Scope

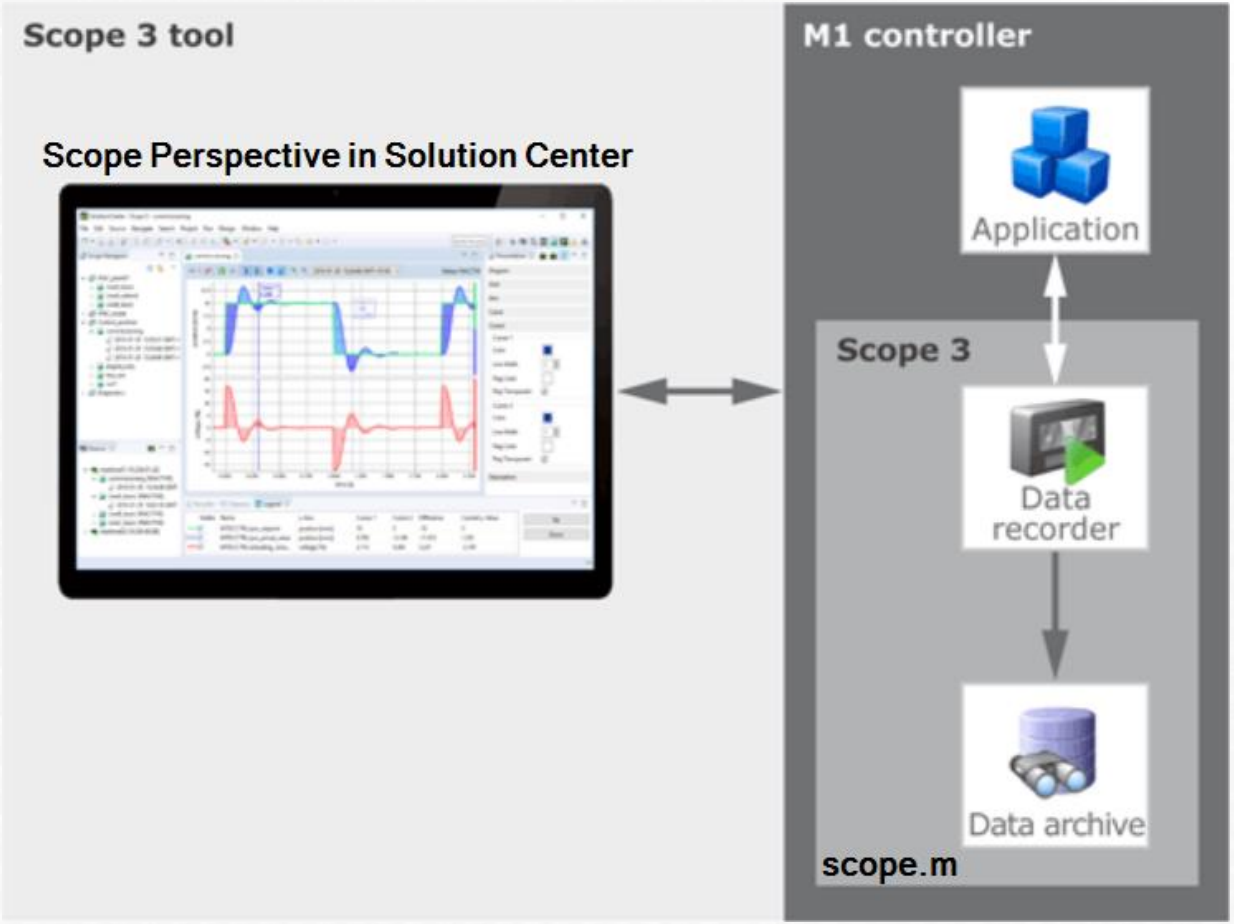
Setting Up and Usage

What is Scope

Scope 3 is a software for recording and diagnosing process variables and hardware channels of M1 controllers.

Scope 3 consists of a central recording and archiving system (software module SCOPE.M) and a graphical application for configuring, displaying and analyzing data records (Perspective in Solution Center).

Scope 3

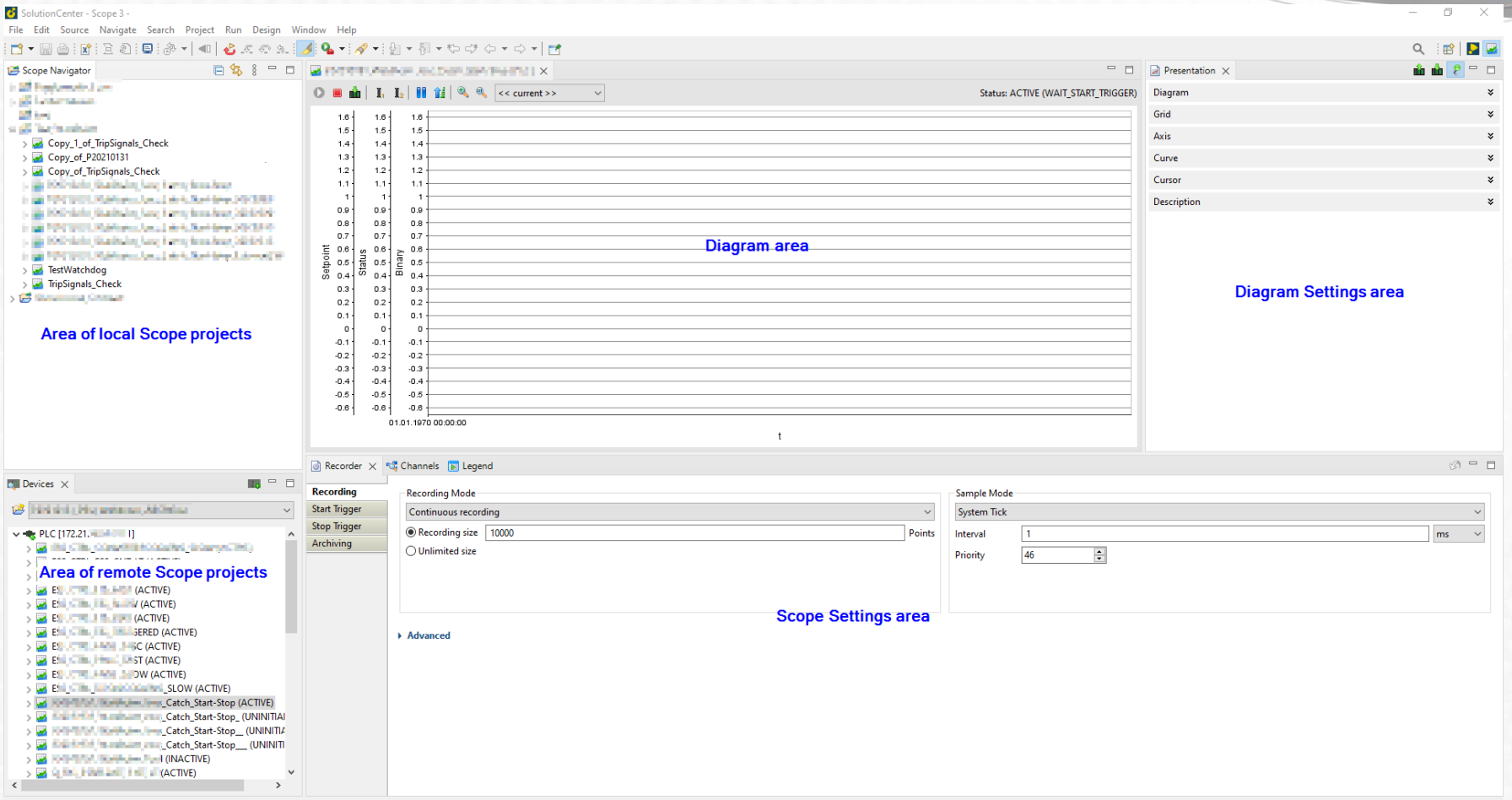

Scope 3 tool
Scope Perspective in Solution Center
M1 controller
Application
Scope 3
Data recorder
Data archive
scope.m

Opening the Scope Perspective

1. Open your Solution Center
2. Go to the menu
   `Window > Perspective > Other…`
3. Select "Scope 3" and click Open

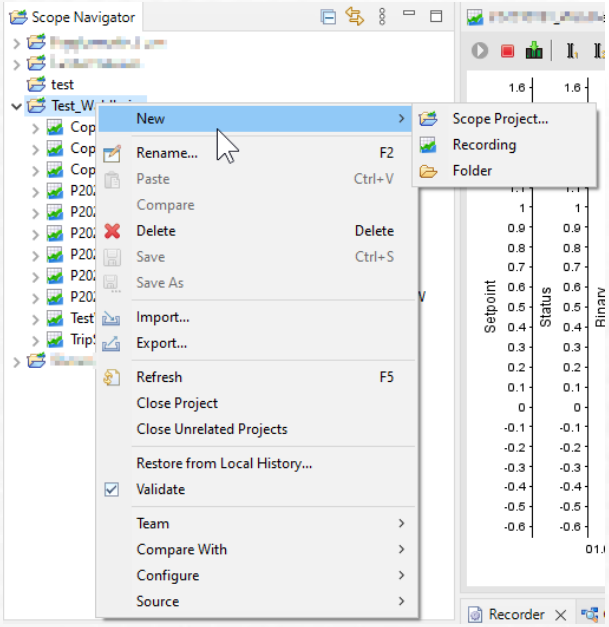
From now on the icon is in the top right of your Solution Center for faster switching:

Using Scope Perspective



Local Scope Projects

- Local Scope projects are offline on your PC
- You can organize the Scopes in Scope Projects
- Below Scope Projects you can organize Recordings and folders
- You can import and export Recordings



Remote Scope Projects

- The Drop-Down lists all "Solutions" you have created in the Solution Perspective
- Below you find all PLCs organized in the selected Solution
- Click on the PLC and wait…
  No loading process is indicated!
  Just wait!
- The online available Scopes are listed
- Below Scopes the Recordings (Archives) are listed

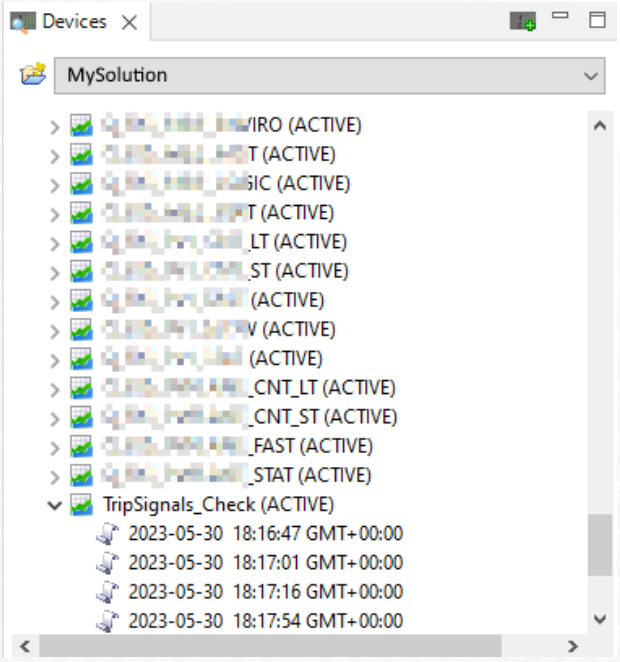


Diagram Area

Switch on/off the measurement cursors 1&2

Stop live recording

Start live recording

Disconnect from Recorder

Connect to or install Recorder

Interrupt diagram movement in live view

Switch between stapled and combined diagrams

Zoom into Diagram (or use CTRL + Mouse)

Auto-Fit diagrams

Select Record of Scope

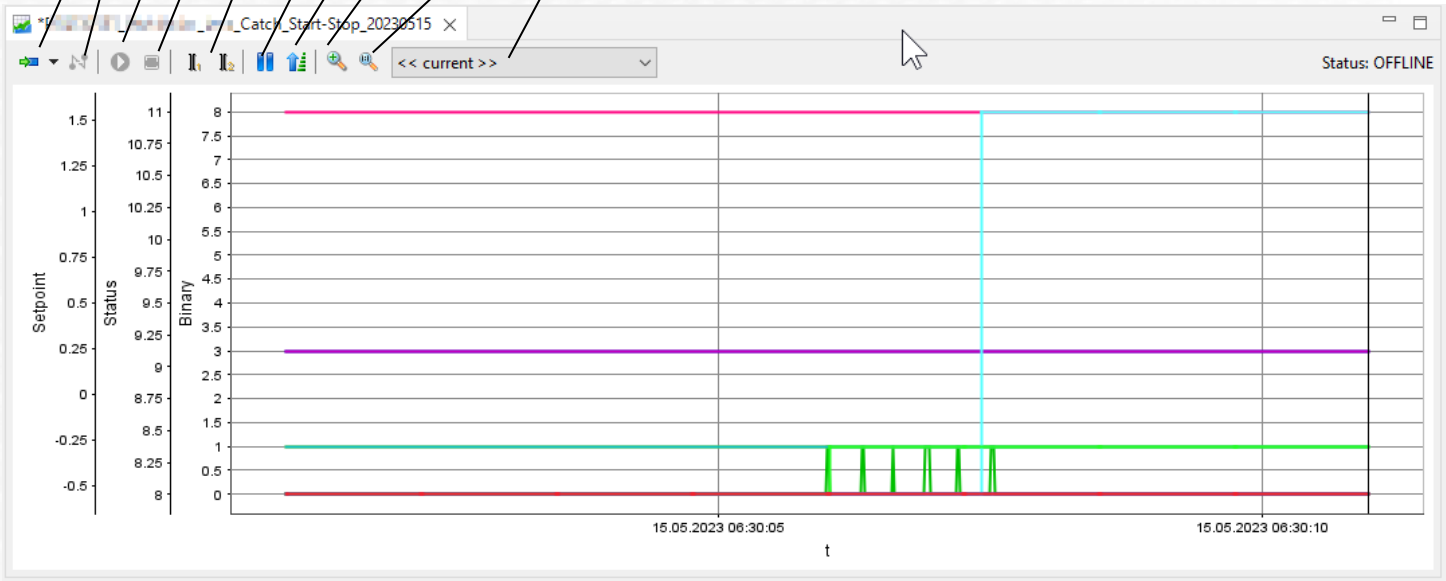
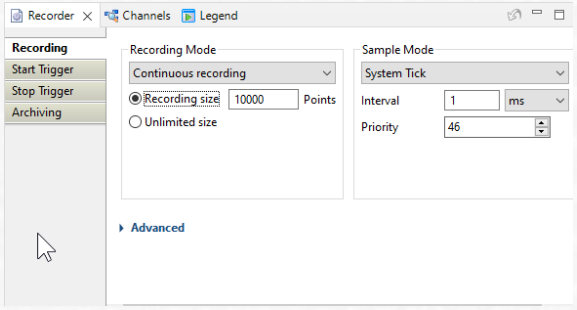


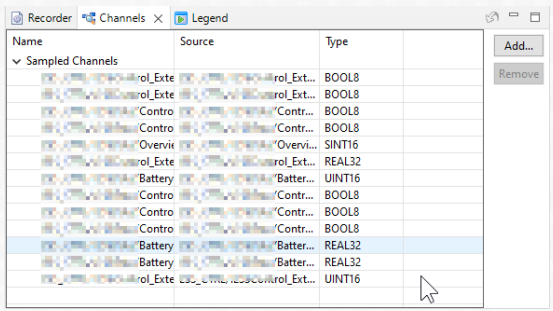
Diagram Settings Area

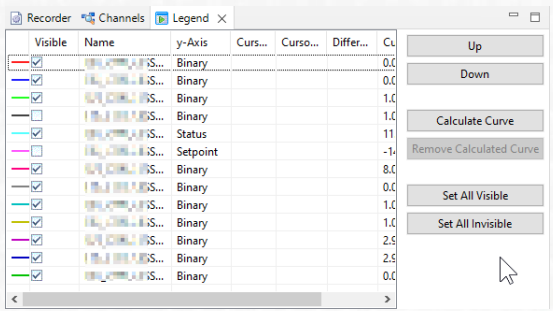
- Here you can make settings for any element in the Diagram area
- Click on a Curve or Axis of the Diagram to modify the settings in this area
- Play with it: fillings, interpolation, calculations
- In "Diagram" you can choose between Absolute (Timestamp) and Relative (time since start) for the time axis

Scope Settings Area

- In this area you can configure the
  - Recorder for Start/Stop triggers and archiving
  - The channels
  - The curves
- In the legend tab you see the values at the 2 cursor positions and the difference between both







Principle of Scope

A software module, specially designed for this purpose, is installed on the PLC and running as independent task.

This module records the parameterized so called Scopes.

The Scopes can be downloaded and displayed in the Scope View in Solution Center.

The Scopes are stored in SQLlite Databases in the filesystem of the PLC.

The Scope Module Settings

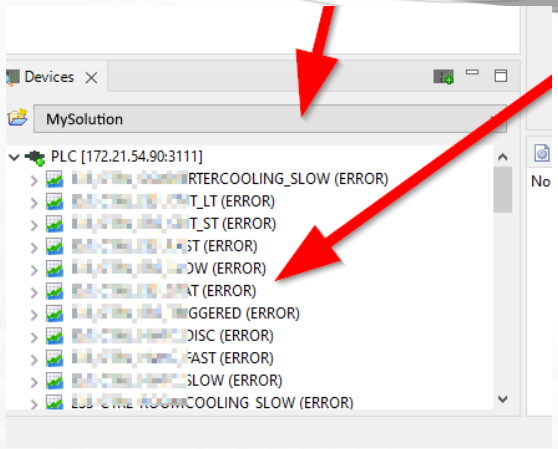
Keyword	Description	Default value
Partition	Defines the memory partition in which the software module is loaded and started for the runtime. In order to ensure proper memory protection, a value ≥ 2 must be used. Allowable values: 0 to 63	Module dependent
DebugMode	Activates the debug mode where general information of the initialization phase and the runtime is written into the logbook and to the console. **Note:** available debug modes are described in the `scope.h` file.	`0x0`
Priority	Defines the priority of the SMI services of the software module.	120 (not configurable)
ModuleIndex	Has no meaning for this software module.	0
ModulePath	Defines the path of the software module. If the software module is not in the default path, a different path can be specified.	`app/`
ModuleName	Has the file name of the software module (file `*.m`) as a fixed value.	`scope.m`
CoreCategory	Defines in which core category the software module is operated. Requirement: The CPU used has multiple cores.	–
ArchiveDir	Specifying which directory the Scope 3 configuration and archive files should be stored in Each recorder has its own configuration and archive file. Important, if the boot device is a host PC (FTP mount) or if the boot device is a PC Card and an archive should be enabled for at least one recorder. In these cases, the path may not refer to the boot device. ➔ Developing (with SolutionCenter) > Chapter 15.2.19 "Archiving recordings"	`APP/SCOPE`
ArchiveLim	Specify the maximum size for the entire contents of the Scope directory (ArchiveDir); If this maximum size is reached, all recorders enter into the **ERROR** state. No more data is recorded. This provides only a limited amount of storage space for Scope 3 on the medium and prevents recording data from filling up the storage medium.	64

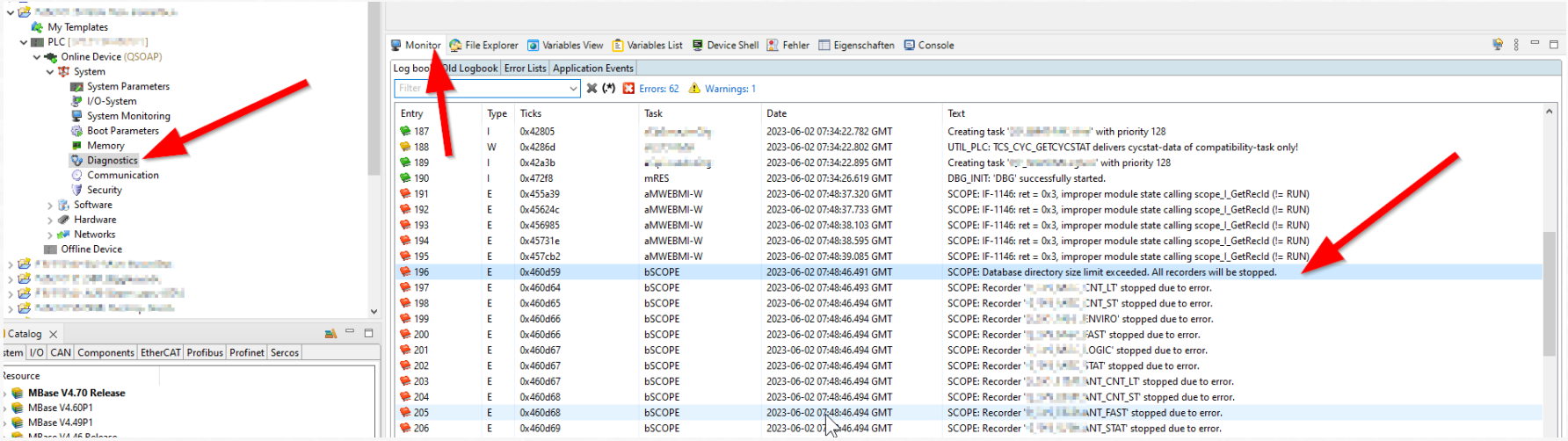
Example:
/cfc0_1/scope/

Make sure you give enough space!

Sidecourse: Scope in Error

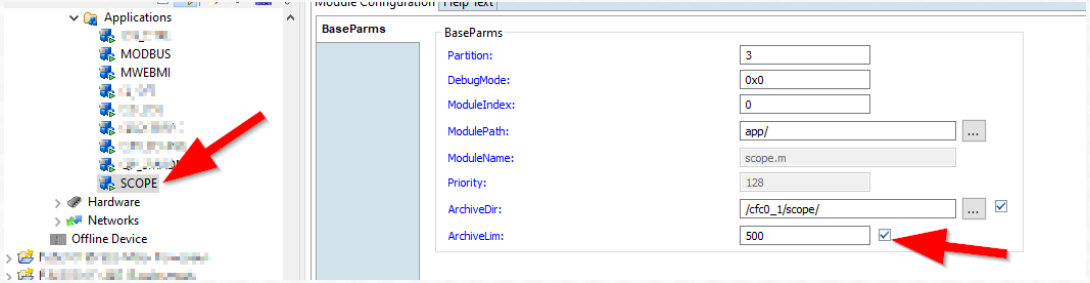
If you calculate the ArchiveLim too small, Scopes might run into error state due to lack of memory:

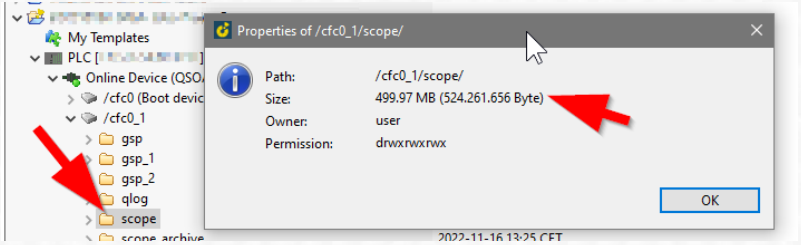


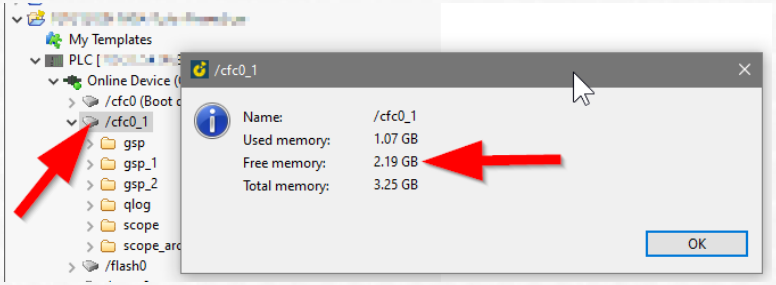


Scope Error due to ArchiveLim

The size of the parameter ArchiveLim of the Scope.m module is set too small. Confirm this and confirm enough space on the drive you use:

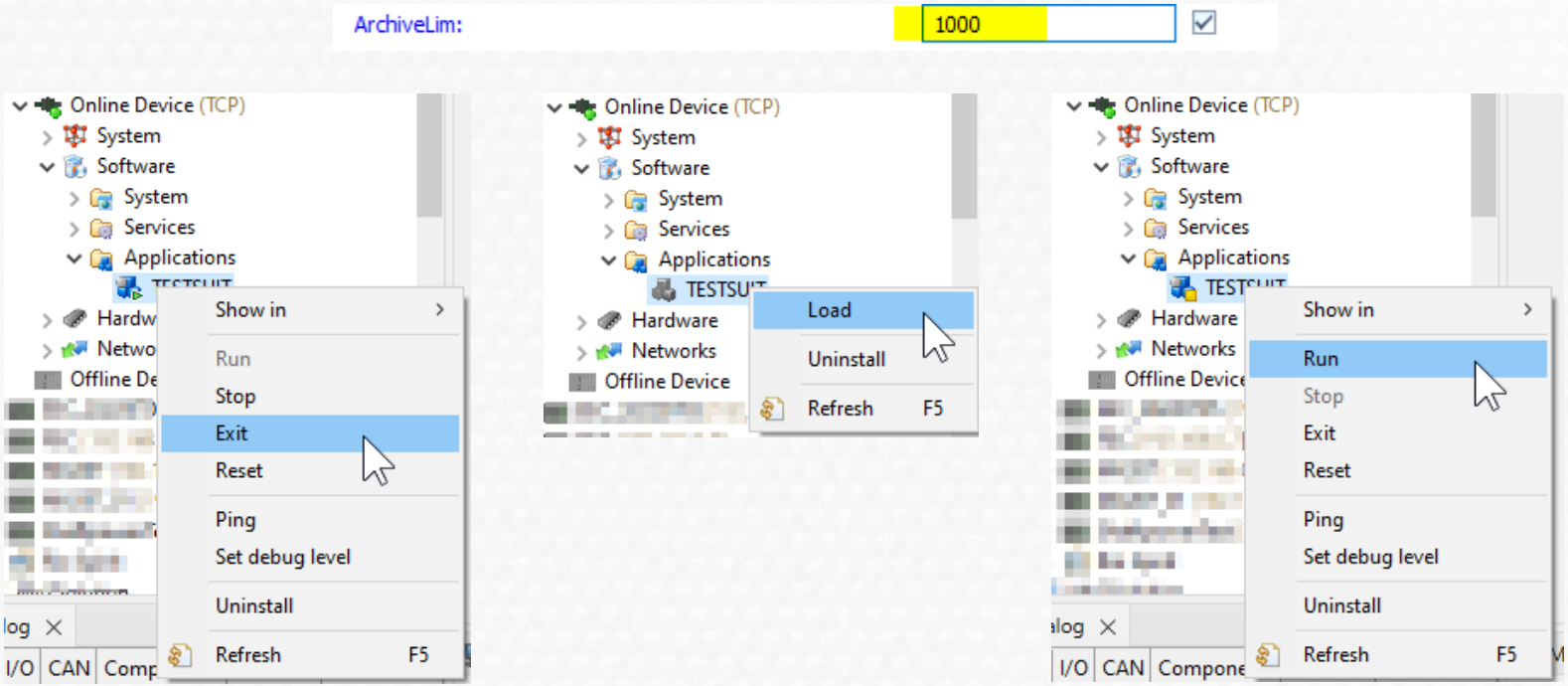






Correct ArchiveLim

Set the ArchiveLim higher and restart the Scope.m module.

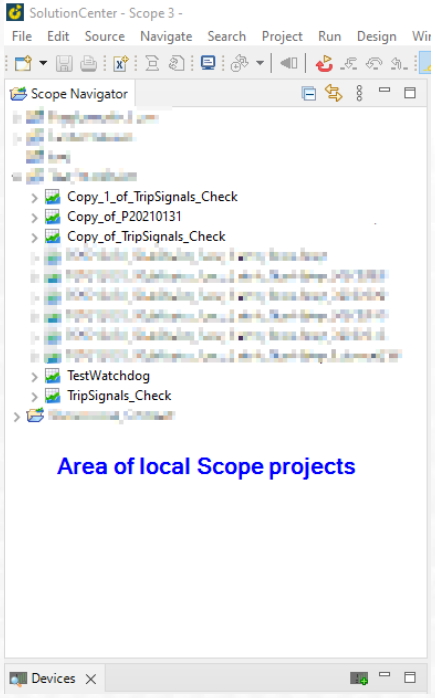


Create a Scope Recording

Open your Solution Center with the Scope 3 perspective.

Create in the Scope Navigator for local Scope projects a new Project.

Below the Project you can now create a Recording.

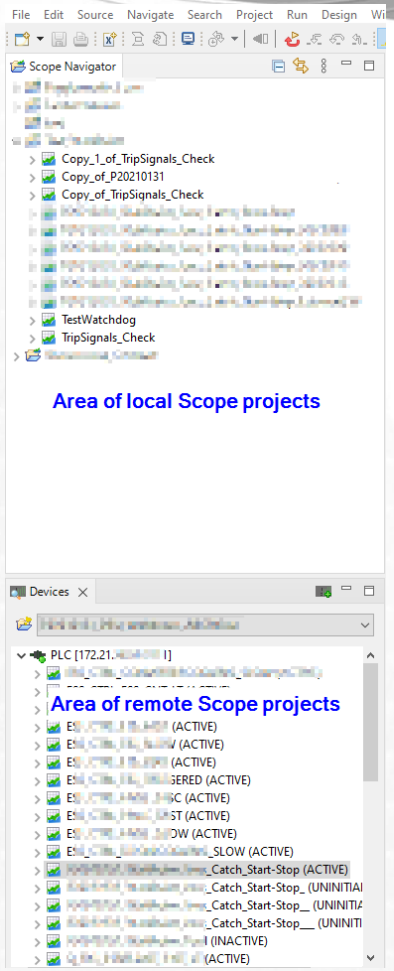


Open a Scope Recording Config

Open the new Scope Recording in the Scope Navigator

or

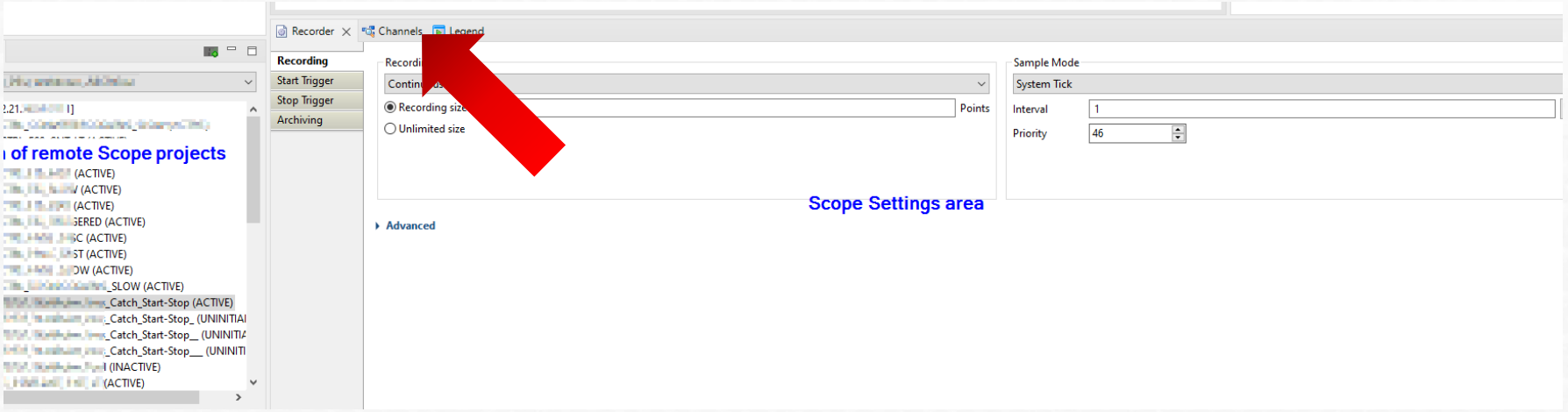
an existing online Recording in the Remote Project area with a double click.



Open Channel Configuration

The first thing should be to create a channel configuration, because you might need the channels for trigger configuration of the recorder. Channels are the values you want to record.

Open the Channels-Tab:



Create a Channel

Click the "Add…" button.

A Dialog will open and offer you three different channel types.

The most interesting is the preselected one:

Sampled Channel

Now the dialog for variable selection will open. Choose the variables you want to record in one or more steps.

Configure a Channel

The added channel(s) you can configure in the "Legend" tab: Mark the channel and go to the Diagram settings area. Open the Curve settings.

Here now you can change colour, icons, Interpolation, Limits and calculations.

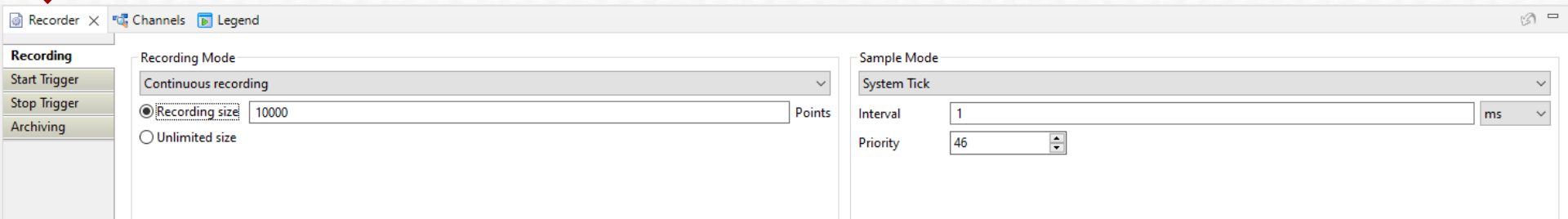
Doing a right click in the Y-Axis in the diagram, you have the possibility to add an Axis. The new axis you can choose in the legend for your channel. This way you can use different Y-Axis if you have channels with very high and very low values in the same graph, like analog and digital ones.

Visible	Name	y-Axis	Cursor 1	Cursor 2	Difference	Current y-Value
☐	S...	Binary	1	1	0	1
☑	S...	Status	8	8	0	11
☐	S...	Setpoint	-4.443	0	4.443	-35.881

Configure the Recorder: Recording

Go to the Recorder tab. First configure "Recording":

- Use a Recording Mode the Continous Recording (otherwise it's only one single shot)
- Choose the sample mode System Tick and choose the recording interval:
  - Interval should fit to program cyle, bus speed, signal duration
  - Faster = bigger recording
  - Slower = you might loose / miss signals



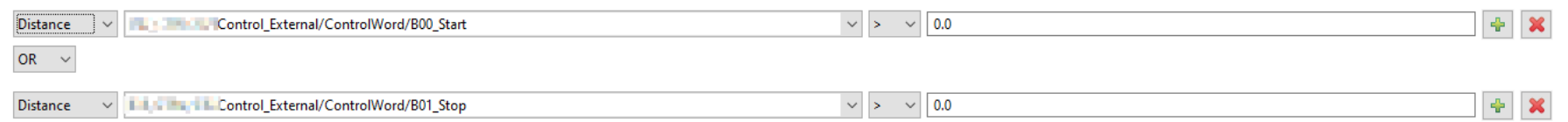
Configure the Recorder: Recording

- Now determine the recording size
  - It's given in points
  - Recording interval: 10ms = each 10ms you get 1 point
  - A size of 1000 points = 1000 x 10ms = 10s recording
- Under "Advanced" you can configure a Pre- and Post-Trigger time, also in Points
  - If you configure a Trigger for the recording (1000 points) and you enter for Pretrigger 500 points, will mean 5 seconds before the trigger and 5s after the trigger will be recorded

Configure the Recorder: Start Trigger

If you don't want a continous recording but a triggered recording, you go to the Start Trigger configuration.

- Click [+]
- Choose one of your configured channels
- Choose Rising/Falling Edge, Distance, Level
- Enter a value
- Add additional conditions



Configure Triggers

Any number of individual conditions, which are combined sequentially with each other through logical links, can be defined for each task. Example: ((A AND B) OR C)

Possible sampling conditions:

- **Level**

  The current sample value of the selected channel must fulfill the condition

- **Rising Edge**

  The current sample of the channel must be greater than or equal to the defined threshold value. The previous sample value must be smaller.

- **Falling Edge**

  The current sample of the channel must be lesser than or equal to the defined threshold value. The previous sample value must be greater.

- **Distance**

  The difference between the current sampling point and the last recorded point must satisfy the condition.

  Sign is observed.

  2 separate conditions must be combined for a distance condition affecting the amount.

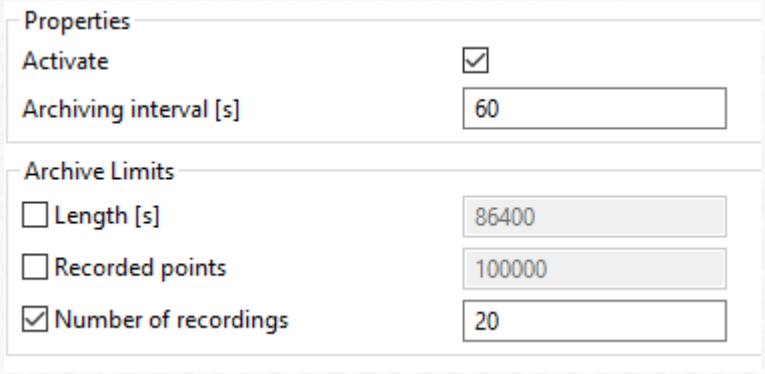
Configure the Recorder: Stop Trigger

If you want a continous recording being stopped on an event, you go to the Stop Trigger configuration.

- Click [+]
- Choose one of your configured channels
- Choose Rising/Falling Edge, Distance, Level
- Enter a value
- Add additional conditions

Configure the Recorder: Archiving

If the recording size is reached or the stop trigger stopped the recording, it is either overwritten by the next start or it can be archived. To keep a certain amount of recordings, go to the Archiving configuration and do the settings, based on length or number of recordings.



Configure the Recorder: Archiving

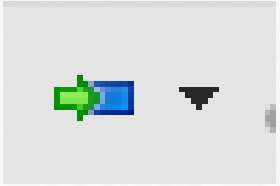
The archiving interval determins at which maximum distance an archival should occur in the database.

Between archiving, recording is done only in an internal RAM memory.

Not yet archived data is lost after a restart of the controller.

Deploying the Recorder to the PLC

- Save the configuration
- Go to the Diagram area
- Click on the "Connect to or install Recorder" icon in the top left corner
- Choose the PLC you want to deploy it to
- Go to the area of remote projects and open the "Recorder Properties" of the lately installed recorder
- Enable "Auto Start" and save



Live view

On Deploy or if you connect to an existing recorder, you can see in the diagram the live recorded values and start/stop or interrupt the recording.

Download archived Recordings

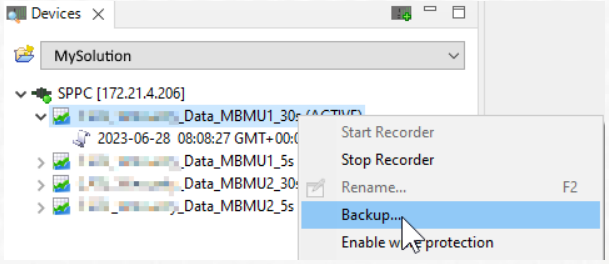
Temporary download:

Just double-click on an archived recording in the Remote Projects area, it will be opened and listed in the drop down of the Diagram area.

Permanent download:

Do a right click in the recorder in the Remote Projects area and choose Backup.

You can save it now into a local Scope project. You can open it then from the local projects.



Configure a Diagram

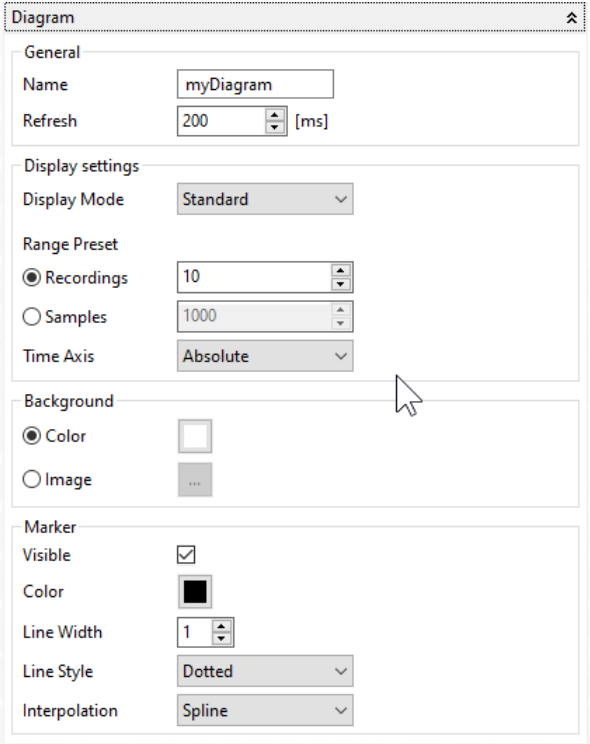
You can click each element in the Diagram area and configure it in the Diagram Settings area.

Here you have different groups for the

- Diagram
- Grid
- Axis
- Curve
- Cursor
- Description

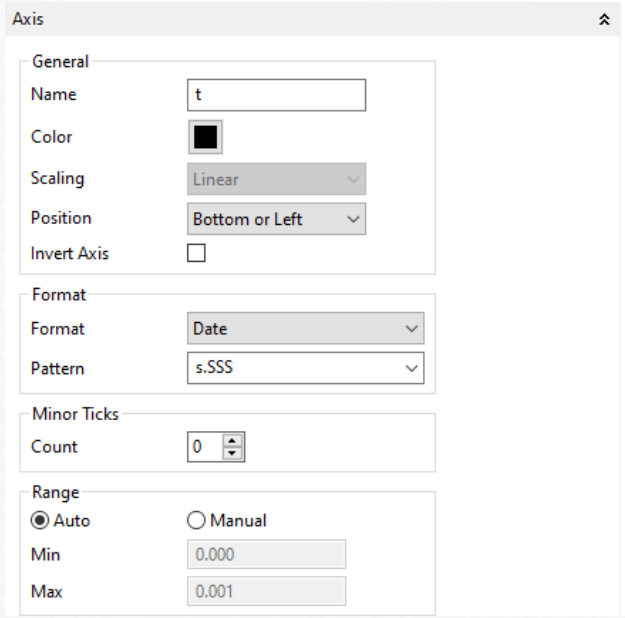
Configure a Diagram: Diagram

- Give it a Name which is displayed as Title
- Choose for the Time Axis the Absolute mode to display the real time stamp of the measurements instead of relative times depending on the start.



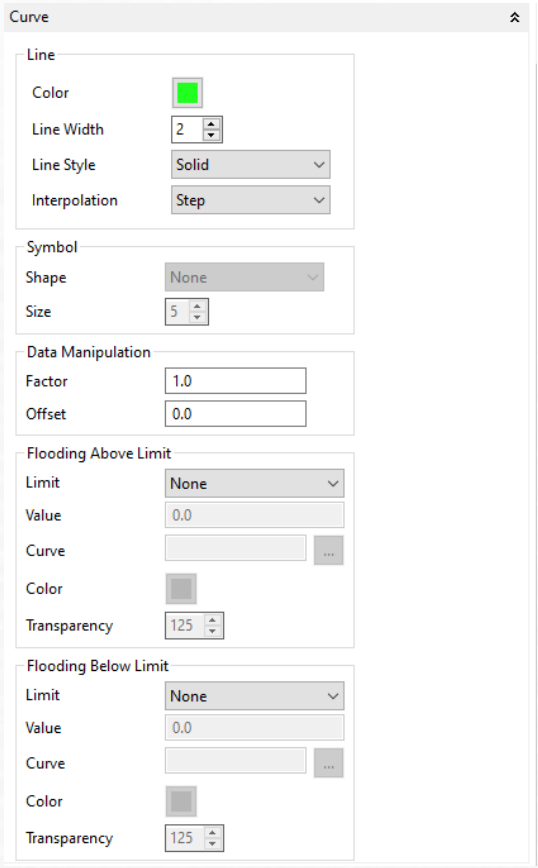
Configure a Diagram: Axis

- Click on one of the displayed Axis
- The settings of this Axis is displayed
- You can set the position
- You can set the displayed name
- You can choose between Auto and Manual range



Configure a Diagram: Curve

- Click on one of the Curves in the diagram or legend
- Choose the line type and colour
- Choose interpolation: how are the recorded dots interconnected
  - Step = 2 Dots are connected by Steps
  - Linear = 2 Dots are connected by a straight line
- Choose flooding if necessary



Stacked Plot

To make a diagram with several curves with different scalings simpler to read, you can do a right click into the Diagram area and choose "Stacked Plot > Separated".

Now each curve is shown in a separate diagram and each curve can be zoomed separately

With "Stacked Plot > Axis grouped", all diagrams with same Y-Axis are grouped in separated disgrams.

Unstack with the icon in the toolbar

Export Diagram as Graphic

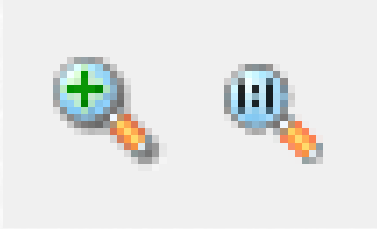
- Do a right click into the Diagram area and choose Save graphic as…
- Choose the format for saving
- Give a name

Export Diagram as CSV

- Do in the Scope Navigator a right click on one archived recording
- Choose Export CSV…
- Use preselected Channel Data as CSV
- Choose a storage location and file name
- Save it
- Now you can use the data in other programs

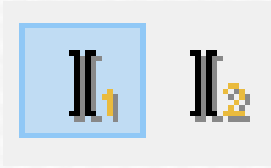
Zooming / Scrolling

- Zooming / Scrooling with pointer in the middle affects both axis
- Zooming / Scrolling with pointer on one axis affects only the axis under the pointer
- Zooming with CTRL + Mousewheel
- Scrolling with Mousewheel
- Field Zoom: CTRL + Click&Drag
- Unzoom: 1:1 Icon in the toolbar



Using Cursors

- In the toolbar you can switch up to two cursors on and off
- Use the flag of the cursor to move it throught the measurement
- You can read the values at the cursor position in the legend table as also the difference between both cursors



Cursor 1	Cursor 2	Difference
0	0	0
0	0	0
1	0	-1
1	1	0
8	8	0
-4.443	0	4.443
8	8	0
0	0	0
1	1	0
1	1	0

The End

Thank you for your attention!