TG Motion

version 4

Oscilloscope

operation manual

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1. Oscilloscope

1.1 Structure Oscilloscope: description of operation

Oscilloscope is a sophisticated tool for recording of as many as 32 channels – values of 32 different registers and their time dependence. Within a certain time interval, it detects and saves values of selected registers into **TGM_Oscilloscope** shared memory. When finished, the data can be processed in other parts of PLC or in a Windows application.

As a rule, the size of the **TGM_Oscilloscope** shared memory amounts to 1 048 576 bytes. The actual size can be read by register **TGM_System.HEADER.Mem_Size_OSC**.

The **TGM_Oscilloscope** memory is common for data of all registers being recorded. If a single channel values are recorded, the entire memory is reserved to the record. If multiple channel data are recorded, the memory is divided uniformly among the channels. The distribution of the recorded data in the **TGM_Oscilloscope** memory and their offsets are determined by **TG Motion**; which saves these parameters in corresponding registers.

*The uniformity of the **TGM_Oscilloscope** memory distribution relates to the number of bytes required to record the values of individual registers.*
*For example, in the case of recording two registers, the first being of Long Integer type (4 bytes) and the other of Double type (8 bytes), **TG Motion** will divide the shared memory of **TGM_Oscilloscope** in the ratio of 1:2, so that the same number of samples can be recorded in both channels.*

The recording time decreases when the number of recorded channels rises.

On the **TG Motion** level, data reading and recording via **Oscilloscope** utility into the shared memory of **TGM_Oscilloscope** is carried out after **Program_04** is executed. In this way, time synchronization of recorded values is guaranteed. However, the reading and recording need not be carried out during every **Cycle_Time**. The number of **Cycle_Times**, during which one record is made, is determined by the **Number_Periods** register.

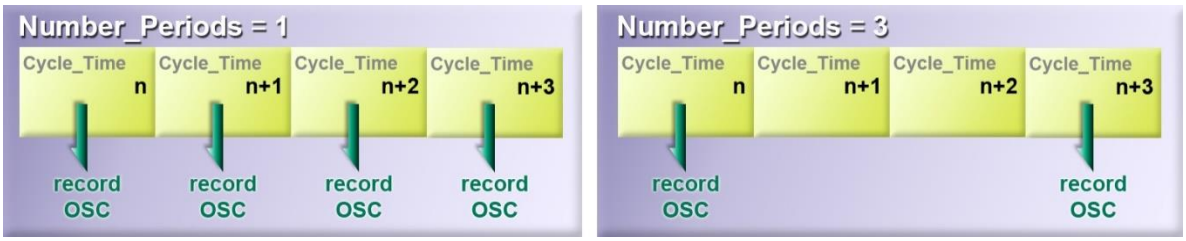

*Fig. Influence of the **Number_Periods** register on the frequency of Oscilloscope records.*

On Windows level, Control Observer offers the Oscilloscope utility, in which the recorded data can be displayed in the form of a chart, saved into file or retrieved, record and display parameters can be modified, or perform an own record.

The Oscilloscope works as one instance, which may be utilized by PLC and also by Control Observer. However, it cannot be used simultaneously from PLC and Control Observer (or from other applications).

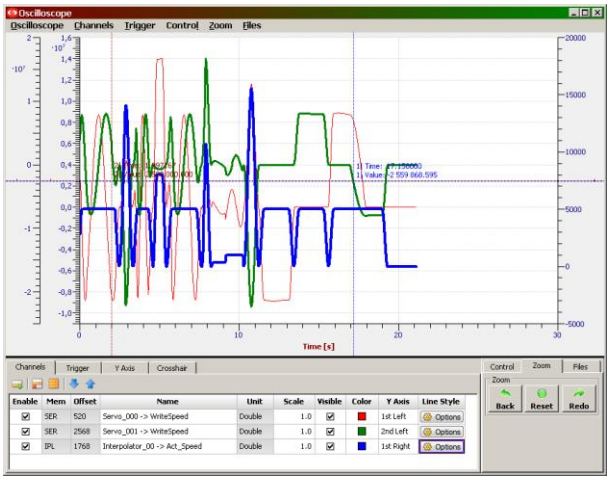

Fig. Oscilloscope utility contained in Control Observer

For a detailed description of the Oscilloscope utility of Control Observer, refer to Control Observer Chapter.

1.2 Oscilloscope registers and their meaning

The registers, by means of which the **Oscilloscope** utility is controlled or where it saves its settings, are located in the **TGM_System** shared memory starting from offset 4736. They can be divided into three groups for clarity.

general registers – *they apply to the setting of Oscilloscope utility as a whole*
channel registers – *they apply to particular channels only*
auxiliary registers – *they contain information on records*

General Oscilloscope registers

The general registers are used to carry out general setting and control of the **Oscilloscope** utility.

Control – it is used to control the structure Oscilloscope.
- **0** – no record is being performed or is used to stop recording
- **>0** – record activation; it starts the recording or waiting for Trigger (according to Status register)

Status – displays the status of the structure Oscilloscope
- **0** – neither record nor waiting for Trigger are taking place
- **1** – recording is under way
- **2** – waiting for Trigger

Number_Periods – number of servo ticks per sample. Specifies the number of Cycle_Times during which one Oscilloscope data record is carried out
Number_Channels – number of channels being recorded or already recorded
Mem – type of the shared memory, in which the triggering register is situated
- **0** – TGM_System
- **1** – TGM_Data
- **2** – TGM_Cam_Profile
- **3** – TGM_Oscilloscope
- **4** – TGM_Servo
- **5** – TGM_Dio
- **6** – TGM_Interpolator
- **7** – InterpolatorWriteMemory

8 – InterpolatorReadMemory
9 – TGM_ODS
10 – TGM_CNCEX
11 – TGM_GCODE

Offset_Trigger – offset of the triggering register in the memory specified by the Memory_Type_Trigger register

Mode_Trigger – mode of the triggering algorithm

0 – triggering inactive
1 – triggering by the leading edge
2 – triggering by the descending edge

Type_Trigger – data type of the triggering register

Level_Trigger – value of the triggering register which triggers the recording

Any shared memory register can make the triggering register.

Although the loaded value of the triggering register need not be continuous, the triggering algorithm does presume the continuity.
*Example: for **Level_Trigger = 20**, **Mode_Trigger = 1** and for consecutive values of triggering registers **17** and **22** it is assumed that the value of **20** has already be reached and the **Oscilloscope** record is triggered.*

Functioning principle of Oscilloscope utility

If **Mode_Trigger = 0** and when setting the **Contro**l register **> 0** the Oscilloscope utility will trigger the data recording. The recording can be terminated by setting the register **Control = 0**.

If **Mode_Trigger > 0**, then when setting the **Control** register **> 0** then the utility activates the triggering algorithm to test each **Cycle_Time** and evaluate the values of the triggering register. When the triggering condition is met, data recording will be launched. The Oscilloscope recording can be terminated by setting the register **Control = 0**.

*If the reserved memory of **TGM_Oscilloscope** is filled up during the **Oscilloscope** recording, the record process will stop automatically and the **Control** and **Status** registers will be set to zero (**0**).*

*For a complete list of all **Oscilloscope** registers including their description, refer to Appendix.*

Channel registers

These registers determine the parameters, which relate to particular channels. Location of recorded data in the **TGM_Oscilloscope** memory, identification of the data source (memory type and offset) and recorded register data type are ensured here. Four registers pertain to each of the channels.

Offset – offset of the channel data recorded in the **TGM_Oscilloscope** memory (assigned by **TG Motion**)

Memory_Type_Value – type of the shared memory, in which the recorded register is located

0 – TGM_System
1 – TGM_Data
2 – TGM_Cam_Profile
3 – TGM_Oscilloscope
4 – TGM_Servo
5 – TGM_Dio
6 – TGM_Interpolator

7 – InterpolatorWriteMemory
8 – InterpolatorReadMemory
9 – TGM_ODS
10 – TGM_CNCEX
11 – TGM_GCODE

Offset_Value – offset of the register being recorded in the memory specified by the Memory_Type_Value
Type_Value – data type of the register being recorded

0–3 – 32bit integer
4–7 – 64bit integer
8 – double (64bit floating point value)
9 – float (32bit floating point value)

*For a complete list of all **Oscilloscope** registers including their description, refer to Appendix.*

Auxiliary registers

The auxiliary registers provide information on the record parameters of **Oscilloscope** utility.

Number_Samples – number of available samples
Actual_Samples – actual number of recorded samples
Sample_Time – sampling time interval (Sample_Time = Cycle_Time × Number_Periods) [µs]

*The **Actual_Samples** register increments by **1** with every sample. If sampling is stopped (for example, when setting the **Control** register **= 0**), the **Actual_Samples** register value denotes the last sample taken.*

*For a complete list of all **Oscilloscope** registers including their description, refer to Appendix.*

2. Appendix

List and description of registers in the structure Oscilloscope

General Oscilloscope registers

name	access	offset	description
Control	RW	4736	it is used to control the structure Oscilloscope 0 – no record is being performed or is used to stop recording >0 – record activation (it starts the recording or waiting for Trigger)
Status	R	4740	status of the structure Oscilloscope 0 – no recording tis taking place 1 – the recording is under way 2 – waiting for Trigger
Number_Periods	RW	4744	number of servo tics per sample; specifies the number of Cycle_Times during which one Oscilloscope data record is carried out
Number_Channels	RW	4748	number of recorded channels
Memory_Type_Trigger	RW	4752	type of the shared memory, in which the triggering register is located
Offset_Trigger	RW	4756	offset of the triggering register in the memory specified by the Memory_Type_Trigger register
Mode_Trigger	RW	4760	mode of the triggering algorithm 0 – triggering inactive 1 – leading edge 2 – descending edge
Type_Trigger	RW	4764	data type of the triggering register variable
Level_Trigger	RW	4768	value of the triggering register which triggers the recording

Registers of OSC channels-> CHANNEL_00

name	access	offset	description
Offset	R	4776	offset of channel data recorded in TGM_Oscilloscope memory
Memory_Type_Value	RW	4780	type of the shared memory, in which the triggering register is located 0 – TGM_System 1 – TGM_Data 2 – TGM_Cam_Profile 3 – TGM_Oscilloscope 4 – TGM_Servo 5 – TGM_Dio 6 – TGM_Interpolator 7 – InterpolatorWriteMemory 8 – InterpolatorReadMemory 9 – TGM_ODS 10 – TGM_CNCEX 11 – TGM_GCODE
Offset_Value	RW	4784	offset of the register being recorded in the memory specified by the Memory_Type_Value
Type_Value	RW	4788	data type of the register being recorded 0–3 – 32bit integer 4–7 – 64bit integer 8 –double (64bit floating point value) 9 – float (32bit floating point value)

Registers of the other OSC channels -> CHANNEL_01 - CHANNEL_31

name	offset	description
CHANNEL_01	4792	registers pertaining to channel 01
CHANNEL_02	4808	registers pertaining to channel 02
CHANNEL_03	4824	registers pertaining to channel 03
I	I	I
CHANNEL_31	5272	registers pertaining to channel 31

Auxiliary registers

name	access	offset	description
Number_Samples	R	5288	number of available samples
Actual_Samples	R	5292	actual number of recorded samples
Sample_Time	R	5296	sampling time interval (Sample_Time = Cycle_Time × Number_Periods) [µs]

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