Common Simulink Components

For most of the systems we will encounter, we only need to be concerned with a small fraction of Simulink’s component library. For further details, just double-click on any block. In particular, you should get familiar with the following components, grouped by Library:

**Continuous:**

- **Derivative**
  - Numerical derivative of a signal

- **Integrator**
  - Continuous-time integration of a signal.

- **State-Space**
  - Add a system block in state-space form.

- **Transfer Fcn**
  - Add a system block in transfer function form.

**Discontinuous:**

- **Saturation**
  - Limit input signal to specified upper and lower saturation values.

**Math Operations:**

- **Abs**
  - Absolute value.

- **Gain**
  - Constant gain. By double-clicking and changing the multiplication type to “Matrix(K*u)”, can do matrix multiplication.

- **Math Function**
  - Math functions such as exp, log, ln, sqrt, square, pow, etc. Double-click and see Function drop-down menu for complete list.

- **Sum**
  - Add/subtract two or more signals. Double-click and modify List of Signs to change signs or add/remove input nodes.

- **Trigonometric Function**
  - Used to place non-linear trig elements such as sin, cos, tan, and their inverses.

**Ports & Subsystems:**

- **In1**
  - Add an input to a subsystem.

- **Out1**
  - Add an output to a subsystem.

- **Subsystem**
  - Create a user-defined subsystem with variable number of inputs and outputs. Double-click block to view/edit the subsystem.
Signal Routing:

- Demux: Used to split up a bus of multiple signals into its individual signals.
- Mux: Used to combine multiple signals into a single bus.
- Switch: You can think of this as a mux. 2\textsuperscript{nd} input is compared against threshold and passes either 1\textsuperscript{st} input or 3\textsuperscript{rd} input based on value.

Sinks:

- Scope: Used to view system signals DURING simulation. Can plot more than one signal at once (connect bus to input).
- To Workspace: Stores signal into MATLAB workspace as specified Variable Name, where you can plot or process it as you wish. Make sure to double-click and change Save Format to “Array”.

Sources:

- Clock: Clock signal returns time values used in simulation.
- Constant: Constant.
- Pulse Generator: Periodic pulse signal with specified amplitude, period, duty cycle, and phase delay.
- Ramp: Ramp signal with specified slope and start time.
- Sine Wave: Sinusoid with specified amplitude, bias, frequency, and phase.
- Step: Step signal with specified initial and final values and step time.

Quanser: (find these in QuaRC Targets → Data Acquisition → Generic)

- HIL Initialize: Found under “Configuration.” Initialization block must be present in Simulink diagram to work on hardware. If you’re using the large green interface boards, make sure Board Type is set to “q4.” If you’re using the black interface boxes, make sure Board Type is set to “q2_usb.”

- HIL Read Encoder: Found under “Immediate I/O.” Read quadrature encoder inputs. Double-click and change Input Port to vector \([0 \ 1]\) to read multiple inputs. Make sure target is not “unassigned.”
HIL Write Analog

Found under “Immediate I/O.” Write voltage signal to analog output. Make sure target is not “unassigned.”