Cockpit LT©
User Manual

The official commissioning USB Tool

*.. For **TWX** motor series*

Introduction

CockpitLT is the new Integrated Development Environment (IDE) developed by Phase Motion Control to configure, control and tune drives in its TWX drives series.

CockpitLT uses as base the Eclipse IDE and introduces a set of TWX drive dedicated functionalities using the Eclipse's plugin features. As well as the Eclipse IDE, CockpitLT uses Java technology integrating native code through JNI technology and takes advantage of JAVAFX features for graphics.

Installation

CockpitLT runs on a standard Windows 10 64bit machine and can be obtained for free directly from Phase Motion Control's web site download area (www.phase.eu)

CockpitLT is distributed by using an easy-to-use self-extracting executable that takes care to install all the parts needed to work properly, including the Java Runtime Environment and all the libraries, so no further user action is needed after the installation wizard completes.

Drive Connection and data exchange

The communication between CockpitLT and the TWX drive is done by using a dedicated channel through the USB-C standard port located on the TWX drive.

A dedicated native code tool named ***Connection Server*** is used to interface CockpitLT IDE with the drive and it can also be used to directly perform few simple tasks on the TWX drive.

Connection Server, and thus CockpitLT, can simultaneously manage multiple drives connections. The only constraint is that each connected drive uses a dedicated USB connection.

Connection Server is started automatically when CockpitLT IDE starts and automatically shuts down after CockpitLT termination.
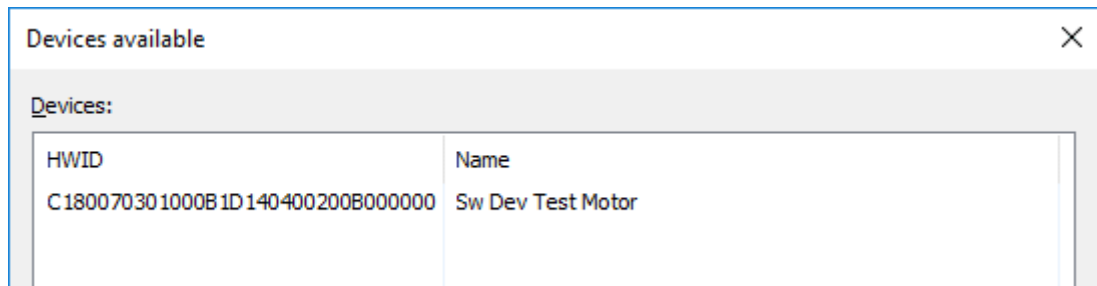Connection Server can be located on Windows toolbar through its C shaped blue icon.

With a right click on the icon it's possible to open the Connection Server context menu and access the Connection Server's commands.
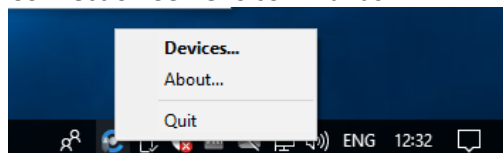
⬉ Devices

*By selecting "Devices",* a window reports the list of drives connected to the local computer:

The window simply reports two values for each of the connected drives:

1. **HWID**: It is a unique identification number for each TWX drive. This number is internally used by CockpitLT to correctly manage data transactions to/from drive.
2. **Name**: It is a customizable identification label that helps the user to simply understand which is the drive he is currently working on. The label can be easily changed by clicking the value in the Name column and writing the new name in the line editor.

Left click on a Device: perform a device selection.

Right click on a Device: shows a context menu that allow to execute some simple tasks on device
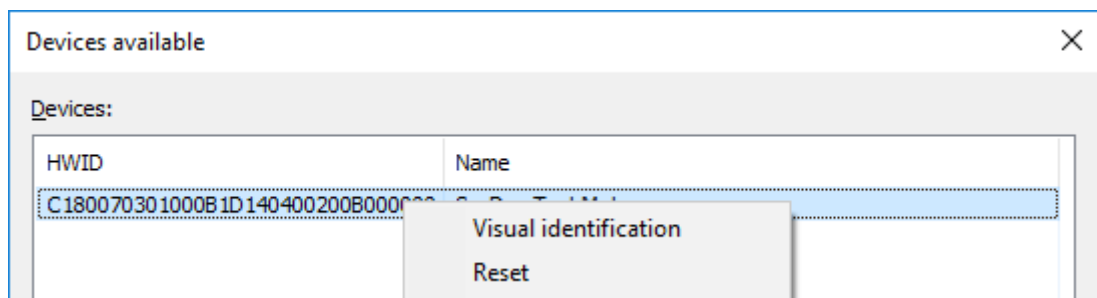
The commands available in this menu are:

1. **Visual Identification***: It can be used to physically identify the selected drive. After command selection, LEDs on drive start fast blinking for a 5 second period.
2. **Reset**: This command issues a reset of the drive.
3. **Firmware update**: It can be used to load a new firmware on drive by using a file, containing the new firmware version, stored on local computer hard drive.

Led position on TWX motor, useful for device status indication, and for "Visual identification" cockpitLT funcion (see blu circle on picture)

⬉ About Command

This command simply opens a window that reports the Connection Server version.

⬉ Quit Command

This command terminates the Connection Server. Please be aware that when the Connection Server is not running, CockpitLT IDE cannot connect and manage any drive.

CockpitLT IDE

CockpitLT IDE is derived from the Eclipse IDE and inherits some other Eclipse IDE concepts like the **Workspace** and the **Projects.**

The **Workspace** is a container to store the *Projects.* It can be placed in any folder on the local file system.

CockpitLT sets by default the workspace in the user **Documents** folder by using a subfolder named *CockpitLT,* but the user can anyway select a different location.

It is also possible to have multiple workspaces stored on the local file system, which can help the user to easily organize his/her projects.

The workspace selection can be performed on CockpitLT startup or by using the dedicated *Switch Workspace* command in the main window *File* menu.

In case the workspace selected on CockpitLT startup does not exist, the IDE will create it automatically.

The **Project** is a container like the *Workspace.* It is more specialized than the *Workspace* and some special features, dedicated to motion control applications, have been created to adapt the Eclipse project to its specific role inside CockpitLT.

One of the constraints in CockpitLT is that between a project and a controlled TWX drive there must be a one-to-one mapping. This mapping must be done by synchronizing the information between the project and the TWX drive.

From the user–point of view, this synchronization is completely transparent since CockpitLT takes automatically care to exchange and to correctly align data between the project and the TWX drive.

A **Project** that already contains configuration data for a TWX drive can be reused to perform the same set-up on a different TWX drive by using a so-called *Retarget* operation that will be explained later.

First Startup

When CockpitLT starts for the first time or when a new workspace is created, the IDE window appears like in the following picture:
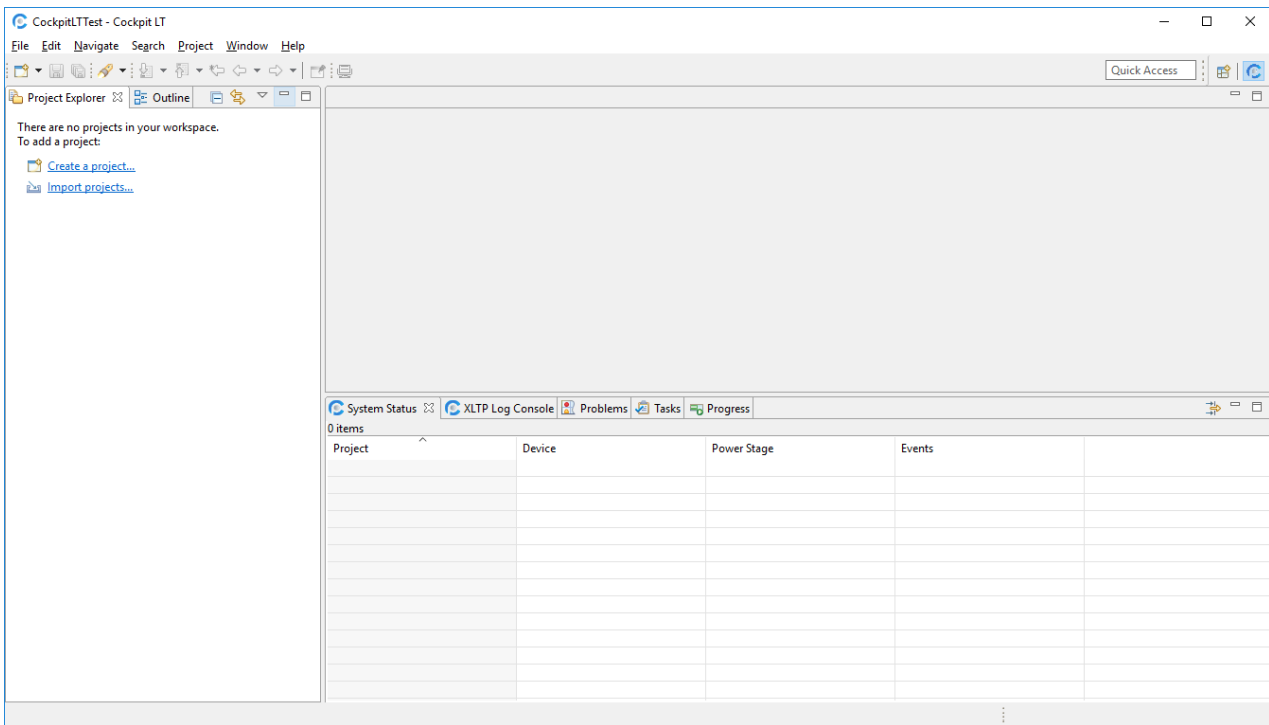
On the left it is possible to see a tab named **Project Explorer** that shows the content of the workspace. As mentioned before the workspace contains a set of projects.

At the first start-up the workspace is empty, and the tab contains the links to the possible options available to populate the workspace, **Create a project** and **Import project.**

The same commands are also available in **File** menu and in right-click context menu.

Project creation

To create a new TWX project, CockpitLT needs some information related to the firmware in use on the drive. These data can be retrieved by CockpitLT from three different sources and the project creation wizard gives the user the possibility to choose between these options.

The possible data sources are:

- **The drive itself**: The drive contains a copy of data needed to create the project and during the project creation wizard, if necessary, these data can be downloaded through the USB connection to the local hard drive.
- **Local CockpitLT cache**: CockpitLT maintains a local data cache where it stores a copy of raw configuration data from each drive that has been connected and configured. In this way it is possible to avoid downloading again from TWX drive data that are already present in cache and it makes possible to create a new project even if the drive is not connected. In project created using this procedure the parameters values are initialized to firmware default values.
- **Exported Parameter Table**: CockpitLT can export the configuration of a drive in a special data format that includes the set of parameters and all their current values. The primary use of this file is to allow to different users to share their configurations thus the file can be used to create new projects or to import setup values to existing projects. In projects created by using this method the parameters values are initialized to the values in use at the time when the export file was created.

Create project wizard

Project creation is performed by executing the dedicated wizard that drives the user step by step.
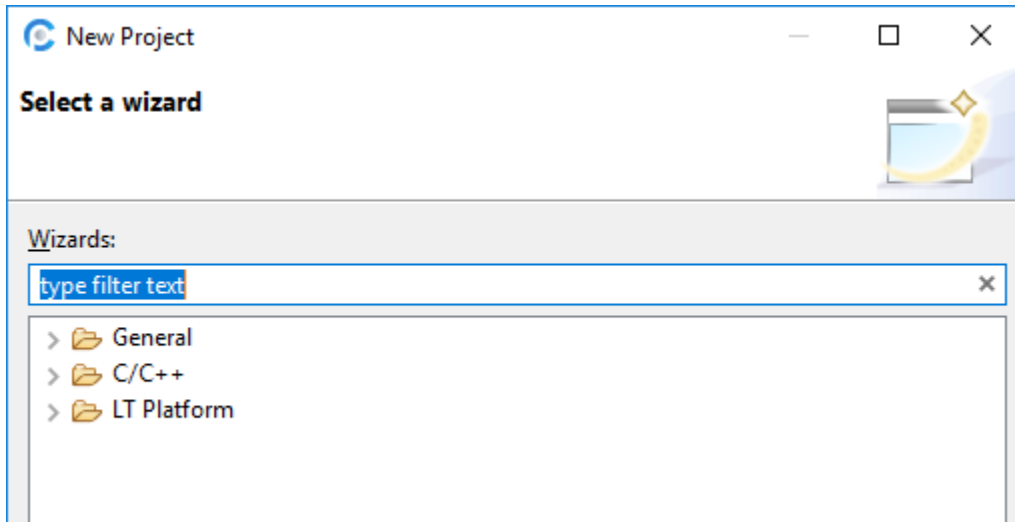
As first step the user must select which kind of project wants to create. In case of a TWX drive it is necessary to expand the LT folder and select **System Manager Project** as shown below.
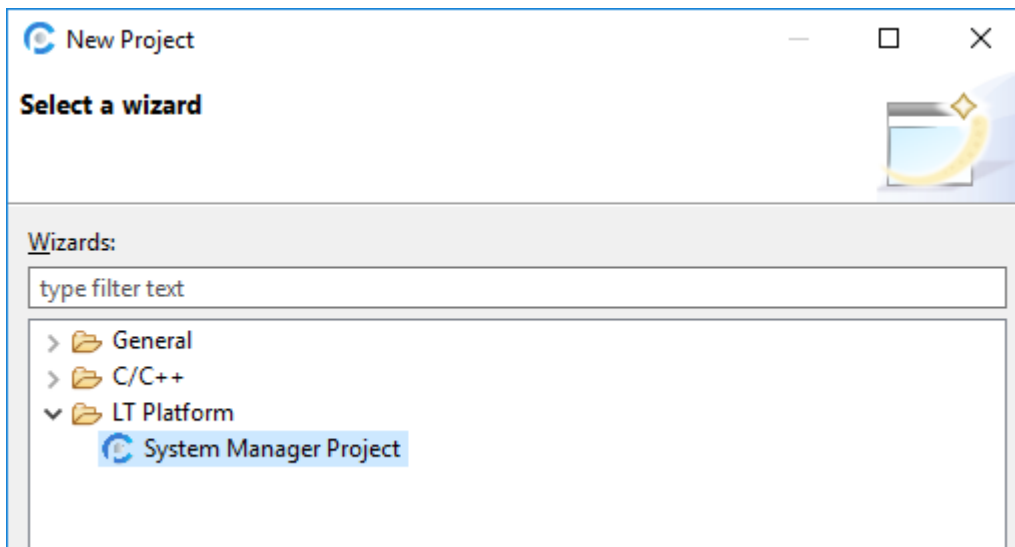
The next step implies the necessity to give a name to the project that is going to be created.

The project name is a free choose for the user, it is suggested to choose a name that can help the user to easily identify the project content.

The radio button selection permits to the user to choose between three possible methods to create the project.

Local Projects Repository

As described above this selection permits to choose as target one of the TWX drives firmware that has been already used in the current CockpitLT installation.

By selecting this option, the wizard moves to a screen where it is possible to recall, through the **Browse** button, the window of available cached firmware where to select the desired version.

By selecting the checkbox *Connect to remote device* the wizard will rise the Device selection screen and the selected device will be connected to the project, otherwise the project will not be bound to any TWX drive, and it will be necessary to perform later a *Retarget* operation to bind project and drive together.

In case local cache contains multiple builds of the same firmware version only the more recent is shown by default. The *Show all builds* checkbox is dedicated to give the user the possibility to select one between the oldest builds.
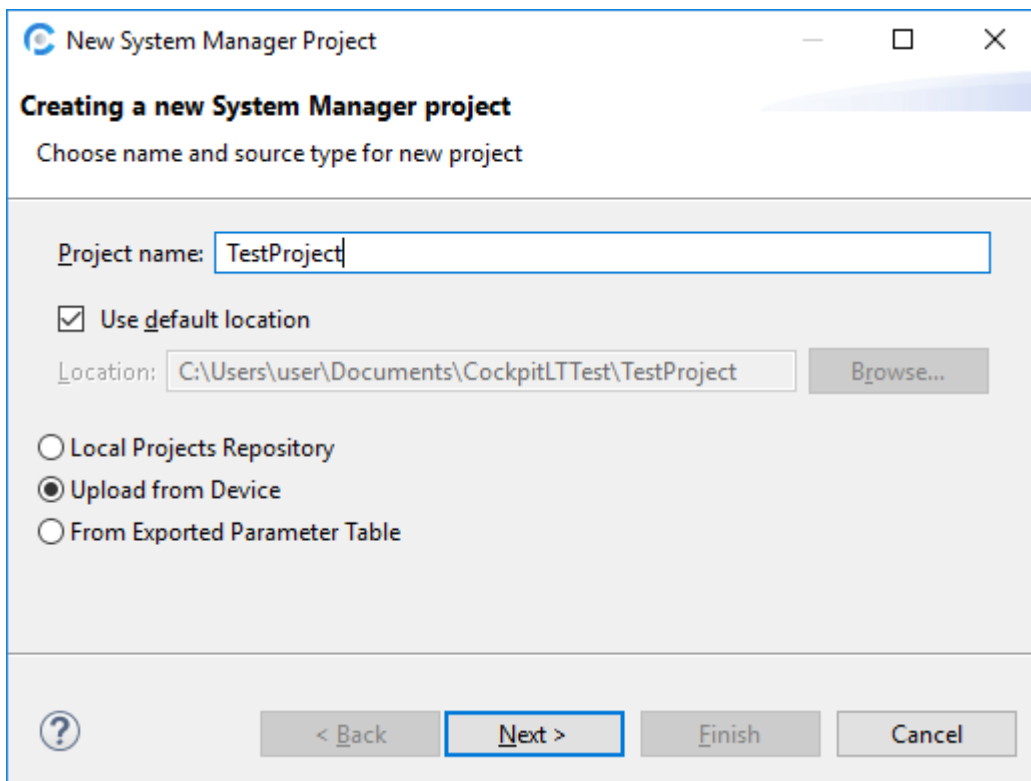
Select Param Table from local cache ✕

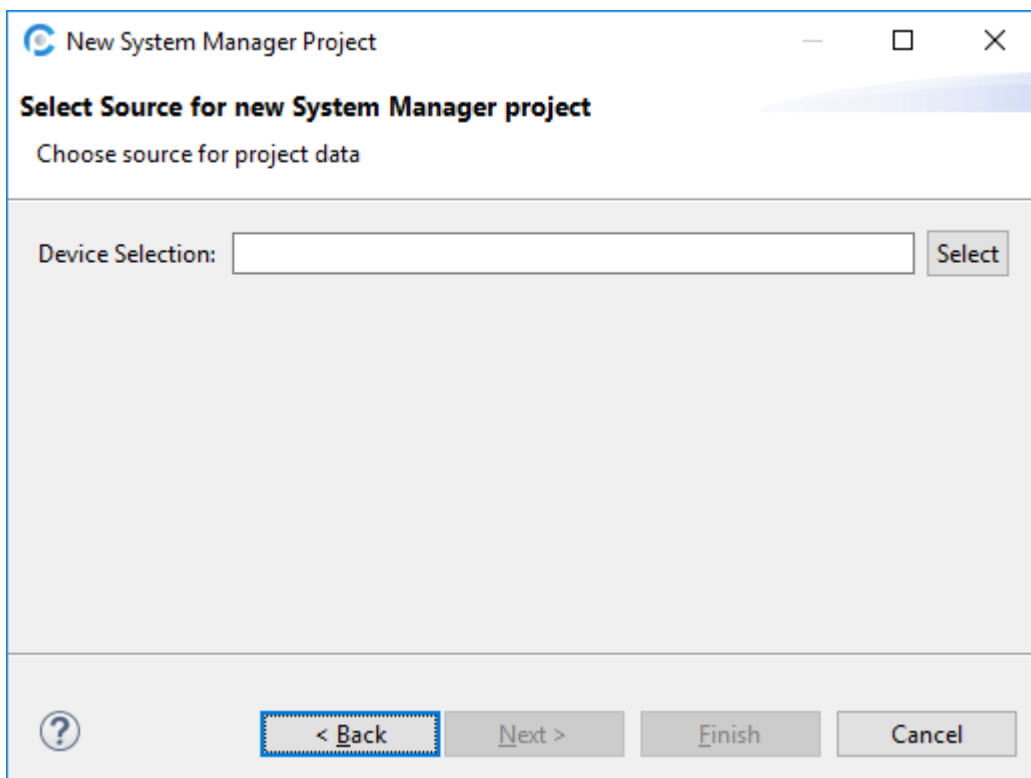| Name	Version	Timestamp	UUID	HASH
CiA DSP402 Motion Control	1.1.0	2021/05/11 12:14:53	3A0C640D7F47435688B432CD302F8F0A	471FD6BAB4562CF31645E27939B6911C

☐ Show all builds

OK Cancel

Upload from Device

In this case the TWX drive data are directly requested to the drive and, at the end of the wizard, the selected drive will be connected to the project.

The **Select** button, as discussed above, will rise the Device selection window.

After user selection the Device Selection field will be filled by using the firmware unique identifier.

At the end of the wizard the project will be created, and the device status will be available in device status window in the bottom part of the IDE.

From Exported Parameter Table

In this case the project will be created from an export file which has **xpar** extension.

The **xpar** file can be created from an existing project by using the dedicated export procedure.

Once the file has been created it can be used as an easy method to share drive configurations between different users or to replicate existing configurations above different projects.
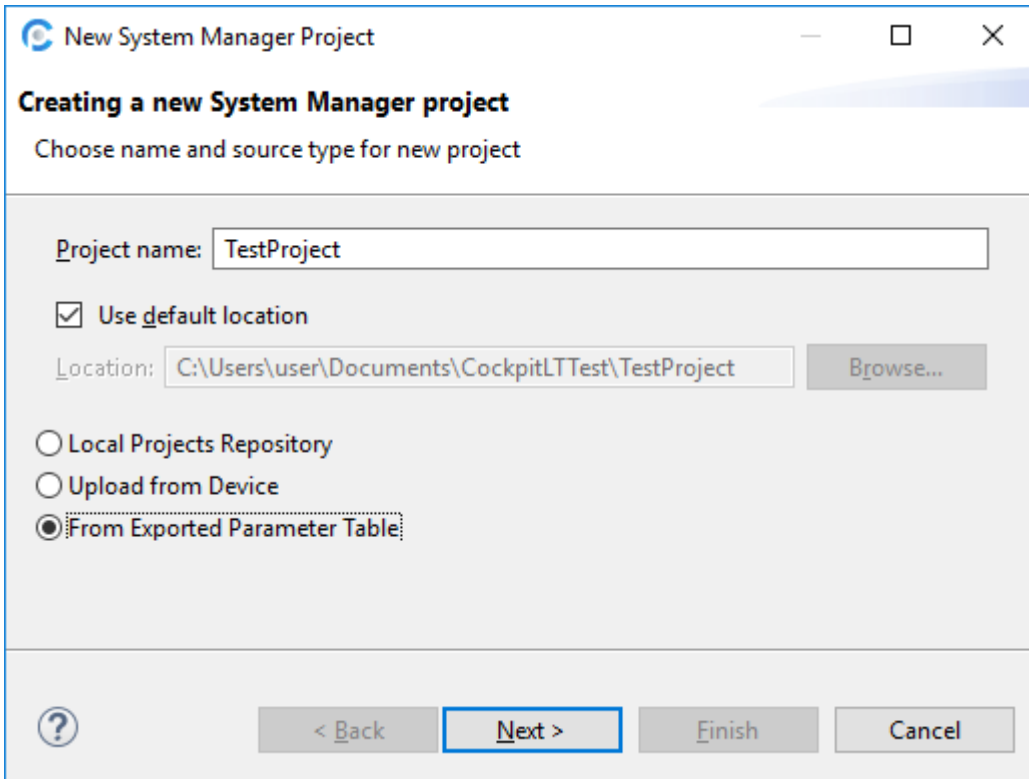
The **Select** button opens the file selection window.
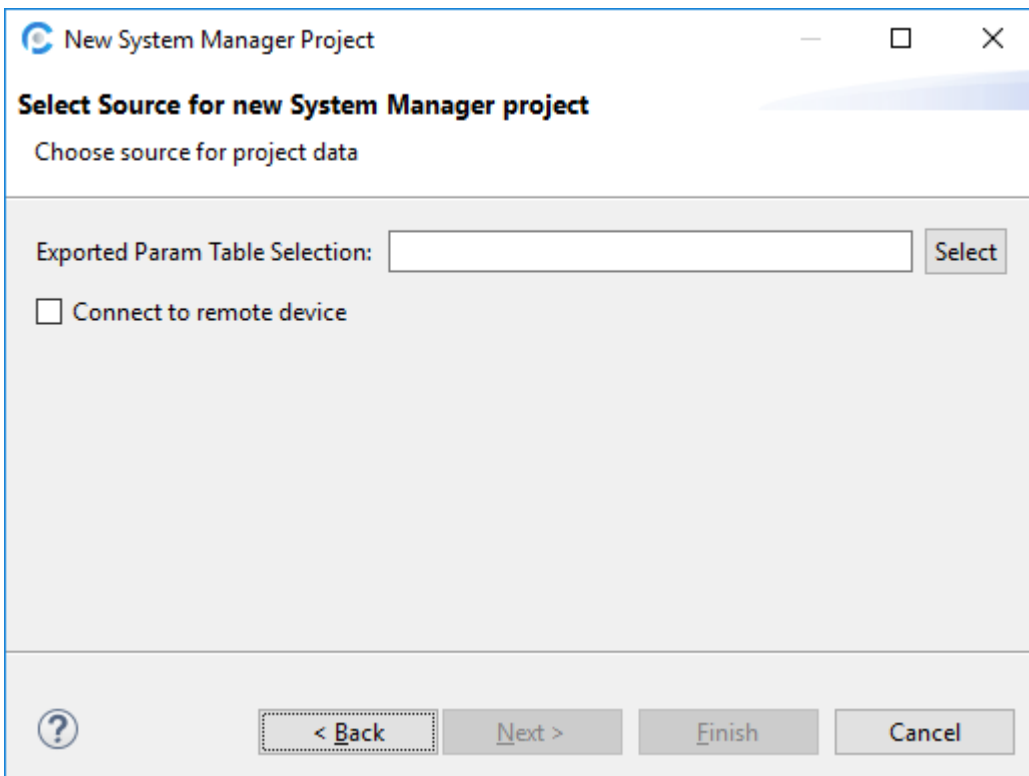
The file selection window permits to load the file from any path in the local hard drive.
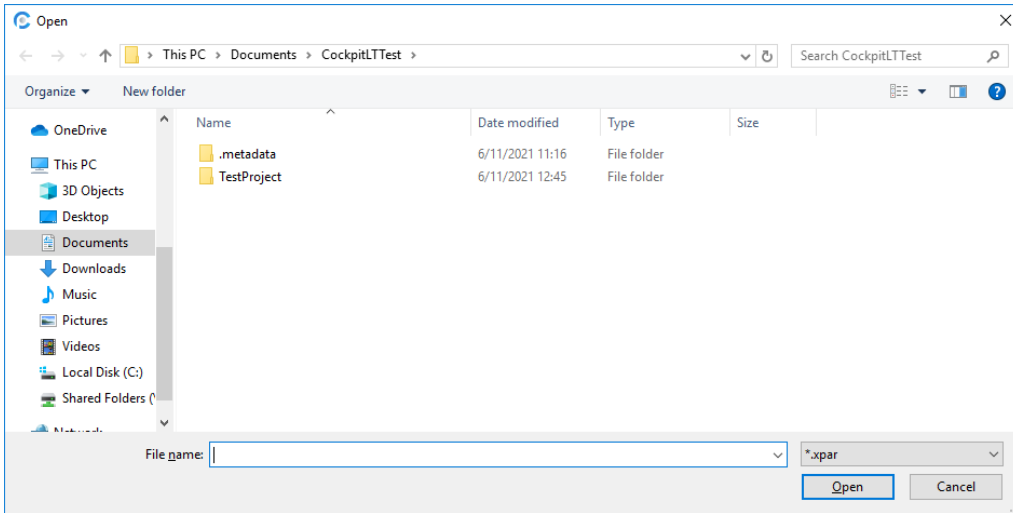
Once the file is located and selected the *Exported Param Table Selection* field reports file's full path.
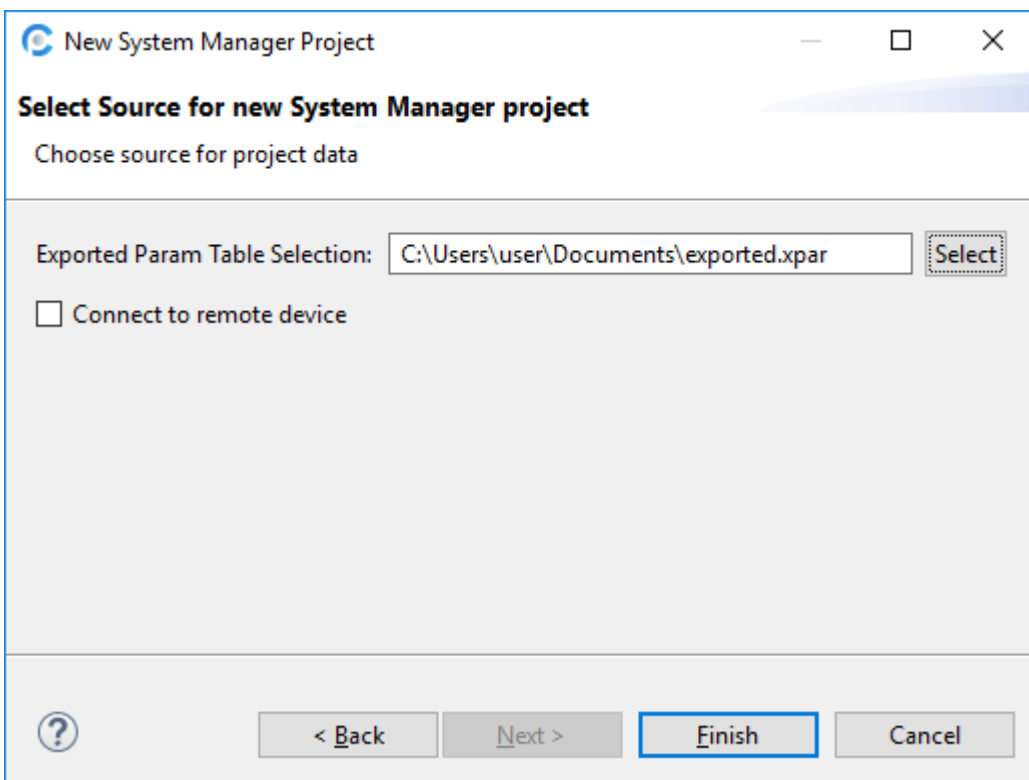
As already seen in project creation from Local Project Repository, also in this case by default the created project will be not connected to any drive. The *Connect to remote device* checkbox can be used to perform the device selection directly at the end of the wizard and to select the project target device.

Import project

Project Import is substantially a direct method to load data from a *xpar* file into an existing project.

The wizard simply asks for *xpar* file selection and loads data into the Project Explorer's selected project.

In case in Project Explorer no project is selected the wizard will start the creation for a new project from exported parameter table as discussed in the ***Create Project Wizard*** above chapter.

Device Retarget

Device retarget is the operation that is executed in order to bind a remote device to a project independently from the fact that the project is already bound or not to a device.

This operation checks the consistency between the parameter table used in project and the one stored on drive. If the two tables match, then the project is connected to the device, otherwise an automatic procedure takes care to download the remote device parameters table and to import into that table the setup values from the table in use inside the project.

The import procedure performs a validity check for variables definitions as well as for data values and it reports, in case of inconsistency, a detailed list for the values that cannot be imported and that will be discarded. The user can take note for these values before to accept the retarget result and to start working with the new table and the connected device.

The user can also reject the parameters import result. In that case the project parameter table will not be changed, and the project will not be connected to the drive.

The retarget command can be found in the context menu of the device status window:
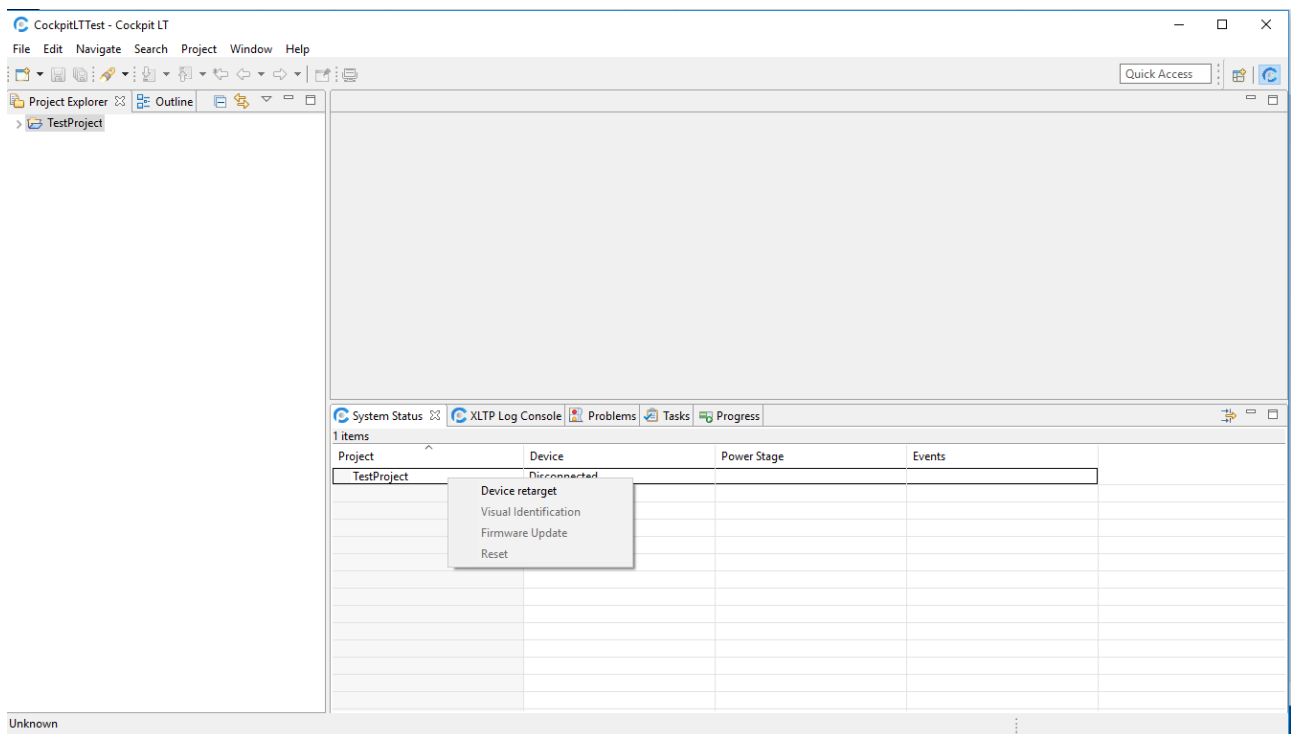
Or from the Project context menu under the **LT Platform** sub-menu:
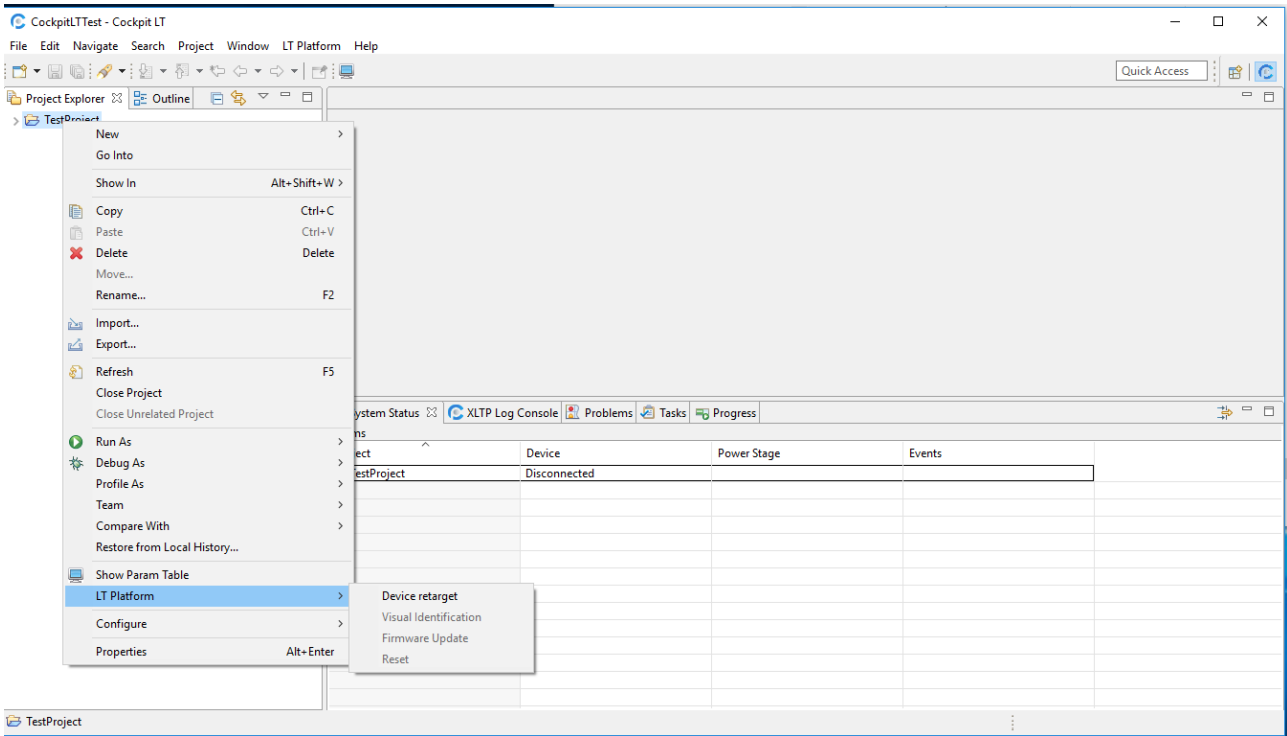
The operation starts opening the device selection window and waiting for the user selection of target device. After user selection is confirmed all the operations needed are performed automatically.

Device management screens

To manage data to/from the TWX drive a dedicated set of screens has been developed in CockpitLT.

The organization of these screens takes advantage of a hierarchical tabbed pane editor set. The main pane has the name of the corresponding project. Each project defined inside the workspace uses a separated pane.
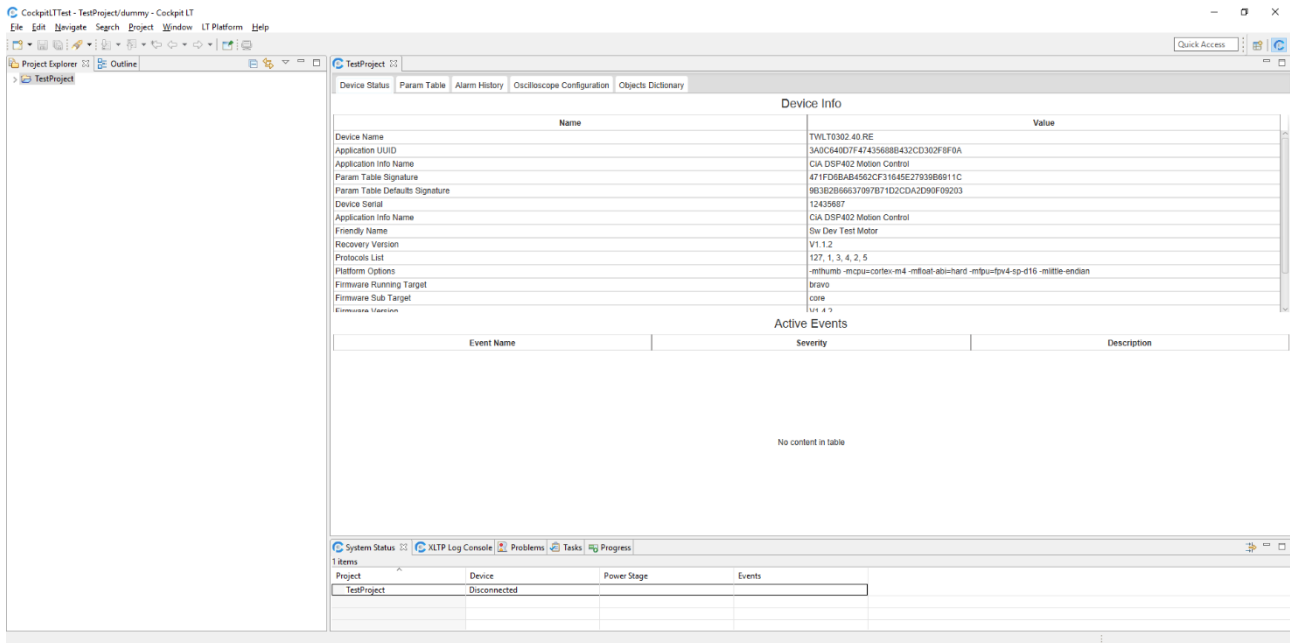
Once the main pane, and thus the project, has been selected, a set of sub-panes is proposed to the user. Each sub-pane manages a different data set from TWX drive.

Device Status

This pane reports information about device configuration and status.

The pane is read-only, so the user cannot change any fields.

The pane is horizontally split in two parts.

The upper part, named **Device Info**, reports all the information related to the TWX drive firmware. It is a two columns table; the **Name** column display the description of the field shown. The **Value** column displays the corresponding value retrieved from the TWX drive.

The lower part, named **Active Events**, instead, reports a list of events that are currently active on TWX drive. This part is normally empty, and it is automatically populated when an event occurs on the TWX drive. Data related to TWX drive events are displayed using a three columns table when the first column shows the **Event Name**, the second column shows the **Event Severity**, and the last column shows a short description.

The content of this pane is automatically updated when the TWX drive is connected. In case the TWX drive is disconnected this pane shows a cached copy of the last values downloaded from TWX drive. When the TWX drive is connected again data in pane are automatically invalidated and updated using data from TWX drive.

Param Table

This pane contains the list of all parameters that the TWX drive firmware exposes to control, monitor, and manage the drive.
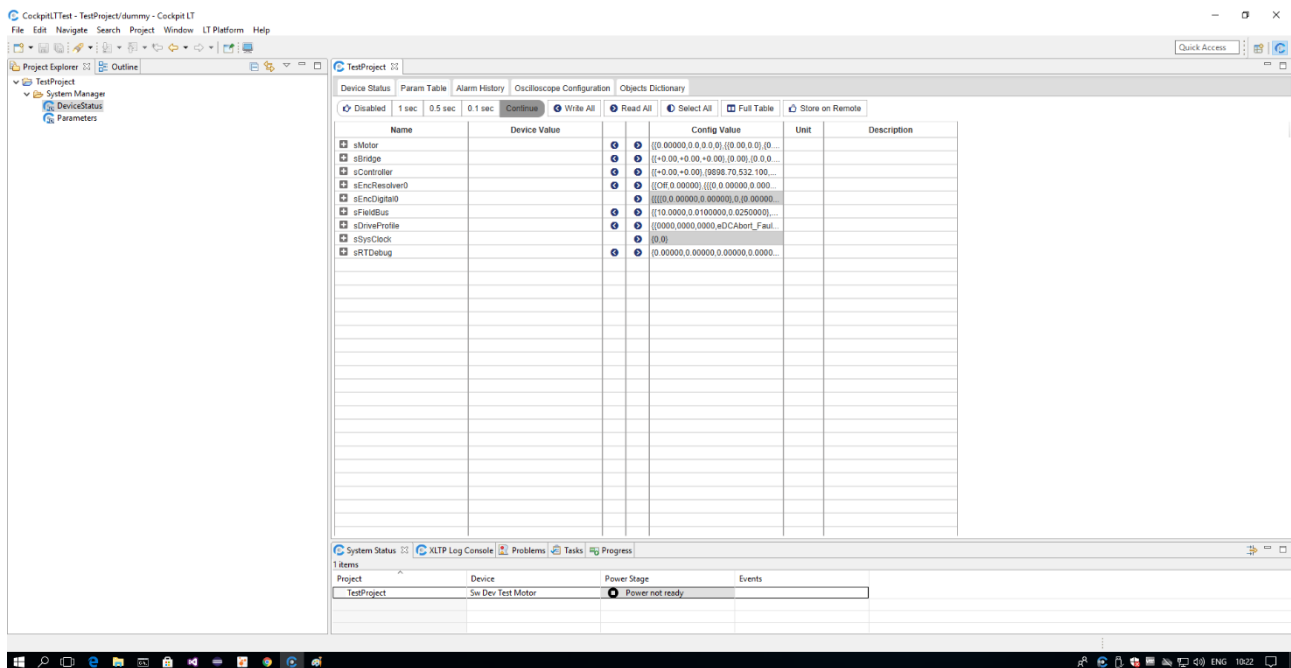
The pane is composed by a toolbar containing commands in the upper part and a table containing data in the lower part.

The table is organized to show at the same time, for each parameter exposed by TWX firmware, the value in use on the TWX drive and the value set up in the local copy of the param table, a detailed description of this feature will be given later.

Param Table Toolbar

The commands inside the toolbar are used to manage data content to/from drive:

- On the left part of the toolbar can be found a set of 5 buttons. This button behaves using a radio-button style, that means that there is always a button pressed and that when a new button is pressed the old one is automatically disengaged.
  The requests for data values to remote device are issued only for single variable effectively shown in the table and not for groups of variables.
  This set of buttons is used to control the update speed for the values in use on TWX drive and the values has the following use:
  - o Disabled → values from device are not requested and the corresponding data column is empty.
  - o 1 sec → data from TWX drive are requested using a 1 second wait time between the time when a data is received from drive and the next data request.
  - o 0.5 sec → same as for 1 sec but the wait time is equal to 0.5 sec.
  - o 0.1 sec → same as for 1 sec but the wait time is equal to 0.1 sec.
  - o Continue → in this case at the same moment the data from remote TWX drive is received a new data request is delivered. This is the default value.
- *Write All* → This button is used to copy all the parameters local value to the remote TWX drive.
- *Read All* → This button is used to load all the parameters remote values from TWX drive to local.
- *Select All* → This button is used to select all the data table lines containing parameters. This command is intended to be used together with the right-click context menu that will be discussed later.
- *Full Table* → By default the data table hides two columns containing variable data type and default values used by firmware respectively. This button can be used to show/hide these hidden columns.

- **Store On Remote** → Parameters values set up to TWX remote drive are not permanent but are cleared after a reset or a power cycle. This button is used to permanently save the modified values on the remote drive.

The table displays parameters using a tree data structure that directly reflects the way they are organized inside the firmware data structures.

The table columns are the following:

- **Name** → It shows the name of a group of variables (data structure) or of a variable. In the first case a + or – sign is shown on the left of the name. By clicking on the sign, it is possible to expand or collapse the children parameters defined inside the group.
- **Device Value** → It shows the current value on the TWX drive for the variable in the corresponding table line. Values on this cell are shown only in case the table line corresponds to a variable while the cell results empty for data structures.
- **Blue arrow pointing left** → This arrow corresponds to the command used to copy the local stored value for parameter or data structure to the TWX drive. Please note that it is possible that the left pointing arrow is missing for some parameters or data structures. In that case the corresponding parameter or data structure is defined inside TWX firmware as read-only. The same result can be obtained, after parameter line selection by the keyboard combination CTRL+w.
- **Blue arrow pointing right** → This arrow corresponds to the command used to copy remote value for parameter or data structure from TWX drive to local data structure. The same result can be obtained, after parameter line selection by the keyboard combination CTRL+r.
- **Config Value** → This column shows the parameters and parameters groups values stored in local data structure. In case of a group of parameters it is presented a condensed value where values are comma separated and nested data structures are grouped using curly brackets, following the standard C/C++ notation.
- **Unit** → This column shows the measurement unit used for the parameter in the corresponding line. This value is defined inside firmware, and it is intended to help the user to understand the physical meaning of the parameter. It is possible that this field is empty.
- **Description** → This column shows a synthetic description for parameter. This value is defined inside TWX drive firmware.
- **Default Value** → (hidden column) As mentioned before this column reports values set as default by firmware. As done for **Config Value** column, in case of parameters groups, the value is shown as curly brackets, comma-separated values.
- **Data Type** → (hidden column) This column reports the C/C++ data type defined at firmware level for each parameter. In case of parameters groups the type corresponds to the data structure type name.
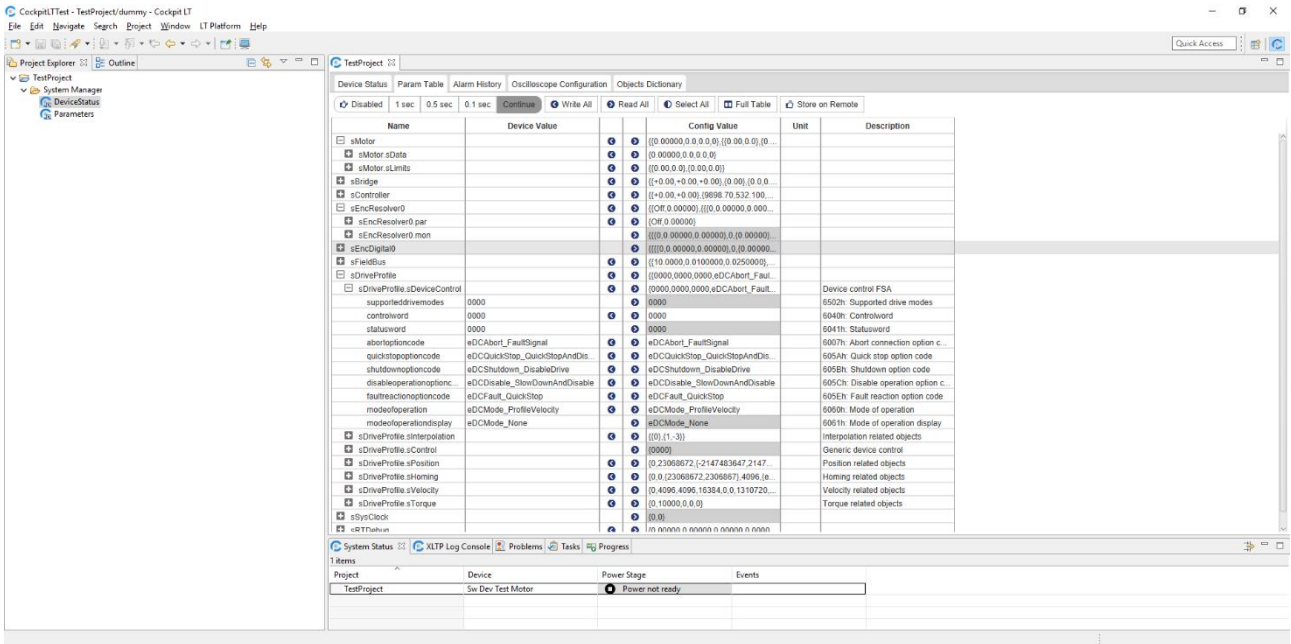
The parameters table accepts changes only in Config Value column for both parameters and parameters groups excluding read-only parameters. A consistency check for inserted value is automatically done and, in case of error, the inserted value is rejected, and the old value is restored. In this case a popup window will inform the user.

To start the change it is sufficient to click on the desired cell or to hit the carriage return key after selecting a line and a cell editor will open making the cell editable. After modification it is necessary to press the carriage return button to validate the value change. If the Esc key is pressed or if the cell lost focus before the carriage return is pressed the value change is invalidated and the previous cell value is restored.

It is also possible to navigate the table using arrow keys to change selected line and to fold/unfold parameters tree elements.

The combination of CTRL key and mouse pointer selection can be used to select sparse multiple lines in table.

The combination of SHIFT key together with mouse pointer or arrow-up arrow-down keys can be used to perform a multiple contiguous lines selection, as normally done in any GUI based application.

By using the right-click on mouse a context menu is raised and the commands operate on the selected set of parameters.
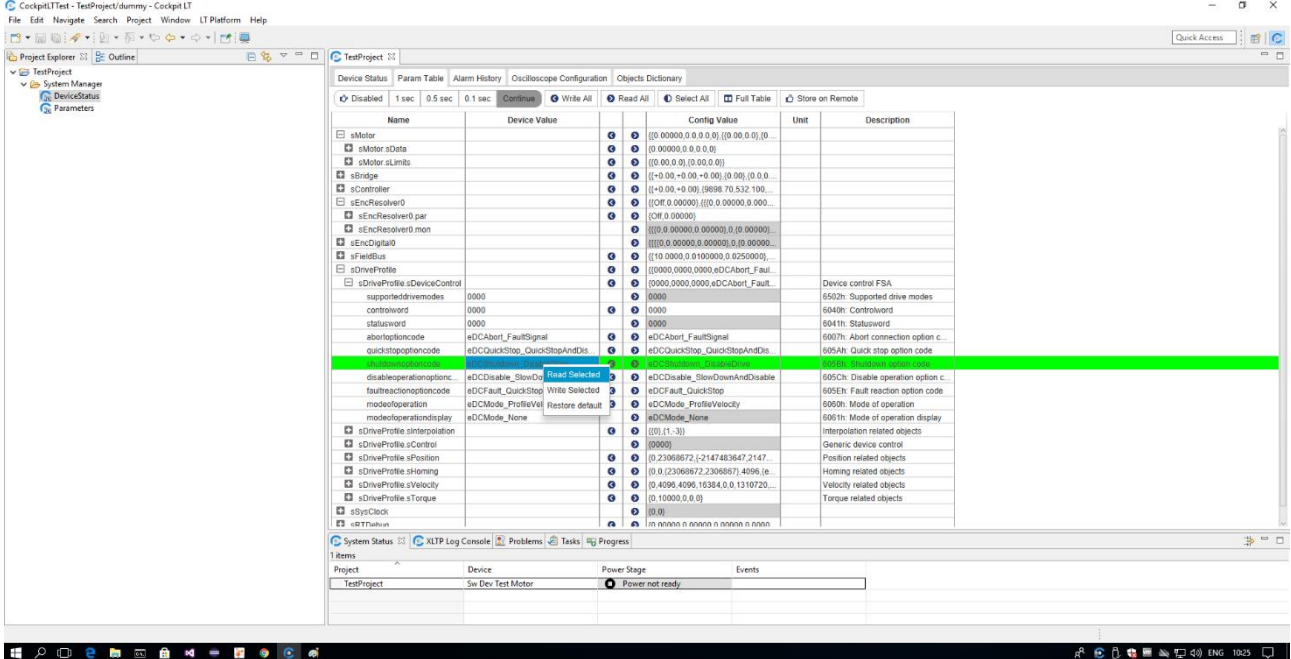
The commands inside context menu are:

- **Read Selected** → This command retrieves from drive up to date values for all selected variables and it updates corresponding local value in **Config Value** column.
- **Write Selected** → This command sets up TWX drive remote values for selected parameters using the values in **Config Value** column. This obviously does not happen for read-only variables eventually included in selection.
- **Restore Default** → This command restores the value in **Config Value** column using the default value stored in the hidden column discussed above.

Alarm History

This pane reports the log history of all events occurred on TWX drive.

The page is also in this case horizontally split in two parts.

The upper part contains the list of device events. The four columns in the table indicate:

- **Name** → The name of the occurred event.
- **Severity** → The level assigned by firmware used to identify the alarm gravity.
- **Timestamp** → A time marker to identify when the event occurred.
- **Description** → A short description defined by firmware to explain the cause of the event.

The lower part, named **Alarm Details**, is automatically filled when an event is selected in the upper part.

This table is also composed by four columns which content is defined inside firmware:

- **Name** → the name of the variable reported by alarm detail.
- **Value** → the value of the variable when the event happened.
- **Unit** → the measurement unit of the variable.
- **Description** → a short description to help the user to understand the meaning of the variable.

Oscilloscope Configuration

This pane is used to configure a data acquisition of TWX drive parameters using an internal oscilloscope like software feature. This grants the possibility to collect values for a restricted set of TWX drive parameters and to store them in dedicated data files. The content of these files can be analyzed using the **Oscilloscope Waveform Editor** that will be discussed later.
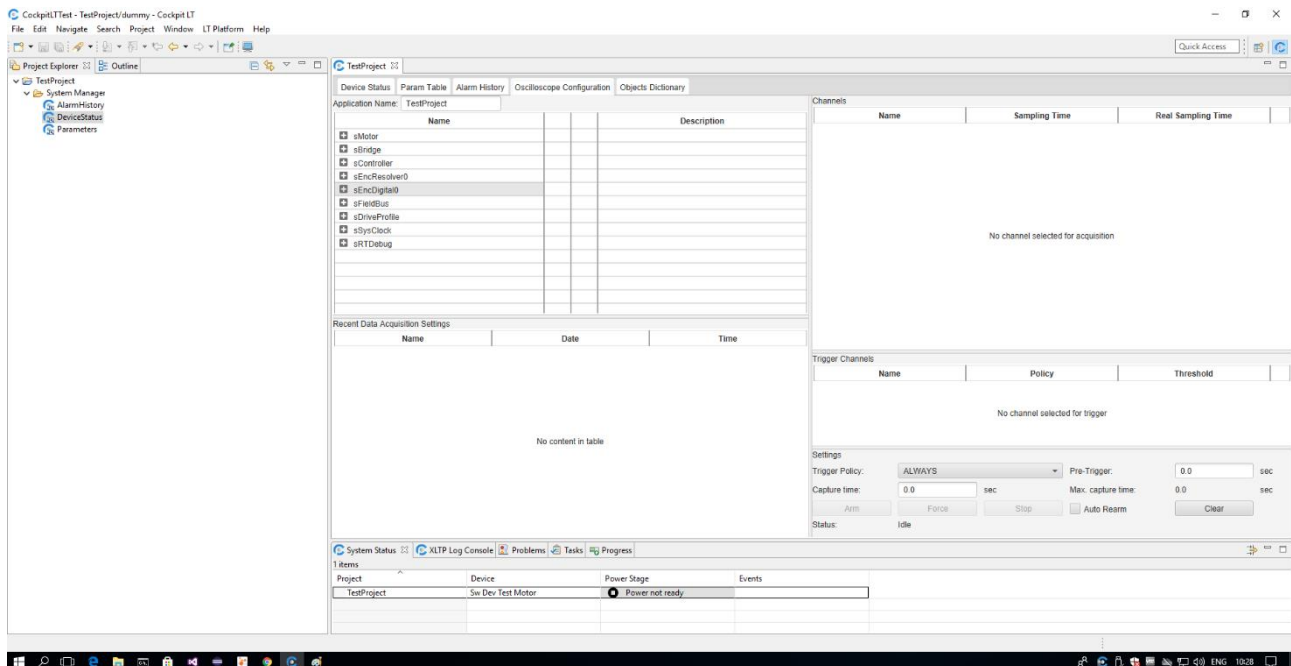
Let us start describing the **Oscilloscope Configuration** pane from the upper left corner, where it is possible to find the **Application Name** field. This field is freely user editable, and it is used to define the first part of the name for data file, the other part of the file name will be a timestamp string indicating date and time of data acquisition.

Immediately below the **Application Name** field it is present the Parameters selection table, containing the TWX drive parameters organized in a foldable tree equal to the one already seen in **Param Table** pane. This table contains 4 columns that are:

- **Name** → the name of the parameter or data structure, that is the same used in **Param Table** pane.
- **DAQ enable** → the second column, that has no header, is used to select which channels must be enabled during data acquisition.
- **Trigger enable** → the third column, that has no header, is used to select which channels must be used as trigger for the acquisition.
- **Description** → This column contains a description for the parameter, that is the same used in Param Table pane.
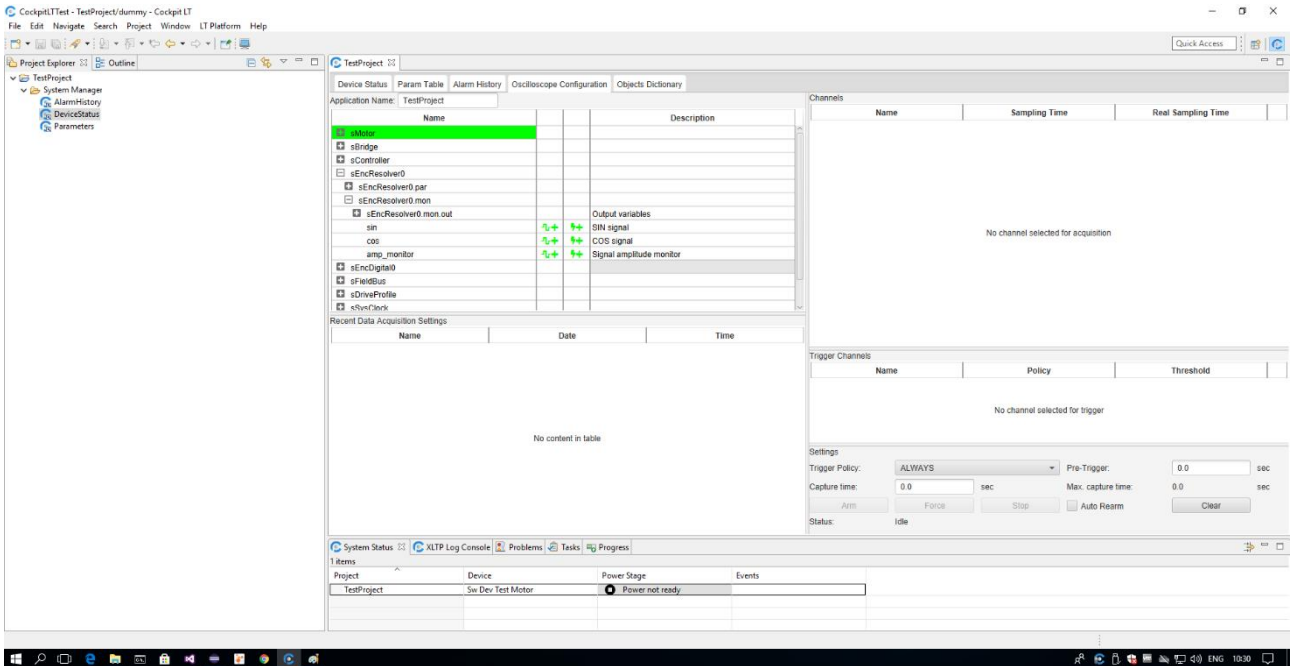
The selection of a parameter for data acquisition is done by simple clicking on the corresponding cell. The data acquisition symbol, that is a squared green waveform followed by a plus sign, disappears and the parameter appears in the Channels table on the right side.
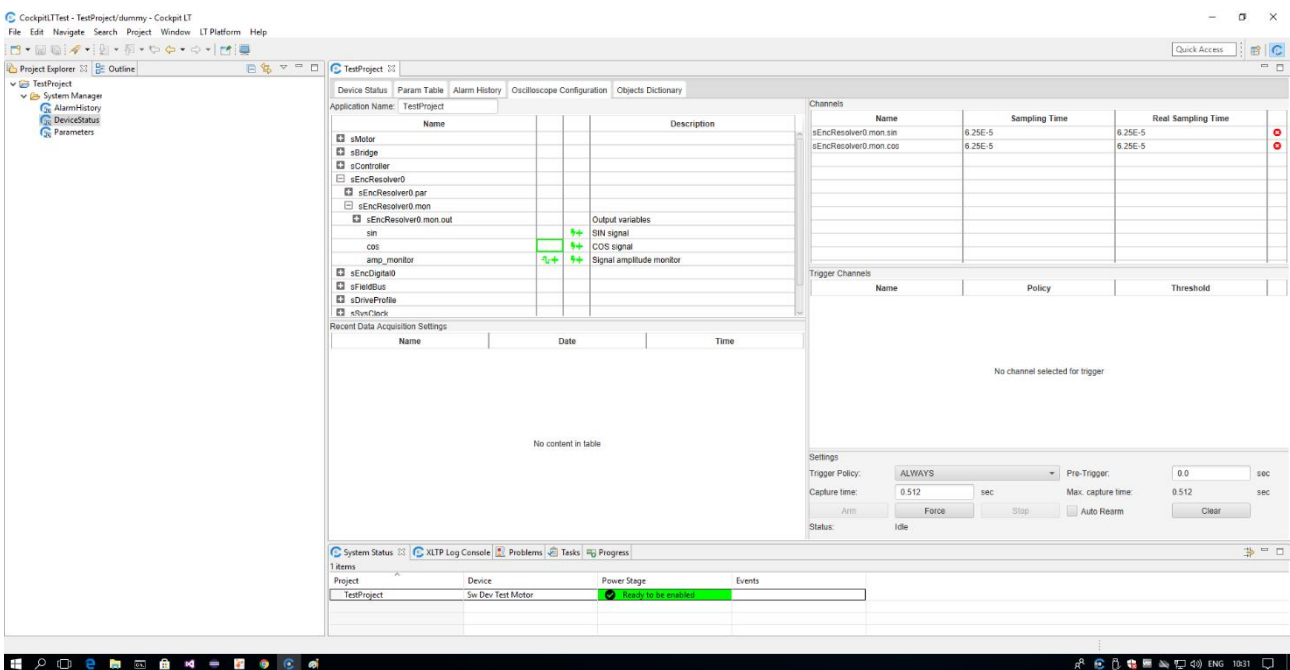
In the Channels table, for each parameter selected, are available the following columns:

- **Name** → the parameter name using the fully qualified notation that also includes parent data structures names.
- **Sampling Time** → The requested sampling time for the acquisition. This value can be changed by the user by click and edit the corresponding cell. When this value is changed the oscilloscope software manager takes care to forward the request to the TWX drive that will set up the new sampling time accordingly with its internal constraints.
- **Real Sampling Time** → This column reports to the user the real sampling time used during the acquisition, it is possible that this value is not equal with the value set up in **Sampling Time** column. As discussed above this is due to TWX drive acquisition procedures constraints. The real time step used in data acquisition is the one reported in this column.
- **Remove From Acquisition** → this column, that has no header, shows for each row that correspond to a parameter an icon with a red cross. By clicking the icon, the parameter is removed from the data

acquisition set, the corresponding line in table is deleted and the acquisition icon in **DAQ Enable** column is restored in parameter selection table.

The selection of a parameter as trigger channel is done by simple clicking on the corresponding cell. The trigger selection symbol, that is a green lightning followed by a plus sign, disappears and the parameter appears in the Trigger Channels table on the right side.
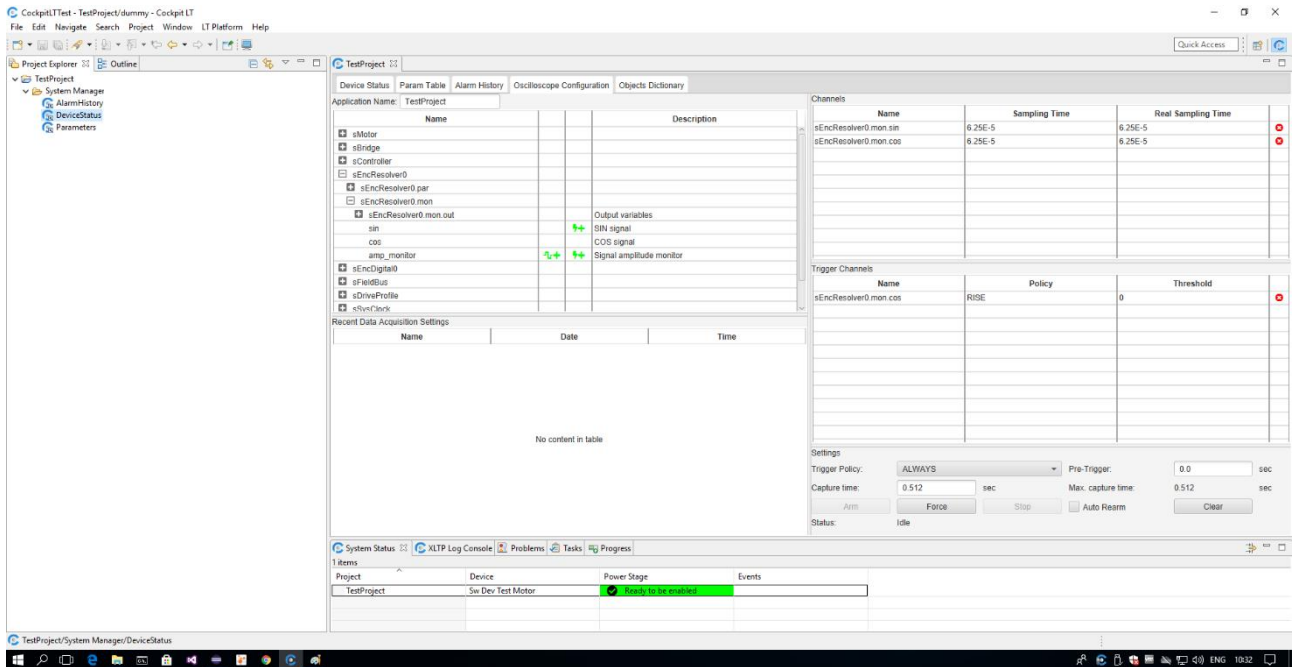
The Trigger Channels table contains 4 columns that are:

- **Name** → the parameter name using the fully qualified notation that also includes parent data structures names.
- **Policy** → the policy used for trigger signal.
- **Threshold** → the value used as threshold in trigger condition detection.
- **Remove from trigger** → this column, that has no header, shows for each row that correspond to a parameter an icon with a red cross. By clicking the icon, the parameter is removed from the trigger channels set, the corresponding line in table is deleted and the trigger icon in **Trigger Enable** column is restored in parameter selection table.

Immediately below the Trigger Channels table it is possible to find a sub-pane named **Settings**. This pane contains the parameters and commands necessary to start a data acquisition:

- **Trigger Policy** → this dropdown contains possible policies applicable in acquisition, that are substantially the rules used to combine trigger channels conditions.
- **Pre-Trigger** → in this field it is possible to set up, expressed in seconds, the amount of time the acquisition must report before the trigger event.
- **Capture Time** → This field contains the whole acquisition time duration including pre-trigger period.
- **Max Capture Time** → This field reports the maximum allowable time for data acquisition. It is the upper limit for capture time. This value comes from TWX drive, and it depends on the number of channels selected as acquisition and their sampling time. In case the user sets up a **Capture Time** value greater than **Max Capture Time** the acquisition time will be automatically set up to **Max Capture Time** value.

To control the data acquisition operation a set of buttons Arm, Force, Stop are provided in the lower part.

The Clear button can be used to clear all data acquisition settings and restore a clean condition before to define a new configuration.

The checkbox named **Auto Rearm**, when selected, permits to automatically start a new data acquisition, using the same acquisition setup, immediately after a data acquisition has been triggered and data

acquisition has been completed. The sequences of data acquired using this feature are stored in the same data file and it is possible to analyze them in the same Oscilloscope Waveform Editor window, details will be discussed later.

The number of parameters that can be selected as channels for data acquisition or that can be used as triggers depends exclusively by TWX drive firmware limits. The Oscilloscope Configuration pane just manage information from TWX drive to limit user choices when TWX drive firmware set up some limit.

When a data acquisition is performed by pushing Arm or Force button a copy of the configuration is saved to file and a reference appears in the Recent Data Acquisition Settings table.
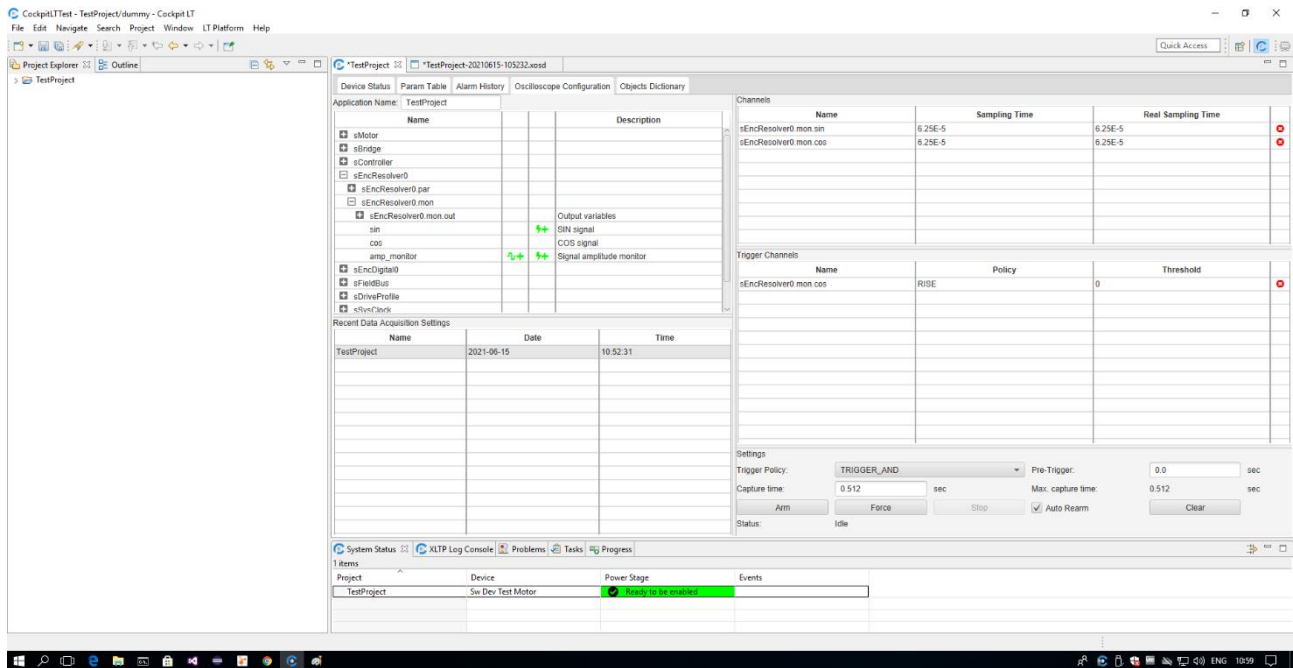
The table contains three columns that are:

- **Name** → the Application Name value set up for acquisition.
- **Date** → the date when the data acquisition has started.
- **Time** → the time when the data acquisition has started.

The store to file procedure does not happen all the times an acquisition is started but, to avoid a lot of duplicated data, it happens only if the starting data acquisition differs, in at least one parameter, from the already saved acquisition settings.

By double-clicking on a line of the **Recent Data Acquisition Settings** table the selected configuration is loaded and it is possible to execute the acquisition using the stored settings.

Object Dictionary

This pane can be used to set up CANOpen or EtherCAT TWX drive features. The availability of such kind of features depends on TWX drive firmware configuration.
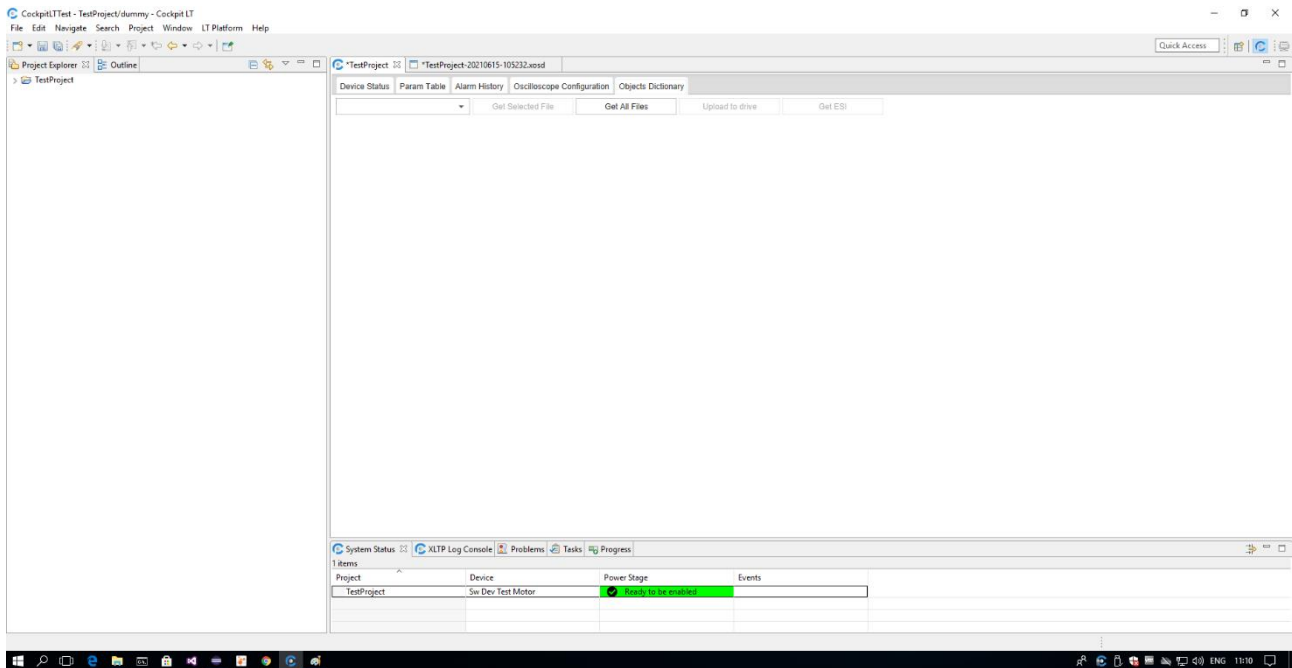
On the first use the pane looks empty except for the upper toolbar. The toolbar contains the following items:

- **File name drop-down** → when expanded it gives the list of available object dictionary files. The user can select the desired file based on application needings. If TWX drive does not include any object dictionary feature the dropdown list is empty and no selection is allowed.
- **Get Selected File** → This button, disabled by default, is enabled only when an object dictionary file is selected in described dropdown. This button starts automatic procedures to download and decode object dictionary selected file from TWX drive and to store a copy on local filesystem. When the file is effectively on local filesystem the remaining part of the screen will be populated using file content.
- **Get All Files** →This button downloads and stores in local filesystem all object dictionary files stored in TWX drive.
- **Upload to drive** → This button encodes the data available in the page in a file and upload it to TWX drive. This operation is necessary in order made operative all the changes done inside object dictionary editor on TWX drive.
- **Get ESI** → This button can be used to download the object dictionary catalog to a file in local filesystem. By pressing this button, a standard file selection window will open to select where to save the file.

Once the object dictionary file has been selected and downloaded the page will automatically load file content and will add editors needed to modify all available fields.
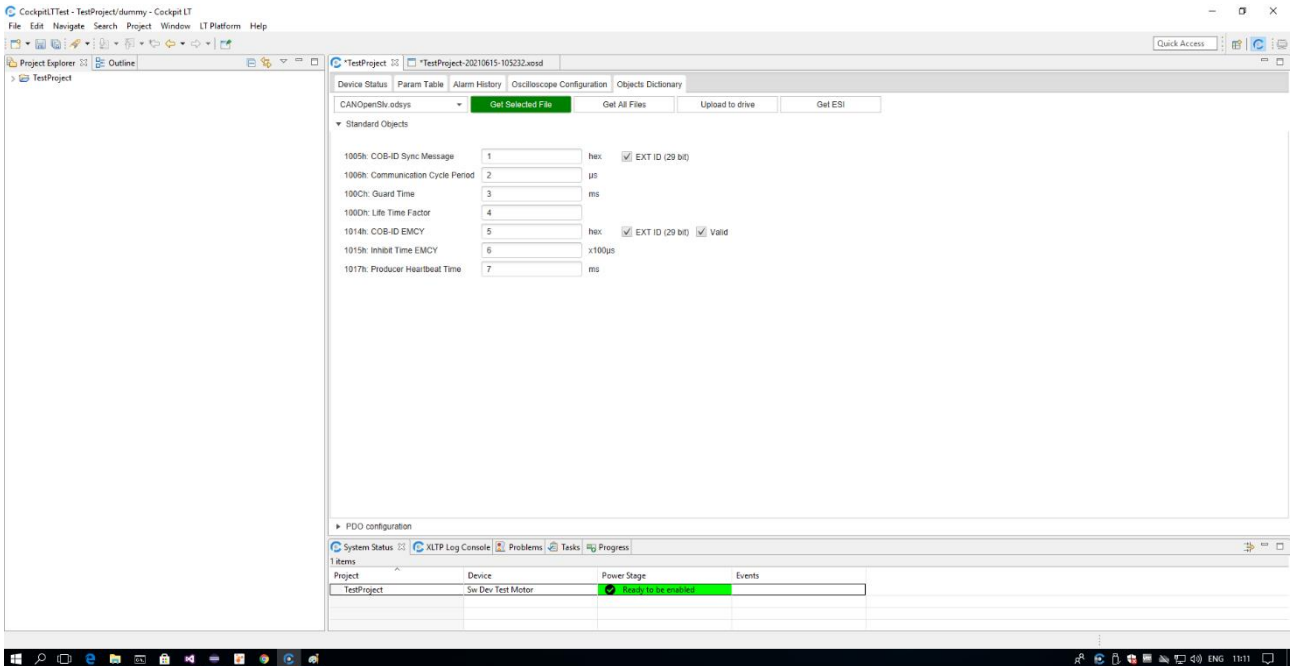
In figure it is possible to see the editors available for a CANOpen object dictionary the page is composed by two horizontal folders named **Standard Objects** and **PDO Configuration**.

Each of these folders contains parameters for CANOpen/EtherCAT defined data objects. For definitions and meanings of these data objects it is suggested to refer directly to CANOpen and EtherCAT documentation.
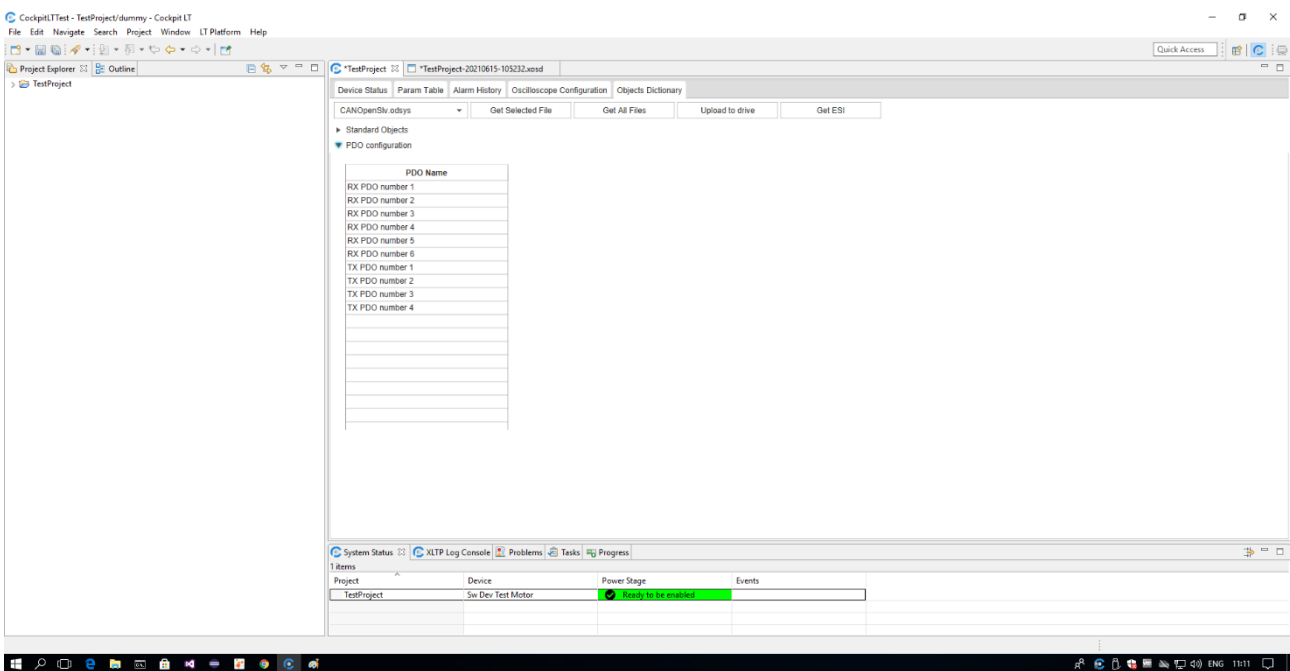
In PDO configuration folder it is possible to see a list of available PDOs defined on TWX drive. Upon selection of one of the elements of the list the editable properties will be displayed. Only valid fields for the selected PDO will be displayed in the pane.

Screenshot 1

CockpitLTTest - TestProject/dummy - Cockpit LT

File Edit Navigate Search Project Window LT Platform Help

Quick Access

Project Explorer Outline

> TestProject

*TestProject-20210615-105232.xosd   TestProject

Device Status | Param Table | Alarm History | Oscilloscope Configuration | Objects Dictionary

CANOpenSlv.odsys ▼   Get Selected File   Get All Files   Upload to drive   Get ESI

▶ Standard Objects
▼ PDO configuration

PDO Name
RX PDO number 1
RX PDO number 2
RX PDO number 3
RX PDO number 4
RX PDO number 5
RX PDO number 6
TX PDO number 1
TX PDO number 2
TX PDO number 3
TX PDO number 4

COB-ID: 201 hex   ☑ PDO Valid   ☐ EXT ID (29 bit)

Type: Event-driven (profile-specific)

Event Timer: 0 ms

Description	Index	SubIndex	Size
Dummy Entry 8 bit	5	0	8
Dummy Entry 16 bit	6	0	16
Dummy Entry 32 bit	7	0	32
1001h: Error Register	1001	0	8
1002h: Manufacture...	1002	0	32
6040h: Controlword	6040	0	16
6060h: Mode of ope...	6060	0	8
6065h: Following err...	6065	0	32
6066h: Following err...	6066	0	16
6067h: Position win...	6067	0	32
6068h: Position time...	6068	0	16
606Dh: Velocity win...	606D	0	16
606Eh: Velocity win...	606E	0	16
606Fh: Velocity thre...	606F	0	16
6070h: Velocity thre...	6070	0	16
6071h: Target torque	6071	0	16

Description	Index	SubIndex	Size
6040h: Controlword	6040	0	16

Add
Remove

Move Up
Move Down

System Status | XLTP Log Console | Problems | Tasks | Progress

1 items

Project	Device	Power Stage	Events
TestProject	Sw Dev Test Motor	Ready to be enabled	

ENG 11:21

Screenshot 2

CockpitLTTest - TestProject/dummy - Cockpit LT

File Edit Navigate Search Project Window LT Platform Help

Quick Access

Project Explorer Outline

> TestProject

*TestProject-20210615-105232.xosd   TestProject

Device Status | Param Table | Alarm History | Oscilloscope Configuration | Objects Dictionary

CANOpenSlv.odsys ▼   Get Selected File   Get All Files   Upload to drive   Get ESI

▶ Standard Objects
▼ PDO configuration

PDO Name
RX PDO number 1
RX PDO number 2
RX PDO number 3
RX PDO number 4
RX PDO number 5
RX PDO number 6
TX PDO number 1
TX PDO number 2
TX PDO number 3
TX PDO number 4

COB-ID: 181 hex   ☑ PDO Valid   ☐ EXT ID (29 bit)   ☑ RTR Allowed

Type: Event-driven (profile-specific)

Inhibit time: 0 x100 µs

Event Timer: 0 ms

Description	Index	SubIndex	Size
1001h: Error Register	1001	0	8
1002h: Manufacture...	1002	0	32
603Fh: Error code	603F	0	16
6040h: Controlword	6040	0	16
6041h: Statusword	6041	0	16
6060h: Mode of ope...	6060	0	8
6061h: Mode of ope...	6061	0	8
6062h: Position dem...	6062	0	32
6064h: Position actu...	6064	0	32
6065h: Following err...	6065	0	32
6066h: Following err...	6066	0	16
6067h: Position win...	6067	0	32
6068h: Position time...	6068	0	16
606Bh: Velocity de...	606B	0	32
606Ch: Velocity act...	606C	0	32
606Dh: Velocity win...	606D	0	16

Description	Index	SubIndex	Size
6041h: Statusword	6041	0	16

Add
Remove

Move Up
Move Down

System Status | XLTP Log Console | Problems | Tasks | Progress

1 items

Project	Device	Power Stage	Events
TestProject	Sw Dev Test Motor	Ready to be enabled	

ENG 11:22

Oscilloscope Waveform Editor

The Oscilloscope Waveform Editor is the graphical tool that can be used to analyze data acquired by using the Oscilloscope Configuration page.

Oscilloscope Waveform Editor is automatically opened when a data acquisition is completed by the TWX drive, but it can also be opened by double-clicking on an acquisition data file under *System Manager\Digital Scope* project folder. Acquisition data files use the *xosd* file extension.

Oscilloscope Waveform Editor looks very similar to a standard oscilloscope, but it works only on local saved data and not on living stream data like a real oscilloscope does.

From a functional point of view the CockpitLT oscilloscope takes advantage of the integration with the TWX drive firmware that makes possible to acquire all the parameters exposed by the firmware accordingly with the measurement units defined by the firmware. For each measurement unit, found in the set of acquires parameters, a different vertical axis is automatically provided, and the axis scale is automatically tuned to display the full waveform.

In the example image 6 different waveforms are displayed and have three different measurement units.
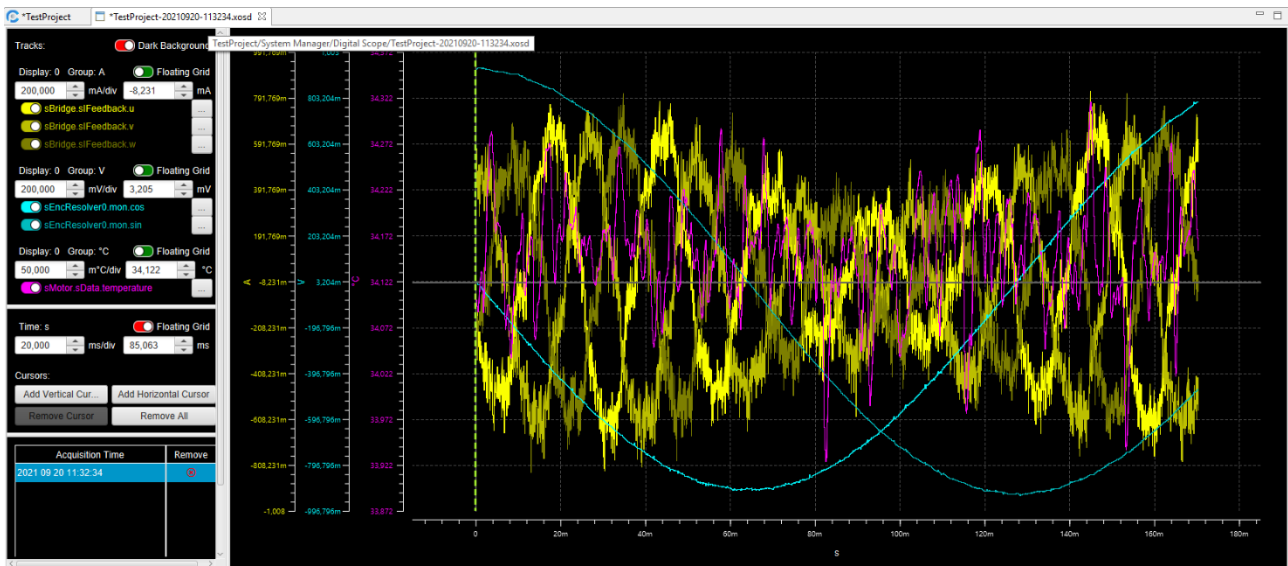
The detailed image below permits to better understand waveforms layout:
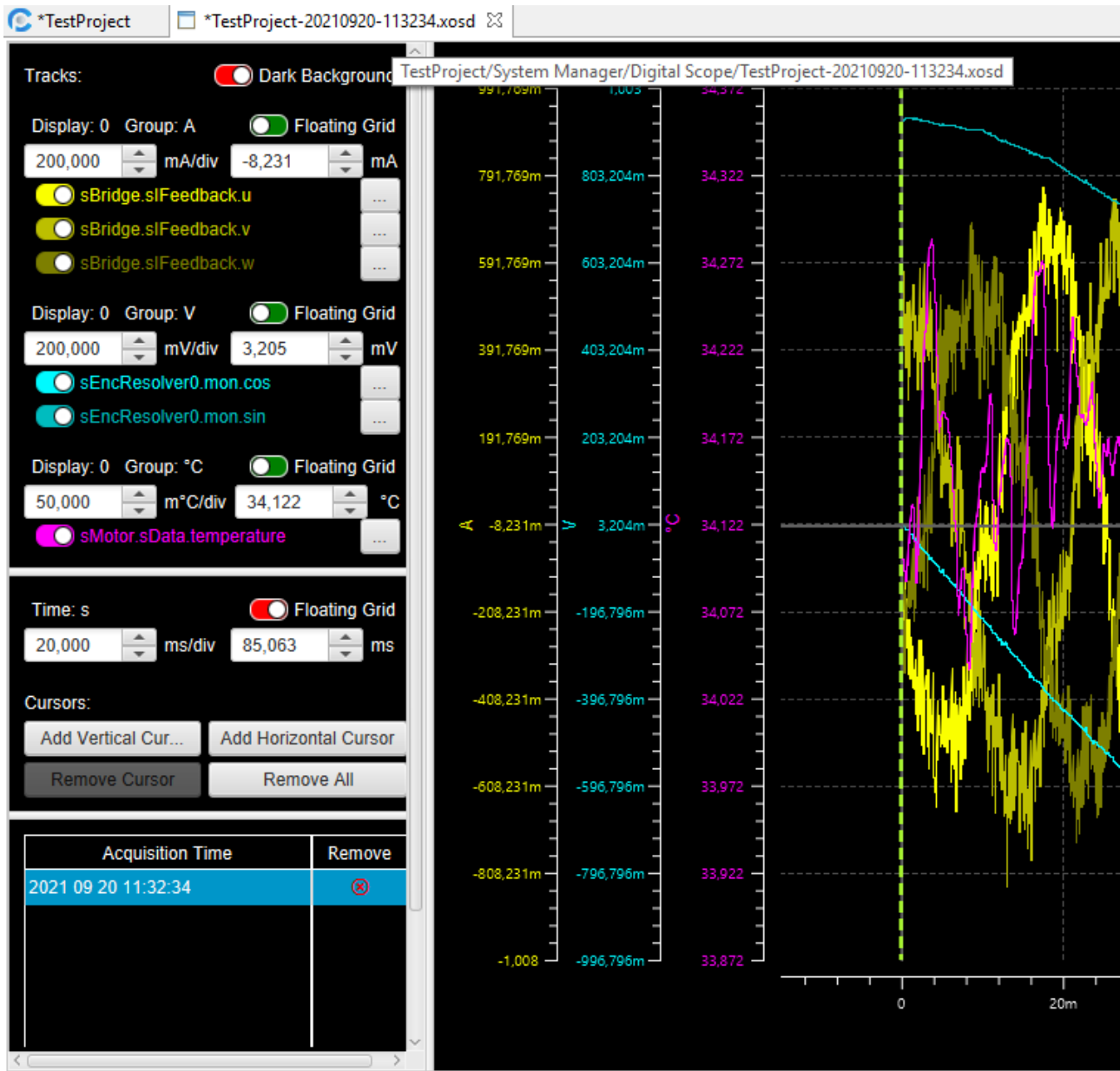
Waveforms Control Panel

In the left column are contained the controls and the references for the acquired waveforms.

At the top of the column a switch for background color is provided, it simply changes the panel and waveforms background from black to white and vice versa.

Waveforms Control Group

The acquired waveforms are grouped considering the measurement unit provided by the TWX firmware.

The waveforms sharing the same measurement unit are displayed in the same color using different color tone, from brighter to darkest.

In the example data acquisition reported in figures the waveforms related to Ampere unit are displayed in yellow, waveform related to Volt unit are displayed in cyan and temperature in Celsius degrees are displayed in purple.

For each measurement unit a block of controls is provided, let us analyze the Ampere controls:
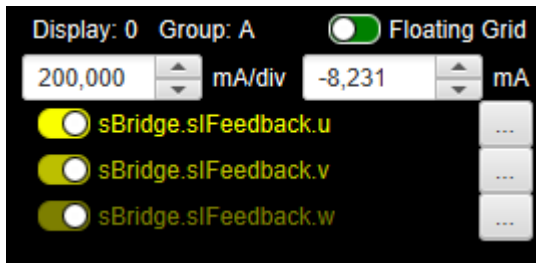
In the first row are present the following information:

- Display: the number indicated is related to panel where the waveforms are displayed. In this example only display number 0 is available, but it is possible to split the waveforms view in different vertical stacked displays. The numbering is then assigned from top to bottom in the displays stack starting from 0.
- Group: the value indicated by group entry corresponds to the measurement unit of the waveforms. In this example the A letter means Ampere.
- Floating Grid: this switch can be used to tight the waveforms horizontal grid to the corresponding axis. When this feature is activated, the horizontal grid is aligned with the magnitude values and all the values displayed on the axis are integer multiples of the grid magnitude. On a single display only one axis can be bound to horizontal grid, when the Floating Grid control is activated on an axis it is automatically disabled on all other axes.

In the second row are present two spinner controls:

- The control to the left represents the grid magnitude for each grid division. Increasing or decreasing this value corresponds to a vertical zoom out or zoom in.
- The control to the right represents the waveforms offset and increasing or decreasing this value corresponds to a shift up or down for all the waveforms controlled in this group.

After the spinner controls a list of all the waveforms included in the group is provided. Each waveform name is shown using the fully qualified dotted-separated form, that includes parent data structures as reported in Parameters Table Editor and Oscilloscope Configuration Editor.

The color of the name is the same used to display the waveform in the waveform panel.

On the left of the waveform name, it is present a switch that can be used to toggle the waveform visibility in the waveform panel.

On the right of the waveform name, it is present a button with three dots. This button opens a color table selector that can be used to change the waveform color.

The other waveforms controls use the same schema simply changing measurement unit, scale values and number of waveforms.

Time Control and Measurement Cursors Group

In a separate frame from the waveforms controls it is provided the set of controls for time scale and measurement cursors.

Time scale is common to all the waveforms displayed in the waveform panel even if the waveforms are displayed in a single pane or if they are shown in split panes.
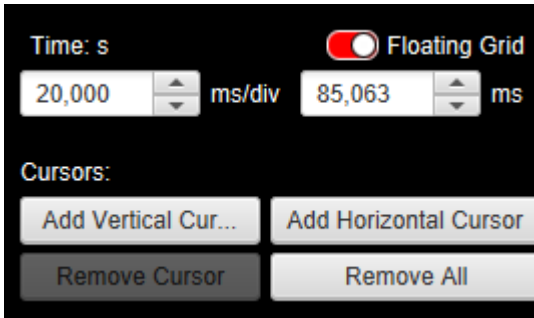
As well as seen for the waveforms control the first row in the control box contains a label to report the axis content and the measurement unit, that is Time and s (seconds), as well as the Floating Grid switch that operates in the same way as above but, in this case, on the horizontal axis.

On the second line two spinner controls for time scale magnitude and time scale offset are provided.

The Cursors section contains:

- Two distinct buttons to add horizontal and vertical cursors.
- One button to remove the selected cursor, if no cursor is selected the button is disabled.
- One button to remove all cursors.

The use of measurement cursors will be described in a dedicated chapter.

Acquired Waveforms List

The Acquired Waveforms List contains a list of data values available in the acquisition file sorted by using date and time of the acquisition itself.

In the case of a single acquisition, it is reported in this panel just date and time of the acquisition.

In case of multiple acquisitions, performed by using the Oscilloscope Configuration's auto-rearm feature a list of available acquisitions included in file is proposed. This feature will be discussed in next chapters.

Oscilloscope Configuration Connector

In the lower part of the control's column, it is present a connector that directly communicates with Oscilloscope Configurator.
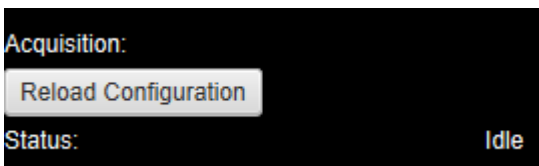
In the upper part the **Reload Configuration** button can be used to automatically setup the Oscilloscope Configuration page using the same settings used for the data currently displayed.

The status line reports the status of the oscilloscope data acquisition service.

In case of a single acquisition, like in this case the status shown is normally the Idle state.

In case of a multiple acquisition done by using the auto-rearm feature the status will change accordingly with the oscilloscope data acquisition service status.

In case of a multiple acquisition is running the label and functionality of the Reload Configuration button will change to give to the user the capability to stop multiple data acquisitions by using the Stop Auto Rearm button as shown below.
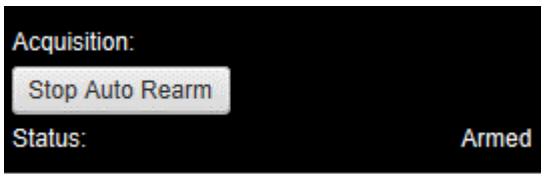
Waveforms Display Panel

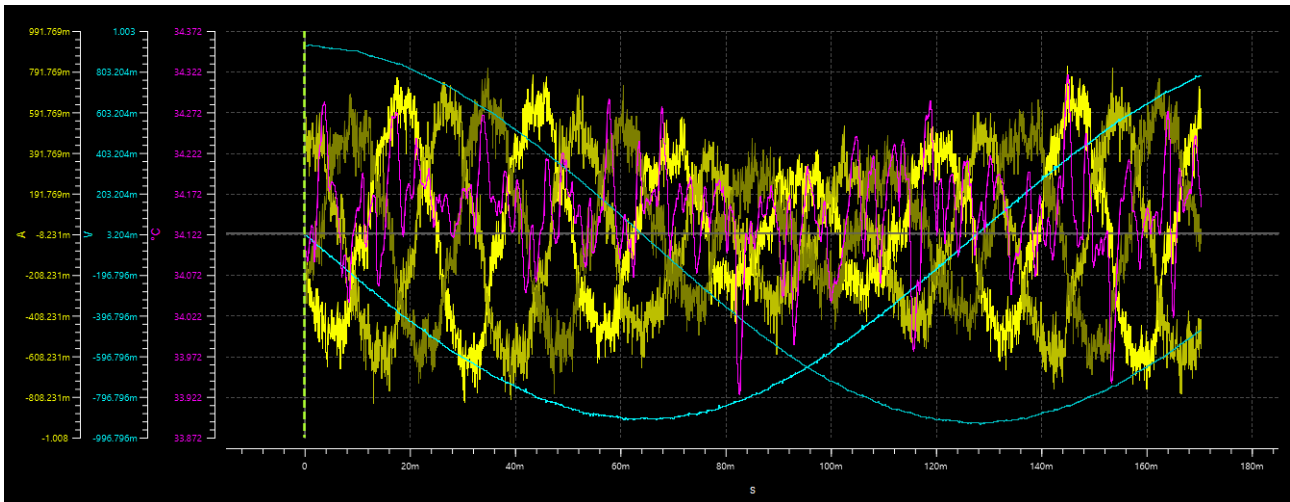The waveform display panel is the part of the application window where waveforms are effectively displayed together with the reference axes.

As discussed in previous chapters on the left part are displayed the references vertical axes, one for each different measurement unit of the displayed waveforms. Each axis has its own dynamic range that can be tuned by using the magnitude and offset spinners described in previous chapters.

In the bottom part of the panel, it is present the time reference axis, common to all waveforms.

The remaining part of the panel contains the waveforms representing the acquired data.

A thick green dashed line represents the trigger time, in the example image the pre-trigger time was set to zero so the trigger time coincides to the time origin. Due to the TWX firmware internal data sampling system in case the pre-trigger time is set to a value different from zero it is possible that the trigger time will be not exactly equal to the value set up for pre-trigger, anyway this is not an issue that can affect the validity of the data acquisition.

Mouse gestures to interact with waveforms

To permit to the user to better analyze the acquired waveforms a set of mouse gestures have been implemented.

Pan zoom

By holding the CTRL button and left mouse button on the waveform panel it is possible to execute the so-called pan zoom that means that all the waveforms are translated following the mouse movements.

All the axes and offsets spinners will update accordingly with pan zoom changes.

Zoom in/out

By simply using the mouse wheel when the mouse pointer is over the Waveforms Display Panel a zoom in, wheel up, or a zoom out, wheel down, on both horizontal and vertical axes is performed.

The central point of the zoom operation corresponds to the mouse pointer position so all the spinners for magnitude and offset for measurement units and time will be updated accordingly with the new zoom window.

Vertical zoom in/out

By holding the CTRL button and acting on mouse wheel a vertical zoom in, wheel up, or a vertical zoom out, wheel down, is performed.

In this case the vertical axes and the magnitude spinners will update accordingly with mouse gesture.

Horizontal zoom in/out

By holding the SHIFT button and acting on mouse wheel a horizontal zoom in, wheel up, or a horizontal zoom out, wheel down, is performed.

In this case the time axis and the time magnitude spinner will update accordingly with mouse gesture.

Zoom on selected area

By holding the SHIFT button and left mouse button a semi-transparent green rectangle will appear on the waveform panel. It is possible to include the interesting waveforms are using this rectangle. When the mouse button is released the waveform panel will zoom to an area equivalent to the selected area.

In this case all the axes, offsets spinners and magnitude spinners will update accordingly with selected zoom area changes.

Splitting waveforms

Up to now all the waveforms were always displayed in a single waveform panel. It is possible, by using a drag-and-drop procedure, to separate waveforms in different panels. This can be useful, for example, if the user has acquired high voltage and low voltage parameters and he/she wants to watch them using the proper dynamics.

To split a waveform in a dedicated panel, it is sufficient to follow this procedure:

1. Left click on a waveform that must be moved to a separated display. This will select the waveform. The selected waveform will change its thickness, becoming bold.
2. Using again left mouse button click and hold over the previously selected waveform. By moving the mouse pointer, it will change its shape to a prohibition sign.
3. Move the mouse pointer over the time axis, the mouse pointer will change back to an arrow with a low rectangle at its base and the time axis area will be highlighted by a semi-transparent white rectangle.
4. Release the left mouse button.

The result of the split operation will result as follow:
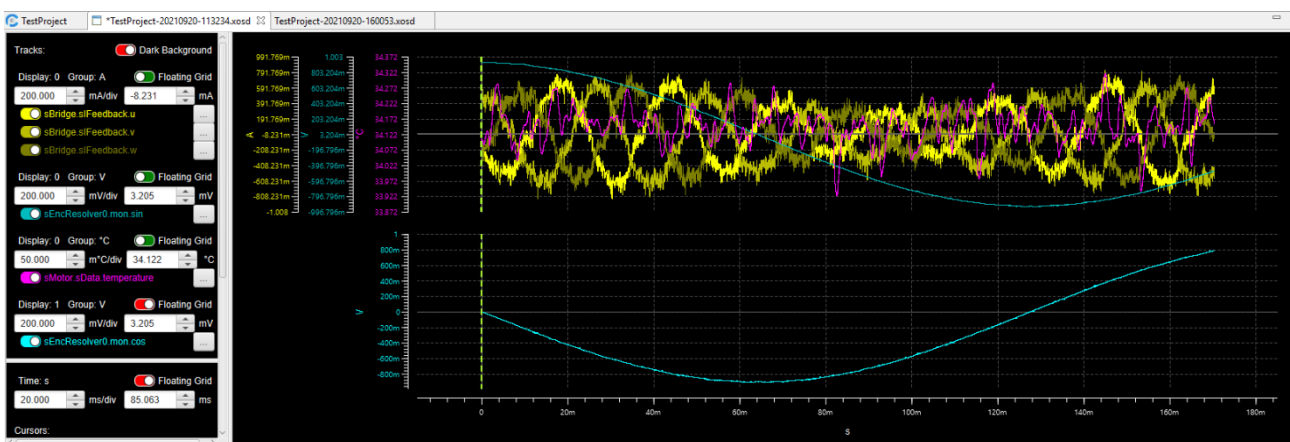
A new display, containing the dragged waveform, is automatically inserted between the old display and the time axis.

The time axis is common to both displays and all the changes in time magnitude or time offset will reflect to both displays.

In correspondence to the new display a vertical axis is added accordingly with the measurement unit of the waveform.
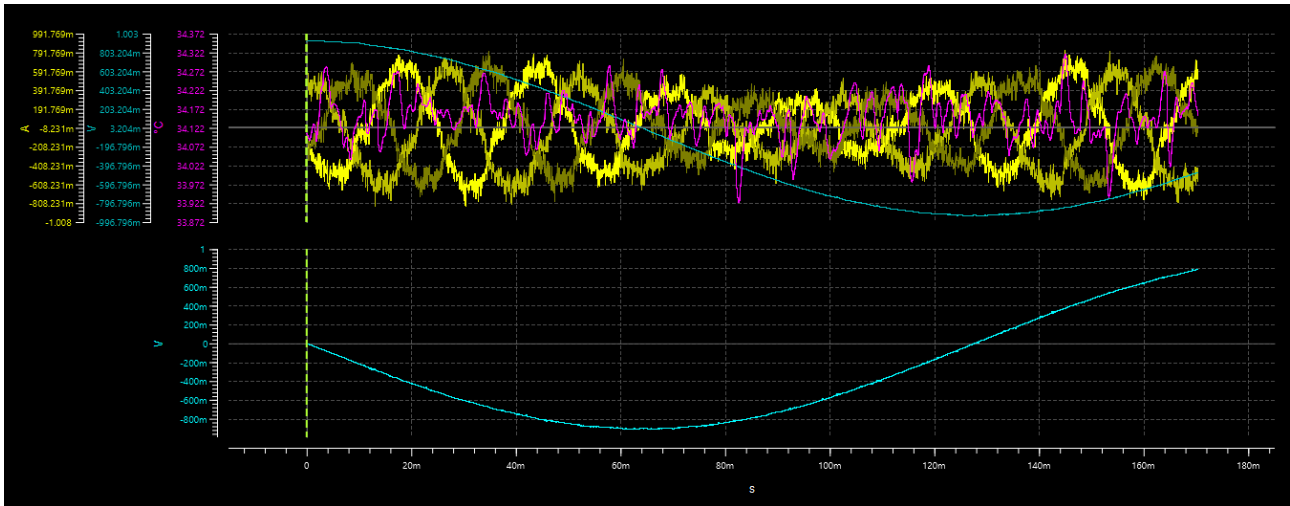
The waveform control panel also reflects the new display configuration.
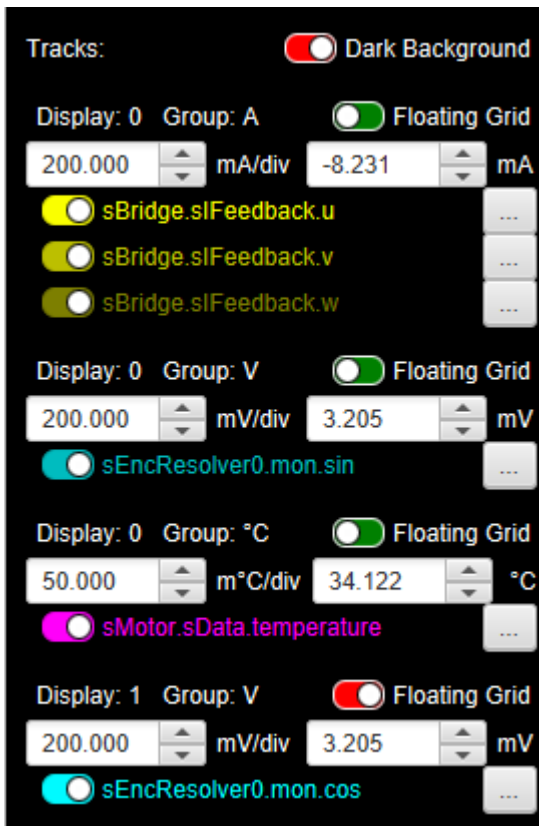
As can be seen in the above image the **Display: 0 Group: V** control does not include anymore the dragged waveform, named **sEncResolver0.mon.cos** that now appears in the last control group **Display: 1 Group: V**.

All the controls in two modified control groups maintain their functionalities, but now vertical axes on the displays are decoupled and the user can tune them differently considering signals dynamics or specific behavior that he/she wants to highlight.

The waveform drag-and-drop feature can be now executed on other waveforms that can be moved to Display 1 or can be inserted on a new display. In the first case the left mouse button must be released when the mouse pointer is over Display 1 area, in the second case the mouse pointer must be over the time axis as it was done for the first waveform.

The split operation is obviously reversible, and the user can drag waveform from Display 1 and drop it to Display 0. The waveform will be automatically moved back, and the empty display will disappear.

The controls groups in the left column automatically update accordingly with the drag-and-drop operation performed.

When a display does not include any waveform for a certain measurement unit the corresponding vertical axis is automatically removed from the panel.

To complete the Oscilloscope waveform editor functionalities a small set of toolbar button is included in the main toolbar.

The toolbar is visible only when an Oscilloscope Waveforms Editor window is on focus.

Each button has a popup balloon that informs the user about the name of the button.
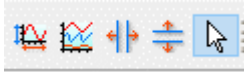
From left to right the buttons are:

Full scale

By pushing this button all offsets and magnitudes values for all axes are automatically tuned to make possible to contain all waveforms data inside their respective displays.

Stagger

This button performs a split/merge operation that involves all the waveforms.

If the waveforms are all contained in a single display by pushing this button each waveform will be assigned to a dedicated display that is like a multiple drag-and-drop operation over all the waveforms.

If the waveforms are displayed on more the one display, then the stagger button will join all the waveforms on a single display.

Horizontal band zoom

By pushing this button, a band zoom operation is activated the button will be highlighted in a pale blue color like the arrow icon in the toolbar image above and the mouse cursor, when moved to the Display Panel will change its shape accordingly to the button icon image.

When the user clicks and holds left mouse button a semi-transparent vertical green bar will appear on the display panel. When the left mouse button is released, a horizontal zoom is performed to the selected display panel area.

When this zoom mode is active all mouse gestures described above are deactivated.

Vertical band zoom

In this case a vertical band zoom operation is activated and the mouse cursor shape changes like in the previous case.

When the user clicks and holds left mouse button a semi-transparent horizontal bar will appear on the display panel. When the left mouse button is released, a vertical zoom is performed to the selected display panel area involving all vertical axes referenced by the panel.

When this zoom mode is active all mouse gestures described above are deactivated.

None

This is the default setting for the zoom toolbar that enables discussed mouse gestures.

To obtain precise measurements value for the waveforms displayed on panel it is possible to add horizontal and vertical measurement cursors, like in a standard oscilloscope.

All cursors are inserted in the middle of the reference axis and can be moved simply using drag-and-drop gestures.

A simple click on a cursor permits to select the cursor itself and enables the **Remove Cursor** button as discussed above.

In case of multiple displays vertical cursors are common to all displays and when moved on one display the cursor on the other display moves accordingly.

If a new display is created when vertical cursors are present in current display also the new display will report the same cursors.

Horizontal cursors will be not reported on new display.

If multiple displays are present when the **Add Horizontal Cursor** button is pushed a new horizontal cursor will be added to each display

When zoom operations are performed on a display where measurement cursors are in place the cursors maintain their reference position, i.e. the value on the axis, and are moved on display accordingly with the zoom changes.

Vertical Cursors

Each vertical cursor is a vertical bar with a measurement flag placed on the upper part of the bar. The flag reports the time, referred to the horizontal axis and the value of the waveform at the point where the cursor is in place.

When the mouse pointer hovers a cursor, a new flag appears to indicate the delta values for time and waveforms values respect other cursors.
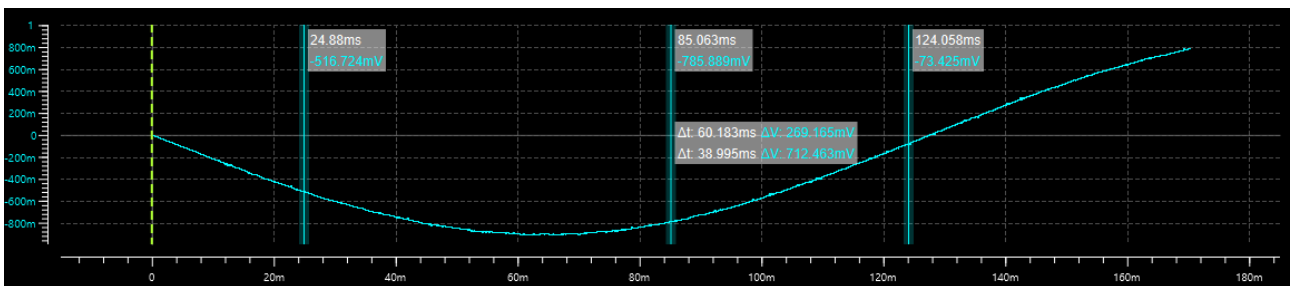
Horizontal Cursors

Each Horizontal Cursors is a horizontal bar with a measurement flag placed on the left part of the bar. The flag reports the corresponding axis value for each axis referenced on the display.

Also for horizontal cursors when the mouse pointer hovers a cursor a new flag appears to indicate the delta values between the cursors on each of the displayed axes.
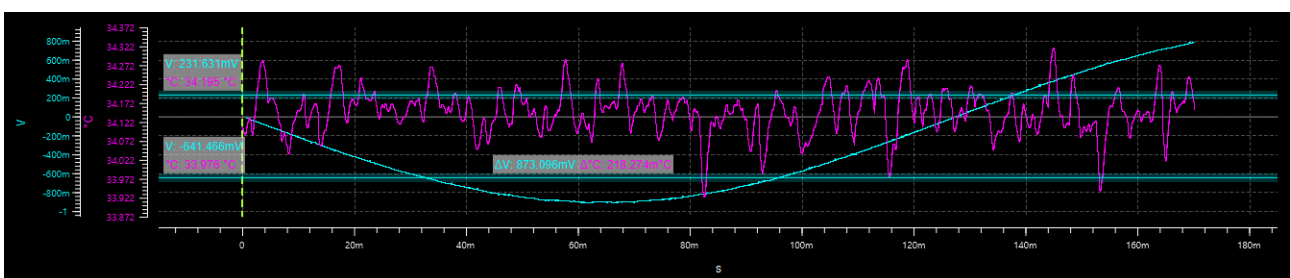
Multiple data acquisition by using auto-rearm feature

As discussed above it is possible to perform a sequence of data acquisitions by using the auto-rearm feature in Oscilloscope Configuration pane.

While the auto-rearm acquisition is running the data displayed in the Oscilloscope Waveform Editor are continuously updated with fresh data from TWX drive.

Once the auto-rearm feature is stopped, as discussed in the paragraph related to the Oscilloscope Configuration Connector, no more data come from the TWX drive and it is possible to found in the Acquired Waveforms List all the data retrieved from TWX drive.

The highlighted line corresponds to the data currently displayed in the Waveform Display Panel. To browse between acquisition data, it is sufficient to select a different line in the table or to scroll table elements using up and down arrows. Displayed data will be automatically updated in Waveform display panel.

If a different axes scale, axes offset, or multiple display view has been set up to better highlight some part of the data acquisition then the data set selection will not change the setup, but it simply updates displayed data, keeping as time reference the trigger time.

If the user finds that one or more of the acquired data sets are not useful, it is sufficient to click on the red cross in the remove column. This action will permanently delete the data set from the file.