

RT Box

DEMO MODEL

Modbus Interface Demo on a Single RT Box

Last updated in RT Box Target Support Package 4.1.1

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- Check the PLECS and RT Box TSP documentation

1 Overview

Modbus is a widely adopted industrial communication protocol that enables reliable data exchange between automation devices such as programmable logic controllers (PLCs), sensors, actuators, and real-time simulation platforms. The PLECS RT Box natively supports Modbus TCP Client and Modbus TCP Server communication blocks, mapping simulated real-time data directly to network variables.

- RT Box as a Modbus TCP Server (formerly Slave) - In this mode, the RT Box simulates a physical system, like a grid inverter or motor drive. An external industrial controller (the Client) reads from and writes to it.
- RT Box as a Modbus TCP Client (formerly Master) - In this mode, the RT Box runs a simulated controller that actively commands or collects data from external plant hardware on the network (the Servers).

A Modbus Server listens on TCP port 502 for requests from a Modbus Client. Only one Modbus Server block can be used per model. It is possible to use multiple Modbus Client blocks within the same model. Several Modbus Client blocks may connect to the same Modbus Server. For example, if different update intervals are desired.

This demo model illustrates the communication between one Modbus Server block and two Modbus Client blocks on a single RT Box. Note that this scenario may not be a practical use case. It is for illustrative purposes to showcase the setup only.

1.1 Requirements

- One PLECS RT Box[1] and one PLECS Coder[2] license.
- The RT Box Target Support Package[3] (minimum version 4.1.1).
- Follow the step-by-step instructions on configuring PLECS and the RT Box in the Quick Start guide of the RT Box User Manual[4].

2 Model

In this demo, both Modbus Clients read the same input register from the Modbus Server, and each Client writes its own holding register value to a separate, consecutive address on the Server. The two Clients are triggered at different intervals. The circuit schematic is shown in Fig. 1.

2.1 Server to Client

The Triangular Wave Generator block connected to the Modbus Server block mimics values calculated by the RT Box real-time model (e.g., simulated phase currents, temperatures, grid frequency). This signal is configured as “Input Registers” under the **Inputs** tab of the Modbus Server block. This is shown in Fig. 2 on p. 4.

Each Modbus Client requests this data from the Modbus Server, and outputs it into the PLECS model (connected to the Scopes named “Client 1 data” and “Client 2 data”). The configurations of Client 1 and Client 2 are shown on the left and right side of Fig. 3 on p. 5, respectively. In the **General** tab of each Client, the server IP address is set to `127.0.0.1` (the loopback/localhost address), because the Server runs on the same RT Box. Each Client’s trigger interval is also set in the **General** tab.

2.2 Client to Server

Each Modbus Client sends out a holding register value to the Modbus Server. This mimics the behavior of a controller that writes commands to control the devices in the field. Each Client’s holding register value is generated by its own Sine Wave Generator. The corresponding configuration of the Mod-

[1] https://www.plexim.com/products/rt_box
[2] https://www.plexim.com/products/plecs/plecs_coder
[3] https://plexim.com/download/rt_box
[4] https://www.plexim.com/sites/default/files/rtboxmanual.pdf

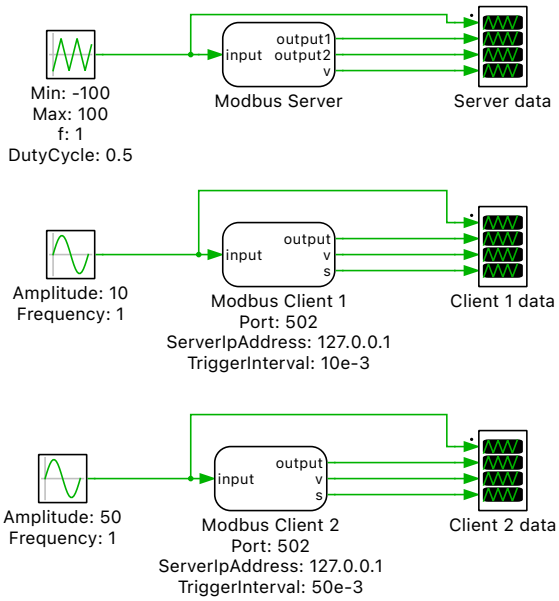


Fig. 1: Subsystem circuit schematic for Modbus interface demo

bus Client 1 and 2 blocks is shown in Fig. 4 on p. 5. The Server receives a holding register value from Client 1 at address 1, and another holding register value from Client 2 at address 2. This configuration is shown in Fig. 5 on p. 6. The Modbus Server outputs the value of these two Holding Registers into the PLECS model (connected to the Scope named “Server data”).

3 Simulation

From the **System** tab of the **Coder options...** window, select the “modbus_demo/RT Box” Subsystem and go to the **Target** tab. **Build** the “RT Box” model onto the RT Box. Once the model is uploaded, from the **External Mode** tab of the **Coder options...** window, **Connect** to the RT Box and **Activate autotriggering**. The real-time simulation results can be observed via the PLECS Scopes in the model.

The Scope called “Server data” depicts the data from each Client to the Server, as shown in Fig. 6 on p. 7. The Sine Wave with an amplitude of 10 is received from Client 1 with a time step of $10\,\mathrm{ms}$. The other Sine Wave with an amplitude of 50 is received from Client 2 with a time step of $50\,\mathrm{ms}$. This behavior fits the model.

The Scope called “Client 1 data” and “Client 2 data” each depict the data coming from the Server, as shown in Fig. 7 on p. 8 and Fig. 8 on p. 9. Each Client receives the Triangular Wave data from the Server with the correct amplitude and frequency, the only difference being the time step ($10\,\mathrm{ms}$ for Client 1 and $50\,\mathrm{ms}$ for Client 2). This behavior fits the model as well.

4 Conclusion

This demo shows how to set up Modbus TCP communication between a Modbus Server and a Modbus Client on the RT Box.

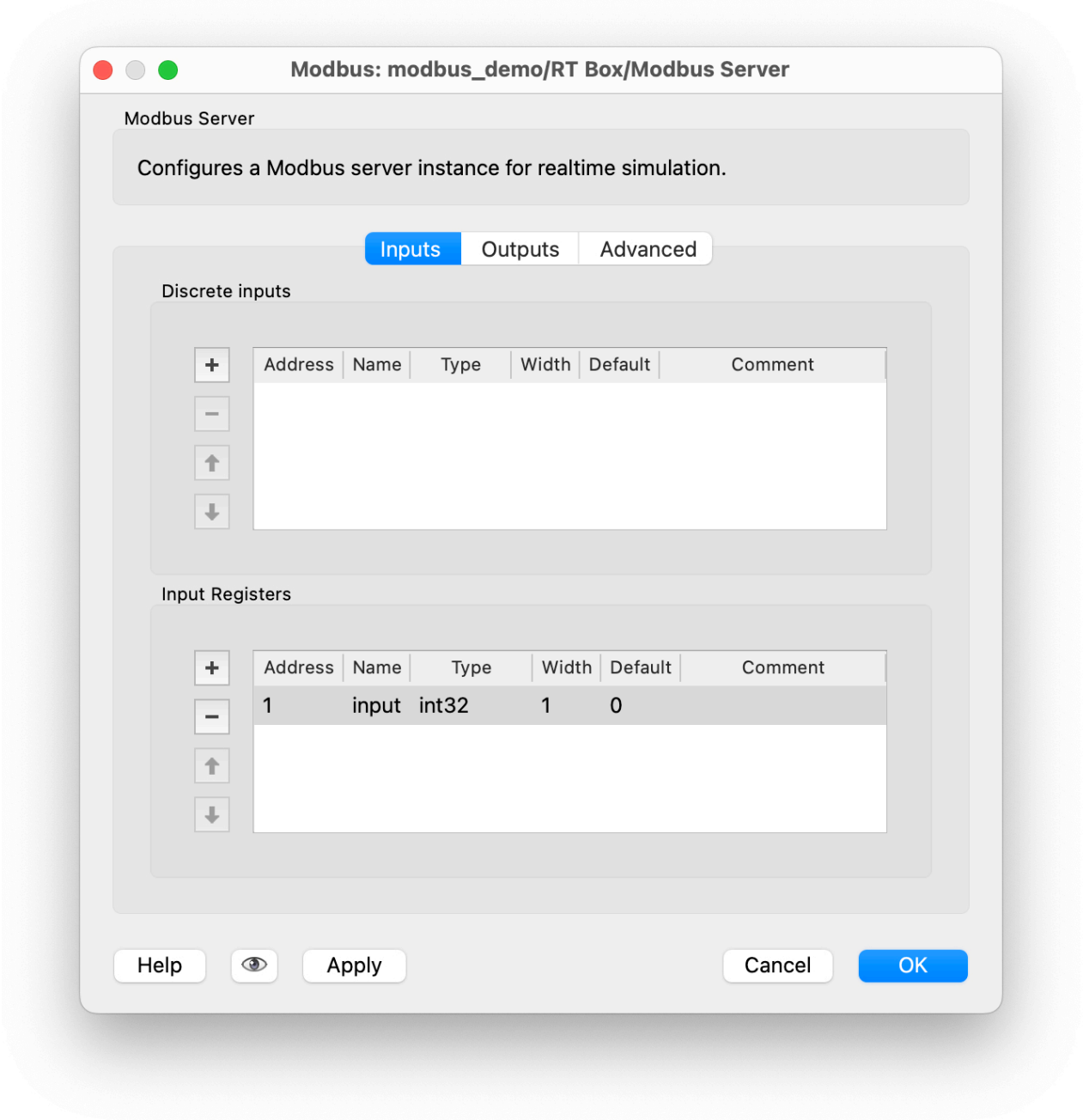


Fig. 2: Inputs configuration of the Modbus Server block

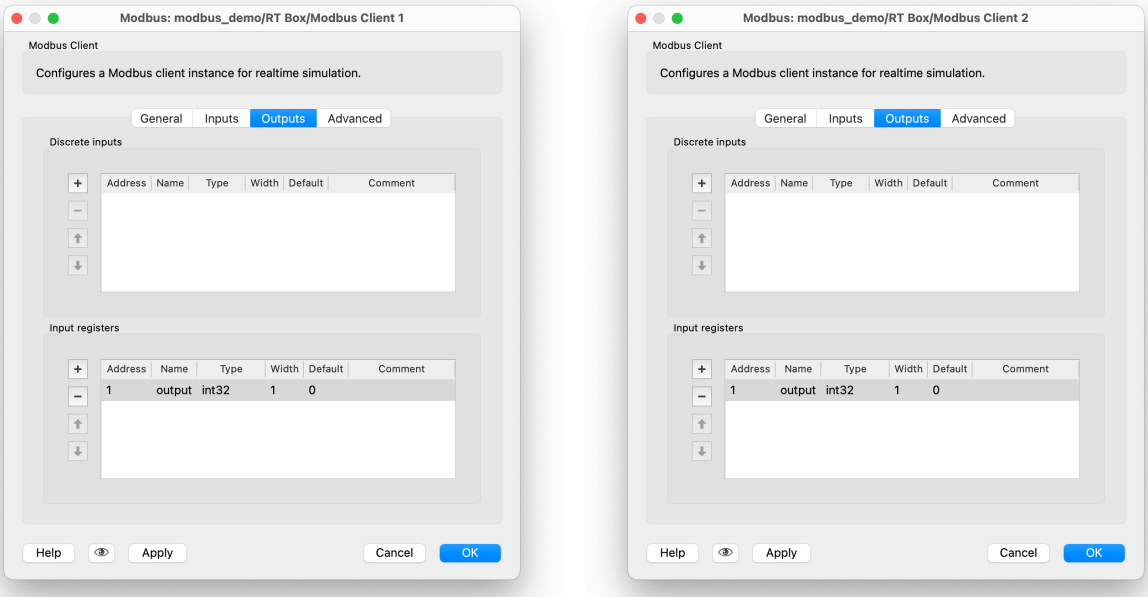


Fig. 3: Outputs configuration of the Modbus Client 1 (left) and Client 2 (right)

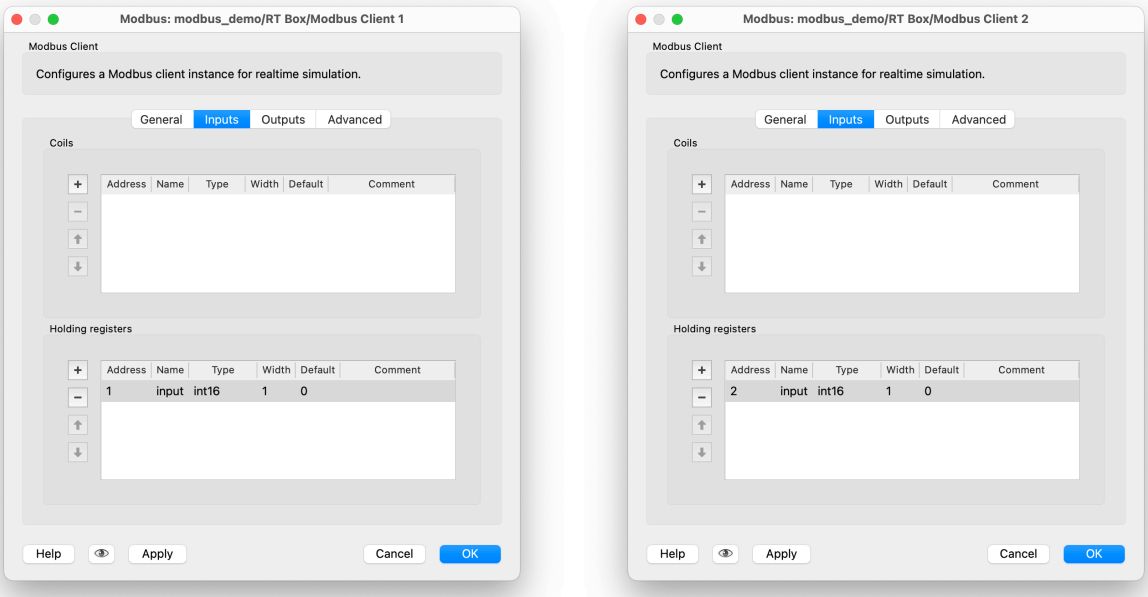


Fig. 4: Inputs configuration of the Modbus Client 1 (left) and Client 2 (right)

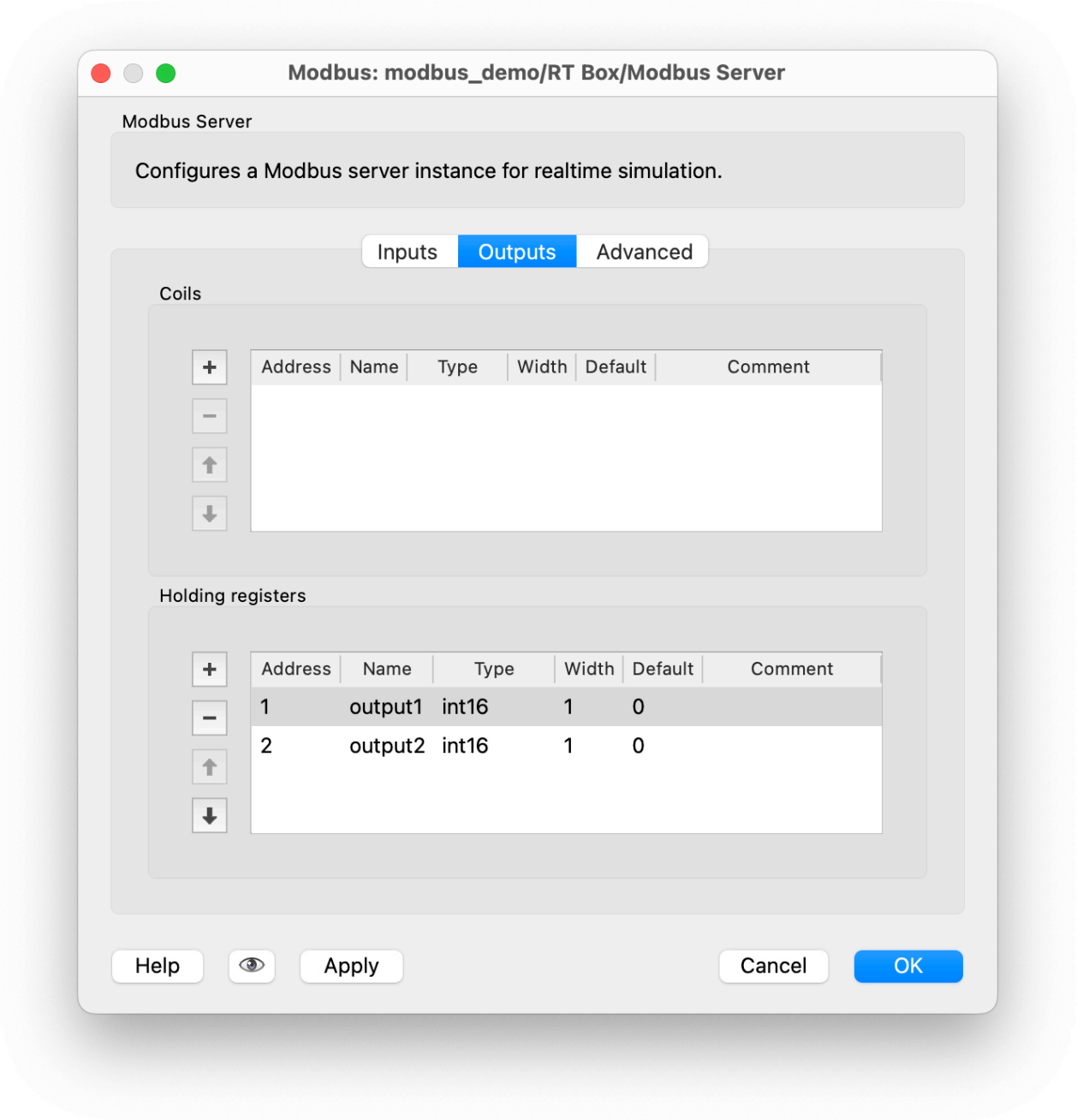


Fig. 5: Outputs configuration of the Modbus Server block

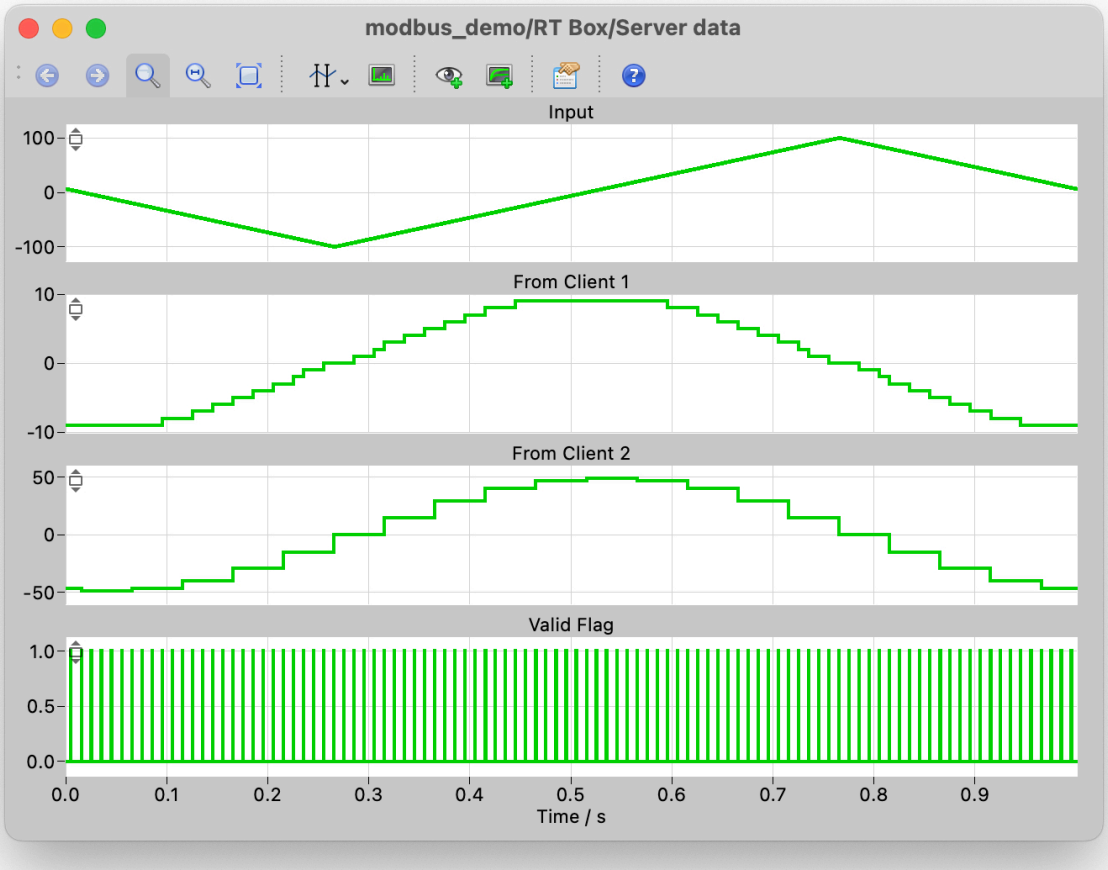


Fig. 6: Real-time waveform showing the Modbus Server data

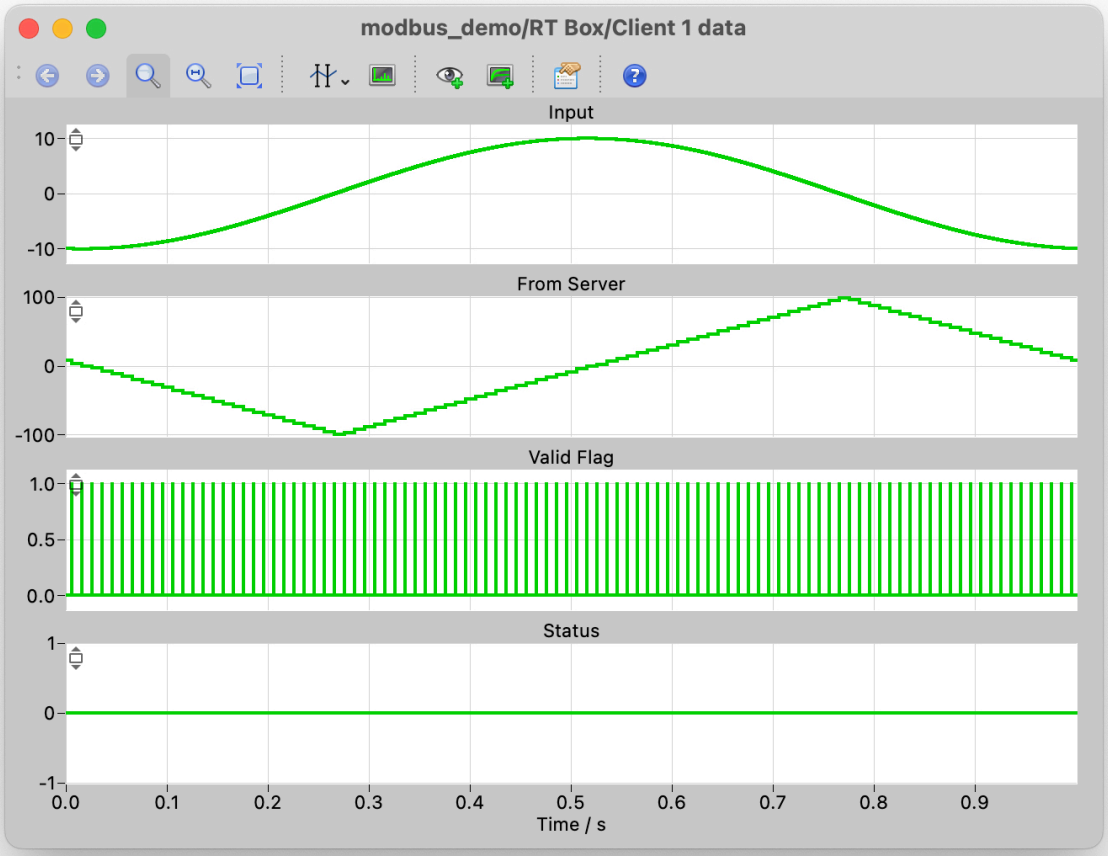


Fig. 7: Real-time waveform showing the Client 1 data

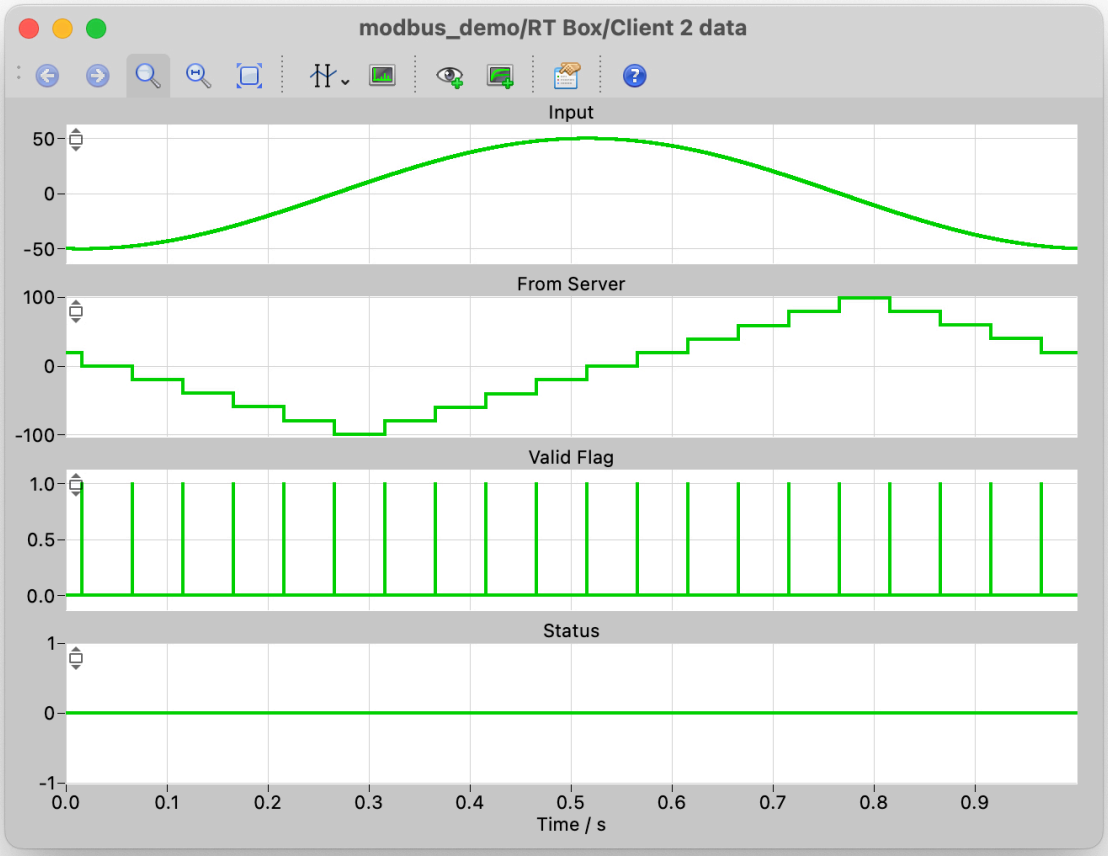


Fig. 8: Real-time waveform showing the Client 2 data

Revision History:

RT Box TSP 4.1.1	First release

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