

# DL PEL-HIL Getting Started

## Host-Target Communication - Scalar

DL R&D

2025-08-07

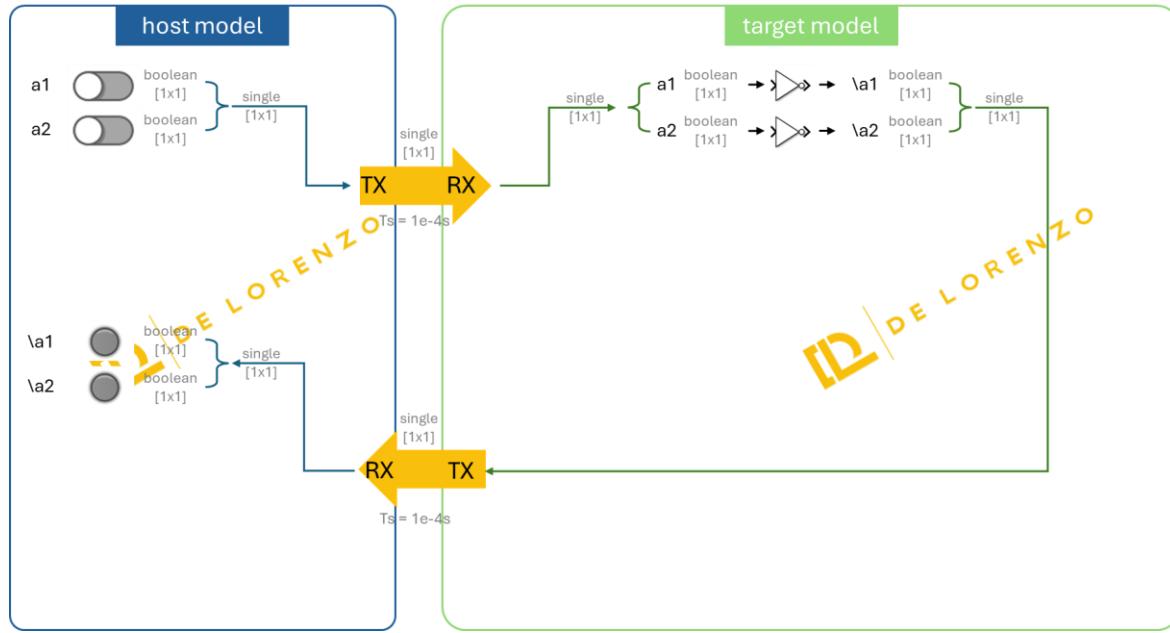
### Description

In this example, we will build a host-target (master-slave) communication system to exchange scalar as shown in the diagram below.

The host model running in the master (PC) will package and transmit data to the target model running in the slave device (DL RCPCORE), including 2 Boolean values.

The DL RCPCORE (slave) will unpack the received data, perform simple processing, then package and return the processed data back to the master.

The master will then receive and unpack the data, display the results, and verify the correctness of the communication.



### Learning Objectives

- how to set up a simple host-target communication system
- understand and differentiate the host model and the target model through hands-on practice
- data packing and unpacking
- understand the significance of time synchronization in communication
- dashboard development

## Prior Knowledge

### 1. Data Types

In DL PEL-HIL, we recommend using three data types: **boolean**, **uint16**, and **single**.

Data Type	Size	Range	Description
boolean	1 bit	1/0	Represents logical states such as on/off or yes/no. Used for flags and condition checks.
uint16	16-bit	[0, 65535]	Efficient for counters, IDs, and hardware register values. Saves memory for positive integers.
single	32-bit	$\pm 1.18 \times 10^{-38}$ to $\pm 3.4 \times 10^{38}$	Used for numeric data with decimals. Suitable for sensor values and control algorithms.

#### Notes:

- Some DL built-in blocks specify a data type and therefore require matching input/output signals for consistency.
- Use single type for precision; use boolean and uint16 for speed and memory efficiency.

### 2. Signal Dimensions

In the context of communication, a signal can take various forms:

- a single data element,
- a combination of multiple single-element signals, or
- a set of signals that each include historical (past) data.

As a starting point, let's first explore the different dimensions that signals can have.

Size	Example	Terminology	Note
[1x1]	5	Scalar	A single value
[2x1]	$\begin{bmatrix} 1.1 \\ 2.1 \end{bmatrix}$	Column vector	A vector with 2 rows and 1 column
[1x3]	[1.1 1.2 1.3]	Row vector	A vector with 1 row and 3 columns
[2x3]	$\begin{bmatrix} 1.1 & 1.2 & 1.3 \\ 2.1 & 2.2 & 2.3 \end{bmatrix}$	Matrix	A matrix with 2 rows and 3 columns

## Step 0. Model parameter settings

Click on 'Click here to edit model parameters' to edit the parameters.

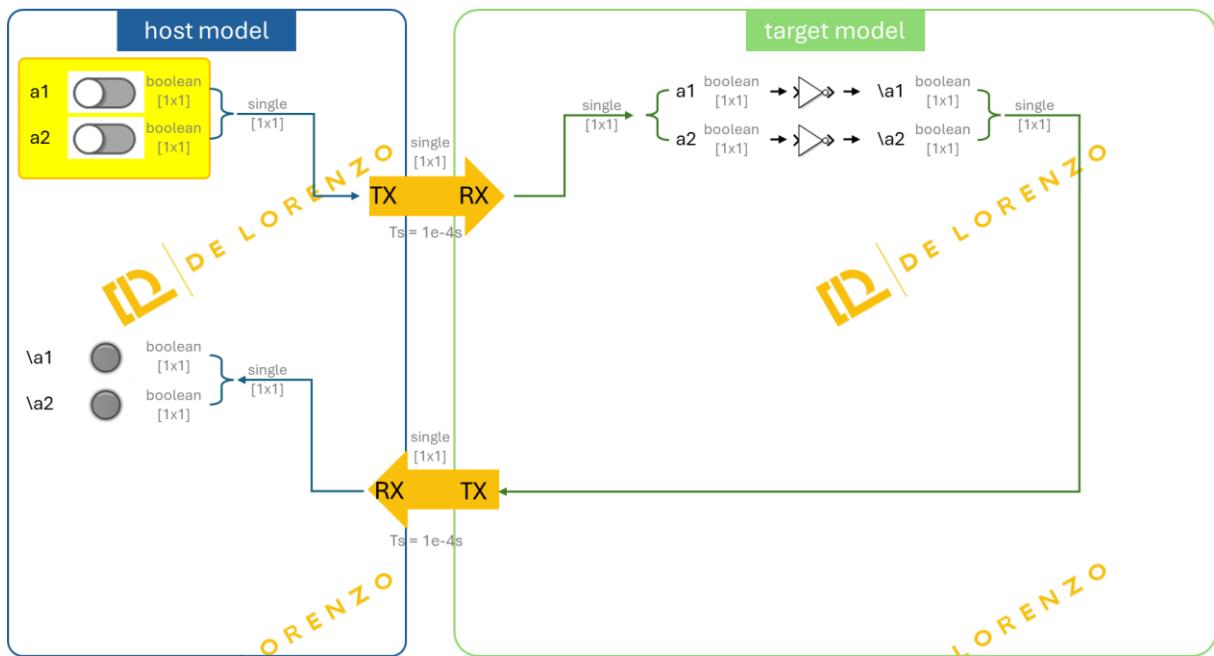
Set the model base sample time **Ts** (which here corresponds to the transmission interval) and the **COM port** recognized by the hardware in Device Manager.

```
%> %% Set PWM Switching frequency
PWM_frequency = 4e3; %Hz // Converter
T_pwm = 1/PWM_frequency; %s // PWM switching
deadtime = 5e-6; %s //rising edge delay fc

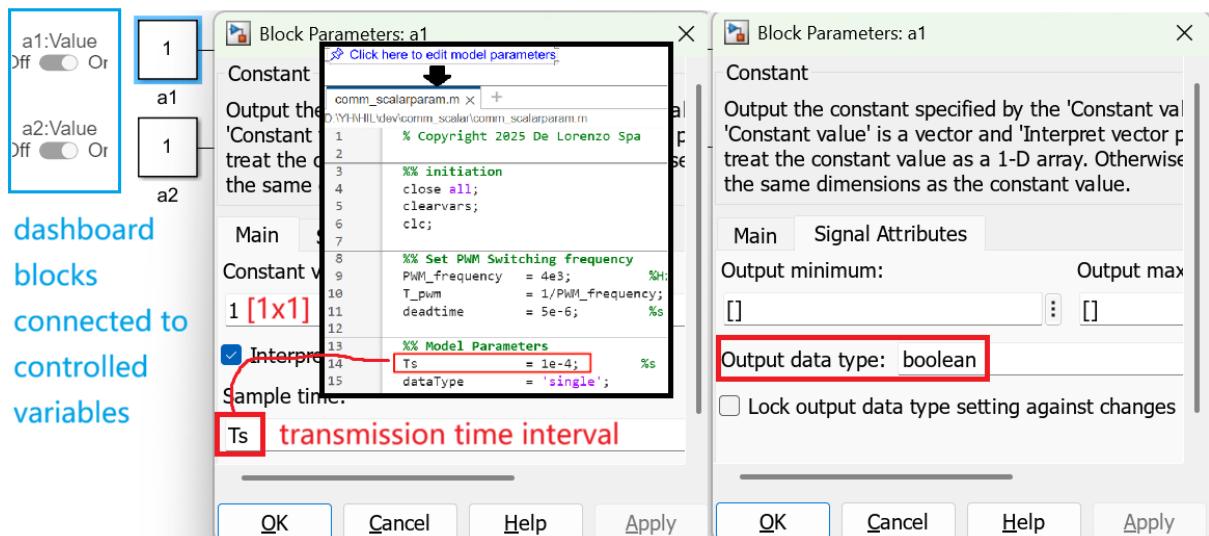
%% Model Parameters
Ts = 1e-4; %s // Sample time for
dataType = 'single'; % Floating point

%% Hardware parameters
% Set controller parameters
target = SetControllerDetails('DL RCPCORE', PWM_
target.comport = 'COM6'; % Update the appropriate
converter = SetConverterParameters('DL 2106T06');
```

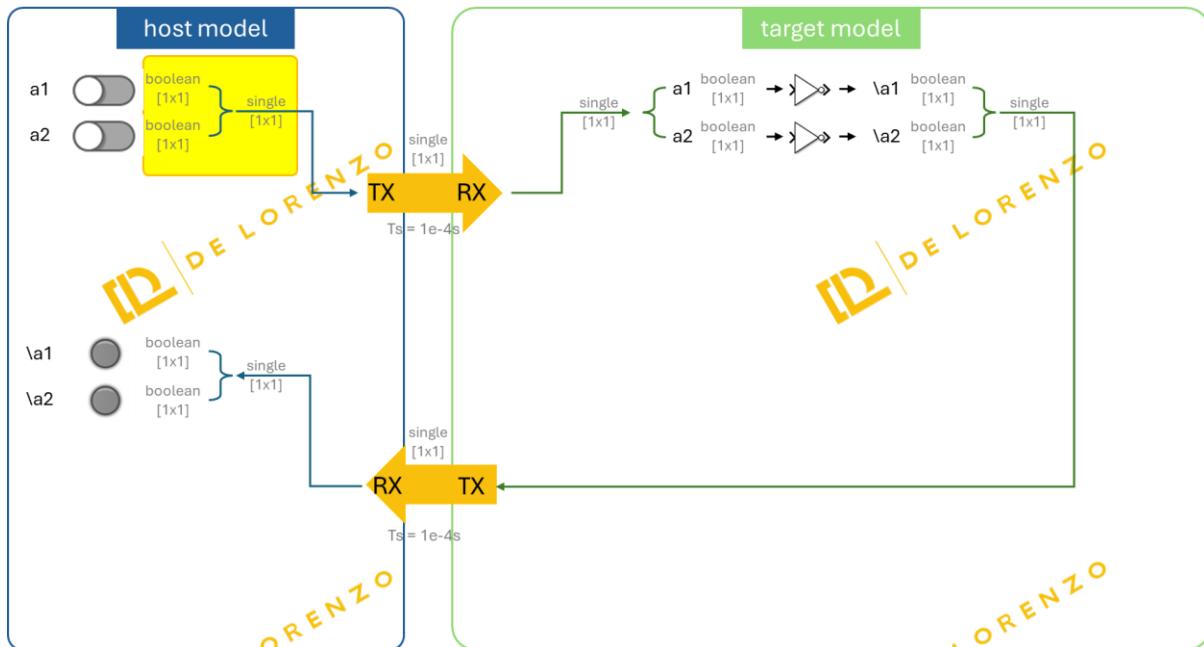
## Step 1. Create controlled variables



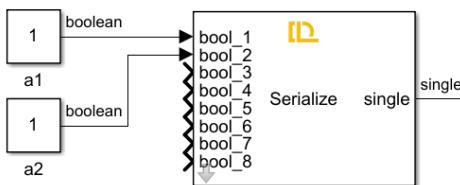
First, we add the corresponding control variables to the host model according to the requirements.



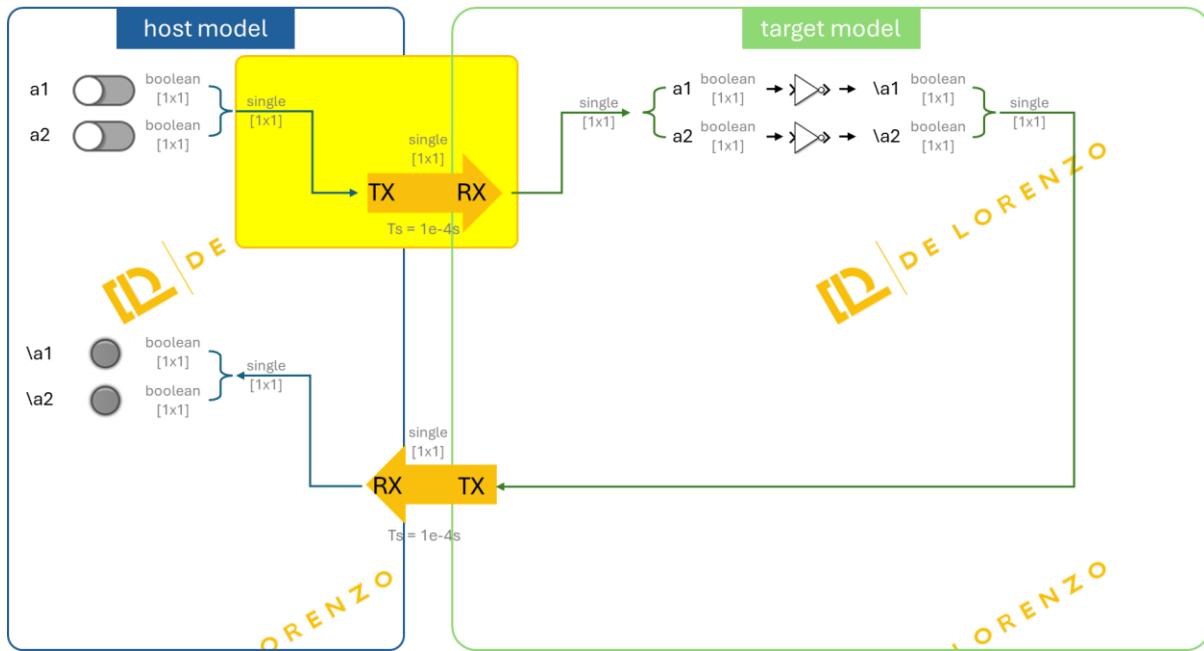
## Step 2. Serialize multiple same-type signals into a single signal



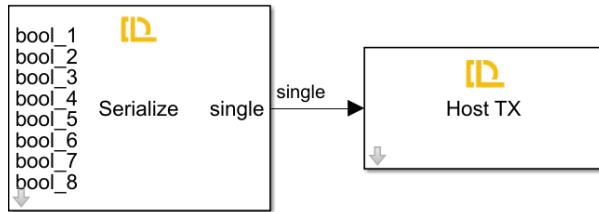
Use the '**Serialize Boolean into Single**' block to combine multiple Boolean signals into a **single**-precision value.



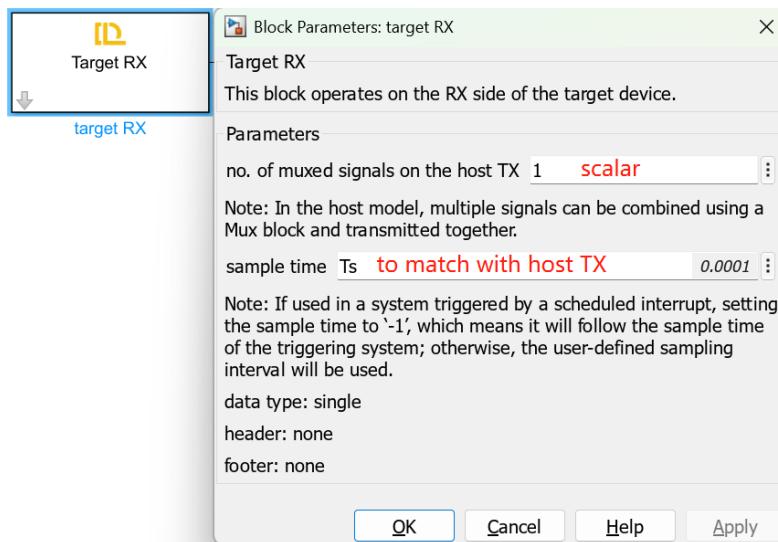
### Step 3. Host-to-target transmission



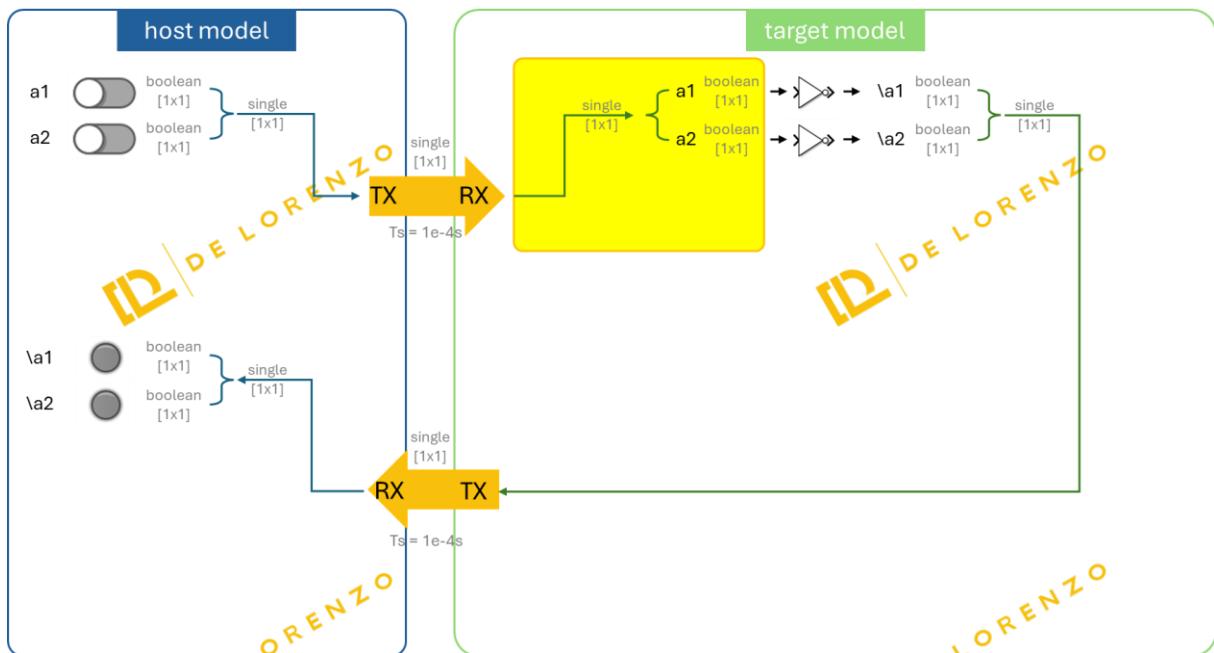
In the **host model**, place the '**Host TX**' block. The transmission rate will follow the sampling interval of the controlled variables.



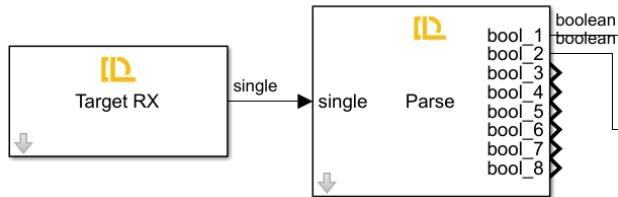
In the **target model**, place the '**Target RX**' block. Since only a single scalar is transmitted from the host side, the number of columns (i.e., the number of single-type signals) at the RX end on the target is set to 1. The reception interval is identical to the transmission interval.



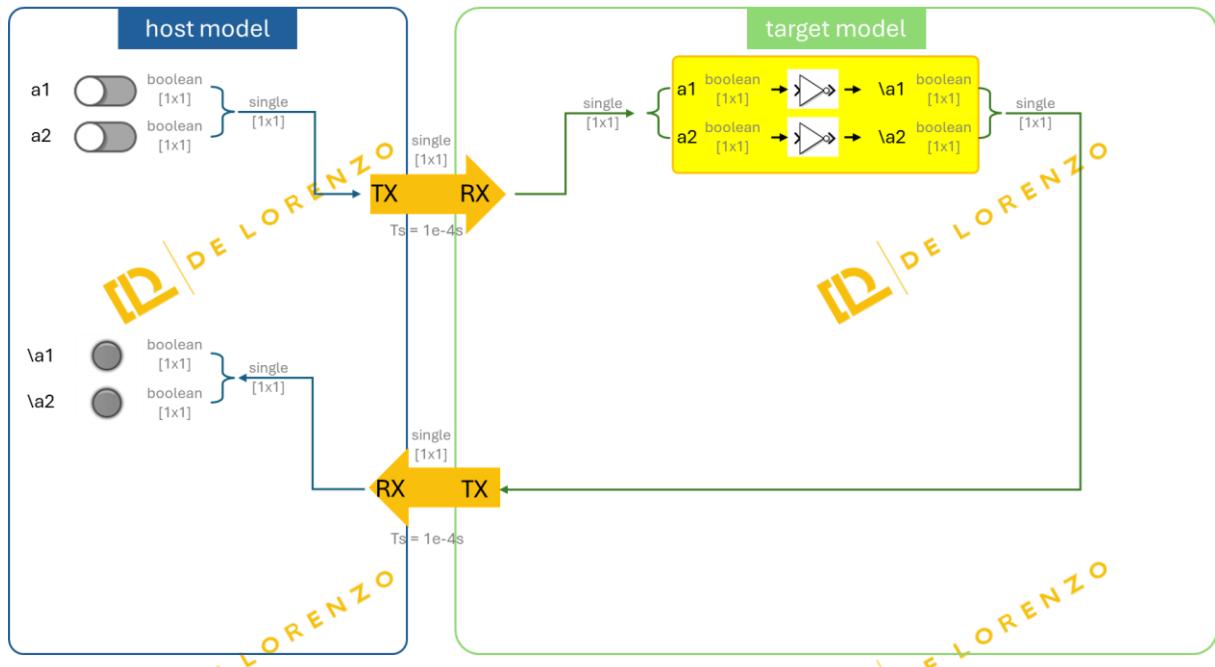
## Step 4. Parse to recover the controlled variables



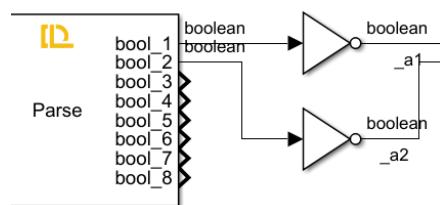
Use the '**Parse Single into Boolean**' block to convert a **single**-type signal into multiple **Boolean** signals and extract the controlled variables from the corresponding channels.



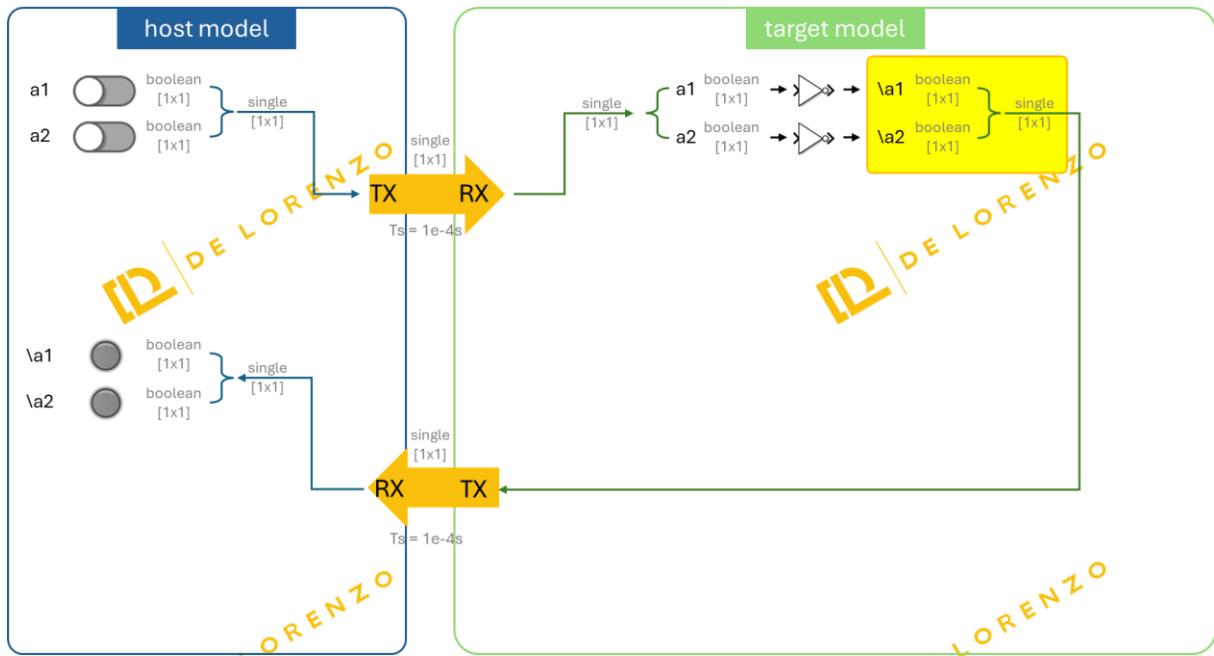
## Step 5. Simple Signal Processing



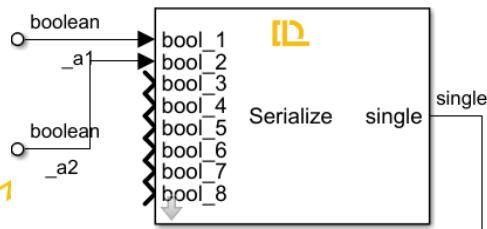
Invert Boolean signals  $a_1$  and  $a_2$  to obtain  $\_a_1$  and  $\_a_2$ .



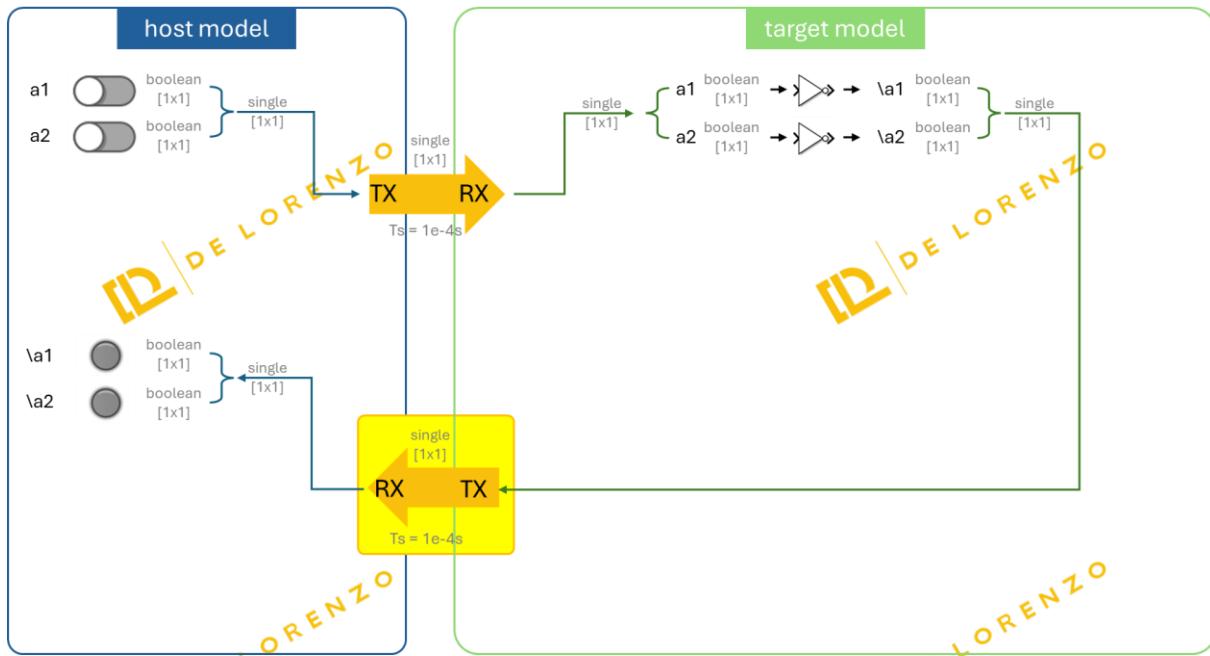
## Step 6. Serialize multiple same-type signals into a single signal



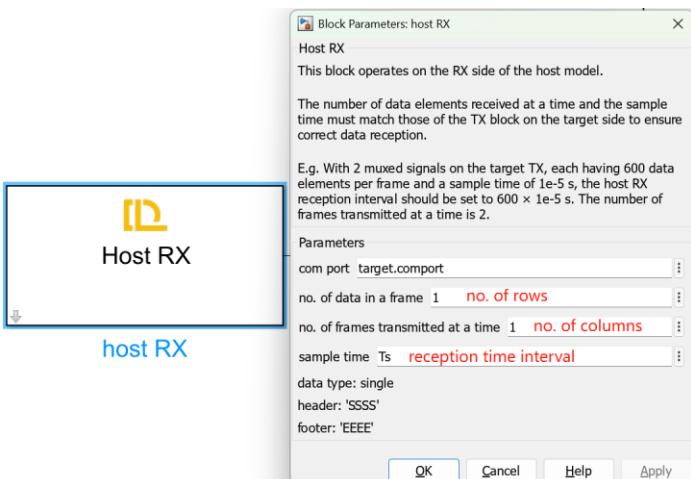
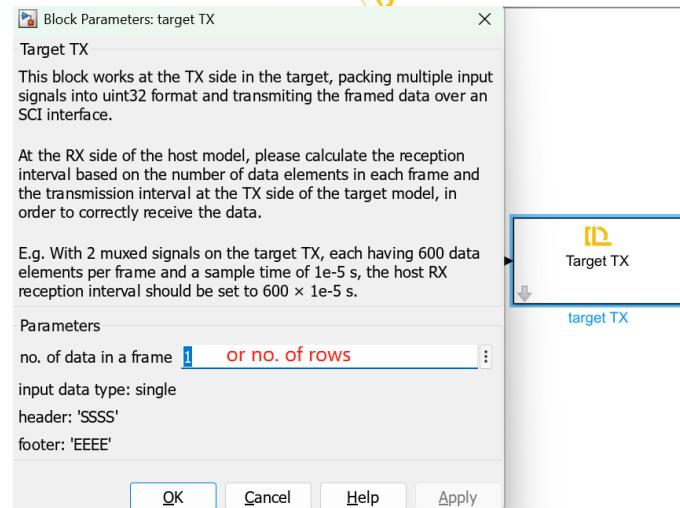
Use the '**Serialize Boolean into Single**' block to combine multiple **Boolean** signals into a **single**-precision value.



## Step 7. Target-to-host transmission

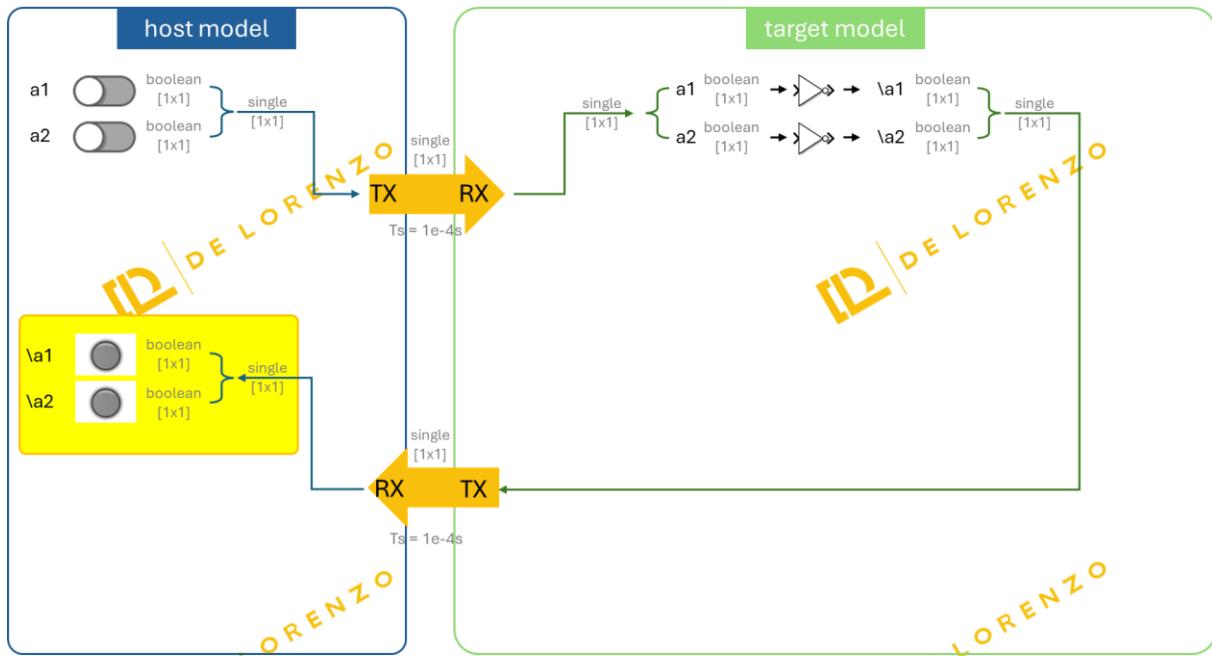


In the **target model**, place the '**Target TX**' block. The transmission rate will follow the target RX interval. Since the transmission and reception intervals on both the host and target sides are identical and only a single scalar is being transferred, the number of rows in the data — that is, the amount of data contained in one frame — is set to 1.

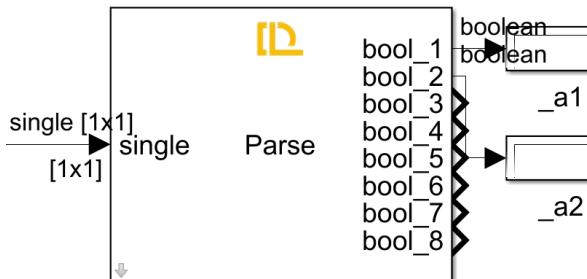


In the host model, place the '**Host RX**' block. For receiving a single scalar value, set both the number of rows and the number of columns to 1. Ensure that the reception interval matches the transmission interval.

## Step 8. Parse to recover the processed variables



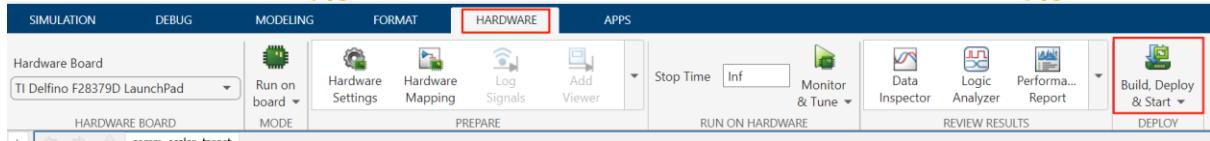
Use the 'Parse Single into Boolean' block to convert a **single**-type signal into multiple **Boolean** signals and extract the controlled variables from the corresponding channels.



## Step 9. Debugging

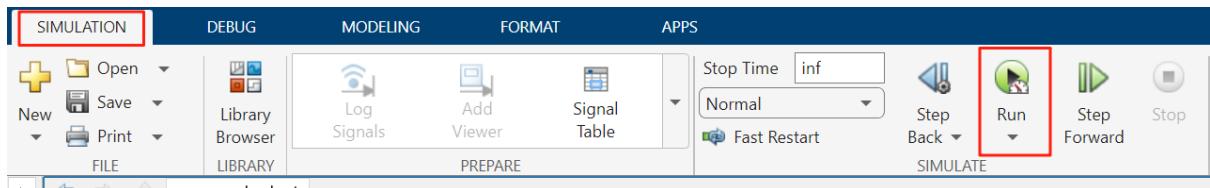
In the **target model**, compile and deploy the model to the DL RCPCORE hardware.

Wait for the 'Ready' message in the lower-left corner. If an error occurs, check and resolve it.

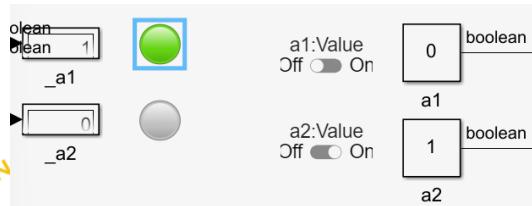


In the **host model**, after confirming that the target model has been deployed and is running on the DL RCPCORE, run the host model to begin debugging.

If an error occurs, check and resolve it.



Modify the control variables and verify whether the values processed by the target model are correctly sent back.



**Note:** Pay attention to the lamp color settings.

