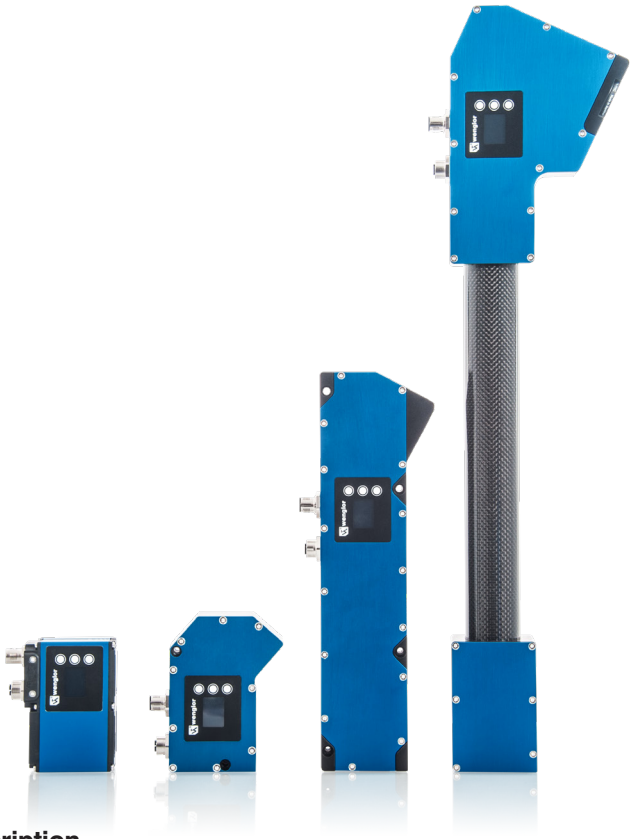
EN

GigE Vision

weCat3D MLSL/MLWL Profile Sensors



Interface Description

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Table of contents

1. Change Index

Document version	Release Date	Description	Software version
1.0.0	26.07.2016	Initial document	
1.1.0		• Adding the chapter “Network configuration” • Description of new GigE Vision features in version 1.3.0 • Update of the screenshots	
1.2.0	29.05.2018	• Fixing some typos • Updated screenshots • Adding new timechart examples in “TriggerSelector”	
1.3.0	21.02.2019	• New PixelFormat types • New GigE Vision features • New Halcon example • Stop of supporting x32 version (only releasing x64 bit applications)	
2.0.0	12.11.2020	• New Timeout option (-t) • Added multi region support (RegionSelector) • Added multi component support (ComponentSelector, based on GigE Vision standard 2.1) • New feature Scan3DCoordinateSource • New feature ResultingAcquisitionLineRate • Added new pixel format Mono10/Mono10Packed for Intensity component • Removed 2D representation of the scanned profile when Mono8 pixel format is selected • Removed Mono8 pixel format	2.0.0
2.0.1	26.01.2021	• Fix bug: Crash when the Frame Height is set to a large value • Fix bug: Fix a bug when the number of points in range component does not equal to number of points in intensity component • List of ASCII commands included • Add example on how to compute the Scan3dCoordinateScale value	2.0.1
2.1.0	30.11.2021	• Added description for multi instance operation	2.1.0
2.1.1	13.01.2022	• Bug fixing in section 6.1	2.1.0

2. Document Information

2.1 References

Document	Version
Operating Instructions MLSL MLWL.pdf	1.7.3

Table 2: References to external documents

3. Introduction

This document describes the commands and the supported features of the weCat3D GigE Vision interface for weCat3D sensors with any compatible GigE Vision client.

System Requirements:
The weCat3D GigE Vision interface is developed as an external application that can run on any computer with Windows 7 or 10, x64, Linux Ubuntu 16.04, 18.08 or OpenSuse,version 42.
The minimum requirements to run one application are i3 Intel processor or any processor that supports SSE2 instructions set (please refer to your CPU datasheet). 4 GByte RAM or higher and a Gigabit Ethernet adapter. These requirements are only valid for running one weCat GigE Vision interface per computer. If several weCat GigE Vision interfaces should run on one computer (connection to several profile sensors) the requirements shall increase.

4. Content of the weCat3D GigE Vision Interface

The weCat3D GigE Vision interface is available for download on
http://www.wenglor.com.
It is located on the product page of the 2D/3D Profile Sensors under the tab Download.

Content:

- Documentation
- weCat3D GigE Vision interface (64bit)
- Halcon Demo program

5. Network and Computer Setup

In order to guarantee a smooth experience of the weCat3D GigE Vision interface the computer as well as the network adapter should be set up accordingly:

5.1 Deactivation of the GigE Vision Filters (Drivers)

Normally when a GigE Vision client (Halcon, Matrix Vision, Ebus player, Eyevision, etc.) is installed the client also installs a GigE Vision filter/driver.These filters/drivers are used to improve the communication between the client and the GigE Vision device by filtering the UDP packets and reduce the CPU load of the computer.

Since the weCat3D profile sensors use an external application to make the profile sensor compatible with GigE Vision standards and since the interface could run on the same computer as the client (localhost) it is important to deactivate all GigE Vision filters/drivers. The GigE Vision filters/drivers block all large UDP packets which are transmitted between the GigE Vision interface and the client on localhost. If the GigE Vision filter is active, the client could fail to receive any images from the weCat3D GigE Vision interface.

NOTE!
For deactivating the GigE Vision filters/drivers make a right click on the network connection you are using. Select “Properties” in the context menu and the window with the network properties will be displayed (see Fig. 1).

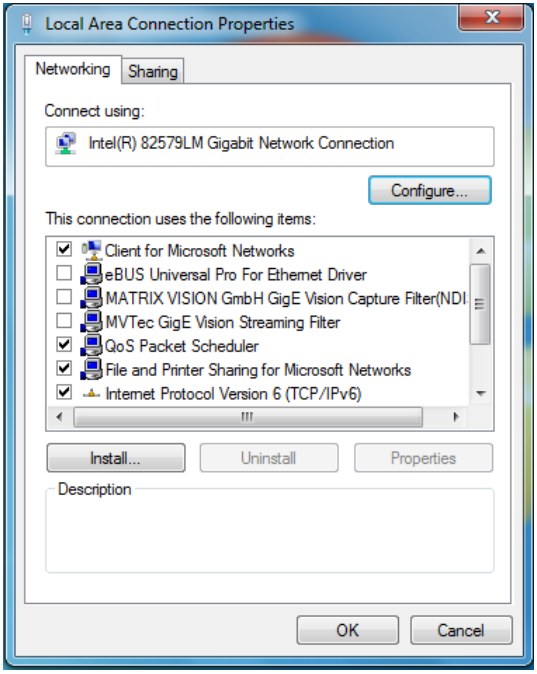


Fig. 1: Local Area Connection Properties

NOTE!
Make sure, that all installed GigE Vision filters/drivers are deactivated.

5.2 Assigning a Static IP Address to the Network Adapter Card

The IP address of the network adapter card is set to be dynamic by default (automatic assignment). Change the setting to “static” (see Fig. 2 and Fig. 3).

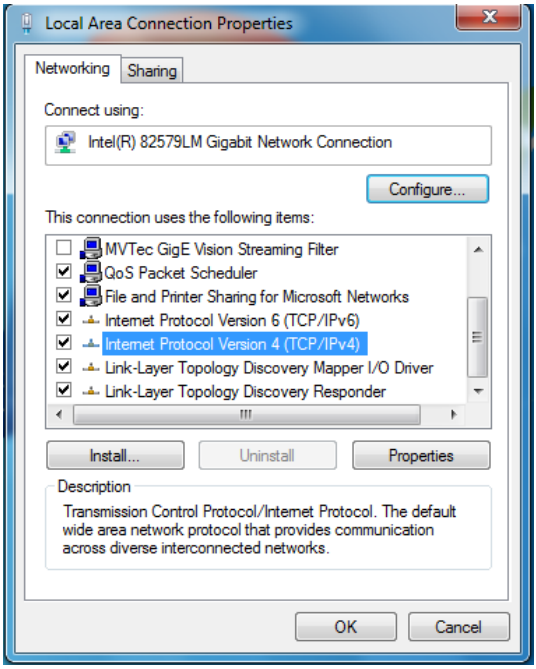


Fig. 2: Local Area Connection Properties

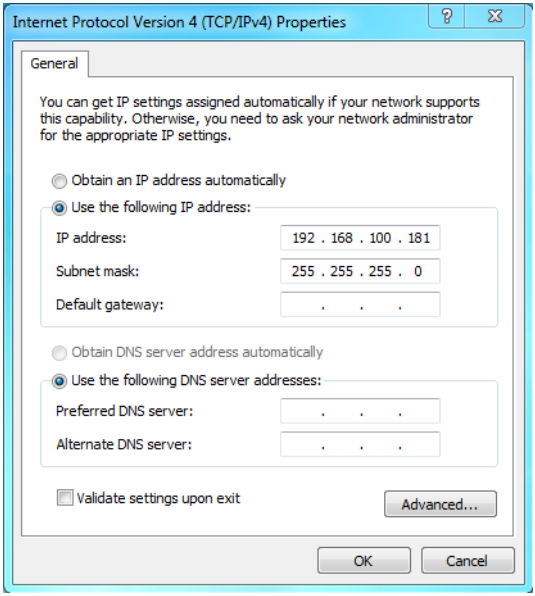


Fig. 3: Properties of Internet Protocol

5.3 Set up the Network Adapter Features

Make a right click on the network connections you are using to set up the network adapter features. Select “Properties” in the context menu. This will display the network properties (see Fig. 1). Click on “Configure” and then on the tab “Advanced”.

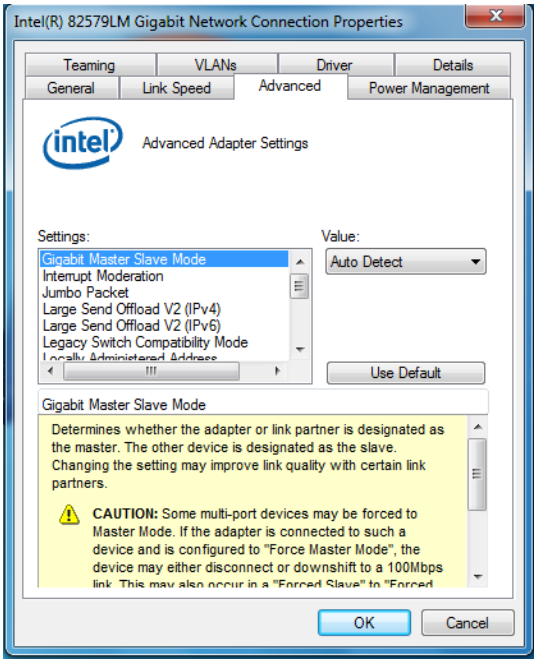


Fig. 4: Gigabit Network Connection Properties

The following features have to be set up:

- Jumbo frames: change it to the highest possible value
- Transmit descriptor (or transmit buffer): change to highest possible value
- Max. IRQ per second: 1000
- Interrupt moderation: On
- Interrupt moderation rate: Extreme

Depending on the network card/network driver it may be possible that not all features mentioned above are available. Please change all those which exist.

5.4 Deactivating Firewall and Antivirus

In some cases the Windows firewall and antivirus programs tend to block some of the UDP packets sent between the weCat3D GigE Vision interface and the GigE Vision client. It is highly recommended to switch off these programs.

6. Starting the weCat3D GigE Vision Interface as a Service

Go to the directory in the console window of your operating system where the weCat3D GigE Vision interface is saved and run the interface with the following command:
Syntax: weCat3DGigEInterface.exe -s SERVER_IP -i SCANNER_IP
SCANNER_IP is the IP of the weCat3D profile sensor you want to connect to.
SERVER_IP is the IP for the connection between the interface and the network.

The interface connects to the sensor through the given weCat3D Sensor IP (SCANNER_IP). Once the interface connects to the specified sensor, it reads the sensor's registers and updates the corresponding GigE Vision features. Finally, the interface connects to the network through the given server IP (SERVER_IP). The server IP should match the main IP of the Network Interface Card (NIC).
To get a list of all available IPs from the computer, just start the weCat3D GigE Vision interface without any input arguments or with the input argument (–h).
If the SERVER_IP is not available in the system, the GigE Vision interface will add this IP temporarily to the chosen NIC (see option -n, Fig. 5). The IP will be removed after a system restart. The GigE Vision interface should run with administration rights enabling it to add the IP into the system.

The interface also supports multiple options:

```
C:\weCat3DGigEInterface>weCat3DGigEInterface.exe
Version: 2.0.0


The weCat3DGigeInterface is an application that makes the weCat3D scanners compatible with any GigE compatible client. T
he application is console based. It is Windows and Linux compatible.

Available options:

 -i [SCANNER_IP] the IP address of the weCat3D scanner.

 -s [SERVER_IP] the IP address of the server, to which the application connects.
(Windows) The user defines the interface the server should be connected to (see -n).(Linux) unlike windows, the user in
linux can use any IP to connect the server. The user, however, should add this IP to the system manually

 -n [X] (only windows) the interface index, thorugh which the application connects.
If the server IP given by the option -s is not registered in the system, the server will add this IP to the system
(requires to run the application as system adminstrator).

 -r enable auto connect to the scanner. If this mode is enabled and a disconnected state is detected, the application wi
ll try to reconnect to the scanner for unlimited time. Otherwise the application will end itself

 -d print out in the console debug messages. The debug messages are the comands sent and received from the client.

 -f [FILENAME] print the debug messages into an external file. The debug messages are the commands sent and received fro
m the client.

 -u [USERNAME] set the user defined name in the scanner (Only in FW 1.1.x and higher).

 -p [X] save X scans  into a PCL compatible file format. The point cloud is saved after receiving the StartAcquisition c
ommand from the client.
The new point cloud will overwrite the old one.

 -t [TIMEOUT] set the profile receive timeout. If the weCat3DGigEInterface did not receive a profile from the scanner wi
thin timeout; the application sends the GigE image to the network without waitingthe height of the image to complete. De
fault value for timeout is 1000 [ms]. Set timeout to 0 to disable timeout.

 -w [FILENAME] set the name of the PCL compatible file, if not given; a file with default name (ScanData.txt) is used.

 -h print out the help text.

For more Info, please refer to the weCat3DGigeInterface user manual
```

Fig. 5: weCat3DGigE interface

- -i [SCANNER_IP]: Describes the IP address of the weCat3D Profile Sensor.
- -s [SERVER_IP]: Gives the server's IP address to which the application is connected. Windows users have to define the interface to which the server should be connected (see also option -n). Linux users can use any IP address to connect to the server. This IP must be added to the system manually.
- -n [X]: Defines the NIC's interface where the interface adds the IP, if it is not available in the system. Start the interface with option -h to see the index of your NIC.

NOTE!
This option requires to run the application with administration rights.

- -r: Enables auto reconnect to the weCat3D Profile Sensor in case of a lost connection.
- -d: Prints debug messages in the console. The debug messages are the commands sent and received from the GigE Vision client.
- -f [FILENAME]: Saves the debug messages in an external file.

ATTENTION!
"-d" and "-f" options decrease the performance and the communication time of the weCat3DGigEInterface with the GigE client. It should be used only for debugging purpose. In a normall runnig mode, "-d" and "-f" options should not be used.

- -u [USERNAME]: A specific user defined name. Some GigE Vision client applications (like Halcon) require this name as an extra paramter when they connect to the GigE Vision device.
- -p [X]: Saves X scans into a Point Cloud Library (PCL) compatible file format. The application will start to save the point cloud after receiving the StartAcquisition command from the client. If a new StartAcquisition command is received, the new point cloud will overwrite the old one.
- -t [TIMEOUT]: Sets the profile receive timeout. If the weCat3DGigEInterface did not receive a profile from the sensor within timeout the weCat3DGigEInterface sends the GigE image to the network without waiting for the height of the image to complete. The weCat3DGigEInterface fills the missing scans and chunk data with zeros. Default value for timeout is 1000 ms. Set timeout to 0 to disable timeout.
- -w [FILENAME]: Sets the name of the PCL compatible file. If not given, a file with default name (ScanData.txt) is used.
- -h: Displays a help text on how to use the interface in the console.

6.1 Start Multi Instance of the weCat3DGigEInterface

Below is an example of connecting multiple weCat3D profile sensors to multiple instance of weCat3DGigEInterface on the same host.
Suppose that the we have two weCat3D sensors, the first has the IP address 192.168.100.1 and the second has the 192.168.100.2
The user can connect both sensors to two different weCat3DGigEInterfaces by starting the weCat3DGigEInterface with option -n (refer to option -n in section 6):

weCat3DGigEInterface.exe -s 192.168.100.101 -i 192.168.100.1 -n 2 and

weCat3DGigEInterface.exe -s 192.168.100.102 -i 192.168.100.2 -n 2

192.168.100.101 and 192.168.100.102 are temporary SERVER_IPs added by the weCat3DGigEInterface in the operating system, -n 2 is the index of the network interface where the weCat3DGigEInterface adds the new SERVER_IPs. You can detect the index of the network interface you want to add the IPs on it by running the weCat3DGigEInterface without any input arguments (or with -h Option).

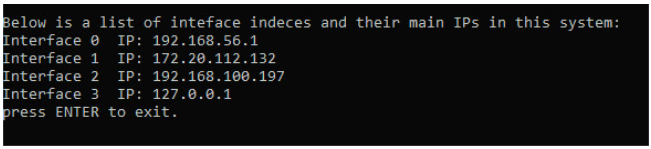


Fig. 6: Indices of available network interfaces

NOTE!
A static IP address should be assigned to the selected network interface.

NOTE!
For this example to work, the user must start the weCat3DGigEInterface in administration mode.

In this case the client recognizes two GigE devices having the IPs 192.168.100.101 and 192.168.100.102.

The temporary SERVER_IPs are deleted after either:

1. Ending the weCat3DGigEInterface by hitting the return button on the terminal where the weCat3DGigEInterface runs or

2. PC restart. Closing the terminal window does not delete the temporary SERVER_IPs and prevent the weCat3DGigEInterface from starting again with the same SERVER_IP.

7. GigE Vision Features

The weCat3D GigE Vision interface provides several features organized into different categories:

- Image Format Control
- Acquisition Control
- Digital I/O Control
- Counter And Timer Control
- Encoder Control
- Profile Control
- Device Control
- Scan3dControl
- ChunkDataControl

NOTE!
Some features and categories are only visible in Expert or Guru mode.

7.1 Image Format Control

Command	ComponentSelector
Access Mode	Read/write
Parameter	Intensity/Range
Description	Selects the component to be transmitted in the output frame. • Intensity: The interface sends the intensity values of the scanned profile from the weCat3D profile sensor in Mono10/Mono10Packed pixel format. • Range: The interface sends the 3D points of the computed profile from the weCat3D profile sensor in Mono16 or Coord3D_ABC32f pixel format. If Mono16 in PixelFormat is selected, then weCat3DGigEInterface sends a rectified 2.5D image which is suitable for different image processing algorithms. The following equations are needed in order to compute the X/Z coordinates in the coordinate system of the sensor from the rectified image: *Distance Z(i) [mm] = (PixelValue(i) × Scan3dCoordinateScale[CoordinateC] + Scan3dCoordinateOffset[CoordinateC]* *Distance X(i) [mm] = i × Scan3dCoordinateScale[CoordinateA] + Scan3dCoordinateOffset[CoordinateA]* “i” is the position of the pixel (column coordinate in image space) in each row, where each row represents an unique profile. Scan3dCoordinateScale[CoordinateA]: Scale factor of the X-axis Scan3dCoordinateScale[CoordinateC]: Scale factor of the Z-axis Scan3dCoordinateOffset[CoordinateA]: Offset factor of the X-axis Scan3dCoordinateOffset[CoordinateC]: Offset factor of the Z-axis Please refer to the Scan3dControl category for more details. If the value of a pixel at position (i) is zero, then it is invalid. Please note that profile sensors do not provide Y-coordinates. Thus an encoder value could be used to distribute the profiles along the Y-direction. Please refer to the feature ExtraData or to the feature ChunkEncoderValue in ChunkDataControl category. If Coord3D_ABD32f in PixelFormat is selected, then the weCat3DGigEInterface sends the scan data of the profile sensor as a native point cloud format according to the new GigE Vision standard 2.0. The Y-coordinate in this pixel format is computed from the encoder value or from the timestamp value, see Scan3dCoordinateSource feature. Use the features Scan3dCoordinateScale[CoordinateB] and Scan3dCoordinateOffset[CoordinateB] to setup the scale and the offset used to convert the encoder value or timestamp value into mm. Please refer to Scan3dControl category for more details. The advantage of this pixel format is that the GigE Vision client should be able to decode the received data natively into point cloud format without any extra effort from the user side.

Command	ComponentEnable
Access Mode	Read/write
Parameter	0/1
Description	Enables (1)/disables (0) sending the selected component in the output frame.

NOTE!
The GigE Vision client software should support the GigE Vision standard 2.1 (Multipart data type) to be able to decode the multi component frame correctly.

Command	RegionSelector
Access Mode	Read/write
Parameter	Scan3DExtraction0/Region0
Description	If Region0 is selected, the features Width, Height, OffsetX and OffsetY define the size of the ROI on the 2D camera chip in pixels. If Scan3DExtraction0 is selected, the features Width, Height, OffsetX and OffsetY control the size of the output image transfered to the client. RegionSelector implementation is compatible with GeniCam standard naming convention (version 2.4).

Command	Width		
Access Mode	Read/write*		
Parameter	MLSL: 32...1280 pixel MLWL: 32...2048 pixel	**Default**	MLSL: 1280 MLWL: 2048
Description	If RegionSelector = Region0, it defines the width of the selected ROI in pixel. If RegionSelector = Scan3DExtraction0, it defines the number of points per scan. Per default Width[Scan3DExtraction0] = Width[Region0], unless the feature SignalEnable = First_and_Second where Width[Scan3DExtraction0] = 2 × Width[Region0].		

* Width[Scan3DExtraction0] is read only, Width[Region0] is read/wrote

Command	Height
Access Mode	Read/write
Parameter	The values depend on the Region selected in RegionSelector
Description	If RegionSelector = Region0, it defines the height of the selected ROI in pixel. The size of the ROI affects the laser sensor's scan rate. Value: MLSL: 32...1024 pixel (default = 1024) MLWL: 32...2048 pixel (default = 2048 If RegionSelector = Scan3DExtraction0, it defines the number of profiles to include in each image. Each row of the image represents an unique profile (acquired from the profile sensor). Value: MLSL / MLWL: 1...10000 (default = 1) **NOTE!** The interface sends an image only when the number of the received profiles reaches the value of Height[Scan3DExtraction0], or timeout is triggered. For continuous profile monitoring task like a tracking guide system, the number of profiles should be set to a smaller value (1) to enable a continuous image (profile) transfer.

Command	OffsetX		
Access Mode	Read/write		
Parameter	MLSL: 0...1279 pixel MLWL: 0...2047 pixel	**Default**	0
Description	If RegionSelector = Region0, it defines the Offset in X of ROI in pixels. If RegionSelector = Scan3DExtraction0: Read only (not used).		

Command	OffsetY		
Access Mode	Read/write		
Parameter	MLSL: 0...1023 pixel MLWL: 0...2047 pixel	**Default**	0
Description	If RegionSelector = Region0, it defines the Offset in Y of ROI in pixels. If RegionSelector = Scan3DExtraction0: Read only (not used).		

The features Height[Region0], Width[Region0], OffsetX[Region0] and OffsetY[Region0] define the size of the ROI in pixels for the internal camera. The min. and max. values for those features depend on hardware. Adjusting the ROI has an influence on the max. measurement rate.
The feature Width[Region0] sets the number of points in X direction. Reducing the value of Width[Region0] decreases the capture area in X direction and hence, reduces the amount of read out pixels from the sensor. This allows to increase the measuring rate and reduce the network load. The feature value "Width" will be updated automatically to match the value of the feature Width[Region0] (to keep the width of the image equal to the number of output points per profile of the sensor).
The Height[Region0] feature sets the capture area for the internal camera of the sensor in Z (Y in camera co-ordinate system) direction. Reducing the Height[Region0] feature decreases the working range of the sensor,

but increases the measurement rate.
The features OffsetX[Region0] and OffsetY[Region0] define the start position of the capture area for the sensor's camera in X and Z (in camera coordinate system) direction respectively.

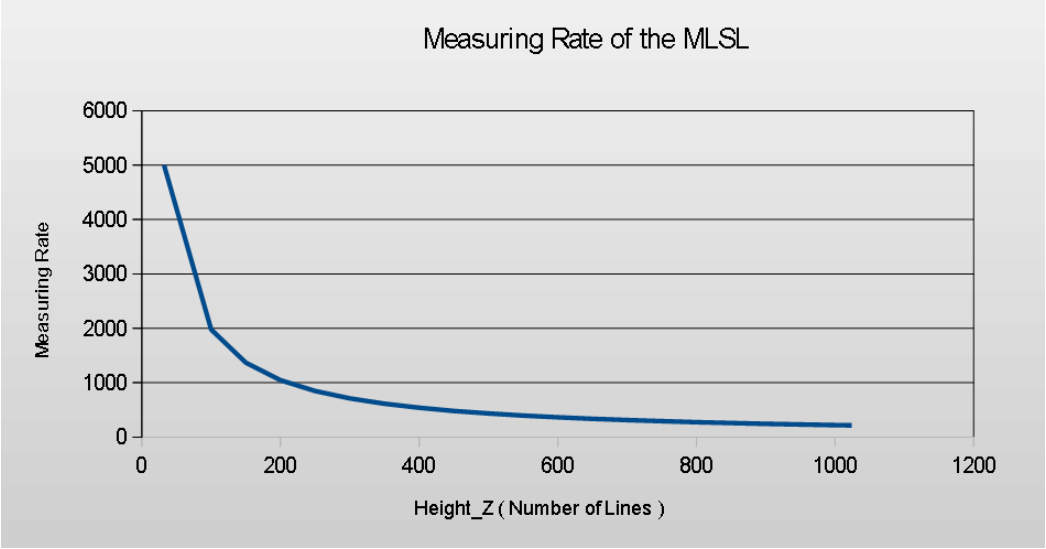


Fig. 7: MLSL: Relationship between number of lines and the measurement rate. Number of Rows in Width_X are set to 1280.

For the weCat3D MLSL Profile Sensor we have two deviating parameters which have influence on the calculation respectively, the measuring rate: Height[Region0] and Width[Region0]. When reducing the number of read out pixels in X for the weCat3D MLSL Profile Sensor, the measuring rate increases.
The formula to calculate the approximate reachable measuring rate is:

$$Measuring\ rate = 1 \times 1000000 / ((0{,}003458273 \times WidthX + 0{,}073443424) \times HeightZ + 56)$$

NOTE!
The formula just gives an approximation, if the range of the Width[Region0] is 345...1280. The measuring rate also depends on exposure time and the resources connected to the computer.

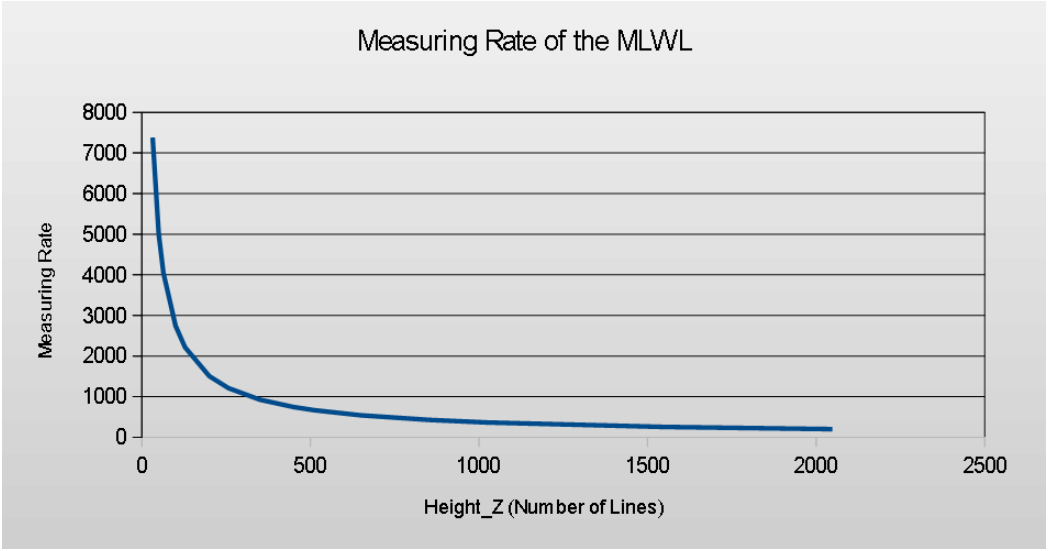


Fig. 8: MLWL: Relationship between number of lines in Z and the measurement rate.

Formula to calculate the measuring rate of the weCat3D MLWL Profile Sensor depending on the number of Height[Region0]:

$$Measuring\ rate = 149359{,}496817005 \times Height^{-0{,}8678007147}$$

NOTE!
The formula just gives an approximation, if the range of the Height[Region0] is 64...1024. The measuring rate also depends on the exposure time and the resources connected to the computer.

NOTE!
For further explanations see the feature ExposureTime which also influences the measuring rate.

NOTE!
The maximum value range in AcquisitionLineRate feature will be updated dynamically according to the given ROI size.

Command	PixelFormat
Access Mode	Read/write
Parameter	Mono10/Mono10Packed/Mono16/Coord3D_ABC32f
Description	This command defines the type of image sent to the client. • Mono10/Mono10Packed: Only available if Intensity component is selected. • Mono16: Only available if Range component is selected. • Coord3D_ABC32f: Only available if Range component is selected.

Command	PayloadSize
Access Mode	Read only
Description	Returns the size of the expected image payload in bytes. Depends on the features Width, Height and PixelFormat.

Command	SensorWidth
Access Mode	Read only
Description	Delivers the effective width of the integrated camera in pixel (MLSL: 1024 pixels; MLWL: 2048 pixels).

Command	SensorHeight
Access Mode	Read only
Description	Delivers the effective height of the integrated camera in pixel (MLSL: 1280 pixels; MLWL: 2048 pixels).

Command	Scan3DSortX		
Access Mode	Read/write		
Parameter	On Off	**Default**	Off
Description	Switch the sorting function of the point cloud on/off with respect to X values (ascending). Normally, output data from the sensor are already sorted with respect to X. In some extreme cases it could happen that output data are not sorted due to the calibration process and the extreme orientation of the surface in front of the scanner. **NOTE!** Switching the feature to “ON” could reduce the performance of the weCat GigE Vision interface.		

7.2 Acquisition Control

Command	AcquisitionMode
Access Mode	Read/write
Parameter	Continous/SingleFrame
Description	Defines the acquisition mode of the interface: in continuous mode, once the interface receives the command StartAcquisition from the client, it keeps sending images until the client sends a StopAcquisition command. In SingleFrame mode, the interface sends only one image per StartAcquisition command and the client does not need to send a StopAcquisition command.

Command	AcquisitionLineRate		
Access Mode	Read/write		
Parameter	MLSL: 10...4000 Hz (from firmware version 1.0.10: 1...4000 Hz) MLWL: 10...6000 Hz (from firmware version 1.0.10: 1...6000 Hz)	**Default**	MLSL: 200 MLWL: 175
Description	Defines the measurement rate of the sensor in Hz (i.e. number of measured profiles per second). The maximum value for the feature is hardware dependent, and it depends on the value of the feature ExposureTime as well as the size of the active ROI. Please refer to the weCat3D MLSL/MLWL Profile Sensors Operating Instructions and the features to set up the ROI in this documentation. The AcquisitionLineRate is only considered if the LineStart trigger mode is Off (the sensor is in Intern trigger mode). The measurement rate of the sensor in other trigger modes depends on input signals and value of TriggerDivider. **NOTE!** If the AcuisitionLineRate is set to a large value without taking into consideration the size of the ROI, the sensor will fail to send reliable profiles and the bit5 in ChunkScannerState is set to 1.		

Command	ResultingAcquisitionLineRate
Access Mode	Read only
Description	Shows the actual measurement rate of the sensor, updates every 1 second.

Command	ExposureTime		
Access Mode	Read/write		
Parameter	0...100 000	**Default**	150
Description	Sets the exposure time of the integrated camera in µs. For further information see the weCat3D MLSL/MLWL Profile Sensors Operating Instruction.		

The allowed values for AcquisitionLineRate and ExposureTime depend on each other. The allowed value for AcquisitionLineRate and ExposureTime should hold for the following equation:

$$1000000 \times (1 / AcquisitionLineRate) \geq ExposureTime + 40\ (\mu s)$$

Command	TriggerSelector
Access Mode	Read/write
Parameter	LineStart/FrameStart/AcquisitionActive
Description	Selects the trigger function to configure. • LineStart: Defines the trigger settings of the sensor for generating a profile. • FrameStart: Defines the sensor‘s trigger settings in the fixed mode. • AcquisitionActive: Acts as a global trigger enable/disable.

A frame is defined as an image where each row of the image represents a scanned profile. The trigger source for generating a profile is defined in TriggerSource (after selecting “LineStart” in theTriggerSelector feature).
If the “FrameStart” trigger function is off, the weCat3D GigE interface sends continuous frames, taking into consideration the trigger source in “LineStart” function.
If the “FrameStart” trigger function is on, then the weCat3D GigE interface will send a frame only after receiving a new trigger signal as defined in TriggerSource (after selecting “FrameStart” in TriggerSelector).
For further information refer to “fixed mode” in section “I/O Settings” in the weCat3D MLSL/MLWL Profile Sensors Operating Instructions.

ATTENTION!
It is not possible to select the same trigger source in “LineStart” and “FrameStart”.

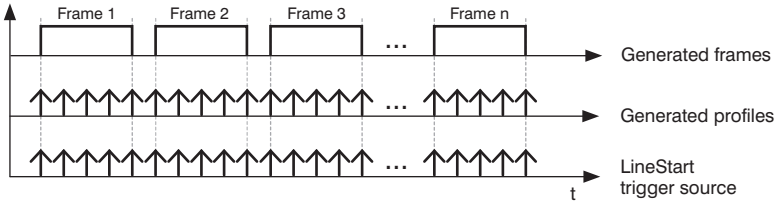
The “AcquisitionActive” trigger function is used as a global trigger enable function. If “AcquisitionActive” mode is on, the weCat3D sensor will generate profiles only when the selected line in TriggerSource (after selecting the “AcqusitionActive” trigger function in TriggerSelector) is active.
For further information refer to “Profile enable” pin function in chapter “I/O Settings” in the weCat3D MLSL/MLWL Profile Sensors Operating Instructions.

NOTE!
It is recommended to use the “AcquisitionActive” trigger function only when Height[Scan3DExtraction0] is set to 1, since it is difficult to synchronize the duration of the “AcquistionActive” signal with the end of the frame.

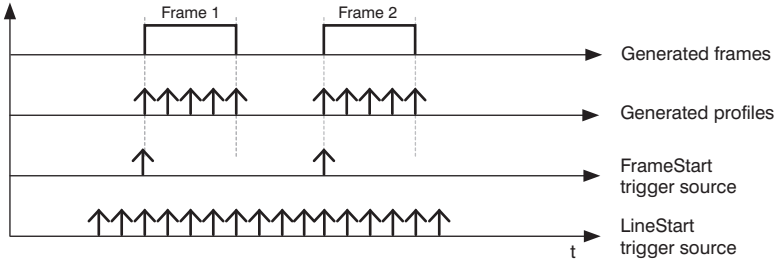
ATTENTION!
It is not possible to activate both “FrameStart” and “AcquisitionActive” since both modes share the same scanner resources.

Following some examples with timechart to illustrate the relationship between “LineStart”, “FrameStart” and “AcquisitionActive”.

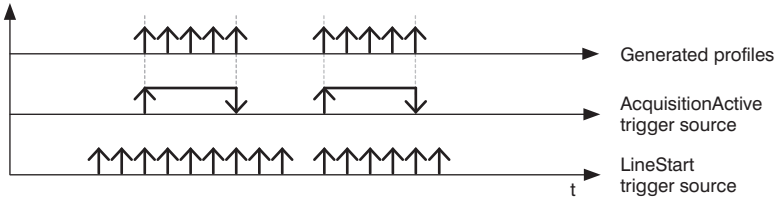
Example 1:
Height[Scan3DExtraction0] = 5
TriggerSelector = LineStart
TriggerSource = Off, Line, Encoder or Software
TriggerSelector = FrameStart
TriggerMode = Off
TriggerSelector = AcquisitionActive
TriggerMode = Off



Example 2:
Height[Scan3DExtraction0] = 5
TriggerSelector = LineStart
TriggerSource = Off, Line, Encoder or Software
TriggerSelector = FrameStart
TriggerMode = On
TriggerSource = Line1
TriggerSelector = AcquisitionActive
TriggerMode = Off



Example 3:
Height[Scan3DExtraction0] = 1
TriggerSelector = LineStart
TriggerSource = Off, Line, Encoder or Software
TriggerSelector = FrameStart
TriggerMode = Off
TriggerSelector = AcquisitionActive
TriggerMode = On
TriggerSource = Line3



Command	TriggerMode
Access Mode	Read/write
Parameter	On/Off
Description	TriggerMode switches the trigger function selected in the feature TriggerSelector on or off. If LineStart is selected: • **Off:** The sensor is in Intern trigger mode. The sensor generates profiles according to the value set in feature AcquisitionLineRate. • **On:** The sensor generates profiles from the source defined in TriggerSource. If FrameStart is selected: • **Off:** The sensor is in dynamic mode, the frames are sent without wating for frame trigger signal. • **On:** The sensor is in FixedFrame mode. The sensor sends a frame only when it receives a trigger signal definded in TriggerSource. If AcquisitionActive is selected: • **On:** The global enable is activated. • Off: Global disable is deactivated. **NOTE!** It is not possible to switch on “FrameStart” and “AcquisitionActive” at the same time, because both trigger functions share some of the sensor‘s resources.

Command	TriggerSource
Access Mode	Read/write
Parameter	Line1/Line2/Line3/Line4/Encoder1/Encoder2/Software
Description	**Line1...Line4:** Depending on the trigger function selected in TriggerSelector feature: With “LineStart” function the sensor will generate a profile only when the selected line is activated (SyncIn mode). With “FrameStart” function the sensor will send one frame each time the selected line is activated (fixed mode). With “AcquisitionActive” function the sensor will generate profiles as long as the selected line is active (ProfileEnable mode). Encoder1: Only available in “LineStart” trigger function. The sensor will generate a profile with each HTL encoder step. The HTL encoder should be connected to the profile sensor and activated (please refer to the weCat3D MLSL/MLWL Profile Sensors Operating Instructions on www.wenglor.com on how to connect an encoder). Encoder2: Only available in “LineStart” trigger function. The sensor will generate a profile with each TTL encoder step. The TTL encoder should be connected to the sensor and activated (please refer to the MLSL/MLWL Profile Sensors Operating Instructions on www.wenglor.com on how to connect an encoder). Software: Available in “LineStart” and “FrameStart” trigger functions. With “LineStart” function the sensor scans one profile each time a trigger software command is received. With “FrameStart” function the sensor sends one frame each time a trigger software command is received.  **NOTE!** It is not possible to select “Software” as a trigger source for both “LineStart” and “FrameStart” at the same time.

Command	TriggerActivation
Access Mode	Read/write
Parameter	RisingEdge/FallingEdge/LevelHigh/LevelLow
Description	Only available if the selected TriggerSource is Line1...Line4. It defines the activation signal. “RisingEdge” and “FallingEdge” are available for the trigger functions “LineStart” and “FrameStart”. “LevelHigh” and “LevelLow” are available only for “AcquisitionActive” trigger function.

Command	TriggerDelay
Access Mode	Read/write
Parameter	0...100000
Description	Sets a constant delay for profile acquisition in µs (only available at intern trigger source). The allowed value depends on the values of AcquisitionLineRate and ExposureTime.

Command	TriggerDivider
Access Mode	Read/write
Parameter	0...65535
Description	Sets the division factor for the external trigger source. This feature is available in “Encoder” and “Line1...Line4” trigger source. For Example, if the TriggerDivider is set to 150, the sensor triggers on the encoder values 150, 300, 450 and so on.

Command	TriggerSoftware
Access Mode	Command button
Description	Sends a software trigger command to weCat3D Profile Sensor.

Command	AcquisitionStart
Access Mode	Command button
Description	The command starts the acquisition of profiles (image) from the weCat3D Profile Sensor (command button).

Command	AcquisitionStop
Access Mode	Command button
Description	The command stops the acquisition of profiles (image) from the weCat3D Profile Sensor (command button).

7.3 Digital I/O Control (E/A)

Command	SyncOut (deprecated)		
Access Mode	Read/write		
Parameter	Value range: 0...100 000	Default	0
Description	This command sets the signal‘s width on “SyncOut” pin in µs (see weCat3D MLSL/MLWL Profile Sensors Operating Instructions).		

Command	SyncOutDelay (deprecated)		
Access Mode	Read/write		
Parameter	Value range: 0...100 000	Default	0
Description	This command sets a constant delay between the sensor‘s trigger and the “SyncOut” signal in µs (see weCat3D MLSL/MLWL Profile Sensors Operating Instructions).		

NOTE!
The features SyncOut and SyncOutDelay have been deprecated since they are not defined in the GenICam Standard Features Naming Conversions (SFNC). The features are set to invisible. Old programs can still use these two features. Both have been replaced by other features (see section 7.4). It is highly recommended to use the new defined features which apply to the GenICam SFNC.

Command	LineSelector
Access Mode	Read/write
Parameter	Line1/Line2/Line3/Line4
Description	Selects the user I/O to be configured.

Command	LineMode
Access Mode	Read/write
Parameter	Input/Output
Description	Defines the selected line as input or output.

Command	LineInverter
Access Mode	Read/write
Parameter	True/False
Description	Controls the signal‘s inversion of the selected line. Only available, if the selected line is “Input”.

Command	LineStatus
Access Mode	Read only
Parameter	True/False
Description	Displays the current status of the selected line.

Command	LineSource
Access Mode	Read/write
Parameter	UserOutput/Timer1Active
Description	Defines the control of ouput signal for the selected line. Only available, if the selected line is “Output”. • “UserOutput”: allows the user to activate the output signal manually. See the feature UserOutputValue. • “Time1Active”: The output signal is activated by Timer1, see CounterAndTimerControl.

Command	UserOutputValue
Access Mode	Read/write
Parameter	True/False
Description	Activates the signal of the selected line. The selected line should be “Output” and the LineSource feature value should be “UserOutput”.

Command	OutputFunction
Access Mode	Read/write
Parameter	Push_Pull/PNP/NPN
Description	Controls the current electrical format of the selected line. Only available, if the selected line is “Output”.

Command	InputLoad
Access Mode	Read/write
Parameter	True/False
Description	Controls the current electrical format of the selected user line. Only available, if the selected line is “Input”.

7.4 Counter and Timer Control

Command	TimerSelector
Access Mode	Read/write
Parameter	Timer1
Description	Selects the timer to be configured (corresponds to SyncOut, please see example below).

Command	TimerTriggerSource
Access Mode	Read/write
Parameter	LineTrigger
Description	Selects the trigger source for starting the timer.

Command	TimeDuration
Access Mode	Read/write
Parameter	0...100000
Description	Defines the active signal‘s duration (in µs) of the timer.

Command	TimerDelay
Access Mode	Read/write
Parameter	0...100000
Description	Defines the delay (in µs) between triggering and activating the timer.

The following example illustrates how to set up E/A4 to SyncOut function
(sensor settings: Signal Width = 1000 µs and SyncOutDelay = 5000 µs):

in DigitalIOControl:
LineSelector = Line4
LineMode = Output
LineSource = Timer1Active

in CounterAndTimerControl:
TimerSelector = Timer1
TimerTriggerSource = LineTrigger
TimerDuration = 1000 µs
TimerDelay = 5000 µs

7.5 Encoder Control

It is possible to connect two types of encoders to the profile sensor: HTL encoder through E/A1 and E/A2 and TTL encoder through the specific input pins. Only one encoder can trigger the sensor in “LineStart” function. Please refer to the weCat3D MLSL/MLWL Profile Sensors Operating Instructions on how to connect and activate the encoders.

Command	EncoderSelector
Access Mode	Read/write
Parameter	Encoder1/Encoder2
Description	Selects the encoder to be configured. Encoder 1 refers to HTL encoder and encoder 2 refers to TTL encoder.

Command	EncoderSourceA
Access Mode	Read/write
Parameter	Line1/Off
Description	Selects the input line for encoder A signal. Only available for Encoder1 (HTL).

Command	EncoderSourceB
Access Mode	Read/write
Parameter	Line2/Off
Description	Selects the input line for encoder B signal. Only available for Encoder1 (HTL).

NOTE!
If the features EncoderSourceA or EncoderSourceB are switched off, the HTL encoder is deactivated and the sensor can be triggered through TTL encoder.

Command	EncoderOutputMode	
Access Mode	Read/write	
Parameter	PositionUp/PositionDown/DirectionUp/DirectionDown/Motion	
Description	PositionUp:	The encoder triggers the sensor only in one direction (counting up) and only if the new encoder value is higher than the highest last value (please refer to the weCat3D MLSL/MLWL Profile Sensors Operating Instructions for more details).
	PositionDown:	Same as “PositionUp”, but in opposite direction.
	DirectionUp:	The encoder triggers the sensor only in one direction without considering the last position.
	DirectionDown:	Same as DirectionUp, but in opposite direction.
	Motion:	The encoder triggers the sensor in each direction (counting up or down).

Command	EncoderResetSource
Access Mode	Read/write
Parameter	Line1/Line2/Line3/Line4/Off
Description	Selects the signals to reset both encoders.

Command	EncoderResetActivation
Access Mode	Read/write
Parameter	AnyEdge/RisingEdge/FailingEdge
Description	Selects the activation mode of the EncoderResetSource signal.

Command	EncoderReset
Access Mode	Command button
Parameter	Encoder1/Encoder2
Description	Software command to reset both encoders.

Command	EncoderValue
Access Mode	Read only
Response	Encoder specific
Description	Displays the encoder value of the selected encoder.

7.6 Profile Control

Command	SignalEnable		
Access Mode	Read/write		
Parameter	First/Second/First_and_Second	Default	First
Description	The command sets the number of signals given out per position. For further information see the weCat3D MLSL/MLWL Profile Sensors Operating Instructions.		

Command	SignalSelection		
Access Mode	Read/write		
Parameter	Top/Strength/Signal Width/Bottom	Default	Strength
Description	The command sorts the signals that are received by the internal camera according to one of the listed criteria. There are four criteria for signal sorting in SignalSelection: top, strength, width and bottom. For example: if the sorting criteria in SignalSelection is set to top, then the sensor will sort the signals based on their length to Signal1 and Signal2. For further information see the weCat3D MLSL/MLWL Profile Sensors Operating Instructions.		

Command	SignalWidthMin		
Access Mode	Read/write		
Parameter	0...63 pixels	Default	0
Description	This is a filter to define the minimum peak width for the evaluation in pixels.		

Command	SignalWidthMax		
Access Mode	Read/write		
Parameter	0...63 pixels	Default	63
Description	This is a filter to define the maximum peak width for the evaluation in pixels.		

Command	SignalStrengthMin		
Access Mode	Read/write		
Parameter	0...1023	Default	0
Description	Defines the minimum signal strength to evaluate the signal.		

The features SignalWidthMax and SignalWidthMin define the peak maximum and minimum width in pixels for evaluation, while SignalStrengthMin defines the signal‘s minimum strength.

7.7 Device Control

Most of the features in the Device Control category are for displaying information about the connected sensor, thus they are hardware dependent.

Command	DeviceType
Access Mode	Read only
Response	Transmitter
Description	General info about the device

Command	DeviceModelName
Access Mode	Read only
Response	Sensor specific
Description	General info about the device

Command	DeviceVendorName
Access Mode	Read only
Response	wenglor sensoric GmbH
Description	Name of the device vendor

Command	DeviceVersion
Access Mode	Read only
Response	Sensor specific
Description	General Info about the device

Command	DeviceFirmwareVersion
Access Mode	Read only
Response	Sensor specific
Description	General info about the device

Command	DeviceSerialNumber
Access Mode	Read only
Response	Sensor specific
Description	General Info about the device

Command	DeviceTLType
Access Mode	Read only
Response	GigEVision
Description	General Info about the transport layer type of the device.

Command	DeviceTemperatureSelector
Access Mode	Read/write
Parameter	CPU
Description	Selects the location of the device where the temperature is measured.

Command	DeviceTemperature
Access Mode	Read only
Response	Location specific
Description	Device temperature at the selected location in degrees Celsius (°C).

Command	DeviceReset
Access Mode	Command button
Description	Reset of the device to its power up state. **NOTE!** For updating all feature values after a reset command, the GigE Vision client should be disconnected from the profile sensor and reconnected again.

Command	AsciiCommand
Access Mode	Write only (string)
Description	Sends an ASCII command to the weCat3D profile sensor. List of supported ASCII commands are summarized below. A detailed description is given in the SDK package of the weCat3D profile sensor which can be found on the wenglor web page. Sending an ASCII command is recommended only if the feature is not directly implemented in the GigE Vision feature tree.

NOTE!
Sending ASCII commands could result in a defined behaviour. ASCII commands should be sent only in StopAcquisition mode.

ASCII commands:

SetExposureTime=x	SetSyncOut=x
SetAutoExposureMode=x	SetSyncOutDelay=x
SetAutoExposureTimeMin=x	SetSignalEnable=x
SetAutoExposureTimeMax=x	SetSignalWidthMin=x
SetAutoExposureIntensityRangeMin=x	SetSignalWidthMax=x
SetAutoExposureIntensityRangeMax=x	SetSignalSelection=x
SetAutoExposureRangeXMin=x	SetLinearizationMode=x
SetAutoExposureRangeXMax=x	SetEncoderCountDirection=x
SetAcquisitionLineTime=x	SetROI1WidthX=x
SetHDR=x	SetROI1OffsetX=x
SetExposureTime2=x	SetROI1StepX=x
SetLaserDeactivated=x	SetROI1HeightZ=x
SetUserLED=x	SetROI1OffsetZ=x
SetSignalContentZ=x	SetROI1StepZ=x
SetSignalContentStrength=x	SetEA1Function=x
SetSignalContentWidth=x	SetEA1FunctionLaserOff=x
SetSignalContentReserved=x	SetEA1FunctionProfileEnable=x
SetSocketConnectionTimeout=x	SetEA1FunctionResetCounter=x
SetHeartBeat=x	SetEA1ResetCounterRepeat=x
SetResetEncoder\r	SetEA1ResetCounterSignaledge=x
SetResetPictureCounter	SetEA1ResetCounterBaseTimeCounter=x
SetSettingsSave=x	SetEA1ResetCounterPictureCounter=x
SetResetBaseTime	SetEA1ResetCounterEncoderHTL=x
SetSettingsLoad=x	SetEA1ResetCounterEncoderTTLRS422=x
SetTriggerSource=x	SetEA1InputFunction=x
SetTriggerEncoderStep=x	SetEA1InputLoad=x
SetTriggerDelay=x	SetEA1Output=x
SetEncoderTriggerFunction=x	SetEA1OutputFunction=x
SetTriggerAmountProfilesY=x	SetEA1FunctionInputCounter=x
SetAmountProfilesY=x	

7.8 Scan3dControl

Command	Scan3dCoordinateSelector
Access Mode	Read/write
Parameter	CoordinateA/CoordinateB/CoordinateC
Description	Selects the idividual axis for 3D information/transformation. CoordinateA is for X axis CoordinateB is for encoder (Y) axis CoordinateC is for Z axis

Command	Scan3dCoordinateScale
Access Mode	Read/write (see conditions below)
Description	Scale factor used to transfrom a pixel value (in Mono16 images) or Encoder/Timestamp value (if CoordinateB is selected) into mm coordinates. The access mode and the value of the feature is updated according to the selected values in PixelFormat and Scan3dCoordinateSelector as follows: Coord3D_ABC32f: Scan3dCoordinateSelector = CoordinateA Scan3dCoordinateScale = 1 (Read only) Scan3dCoordinateSelector = CoordinateB Scan3dCoordinateScale = 1 (Read/ write) Scan3dCoordinateSelector = CoordinateC Scan3dCoordinateScale = 1 (Read only) Mono16: Scan3dCoordinateSelector = CoordinateA Scan3dCoordinateScale = Device specific (Read/write) Scan3dCoordinateSelector = CoordinateB Scan3dCoordinateScale = 1 (Read/ write) Scan3dCoordinateSelector = CoordinateC Scan3dCoordinateScale = Device specific (Read only)

There are two ways to compute the Y coordinates (Coordinate B) in the weCat3DGigeInterface: Using the Encoder or using the Timestamp, see feature Scan3dCoordinateSource.

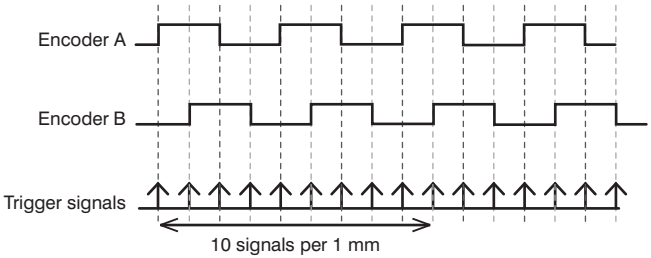


Fig. 9: Encoder trigger signals

Example:

If Scan3dCoordinateSource = Encoder and encoder trigger is 10 signals per 1 mm, then Scan3dCoordinateScale = 1/10 = 0.1

If Scan3dCoordinateSource = Timestamp, the sensor AcquisitionLineRate = 100 [Hz] and the linear speed of the conveyor belt is 10 [mm/s] then
Scan3dCoordinateScale = 10 (speed of conveyor belt) / 100 (sensor AcquisitionLineRate) * 10 ^ -6 (convert from μs to s) = 0.001

Command	Scan3dCoordinateOffset
Access Mode	Read/(write, see conditions below)
Description	Offset factor, used to transform a pixel value (in Mono16/RGB16/RGB16Planar images) or encoder value (if CoordinateB is selected) into mm coordinates. The access mode and the value of the feature is updated according to the selected values in PixelFormat and Scan3dCoordinateSelector as follows: Coord3D_ABC32f: Scan3dCoordinateSelector = CoordinateA Scan3dCoordinateOffset = 0 (Read only) Scan3dCoordinateSelector = CoordinateB Scan3dCoordinateOffset = 0 (Read/ write) Scan3dCoordinateSelector = CoordinateC Scan3dCoordinateOffset = 0 (Read only) Mono16: Scan3dCoordinateSelector = CoordinateA Scan3dCoordinateOffset = Device specific (Read/write) Scan3dCoordinateSelector = CoordinateB Scan3dCoordinateOffset = 0 (Read/ write) Scan3dCoordinateSelector = CoordinateC Scan3dCoordinateOffset = Device specific (Read only)

Command	Scan3dCoordinateSource
Access Mode	Read/write
Parameter	Encoder/Timestamp
Description	This feature is only available when CoordinateB in Scan3dCoordinateSelector is selected. This feature defines the source to compute the Y coordinate for the Range component of the image in Coord3D_ABD32f pixel format.

Command	Scan3dInvalidDataFlag
Access Mode	Read only
Parameter	True/false
Description	Enables the definition of a non-valid point flag value in the received data. The flag is enabled only in CoordinateC (Z axis). The feature is not available if CoordinateB is selected.

Command	Scan3dInvalidDataValue
Access Mode	Read only
Description	The value which indentifies a non-valid pixel/point if Scan3dInvalidDataFlag is enabled. The flag is only enabled in CoordinateC (Z axis) and the value is 0. The feature is not available if CoordinateB is selected.

Command	Scan3dAxisMin
Access Mode	Read only
Description	The minimum valid transmitted coordinate value of the selected axis. The feature is not available if CoordinateB is selected.

Command	Scan3dAxisMax
Access Mode	Read only
Description	The maximum valid transmitted coordinate value of the selected axis. The feature is not available if CoordinateB is selected.

7.9 ChunkDataControl

Use ChunkData instead of ExtraData to get data (like encoder value or state of the E/A's) related to each scan line (row) in the received image.
ChunkData is implemented according to the latest GigE Vision standard introduced in version 2.0.
Use the feature ChunkScanLineSelector to read the chunk value from a specific scan line in the received image.

Command	ChunkDataSelector
Access Mode	Read/write
Parameter	ChunkPictureCounter / ChunkTimestamp / ChunkLineStatusAll / ChunkEncoderValue / ChunkScannerStatus
Description	Selects the chunk feature to enable or control.

Command	ChunkEnable
Access Mode	Read/write
Parameter	True/false
Description	Enables/disables the selected chunk feature to be transmitted with data stream.

Command	ChunkScanLineSelector
Access Mode	Read/write
Description	Index for vector representation of one chunk value per line in the received data.

Command	ChunkPictureCounter
Access Mode	Read only
Description	Returns the value of the picture counter of the selected line (row) in the received data ChunkPictureCounter[ChunkScanLineSelector]

Command	ChunkTimestamp
Access Mode	Read only
Description	Returns the value of the timestamp of the selected line (row) in the received data ChunkTimestamp[ChunkScanLineSelector]

Command	ChunkTemperature
Access Mode	Read only
Description	Returns the value of the temperature of the selected line (row) in the received data ChunkTemperature[ChunkScanLineSelector]

Command	ChunkLineStatusAll
Access Mode	Read only
Description	Returns the value of the LineStatusAll of the selected line (row) in the received data ChunkLineStatusAll[ChunkScanLineSelector]. The ChunkLineStatusAll encodes the state of all lines E/A1...E/A4 at the time of generating the profile as follows: bit0: E/A1 status bit1: E/A2 status bit2: E/A3 status bit3: E/A4 status

Command	ChunkEncoderValue
Access Mode	Read only
Description	Returns the value of the activated encoder value of the selected line (row) in the received data ChunkEncoderValue[ChunkScanLineSelector]

Command	ChunkScannerState
Access Mode	Read only
Description	Returns the value of the sensor state of the selected line (row) in the received data ChunkScannerState[ChunkScanLineSelector].The ChunkScannerState encodes the state of the profile sensor at the time of generating the profile as follows: bit0: Ready OK (0=NOK; 1=OK) bit1: Exposure time OK (0=NOK; 1=OK) bit2...bit4: Internal use only bit5: Frame request too fast (0=frame request is OK; 1=frame request is too fast) bit6: Laser enable (0=Off; 1=On)

8. Troubleshooting

8.1 Connection Broken

In the case that the connection between the weCat3D GigE Vision interface (service) and the sensor is broken, the interface sends an Event message (Event No.: 10) with the error message: connection to the sensor is lost. After that, the interface service will close itself automatically.

8.2 No Connection to the Sensor

In the case that the weCat3D GigE Vision interface fails to connect to the sensor, the interface will not start and the GigE Vision server will not be available online! This case happens when the sensor is already connected to other clients or when the interface failed to receive data from the sensor.
It is possible to check the connection status of the profile sensor by the web interface. Refer to weCat3D MLSL/MLWL Profile Sensors Operating Instructions.

8.3 The weCat3D GigE Interface Is Not Available Online

If the given server IP is not available in the system, the interface will fail to go online. As a result, the client can not detect the interface (to see a list of available IPs just start the weCat3D GigE interface without any input parameters or with the input argument "-h").
Possible solutions are either to add the IP address manually into the operating system or to start the application with the option "-n" (see section 6).

8.4 The Sensor Triggers Too Fast

The bit5 in sensor status is set to 1 (see the ExtraData feature) and the feature AcquisitionStatus will be "TooFast".

8.5 The sensor Sends Profiles Faster than the Network Can Handle

This happens when the network card is not compatible with GigE Vision or the network rate is 100 Mbit instead of 1 Gbit. This results in loosing some of the profiles (see section 5 on how to set up the network adapter).

8.6 The client does not receive images

If the weCat3D GigE interface is located and running on the same machine where the GigE client software is running, then in some cases it is necessary to deactivate the additional GigE Vision driver of the client software directly inside the connection settings of the active Local Area Connection.