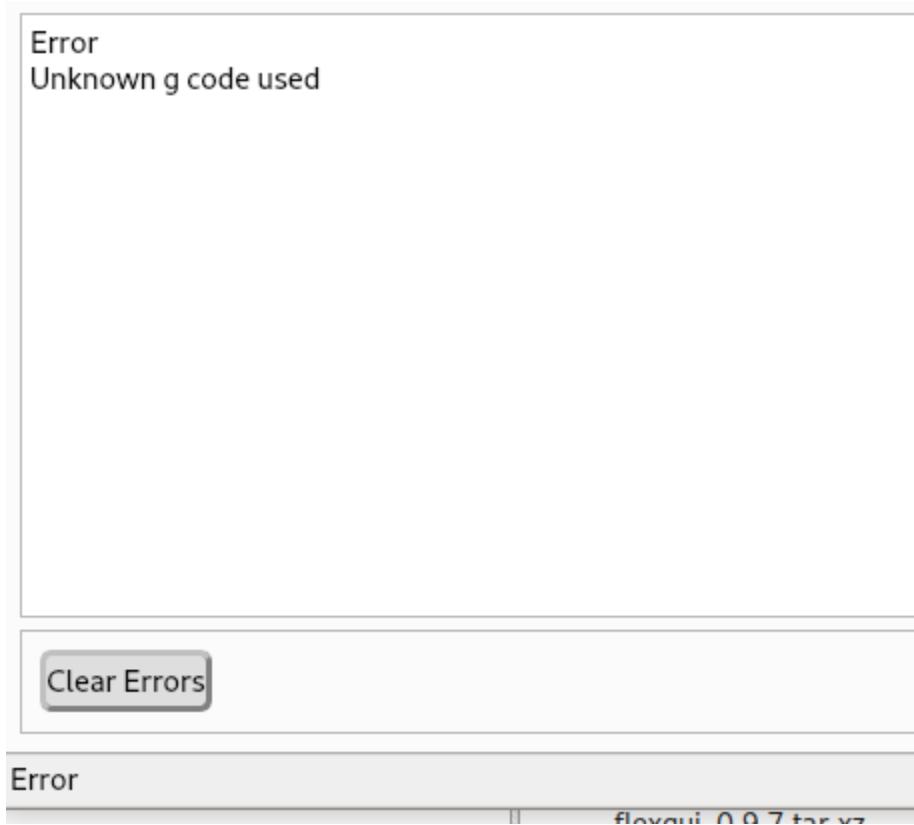
To add a MDI viewer, add a *QListWidget* from Item Widgets and name it *mdi\_history\_lw*



To enter MDI commands, add a Line Edit and name it *mdi\_command\_le*.

## 18.4 Error Viewer

To add an error viewer, add a *QPlainTextEdit* from Input Widgets and name it *errors\_pte*



To clear the error history, add a QPushButton and set the objectName to `clear_errors_pb`.

To copy the errors to the clipboard, add a QPushButton and set the object name to `copy_errors_pb`.

**Warning:** The error viewer must be a QPlainTextEdit not a QTextEdit.

## 18.5 Information Viewer

To add an information viewer, add a `QPlainTextEdit` from Input Widgets and name it `info_pte`. Information messages from MSG, DEBUG and PRINT will show up in the Information Viewer if it exists.

If `info_pte` is not found and the `errors_pte` is found, then information messages will show up in the Error Viewer.

To clear the information viewer, add a QPushButton and name it `clear_info_pb`.

**Warning:** The information viewer must be a QPlainTextEdit not a QTextEdit.

## 18.6 Speed & Feed Calculators

To add a milling Speeds and Feeds Calculator, add a *QFrame* or *QWidget* and set the Object Name to *fsc\_container*

Diameter .125      Flutes 4

RPM 2500

Chip Load

|                  |                    |
|------------------|--------------------|
| Feed IPM 25      | Chip Load in .0015 |
| <b>Calculate</b> | <b>Calculate</b>   |
| 0.0025 IPT       | 15.00 IPM          |

Feed Rate

Surface Speed

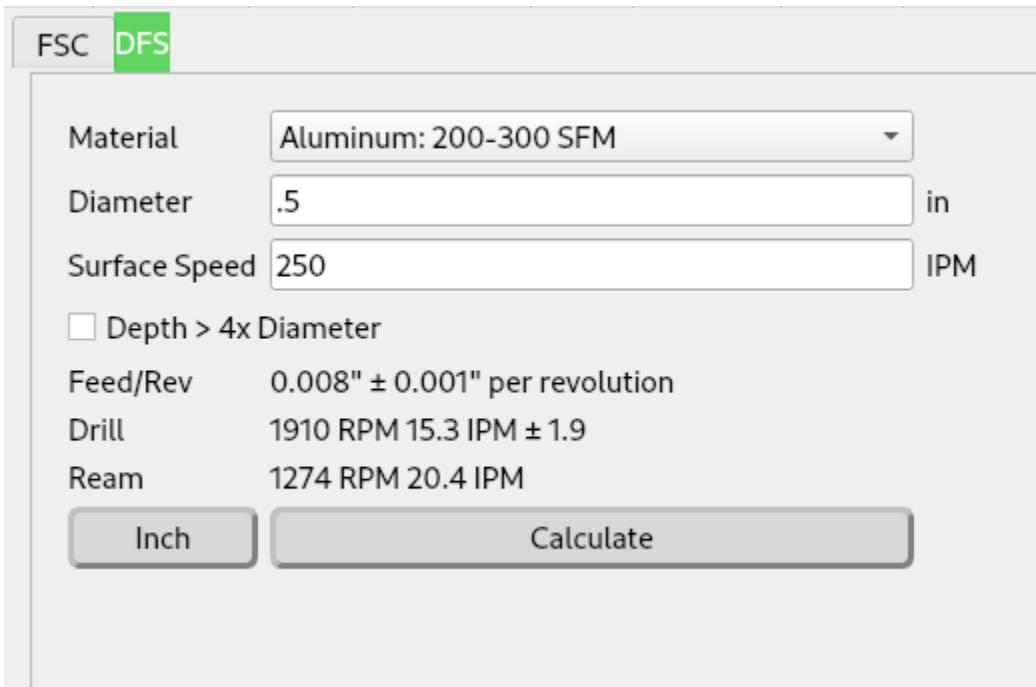
|      |                  |           |
|------|------------------|-----------|
| Inch | <b>Calculate</b> | 81.81 SFM |
|------|------------------|-----------|

To make the entry boxes touch-screen aware, add a Dynamic Property called *mode* and set the value to *touch*. Then when you touch an entry field, a numeric popup will show up to allow you to enter the value without a keyboard. See *Dynamic Properties*



To add a Drill Feed and Speed calculator, add a *QFrame* or *QWidget* and set the Object Name to *dsf\_container*.

To make the entry boxes touch-screen aware, add a Dynamic Property called *mode* and set the value to *touch*. Then when you touch it, a numeric popup will appear, allowing you to enter the numbers



## 18.7 Help System

A QPushButton can be setup to launch a Help dialog which contains text from a file in the configuration directory. A help button can be placed on multiple places with different file names. Only one Help dialog can be open at a time.

Table 1: Help Button Dynamic Properties

| Property Name | Type   | Value                           |
|---------------|--------|---------------------------------|
| function      | string | help                            |
| file          | string | file name                       |
| topic         | string | title of topic                  |
| x_pos         | string | x location of upper left corner |
| y_pos         | string | y location of upper left corner |
| horz_size     | string | width                           |
| vert_size     | string | height                          |

---

**Note:** The x\_pos is from the left edge of the screen and the y\_pos is from the top of the screen.

---

Dynamic Properties

| pushButton_6 : QPushButton |                          |
|----------------------------|--------------------------|
| Property                   | Value                    |
| autoExclusive              | <input type="checkbox"/> |
| autoRepeatDelay            | 300                      |
| autoRepeatInterval         | 100                      |
| QPushButton                |                          |
| autoDefault                | <input type="checkbox"/> |
| default                    | <input type="checkbox"/> |
| flat                       | <input type="checkbox"/> |
| Dynamic Properties         |                          |
| ▶ function                 | help                     |
| ▶ file                     | home_help.txt            |
| ▶ topic                    | Help On Homing           |
| ▶ horz_size                | 500                      |
| ▶ vert_size                | 500                      |
| ▶ x_pos                    | 100                      |
| ▶ y_pos                    | 100                      |

Help Dialog

This is a test of the help system  
Tab on this line.

No tab

Spaces|

---

CHAPTER  
NINETEEN

---

## HAL PINS

### HAL Tutorial

---

**Note:** Dynamic Property names are case sensitive and must be all lower case. Hal types and directions are case sensitive and must be all caps. The function value must be lower case.

---

---

**Note:** Hal pin names can contain a-z, A-Z, 0-9, underscore \_, or dash -.

---

### 19.1 Button

Any QPushButton, QCheckBox or QRadioButton can be assigned to a HAL *bit* pin by adding four string type Dynamic Properties. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-button would be in HAL *flexhal.my-button*. See *Dynamic Properties*

Table 1: HAL Push Button

| Property Name | Pin Value       |
|---------------|-----------------|
| function      | hal_pin         |
| pin_name      | any unique name |
| hal_type      | HAL_BIT         |
| hal_dir       | HAL_OUT         |

### 19.2 Spinbox

Any QSpinBox or QDoubleSpinBox can be a HAL *number* pin by adding four string type Dynamic Properties. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-spinbox would be in HAL *flexhal.my-spinbox*.

Table 2: HAL Spin Box

| Property Name | Pin Value                       |
|---------------|---------------------------------|
| function      | hal_pin                         |
| pin_name      | any unique name                 |
| hal_type      | HAL_FLOAT or HAL_S32 or HAL_U32 |
| hal_dir       | HAL_OUT                         |

---

**Note:** A QSpinBox can only be HAL\_S32 or HAL\_U32 data type. A QDoubleSpinBox can only be HAL\_FLOAT data type.

---

## 19.3 Slider

A QSlider can be a HAL pin by adding these four string type Dynamic Properties. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-slider would be in HAL<sub>flexhal</sub>.my-slider. See [Dynamic Properties](#)

Table 3: HAL Slider

| Property Name | Pin Value          |
|---------------|--------------------|
| function      | hal_pin            |
| pin_name      | any unique name    |
| hal_type      | HAL_S32 or HAL_U32 |
| hal_dir       | HAL_OUT            |

## 19.4 Label

A QLabel can be used to monitor HAL pins. HAL connections must be made in the post gui HAL file. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-reader would be in HAL<sub>flexhal</sub>.my-reader.

Table 4: HAL Label

| Property Name | Pin Value                                  |
|---------------|--|
| function      | hal_pin                                    |
| pin_name      | any unique name                            |
| hal_type      | HAL_BIT or HAL_FLOAT or HAL_S32 or HAL_U32 |
| hal_dir       | HAL_IN                                     |

---

**Note:** A HAL\_FLOAT QLabel can have a string Dynamic Property called *precision* with a value of the number of decimal digits.

---

## 19.5 Bool Label

A QLabel of hal\_type HAL\_BIT can have True and False text by adding two additional Dynamic Properties. See [Dynamic Properties](#)

Table 5: HAL Bool Label

| Property Name | Pin Value                  |
|---------------|----------------------------|
| function      | hal_pin                    |
| pin_name      | any unique name            |
| hal_type      | HAL_BIT                    |
| hal_dir       | HAL_IN                     |
| true_text     | text to display when True  |
| false_text    | text to display when False |

| label_5 : QLabel     |                          |
|----------------------|--------------------------|
| Property             | Value                    |
| alignment            | AlignLeft, AlignVCenter  |
| Horizontal           | AlignLeft                |
| Vertical             | AlignVCenter             |
| wordWrap             | <input type="checkbox"/> |
| margin               | 0                        |
| indent               | -1                       |
| openExternalLinks    | <input type="checkbox"/> |
| textInteractionFlags | LinksAccessibleByMouse   |
| buddy                |                          |
| ▼ Dynamic Properties |                          |
| function             | hal_pin                  |
| pin_name             | bool-label               |
| hal_type             | HAL_BIT                  |
| hal_dir              | HAL_IN                   |
| true_text            | I'm OK                   |
| false_text           | FAULT                    |

## 19.6 Multi-State Label

A QLabel of hal\_type HAL\_U32 can have multiple text by adding as many Dynamic Properties as needed. The *text\_n* starts at 0 for example text\_0, text\_1 etc.

Table 6: HAL Multi-State Label

| Property Name | Pin Value                                |
|---------------|--|
| function      | hal_msl                                  |
| pin_name      | any unique name                          |
| hal_type      | HAL_U32                                  |
| hal_dir       | HAL_IN                                   |
| text_n        | text to display when value is equal to n |

---

**Note:** The text values must start at 0 and be sequential.

---

| multi_state : QLabel      |          |
|---------------------------|----------|
| Property                  | Value    |
| <b>Dynamic Properties</b> |          |
| ▶ <b>function</b>         | hal_msl  |
| ▶ <b>pin_name</b>         | ms-label |
| ▶ <b>hal_type</b>         | HAL_U32  |
| ▶ <b>hal_dir</b>          | HAL_IN   |
| ▶ <b>text_0</b>           | Zero     |
| ▶ <b>text_1</b>           | One      |
| ▶ <b>text_2</b>           | Two      |

## 19.7 LCD

A QLCDNumber can be used to monitor HAL pins. HAL connections must be made in the post gui HAL file. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-reader would be in HAL *flexhal.my-reader*.

Table 7: HAL LCD

| Property Name | Pin Value                       |
|---------------|---------------------------------|
| function      | hal_pin                         |
| pin_name      | any unique name                 |
| hal_type      | HAL_FLOAT or HAL_S32 or HAL_U32 |
| hal_dir       | HAL_IN                          |

---

**Note:** A HAL\_FLOAT QLCDNumber can have a string Dynamic Property called *precision* with a value of the number of decimal digits.

---

Pin Types:

|           |
|-----------|
| HAL_BIT   |
| HAL_FLOAT |
| HAL_S32   |
| HAL_U32   |

Pin Directions:

|         |
|---------|
| HAL_IN  |
| HAL_OUT |
| HAL_IO  |

Currently only *HAL\_BIT* with *HAL\_OUT* have been tested.

**Warning:** By default, no QRadioButtons are checked unless you set one checked in the Designer. Starting up with none checked could be a problem if you expect one to be selected at startup.

## 19.8 Progress Bar

A QProgressBar can be used to monitor HAL pins. HAL connections must be made in the post gui HAL file. The pin\_name used will create a HAL pin prefixed with *flexhal*. A pin\_name of my-bar would be in HAL.*flexhal.my-bar*.

Table 8: HAL Progressbar

| Property Name | Pin Value          |
|---------------|--------------------|
| function      | hal_pin            |
| pin_name      | any unique name    |
| hal_type      | HAL_S32 or HAL_U32 |
| hal_dir       | HAL_IN             |

## 19.9 Step by Step

---

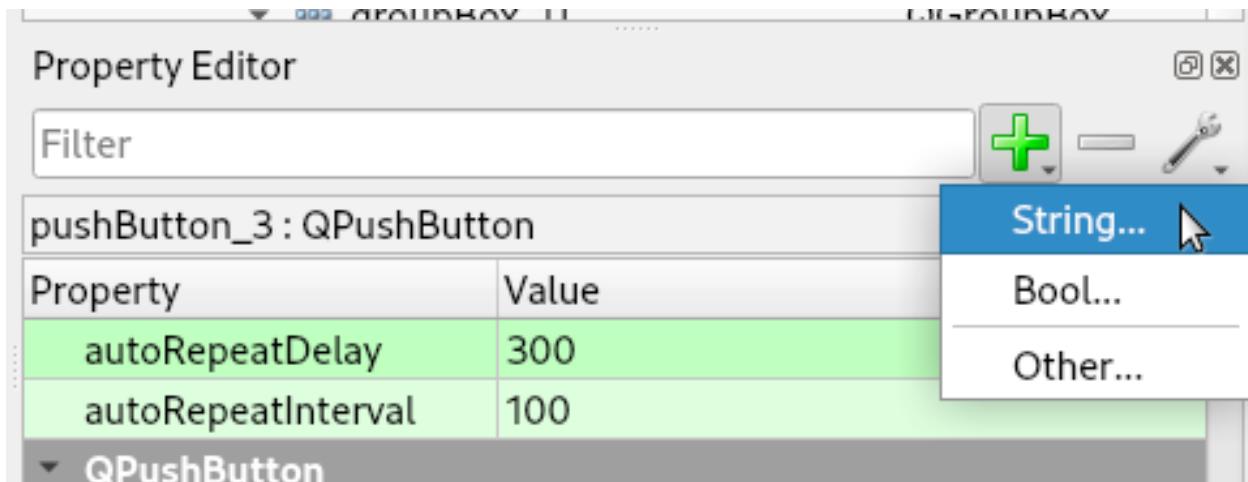
**Note:** This example is for a QPushButton

---

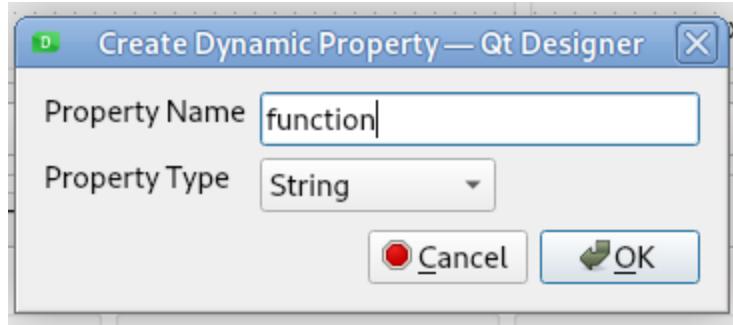
You can use a QPushButton as a momentary output, or with *checkable* selected for a toggle type output, or QCheckBox or QRadioButton for a HAL output control.

Drag the widget into the GUI and the widget can have any name you like; names are not used by HAL controls in Flex GUI - it is the following that matters.

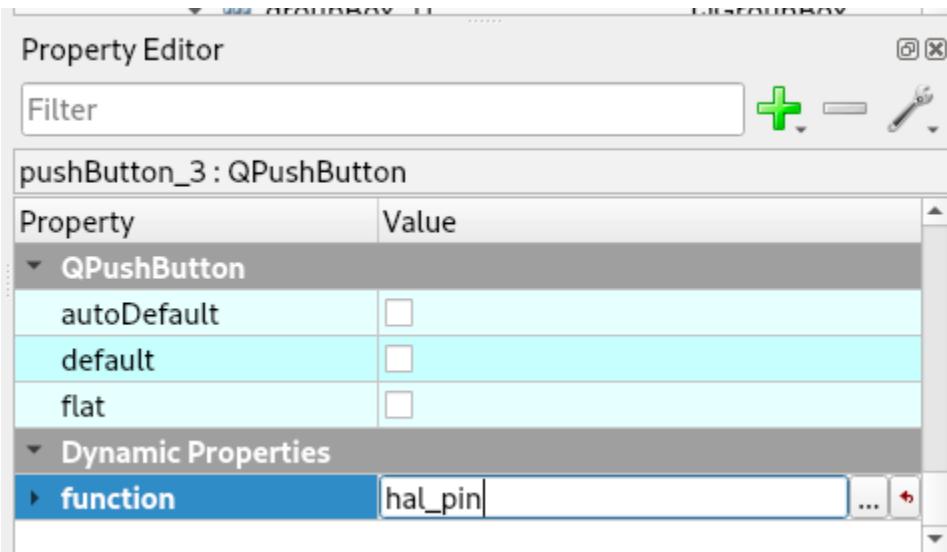
Click on the widget to select it then click on the green plus sign in the Property Editor for that widget to add a Dynamic Property and select String. See *Dynamic Properties*



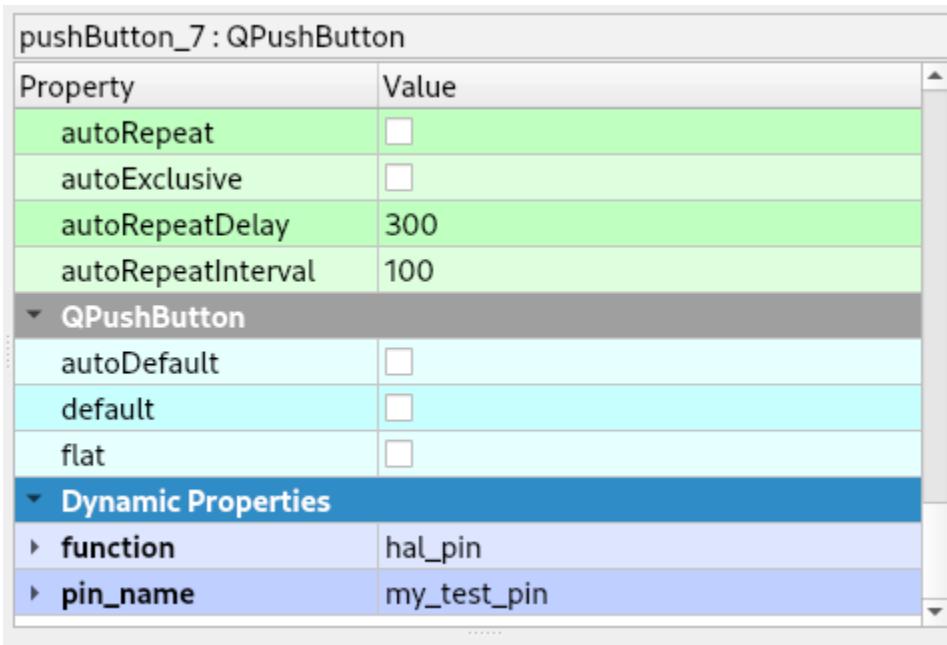
Set the Property Name to *function* and click Ok



Set the Value to *hal\_pin*; this tells Flex GUI that this widget is going to be for a HAL pin



Add another string Dynamic Property named *pin\_name* and set the value to any unique name



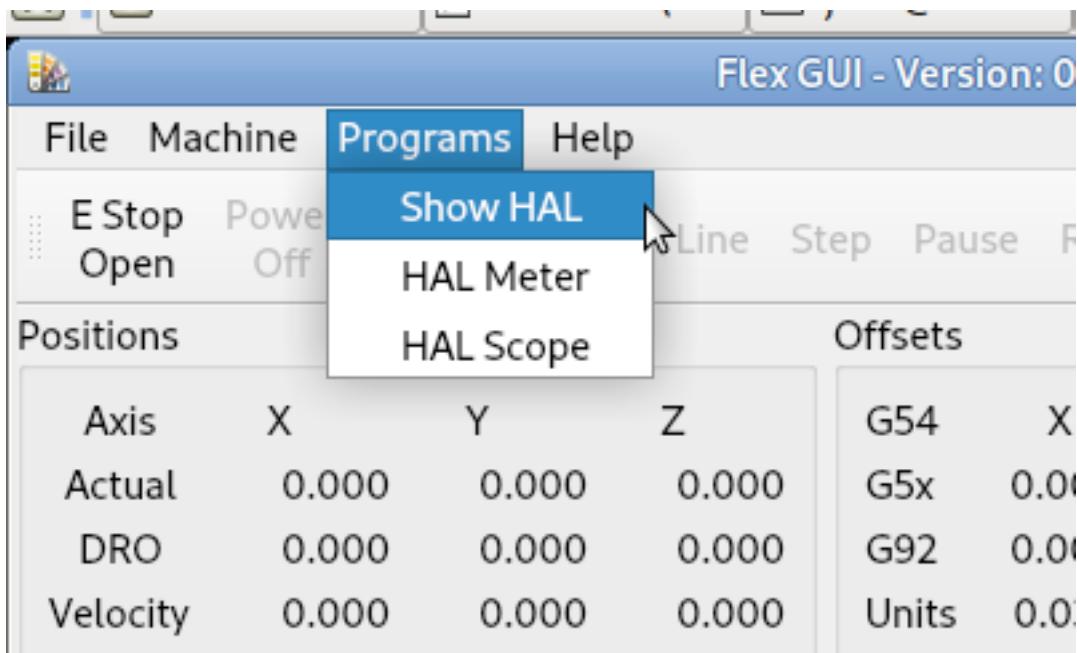
Add another Dynamic Property named *hal\_type* and set the value to HAL\_BIT

| pushButton_7 : QPushButton |                          |
|----------------------------|--------------------------|
| Property                   | Value                    |
| autoExclusive              | <input type="checkbox"/> |
| autoRepeatDelay            | 300                      |
| autoRepeatInterval         | 100                      |
|                            |                          |
| ▼ QPushButton              |                          |
| autoDefault                | <input type="checkbox"/> |
| default                    | <input type="checkbox"/> |
| flat                       | <input type="checkbox"/> |
|                            |                          |
| ▼ Dynamic Properties       |                          |
| ▶ function                 | hal_pin                  |
| ▶ pin_name                 | my_test_pin              |
| ▶ hal_type                 | HAL_BIT                  |

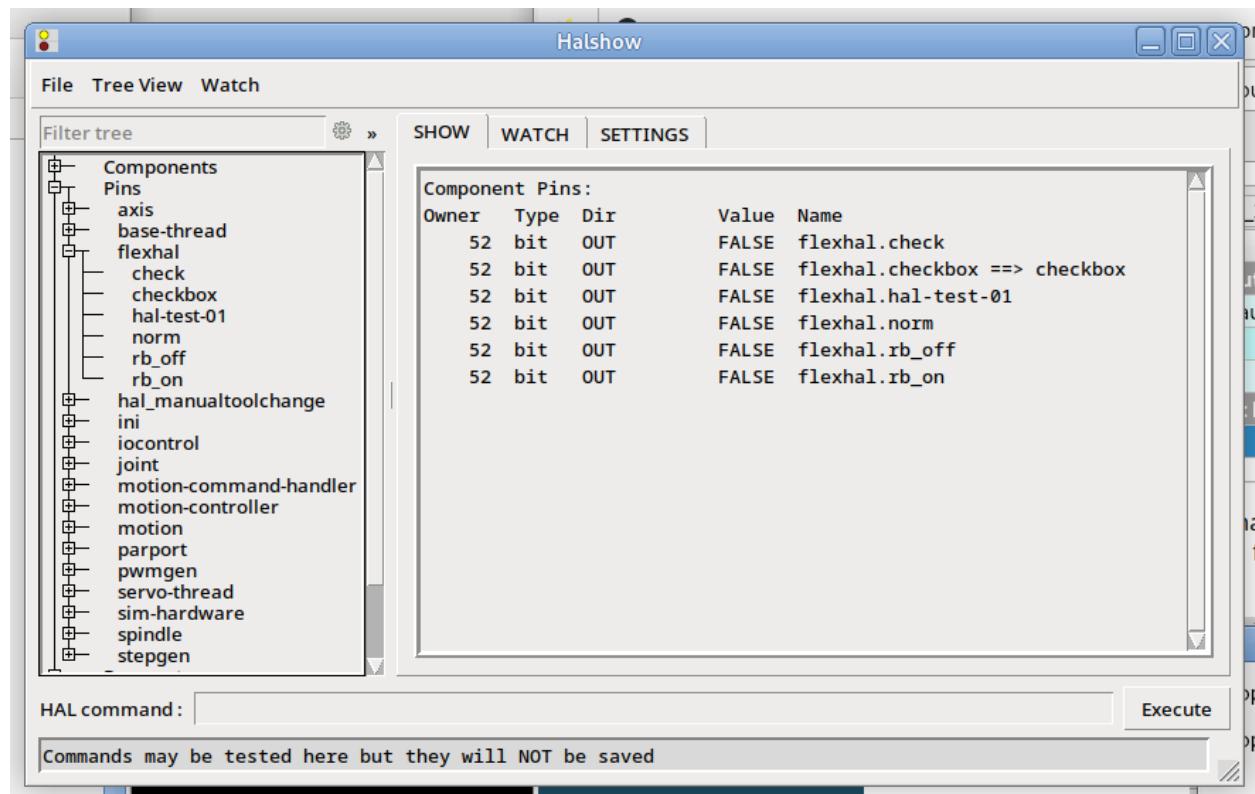
Add another Dynamic Property named *hal\_dir* and set the value to HAL\_OUT

| pushButton_7 : QPushButton |                          |
|----------------------------|--------------------------|
| Property                   | Value                    |
| autoRepeatDelay            | 300                      |
| autoRepeatInterval         | 100                      |
|                            |                          |
| ▼ QPushButton              |                          |
| autoDefault                | <input type="checkbox"/> |
| default                    | <input type="checkbox"/> |
| flat                       | <input type="checkbox"/> |
|                            |                          |
| ▼ Dynamic Properties       |                          |
| ▶ function                 | hal_pin                  |
| ▶ pin_name                 | my_test_pin              |
| ▶ hal_type                 | HAL_BIT                  |
| ▶ hal_dir                  | HAL_OUT                  |

If you added Show HAL to your menu, you can open up the *Halshow* program and view the pin names



The pin names will all start with *flexhal* plus the unique name you gave them



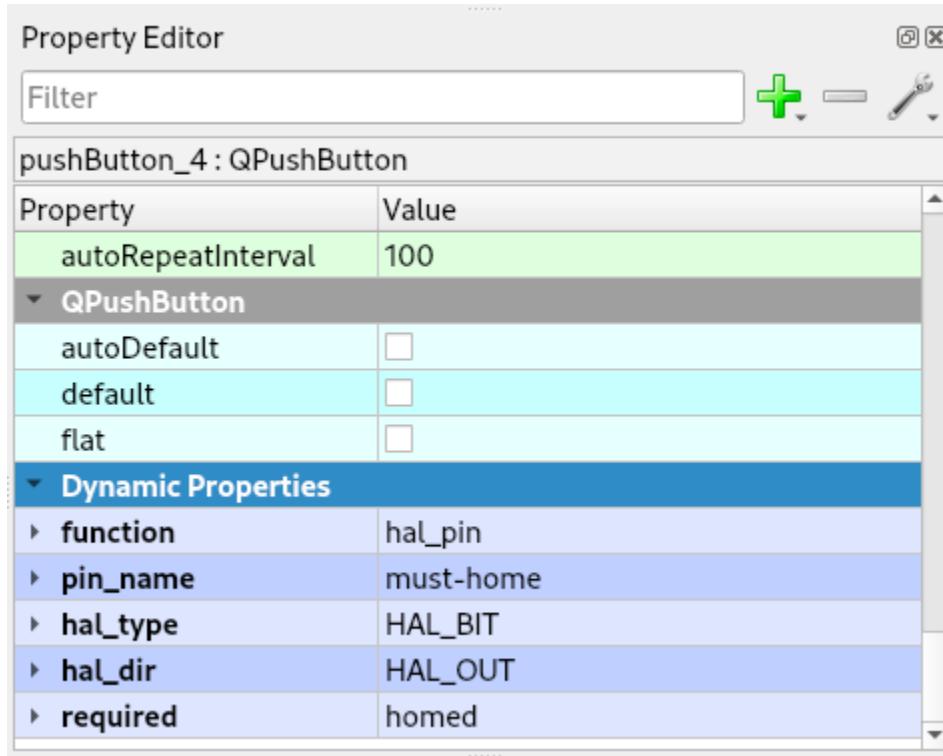
Now you can connect the Flex HAL pin in the postgui.hal file like normal

```
net some-signal-name flexhal.hal-test-01 => some-other-pin-in
```

After installing Flex GUI, from the CNC menu, you can copy the Flex GUI examples and look at the hal-btn example.

## 19.10 Homed Required

If the HAL button requires all joints to be homed before being enabled, you can specify that by adding a Dynamic Property named *required* and set the value to *homed*.



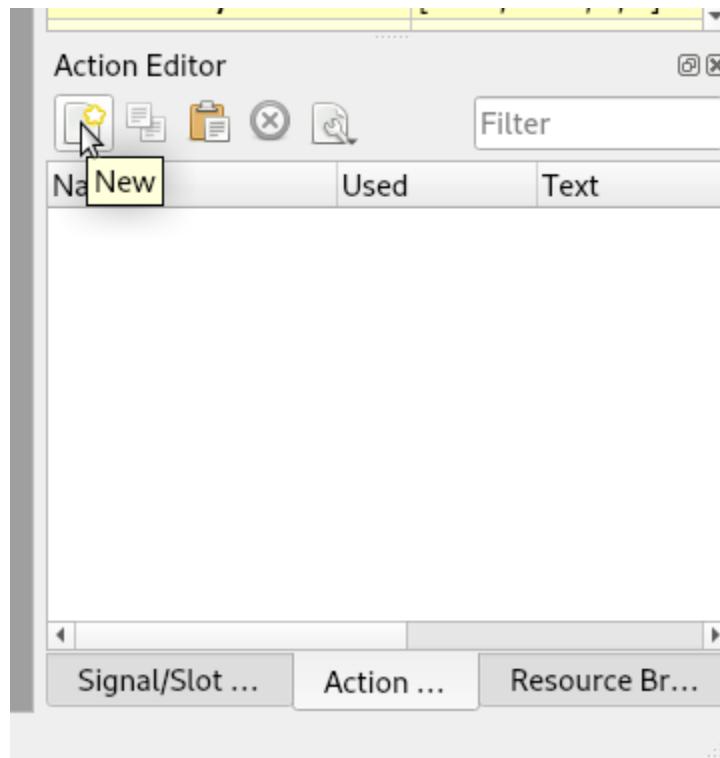


## TOUCH SCREENS

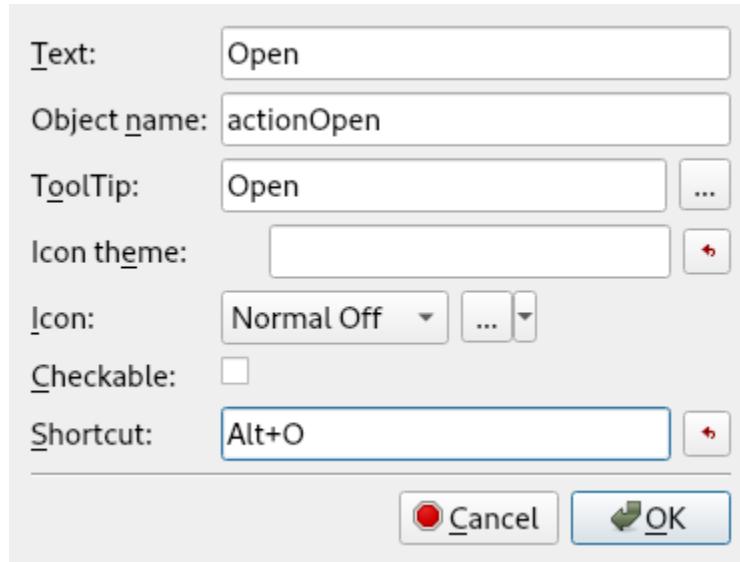
Some entry widgets like MDI and Touch-Off have a touch-screen popup available to make it easier for those users to enter the data.

### 20.1 Tool Bar

To add a button to the tool bar without having a menu item that creates an action, you just have to create the action yourself

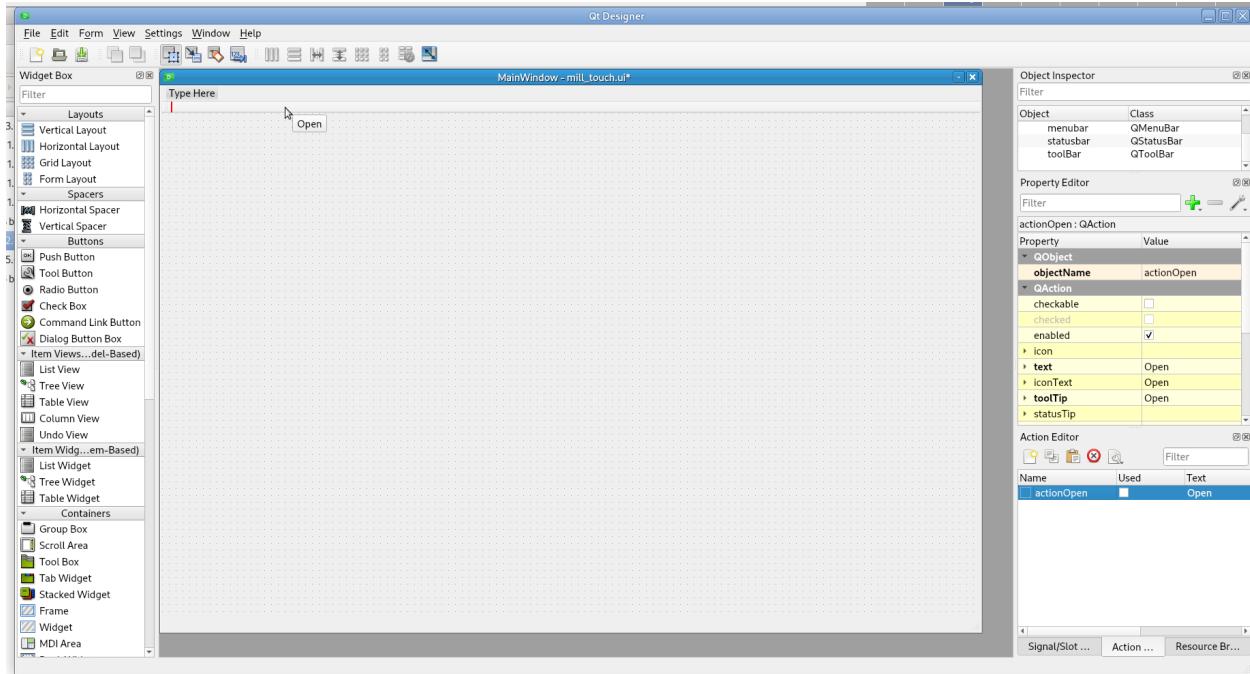


The action creating window, when you type in the Text name, the Object name is created for you



**Warning:** Make sure the Object name matches the Action Name created when you create a menu item - see the [Menu](#) section for the full list of Action Names.

Now you just drag the action into the tool bar to create a new tool bar button

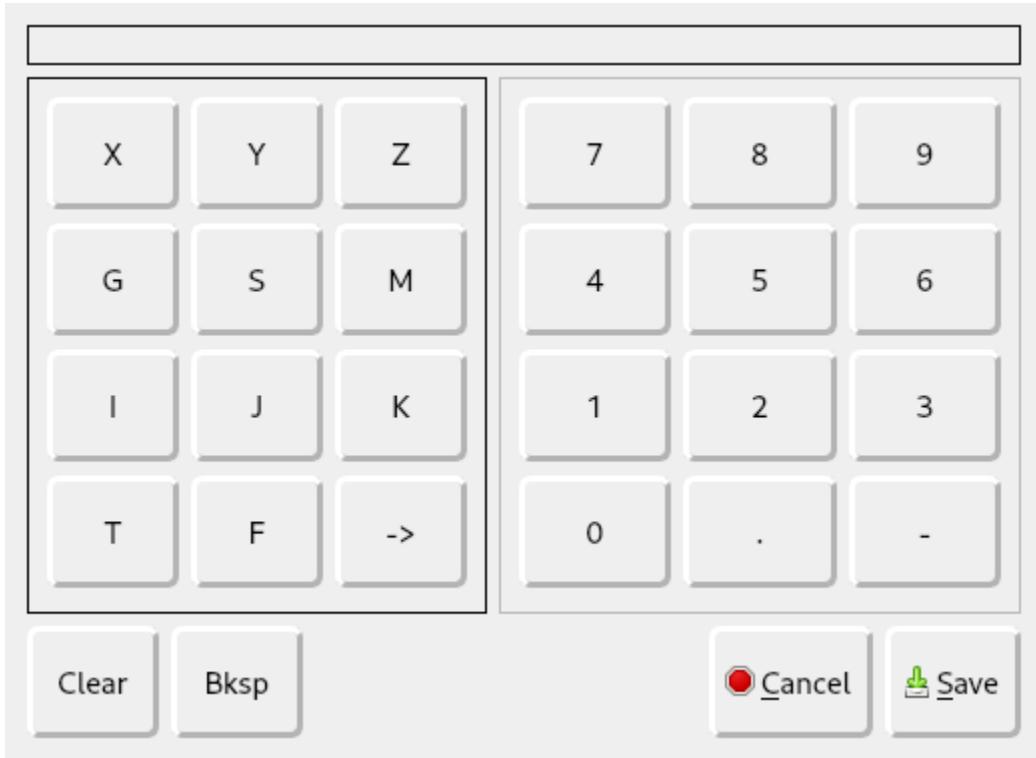


Another option is to just use QPushButtons in a QFrame, as every menu action has a QPushButton as well that executes the same function.

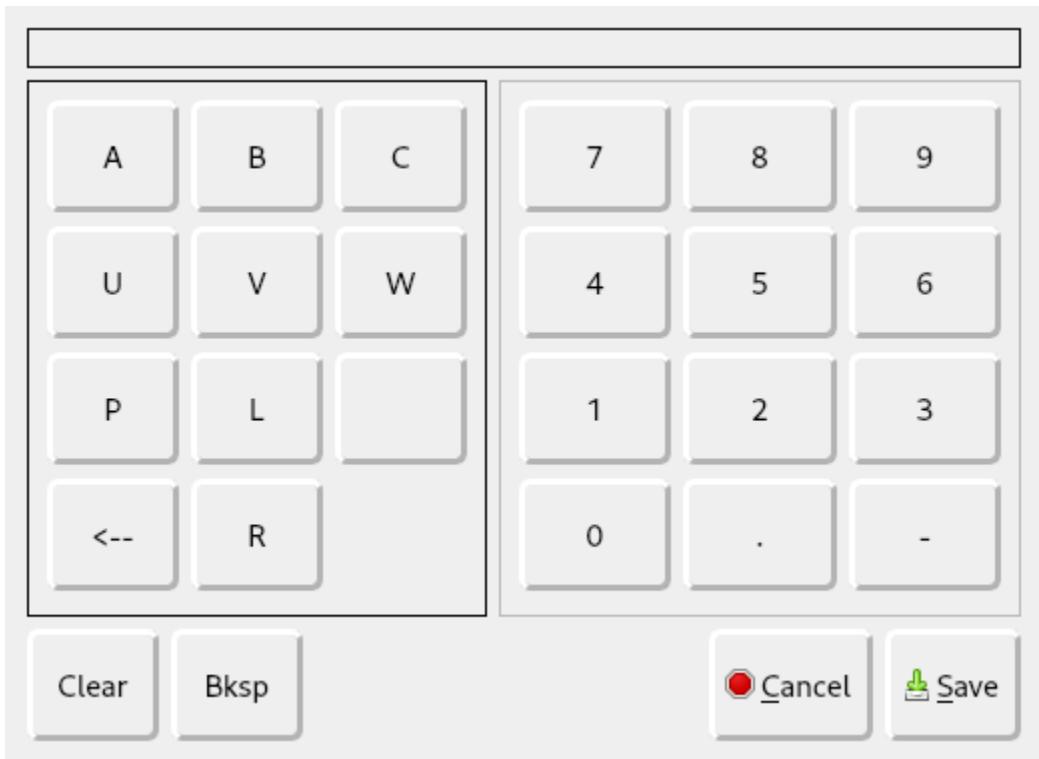
## 20.2 MDI

To enable the popup entry dialogs for the MDI entry, the QLineEdit object name must be *mdi\_command\_le* and the Dynamic Property *input* must be *nccode* for the NC codes popup or *keyboard* for a full keyboard popup.

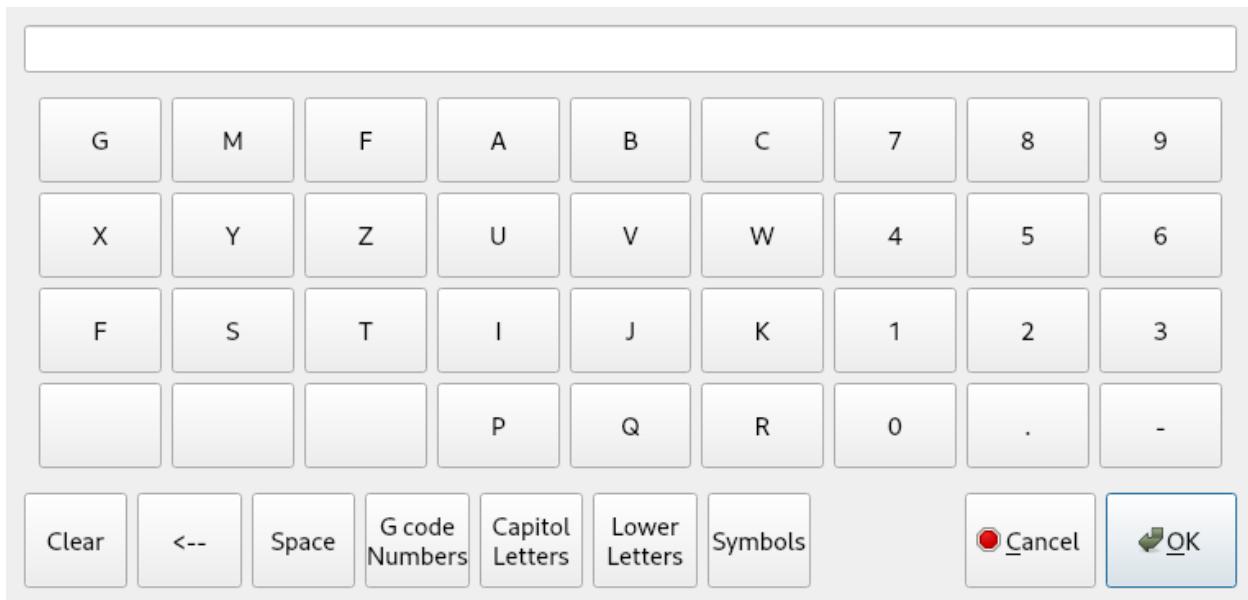
The G codes dialog will appear when you touch the MDI entry box



The arrow buttons change the letters section to different letters



The full keyboard



## 20.3 Touch Off

The Coordinate System Touch-Off offset is a QLineEdit named `touchoff_le`. To enable the number pad popup for the offset entry, add a Dynamic Property named `input` and set the value to `number`



Touch-Off:

Touch Off

|   |             |             |             |
|---|-------------|-------------|-------------|
| Coordinate System                         | Position    |             |             |
| Current                                   | Touch Off X | Touch Off Y | Touch Off Z |
| Change Coordinate System                  |             |             |             |
| G54 G55 G56 G57 G58 G59 G59.1 G59.2 G59.3 |             |             |             |

## 20.4 Tool Touch-Off

The Tool Touch-Off offset is a QLineEdit named `tool_touchoff_le`. To enable the number pad popup for the offset entry, add a Dynamic Property named `input` and set the value to `number`.

## 20.5 Spin Boxes

QDoubleSpinBox and QSpinBox can use the popup numbers keypad by adding a Dynamic Property named `input` and setting the value to `number`. If you enter a float value for a QSpinBox the value will get converted to an integer.

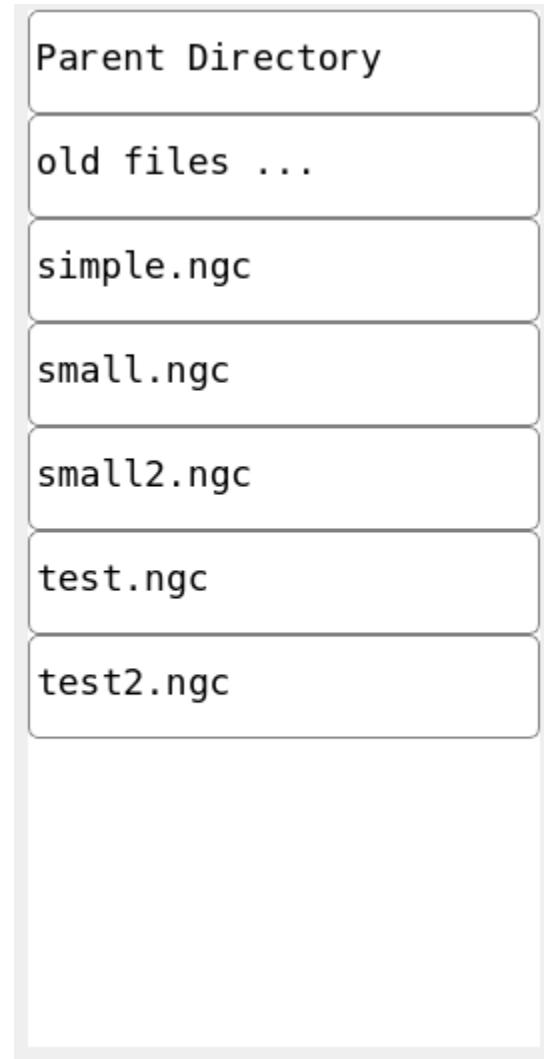
## 20.6 Line Edits

A QLineEdit can have a popup entry for numbers, G codes, or a full keyboard. Add a Dynamic Property named `input` and set the value to one of these `number`, `nccode`, or `keyboard`.

## 20.7 File Navigator

If a QListWidget with an objectName of `file_lw` is found, a touch-friendly file selector is added. A Parent Directory and possibly a directory name with an ellipsis can be used to change directories. Touch a file name and it is loaded into the GUI.

If PROGRAM\_PREFIX is specified, that will be the starting directory:





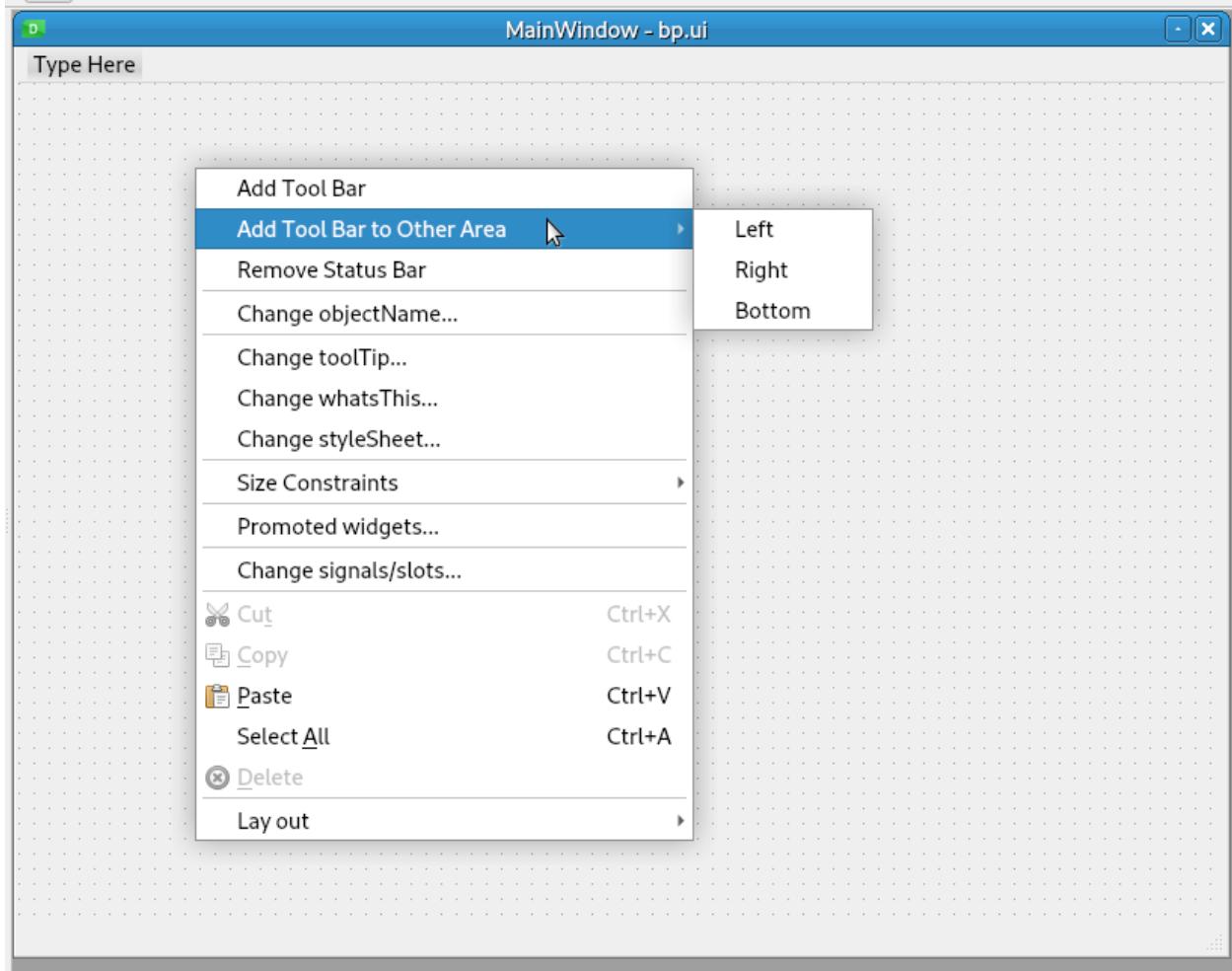
---

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**TWENTYONE**

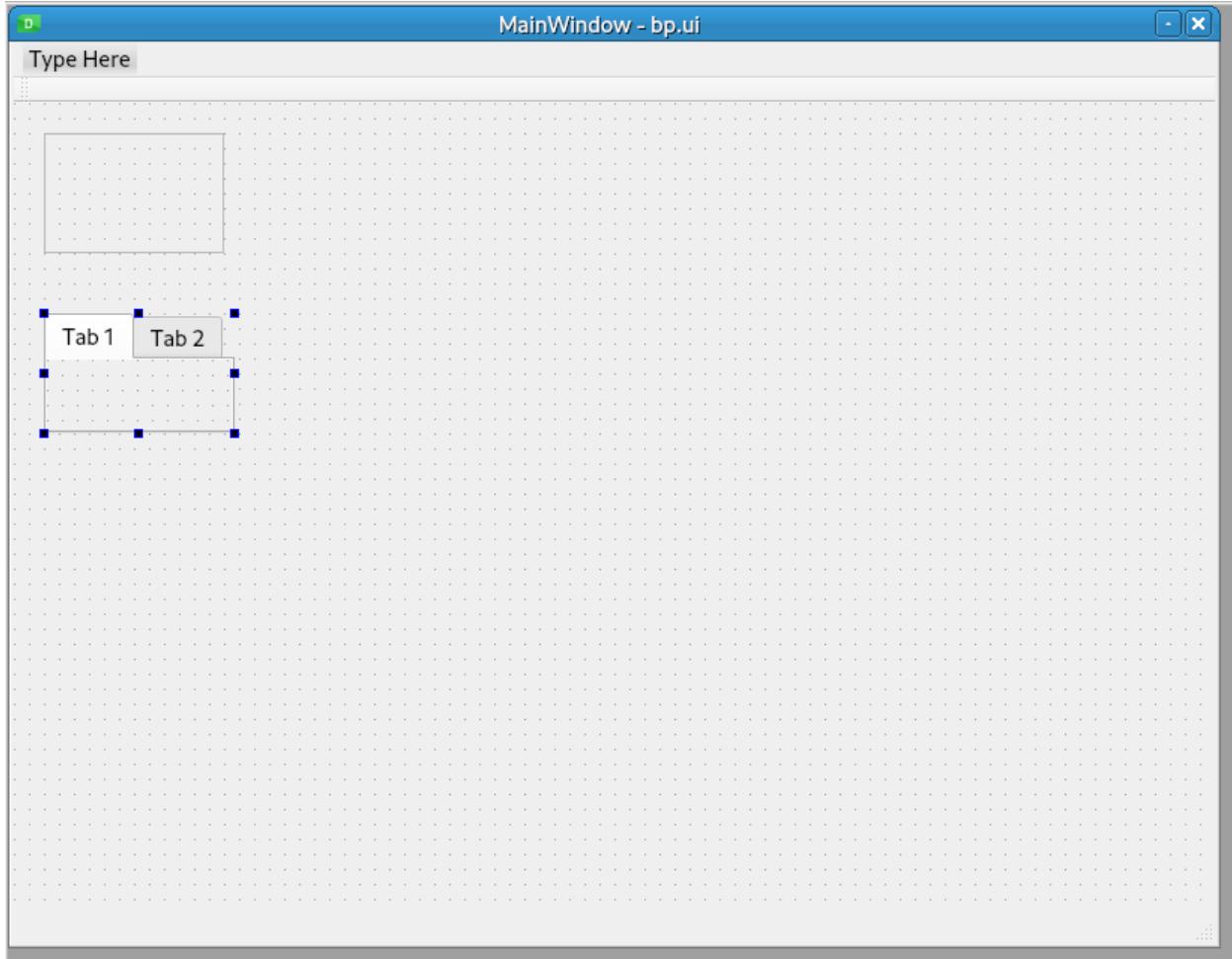
---

## MASTER LAYOUT

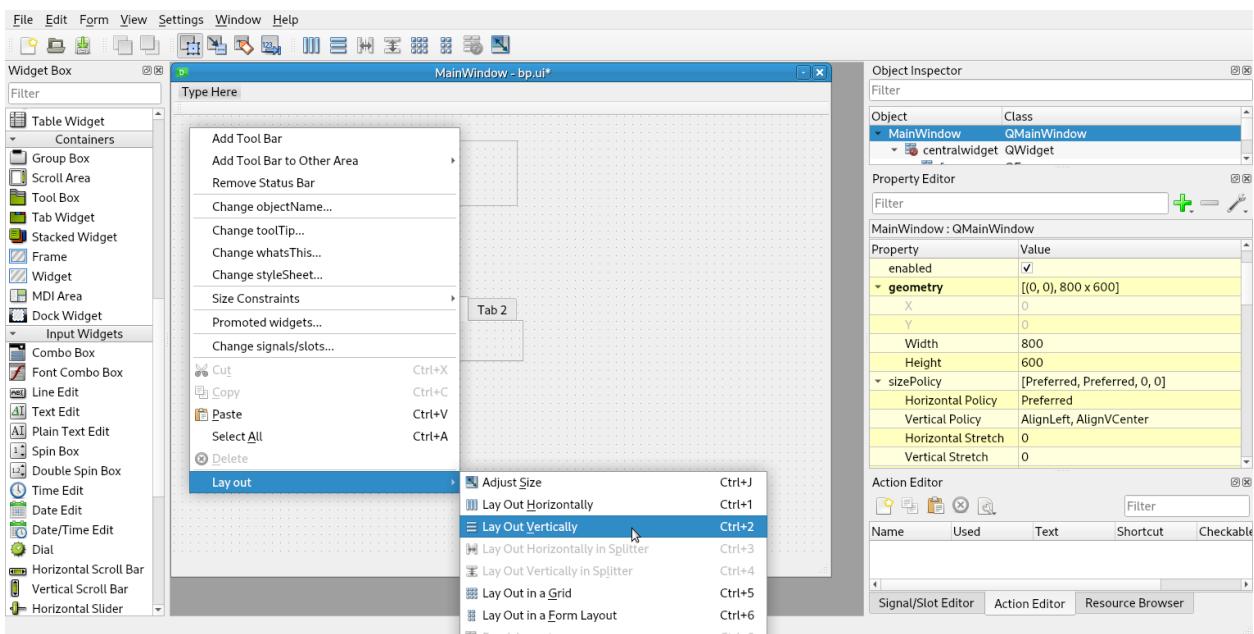
Starting with an empty Main Window, if you right-click in it you can add a tool bar or remove the status bar



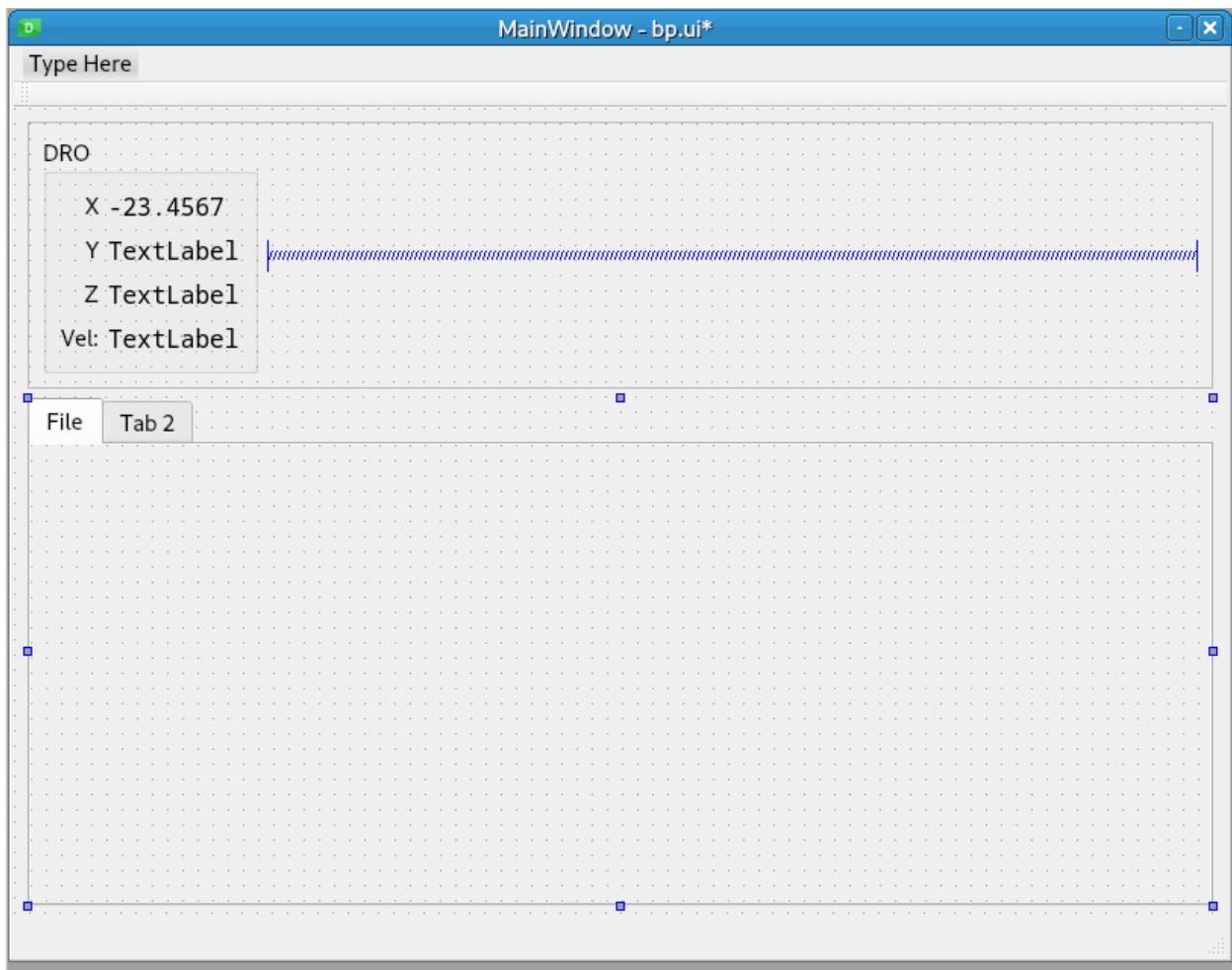
Next, if you have some items you want visible all the time you can add a QFrame or QWidget then below that, add a QTabWidget



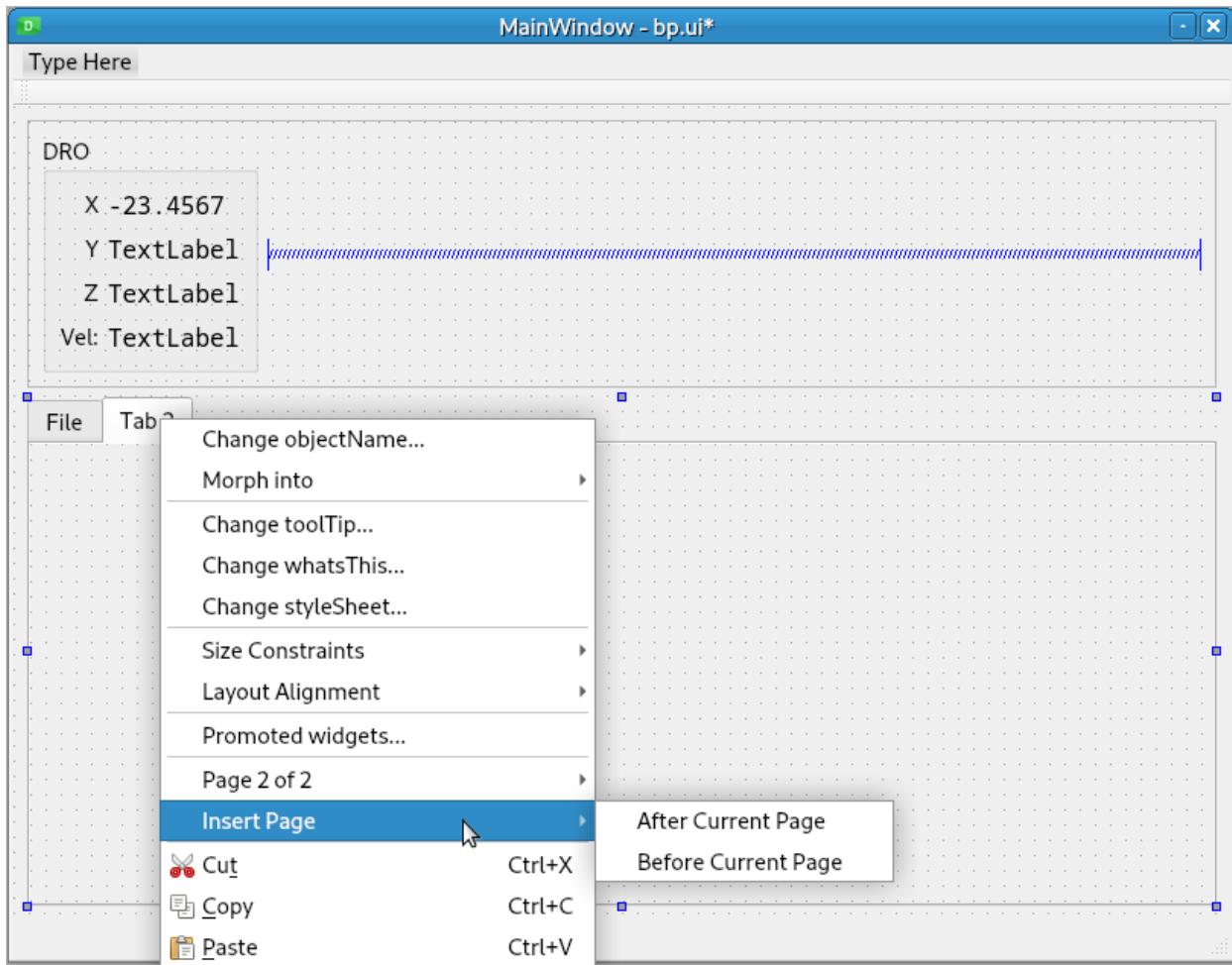
Now that you have at least one widget in the main window, you can right-click and select the layout you want to use



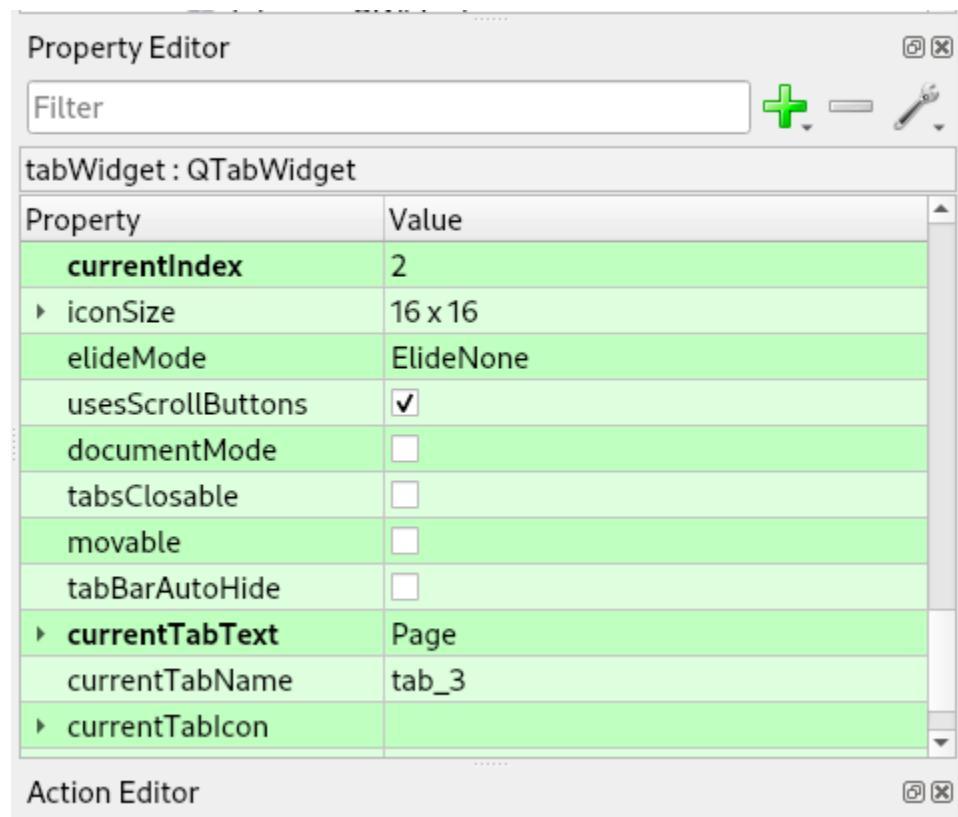
Example layout:



To add more tabs to a tab widget, right click on the tab then select Insert Page and where you want it to be inserted



To change the tab name, in the Property Editor QTabWidget section, change the currenTabText value to the new desired name.





---

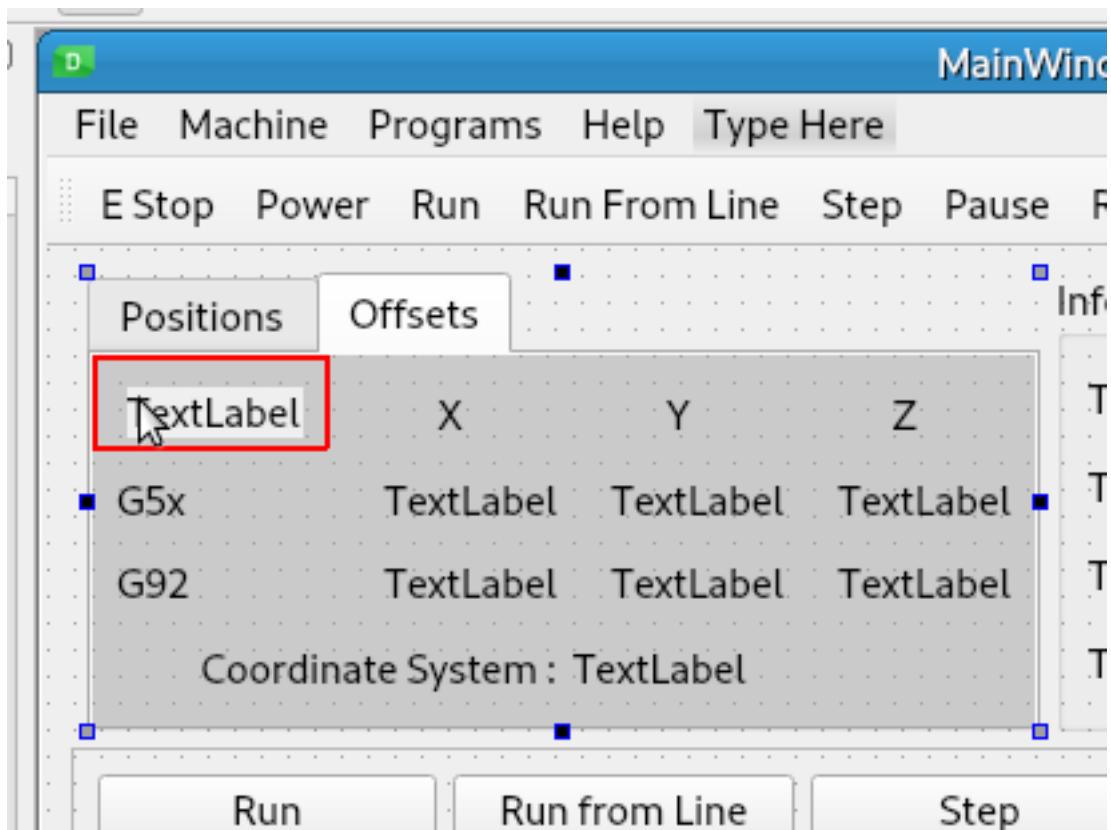
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TWENTYTWO

---

GUI TIPS

To group items together, use a container like a QFrame, QGroupBox or a QTabWidget.

If the contents of a container are rows and columns after adding at least one widget, right click and select *Layout* then *Lay Out in a Grid*. Now you can drag and drop widgets into the container. The blue line or red box indicate where it will be placed in the grid.



When using a grid layout for items that may change like Dro labels, change the text to represent the longest number including a minus sign. Next, in the property editor look at the Width and select (I usually use the column title) a widget and set the minimum width a tad bigger than the widest widget in that column. This will prevent the column from resizing as the values change.

For example, the numbers in the Actual column can contain up to 8 characters like -23.4567. In the next image no minimum width has been set

|             |       | Positions | Offsets      |         |         |  |  |
|-------------|-------|-----------|--------------|---------|---------|--|--|
| Axis        | Homed | Actual    | DRO          | Vel/Sec | Vel/Min |  |  |
| X           | ■ ■ ■ | 0 ■ ■     | 0            | 0       | 0       |  |  |
| Y           |       | 0         | 0            | 0       | 0       |  |  |
| Z           |       | 0         | 0            | 0       | 0       |  |  |
| XY Velocity |       | 0         | XYZ Velocity |         | 0       |  |  |

All the cells in the column will have the same width - here you can see it has a width of 44

| actual_lb_x : QLabel |                                     |
|----------------------|-------------------------------------|
| Property             | Value                               |
| objectName           | actual_lb_x                         |
| enabled              | <input checked="" type="checkbox"/> |
| geometry             | [115, 34), 44 x 20]                 |
| X                    | 115                                 |
| Y                    | 34                                  |
| Width                | 44                                  |
| Height               | 20                                  |
| sizePolicy           | [Preferred, Preferred, 0, 0]        |
| Horizontal Policy    | Preferred                           |

If we double-click in the label and add -23.4567 the width changes to 61

| actual_lb_x : QLabel |                                     |
|----------------------|-------------------------------------|
| Property             | Value                               |
| objectName           | actual_lb_x                         |
| enabled              | <input checked="" type="checkbox"/> |
| geometry             | [106, 34), 53 x 20]                 |
| X                    | 106                                 |
| Y                    | 34                                  |
| Width                | 53                                  |
| Height               | 20                                  |
| sizePolicy           | [Preferred, Preferred, 0, 0]        |
| Horizontal Policy    | Preferred                           |

I usually set the title of a column width to be a bit wider than the widest widget in the column

|                 |                     |
|-----------------|---------------------|
| verticalStretch | 0                   |
| ▼ minimumSize   | 65 x 0              |
| Width           | 65                  |
| Height          | 0                   |
| ► maximumSize   | 16777215 x 16777215 |
| ...             | ...                 |

If you drag a container into another container that has a layout and it's real short, just set the minimum height to make it larger and easier to drag and drop into.

Ctrl + left click to select several widgets at once to change all their properties.

The Monospace font is good for numbers that need a fixed width like DRO values.



---

CHAPTER  
**TWENTYTHREE**

---

## **STYLESHEET**

You can use your own .qss style sheet by creating a valid .qss file in the configuration directory and setting it in the *INI Settings*.

```
[DISPLAY]
QSS = name_of_file.qss
```

---

**Note:** If a THEME is found in the ini file the QSS entry is ignored

---

The Qt [Style Sheets Reference](#) and the [Style Sheet Syntax](#) and the [Style Sheet Examples](#) are good references to use when creating your own stylesheets.

---

**Note:** If there is an error in the stylesheet syntax, no warning is issued, it is just ignored. So don't forget the ; at the end of each setting. And do not accidentally use any backslashes it will break the whole file.

---

```
Warning: If you only set a background-color on a QPushButton, the background may not appear unless you set the border property to some value, even if border is set to none.
```

### **23.1 Colors**

Most colors can be specified using Hex, RGB or RGBA color model. RGB is Red, Green, Blue and A means Alpha or transparency. The alpha parameter is a number between 0.0 (fully transparent) and 1.0 (not transparent at all). Hex is red, green blue in hexadecimal number pairs from 00 to ff.

```
#0000ff
rgb(0, 0, 255) Blue
rgba(0, 0, 255, 25%) Light Blue
```

## 23.2 Examples

```
/* Set the background color for all QPushButtons, border is required */
QPushButton {
    background-color: rgba(224, 224, 224, 50%);
    border: 1px;
}

/* Set the background color and style for all QPushButtons when Pressed */
QPushButton:pressed {
    background-color: rgba(192, 192, 192, 100%);
    border-style: inset;
}

/* Set settings for a QPushButton named exit_pb */
QPushButton#exit_pb {
    border: none;
    background-color: rgba(0, 0, 0, 0);
}

/* Using sub controls */
QAbstractSpinBox::up-button {
    min-width: 30px;
}

/* Combining sub controls and state */
QTabBar::tab:selected {
    background: lightgray;
}

/* Target by Object Name starts with something common*/
QLabel[objectName*="dro"] {
    font-family: Courier;
    font-size: 14pt;
    font-weight: 700;
}
```

## 23.3 Tool Bar Buttons

A tool bar button created from a menu action can be styled by using the QToolButton` selector:

```
QToolButton:hover {
    background-color: rgba(255, 0, 0, 75%);
}
```

To set the style of a single tool bar button, you need to use the widget name for that action. The tool bar button must exist in the tool bar.

Table 1: Tool Button Names

| Menu Item         | Action Name             | Widget Name            |
|-------------------|-------------------------|------------------------|
| Open              | actionOpen              | flex_Open              |
| Edit              | actionEdit              | flex_Edit              |
| Reload            | actionReload            | flex_Reload            |
| Save As           | actionSave_As           | flex_Save_As           |
| Edit Tool Table   | actionEdit_Tool_Table   | flex>Edit_Tool_Table   |
| Reload Tool Table | actionReload_Tool_Table | flex_Reload_Tool_Table |
| Ladder Editor     | actionLadder_Editor     | flex_Ladder_Editor     |
| Quit              | actionQuit              | flex_Quit              |
| E Stop            | actionE_Stop            | flex_E_Stop            |
| Power             | action_Power            | flex_Power             |
| Run               | actionRun               | flex_Run               |
| Run From Line     | actionRun_From_Line     | flex_Run_From_Line     |
| Step              | actionStep              | flex_Step              |
| Pause             | actionPause             | flex_Pause             |
| Resume            | actionResume            | flex_Resume            |
| Stop              | actionStop              | flex_Stop              |
| Clear MDI History | actionClear_MDI_History | flex_Clear_MDI_History |
| Copy MDI History  | actionCopy_MDI_History  | flex_Copy_MDI_History  |
| Show HAL          | actionShow_HAL          | flex_Show_HAL          |
| HAL Meter         | actionHAL_Meter         | flex_HAL_Meter         |
| HAL Scope         | actionHAL_Scope         | flex_HAL_Scope         |
| About             | actionAbout             | flex_About             |
| Quick Reference   | actionQuick_Reference   | flex_Quick_Reference   |

The syntax to select a tool bar button by name (here the flex\_Quit button) is:

```
QToolButton#flex_Quit:hover {
    background-color: rgba(255, 0, 0, 75%);
}
```



---

CHAPTER  
**TWENTYFOUR**

---

## **RESOURCES**

To create a resources.py file with images to use with the .qss stylesheet, start by placing all the images in a different directory than the configuration files. A subdirectory in the configuration directory is fine

```
└── configs
    └── my_mill
        └── images
```

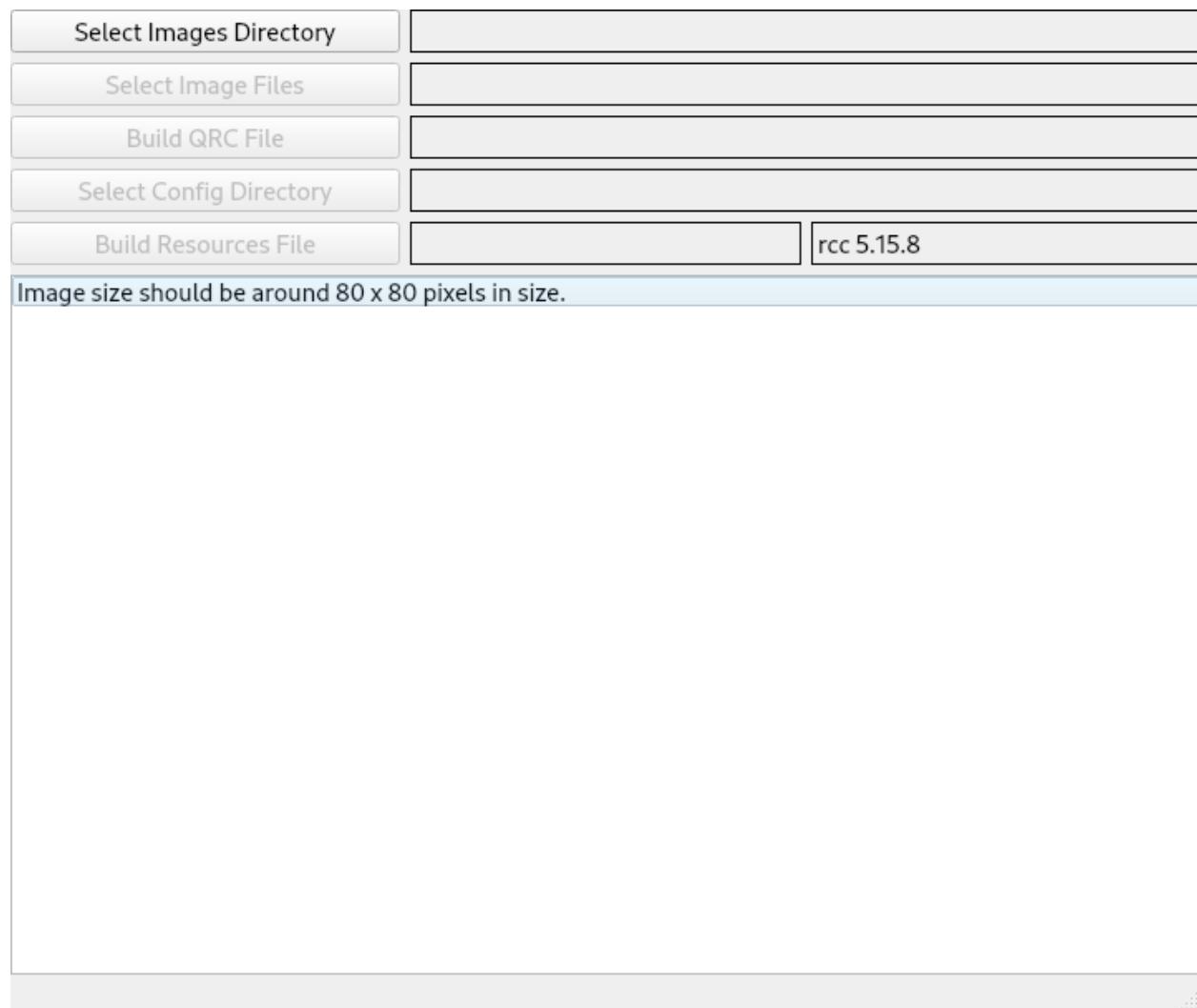
Add the following library if not installed

```
sudo apt install qtbase5-dev-tools
```

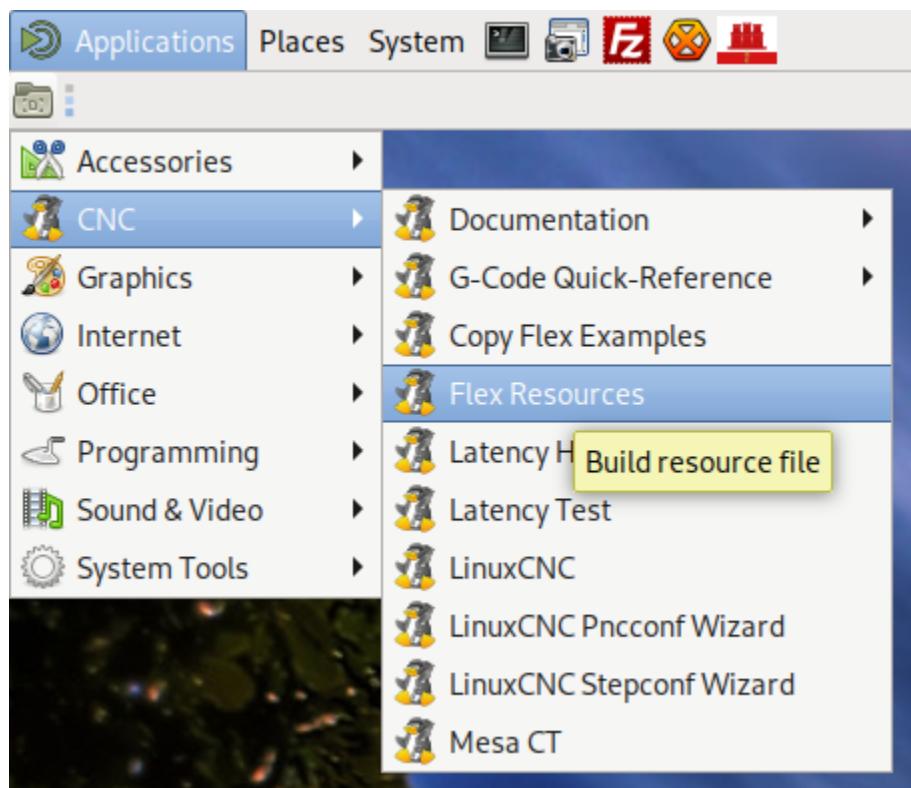
After installing Flex GUI on the CNC menu run *Flex Resources*

## Flex GUI

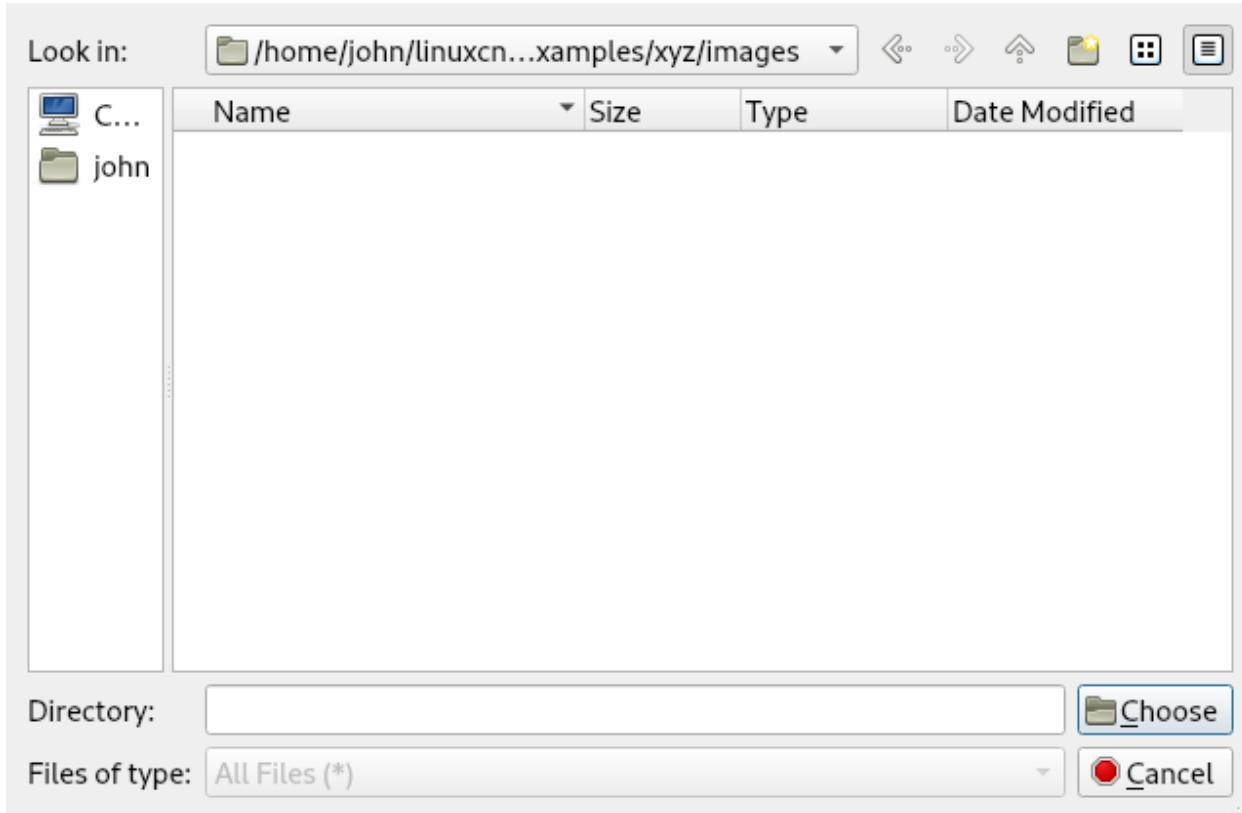
---



Startup



Next Select Images Directory



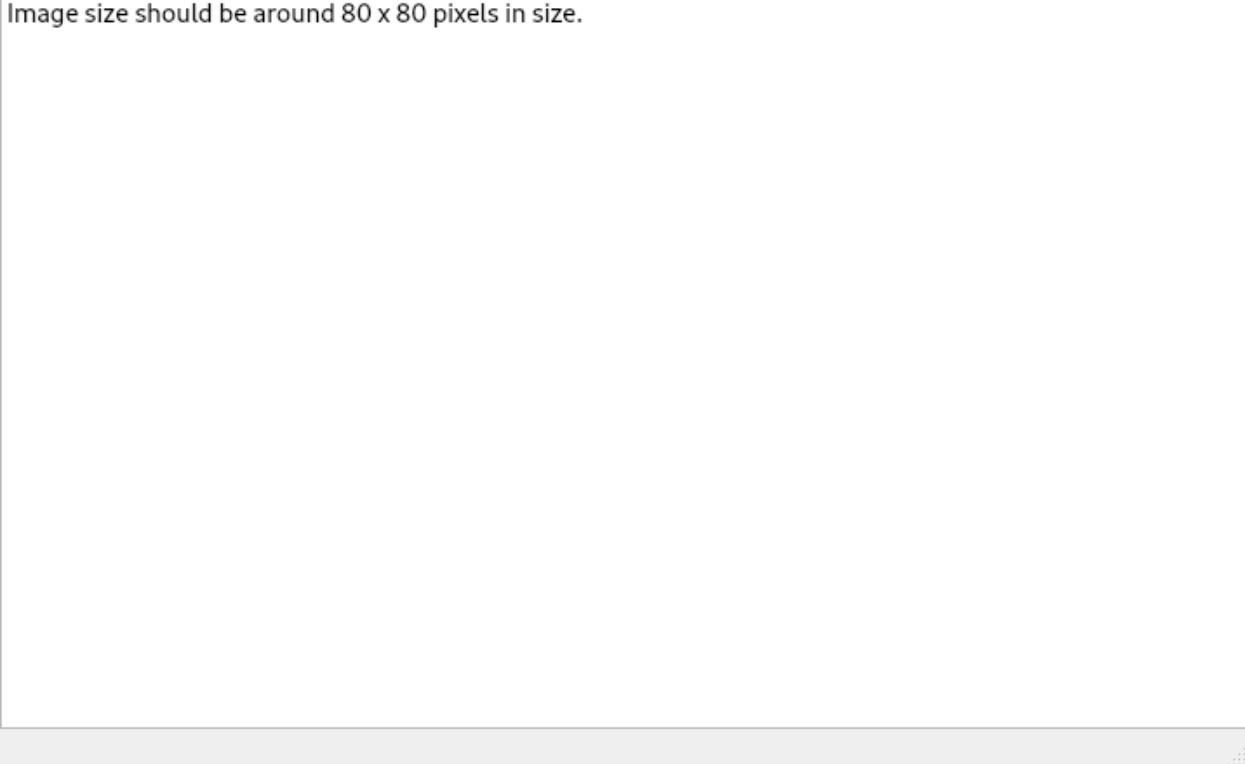
The selected directory is shown in the label

## Flex GUI

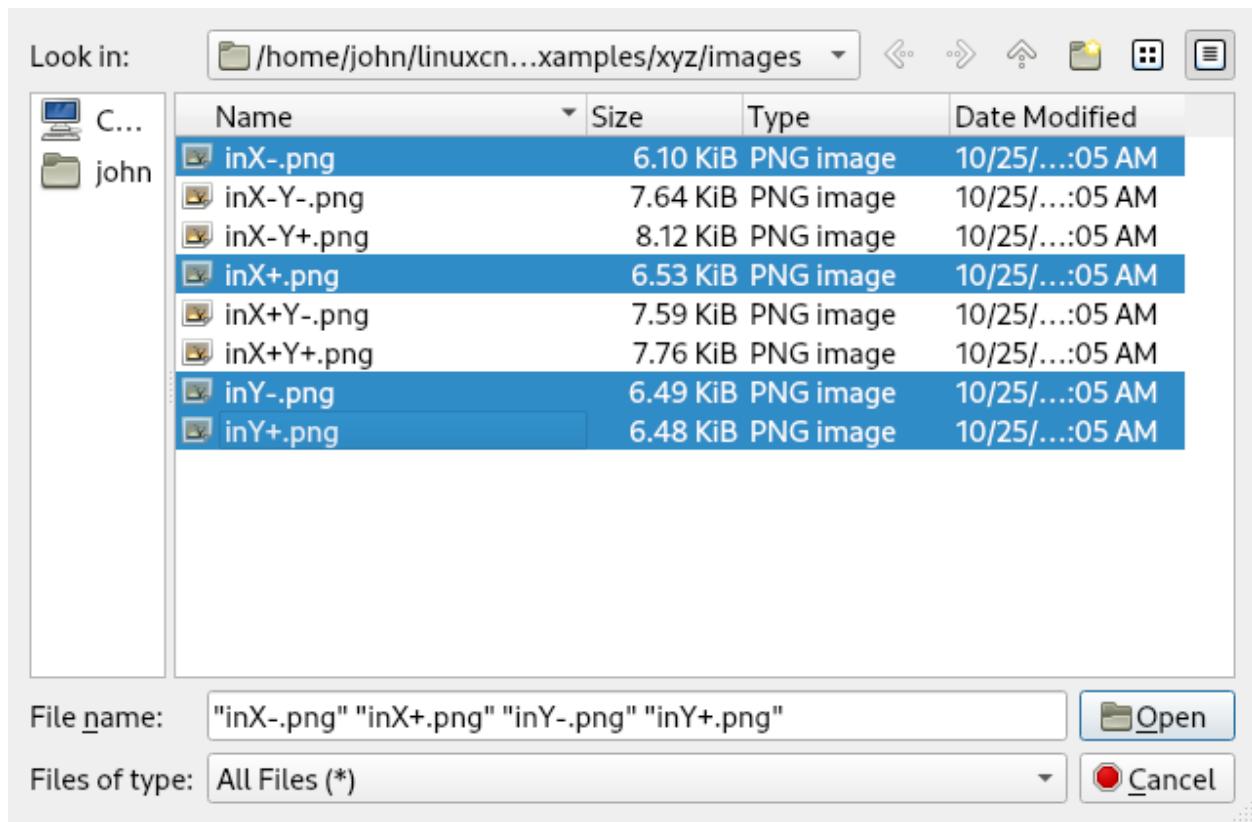
---

|                         |  |
|-------------------------|--|
| Select Images Directory | /home/john/linuxcnc/configs/flex_examples/xyz/images |
| Select Image Files      |  |
| Build QRC File          |  |
| Select Config Directory |  |
| Build Resources File    | rcc 5.15.8   |

Image size should be around 80 x 80 pixels in size.



Next Select Image Files. To select all the images left click on the first one and hold down the shift key and left click on the last one. To pick several images but not all hold down the ctrl key while you left click on each one.



The images selected are shown below

## Flex GUI

---

|                         |  |
|-------------------------|--|
| Select Images Directory | /home/john/linuxcnc/configs/flex_examples/xyz/images |
| Select Image Files      | 4 images selected                                    |
| Build QRC File          |  |
| Select Config Directory |  |
| Build Resources File    | rcc 5.15.8   |

/home/john/linuxcnc/configs/flex\_examples/xyz/images/inX-.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inX+.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inY-.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inY+.png

Next Build QRC File

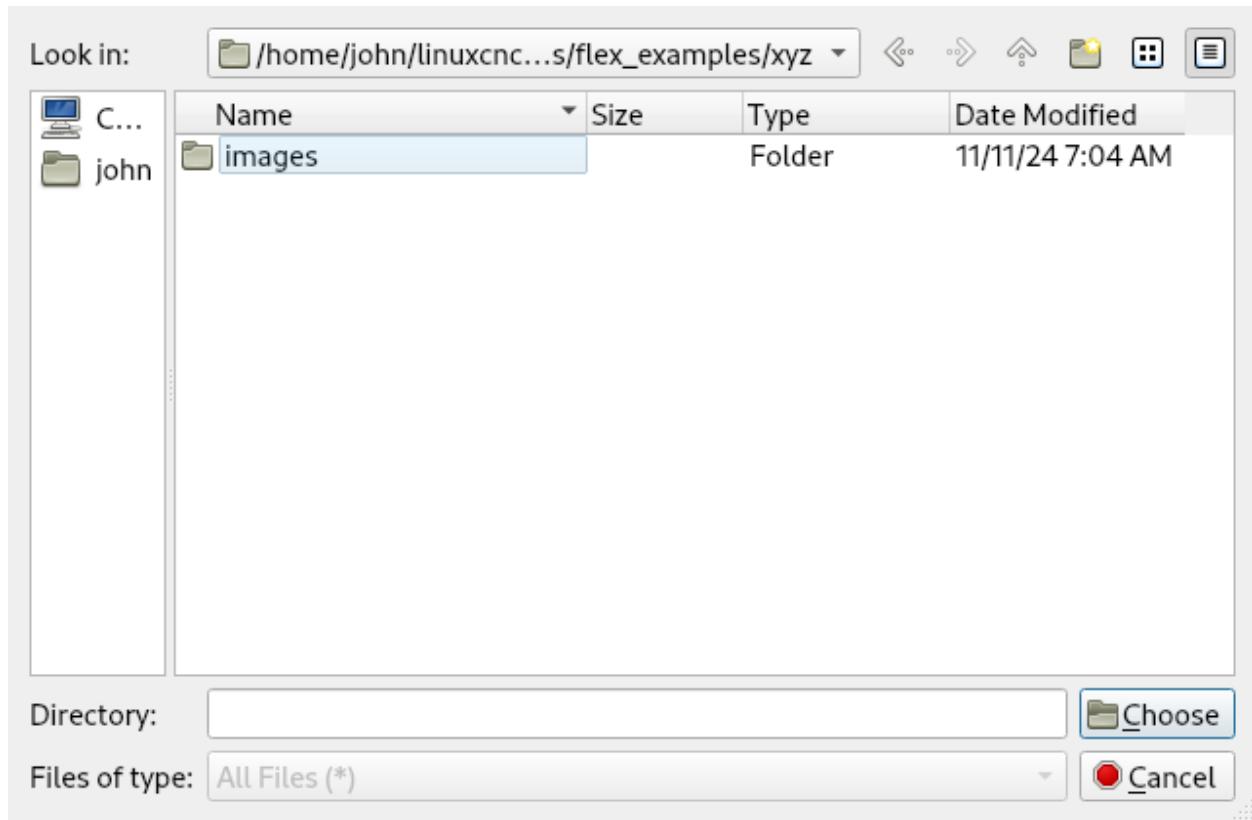
|  |  |
|--|--|
| Select Images Directory  | /home/john/linuxcnc/configs/flex_examples/xyz/images |
| Select Image Files   | 4 images selected                                    |
| Build QRC File  | Build QRC Done                                       |
| Select Config Directory  |  |
| Build Resources File   | rcc 5.15.8   |

/home/john/linuxcnc/configs/flex\_examples/xyz/images/inX-.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inX+.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inY-.png  
/home/john/linuxcnc/configs/flex\_examples/xyz/images/inY+.png

Next Select Config Directory

## Flex GUI

---

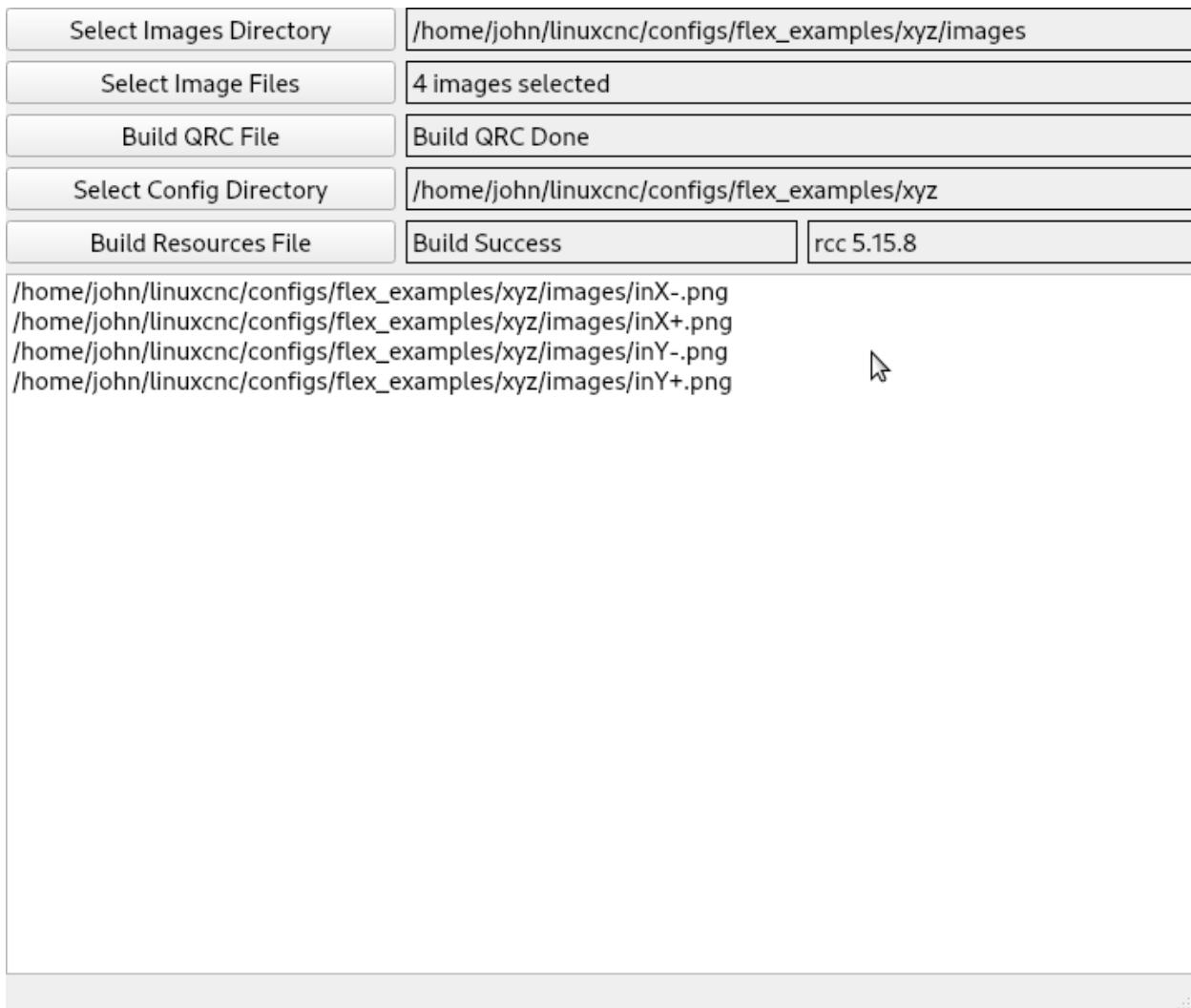


---

**Note:** The Image directory and the configuration directory must be different

---

Next Build Resources File



The Flex Resource Builder can be closed now. In the configuration directory you will have a resources.py file that contains the images used by the stylesheet.

Next edit the ini file and in the [DISPLAY] section add the following line

```
RESOURCES = resources.py
```

In the [DISPLAY] section add the style sheet

```
QSS = xyz.qss
```

To add an image named my-image.png to a QPushButton with an object name of my\_pb add the following to the qss file

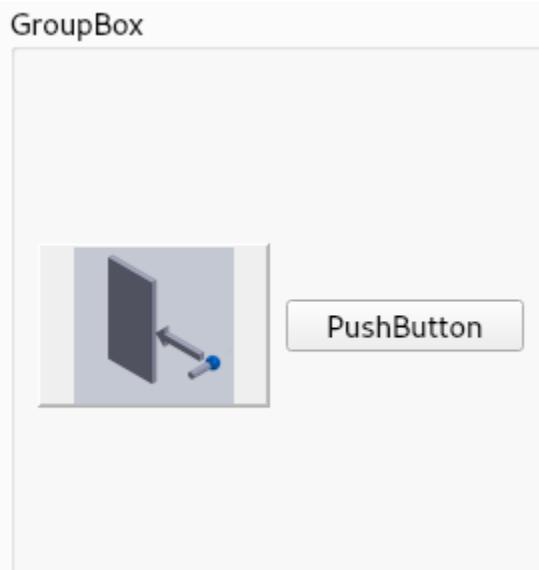
```
QPushButton#my_pb {
    min-height: 80px;
    min-width: 80px;
    margin: 2px;
    background-position: center;
    background-origin: content;
    background-clip: padding;
```

(continues on next page)

(continued from previous page)

```
background-repeat: no-repeat;  
background-image: url(:my-image.png);  
}
```

Now when you run the configuration the image will be on the QPushButton



---

**Note:** Delete any text in the QPushButton or it will be on top of the image

---