

# RegaLink RT - Typhoon HIL

Get the fastest response times using the digital RegaLink RT interface in combination with a HIL from Typhoon

## 1 Introduction

This application note outlines the integration of a Typhoon HIL system with REGATRON DC power supplies G5 series using the optional RegaLink RT interface, based on the Aurora protocol. To make the integration of the RegaLink RT interface as straightforward as possible, REGATRON built its own package for Typhoon HIL. It includes step-response measurements, a comparison with the analog interface, a representative battery-simulation use case, and a step-by-step guide to ensure a seamless integration process.

## 2 RegaLink RT configuration

Using the RegaLink RT interface is straightforward. Simply connect your Typhoon HIL via an SFP cable with the SFP port of the REGATRON power supply. Ensure that the RegaLink RT option is unlocked on the G5 device. Next, install the REGATRON Typhoon package provided by us. A detailed step-by-step installation guide is included at the end of this document. Once the installation is complete, the REGATRON component block can be added directly to your Typhoon HIL model.



Figure 1: REGATRON G5 component in the Typhoon HIL Schematic Editor.

Within the G5 component you can freely choose between various Control Modes, Load Protect settings, Limit settings, Output signals and configure the simulation step size.

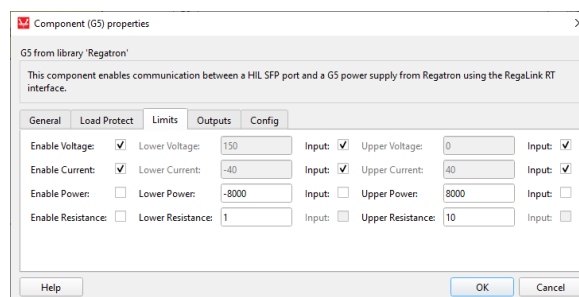


Figure 2: Example of the *Limits* configuration tab, showing the configuration of the RegaLink RT G5 block with all required signals.

### 3 RegaLink RT step response performance

Since the protocol is fully digital, there is no additional latency from analog-to-digital converters (ADC) that would otherwise be required to convert the HIL output to an analog signal and then reconvert it back to a digital signal inside the G5. By using the SFP interface, these conversion steps are eliminated, enabling significantly faster transmission. In addition, only a single connection is required. This avoids the complexity of multiple analog cables and removes the need to configure gains, offsets, or calibration parameters.

In addition, the SFP interface supports optical links, allowing the connection to remain virtually unaffected by any electromagnetic fields present in an experimental setup. This makes the interface extremely robust and simple to implement.

With the new digital interface, the minimum delay has been reduced from 90  $\mu\text{s}$  (analog interface) to only 45  $\mu\text{s}$ . The expected jitter for the RegaLink RT interface is 20.8  $\mu\text{s}$  plus the simulation step time of the HIL system. This jitter results from the asynchronous clocks of the HIL system and the REGATRON power supply.

The delay was measured in a back-to-back setup of two G5 1000 V 18 kW units, one was in a static voltage-controlled mode with 200 V and the other one was controlled via the RegaLink RT interface with a -40 A to +40 A step. The HIL new reference value was also routed to an analog output which was used as the trigger for the oscilloscope.

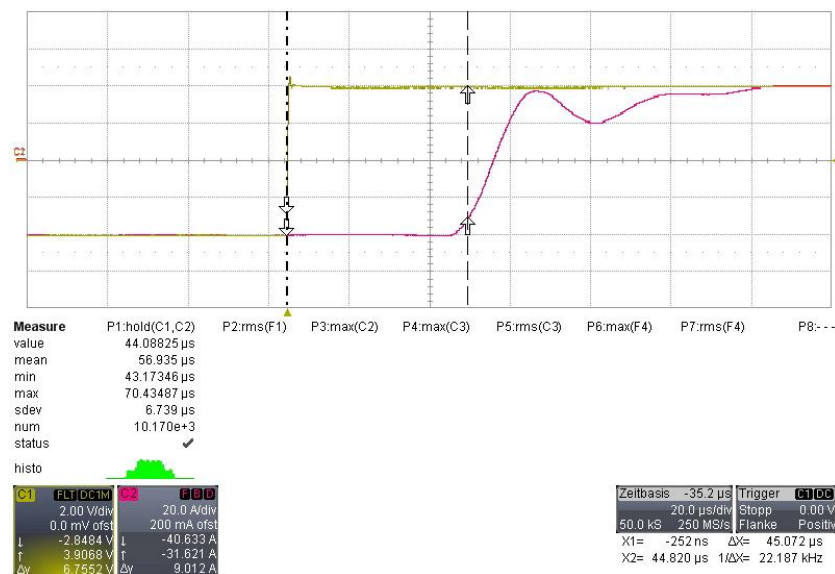


Figure 3: Showing in yellow the HIL reference value and in red the output current of the connected G5. The HIL had a simulation step time of 6  $\mu\text{s}$ .

The same step was measured using the analog interface. In this case, drawbacks of the analog signal become apparent: a small overshoot of the set value occurs because the signal is influenced by the impedance of the signal lines and by electromagnetic interference from nearby equipment. Additionally, the current waveform before the step is noticeably less smooth compared to the one obtained with the digital RegaLink RT interface.

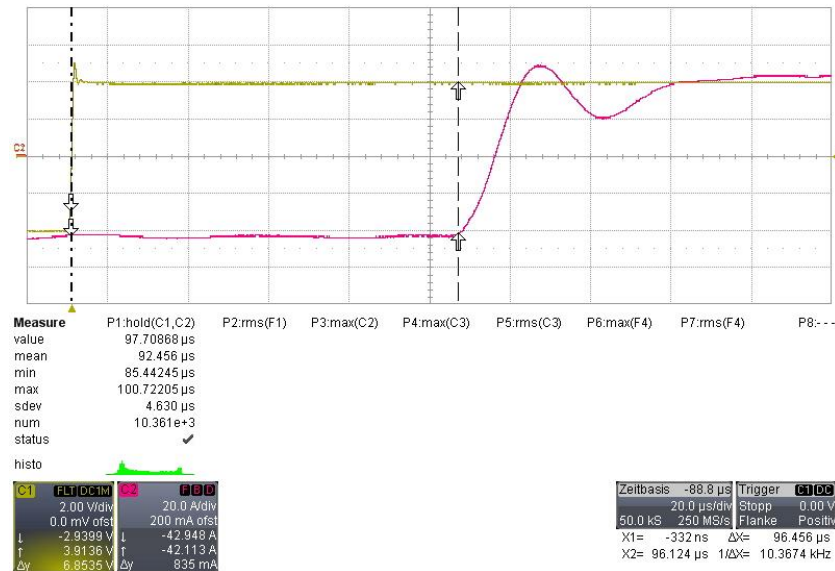
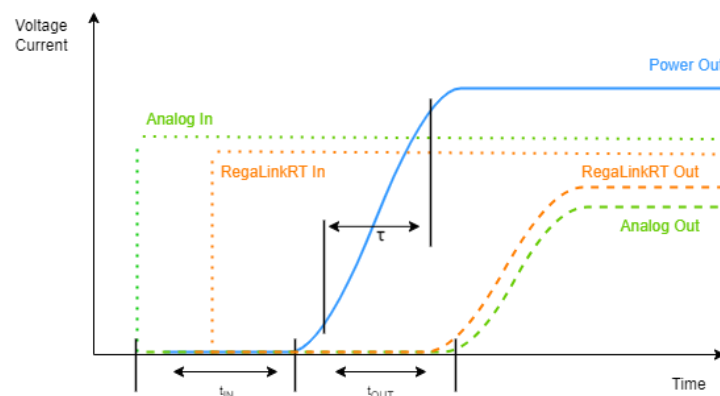


Figure 4: Showing in yellow the HIL analog reference value and in red the output current of the connected G5. The HIL had a simulation step time of 6 µs, but since the signal is analog the jitter caused by the HIL cannot be measured.

A comparison of the faster response time of the RegaLink RT interface compared to the analog interface can be seen in the diagram below:



#### G5 step response times

Analog	RegaLink RT	
90 µs	45 µs	$t_{IN}$ time delay setpoint in to power out
42 µs	42 µs	$t_{OUT}$ time delay power out to setpoint out
20 µs	20 µs	$\tau$ rise/fall time current step 10 % ... 90 % full scale
170 µs	170 µs	$\tau$ rise/fall time voltage step 10 % ... 90 % full scale

## 4 RegaLink RT battery simulation

The new RegaLink RT interface simplifies the use of HIL systems for circuit simulation. Just connect your circuit to a REGATRON component—there is no need to hassle with HIL pinouts, adjust the gains of analog inputs and outputs or have a jungle of multiple analog signal lines from the power supply to the HIL.

To demonstrate this, a simple static battery simulation based on an enhanced Thevenin model featuring two RC circuits was implemented:

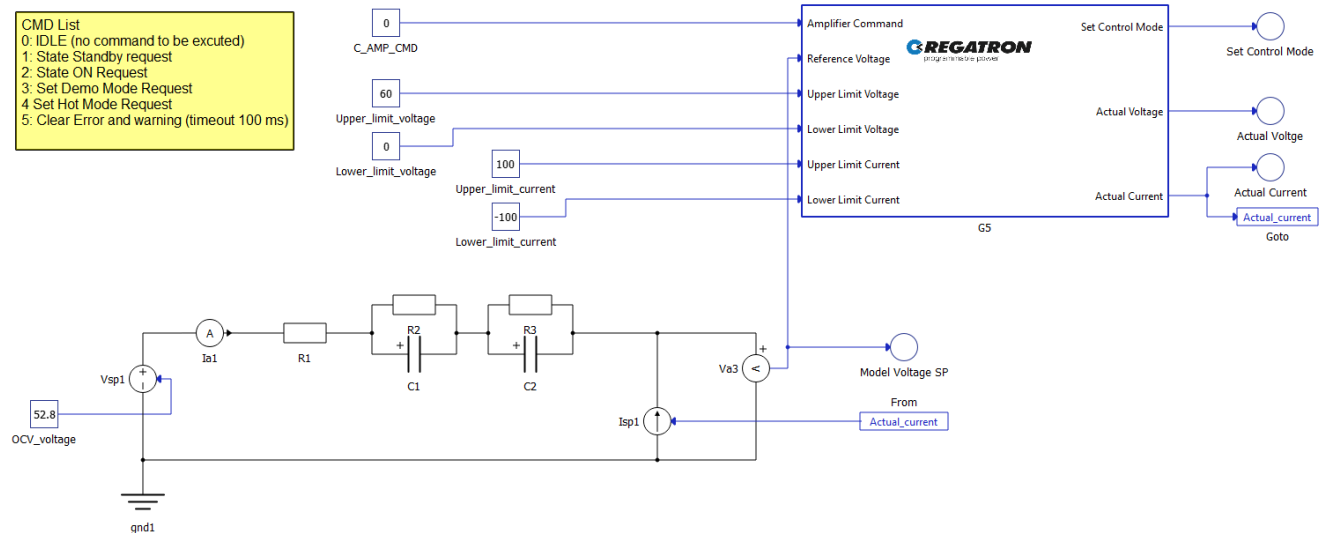


Figure 5: Static battery simulation based on an enhanced Thevenin model featuring two RC circuits connected to a G5 block in the HIL software.

The battery simulation connected to a G5 was loaded with a current step from -20 A to +20 A to measure the step response of the setup.

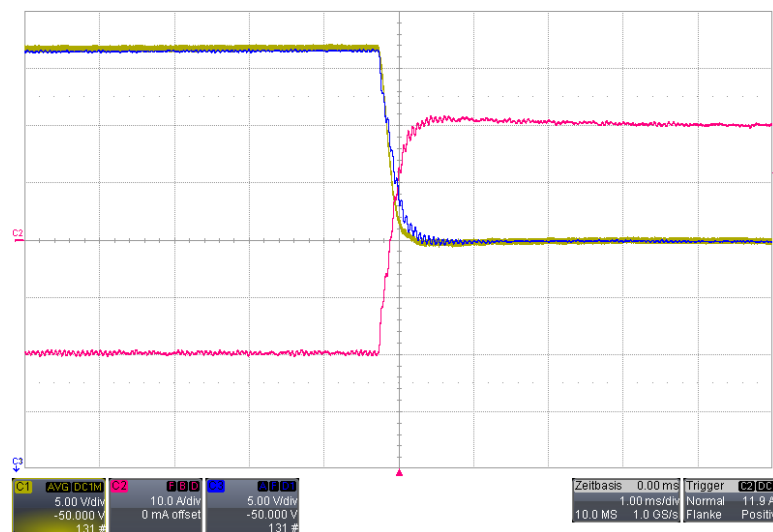


Figure 6: Showing in yellow the HIL reference value, in blue the output voltage and in red the output current of the connected G5. The HIL had a simulation step time of 6  $\mu$ s. Current step from charging the simulated battery with 20 A to a 20 A discharge.

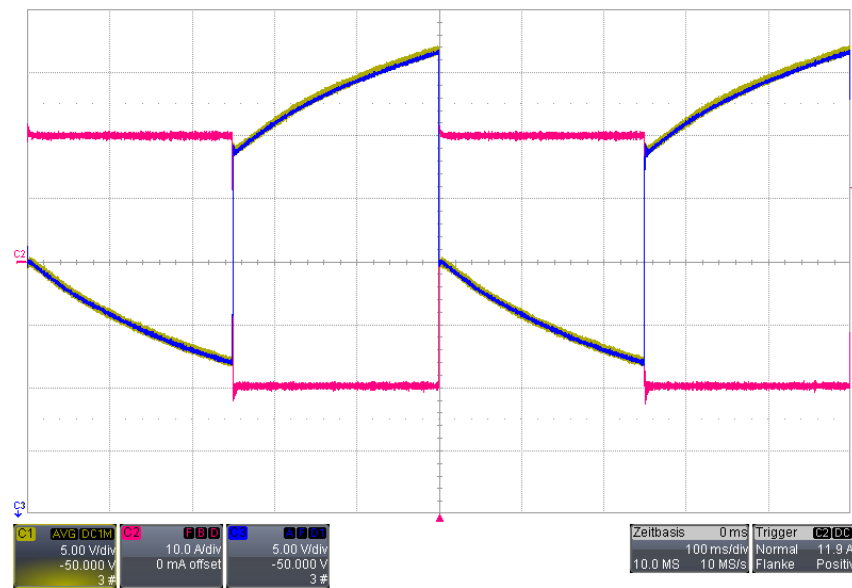


Figure 7: Showing in yellow the HIL reference value, in blue the output voltage and in red the output current of the connected G5. The HIL had a simulation step time of 6  $\mu$ s. Zoomed out version of the step shown in figure 6.

## 5 Step-by-step connection guide

### 5.1 Minimum setup requirements:

- REGATRON:
  - o G5 with software option “RegaLink RT” and firmware package from March 2026 or newer. This can be checked in the G5.Control Software => Device => Licensing and Info => Device Info.
- Typhoon HIL:
  - o HIL with an SFP port (for example HIL101, HIL404, HIL506 or HIL606)
  - o Typhoon HIL version 2026.1 or newer
  - o Custom Firmware Package for the RegaLink RT interface (contact Typhoon HIL Support)
- SFP Link cable copper or optical with appropriate SFP connector

### 5.2 Connection

One cable is all it takes: just connect the SFP cable from the HIL to the SFP port of the REGATRON power supply.

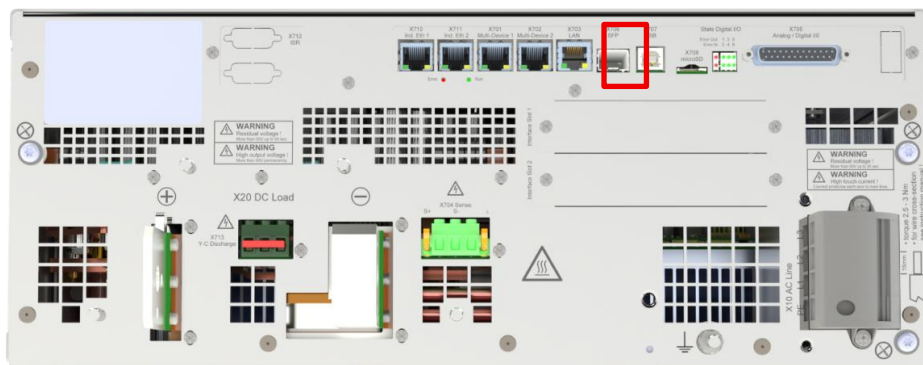
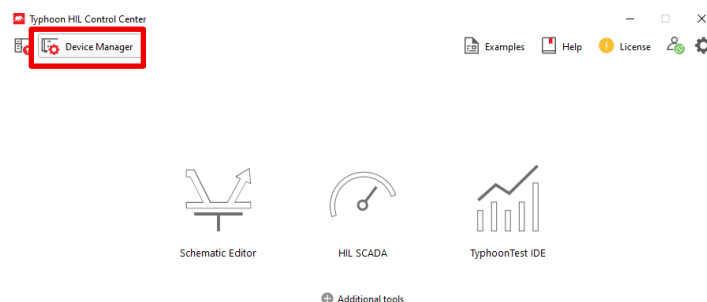


Figure 8: The X706 SFP port on the G5 device is located at the back of the unit (red box).

### 5.3 Flash custom Firmware on the Typhoon HIL

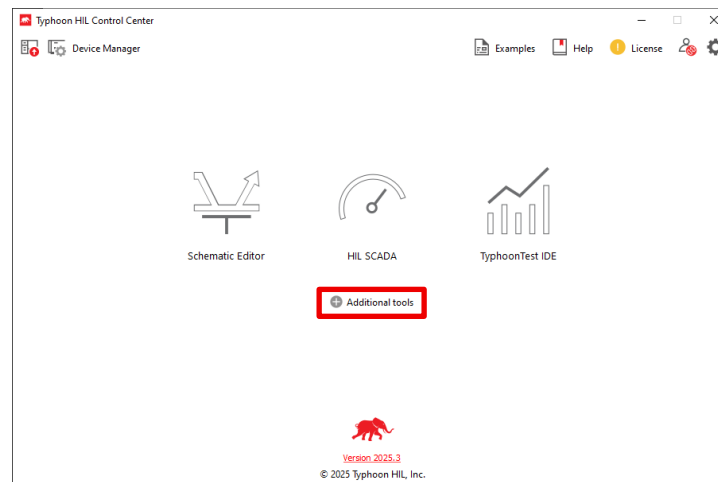
The RegaLink RT interface is not included in the standard Typhoon HIL firmware. Therefore, a dedicated firmware package provided by Typhoon HIL must be installed to enable the RegaLink RT functionality. To obtain this firmware, open a support ticket through the Typhoon HIL Support Center. In your request, specify the HIL model you are using and indicate that you require access to the Typhoon firmware package for the RegaLink RT interface from REGATRON.

Once Typhoon HIL grants access, the custom firmware package will be available in the Device Manager tool. From there, you can update the HIL device and select the RegaLink RT configuration in the Typhoon HIL Control Center.

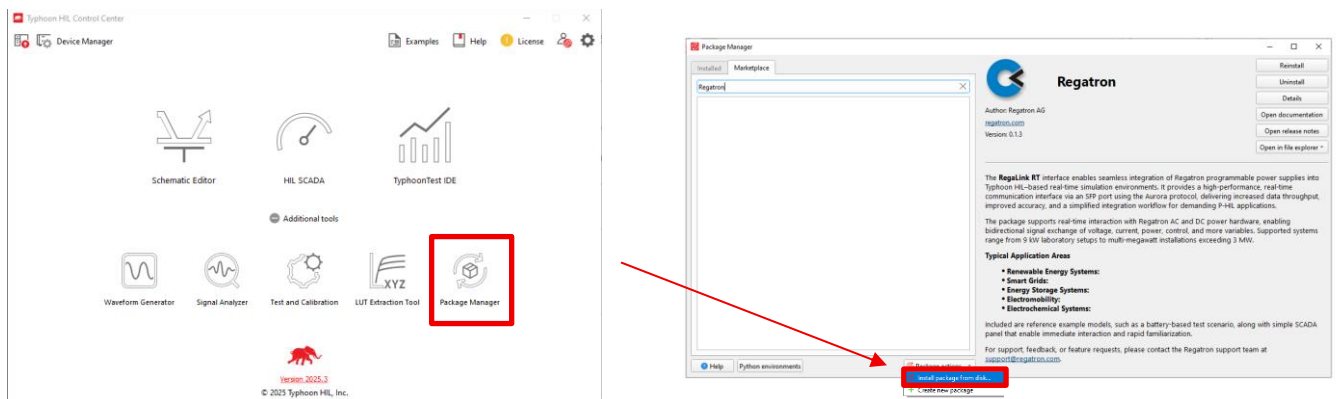


## 5.4 Typhoon HIL Control Center setup:

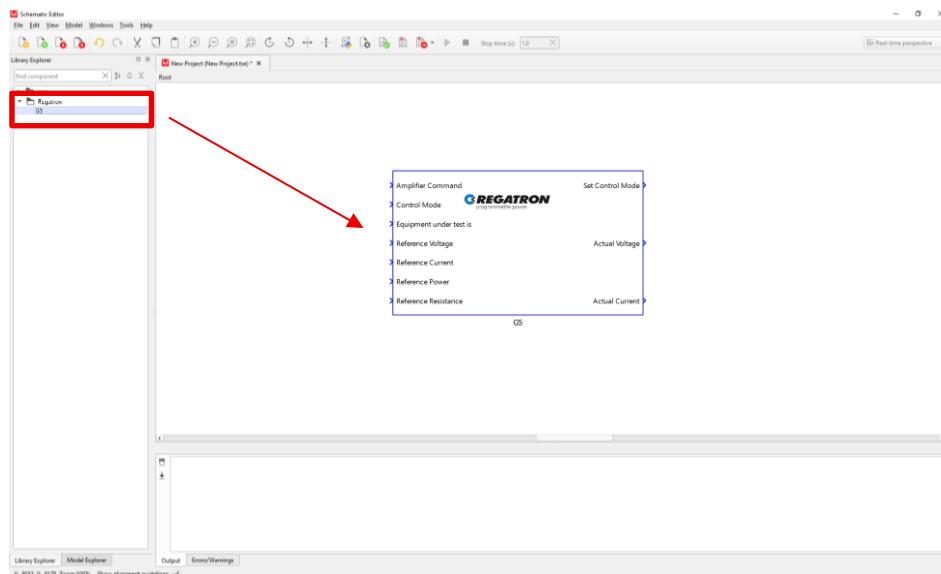
To install the REGATRON component use the Typhoon HIL Control Center start screen.



Choose the Package Manager, where you then can install the REGATRON component library.

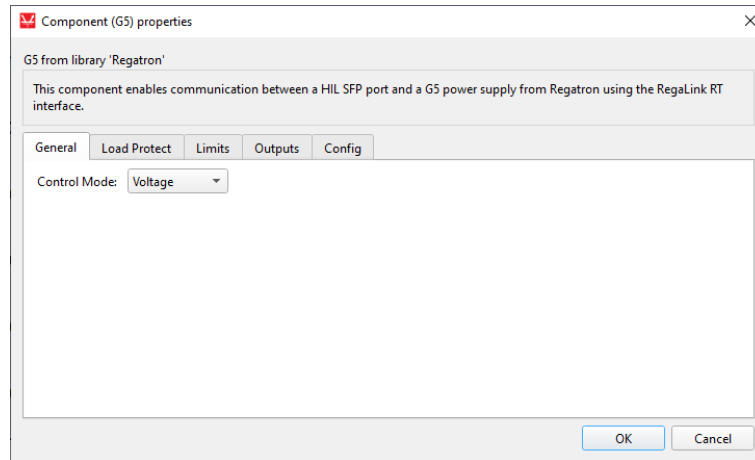


Using the REGATRON library is then a matter of drag and drop.

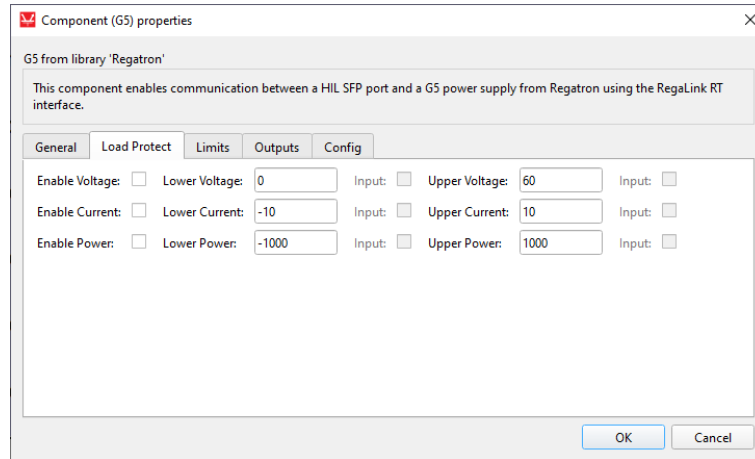


By double clicking on the REGATRON component you can open its properties window.

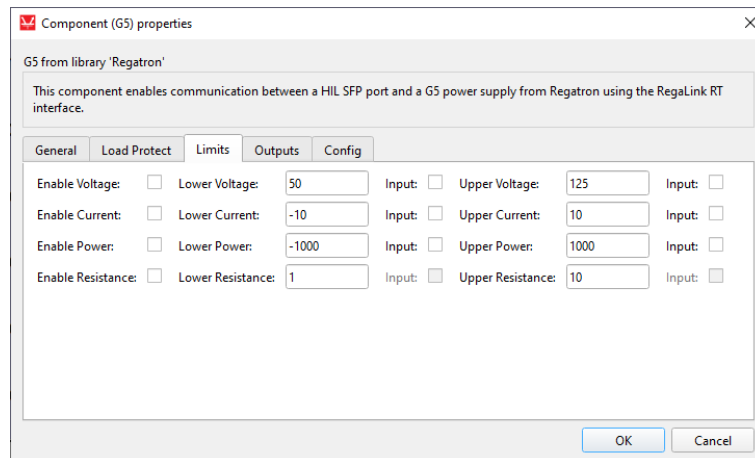
In the **General** tab you can choose the control mode between: Voltage, Current, Power, Resistance or User defined.



In the **Load Protect** tab you can enable, edit and configure the Load Protect values either as fixed values or as input signals, which allows you to change these values during the simulation.

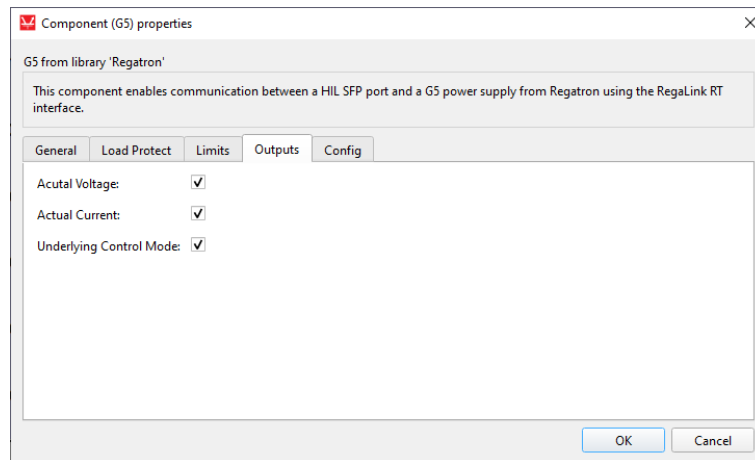


In the **Limits** tab you can enable, edit and configure the limit values either as fixed values or as input signals, which allows you to change these values during the simulation.

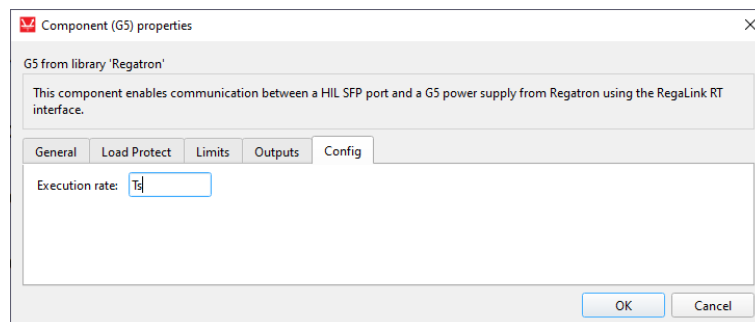




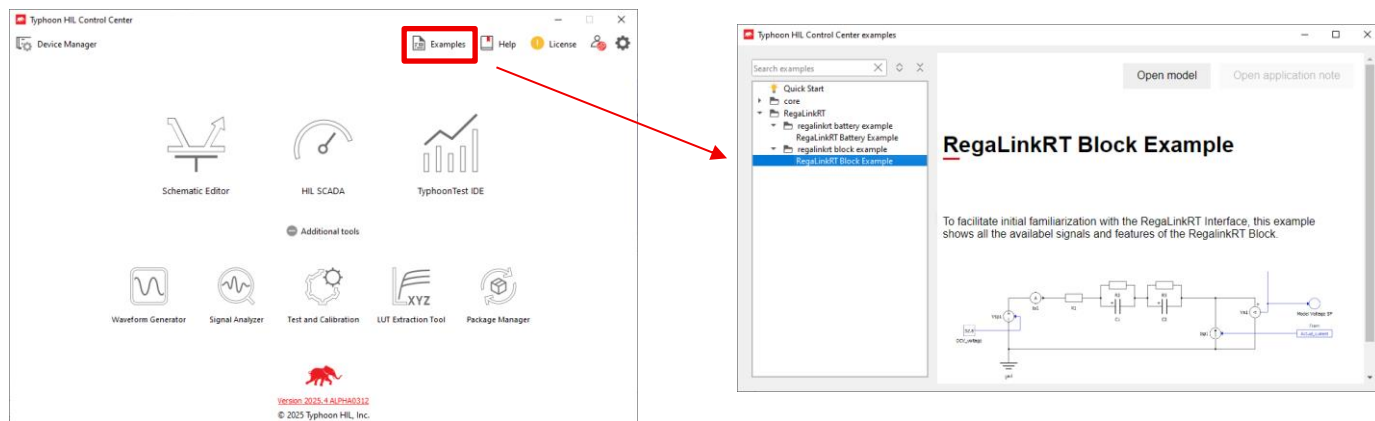
In the **Outputs** tab you can enable that the block reads back the measured voltage, current and underlying control mode from the REGATRON power supply. Enabling you to create a closed loop model directly with one SFP connection to a REGATRON power supply, making the setup seamless and easy.



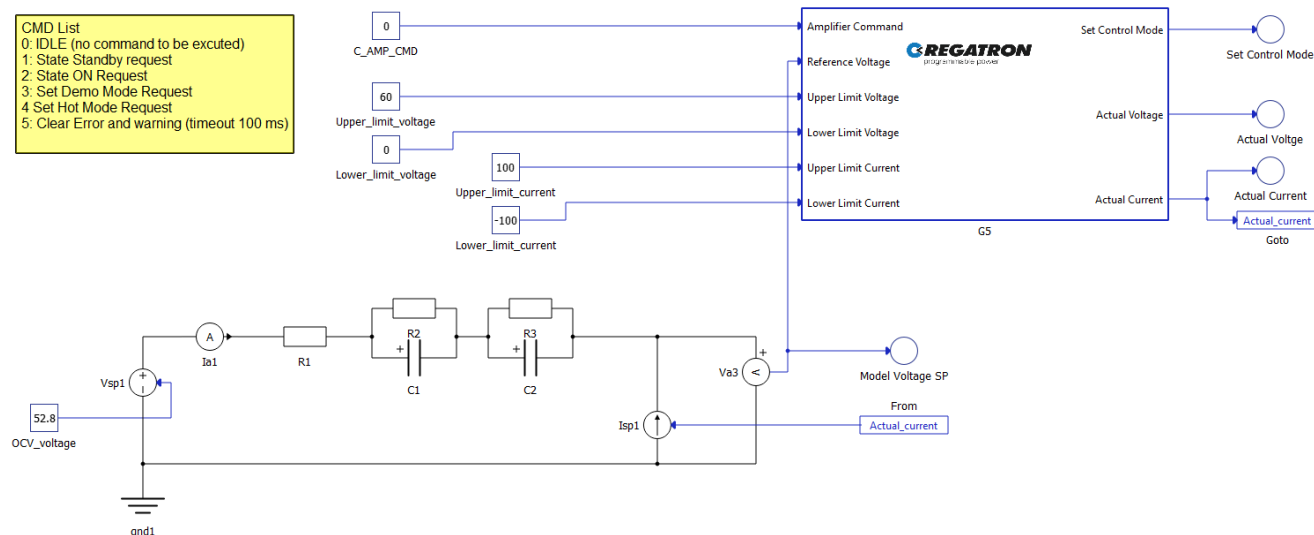
You can also configure the execution rate of the REGATRON component, which determines the update rate of Component. The execution rate must be greater than 3  $\mu$ s to ensure correct operation of the communication protocol.



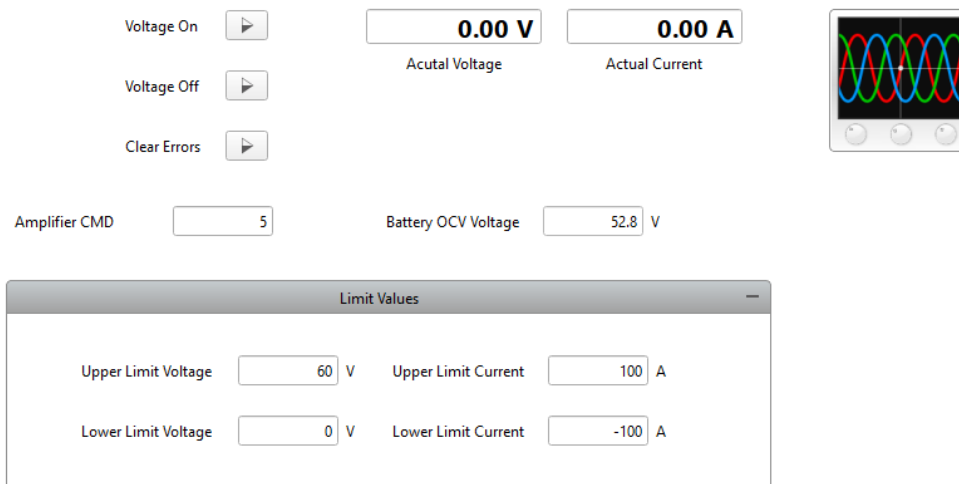
Included in the RegaLink RT Package are also two examples which can be accessed via the Examples tab:



With a schematic:



And a SCADA panel:



## 5.5 Possible Commands

### 5.5.1 Amplifier Command Input:

Binary	Integer	Command
0000	0	Idle (no command to be executed)
0001	1	State "Standby" request
0010	2	State "Voltage On" request
0101	5	Clear Errors and warnings

### 5.5.2 Control Mode Input:

Binary	Integer	Command
0000	0	Idle (no command to be executed)
0001	1	Set Voltage control mode
0010	2	Set Current control mode
0011	3	Set Power control mode
0100	4	Set Resistor control mode

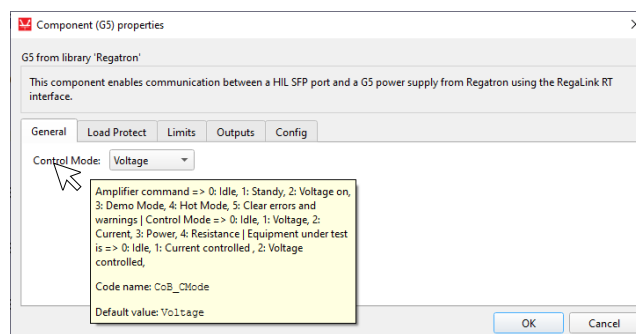
### 5.5.3 Equipment under test is Input:

Binary	Integer	Command
0000	0	Idle
0001	1	Equipment under test is Current controlled
0010	2	Equipment under test is Voltage controlled

### 5.5.4 Underlying Control Mode Output:

Binary	Integer	Command
0000	0	Idle
0001	1	Power supply is Voltage controlled
0010	2	Power supply is Current controlled

For quick reference, we also included the available commands in the description that appears when you hover over elements such as the Control Mode text:



For detailed technical information, contact REGATRON or your local sales partner.

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