



Industry Automation

SINAMICS/SIMATIC

Using the trace and logic analyzer function

Function Manual

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Legal information

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 WARNING
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 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.
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Preface

Purpose of the documentation

The diagnostics options available with the trace and logic analyzer function are described in this documentation. Depending on the device used, the recording options can vary.

Required basic knowledge

In order to understand this documentation, the following knowledge is required:

- General knowledge in the field of automation
- Knowledge about the use of Windows-based computers
- S7-1200/1500 CPUs
 - Knowledge of working with the SIMATIC industrial automation system
 - Knowledge of working with TIA Portal >= V12.0
- SINAMICS G120
 - Knowledge of working with the drive

Validity of the documentation

This documentation applies to all products of the S7-1200, S7-1500 and SINAMICS G120 product family.

Conventions

This documentation contains pictures of the devices described. The pictures may differ slightly from the devices supplied.

Please also observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product and on the section of the documentation to which particular attention should be paid.

Further support

- The range of technical documentation for the individual SIMATIC products and systems is available on the Internet (<http://www.siemens.com/simatic-tech-doku-portal>).
- The online catalog and the online ordering system is available on the Internet (<http://mall.automation.siemens.com>).

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Description

1.1 Supported hardware

The following devices (Page 41) support the trace and logic analyzer function:

- SIMATIC S7-1200 CPUs (as of firmware version V4.0)
- SIMATIC S7-1500 CPUs
- SINAMICS G120

1.2 Recording of measured values with the trace function

Introduction

The trace and logic analyzer function can be called in the device folder in the project navigator under the name "Traces" (Page 11).

You record device tags and evaluate the recordings with the trace and logic analyzer function. Tags are, for example, drive parameters or system and user tags of a CPU. The maximum recording duration is limited by the memory size. How much memory is available for the recording depends on the hardware used.

The recordings are saved on the device and, when required, can be read out with the engineering system (ES) and saved permanently. The trace and logic analyzer function is therefore suitable for monitoring highly dynamic processes. The recorded values are overwritten when "Installed traces" is activated again.

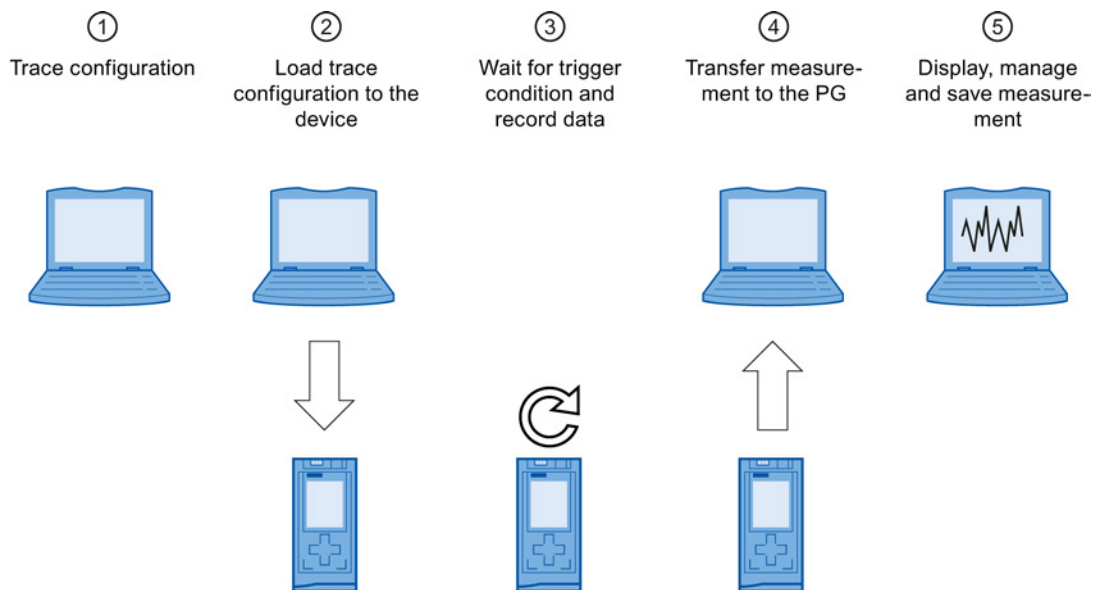
Active recordings from the axis control panel or from the PID are displayed at "Installed traces". These recordings can be added to the measurements in the curve diagram of the axis control panel or the PID via a shortcut menu command.

Depending on the device (Page 41) used, the recording options can vary.

A quick start (Page 27) for working with the trace and logic analyzer function can be found in the Operation section.

1.2 Recording of measured values with the trace function

The following figure shows the method of operation of the "Traces":



① Trace configuration on the programming device (PG) in the TIA Portal

You can specify the signals to be recorded, the duration of the recording and the trigger condition in the trace configuration. The trace configuration depends on the device and is described at the respective device (Page 41).

② Transferring the trace configuration from the PG to the device

You can transfer the complete trace configuration (Page 34) to the device when an online connection is established.

③ Waiting for the recording

If the installed trace configuration is activated (Page 35), then the recording is performed independently of the PG. The recording is started as soon as the trigger condition is satisfied.

④ Transferring the measurement from the device to the PG

The saving of the measurement in the project (Page 36) stores the measurement in the opened project of the TIA Portal. The measurement can be saved at any time after completing the recording, irrespective of the time of the measurement.

⑤ Evaluating, managing and saving the measurement

Numerous options are available for the evaluation of the measurement in the curve diagram and in the signal table (Page 36). Various display types are possible, for example, a bit representation for binary signals.

Measurements can also be exported and imported as a file.

With the saving of the project (Page 36) in the TIA Portal, the measurements transferred to the project are also saved.

1.3 Trace configuration, recording and measurement

This section explains the meaning of the terms: trace configuration, recording and measurement.

Trace configuration

You can make the following settings in the trace configuration :


- Signals to be recorded
- Recording conditions
 - Sampling
 - Trigger

Recording

A recording is performed in the device. There is only one recording for each installed trace configuration. When a new recording is started, the old recording is overwritten.


An installed recording is not retentive (it is lost when the device is switched off/on) and can be saved permanently in the project as a measurement.

Installed traces

An installed trace  consists of a trace configuration and optionally a recording. The maximum number of installed traces depends on the device.

The status of an installed trace can be viewed online.

Measurement

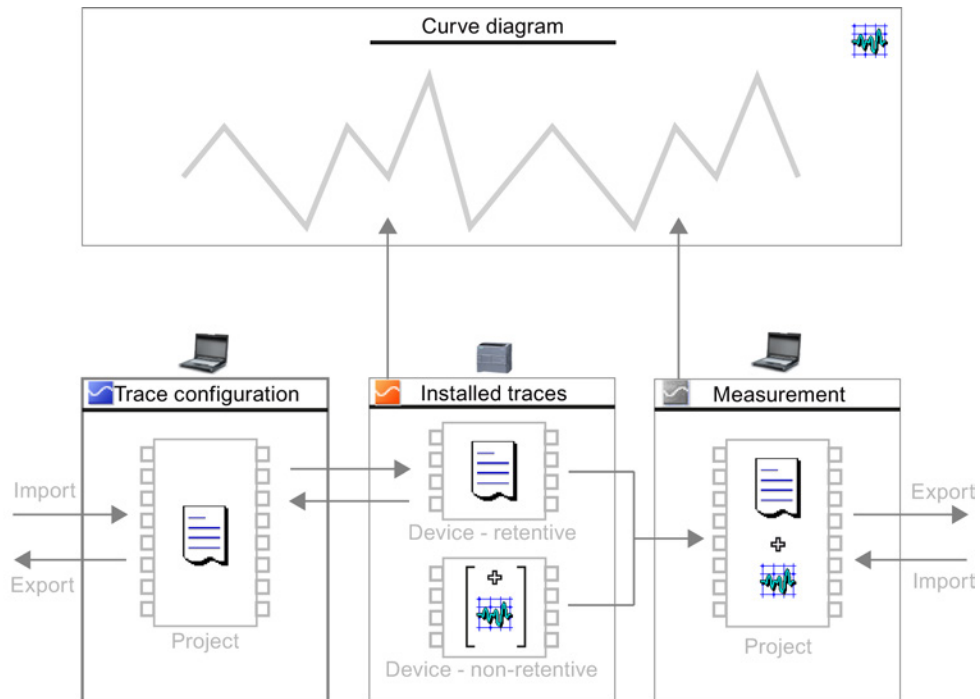
A measurement  always consists of a trace configuration with an associated recording. If an installed trace contains a recording, it can be saved in the project as a measurement.

The recording of a measurement can be viewed offline.

1.4 Data storage

The trace handling and the curve diagram also enable the transfer of the trace configuration and the viewing of the recording.

The following figure is a schematic diagram of the data storage:



Note

Saving the trace configuration and measurement

You save the trace configuration and measurement with the project in the TIA Portal.

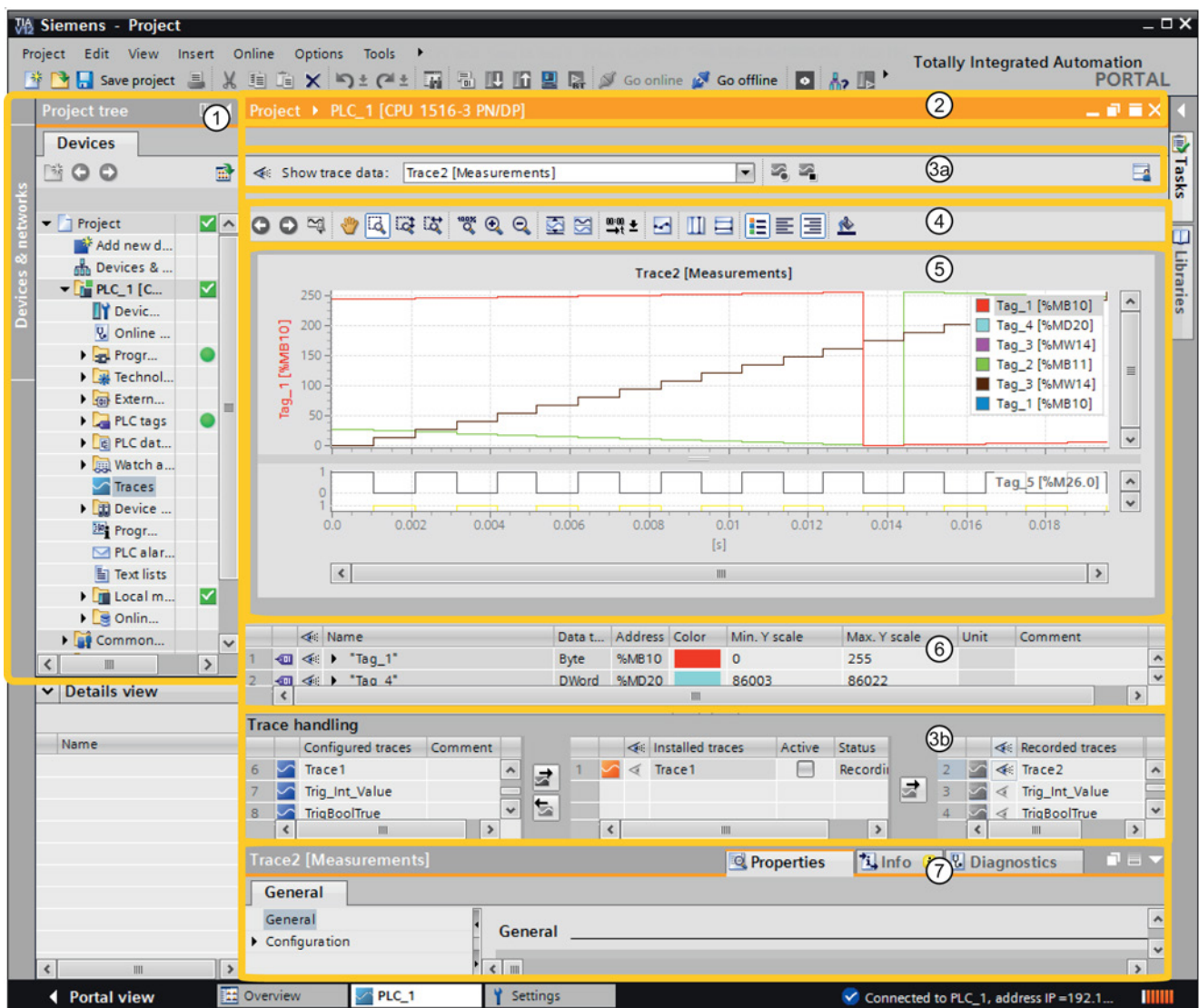
If you close the project without saving, the trace configurations and the measurements transferred to the project are discarded. The trace editor can be closed and reopened without loss of data until the project is closed.

Software user interface

Display areas

The user interface of the trace and logic analyzer function consists of several areas.


The example in the figure below shows the division of the user interface in the TIA Portal:



2.1 Project navigator

1	Project navigator	
	Working area	
2		Title bar of the working area Shows the device to which the current display belongs.
3a		Toolbar of the trace handling (Page 18) Selection of recordings for display in the curve diagram and buttons for activation/deactivation of installed traces.
4		Toolbar of the curve diagram (Page 13) Tools for editing the measurement and for adapting the display in the curve diagram.
5		Curve diagram (Page 13) Display of the recorded values.
6		Signal table (Page 16) Signals of the shown measurement.
3b		Trace handling (Page 18) Creation of new trace configurations and the handling of the measurements.
	Device-specific area (see Devices (Page 41))	
7		Properties area in the Inspector window Configuration dialog boxes for the recording duration, trigger condition and signal selection.

2.1 Project navigator

If a device supports the trace and logic analyzer function,  "Traces" is offered for selection in the project navigator below the device.

Double-clicking  "Traces" opens the trace editor.

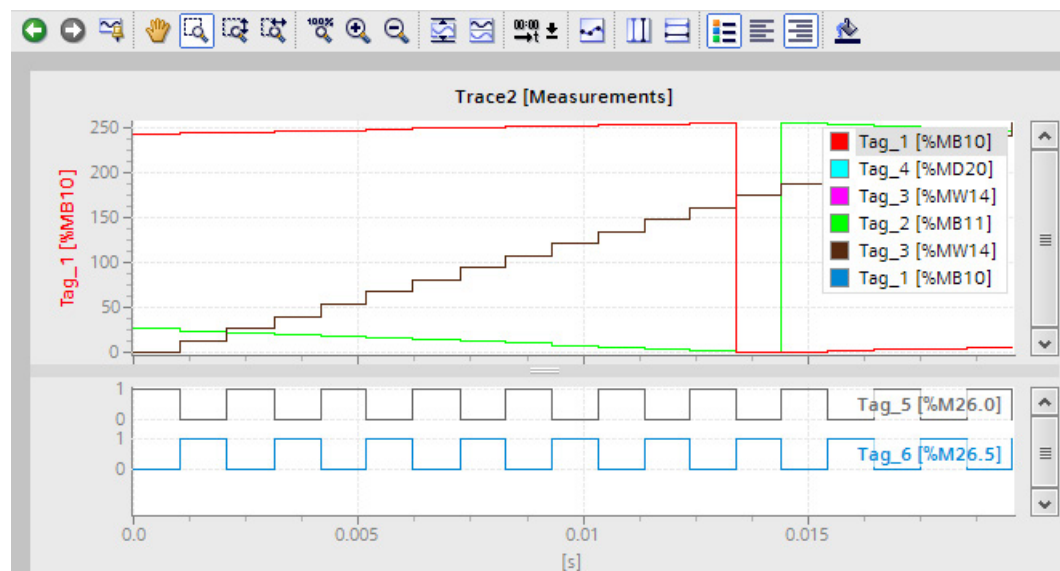
2.2 Working area

2.2.1 User interface - curve diagram

The curve diagram displays the selected signals of a recording. Bits are shown in the lower diagram as a bit track. You can adjust the display of the signals in the signal table (Page 16) and with the aid of the toolbar of the curve diagram.

Setting options and displays in the curve diagram

The following figure shows an example of the display in the TIA Portal:



The scale in the diagram applies to the selected (highlighted in gray) signal in the legend. The legend can be moved laterally with the mouse.

Shortcut menu commands
















The following table shows the shortcut menu commands in the curve diagram:






Shortcut menu command	Description
"Save diagram as image"	Exports the current display as a bitmap.
"Copy image to clipboard"	Copies the current display to the clipboard.
"Center measurement cursors"	Positions the activated measurement cursors at a central point in the current display.
"Add to measurements" (only axis control panel and PID)	Adds the shown recording to the "Measurements" table.

Toolbar of the curve diagram

Tools are available for adapting the display via buttons.

The following table shows the functions of the buttons:

Icon	Function	Description
	Undo zoom	Undoes the zoom function executed last. If several zoom functions have been executed, they can be undone step-by-step.
	Redo zoom	Redoes the last undone zoom function. If several zoom functions have been undone, they can be redone step-by-step.
	Standard view	Uses the current view as standard for this recording. If the trace recording is shown again later, the standard view is restored.
	Move view	Moves the display with the mouse button pressed.
	Zoom selection	Selection of an arbitrary range with the mouse button pressed. The display is scaled to the range selection.
	Vertical zoom selection	Selection of a vertical range with the mouse button pressed. The display is scaled to the range selection.
	Horizontal zoom selection	Selection of a horizontal range with the mouse button pressed. The display is scaled to the range selection.
	Display all	Scales the display of the available data so that the entire time range and all values are displayed. Note The dynamic progress indicator of a running trace is stopped when a zoom function is activated. This button activates the progress indicator again.
	Zoom in	Enlargement of the display. The ranges of the time axis and value axis are reduced every time the button is clicked. The curves are displayed larger.
	Zoom out	Reduction of the display. The ranges of the time axis and value axis are increased every time the button is clicked. The curves are displayed smaller.
	Scale automatically	Scaling of the display so that all values are displayed for the currently displayed time range.
	Arrange in tracks	Arranges signals one beneath the other without overlaps.
	Unit changeover of the time axis	Changeover of the unit between time and cycles.
	Display samples	The samples are displayed as small circles on the curves.
	Display vertical measurement cursors	Display of the vertical measurement cursors. The vertical position of the two measurement cursors can be moved with the mouse. The associated measured values and the difference of the measurement cursors corresponding to the position are shown in the signal table.

Icon	Function	Description
	Display horizontal measurement cursors	Display of the horizontal measurement cursors. The horizontal position of the two measurement cursors can be moved with the mouse.
	Display chart legend	Display or hiding of the chart legend in the curve diagram.
	Align the chart legend to the left	Display of the chart legend on the left side of the curve diagram.
	Align the chart legend to the right	Display of the chart legend on the right side of the curve diagram.
	Change background color	Changeover between various background colors.







2.2.2 User interface - signal table

The signal table lists the signals of the selected measurement and provides setting options for some properties. If recording data of "Installed traces" is displayed and the settings are changed in the signal table, these settings are retained until there is a change to the offline mode. If the "Installed trace" is added to the measurements, the current settings of the signal table are saved in the measurement.



































































The signals can be sorted using drag-and-drop. The bits of a signal can be resorted within a signal.

Setting options and displays in the signal table

The following figure shows an example of the display in the TIA Portal:

		Name	Data type	Address	Color	Min. Y scale	Max. Y scale	Y(t1)	Y(t2)	DeltaY	Unit	Comment
1		▶ "Tag_1"	Byte	%MB10		1	20	7	13	6		
2		▶ "Tag_4"	DWord	%MD20		1	20	7	13	6		
3		▶ "Tag_3"	Word	%MW...		3	60	21	39	18		

The following table shows the settings and displays of the recorded signals:

Column	Description																																								
	Static display of the signal icon																																								
 	Selection for the display in the curve diagram The point indicates that at least one bit has been selected for display as bit track for the signal in the bit selection.																																								
"Name"	Display of the signal name A click on the name of a displayed signal updates the scale in the curve diagram.																																								
	Open bit selection Individual bits can also be selected for the following data types for display as a bit track in the lower curve diagram. <ul style="list-style-type: none">Byte, Word, DWord, LWordSInt, USInt, Int, UInt, DInt, UDIInt, LInt, ULInt Example of an opened bit selection for the DWORD data type: <table><tr><td>1</td><td></td><td></td><td></td><td>*Tag_1*</td><td>Byte</td><td>%MB10</td><td></td></tr><tr><td>2</td><td></td><td></td><td></td><td>*Tag_4*</td><td>DWord</td><td>%MD20</td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td>Bool</td><td>%M23.0</td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td><td>Bool</td><td>%M23.1</td><td></td></tr><tr><td>5</td><td></td><td></td><td></td><td></td><td>Bool</td><td>%M23.2</td><td></td></tr></table> Select or deselect the relevant bit for display by clicking the  icon.	1				*Tag_1*	Byte	%MB10		2				*Tag_4*	DWord	%MD20		3					Bool	%M23.0		4					Bool	%M23.1		5					Bool	%M23.2	
1				*Tag_1*	Byte	%MB10																																			
2				*Tag_4*	DWord	%MD20																																			
3					Bool	%M23.0																																			
4					Bool	%M23.1																																			
5					Bool	%M23.2																																			
"Data type"	Display of the data type																																								
"Address"	Display of the address (not for symbolic tags)																																								
"Color"	Display and setting option for the color of the signal																																								
"Min. Y-scale"	Display or input of the minimum value for the scaling of the signal																																								
"Max. Y-scale"	Display or input of the maximum value for the scaling of the signal																																								
"Signal group"	Display or input of the signal group name for one signal group The Y-scales are scaled identically for all signals of one signal group. Enter an identical signal group name for those signals that are to be scaled identically. Signals can be removed from the signal group by deleting the signal group name. The signal groups can be saved via the function "Use current view as standard" (button ).																																								
"Y(t1)"	Display of the value at the position of the first measurement cursor																																								
"Y(t2)"	Display of the value at the position of the second measurement cursor																																								
"ΔY"	Display of the value difference between the first and the second measurement cursor																																								
"Unit"	Display of the unit (e.g. for technology objects)																																								
"Comment"	Display and input option for a comment about the signal																																								

Shortcut menu commands

The following table shows the shortcut menu commands of the signal table:

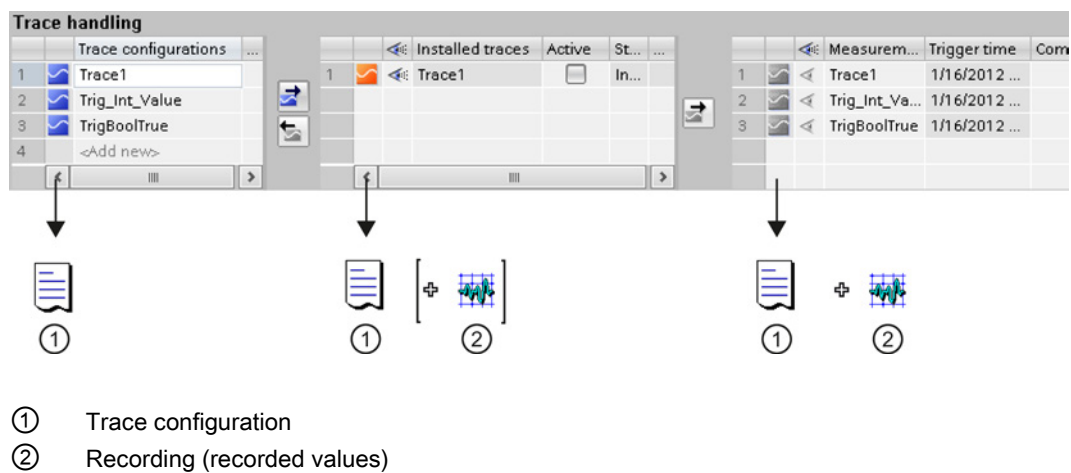
Shortcut menu command	Description
"Cut"	Cannot be selected.
"Copy"	Copies the contents of the selected lines to the clipboard.
"Paste"	Cannot be selected.
"Show/hide signal"	Shows/hides the signal in the curve diagram.
"Bring to foreground"	Displays the selected signal in the foreground. The other signals are hidden.

2.2.3 User interface - trace management

The trace handling enables the configuration and handling of trace configurations.

Setting options and displays in the trace handling

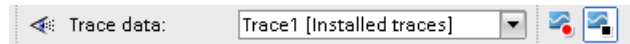
The following figure shows an example of the display in the TIA Portal:



Toolbar of the trace handling

A recording can be selected for display via a drop-down list and buttons, and activated or deactivated.

The example in the figure below shows the toolbar of the trace handling



The following table describes the functions of the buttons:

Icon	Description
	Static icon display of the drop-down list selection in the curve diagram
	Selection of an "Installed trace" or a "Measurement" for display in the curve diagram
	Activation of the recording The button is available for "Installed traces".
	Deactivation of the recording The button is available for "Installed traces".

"Trace configurations" table

The table contains all the trace configurations of the project that can be transferred to the device. Each trace configuration contains the tags to be recorded and the required recording settings. The data is displayed in offline and online mode.

The following table shows the settings and displays:

Column	Icon	Description
-	 	Display of the icon for the trace configuration Incorrect trace configurations are shown with a red border and cannot be transferred to the device. Check the configuration in the Inspector window. Double-clicking the icon brings the Inspector window with the properties to the foreground.
"Trace configuration"	-	Name of the trace configuration. The name can be changed after double-clicking the field.
"Comment"	-	Input field for a comment.

Shortcut menu commands







The following table shows the shortcut menu commands of the "Trace configurations" table when a line is selected:

Shortcut menu command	Description
"Cut"	Cannot be selected.
"Copy"	Copies the contents of the selected lines to the clipboard.
"Paste"	Pastes the contents of the clipboard.
"Delete"	Deletes the selected lines from the table or deletes the name of the selected cell.
"Rename"	Switches the selected cell to the editing mode.
"Transfer trace configuration to device"	Transfers the trace configuration selected in the "Trace configurations" table to the device. The button is active when all the required settings in the device-specific configuration have been configured correctly in the Inspector window and there is an online connection.
"Export trace configuration"	Exports a trace configuration as a file with the "*.ttcfgx" file extension. For compatibility reasons, the "*.ttcfg" file extension will be supported in V12, but does not contain any information about the device family.
"Import trace configuration"	Imports a trace configuration from a file.
"Properties"	Brings the Inspector window with the device-specific properties to the foreground.

"Installed traces" table

The table contains the trace configurations already transferred to the device and their current status. The data is displayed in the online mode.

The following table shows the settings and displays:

Column	Icon	Description
-		Static display of the online icon Double-clicking the icon brings the Inspector window with the device-specific properties to the foreground.
	 	Selection for the display in the curve diagram A click on the icon shows/hides the recording in the curve diagram.
"Installed traces"	-	Name of the trace configuration.
"Active"	 	Activation of the recording and feedback of the status. The checkbox is reset at the end of the recording. If the recording of an installed trace is repeated, then the settings relevant for the display (curve diagram and signal table) are also retained for the new recording.
"Status"	-	Status display of the trace configuration The following states are possible: <ul style="list-style-type: none"> • "Installing" • "Waiting for trigger" • "Recording" • "Recording completed" • "Aborted" • "Fault"
"Comment"	-	Display of the trace configuration comment

Shortcut menu commands

The following table shows the shortcut menu commands of the "Installed traces" table when a line is selected:




Shortcut menu command	Description
"Cut"	Cannot be selected.
"Copy"	Copies the contents of the selected lines to the clipboard.
"Paste"	Cannot be selected.
"Delete"	Deletes the selected lines from the table.
"Rename"	Cannot be selected.
"Add to trace configurations"	Transfers the installed trace configuration to the "Trace configurations" table.
"Add to measurements"	Adds the selected "Installed trace" to the "Measurements" table. Note The "Installed trace" data can be saved as a measurement after being displayed once in the curve diagram. The recording data is loaded from the device for the display.
"Activate"	Activates the recording and shows the status in the table
"Show/hide in curve diagram"	Shows/hides the recording in the curve diagram.
"Properties"	Brings the Inspector window with the device-specific properties to the foreground.

"Measurements" table

The table contains the trace configurations with recordings. The data is displayed in offline and online mode.

Measurements can also be exported and imported, see Exporting and importing measurements (Page 37).

The following table shows the settings and displays:

Column	Icon	Description
-		Static display of the icon for a measurement Double-clicking the icon brings the Inspector window with the device-specific properties to the foreground.
		Selection for the display in the curve diagram A click on the icon shows/hides the recording in the curve diagram.
"Measurements"	-	Name of the measurement The name can be changed after double-clicking the field.
"Trigger time"	-	The meaning of the time stamp depends on the device Examples: <ul style="list-style-type: none"> SIMATIC S7-1200/1500 CPUs The absolute time of the controller is entered at the start of the recording. SINAMICS G120 The transfer time is entered with the transfer of the trace configuration to the device.
"Comment"	-	Input field for a comment.




Shortcut menu commands

The following table shows the shortcut menu commands of the "Measurements" table when a line is selected:

Shortcut menu command	Description
"Cut"	Cannot be selected.
"Copy"	Copies the contents of the selected lines to the clipboard.
"Paste"	Pastes the contents of the clipboard.
"Delete"	Deletes the selected lines from the table or deletes the name of the selected cell.
"Rename"	Switches the selected cell to the editing mode.
"Add to trace configurations"	Transfers the trace configuration of the measurement to the "Trace configurations" table.
"Show/hide in curve diagram"	Shows/hides the recording in the curve diagram.
"Export measurement"	Exports a measurement as a file with the "*.ttrecx" or "*.csv" file extension. For compatibility reasons, the "*.ttrec" file extension will be supported in V12, but does not contain any information about the device family.
"Import measurement"	Imports a measurement from a file with the "*.ttrecx" file extension. For compatibility reasons, the "*.ttrec" file extension will be supported in V12, but does not contain any information about the device family.
"Properties"	Brings the Inspector window with the device-specific properties to the foreground.

Buttons

The following table shows the functions available via buttons:

Icon	Description
	Button to transfer a selected trace configuration to the device The selected trace configuration in the "Trace configurations" table is transferred to the device. The button is active when all the required settings in the configuration have been correctly configured in the Inspector window and there is an online connection.
	Button to transfer a selected trace configuration from the device The trace configuration selected in the "Installed traces" table is transferred from the device to the "Trace configurations" table.
	Button to transfer a selected measurement from the device to the project The selection in the "Installed traces" table is added to the "Measurements" table. Note for S7 CPUs In order to be able to save the "Installed trace" data as a measurement, it must first have been displayed once in the curve diagram. The recording data is loaded from the device when displayed.

2.3 Device-specific area

The device-specific area enables the trace configuration.

The signals to be recorded and the trigger condition are specified here. These and other configuration options are described in the device-specific part (Page 41) for the individual devices.

Operation

3.1 Quick start

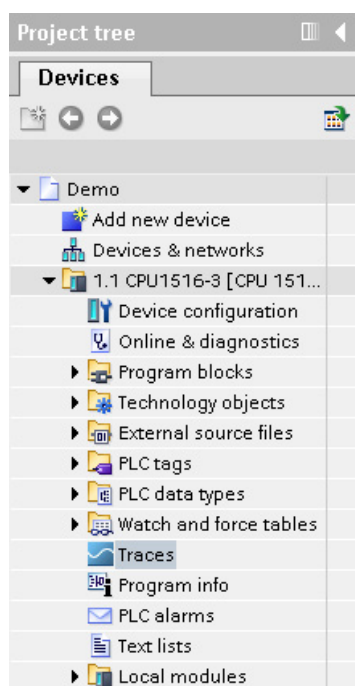
This description shows the steps for a recording of the S7-1500 CPU as an example. The displayed settings can differ depending on the device.

Requirement

A device is configured that supports the trace and logic analyzer function.

Calling the trace editor

The following figure shows the project navigator with "Traces" below the device:



Procedure:

1. Open the trace editor by double-clicking the "Traces" entry.

Creating a trace configuration

The following figure shows the "Trace configurations" table:

	Trace configurations	Comment
1	Machine1	
2	<Add new>	

Procedure:

1. Enter the name of the trace configuration in the "Trace configurations" table.

Selecting signals

The following figure shows the configuration of the signals:

	Name	Data type	Address	Color	Comment
1	"Tag_1"	Byte	%MB10	Red	
2	"Tag_2"	Byte	%MB11	Cyan	
3	"Tag_3"	Word	%MW14	Magenta	
4			<Add new>		
	"Tag_2"	Byte	%MB11		
	"Tag_3"	Word	%MW14		
	"Tag_4"	DWord	%MD20		
	"Tag_5"	Bool	%M26.0		
	"Tag_6"	Bool	%M26.5		
	"Trig_Int_Value_Merker"	Bool	%M300.1		
	"TrigBit_False"	Bool	%M52.0		
	"TrigBit_False_Merker"	Bool	%M52.1		

Procedure:

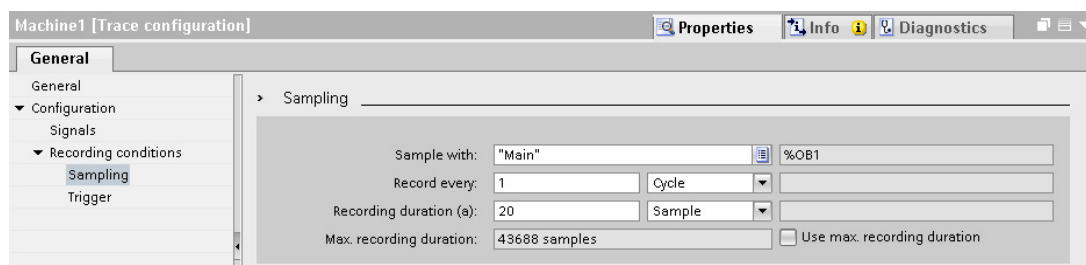
1. Select the signals to be recorded in the "Signals" area of the Inspector window.

Or:

1. Drag a signal to the table using drag-and-drop.

Configuring the recording cycle

The following figure shows the configuration of the sampling:

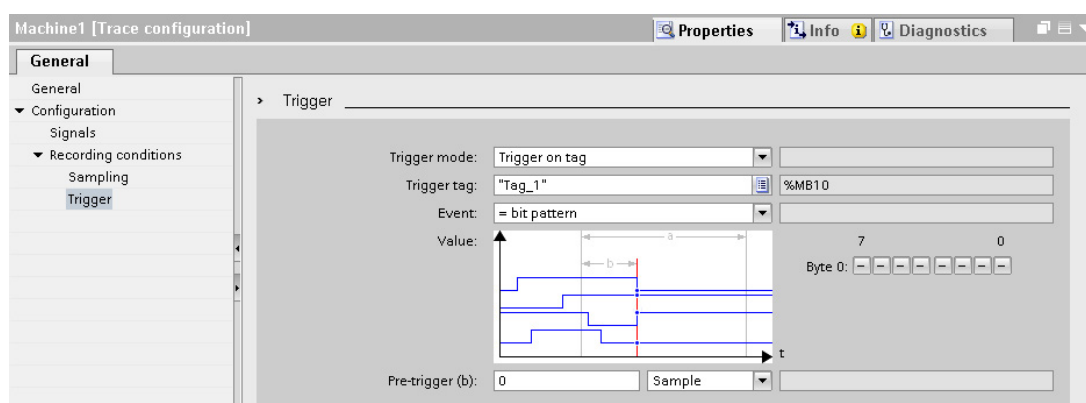


Procedure:

1. Configure the sampling.

Configuring the trigger

The following figure shows the configuration of the trigger:

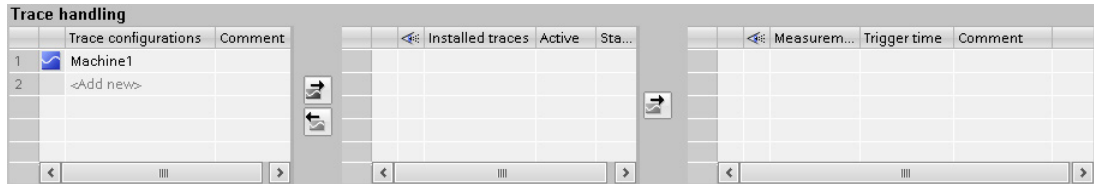


Procedure:

1. Configure the trigger mode and the condition for the selected trigger.


Transferring the trace configuration to the device


The following figure shows the trace handling in online mode:




Procedure:

1. Check whether the configuration is correct based on the icon in the "Trace configurations" table.

The  icon indicates a correct trace configuration.

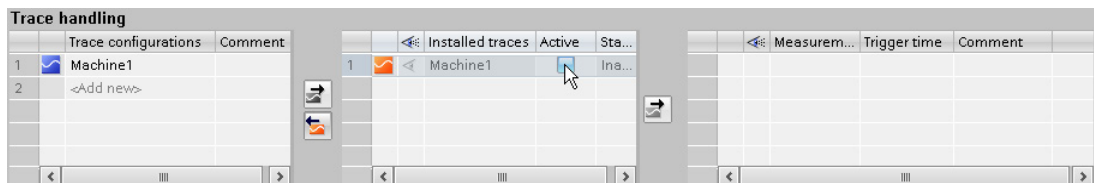
The  icon indicates a faulty trace configuration.

Only correct trace configurations can be transferred to the device.

2. Establish an online connection to the device.
3. Select the trace configuration in the "Trace configurations" table and transfer it to the device with the  button.

Activating a recording

The following figure shows the trace handling with an installed trace configuration:

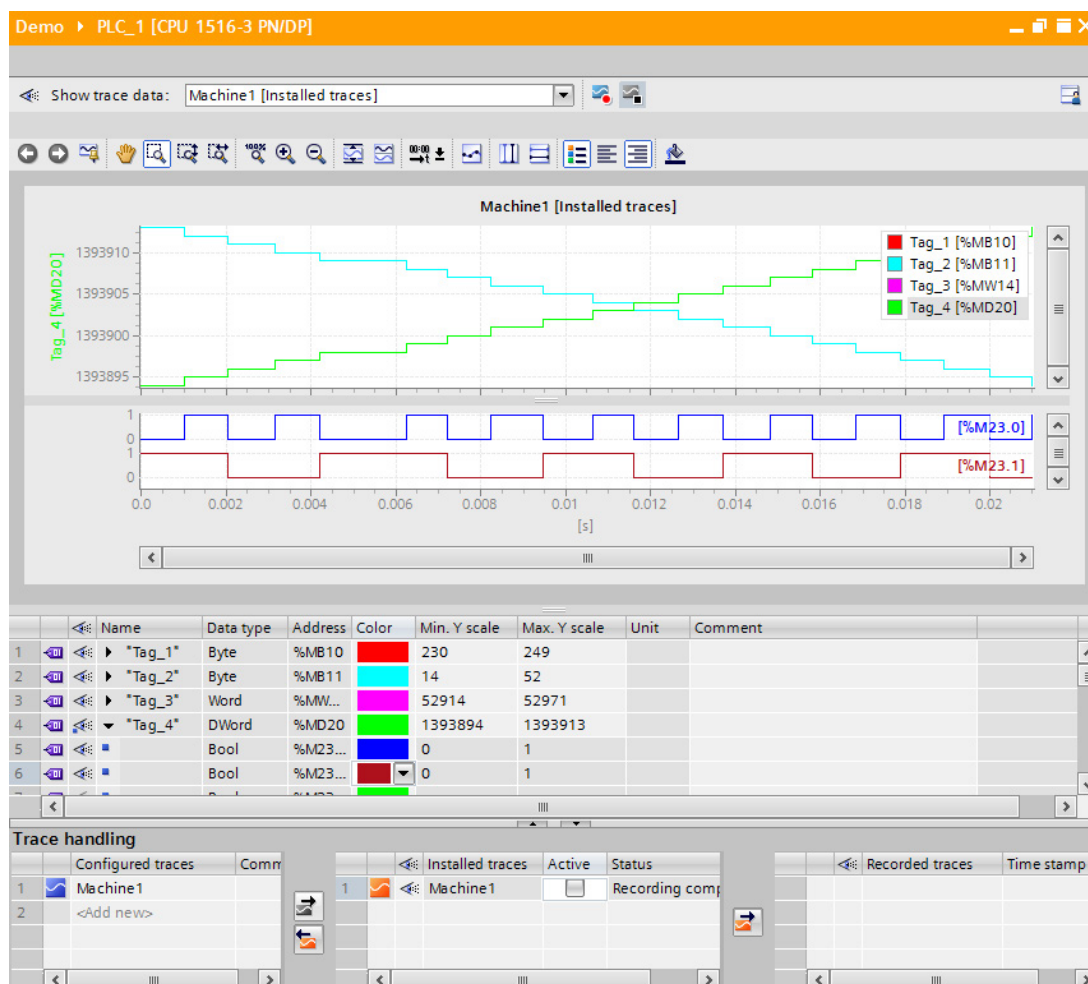


Procedure:



1. Click the checkbox in the "Active" column in the "Installed traces" table.

Displaying the recording



The following figure shows the curve diagram with the recording of the "Installed trace":



Procedure:

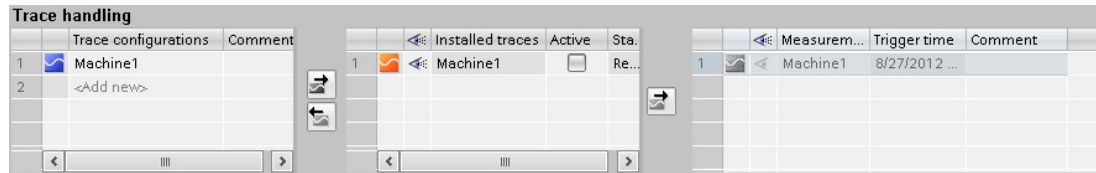
1. Wait until the "Recording" or "Recording completed" status is displayed in the "Installed traces" table.
2. Click the  icon in the "Installed traces" table to display the recording in the curve diagram.
3. Click the  icon of a signal in the signal table.

The individual bits of the signal are offered for display as a bit track.


4. In the signal table, select or deselect the individual signals and bits for display with the   icon.

Saving the measurement in the project

The following figure shows the measurement saved in the project:



Procedure:

1. Select the measurement in the "Installed traces" table and transfer it to the project with the  button.

3.2 Using the trace function - overview

Requirement

A device is configured in the TIA Portal that supports the trace and logic analyzer function and to which an online connection has been established.

Procedure

The following table shows a procedural overview with typical steps when working with the trace and logic analyzer function.

Step	Description
1	Calling the trace editor (Page 33)
2	Configuring the trace (Page 33)
3	Transferring the trace configuration to the device (Page 34)
4	Activating/deactivating an installed trace (Page 35)
5	Monitoring the recording (Page 36)
6	Saving measurements in the project (Page 36)
7	Displaying the recording (Page 36)

3.3 Calling the trace editor

A trace editor can be opened for each device in the project navigator.

The following instructions describe how you call the trace editor in the work area of the TIA Portal.

Requirement

A device is configured that supports the trace and logic analyzer function.

Procedure

To call the trace editor, proceed as follows:

1. In the project navigator, double-click the device.
The device folder opens.
2. Double-click "Traces".

3.4 Trace handling

3.4.1 Configuring the trace

Requirement

The trace editor is open.

Creating and deleting the trace configuration

To create a new trace configuration, proceed as follows:

1. Click the "<Add>" entry in the "Trace configurations" table in the Trace handling (Page 18).
The new trace configuration is created.
2. Enter the name for the trace configuration.

To delete a trace configuration, proceed as follows:

1. Right-click a trace configuration in the "Trace configurations" table and select the shortcut menu command "Delete".
The trace configuration is deleted.

Configuring the trace

In the configuration, you specify the recording and trigger conditions and select the signals to be recorded.

See Section "Configuration" below the respective device (Page 41).

Note


Saving the trace configuration

You save the trace configuration with the project in the TIA Portal.

If you close the project without saving, the configuration is discarded. The trace editor can be closed and reopened without loss of data until the project is closed.



3.4.2 Transferring the trace configuration to the device

Requirement

- A valid trace configuration  is located in the "Trace configurations" table.
- The maximum number of "Installed traces" has not been reached yet.
- There is an online connection to the device.

Procedure

To transfer a trace configuration to the device, proceed as follows:

1. Select a trace configuration  in the "Trace configurations" table.
2. Click the  button to transfer the trace configuration to the device.

Result

The trace configuration is transferred to the device and displayed in the "Installed traces" table.

3.4.3 Activating/deactivating an installed trace

Requirement

A trace configuration is installed and there is an online connection to the device.

Activating an installed trace

To activate the recording for an installed trace, proceed as follows:

1. Activate the checkbox of the "Active" column in the "Installed traces" table.

The installed trace is activated and starts the recording according to the configured trigger condition. The trigger condition is device-specific and described in Section "Configuration" below the respective device (Page 41).

Note

When a recording is restarted, the previously recorded values are lost.

To save the recorded values, save the measurement in the project (Page 36) before you activate the recording again.

Deactivating an installed trace

To deactivate an activated installed trace, proceed as follows:

1. Deactivate the checkbox of the "Active" column in the "Installed traces" table.

The installed trace is deactivated.


3.4.4 Displaying the recording

Requirement


A trace configuration with recording is in the device and there is an online connection to the device or there is an entry in the "Measurements" table.

Procedure

To display the recording, proceed as follows:

1. Select an entry in the "Installed traces" table.
2. Click  in the column for the selected entry.

Or:

1. Select an entry in the "Measurements" table.
2. Click  in the column for the selected entry.

Result

The recording is displayed in the curve diagram and the signal table.

3.4.5 Saving measurements in the project


Requirement

A trace configuration with recording is installed and there is an online connection to the device.

The "Installed trace" data must have been displayed at least once in the curve diagram. The recording data is loaded from the device for the display.

Procedure

To save a recording in the project, proceed as follows:

1. Click an entry in the "Installed traces" table in the trace handling.
2. Click the  button to transfer the selected entry.

The selected entry in the "Installed traces" table is added to the "Measurements" table.

3. Save the project in the TIA Portal.

3.4.6 Exporting and importing measurements

Requirement

There is at least one measurement in the "Measurements" table.

Exporting measurements

To export a measurement, proceed as follows:

1. Right-click an entry in the "Measurements" table and select the shortcut menu command "Export measurement".
2. Select a folder, a file name and a data type to save the measurement.
3. Click the "Save" button.

Importing measurements

To import a measurement, proceed as follows:

1. Right-click in the "Measurements" table and select the shortcut menu command "Import measurement".
2. Select the file of the "*.ttrecx" file type with the measurement to be imported.
3. Click the "Open" button.

The imported measurement is displayed with the file name in the "Measurements" table.


3.4.7 Transferring the trace configuration from the device to the project

Requirement

A trace configuration is installed and there is an online connection to the device.

Procedure

To transfer a trace configuration to the project, proceed as follows:

1. Select an entry in the "Installed traces" table.
2. Click the  button to transfer the trace configuration from the device.

Result

The configuration of the "installed trace" is transferred to the "Trace configurations" table.

3.4.8 Deleting installed traces

Requirement

A trace is installed and there is an online connection to the device.

Deleting an installed trace

To delete an installed trace, proceed as follows:

1. Select one or more lines to be deleted in the "Installed traces" table.
2. Press to delete the "Installed traces".


3.5 Signal table

3.5.1 Use of the signal table

The signal table shows the signals of an installed trace or a measurement. You can show or hide individual signals for the display in the table and adapt the properties for the display. Individual bits can be selected for some data types and displayed as a bit track.


The following operating instructions describe the operation of the signal table.

Requirement

- An entry is selected in the  column in the "Installed traces" or "Measurements" table.
- For the display of individual bits as a bit track:
At least one recorded signal supports the display as a bit track.



Selecting individual signals in the signal table and changing the format

To adapt the display to suit your requirements, proceed as follows:

1. Click the icon of the respective signal in the  column to select or deselect it for the display.
2. Click in the "Color" column for the respective signal to change the default color of the signal.
3. Click the "Bring to foreground" entry in the shortcut menu of a signal to display it in the foreground.

Selecting individual bits in the signal table for display as a bit track

To display individual bits as a bit track in the lower curve diagram, proceed as follows:

1. Click the  icon of a signal in the signal table.
2. Click the  icon in the opened bit selection of the signal to select or deselect individual bits for the display.

3.6 Curve diagram

3.6.1 Use of the curve diagram

The curve diagram shows the signals of a recording selected in the signal table. Select the recording in the "Installed traces" or "Measurements" table of the trace handling.

The display area can be zoomed as required. Measurement cursors can be used to select individual values for display in the signal table.


The following operating instructions describe the use of the measurement cursors.

Requirement

A recording has been selected for display.

Evaluation of a certain instant of a recording


To display the values for a specific sample, proceed as follows:

1. Display the vertical measurement cursors via the  button.
2. Move a measurement cursor with the mouse to the required position in the recording.

The values of the signals are displayed in the signal table. The time or sample for the measurement cursors is displayed in the lower area of the curve diagram.

Evaluation of the difference between two samples


To display the difference, proceed as follows:

1. Display the vertical measurement cursors via the  button.
2. Move both measurement cursors with the mouse to the required samples in the recording.

The values of the signals and the difference are displayed in the signal table. The time or sample for the measurement cursors is displayed in the lower area of the curve diagram.

Using horizontal measurement cursors

To check whether a certain value has been reached, proceed as follows:

1. Display the horizontal measurement cursors via the  button.
2. Move a measurement cursor with the mouse to the required value of the recording.

The values of the measurement cursor for the selected signal are displayed in the lower area of the curve diagram.

3.6.2 Printing a recording

The curve diagram supports the saving of the display as a bitmap and the copying of the display to the clipboard. Also use these functions (Page 13) for printing.

Devices

4.1 S7-1200/1500 CPUs

4.1.1 Recordable variables

Device-dependent recording of tags

The following list shows the operand areas from which tags can be recorded:

- Process image input
- Process image output
- Bit memory
- Data blocks

Data types

Elementary data types can be recorded. The availability of the individual data types depends on the device used:

The following table lists the elementary data types:

Data types	Note
Binary numbers	
BOOL	-
Bit strings	
BYTE	-
WORD	-
DWORD	-
LWORD	Symbolic name required
Integers	
SINT	-
USINT	-
INT	-
UINT	-
DINT	-
UDINT	-
LINT	Symbolic name required
ULINT	Symbolic name required
Floating-point numbers	
REAL	-
LREAL	Symbolic name required

4.1.2 Lifetime of the installed trace configuration and recorded values

Installed trace configurations are retained after POWER OFF. The recording is activated again after the restart of the CPU.

Recorded values are lost during the restart.

Note**Downloading a configuration to the device in the "STOP" operating state**

Note that after downloading a configuration in the "STOP" operating state, you must check the installed traces and, if required, reactivate them or transfer them again.

Note

If signals or trigger tags that affect the address are changed, the trace configuration must also be transferred to the device again.

This is the case for example, when a data block is shortened or extended or the data type is changed.

4.1.3 Recording levels

The following list shows the execution levels that can be selected for the recording cycle:

- Program cycle - OB 1
- Time-of-day interrupt - OB 1x
- Time-delay interrupt - OB 2x
- Watchdog interrupt - OB 3x
- Synchronized processing cycles - OB 6x, not OB 60
- Servo task - OB 91 (S7-1500)
- IPO - OB 92 (S7-1500)

Note

The measured values are recorded at the end of the OB after the processing of the user program.

4.1.4 Quantity structure

The following table shows the maximum quantity structure that can be recorded with the trace and logic analyzer function:

Device	Maximum number of "Installed traces"	Maximum number of signals per trace configuration
S7-1200 (as of firmware version V4.0)	2	16
S7-1500	At least 4 (depending on the CPU type)	16

Example of S7-1516

- Maximum of 3854 samples for 16 long tags
- Maximum of 21844 samples for 16 binary tags
- Maximum of 58250 samples for 1 binary tag

Refer to respective manual for more detailed information.

4.1.5 CPU load through trace recording

A trace recording increases the runtime of the respective recording level that can result in an execution level overflow with high utilization of the CPU.

Remedy

- **Change the trace configuration**
 - 1) Configure fewer tags and signals.
 - 2) Then increase the number of tags and signals up to the maximum number of signals step-by-step without an execution level overflow.
- **Select a slower recording level**

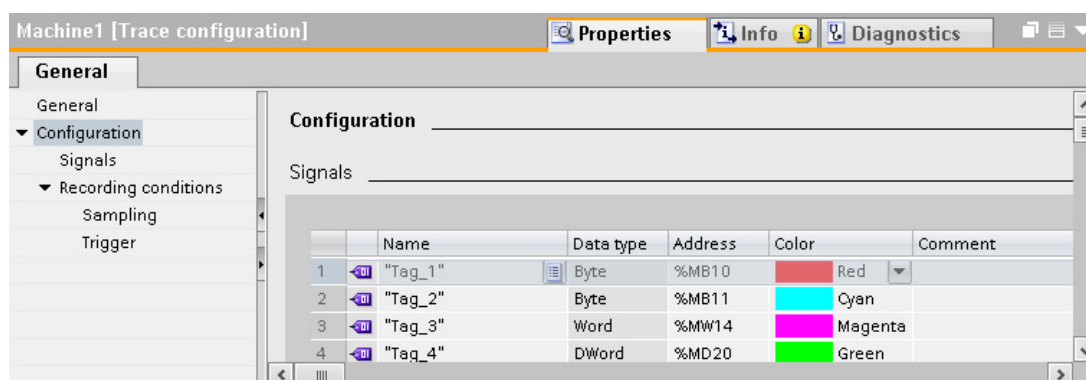
4.1.6 Software user interface of the device-specific area

4.1.6.1 Structure of the user interface

Display areas in the Properties window of the Inspector

The settings options differ depending on the configured device.

The following figure shows an example of the display in the TIA Portal:



The area navigation provides the following entries for selection:

- General
- Configuration
 - Signals (Page 46)
 - Recording conditions (Page 48)

Display of the properties of a trace configuration

The trace configuration is selected in the trace handling:

- Selection in the "Trace configurations" table
 - The properties are displayed in the Inspector window and can be changed.
- Selection in the the "Installed traces" table or "Measurements" table
 - The properties are displayed write-protected in the Inspector window.

4.1.6.2 User interface - General

The "General" area shows the name of the trace configuration and input fields for the author and a comment.

Input options and displays in General

The following figure shows an example of the display in the TIA Portal:

The screenshot shows the 'General' tab of a configuration window. It contains three input fields: 'Name' with the value 'Machine1', 'Author' (empty), and 'Comment' (empty text area).

The following table shows the input fields and displays:

Column	Icon	Description
"Name"	-	Name of the trace configuration
"Author"	-	Author of the trace configuration
"Comment"	-	Input field for a comment

4.1.6.3 User interface - Signals

The "Signals" area shows a table in which the signals to be recorded are configured for the selected trace configuration.

Signals can also be inserted in the table using drag-and-drop.
The signals can be sorted using drag-and-drop.



Setting options and displays in "Signals"

The following figure shows an example of the display in the TIA Portal:

The screenshot shows the 'Signals' tab with a table containing the following data:

	Name	Data type	Address	Color	Comment
1	"Tag_1"	Byte	%MB10	Red	
2	"Tag_2"	Byte	%MB11	Cyan	
3	"Tag_3"	Word	%MW14	Magenta	
4	"Tag_4"	DWord	%MD20	Green	

The following table shows the settings and displays:

Column	Icon	Description
		Display of the signal icon for a selected signal.
"Name"	-	Input field for the name or address of the signal. Examples: <ul style="list-style-type: none"> • M0.0 • DB1.DBW3 • "Data_block_1".pressure
-		Button to open the signal selection table. The button is displayed when the table line is selected. Clicking the icon opens a table which offers possible signals for selection. The selected signal is displayed in the input field.
"Data type"	-	Text field with display of the data type for the signal.
"Address"	-	Input field for the address of the signal. With purely symbolic signals the field remains empty.
"Color"	-	Text field for display and selection of the color. Click the selected field to display the signal color. Click the signal color to open the color selection dialog.
"Comment"		Input field for a comment on the signal.

Shortcut menu commands

The following table shows the shortcut menu commands of the table:

Shortcut menu command	Description
"Cut"	Cannot be selected.
"Copy"	Copies the contents of the selected lines to the clipboard.
"Paste"	Pastes the contents of the clipboard to the selected line. The existing contents are overwritten.
"Delete"	Deletes the selected lines from the table or deletes the name of the selected cell.
"Rename"	Switches the selected cell to the editing mode.

4.1.6.4 Recording conditions

Supported data types

The following table shows the supported data types for the trigger tag:

Memory requirement and format of the number	Data type
1 byte	BOOL
8-bit integers	SINT, USINT, BYTE
16-bit integers	INT, UINT, WORD
32-bit integers	DINT, UDINT, DWORD
64-bit integers	LINT, ULINT, LWORD (device-dependent)
32-bit floating-point numbers	REAL
64-bit floating-point numbers	LREAL

User interface - Recording conditions

The "Recording conditions" area shows the trigger condition for the selected trace configuration and in which cycle, how fast and how long the recording is made. The configuration is only possible if the trace configuration has been selected in the "Trace configurations" table of the trace handling.

Setting options and displays in "Recording conditions"

The following figure shows an example of the display in the TIA Portal:

Recording conditions

> Sampling

Sample with: "Main" %OB1

Record every: 1 Cycle

Recording duration (a): 20 Sample

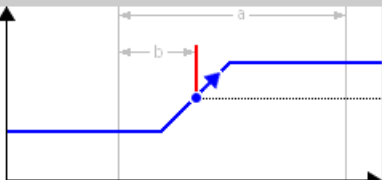
Max. recording duration: 32766 samples ☐ Use max. recording duration

> Trigger

Trigger mode: Trigger on tag


Trigger tag: "C_Int" %MW30

Event: Rising signal

Value:  = 0

Pre-trigger (b): 0 Sample

Setting/display		Description
"Recording time"		
	Drop-down list	Selection of the recording time. See Recording levels (Page 43)
	Text field	Detailed information on the selected recording time.
"Record every"		
	Input field	Input of the reduction in relation to the cycles.
	Drop-down list	Selection of the reduction factor. The following settings are possible: <ul style="list-style-type: none"> "Cycle"
	Text field	Display of the sampling time, taking into account the configured reduction.

Setting/display		Description
"Recording duration"		
	Input field	Input of the recording duration in relation to the samples. If the "Recording duration = max. recording duration" checkbox is activated, entries are overwritten by the value displayed in "Max. recording duration".
	Drop-down list	Select the time unit for the recording duration. The following settings are possible: <ul style="list-style-type: none"> • "Samples"
	Text field	Displays the calculated recording duration.
"Max. recording duration"		
	Text field	Displays the calculated maximum recording duration. The "Max. recording duration" depends on how many signals are recorded and the data type of these signals.
	"Use max. recording duration"	Set the recording duration to the maximum value. When the checkbox is activated, the recording duration is set to the maximum possible recording duration. The set reduction in the "Record every" input field is taken into account. The recording duration is also adapted when additional signals are added.
"Trigger mode"		
	Drop-down list	The following settings are possible: <ul style="list-style-type: none"> • "Record immediately" <p>The recording is made immediately after the device is activated.</p> • "Trigger on tag" <p>The recording is made as soon as the installed trace is activated and the configured trigger condition is fulfilled.</p>
	Text field	Display of the trigger type.
"Trigger tag"		
	Input field	Enter a signal. Examples: <ul style="list-style-type: none"> • M0.0 • DB1.DBW3 • "DataBlock_1".Temperature
		Opens the signal selection table. Clicking the icon opens a table which offers possible signals for selection as trigger tag. The selected signal is displayed in the input field.
	Text field	Display of the trigger tag address.

Setting/display		Description
"Event"		The events that can be used on this trigger tag are offered for selection according to the data type of the trigger tag. The event can only be configured when a valid signal has been entered as trigger tag.
	Drop-down list	Event selection for which the trigger tag is checked. The entries in the drop-down list are described in Section Trigger event (Page 51).
	Text field	Display of the comparison type.
"Value"		Configuration of the selected event. The configuration options differ depending on the format of the trigger tag and the selected event. See Trigger event (Page 51).
"Pre-trigger"		"Pre-trigger" defines the time during which the signals are already recorded before the actual trigger condition is fulfilled. If the trigger event occurs immediately or shortly after the activation of the recording, this may result in a shorter recording duration. Example of "recording duration" = 20 samples and "pre-trigger" = 5 samples: <ul style="list-style-type: none"> Trigger event occurs 50 samples after activation of the recording Actual recording duration = 20 samples Trigger event occurs 2 samples after activation of the recording Actual recording duration = 17 samples
	Input field	Input of the duration in relation to the selection in the drop-down list.
	Drop-down list	Select the time unit The following settings are possible: <ul style="list-style-type: none"> "Samples"
	Text field	Displays the calculated "pre-trigger" period

Trigger event

Depending on the selection in the drop-down list box, the further settings differ for the "event".

The individual events are described below.

"=TRUE"

Supported data types: Bit (Page 48)

The recording starts when the state of the trigger is TRUE.

"=FALSE"

Supported data types: Bit (Page 48)

The recording starts when the state of the trigger is FALSE.

"Rising edge"

Supported data types: Bit (Page 48)

The recording is started when the trigger state changes from FALSE to TRUE.
After activation of the installed trace, at least two cycles are required to identify the edge.

"Rising signal"

Supported data types: Integers and floating-point numbers (Page 48)

The recording is started when the rising value of the trigger reaches or exceeds the value configured for this event.
After activation of the installed trace, at least two cycles are required to identify the edge.

"Falling edge"

Supported data types: Bit (Page 48)

The recording is started when the trigger state changes from TRUE to FALSE.
After activation of the installed trace, at least two cycles are required to identify the edge.

"Falling signal"

Supported data types: Integers and floating-point numbers (Page 48)

The recording is started when the falling value of the trigger reaches or falls below the value configured for this event.
After activation of the installed trace, at least two cycles are required to identify the edge.

"In the range"

Supported data types: Integers and floating-point numbers (Page 48)

The recording starts as soon as the value of the trigger is in the value range configured for this event.

"Outside of the range"

Supported data types: Integers and floating-point numbers (Page 48)

The recording starts as soon as the value of the trigger is outside the value range configured for this event.

"= value"

Supported data types: Integers (Page 48)

The recording starts when the value of the trigger is equal to the value configured for this event.

"<> value"

Supported data types: Integers (Page 48)

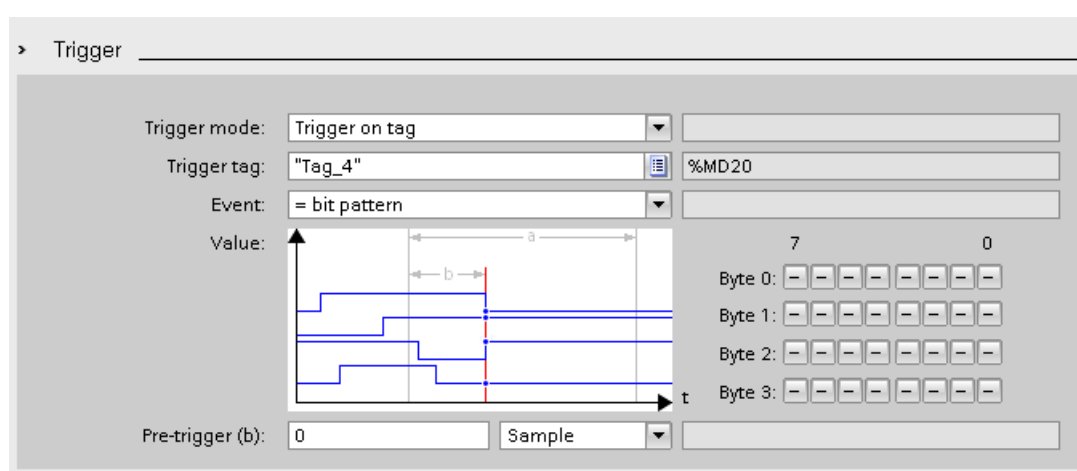
The recording starts when the value of the trigger is not equal to the value configured for this event.

"= bit pattern"

Supported data types: Integers (Page 48)

The recording starts when the value of the trigger matches the bit pattern configured for this event.

The following figure shows the setting options for a "bit pattern":



It is possible to switch between the icons by clicking the respective button.

The following table shows the icons:

Icon	Description
	Bit is not evaluated
	Bit is checked for FALSE
	Bit is checked for TRUE

"<> bit pattern"

Supported data types: Integers (Page 48)

The recording starts when the value of the trigger does not match the bit pattern configured for this event.

See also

Configuring the trigger conditions (Page 57)

4.1.7 Configuration

4.1.7.1 Trace configuration - overview

The configuration of the recording conditions and the signals to be recorded is device-specific.

Requirement

A trace configuration has been created and selected in the "Trace configurations" table of the trace handling.

Procedure

The following table shows the procedure for configuring.

Step	Description
1	Documentation of the configuration (optional) Enter a comment and an author for the configuration.
2	Selecting signals (Page 55) Select the signals to be recorded in the "Signals" area.
3	Configuring the recording cycle and duration Select a recording time, a cycle and the duration in the "Recording conditions" area.
4	Configuring the trigger conditions (Page 57) In the "Recording conditions" area, select whether the recording is to be performed immediately or depending on a trigger condition.


4.1.7.2 Selecting signals

Requirement

- A trace configuration has been created and selected in the "Trace configurations" table of the trace handling.
- The "Signals" area is open in the Inspector window.

Procedure

To configure the signals to be recorded, proceed as follows:

1. Click in the first empty line of the table.
2. Click in the first empty line of the "Name" column.
3. Select a signal. The following options are available:
 - In the "Name" column, click the  button and select a tag.
 - Enter the symbolic tag name in the cell in the "Name" column.
 - Enter the address directly in the "Address" column.
 - Drag a signal to the table using drag-and-drop.
4. Click in the "Display color" column and select a color for the display of the signal.
5. Click in the "Comment" column and enter a comment for the signal.
6. Repeat the procedure from step 1 until all the signals to be recorded have been entered in the table.


4.1.7.3 Configuring the recording cycle and duration

Requirement

- A trace configuration has been created and selected in the "Trace configurations" table of the trace handling.
- The "Recording conditions" area is open in the Inspector window.

Procedure

To configure the cycle and the duration of a recording, proceed as follows:

1. Click the  button for the recording time.
2. Select an OB for the recording time (Page 43).
3. Select a unit for the reduction factor in the drop-down list box for "Record every".
4. Enter the factor for the reduction in the input field for "Record every".
5. Select a unit in the drop-down list box for "Recording duration".
6. Specify the recording duration.
The following options are available:
 - Enter a value for the duration in the input field for "Recording duration".
 - Activate the "Use max. recording duration" checkbox.

4.1.7.4 Configuring the trigger conditions

Requirement

- A trace configuration has been created and selected in the "Trace configurations" table of the trace handling.
- The "Recording conditions" area is open in the Inspector window.


"Record immediately" trigger condition

To start the recording immediately, proceed as follows:

1. Select the "Record immediately" entry in the drop-down list for "Trigger mode".
The input fields for the trigger tag are hidden.

"Trigger on tag" trigger condition

To start the recording depending on a condition, proceed as follows:

1. Select the "Trigger on tag" entry in the drop-down list for "Trigger mode".
2. Select a trigger tag. The following options are available:
 - Click the  button for the trigger tag and select a tag.
 - Enter the address or the symbolic name of the tag directly in the input field for the trigger tag.

A drop-down list with events and input fields is displayed. The display depends on the data type of the tag.

3. Configure the event.
4. Select a unit for the pre-trigger in the drop-down list for "Pre-trigger".
5. In order to record a period before the trigger event, enter a value greater than 0 in the input field for the pre-trigger.

Note

The trigger condition is checked in every cycle irrespective of the setting in "Record every". To reliably identify the trigger, the trigger signal must be present for at least one full cycle.

Glossary

Curve diagram

Displays the selected signals of a recording.

Installed trace

Consists of a trace configuration and optionally a recording.

Measurement

Consists of a trace configuration with an associated recording.

Pre-trigger

Defines the time interval in which the signals are already recorded before the actual trigger condition is fulfilled.

Recording

Is performed in the device. There is only one recording for each installed trace configuration.

Recording condition

Sampling and trigger for a trace configuration.

Recording duration

Factor in number of samples. The factor of 100 means, for example, that 100 samples are recorded.

Reduction

Factor in number of cycles. A factor of 2 means, for example, that a recording is made every second cycle.

Sampling

Setting, in which cycle, how fast and how long the recording is to be made.

Signal table

Lists the signals of the selected measurement and provides setting options for some properties.

Trace configuration

Contains all the information required to record values in a device.

Trace handling

Enables the transfer of trace configurations and measurements to and from the device.
Selection of an installed trace or a measurement displays recordings in the curve diagram.

Trigger

Specifies the trigger mode and the condition for the "Trigger on tag" mode.

Trigger mode

Specifies whether the recording should be started immediately or based on a trigger tag.

Trigger tag

Signal to trigger the recording.

Trigger time

The meaning of the measurement trigger time depends on the device.

For example, SIMATIC S7-1200/1500 CPUs: Specifies the absolute time of the control system at the start of recording.

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