

# DL PEL-HIL Getting Started

## Host-Target Communication

### Fundamentals

DL R&D

V1.0

#### Data Type

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.

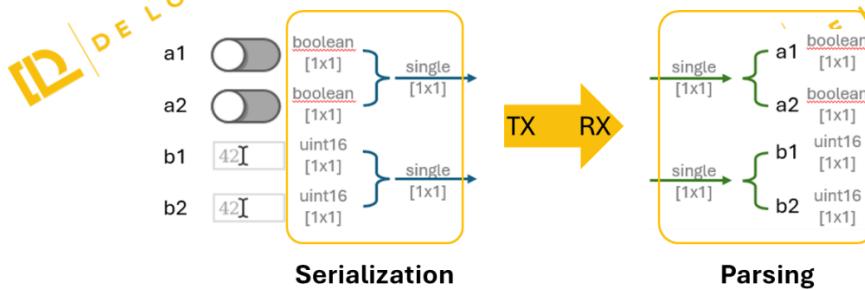
Notes:

- 💡 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.

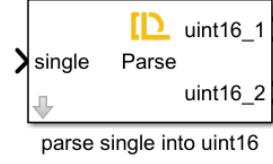
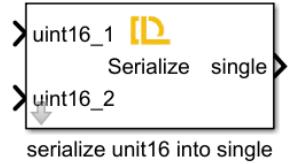
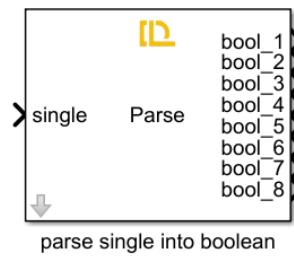
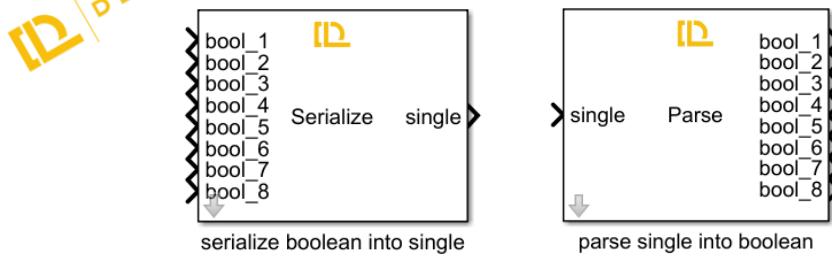
## Data Serialization & Parsing

Single type is unified in DL PEL-HIL RX/TX; multiple **booleans** and **uint16s** are **serialized** into singles before TX.

After RX, Single in DL PEL-HIL RX/TX is **parsed** back into **booleans** and **uint16s** to restore data.



Serialization and Parsing Process



Blocks for Serialization and Parsing

## 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

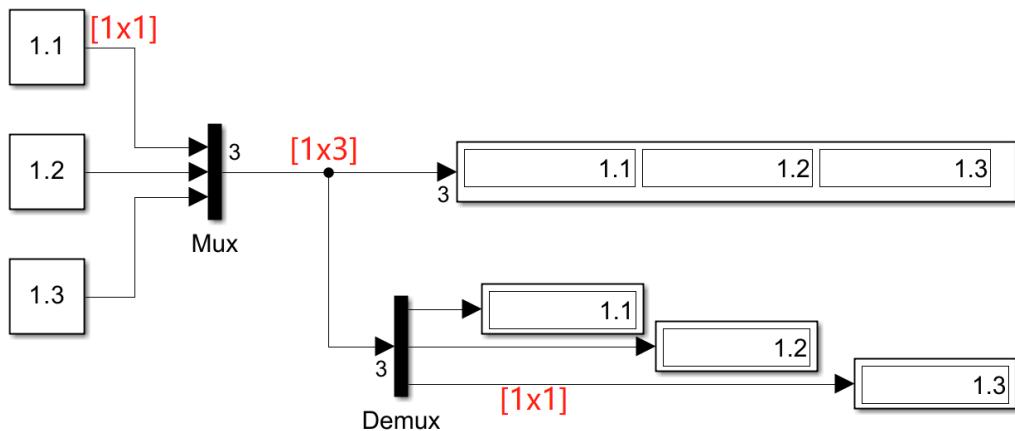
In DL PEL-HIL, we use

- **Scalar** to represent a single data element,
- **Row Vector** to represent a combination of multiple single-element signals,
- **Matrix** to represent a set of signals that each include historical (past) data.

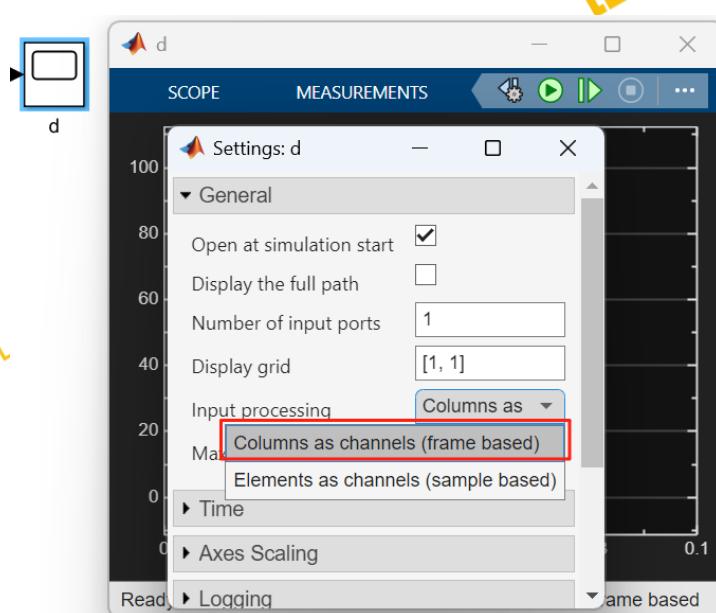
## Row Vector Construction & Extraction

Use **mux** to combine same-type **scalar** elements into a **row vector**.

Use **demux** to extract **scalar** elements from a **row vector**.

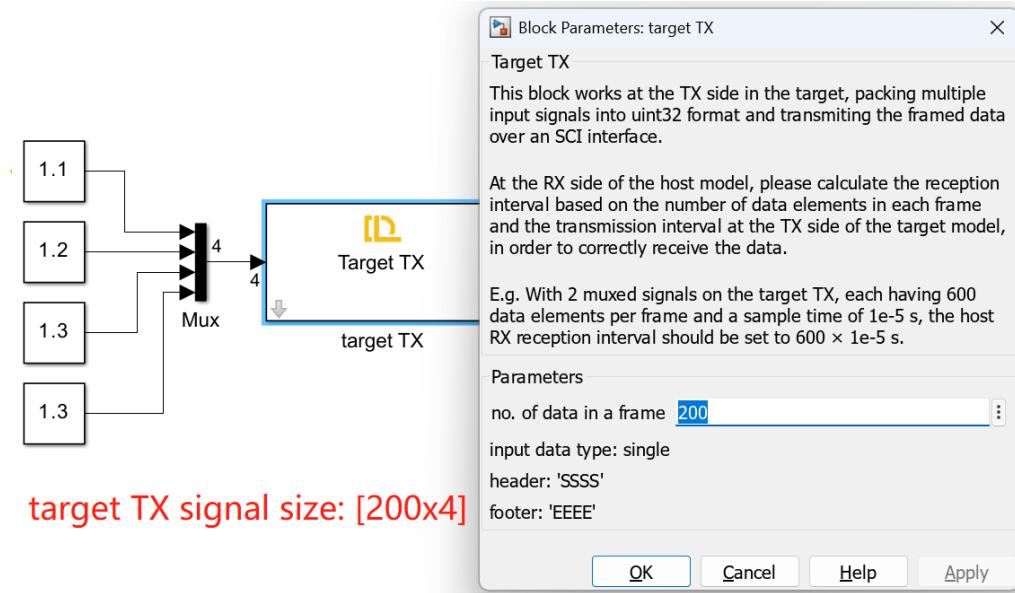


To observe the waveform of a row vector with an **oscilloscope**, process the input as **columns as channels**.



## Matrix Construction & Extraction

Matrix creation occurs only before target model's TX: **no. of columns** defined by **mux**, **no. of rows** defined by target TX's 'no. of data in a frame'.



target TX signal size: [200x4]

Column extraction occurs only after host model's RX, done by **split matrix**.

