Z-Trak™ 3D Profile Sensors

User's Manual

sensors | cameras | frame grabbers | processors | software | vision solutions | 3D imaging

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Notice

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About Teledyne Digital Imaging
Teledyne Digital Imaging is an international high performance semiconductor and Electronics Company that designs, develops, manufactures, and markets digital imaging products and solutions, in addition to providing wafer foundry services.

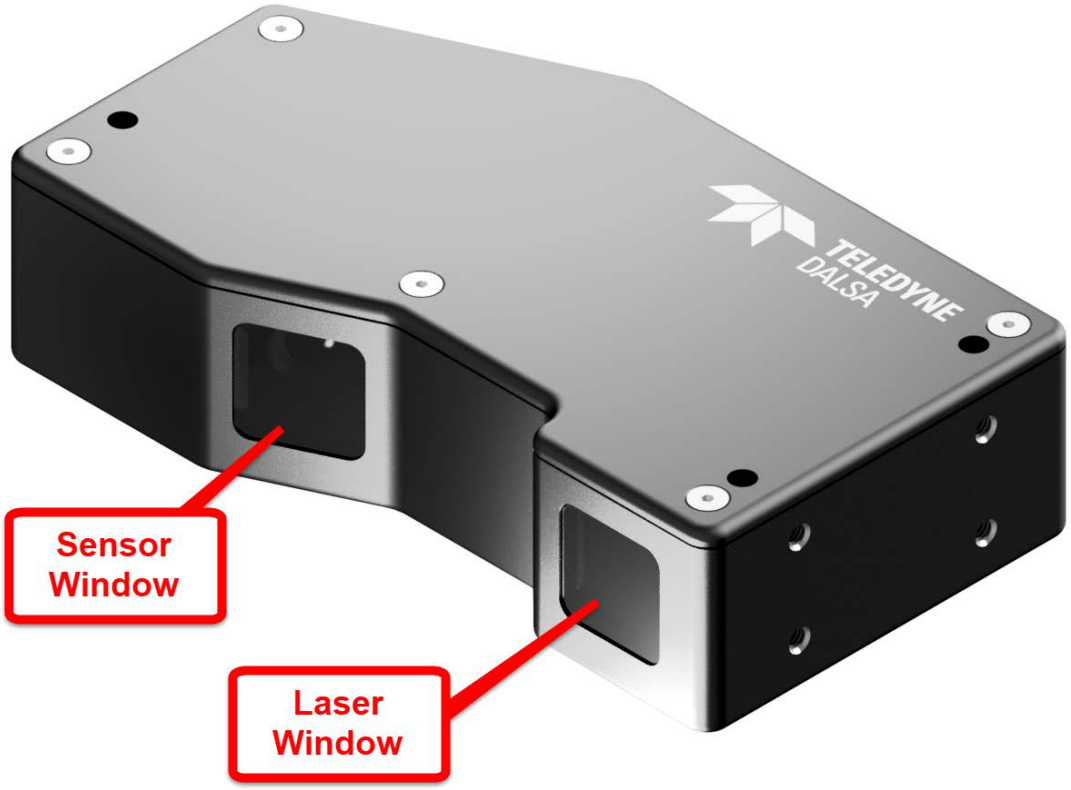
Teledyne Digital Imaging offers the widest range of machine vision components in the world. From industry-leading image sensors through powerful and sophisticated cameras, frame grabbers, vision processors and software to easy-to-use vision appliances and custom vision modules.

Contents

Z-Trak Series Overview

Description

The Z-Trak series of high performance high resolution 3D laser profilers perform height measurements by means of laser triangulation. Profiler sensors are factory calibrated and come in a variety of models to cover measurement ranges from 10mm to 1100mm. Z-Trak 3D sensors come bundled with powerful free software packages. Z-Trak 3D sensors comply with AIA's GigE Vision and EMVA's GenICam 3.0(SFNC 2.4) standards. All Z-Trak models come in IP67 rated enclosures and are ideal for in-line measurement applications in electronics/semiconductor, logistics, automotive, wood processing and food processing markets.



Feature Highlights

- Compact factory calibrated 3D Laser triangulation scanners integrated within a ruggedized protective enclosure *(IP67).*
- Z-Trak is designed as an optimized triangulation system incorporating selected optical components such as laser, image sensor and optics.
- Two multicolor status LEDs quickly provide visual indications of profiler connectivity and laser readiness.
- Broad range of models available with different horizontal measurement widths (X), Measurement Range (MR) and standoff/clearance (SD).
- 3D profile and surface images using an internal or external frame trigger.
- Saturation compensation for high diffusion parts and strong laser power.
- Programmable threshold for dark parts inspections and noise removal.
- Hardware sub pixel accuracy for Z depth values.
- Selectable multiple peak position sorter for optical specular reflections.
- Real time automatic or manual laser power control during scan.
- Fast and evenly spaced scans on Y axis using internal profile triggers or quadrature encoder input.
- Laser reflectivity and 3D profile real time graphic display available on PC.
- Supports GenICam 3D output format.
- Compatible with Sapera LT SDK 8.60 (or higher), Sapera Processing 9.0 (or higher) and Sherlock 8.0 (or higher).
- Includes Free Sapera Processing 3D tool run-time license and Free Sherlock 8.0 3D.
- Third party software supporting using GenICam formats or 16-bit monochrome output.

Hardware Overview

- Supports Power over Ethernet (PoE) or auxiliary power input.
- GigE Vision 1.2 compliant.
- Gigabit Ethernet (GigE) interconnection to a computer via the “M12 8-pin X-coded” connector.
- Native Teledyne DALSA Trigger-to-Image Reliability design framework.
- I/O via the “M16 24-pin” connector.
- 2 general purpose isolated inputs.
- 2 differential RS-422 inputs (phase A and B) for shaft quadrature encoder sources.
- 2 general purpose opto-coupled outputs.
- Flexible general purpose Counter and Timer functions available for internal and external controls.
- 2 sets of User Settings to store and recall device configurations.
- Refer to the Operation Reference and Technical Specifications section of the manual for full details.

Device Firmware

Z-Trak firmware contains open source software provided under different open source software licenses. More information about these open source licenses can be found in the documentation that accompanies the firmware, which is available on the Teledyne DALSA website at www.teledynedalsa.com.

Important: Firmware updates are available for download from the Teledyne DALSA web site www.teledynedalsa.com/imaging/support/downloads. Choose new firmware from the available download sections, then choose the zip file download specific to your Z-Trak model.

When using Sapera LT, update the profiler firmware using Z-Expert (see Updating Firmware via File Access in Z-Expert). The profiler firmware can easily be upgraded within your own application via the API. The Z-Trak has a failsafe scheme which prevents unrecoverable errors even in the case of a power interruption during the upload sequence.

Models

This manual covers the current Z-Trak models summarized in the table. Common Specifications and details for each model follow these tables.

Contact Teledyne DALSA sales for availability information.

Model	Laser Color	Measurement Range (mm)	Near FOV- Far FOV (mm)	Part Number	Part Number Description
LP1-1010-B2	Blue 405nm	10	8.4 to 9.7	3D-L10T-4052L-O10010000	Z-Trak LP1-1010-B2 MR:0010mm, Laser:Blue-405nm:2M, Case:X10
LP1-1040-B2	Blue 405nm	40	20 to 27.6	3D-L10S-4052L-O10040000	Z-Trak LP1-1040-B2 MR:0040mm, Laser:Blue-405nm:2M, Case:X20
LP1-1060-B2	Blue 405nm	60	25.7 to 39	3D-L10S-4052L-O10060000	Z-Trak LP1-1060-B2 MR:0060mm, Laser:Blue-405nm:2M, Case:X20
LP1-1120-R2	Red 660nm	120	42.8 to 80.8	3D-L10S-6602L-O10120000	Z-Trak LP1-1120-R2 MR:0120mm, Laser:Red-660nm:2M, Case:X20
LP1-1200-R2	Red 660nm	200	63.7 to 134.9	3D-L10S-6602L-O10200000	Z-Trak LP1-1200-R2 MR:0200mm, Laser:Red-660nm:2M, Case:X20
LP1-1250-R2	Red 660nm	250	132 to 268	3D-L10M-6602L-O10250000	Z-Trak LP1-1250-R2 MR:0250mm, Laser:Red-660nm:2M, Case:X30
LP1-1400-R3	Red 660nm	400	223 to 520	3D-L10M-6602H-O10400000	Z-Trak LP1-1400-R3 MR:0400mm, Laser:Red-660nm:3R, Case:X30
LP1-1800-R3	Red 660nm	800	400 to 1045	3D-L10L-6602H-O10800000	Z-Trak LP1-1800-R3 MR:0800mm, Laser:Red-660nm:3R, Case:X40
LP1-11100-R3	Red 660nm	1100	411 to 1520	3D-L10L-6602H-O11100000	Z-Trak LP1-11100-R3 MR:1100mm, Laser:Red-660nm:3R, Case:X40

Part Numbers: Cables and Accessories

Part Number	Description	Manufacturer	Manufacturer's P/N
3D-AC00-M16F5M	M16 24-pin to Flying leads 5m (Control and IO cable)	Alysium	A65-5504-TEL(5) rev04
3D-AC00-M16F3M	M16 24-pin to Flying leads 3m (Control and IO cable)	CEI	Z-TRAK BX-03M revA
3D-AC00-M12X5M	M12X-R45 POE 5M (Data cable)	CEI	MI 1-7-L0-05M
3D-AM00-MOUNT1	1/4-20 Mount	Teledyne DALSA	n/a
3D-AP00-24V20W0	Power supply 24V/20W DIN	Meanwell	MDR-20-24

Cable Manufactures Contact Information

Components Express, Inc. (CEI)	http://www.componentsexpress.com/
Alysium-Tech	https://www.alysium.com/
Turck Inc.	https://www.turck.com/
Metz Connect GmbH	https://www.metz-connect.com
Harting Technology Group	https://www.harting.com/DE/en-gb

Sapera LT Development Software

Teledyne DALSA Software Platform for Microsoft Windows	
Sapera LT version 8.60 or later for Windows. Includes Sapera Network Imaging Package and GigE Vision Imaging Driver, Sapera LT Runtime and Z-Expert. Provides everything you will need to configure the Line Profiler and acquire data in your applications. Sapera documentation is provided in compiled HTML help and Adobe Acrobat® (PDF).	Available for download http://www.teledynedalsa.com/imaging/support/
Sapera Processing Imaging Development Library 9.0. Provides a suite of 3D image processing functions for profiles and range maps.	Contact Teledyne DALSA Sales

About GigE Vision

GiGE VISION®	Z-Trak is 100% compliant with the GigE Vision 1.2 specification which defines the communication interface protocol used by any GigE Vision device. The device description and capabilities are contained in an XML file. For more information see: https://www.visiononline.org/vision-standards-details.cfm?type=5
GENICAM	Z-Trak implement a superset of the GenICam™ specification which defines device capabilities. This description takes the form of an XML device description file respecting the syntax defined by the GenApi module of the GenICam™ specification. For more information see www.genicam.org.

The GigE Vision Compliant XML device description file is embedded within the profiler firmware allowing GigE Vision Compliant applications access to capabilities and controls immediately after connection.

Third Party GigE Vision Development

Third Party GigE Vision Software Platform Requirements	
Support of GenICam GenApi version 2.3	General acquisition and control
Support of GenICam GenApi version 2.3	File access: firmware, configuration data, upload & download
GenICam™ support — XML camera description file	Embedded within Z-Trak

Handling Instructions

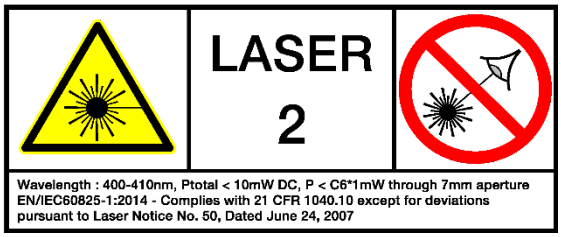
Warnings and Laser Classifications

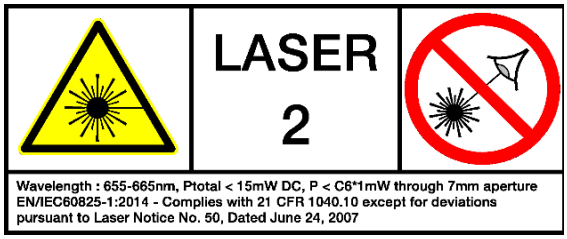
Laser profilers incorporate laser emitters that are generally low power and diffused into a line pattern (versus a focused point), but may still cause eye injuries if mishandled. These devices have laser classifications of Class 2 or Class 3 as per industry standards described in the table below.

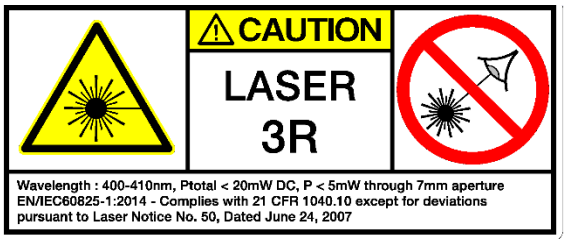
Class 2	Visible laser of no more than 1 mW continuous wave power through a 7mm diameter aperture. Safe if a worker's response to very bright lights ("Blink Reflex") is not suppressed. When exposed to the beam, a person will quickly close their eyes and turn their head before injury to the eye takes place. Not a skin or materials burn hazard.
Class 3R	Visible lasers of no more than 5 mW continuous wave power through a 7mm diameter aperture. Blink Reflex will protect workers from visible lasers unless a telescope or microscope is used. Exposure to beam may cause temporary "flash blindness". Not a skin or materials burn hazard.
Reference Source: Ontario (Canada) Ministry of Labour, etc. https://www.labour.gov.on.ca/english/hs/pubs/gl_lasers.php http://www.lasersafetyfacts.com/laserclasses.html	

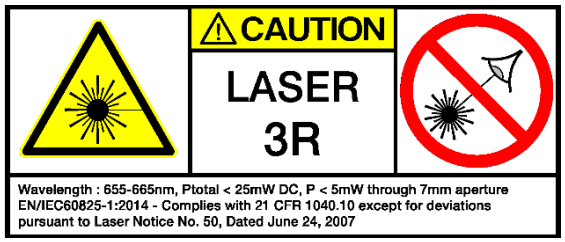
Z-Trak Label Details and Placement

The following graphics show the possible Z-Trak warning labels and their location on the profiler body.









Precautions and Cleaning Instructions

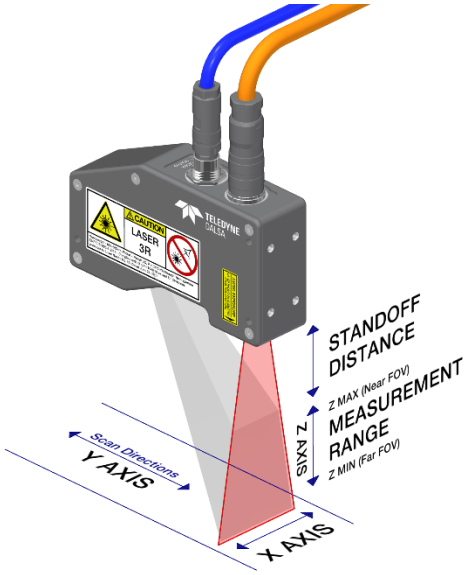
- Clean the laser and image sensor windows carefully with dry cloth lens products or lens cleaning solutions. Teledyne DALSA recommends using lint-free ESD-safe cloth wipers that do not contain particles that can scratch. The Anticon Gold 9”x 9” wiper made by Milliken is both ESD safe and suitable for class 100 environments. Another ESD acceptable wiper is the TX4025 from Texwipe.
- Mount the profiler before connecting the Ethernet and I/O cables. See Technical Specifications for mounting information and the subsection Connectors for cabling information.
- If wanted, implement an **Emergency Laser Control** described in Emergency Laser Stop Function (E-STOP).

Installation Guide

Overview

Z-Trak profile sensors are factory calibrated and require proper setup to produce correct measurements. The Z-Trak installation consists of the physical setup, electrical wiring and software installation and configuration. This section provides details for each of these steps.

The illustration below shows the 3D coordinate system and definitions used for the Z-Trak profile sensors.



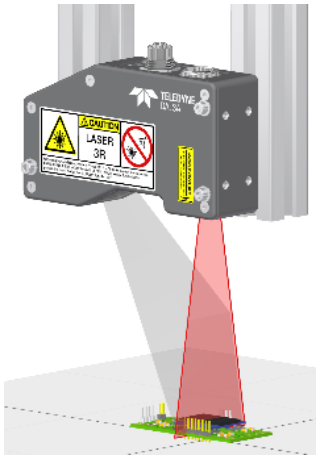
- Referring to the illustration above, the Z-Trak must be installed parallel to the Y-axis. Care must also be taken to ensure that the unit is also parallel to the X-axis as well.
- In order to obtain valid measurement results, the target object must be located in the measurement area. Laser line projection creates a trapezoidal area for the measurement range.
- This trapezoidal Measurement Range is relative to the mechanical profiler enclosure. The maximum measurement range is model dependent and cannot be increased by the user. However the measurement area (measurement AOI) can be reduce by the user to increase the profile rate.
- Standoff distance is measured from the laser exit window. This is the minimum distance the object must be located away from the sensor.
- Connector length, cable bend radius, enclosure height and standoff distance determine the minimum machine opening required for installation.

Quick Start with Z-Expert

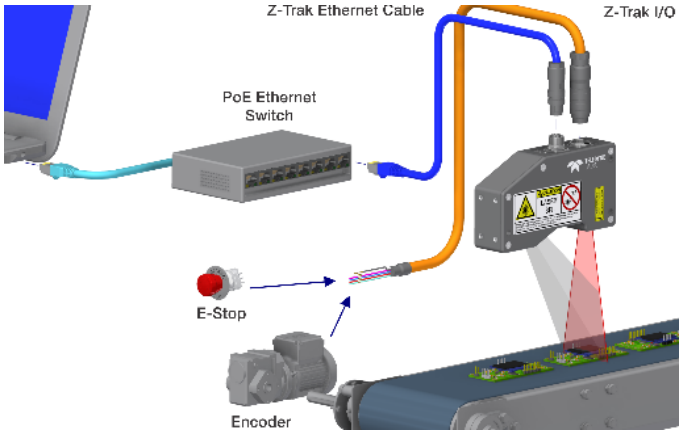
Required Material		
NO.	**Item Description**	**Model/Part**
1	Z-Trak LP1 1K 3D Profile Sensor	LP1-1040-B2 (or similar)
2	Z-Trak I/O Cable:	3D-AC00-M16F5M
3	Data-Cable: M12 8-pin x-coded with RJ45	3D-AC00-M12X5M
4	Z-Trak LP1 Mount (1/4-20)	3D-AM00-MOUNT1
5	1GigE Network Switch with power supply	1GigE NetGear Prosafe with POE (GS10BPE or similar)
6	Network cable	RJ45 to RJ45

H/W Setup

Physical Mounting



Z-Trak Wiring/Host connection



S/W Setup

Software Download

Click the link to download Sapera LT SDK (online registration required)

Click this link to download latest Z-Trak Firmware

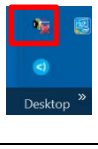
Software Install

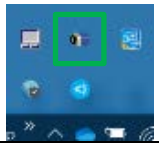
From the Download folder double click on “SaperaSDKSetup.exe” to start the installation

When prompted, select a “Teledyne DALSA 3D Device”

When prompted reboot the PC

After the reboot, double click on the tray icon to verify all Z-Trak devices are detected

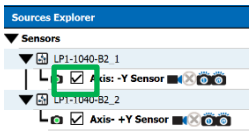
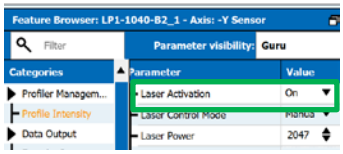
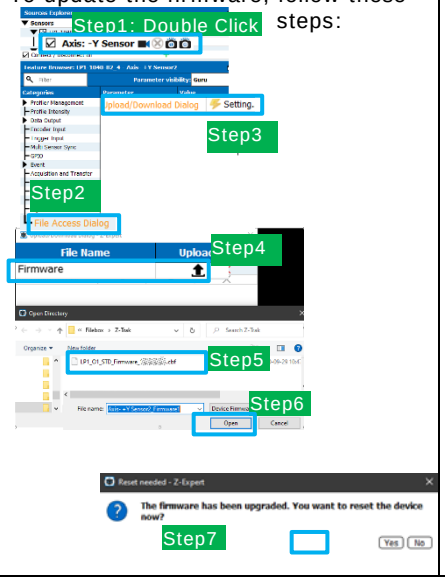
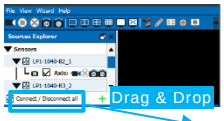
Before 

After 

Starting Z-Expert

Start Z-Expert from the desktop shortcut

A Z-Expert link is also located in Sapera LT program group in the Start menu

Using Z-Expert	Selecting Z-Trak Devices	Firmware Update	Displaying Profile/3D Surface
	From the Z-Expert Source Explorer select one or more detected sensors  Double click on sensor to edit its features Selected “Profile Intensity” category from the Feature Browser” Set Laser Activation to On  	To update the firmware, follow these steps:  	Drag and drop the selected sensor name on the display area  From the quick task bar to grab live profiles

About the Device User ID

The Z-Trak can be programmed with a user defined name to aid identifying multiple profilers connected to the network. Go to the Profile Management category to change the Device User ID.

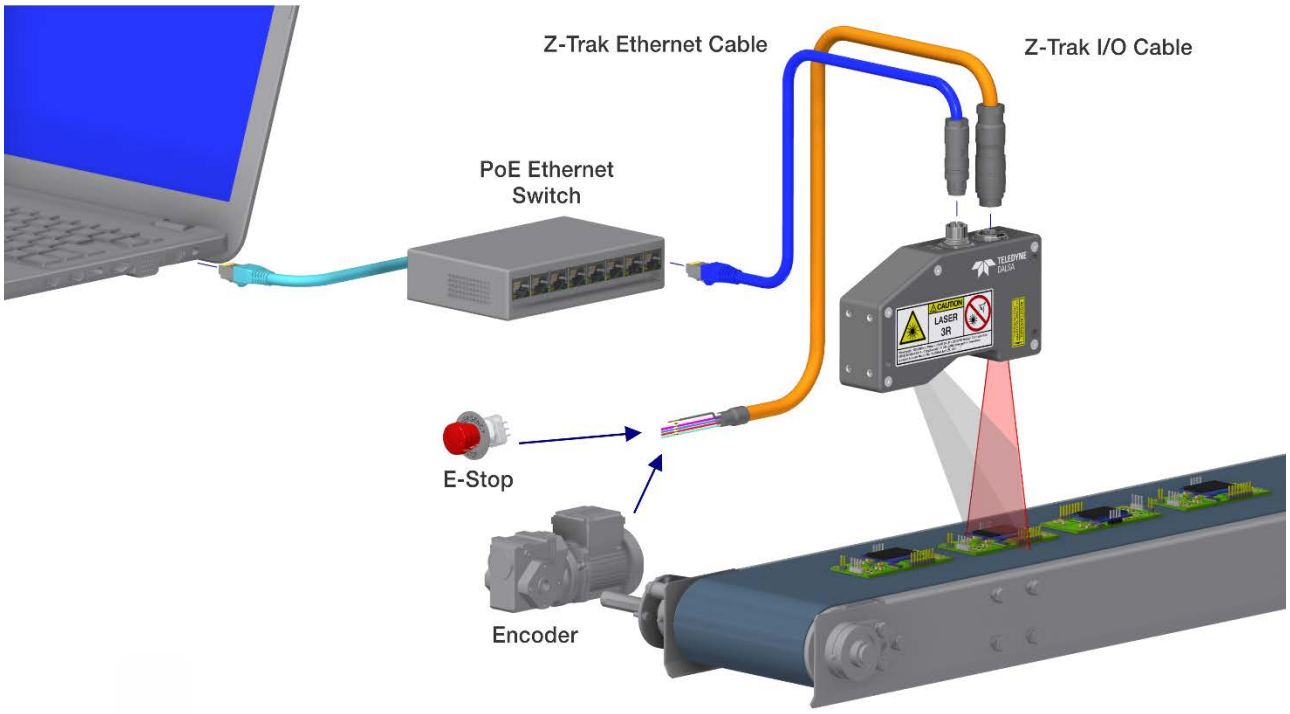
Z-Trak System Overview

Laser profiler measurement systems are composed of the profiler being controlled by a system computer and measurement targets which move relative to the profiler. Movement indicators (such as signals from a shaft encoder) are connected to a PLC which in turn triggers profile acquisitions.

Individual profiles are relative measurement data or are sequentially assembled to form 3D images of the target object.

Typical Laser Profiler Setup

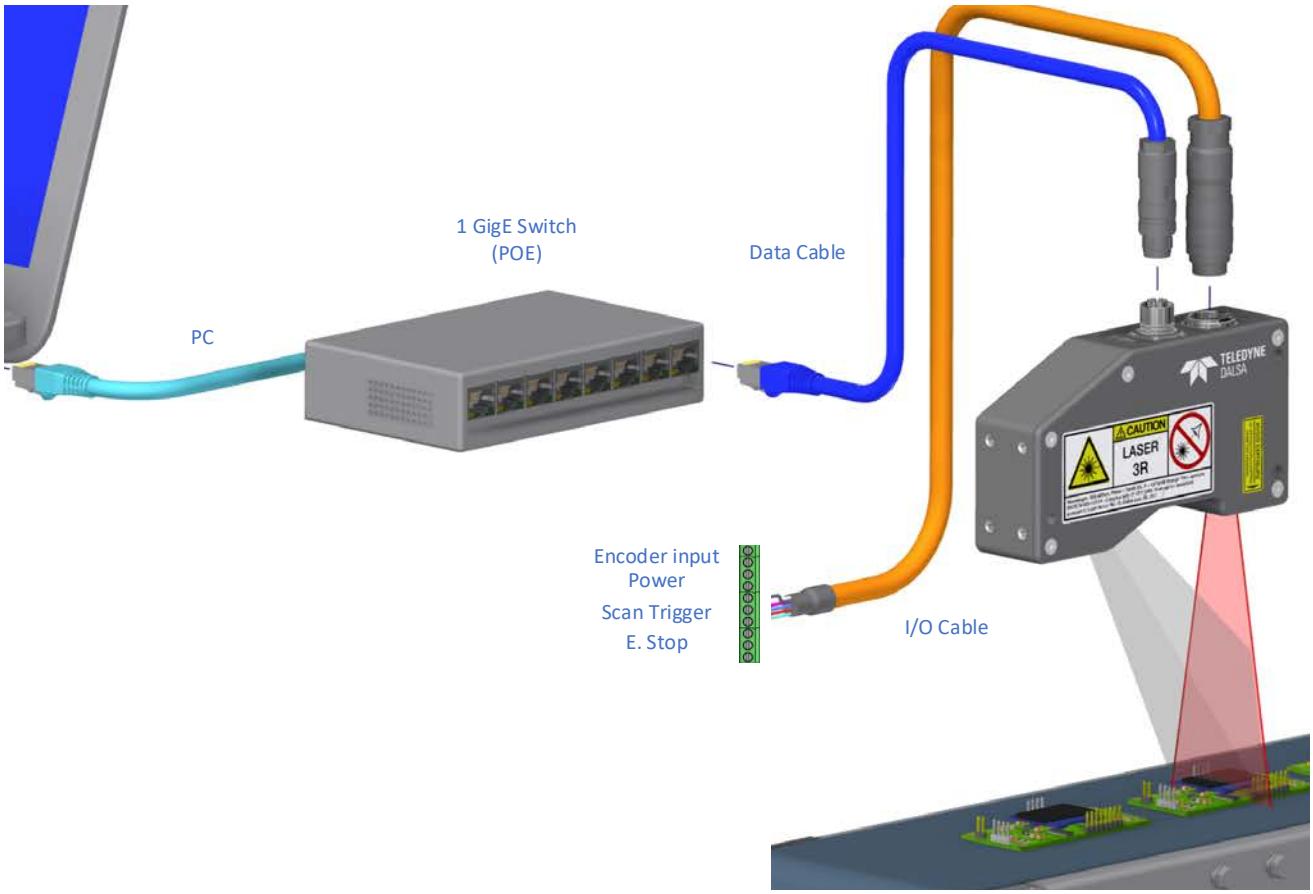
The following graphic shows a basic laser profiler system using the components mentioned in the overview. The profiler is powered by the PoE Ethernet switch which not only provides power to the sensor but also allows connecting other network devices to the computer.



Single Profiler with I/O

A M16 24-pin cable provides a method to wire input and output signals to the Z-Trak. If not using a PoE power source, the I/O cable used allows connecting a power supply.
See Part Numbers: Cables and Accessories.

Also shown is the emergency laser stop switch which can be added for additional user safety.



Mounting Methods

Referring to Technical Specifications within this manual, the Z-Trak body provides a number of screw holes (M4 screw – 0.7 thread pitch) for a variety of mounting options, where mechanical setups may move the Z-Trak or the target that's being measured along the scan directions. Typical mounting aligns the laser directly above the scanned object (i.e. 90° to the scan direction).

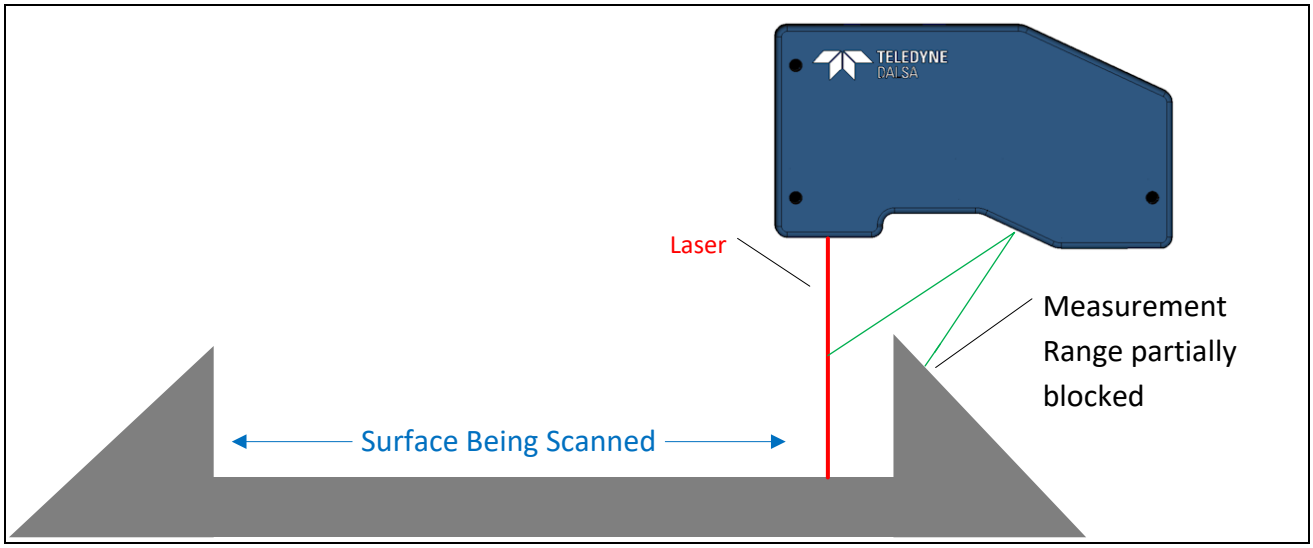
Note that Z-Trak mechanical specifications will vary for different models.

Mounting & Scan Precautions

Acquiring quality profiles or 3D reconstructions of objects entails planning for unwanted laser light reflections or acquisition blockages. The following graphics depict a few problem samples to consider.

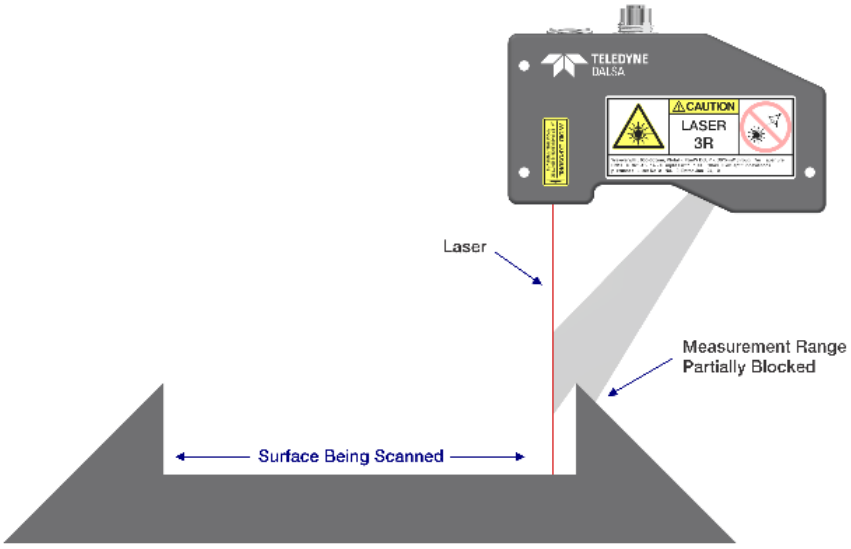
Understand when the Profiler has a blocked Measurement Range

Consider cases where the image sensor may not have complete visibility over the required scan range. The scan direction may need to be reversed or the object may need to be scanned in two opposite directions to fully inspect the object.



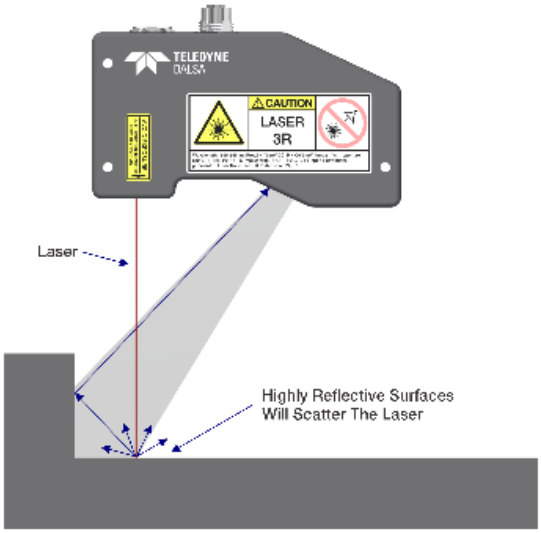
Understand when the Profiler cannot see all Object Sides

Certain objects like the round example below have a partial Measurement Range or areas where the laser is blocked. Scanning the object from two opposite directions in the Y axis can form a more complete profile.



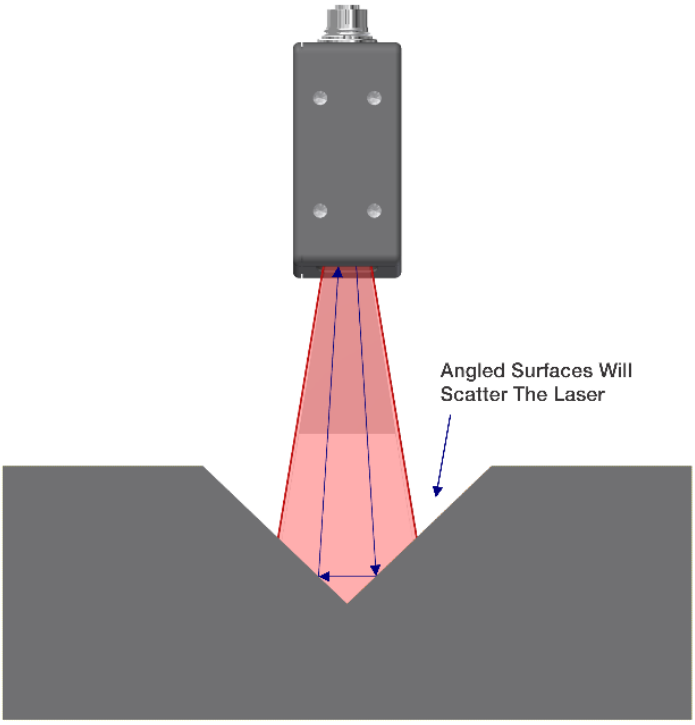
Situations when Highly Reflective Surfaces are scanned

Multiple reflective surfaces may adversely scatter laser light making it difficult to obtain a clean line profile.



Consider the Effect on Profile Quality with Reflective Surfaces

Reflective surfaces scanned by the profiler may scatter laser light making it difficult to obtain a clean line profile. The profiler may need to be pitched forward or backwards to change laser light reflection angles away from entering the profiler's image sensor window. Profiler positioning is dependent on the scanning situation.



Controlling Ambient Illumination

The profiler uses a narrow bandpass optical filter over its image sensor window which is tuned to the laser wavelength (color) of the particular profiler model. This allows the Z-Trak to be used in most ambient light conditions without any measurement interference.

If the Z-Trak is used in a location that has direct sunlight or any other type of bright full spectrum lighting, it is possible that profiles are distorted due to interference with the laser emission. Bright ambient light of similar wavelength to the laser will pass through the 3D sensor filter and interfere with measurements.

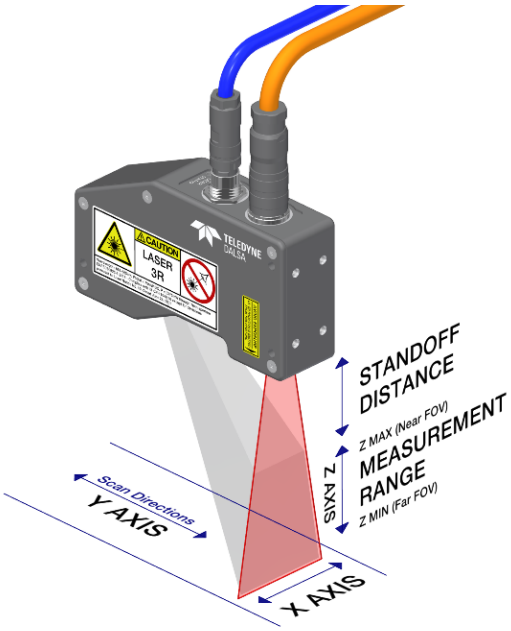
Users need to control such ambient illumination conditions so that the laser line profiles are distinctly detected allowing accurate measurements.

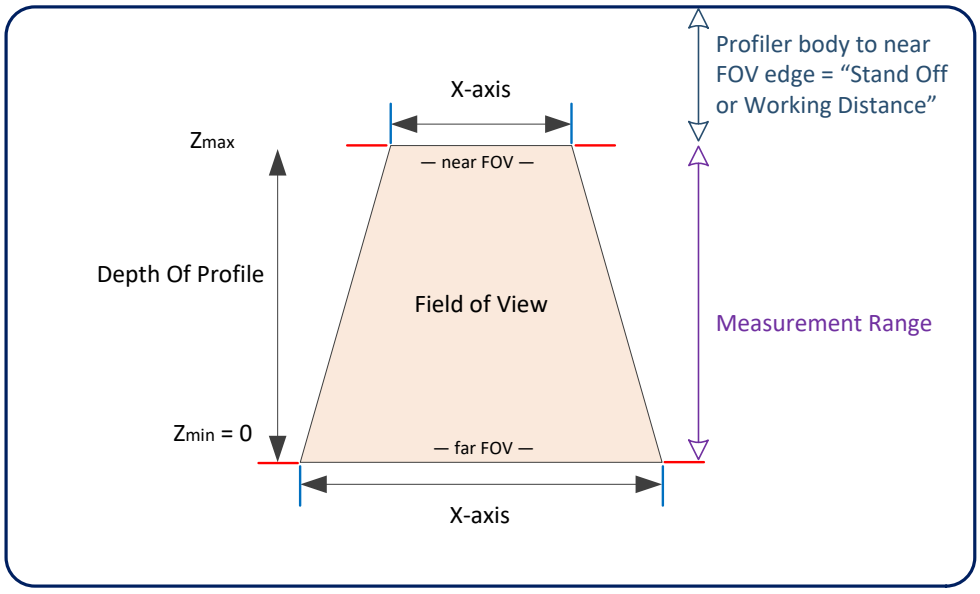
Z-Trak Coordinate System

The following three figures provide details about the profiler Measurement Range.

Axes

The figure below defines the Measurement Range for a laser profiler.





Z-Axis

- Profiles are composed of height (Z) and width (X) values within the measurement Field of View.
- The height measurement (Z) range is reported in calibrated units as microns.
  The actual measurement scale is profiler model dependent. An invalid value captured within the profile is set by the Z-Trak firmware to the value of 65535 (0xFFFF) by default but can be changed by the user.
- Z-Trak scans output Z values by uniformly sampling X values. This 3D Data Type is called "UniformX Z". In the GenICam standard this is also referred to as "RectifiedC" or "RectifiedZ" output.
- See UniformX Z for data format details.
- Profiler resolution and accuracy in Z or X for a fixed static calibrated object are specified for each model.

X-Axis

- The profile width (X) is specified in microns. Importantly the user must note that the upper MR side has an increased X resolution than the lower MR side.
- See Output X-Axis Descriptions for feature related to the X-Axis.

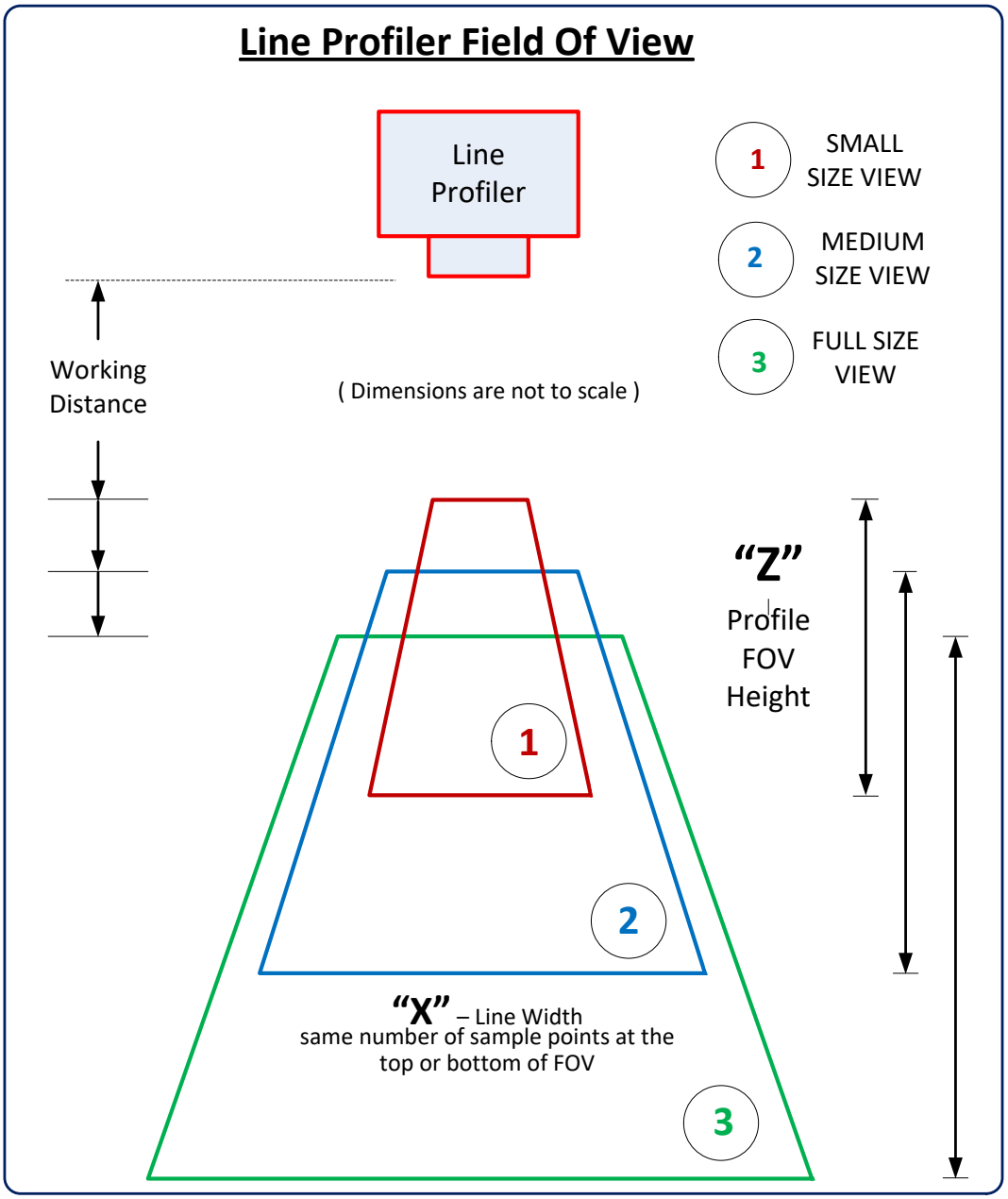
Y-Axis

- The Y axis (not shown is this figure) is the scan direction. Multiple profiles taken of a scanned object in a given time form a 3D range data image of the object.
- Y axis resolution is determined by the scanning speed and frame rate.
- See Encoder Input Feature Descriptions for details.

Overview of MR areas for Different Profiler Models

Laser profiler models are designed and factory calibrated to work with a fixed Working Distance and Measurement Range (FOV) dimensions. The following figure is a *simplified* drawing representing these model variations. The drawing is not to scale. Review the individual model specifications for working distance and FOV profile depth.

Consult Teledyne DALSA application engineers when planning your laser profiler application.



3D Surface View/Range Map Imaging

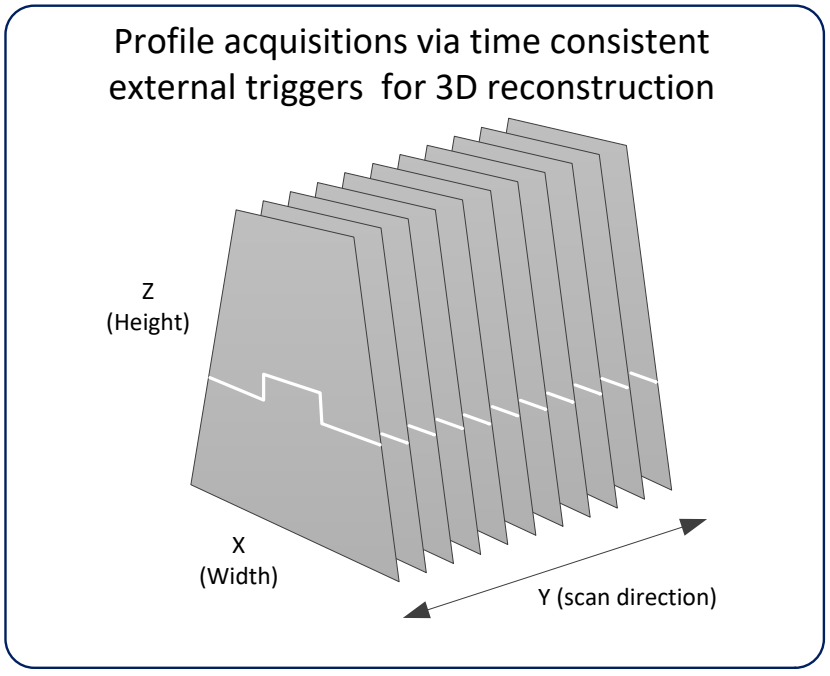
Z-Trak is capable of acquiring a sequence of profiles at the same time. This sequence of profile is called a scan and can be configured by simply setting the feature value of “Data Output->Profile Per Scan” (*profilesPerScan*) to greater than 1.

These scans are triggered by means of an external hardware signal and can be configure as either variable scan (where the *Trigger Start Source* and *Trigger Stop Source* determine the length of the scan) or fixed scan (where the *Scan Per Trigger* feature sets the number of scans to capture).

Combining Profile Trigger and Scan Trigger

The profiles are triggered either by a software event or more commonly by an evenly spaced trigger such as an external quadrature shaft encoder source or other external signal trigger source. See Trigger Input Category and Encoder Control Category.

The external trigger source is typically generated by a shaft encoder or positional 3D sensor driven by the moving platform for the object being scanned or by a moving mount for the profiler. Movement is in the scan direction (Y axis).



Connecting to a Sapera LT Development System

Sapera LT installs the 3D GigE Vision software and a software DHCP server for a NIC tol be used with Z-Trak. Refer to Sapera LT User's Manual concerning application development with Sapera. Computers also need capable 3D graphic systems to adequately display sequential profiles as 3D surfaces.

Multiple profilers can connect through a **Gigabit Ethernet switch**. When using VLAN groups, the Z-Trak and controlling computer must be in the same group (refer to the Teledyne DALSA Network Imaging Package user's manual).

The **Windows Firewall** exceptions feature is automatically configured by the Sapera LT installation, which allows the Sapera GigE Server to pass through the firewall.

	**Note:** Installing Sapera LT requires an administrator login.

Procedure

- The computer used should have its hardware and video drivers up to date..
- Download and install Sapera LT version 8.60 or later. When prompted choose to install the GigE Vision driver and 3D tool package which will also installs the Z-Trak acquisition tool Z-Expert.
- Optional: If the Teledyne DALSA Sapera LT SDK package is not used, click to install the Z-Trak firmware and user manuals only. Follow the on screen prompts.
- Connect the profiler to a separate NIC which is not used for any other network.
- Computers with **VPN software** (virtual private network) may need to have the VPN driver disabled in the properties for the NIC used with Z-Trak.

Z-Trak Firmware Updates

A new Z-Trak installation may require a firmware update. The File Selector feature is used to select a firmware file. See the procedure Updating Firmware via File Access in Z-Expert.

Important: Download the latest firmware version released for any Z-Trak model from the Teledyne DALSA support web page:
http://www.teledynedalsa.com/imaging/support/downloads/firmware/

Firmware via Linux or Third Party Tools

If Z-Trak will be used in a **third party GigE Vision Compliant environment**, Sapera or Sapera runtime is not required. Follow the installation instructions of the third party package.

Consult your third party GigE Vision software package for uploading files to Z-Trak.

Power and Network Connection Overview

Connecting Z-Trak to a computer system is similar whether using the Teledyne DALSA Sapera LT package or a third party GigE Vision development package.

- Physically mount the profiler to your metallic mount (required for proper heat management).
- Power supplies must meet the requirements defined in section DC Power Requirements (PoE supply) or DC Power Requirements (I/O supply).
- Connect to the host computer GigE network adapter via a M12 X-Coded to RJ45 Ethernet cable. **Note:** the cable should not be less than 1 meter long or more than 100 meters long.
- Once communication with the host computer is started the automatic IP configuration sequence will assign an LLA IP address as described in section IP Configuration Sequence Details, or a DHCP IP address if a DHCP server is present on your network (such as the one installed with Sapera LT).
- Check the status LED which is initially red then changes to flashing blue while waiting for an IP configuration. See Laser Status LED for details.
- The factory default for Z-Trak is Persistent IP disabled and DHCP enabled with LLA always enabled as per the GigE Vision specification. For additional information see the Teledyne DALSA Network Configuration manual.

GigE Server Verification

After a successful Z-Trak installation, the GigE Server icon is visible in the desktop taskbar tray area. After connecting (see following section), allow a few seconds for the GigE Server status to update.

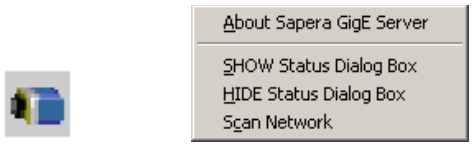
	Device Available	Device IP Error	Device Not Available
GigE Server Tray Icon:			
	The normal GigE server tray icon when the device is found. It will take a few seconds for the GigE Server to refresh its state after the device has obtained an IP address.	The GigE server tray icon shows a warning when a device is connected but there is some type of IP error.	A red X will remain over the GigE server tray icon when the device is not found. This indicates a major network issue. ***Or in the simplest case*,** the device is not connected.

If you place your mouse cursor on this icon, the GigE Server will display the number of GigE Vision devices found by your PC. Right click the icon and select status to view information about those devices.

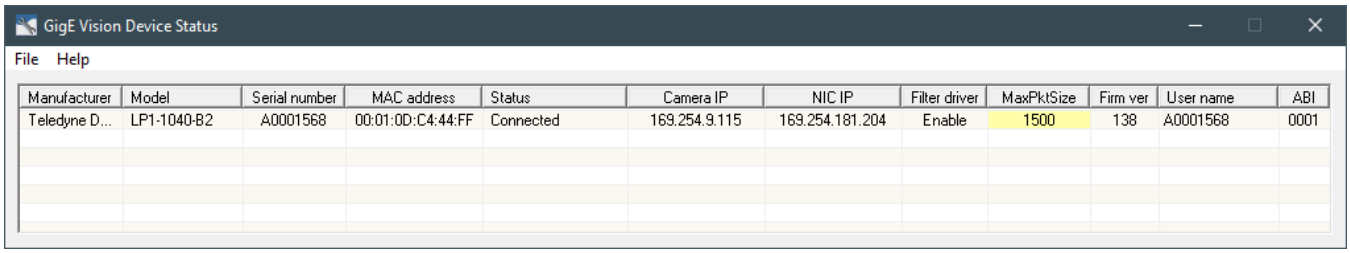
GigE Server Status

Once the Z-Trak is assigned an IP address (its Status LED is steady blue) the GigE server tray icon will not have a red X through it, indicating that the device was found. It might take a few seconds for the GigE Server to refresh its state after an IP address is assigned.

Right-click the GigE Server tray icon to open the following menu allowing verification of the network status.



Click on Show Status to open a window listing all devices connected to the host system. Each GigE device is listed by name along with important information such as the assigned IP address and device MAC address. The screen shot below shows a connected Z-Trak with no networking problems.



In the event that the device is physically connected, but the Sapera GigE Server icon is indicating that the connected device is not recognized, click Scan Network to restart the discovery process. Note that the GigE server periodically scans the network automatically to refresh its state.

Optimizing the Network Adapter used with Z-Trak

Most Gigabit network interface controllers (NIC) allow user modifications. These should be optimized for use with Z-Trak during the installation. Refer to the **NetworkOptimizationGuide.pdf** for optimization information (available with the Sapera LT installation [C:\Program Files\Teledyne DALSA\Network Interface]).

IP Configuration Sequence Details

The Z-Trak IP (Internet Protocol) Configuration sequence to assign an IP address is executed automatically on device power-up or when connected to a network. As a GigE Vision compliant device, Z-Trak attempts to assign an IP address as follows.

For GigE Vision devices, the IP configuration protocol sequence is:

- Persistent IP (if enabled)
- DHCP (if a DHCP server is present such as the Teledyne DALSA Smart DHCP server)
- Link-Local Address (always enabled as default)

The factory defaults for Z-Trak is Persistent IP disabled and DHCP enabled with LLA always enabled as per the GigE Vision specification.

Supported Network Configurations

Preferably, a DHCP server is present on the network, where the Z-Trak issues a DHCP request for an IP address. The DHCP server then provides the IP address. The **Teledyne DALSA Network Configuration tool**, installed with the Sapera Teledyne DALSA Network Imaging Package, provides a DHCP server which is automatically is enabled on the NIC used with the Z-Trak (refer to the Teledyne DALSA Network Imaging user's manual).

The LLA method, if used, automatically assigns a randomly chosen address on the 169.254.xxx.xxx subnet. After an address is chosen, the link-local process sends an ARP query with that IP onto the network to see if it is already in use. If there is no response, the IP is assigned to the device, otherwise another IP is selected and the ARP is repeated. Note that the LLA mode is unable to forward packets across routers.

Connectors

Z-Trak uses two connectors. These connectors comply with the profiler IP67 protection level. **Important:** Take caution when connecting either cable especially the M16-24 pin. Align the mating connector correctly else pins might be bent rendering the cable set as garbage.

- A single **M12 8-pin X-Coded Ethernet** connector for computer control and profile data transmitted to/from the host computer's Gigabit NIC. Z-Trak supports Power over Ethernet (**PoE**) as an alternative to supplying power via the I/O connector.
- A **M16 – 24 pin I/O** connector for device power (if not using PoE), plus trigger, strobe and general I/O signals. See I/O Connector Details for connector pin out specifications.
- See Cable Manufactures Contact Information for secure cable suppliers.

Connector Locations

The following figure shows connector and LED locations. See Mechanical Specifications for details on the connectors and profiler mounting dimensions.

LED Indicators

The Z-Trak has two LED indicators to provide a quick visible indication of laser and profiler state, as described below. Note: the Z-Trak Ethernet connector does not have indicator LEDs; use the LEDs on the Ethernet switch or computer NIC to observe networking status.

Laser Status LED

The laser status LED is ON (amber color) when the laser E-Stop function is "Inactive". The laser is then turned on or off via its software feature controlled by the Laser Profiler application.

The E-Stop (emergency stop) function will immediately disable the laser if the connection between I/O pins 1 & 8 is electrically open. This laser safety function requires an external shorting circuit to allow the laser to function. See Emergency Laser Stop Function (E-STOP) in the I/O connector description section.

Profiler Status LED Indicator

The Z-Trak is equipped with one LED to display its operational status. When more than one condition is active, the LED color indicates the condition with the highest priority (such as – an acquisition in progress has more priority than a valid IP address assignment).

Once connected to a network and an IP address is assigned, the Status LED will turn to steady blue. Only at this time will it be possible for the GigE Server or any application to communicate with the profiler.

The following table summarizes the LED states and corresponding status.

LED State	Definition
LED is off	No power to the Profiler
Steady Red	Initial state on power up before flashing. Remains as steady Red only if there is a fatal error. Profiler is not initialized **
Flashing Red **	Initialization sequence in progress Wait a minute for the profiler to reboot itself.
Steady Red + Flashing Blue	Fatal Error. If the profiler does not reboot itself, verify all connections and host computer requirements before contacting Technical Support.
Slow Flashing Blue	Ethernet cable disconnected. The profiler continuously attempts to assign itself an IP address.
Fast Flashing Blue	File Access Feature is transferring data such as a firmware update, etc.
Steady Blue	IP address assigned; No application connected to the device
Steady Green	Application connected
Flashing Green	Acquisition in progress.

Note: Even if the Z-Trak has obtained an IP address, it might be on a different subnet than the NIC it is attached to. Therefore, if the status LED is blue but an application cannot see it, this indicates a network configuration problem. Review troubleshooting suggestions in the Network Imaging manual.

Preventing Operational Faults due to ESD

Installations which do not protect against ESD (electrostatic discharge) may exhibit operational faults. Problems such as random packet loss, random device resets, and random loss of Ethernet connections, may all be solved by proper ESD management.

Z-Trak when used with a simple power supply and Ethernet cable is not properly connected to earth ground and therefore is susceptible to ESD caused problems. An Ethernet cable has no ground connection and a power supply's 0 volt return line is not necessarily connected to earth ground. Follow the suggestions below to prevent ESD faults.

Teledyne DALSA has performed ESD testing on profilers using a ±4 kilovolt ESD contact generator and ±8 kilovolt in air generator without any indication of operational faults. Use these methods, to prevent ESD problems.

- Mount the profiler on a metallic platform with a good connection to earth ground.
- When using Power over Ethernet (PoE), Teledyne DALSA strongly recommends using a shielded Ethernet cable to provide a ground connection from the controlling computer/power supply, to the Z-Trak. PoE requires a powered computer NIC, or a powered Ethernet switch, or an Ethernet power injector.
- Use a shielded/grounded power supply if not using PoE as stated above.

Z-Expert Overview

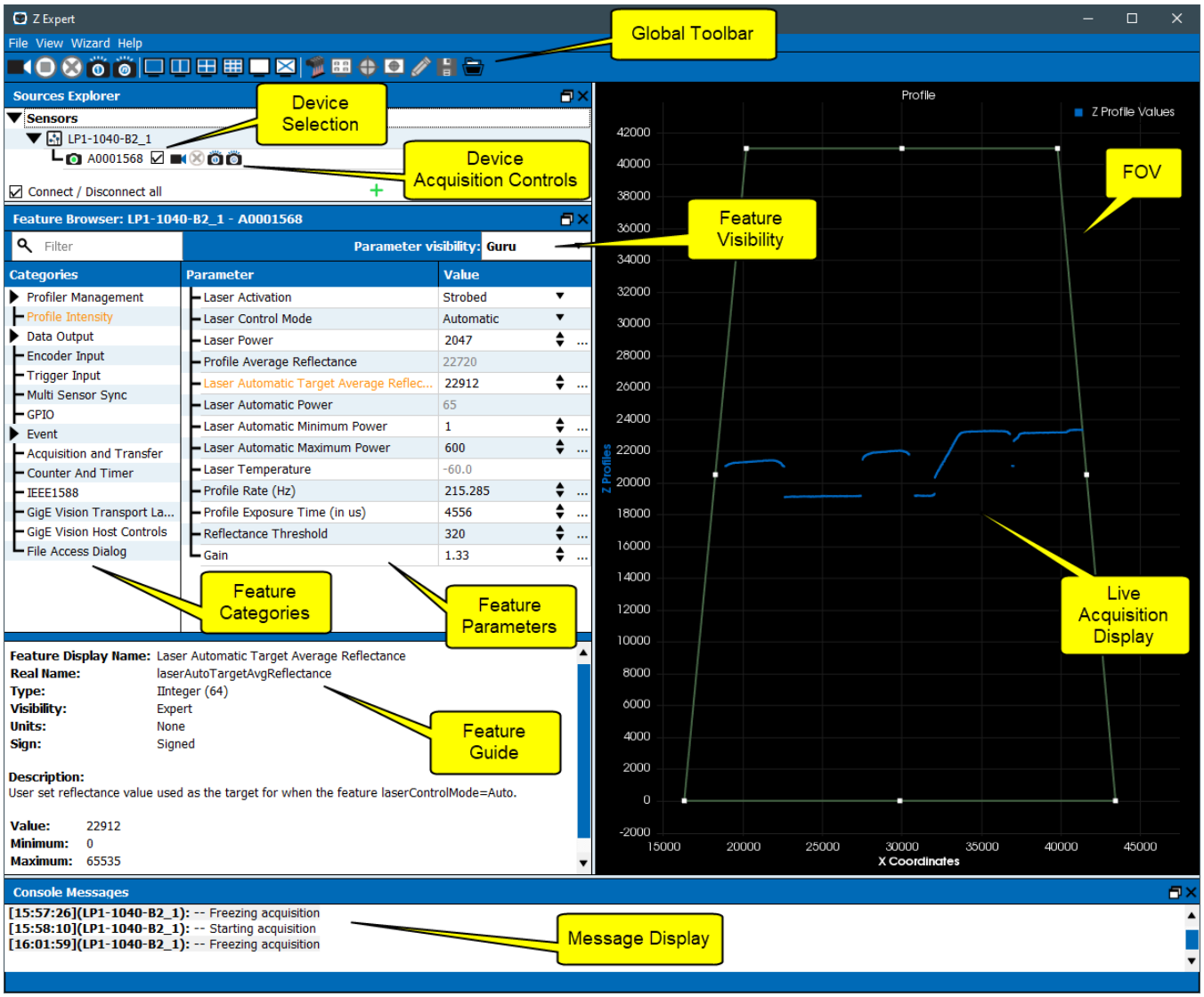
The Sapera LT Z-Expert tool is the interfacing tool for Z-Trak. Z-Expert allows a user to test profiler functions and adjust feature values. Additionally Z-Expert saves a user setting configuration to the profiler (using the configuration save/load feature) or saves multiple configurations as individual device parameter files on the host system (as *.ccf files).

An important component of Z-Expert is its live acquisition display window (Profile View, Image View, 3D View) which allows immediate verification of timing or control parameters without the need to run a separate program. This section provides brief descriptions of the Z-Expert tool functions.

Note: Z-Expert itself has embedded help providing more detailed explanations of its sections. Get help information by floating the mouse over any control and pressing the **F1 key**.

Z-Expert Panes

The various areas of the Z-Expert tool are described in the summary figure below. GigE Vision device Categories and Parameter features are displayed as per the device's XML description file. The number of parameters shown is dependent on the Feature Visibility mode selected (i.e. Beginner, Expert, Guru).



- **Global Toolbar**: Provides a central location for global Z-Expert functions, such as grab and snap, and selecting multiple windows for working with multiple profilers. Simply float the mouse cursor over the symbol for the button's function.
- **Device Selection**: View and select an installed Z-Trak to view parameters applicable to that device.
- **Device Acquisition Controls**: Buttons to control acquisition from a single profiler.
- **Feature Visibility**: All Z-Trak control features have a Visibility attribute which defines its requirement or complexity. The states vary from Beginner (features required for basic operation of the device) to Guru (optional features required only for complex operations). Z-Expert displays features based on their visibility attribute via this drop menu.
- **Feature Categories**: Functional grouping of Z-Trak control features. Select a category to see and adjust parameter features.
- **Feature Parameters**: Allows viewing or changing all device parameters supported by the installed profiler. Features listed in black font are adjustable by the user, while features in gray font are read only or not currently adjustable due to a different feature's setting.

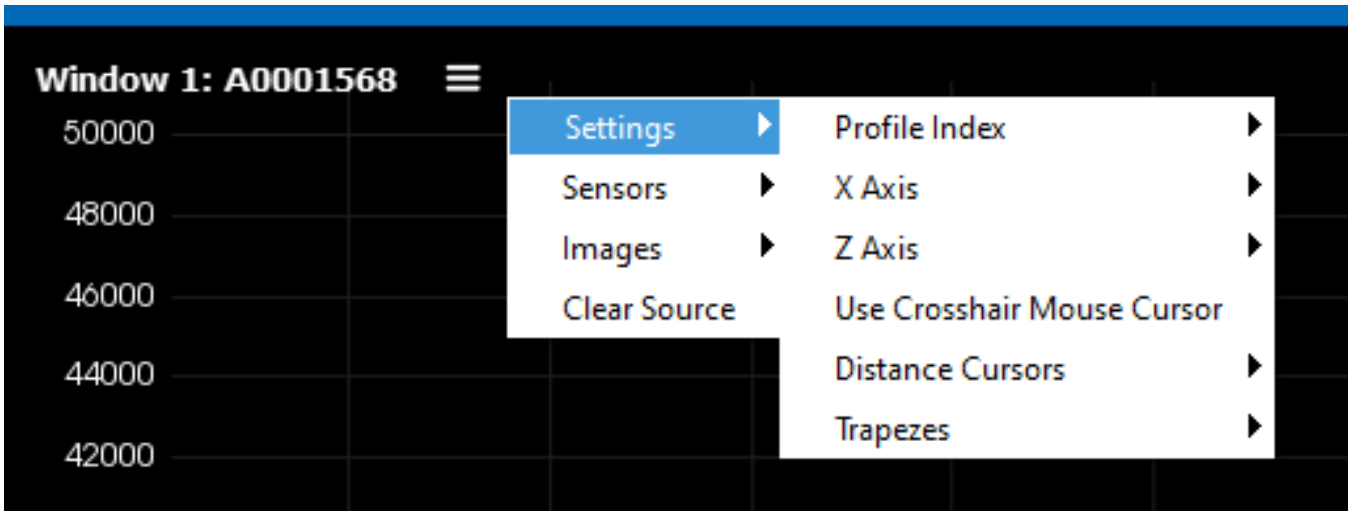
- **Feature Guide**: Displays information about the current feature data range or selectable options. This information is extracted from the Z-Trak XML file which is subject to change with Z-Trak firmware updates.
- **FOV (graphical)**: Provides a visible to the **F**ield **O**f **V**iew measurement area.
- **Display Area**: Provides a display of a continuous or a single profile acquisition.
- **Output Messages**: Displays messages from Z-Expert or the GigE Vision driver.
- **Control Buttons**: The acquisition control buttons and display configuration popup window are described below.

	**Continuous Acquisition Button:** Click once to start live profile grab Click again to stop live profile grab.
	**Single Acquisition Button:** Click once to acquire one profile from device.
	**Acquisition of 'x' Number of Profiles:** When clicked, a popup dialog asks for the use to enter the number of acquisitions to make.

Display Settings Dialog

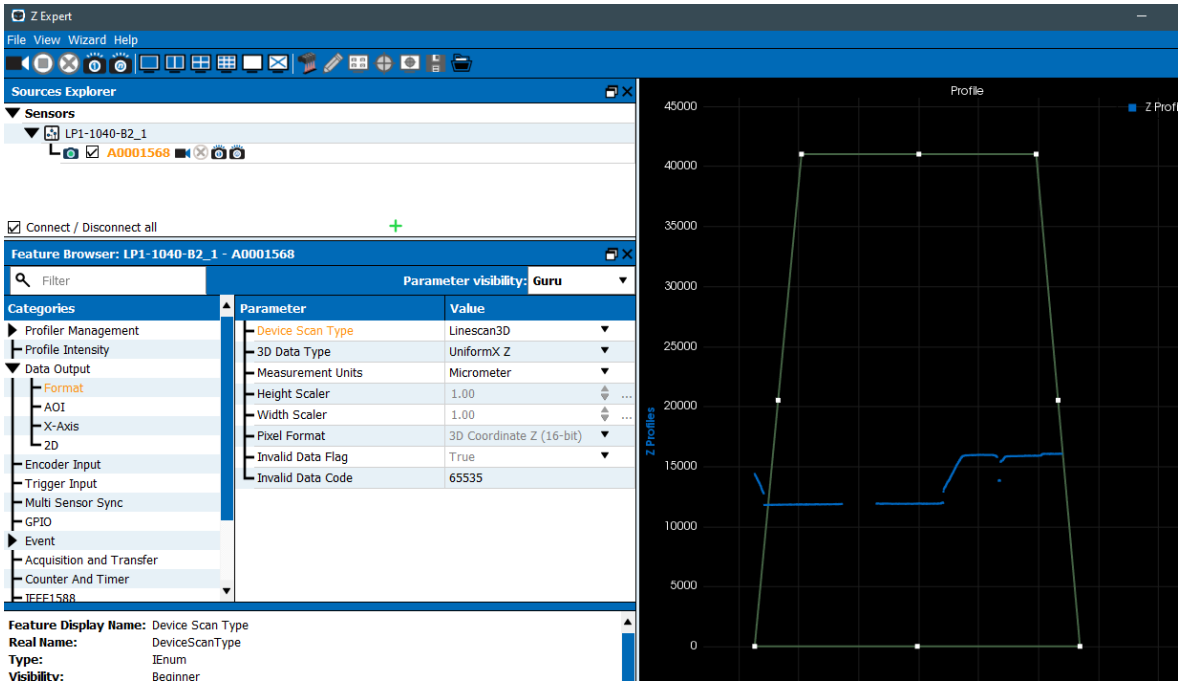
The display settings menus allow adjusting various display controls and the colors used for graphed elements.

When the "Show Invalid Values" item is selected those values are shown above the Measurement FOV trapeze at the top of the absolute measurement range. The actual invalid data value output by the profiler is selectable via the "Scan3dInvalidDataValue" feature.

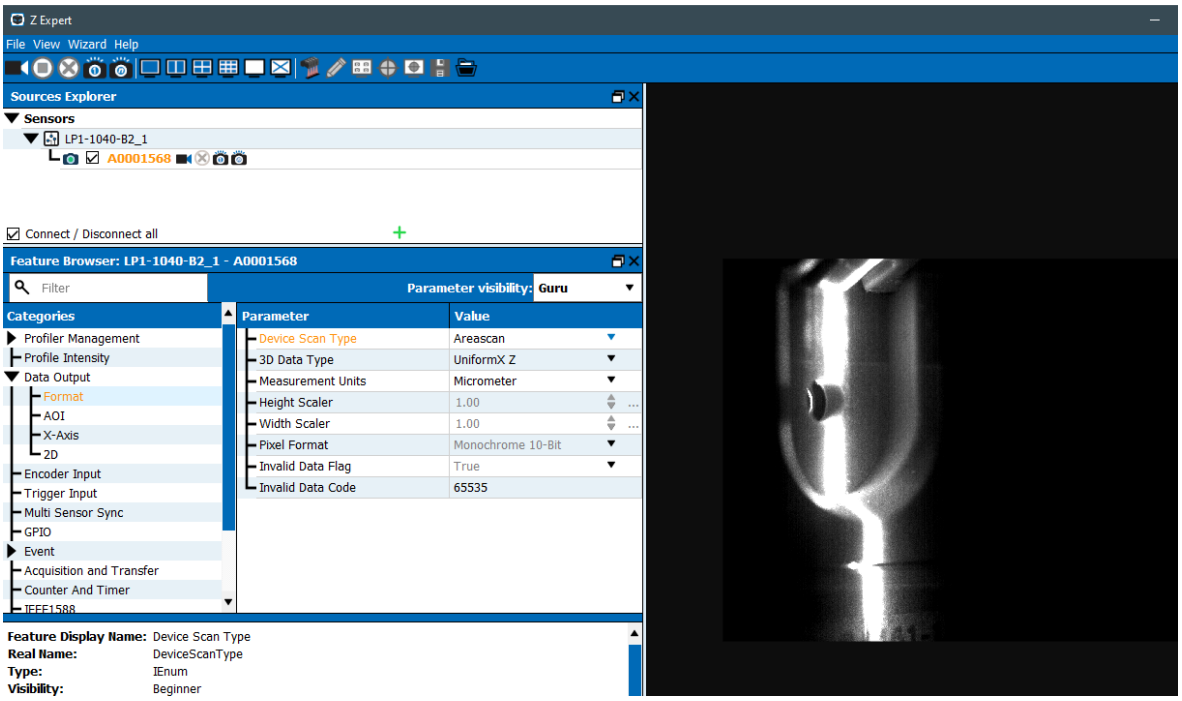


Display Type Drop Menu

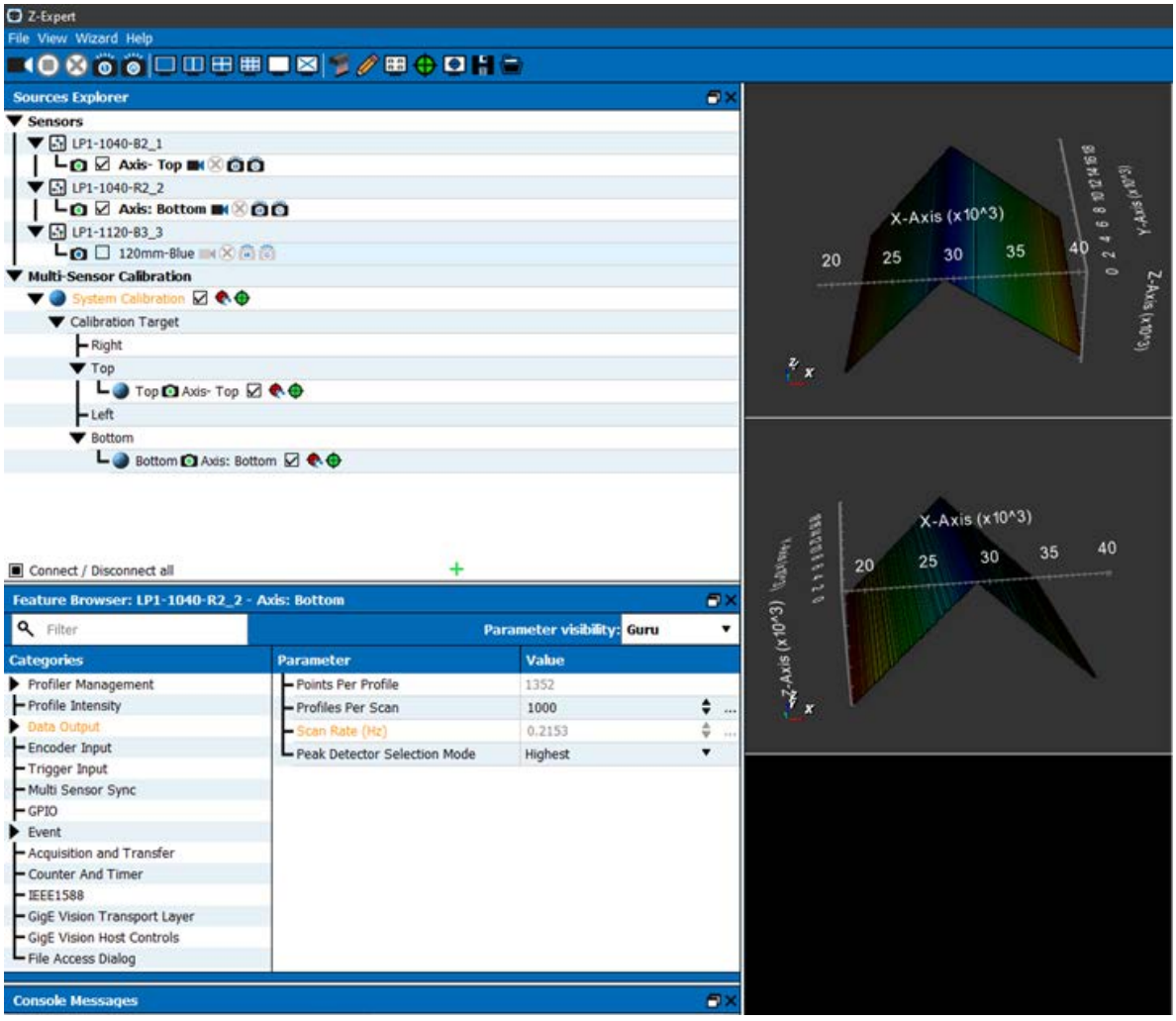
- **Device Scan Type set to 'Linescan3D:** This is the primary display mode of the profiler. This mode in Z-Expert provides a quick method to verify the quality of profile acquisitions along with basic measurements.



- **Device Scan Type set to 'Areascan':** Use this mode to view acquisitions as standard 2D area scans. This mode is useful when verifying acquisition exposure or acquisitions via trigger events.



- **Surface View:** Range Map data – a collection of multiple profiles – can be visualized as a 3D image using the Surface View. This view requires “Device Scan Type” be set to ‘Linescan3D’ and set the “Profiles per Scan” to any amount greater than 1 profile.



Common Specifications

This section provides Z-Trak specifications common to all models.

Common Specifications for all Z-Trak Models

These general and common specifications for all models are listed below. Significant model specific specifications will have their own tables following this section.

General	
Lasers	Class II and IIIR Colors are model dependent (i.e. Red or Blue)
Laser Activation	Constant or Strobed On only during integration
Data Format	Naming compliant to GenICam SFNC 2.3 Linescan3D: RectifiedC, CalibratedAC, CalibratedACRW
Measurement Units	Micrometers (1000th of an inch), Millimeters or Inch
Scan Type	Fixed Scan Variable scan – part in place or start/stop trigger
Points per Profile	Points per profile is dependent on model
Profiler Controls	
Exposure Modes	Single or Continuous Programmable in increments of 1µs (minimum is 34 µs)
Profile Triggers	Encoder – Single or dual phase Internal trigger Timer/Counter driven Software trigger
Scan Trigger	External trigger input Software trigger Time/Counter driven
Multi-Synchronization	Master: Profile trigger – encoder, internal, counter Slave: SyncMaster, internal
Trigger Events support	External Trigger source, Trigger Ignored count
Exposure Control	Internal – Programmable via the profiler API External – based on Trigger Width
Exposure Time Maximum	16 sec
Trigger Inputs	Isolated, 8.9V to 24V typical Debounce range from 0 up to 255 µs with selectable edge or level active Programmable Trigger Delay
Status Indicators	2 LEDs: 1 for profiler Functional Status; 1 for Laser Status
Features	
Laser Intensity Control	PWM duty cycle controlled from 0% to 100%
Laser Power Auto Mode	Manual or Automatic
Counter and Timer	1 Counter and 1 Timer. User programmable, acquisition independent, with event generation and output pin control
User settings	2 user sets and factory set. User selectable power-up configurations.

Mechanical Interface				
Z-Trak Enclosures (L x H x W)	**Enclosure Style**	**Models**	**Design**	**Mass (grams)**
	X10	10mm		466
	X20	40, 60, 120 and 200mm	Mechanical Specifications	468
	X30	250 and 400mm		623
	X40	800 and 1100mm		809
Enclosure	Conforms to IP67 Protection level (IEC)			
Power connector	Via the Ethernet cable with a PoE injector, or via the I/O connector			
Connectors	Ethernet via a M12 X-coded connector and I/O via a M16 24-pin connector			
Electrical Interface				
Power Input Voltage (I/O input) (PoE injector)	+14 to +24 Volts DC (+10%/- 10%) {+33 Volts DC (Absolute max)} Supports the Power Over Ethernet standard. (PoE Class 3 as per IEEE 802.3af) Max. PoE voltage = 57 Vdc			
Inputs/Outputs	2 real time isolated GPI (configurable) 2 x RS-422/RS-485 isolated quadrature shaft encoder inputs (pin 2 for common ground) 2 software driven opto-isolated GPO			
Power Dissipation (typical)	~ 4 Watts (dependent on DC source input and voltage)			
Data Output	Gigabit Ethernet 1000Mbps (10/100 Mbps are not supported) 115 MB/sec max.			
Data and Control	GigE Vision 1.2 compliant			
Environmental Conditions				
Conformity	IP67 (IEC), FDA, ICE (pending), CE, FCC, GenICam, GigE Vision, IEEE 802.3af (PoE)			
Operating Temperature (*at profiler front plate*)	All Models: 10°C to +50°C *Any metallic mounting provides heat-sinking therefor reducing the internal temperature.*			
Operating Relative Humidity	10% to 80% non-condensing			
Storage	-40°C to +80°C (-4°F to +176°F) temperature at 20% to 80% non-condensing relative humidity			

Shock and Vibration Certifications

Vibration & Shock Tests	Test Levels (while operating)	Test Standards
Sinusoidal Vibration	2g, 10Hz to 500Hz	EN/IEC 60068-2-6
Random Vibration	2g, 10Hz to 500Hz	EN/IEC 60068-2-64
Shock (Half-Sine)	15g/6ms, x/y/z directions	EN/IEC 60068-2-27
Additional information concerning test conditions and methodologies is available on request.		

EC & FCC Declarations of Conformity

TELEDYNE DALSA
Everywhereyoulook™
Part of the Teledyne Imaging Group

EMC DECLARATION OF CONFORMITY

We :
Teledyne DALSA, a business unit of Teledyne Digital Imaging, Inc.
880 Rue McCaffrey
St-Laurent, Quebec, Canada
H4T 2C7

Declare under sole legal responsibility that the following products conform to the protection requirements of council directive 2014/30/EU on the approximation of the laws of member states relating to electromagnetic compatibility and are CE-marked accordingly:

Z-Track LP1 3D laser profiler - Models: 3D-L10 sub-series

Part no: 3D-L10[X]-[XXXXX]-[XXXXXXXX][1]

The products to which this declaration relates are in conformity with the following relevant harmonized standards, the reference numbers of which have been published in the Official Journal of the European Communities:

EN55032 (2015)	Electromagnetic compatibility of multimedia equipment — Emission requirements
EN55011 (2016) with A1(2017)	Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement
EN 61326-1 (2013)	Electrical equipment for measurement, control and laboratory use — EMC requirements — Part 1: General requirements
EN 55024 (2010)	Information technology equipment — Immunity characteristics — Limits and methods of measurement
EN 55035 (2017)	Electromagnetic compatibility of multimedia equipment – Immunity requirements

Further declare under our sole legal responsibility that the product listed also conforms to the following international standards:

CFR 47	part 15 (2008), subpart B, for a class A product. Limits for digital devices
ICES-003	Information Technology Equipment (ITE) — Limits and Methods of Measurement
CISPR 11(2015) with A1 (2016)	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
CISPR 32 (2015)	Electromagnetic compatibility of multimedia equipment - Emission requirements
CISPR 35 (2016)	Electromagnetic compatibility of multimedia equipment - Immunity requirements

Note: this product is intended to be a component of a larger industrial system. It is not intended for use in a residential system.

Waterloo, Canada Location	February 14, 2020 Date	Cheewee Tng, P. Eng Director, Quality Assurance

[1] [X…] indicates alphanumeric characters.

Technical Specifications

Mechanical Specifications

Please visit the Z-Trak product page at www.teledynedalsa.com for 'stp' files and dimensional drawings.

Mounting Hole Specifications

All mount points are treaded for metric M4 screws (0.7 thread pitch) with depths of 6mm or 8mm as indicated in the drawing files.

Enclosure: IP67

Conforms to IP67 Protection level (IEC) which is defined as follows:

IP__	Meaning	Definition
6x	Dry: Dust Tight	No ingress of dust; complete protection against contact.
x7	Wet: Immersion up to 1 meter depth for a maximum of 30 minutes.	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion for 30 minutes). The profiler must function correctly once removed from the water.

Important: The Laser Profiler does not make valid measurements submersed in liquid at any depth.

Additional Notes on Z-Trak Identification

Identification Label

Z-Trak profiles have an identification label with the following information:

Model Part Number
MAC ID
Serial number
Revision number
2D Barcode
CE

Temperature Management

Z-Trak profilers are designed to optimally transfer internal component heat to the outer metallic body. If the profiler is free standing (i.e. not mounted) it may become very warm to the touch. Heat management is achieved by mounting the profiler with metal screws onto a metal structure (which will act as a heatsink) via its mounting screw holes.

Connectors

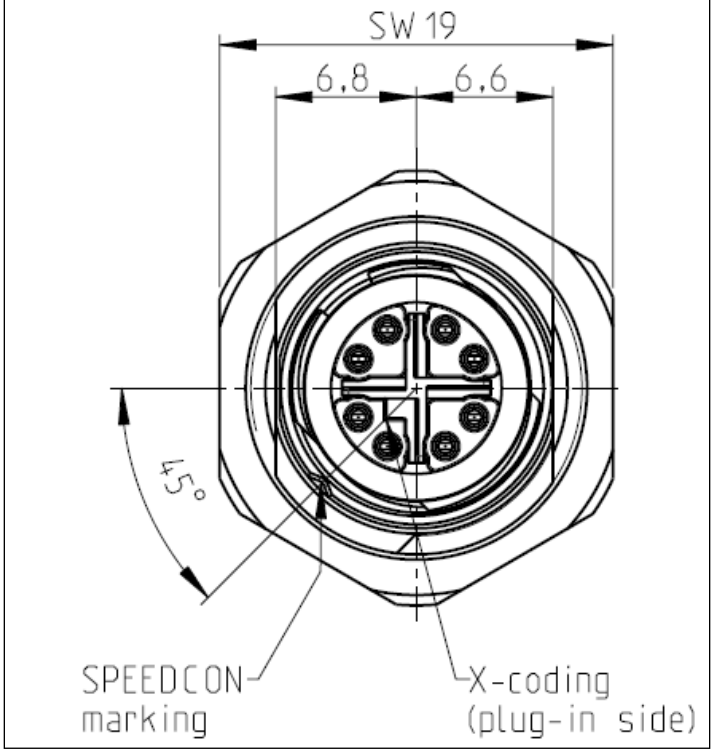
Z-Trak has two connectors; one for an Ethernet network (with optional PoE support) to a controlling computer and the second for all signal I/O. These connectors maintain the IP67 environment rating when used correctly with cables that also are certified for IP67.

See Part Numbers: Cables and Accessories for cable suppliers and products.

Ethernet via a M12 X-coded connector (8-pin)

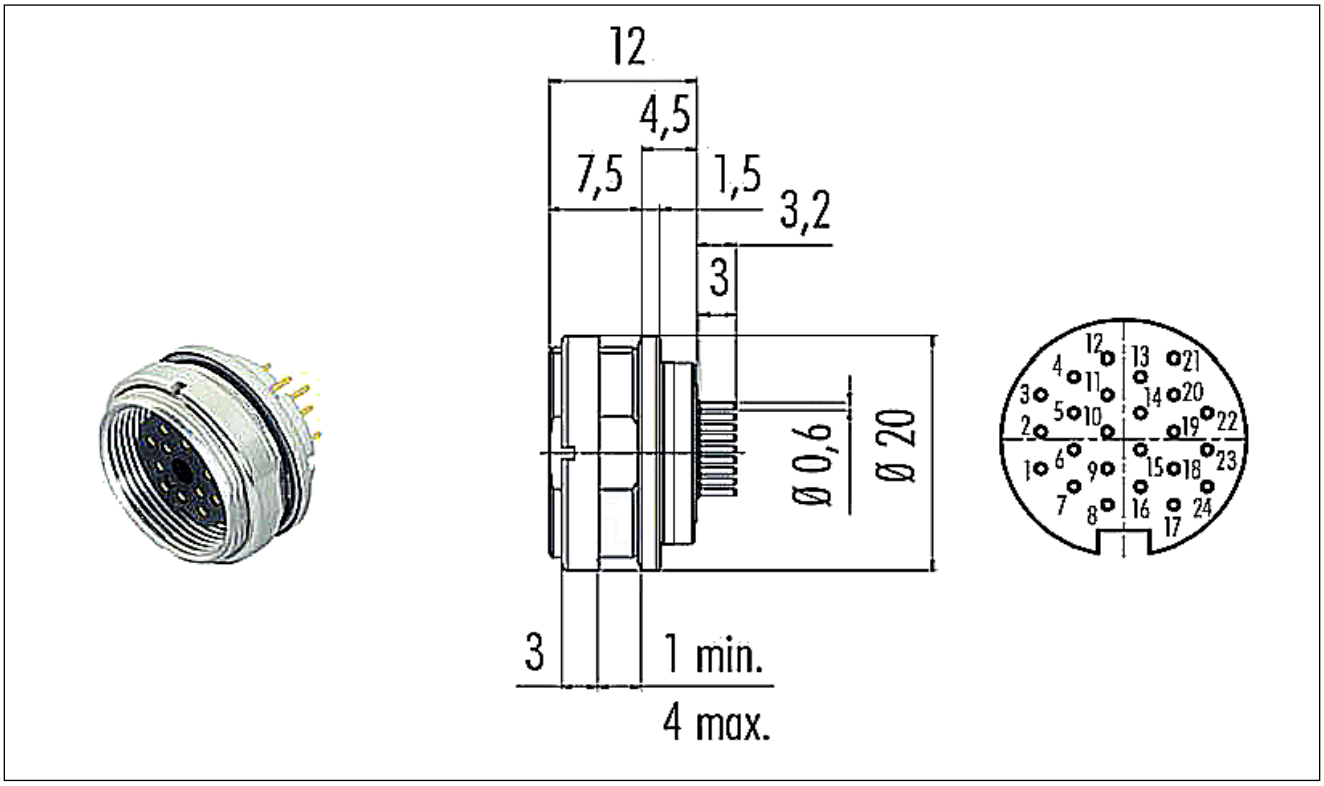
Mating cables for Gigabit Ethernet connectivity (8-pin M12 to RJ45) are available from Teledyne DALSA or directly from suggested manufacturers (see Cable Manufactures Contact Information).

Mechanical data (according to IEC 61076-2-101)	
no. of poles / coding	8 / X
contact termination	dip solder / socket
contact-Ø	0.6mm
temperature range	-40 °C / +90 °C
protection class	IP 67
mating cycles	>100
locking system	M12 STANDARD / SPEEDCON



I/O via a M16 24-pin connector

Mating cables (such as M16 24-pin to blunt end or breakout board) are available from Teledyne DALSA or directly from suggested manufacturers (see Cable Manufactures Contact Information).



I/O Connector Details

Pin Number	Z-Trak	Definition
18, 23	Power Common	DC power common ground – not connected to chassis
17, 24	Power Input	24 volt DC input power (if PoE is not used)
13	A+ (A positive RS-422 signal)	Shaft Encoder A+ input
21	A– (A negative RS-422 signal)	Shaft Encoder A– input
20	B+ (B positive RS-422 signal)	Shaft Encoder B+ input
22	B– (B negative RS-422 signal)	Shaft Encoder B– input
7	GPI-1	General Purpose Input 1 or Trigger 1
16	GPI-2	General Purpose Input 2 or Trigger 2
2	Isolated Input Common	Isolated Input Signal and/or Encoder Common
3	GPO-1	General purpose Output 1
12	GPO-2	General purpose Output 2
4	Output Common Power	Output Signal Common Power
8	E-Stop Feedback	Emergency Laser Stop Control Feedback node (see below)
1	E-Stop Signal Out	Emergency Laser Stop Control Signal Out
5, 6, 9, 10, 11, 14, 15, 19	Reserved	

Emergency Laser Stop Function (E-STOP)

The Emergency Stop Function (E-STOP) is implemented in all models and with any class of lasers used with Profilers. The E-STOP function is as follows:

- With E-STOP pins 1 & 8 shorted together (via an external switch, relay, or other) the Z-Trak laser is turned on or off by the controlling software application. The laser status LED is ON (amber color) indicating that the laser is controlled by the application.
- With E-STOP pins 1 & 8 **NOT** shorted together (external switch open, etc.) the Z-Trak laser is immediately disabled, irrelevant of the software control state. The laser status LED is OFF.

Ensure the Shaft Encoder Inputs are Correctly Used

Incorrectly connecting the shaft encoder phase signals will cause counts to change in the wrong direction. The table below is a simple reminder of the conditions where the counts are wrong.

A+/A- (correct phase connection) **A-/A+ (incorrect phase connection)**	
A+/A- & B+/B-	then Count is ok
A-/A+ & B+/B-	then Count is inverted
A+/A- & B-/B+	then Count is inverted
A-/A+ & B-/B+	then Count is ok again with both phase inputs wired in reverse

DC Power Requirements (I/O supply)

DC Operating Characteristics		
Power Input Voltage	+14 Volts minimum	
Input Power Consumption (Industry Typical)	@ +24 Volt Supply	3.84 Watts typical
Input Power Consumption	@ +14 Volt Supply	3.8 Watts typical
Input Power Consumption	@ +30 Volt Supply	3.9 Watts typical
Note: Power will vary slightly between units and between firmware versions		

Absolute Maximum DC Power Supply Range before Possible Device Failure		
Power Input Voltage Limits	–33 Volt DC	+33 Volts DC

Power over Ethernet (PoE) Support

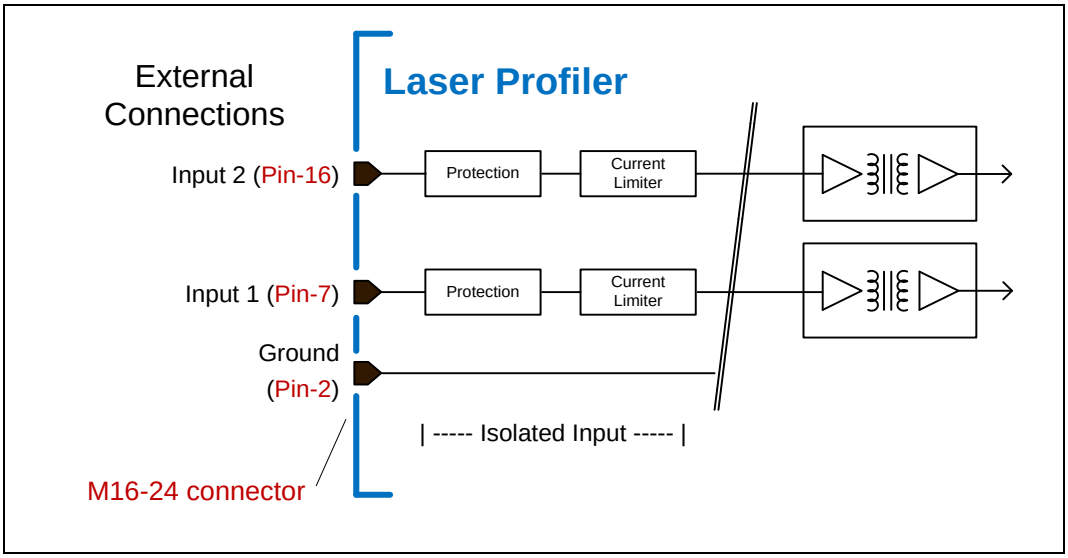
- The Z-Trak requires a PoE Class 3 (or greater) power source when using a PoE Ethernet switch or injector; else a separate external power source connected to I/O Connector is required.
- To use PoE, the device network setup requires a powered computer NIC supporting PoE, or a PoE capable Ethernet switch, or an Ethernet power injector.
- **Important:** Connect power via the I/O connector or PoE, but not both. Although Z-Trak has protection, differences in ground levels may cause operational issues or electrical faults.
- If both supplies are connected and active, the Z-Trak will use the I/O power supply connector. But as stated, ground differences may cause profiler faults or failure.
- **Important:** When using PoE, the Z-Trak I/O pin 18/23 (Device Power – Ground) must not be connected to I/O pin 2 (Input Signal Common Ground).

DC Power Requirements (PoE supply)

PoE DC Operating Characteristics	
PoE Injector Voltage	**Current Consumed (typical)**
PoE = 37 Vdc	108 mA
PoE = 48 Vdc	86.5 mA
PoE = 57 Vdc	76.5 ma

Input Signals Electrical Specifications

External Inputs Block Diagram



External Input Details

- Magnetic isolation with internal current limit.
- Used as trigger acquisition event or general purpose input.
- User programmable debounce time from 0 to 255µs in 1µs steps.
- Source signal requirements:
  - Single-ended driver meeting 12V, or 24V standards

External Signal Input DC Characteristics

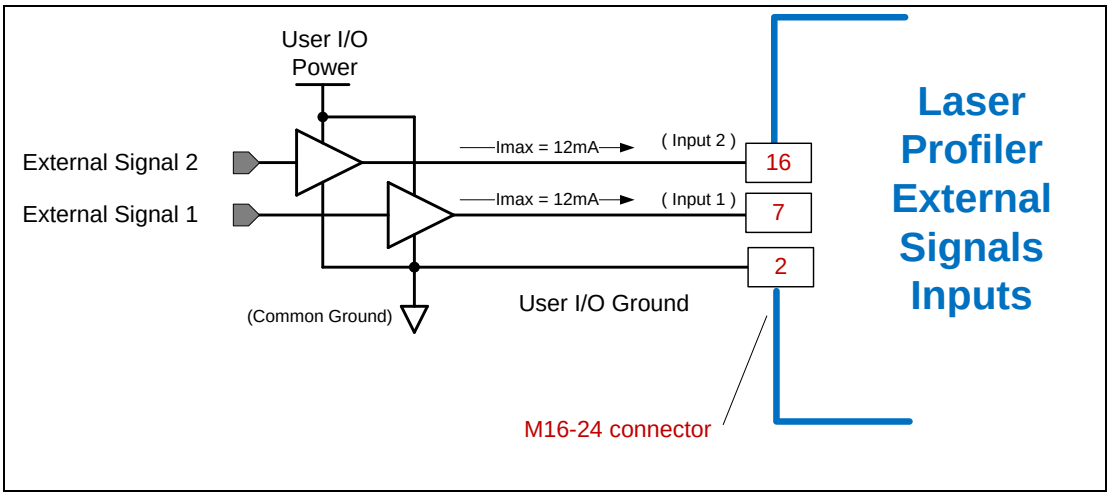
Operating Specification	Minimum	Maximum	Absolute Limits
Input logic Low		< 5.45 V	
Input logic High	> 8.9 V		
Input Voltage	0 V	+30 V	±36 V
Input Current	7 mA	11.6 mA	
Voltage Isolation: All inputs have an isolation voltage up to 2Kvolts			

External Input AC Timing Characteristics

Conditions	Description	Min	Unit
Input Pulse 0V -12V (typical characteristics)	Input Pulse width High	100	ns
	Input Pulse width Low	100	ns
	Max Frequency	5	MHz

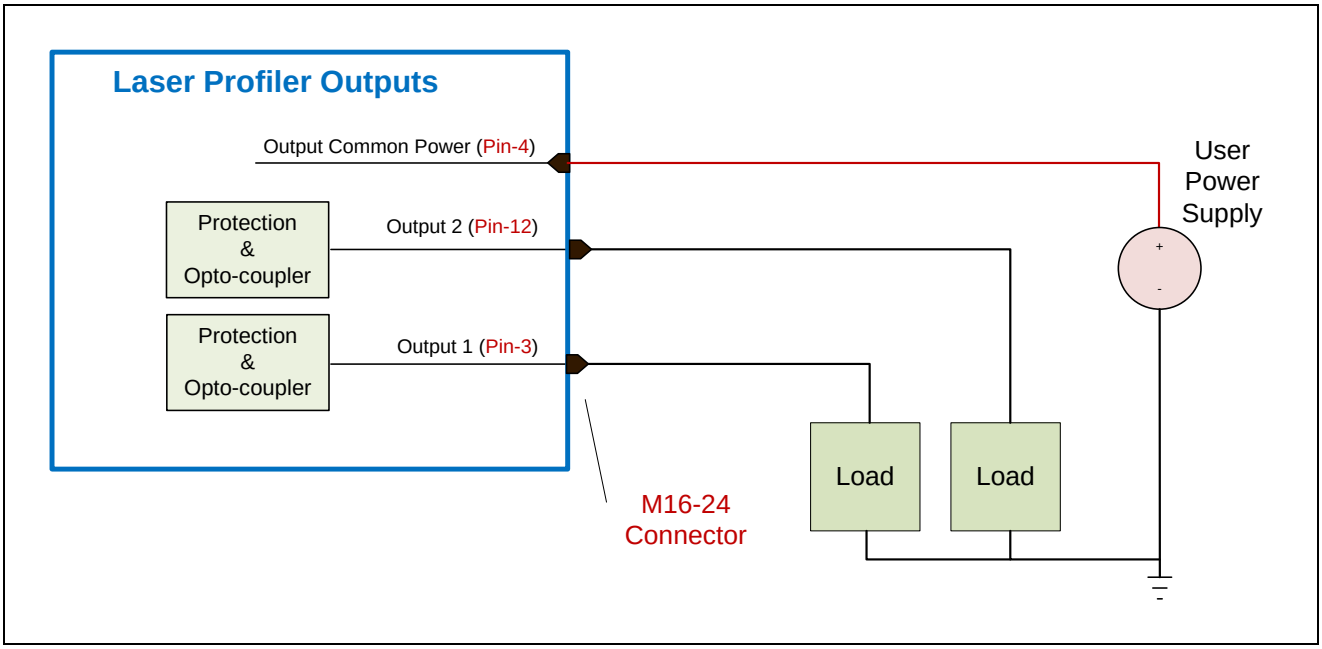
External Inputs: Example Using Buffer Drivers

- External Input maximum current is limited by the Z-Trak circuits to a maximum of 12mA.



Output Signals Electrical Specifications

External Outputs Block Diagram

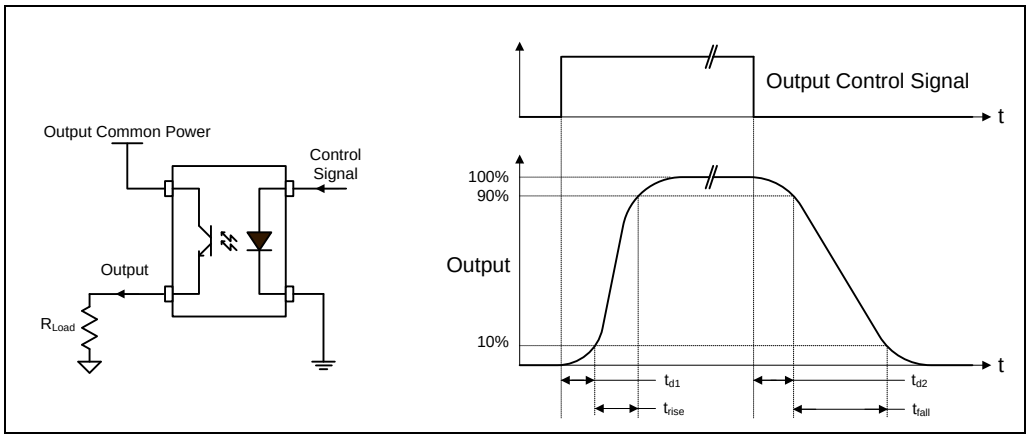


External Output Details and DC Characteristics

- Programmable output mode (see *outputLineSource* feature)
- Outputs are open on power-up with the default factory settings
- A software reset will reset the outputs to the open state if the outputs are closed
- A user setup configured to load on boot will reset the outputs to the open state first then close them again if the setup is such
- Output Short-Circuit Protection effective even for sustained shorts
- **Typical** Operating Common Power Voltage Range: +3V to 28Vdc at 24mA
- **Maximum** Output Current:
  80mA at 12V to 24V
  24mA at 3V
  50mA at 5V

External Output AC Timing Characteristics

The graphic below defines the test conditions used to measure the Z-Trak external output AC characteristics, as detailed in the table that follows.



Note: All measurements subject to some rounding.

Output Common Power	Output Current	td1 (µs) Leading Delay	trise (µs) Rise Time	td2 (µs) Trailing Delay	tfall (µs) Fall Time	Output Voltage
12V	8 mA	0.62	1.1	7	6.5	10V
	12 mA	0.7	1.1	7	5.2	9.8V
	24 mA	0.8	1.2	6.3	4.1	9.3V
24V	8 mA	0.8	1.2	9	7.5	21.9V
	12 mA	0.8	1.2	8.6	5.5	21.6V
	24 mA	0.8	1.2	8.2	4	21.2V

Computer Requirements for Z-Trak

The following information is a guide to computer and networking equipment required to support the Laser Profiler. The Z-Trak series complies with the current Ipv4 Internet Protocol; therefore current Gigabit Ethernet (GigE) equipment should provide trouble free performance.

Host PC System

- Refer to your GigE-Vision compliant SDK for computer requirements.
- GigE network adapter (either add on card or on motherboard). The Intel PRO/1000 MT adapter is an example of a high performance NIC. Typically if a system motherboard has only one Ethernet port, the user needs an additional Ethernet GigE adapter to provide a second network for the profiler.
- **Important:** 10/100 Mb Ethernet is not supported by the Z-Trak series of Profilers. The Status LED will show that it acquired an IP address (solid Blue) but the Z-Trak will not function at these slower connections.

Ethernet Switch Requirements

When there is more than one Z-Trak device on the same network or a device-to-PC separation greater than 100 meters, an Ethernet (Gigabit) switch is required. Since the Z-Trak profiler complies with the Internet Protocol, it should work with all standard Ethernet switches. However, switches offer a range of functions and performance grades, so care must be taken to choose the right switch for a particular application.

Ethernet to Fiber-Optic Interface Requirements

In cases of profiler-to-PC separations of more than 100 meters but an Ethernet switch is not desired, a fiber-optic media converter can be used. The FlexPoint GX from Omnitron Systems (www.omnitron-systems.com) converts GigE to fiber transmission and vice versa. It supports multimode (MM) fiber over distances of up to 220 m (720 ft.) and single-mode (SM) fiber up to 65 km (40 mi.) with SC, MT-RJ, or LC connector types.

Important: The inclusion in this manual of GigE to fiber-optic converters does not guarantee they will meet specific application requirements or performance. The user must evaluate any supplemental Ethernet equipment.

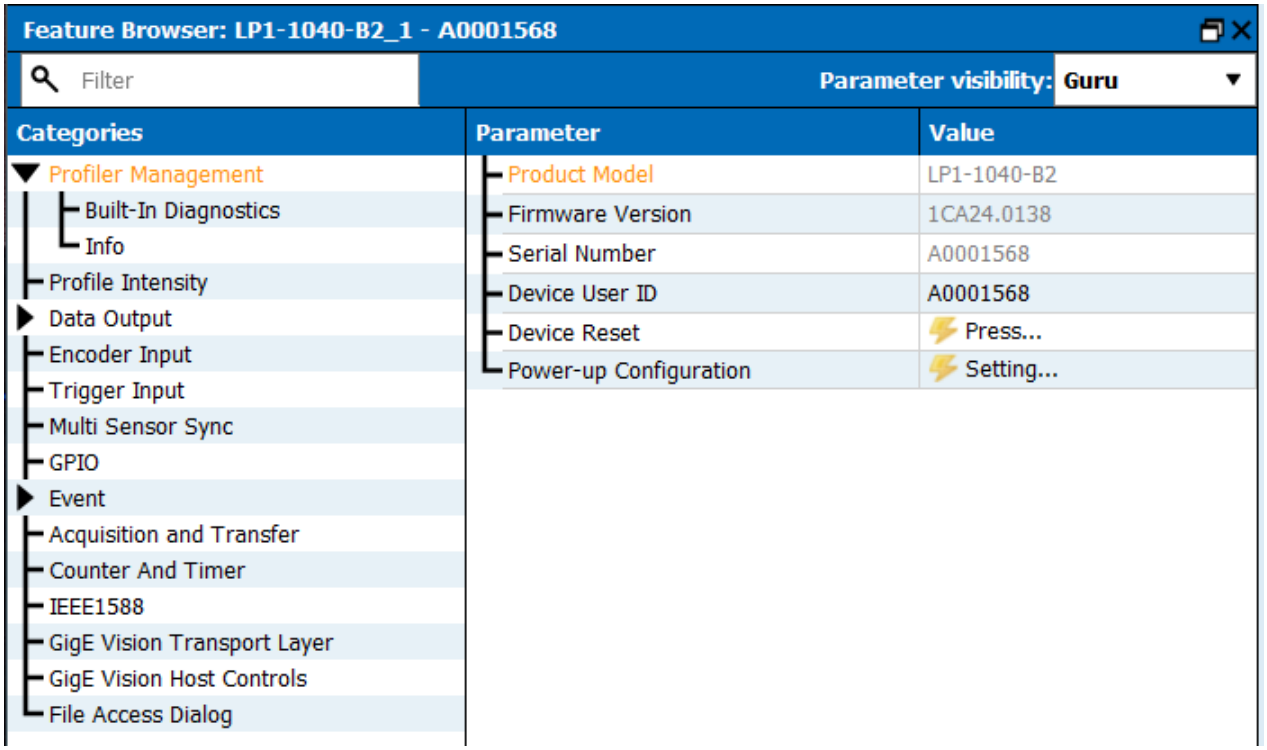
Feature Reference

The Z-Trak feature set is presented in functional categories as grouped by the profiler's XML file. The Z-Expert tool presents these features for the user to read or modify as required to explore the profiler operation in the user's imaging setup. Typically this is followed by a program written with the Sapera LT API to control the profiler in an automated measurement application.

Profiler Management

This category provides profiler information and diagnostics. The profiler features are separated into three groups as shown in the following screen shots. GigE Vision applications retrieve this read-only information to identify the profiler along with its characteristics.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



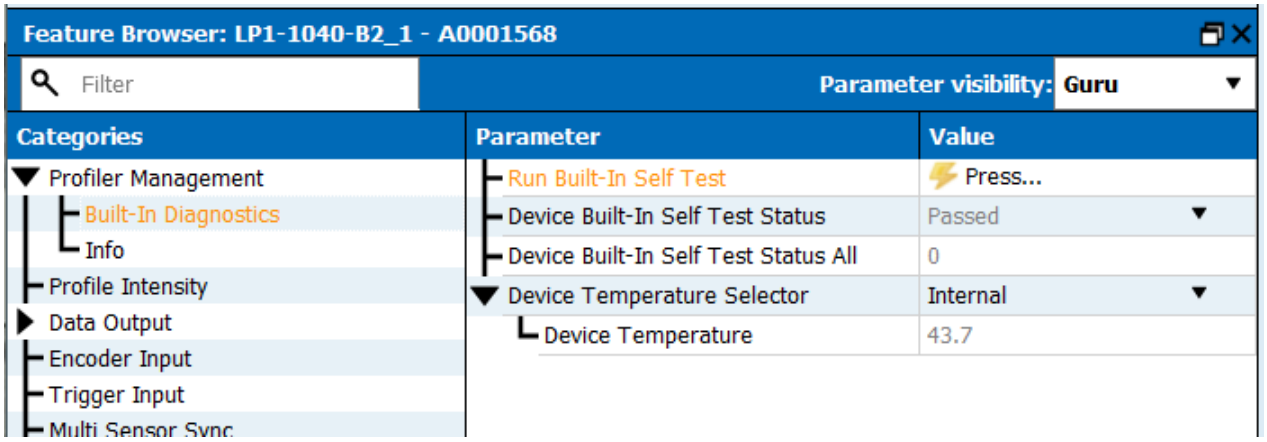
Profiler Management Features

The following tables describe these parameters along with their view attribute and in which device version the feature was introduced. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (indicated by **DFNC**), versus the GenICam Standard Features Naming Convention (**SFNC** tag is not shown). New features released after the initial firmware version are indicated by green version numbers.

Display Name	Feature & Values	Description	Device Version & View
Product Model	DeviceModelName	Displays the device model name.	1.00 Beginner
Firmware Version	DeviceFirmwareVersion	Displays the currently loaded firmware version number. Firmware files have a unique number and have the .cbf file extension.	1.00 Beginner
Serial Number	DeviceSerialNumber	Displays the factory set serial number of the device.	1.00 Expert
Device User ID	DeviceUserID	Feature to store a user-programmable identifier of up to 15 characters. The default factory setting is the device serial number	1.00 Beginner
Power-up Configuration Selector	UserSetDefault	Specify the profile sensor configuration set to load and make active on power-up or reset. The configuration sets are stored in non-volatile memory of the device.	1.00 Beginner
Factory Setting	*Default*	*Select the Factory Setting values as the Power-up Configuration.*	
UserSet1	*UserSet1*	*Select the user defined configuration UserSet 1 as the Power-up Configuration.*	
UserSet2	*UserSet2*	*Select the user defined configuration UserSet 2 as the Power-up Configuration.*	
User Set Selector	UserSetSelector	Selects the configuration set to load feature settings from or save current feature settings to. The Factory set contains default camera feature settings. User configuration sets contain feature settings previously saved by the user.	1.00 Beginner
Factory Setting	*Default*	*Select the default device feature settings saved by the Factory.*	
UserSet1	*UserSet1*	*Select the User defined Configuration space UserSet1 to save to or load from features settings previously saved by the user.*	
UserSet2	*UserSet2*	*Select the User defined Configuration space UserSet2 to save to or load from features settings previously saved by the user.*	
Load Configuration	UserSetLoad	Loads the configuration set, specified by the User Set Selector feature, to the device and makes it active.	1.00 Beginner
Save Configuration	UserSetSave	Saves the current device configuration to the user set specified by the User Set Selector feature. The user sets are located on the device in non-volatile memory.	1.00 Beginner
Device Reset	DeviceReset	Resets the device to its power up state.	1.00 Beginner
Serial Number (Device ID, deprecated)	DeviceID	Displays the device's factory set camera serial number.	1.00 Invisible
Device Acquisition Type	deviceAcquisitionType	Displays the Device Acquisition Type of the product.	1.00 DFNC Invisible

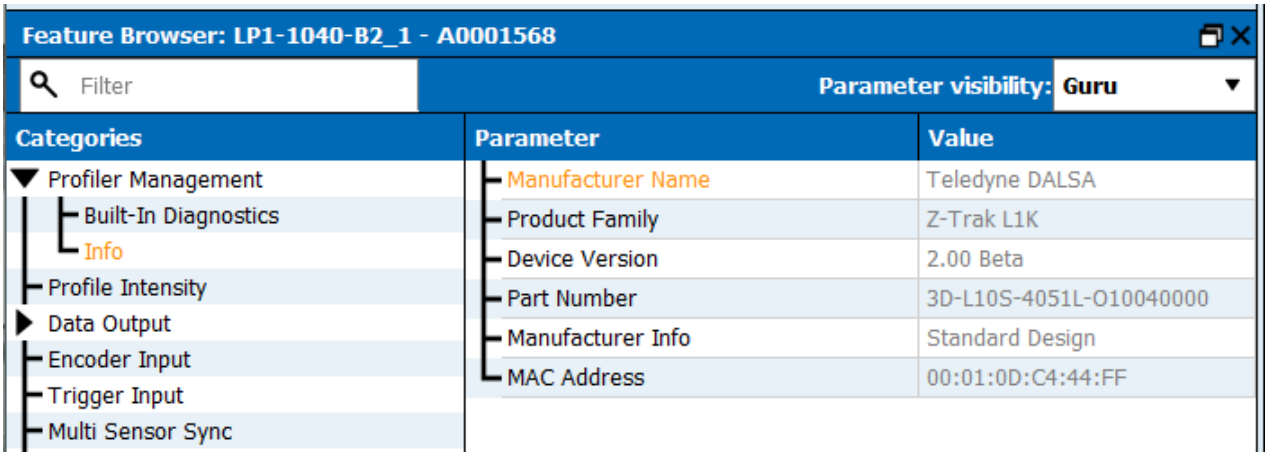
Image Sensor	*Sensor*	*The device gets its data directly from a sensor.*	
3D Profile Sensor	*Euclid_3D_camera*	*The device gets its data from the profiler.*	
Device TL Type	DeviceTLType	Transport Layer type of the device.	1.00 DFNC Invisible
GigE Vision	*GigEVision*	*GigE Vision Transport Layer*	
Device TL Version Major	DeviceTLVersionMajor	Major version of the device's Transport Layer.	1.00 Invisible
Device TL Version Minor	DeviceTLVersionMinor	Minor version of the device's Transport Layer.	1.00 Invisible
DFNC Major Rev	deviceDFNCVersionMajor	Major revision of Dalsa Feature Naming Convention which was used to create the device's XML.	1.00 DFNC Invisible
DFNC Minor Rev	deviceDFNCVersionMinor	Minor revision of Dalsa Feature Naming Convention which was used to create the device's XML.	1.00 DFNC Invisible
SFNC Major Rev	DeviceSFNCVersionMajor	Major Version of the Genicam Standard Features Naming Convention which was used to create the device's XML.	1.00 DFNC Invisible
SFNC Minor Rev	DeviceSFNCVersionMinor	Minor Version of the Genicam Standard Features Naming Convention which was used to create the device's XML.	1.00 DFNC Invisible
Calibration Date	deviceCalibrationDateRaw	Date when the profile sensor was calibrated.	1.00 Invisible
Power-up Configuration Selector (deprecated)	UserSetDefaultSelector	Specify the camera configuration set to load and make active on camera power-up or reset. The camera configuration sets are stored in camera nonvolatile memory.	1.00 Invisible
Factory Setting	*Default*	*Select the Factory Setting values as the Power-up Configuration.*	
UserSet1	*UserSet1*	*Select the user defined configuration UserSet 1 as the Power-up Configuration.*	
UserSet2	*UserSet2*	*Select the user defined configuration UserSet 2 as the Power-up Configuration.*	
userSetError	userSetError	Error Flags for UserSetLoad & UserSetSave	1.00 Invisible
	NoError	*No Error*	
	LoadGenericError	*Unknown error*	
	LoadBusyError	*The device is busy and cannot perform the action*	
	LoadMemoryError	*Not enough memory to load set*	
	LoadFileError	*Internal file I/O error*	
	LoadInvalidSetError	*At least one register could not be restored properly*	
	LoadResourceManagerError	*An internal error happened related to the resource manager*	
	SaveGenericError	*Unknown error*	
	SaveBusyError	*The device is busy and cannot perform the action*	
	SaveMemoryError	*Device ran out of memory while saving set*	
	SaveFileError	*Internal file I/O error*	
	SaveInvalidSetError	*An invalid user set was requested*	
	SaveResourceManagerError	*An internal error happened related to the resource manager*	

Profiler-Built-In Diagnostics



Display Name	Feature & Values	Description	Device Version & View
Run Built-In Self Test	deviceBIST	Command to perform an internal test which will determine the device status.	1.00 Guru
Device Built-In Self Test Status	deviceBISTStatus	Return the status of the device Built-In Self-Test. Possible return values are device-specific.	1.00 Guru
Passed	*Passed*	*No failure detected*	
Last firmware update failed	*FirmwareUpdateFailure*	*Last firmware update operation failed.*	
Unexpected Error	*Unexpected_Error*	*Switched to recovery mode due to unexpected software error.*	
Sensor Initialization Failure	*SensorFailure*	*There was an error initializing the sensor. The device may not be able to capture images.*	
Firmware Error	*FirmwareError*	*Firmware encountered an error during streaming.*	
Unknown Error Returned	*Unknown_Error*	*Undefined single error or multiple simultaneous errors.*	
Device Built-In Self Test Status All	deviceBISTStatusAll	Return the status of the device Built-In Self-Test as a bit field. The meaning for each bit is device-specific.	1.00 DFNC Guru
Device Temperature Selector	DeviceTemperatureSelector	Select the source where the temperature is read.	1.00 Guru
Internal	*Internal*	*Internal temperature of the Sensor.*	
MaxInternal	*MaxInternal*	*Indicates the highest device temperature since power up. Value is reset on power off.*	
Image Sensor	*Image Sensor*	*Temperature of the image sensor.*	
Device Temperature	DeviceTemperature	The temperature of the selected source in degrees Celsius.	1.00 Guru

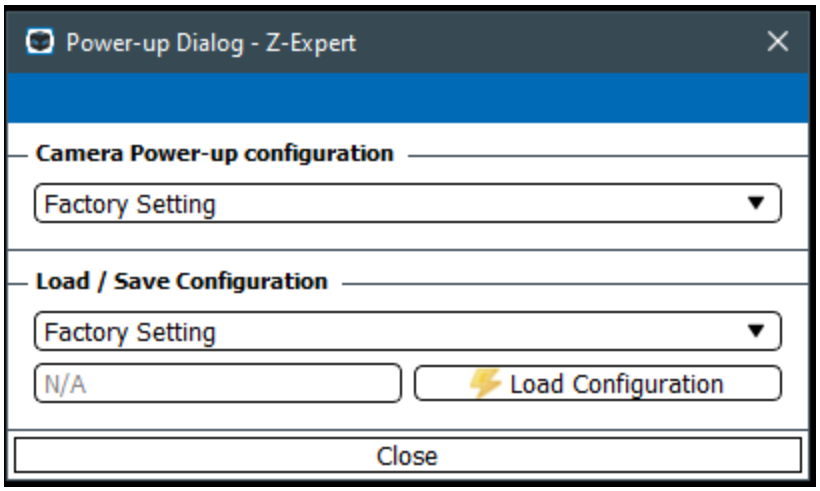
Profiler-Info



Display Name	Feature & Values	Description	Device Version & View
Manufacturer Name	DeviceVendorName	Displays the device vendor name.	1.00 Beginner
Family Name	DeviceFamilyName	Displays the device family name.	1.00 Beginner
Device Version	DeviceVersion	Displays the device version. This tag will also highlight if the firmware is a beta or custom design.	1.00 Beginner
Part Number	deviceManufacturerPartNumber	Displays the device part number.	1.00 DFNC Beginner
Manufacturer Info	DeviceManufacturerInfo	This feature provides extended manufacturer information about the device.	1.00 Beginner
MAC Address	deviceMacAddress	Displays the unique MAC (Media Access Control) address of the Device.	1.00 DFNC Beginner

Power-up Configuration Dialog

Z-Expert allows users to save profiler settings in onboard non-volatile memory. There are two such sets. Users can choose among Factory Setting, Userset 1 or Userset 2 as a power up configuration. Using Z-Expert tool it is also possible to download the current settings from the sensor and save them to a file for later retrieval.



Device Power-up Configuration

The first drop list selects the device configuration state to load on power-up (see feature *UserSetDefaultSelector*).

- The user chooses from one factory data set or one of two possible user saved states.

Load / Save Configuration

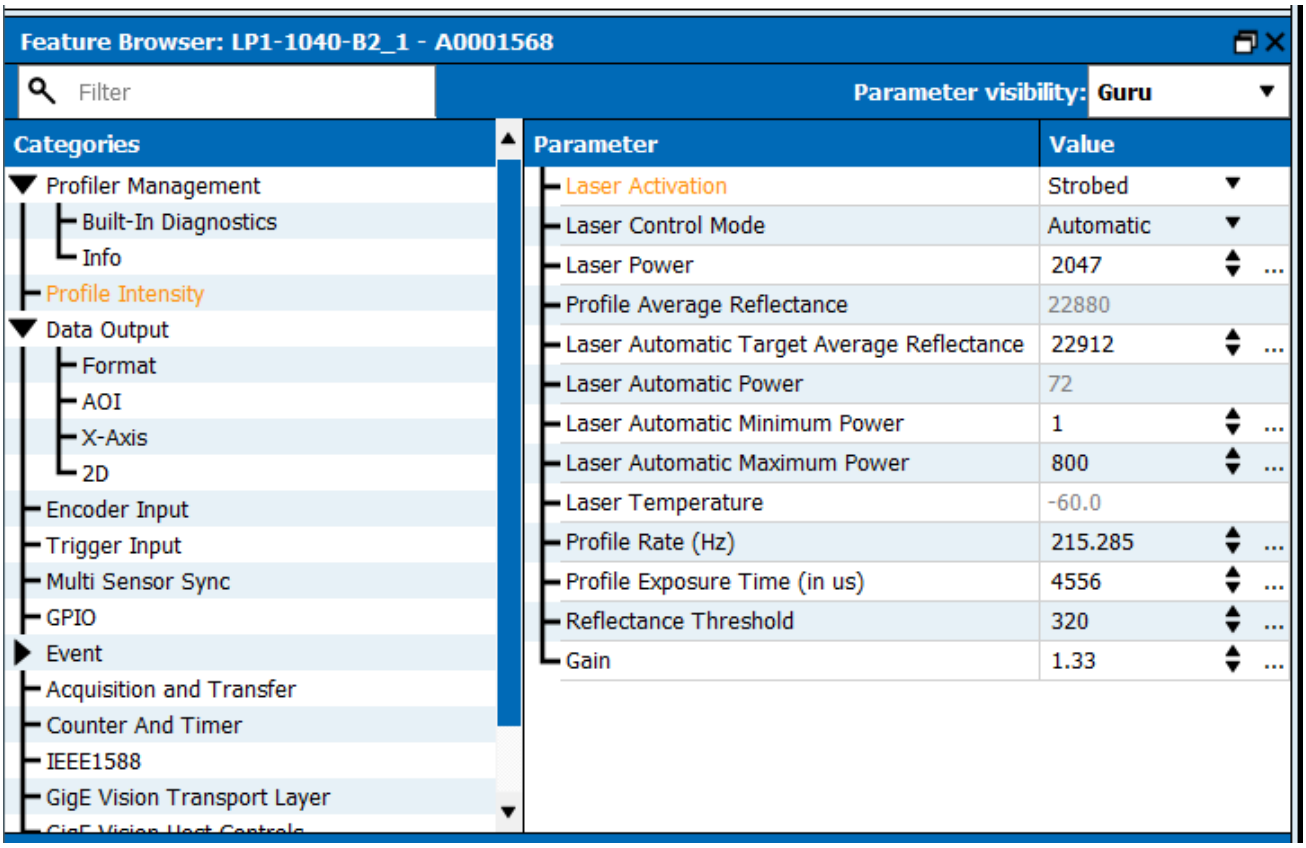
The second drop list allows the user to change the device configuration any time after a power-up (see feature *UserSetSelector*).

- To reset the device to the factory configuration, select *Factory Setting* and click Load, or select a saved user set and click Load to restore a saved configuration.
- To save a current device configuration, select User Set 1 or 2 and click Save.

Profile Intensity Category

The Profile Intensity features as shown by Z-Expert, has parameters used to manage the profiler's laser. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



Profile Intensity Feature Descriptions

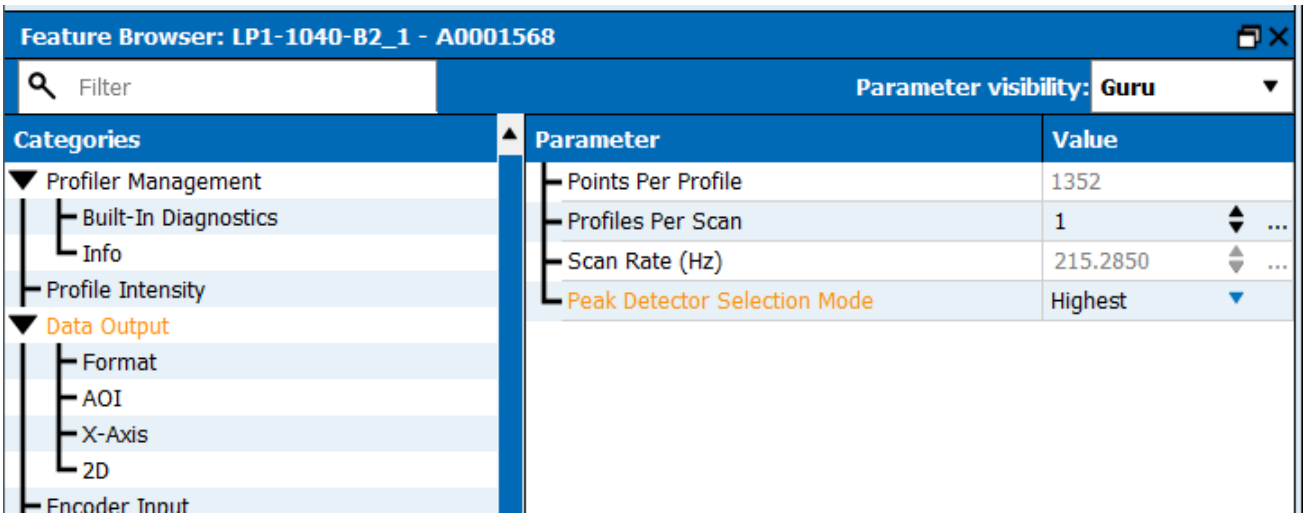
The following table describes these parameters along with their view attribute and. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Laser Activation	laserActivation	Controls the state of the laser. The external Emergency Laser Stop circuit controls the power going to the laser. If the Emergency Laser Stop is "Active" The laser will not turn on.	1.00 DFNC Beginner
Off	*Off*	*Turns the Laser Off.*	
On	*On*	*Turns the Laser On. The laser will power up only if the Emergency Stop is in the "Inactive" state.*	
Strobed	*Strobed*	*The laser will be turn on for the duration of the Profile Exposure Time. The laser will power up only if the Emergency Stop is in the "Inactive" state.*	
Laser Control Mode	laserControlMode	Specifies if the laser intensity will be controlled automatically or manually.	1.00 DFNC Expert
Manual	*Manual*	*The laser intensity is controlled by Laser Power feature.*	
Automatic	*Auto*	*The laser intensity is adjusted automatically by the device to reach the average reflectance value set by the Automatic Target Average Reflectance feature.*	
Laser Power	laserPower	User set laser power setting for when the feature laserControlMode=Manual.	1.00 DFNC Beginner
Profile Average Reflectance	profileAvgReflectance	Reads the average reflectance of the last profile.	1.00 DFNC Expert
Laser Automatic Target Average Reflectance	laserAutoTargetAvgReflectance	User set reflectance value used as the target for when the feature laserControlMode=Auto.	1.00 DFNC Expert
Laser Automatic Power	laserAutoPower	Reads the current laser power setting when the feature laserControlMode=Auto.	1.00 DFNC Expert
Laser Automatic Minimum Power	laserAutoMinPower	Laser Automatic Minimum Power.	1.00 DFNC Expert
Laser Automatic Maximum Power	laserAutoMaxPower	Laser Automatic Maximum Power.	1.00 DFNC Expert
Laser Temperature	laserTemperature	Reads the laser temperature in Celsius.	1.00 DFNC Expert
Profile Rate (Hz)	profileRate	Specifies the profile rate of the sensor, in Hz.	1.00 DFNC Beginner
Profile Exposure Time (in us)	ExposureTime	Sets the exposure time (in microseconds) when the Exposure Mode feature is set to Timed.	1.00 DFNC Beginner
Reflectance Threshold	peakDetectorReflectanceThreshold	Value which identifies the minimum reflectance a peak must have to be considered.	1.00 DFNC Expert
Gain	Gain	Analog gain setting of the image sensor.	1.00 DFNC Beginner

Data Output Features

The Output Controls as shown by Z-Expert has parameters used to configure the profiler data output format, AOI and other controls organized with 4 sub-groups.

Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application. Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.

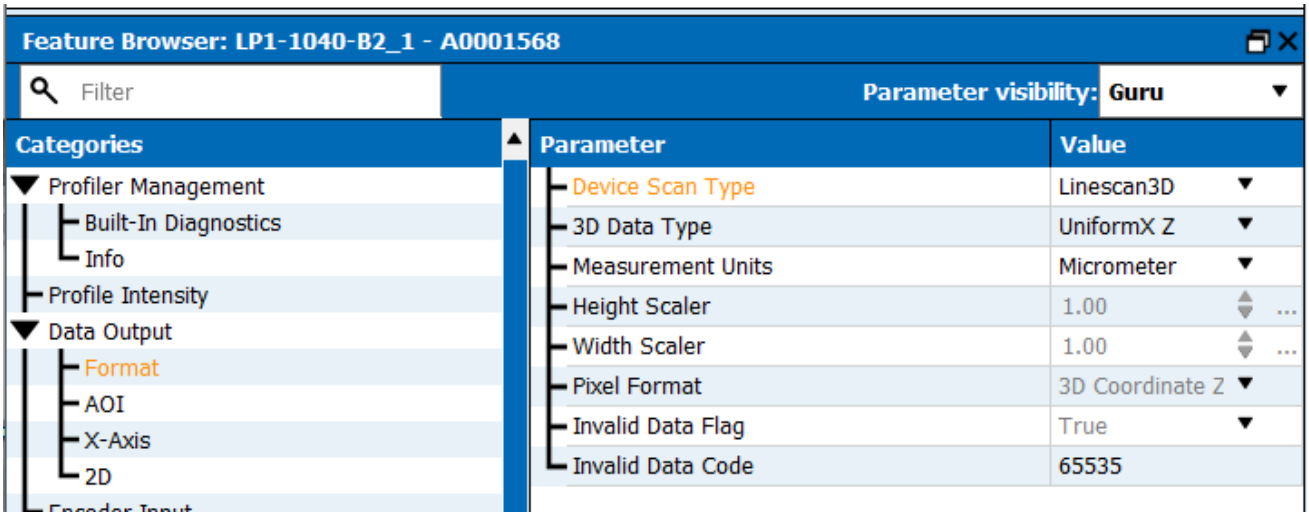


Data Output Descriptions

The following tables describe the five groups of parameters along with their view attribute. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Points Per Profile	pointsPerProfile	Number of points in the profile. This feature is editable when Uniform X Points Per Profile Mode is set to Manual. Otherwise this feature is read only.	1.00 DFNC Beginner
Profiles Per Scan	profilesPerScan	Height of the virtual image provided by the device (in profiles).	1.00 DFNC Beginner
Scan Rate (Hz)	scanRate	Specifies the device internal frame rate, in Hz.	1.00 DFNC Beginner
Peak Detector Selection Mode	peakDetectorSelectionMode	Selects which peak will be output in the profile. (Default is Highest).	1.00 DFNC Expert
Highest	*Highest*	*The peak with the maximum reflectance will be chosen.*	
First	*First*	*The peak that is detected closest to the far field of view will be chosen.*	
Last	*Last*	*The peak that is detected closest to the near field of view will be chosen.*	

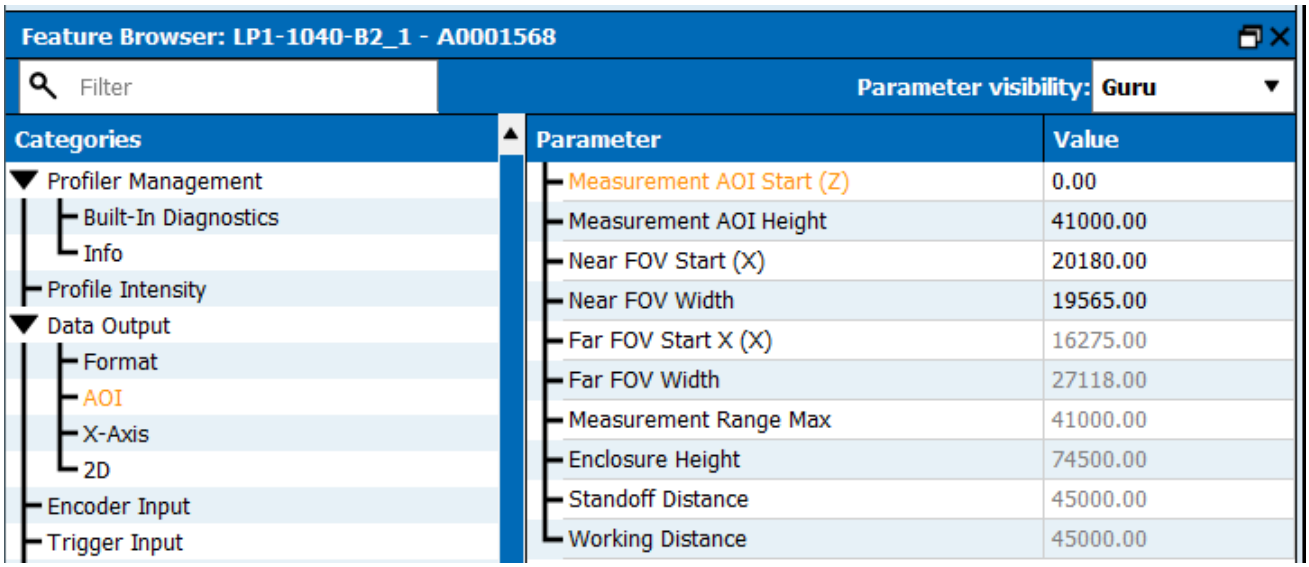
Output Format Descriptions



Display Name	Feature & Values	Description	Device Version & View
Device Output Type	DeviceScanType	Selects the output type of the device.	1.00 DFNC Beginner
Linescan3D	*Linescan3D*	*Device outputs lines of 3D profiles.*	
Linescan 1D (mono 16-bit)	*Linescan*	*Device outputs lines of 3D profiles in Mono16 format. For software packages not compliant with GeniCam 3D standard output formats.*	
Areascan	*Areascan*	*Device outputs 2D area scan images.*	
3D Data Type	Scan3dOutputMode	Selects 3D output data format (default is UniformX Z).	1.00 Beginner
UniformX Z	*RectifiedC*	*Each profile consists of calibrated Z values in a 16-bit data format. The Z values have been resampled to a uniform sampling pattern in the X direction.*	
XZ	*CalibratedAC*	*Each profile consists of calibrated X and Z values in a 32 bit data format.*	
XZRW	*CalibratedACRW*	*Each profile consists of calibrated X, Z, R (reflectance) and W (peak width) values in a 64bit data format. The first two 16-bit fields are as the XZ format, The third and fourth 16-bit fields contain the R and ZW data.*	
Measurement Units	Scan3dDistanceUnit	Sets the measurement units for the profile X and Z data (default is Micrometer).	1.00 DFNC Beginner
Micrometer	*Micrometer*	*All X and Z values are in micrometer units.*	
Millimeter	*Millimeter*	*All X and Z values are in millimeter units.*	
Inch/1000	*Inch_1000*	*All X and Z values are in thousands of an inch (mil).*	
Z Scaler	heightScaler	Scaling factor to convert Z values to the units specified by Measurement Units.	1.00 DFNC Guru
X Scaler	widthScaler	Scaling factor to convert X values to the units specified by Measurement Units.	1.00 DFNC Guru
Pixel Format	PixelFormat	Pixel formats as defined by the GeniCam standard.	1.00 Guru

Monochrome 10-Bit	*Mono10*	*Monochrome 10-Bit data format. Only available in Areascan mode.*	
3D Coordinate Z (16-bit)	*Coord3D_C16*	*3D Coordinate: Z position (16-Bit)*	
3D Coordinate XZ (32-bit)	*Coord3D_AC16*	*3D Coordinate: X and Z positions stored in a 32-Bit value.*	
3D Coordinate XZRW (64-bit)	*Coord3D_ACR016*	*3D Coordinate: X and Z positions, Reflectance and peak Width stored in a 64-bit value.*	
Monochrome 16-Bit	*Mono16*	*Mono16: Monochrome 16-Bit*	
Invalid Data Flag	Scan3dInvalidDataFlag	Enables/Disables the encoding of invalid values in the profile data.	1.00 Guru
True	*True*	*Enables the flagging of the invalid values in the profile data.*	
False	*False*	*Disables the flagging of the invalid values in the profile data.*	
Invalid Data Code	Scan3dInvalidDataValue	Specifies a numerical code that indicates an invalid value in the profile data.	1.00 Guru

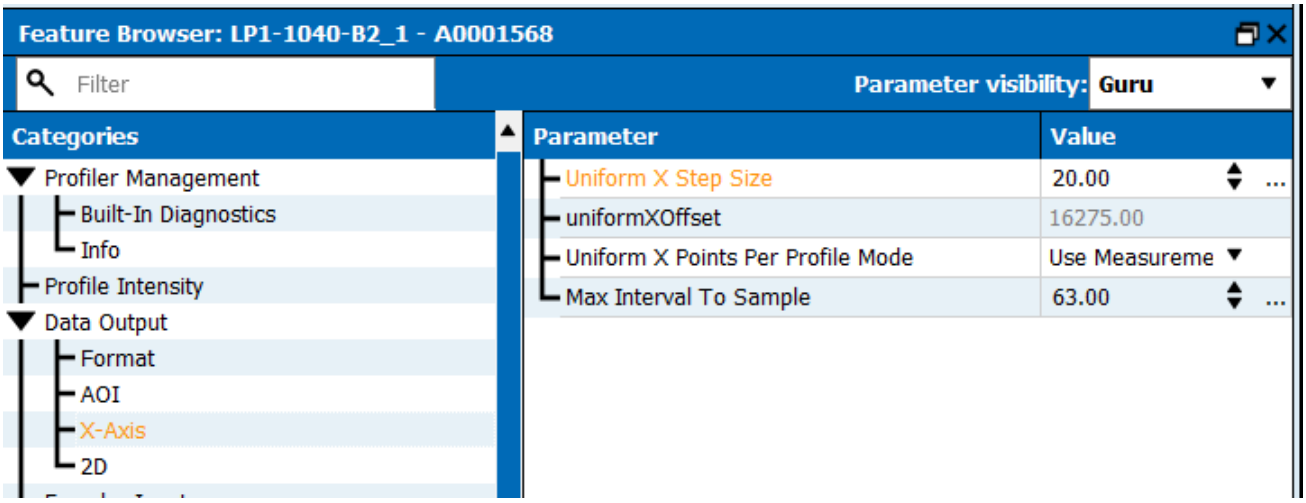
Output AOI Descriptions



Display Name	Feature & Values	Description	Device Version & View
Measurement AOI Start (Z)	aoiZStart	Specifies the vertical start of the measurement AOI. This is the minimum height value that can be measured.	1.00 DFNC Beginner
Measurement AOI Height	aoiHeight	Specifies the height of the measurement AOI.	1.00 DFNC Beginner
Near FOV Start (X)	aoiNFOVStartX	Specifies the horizontal start of measurement AOI at the near FOV.	1.00 DFNC Beginner
Near FOV Width	aoiNFOVWidth	Specifies the width of the measurement AOI at the near FOV.	1.00 DFNC Beginner
Far FOV Start X (X)	aoiFFOVStartX	Indicates the horizontal start of measurement AOI at the far FOV.	1.00 DFNC Beginner

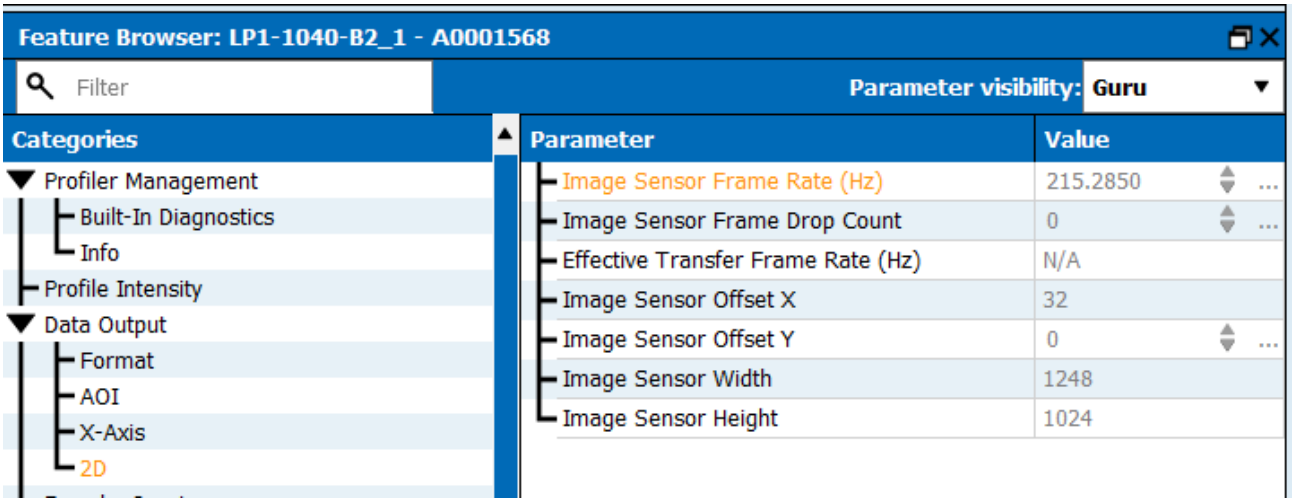
Far FOV Width	aoiFFOVWidth	Indicates the width of the measurement AOI at the far FOV.	1.00 DFNC Beginner
Measurement Range Max	measurementRangeMax	Indicates the absolute maximum measurement range of the device.	1.00 DFNC Expert
Enclosure Height	enclosureHeight	Indicates the mechanical height of the device.	1.00 DFNC Expert
Standoff Distance	standoffDistance	Standoff (Clearance) Distance indicates the distance from the laser window of the device to the top of absolute measurement AOI.	1.00 DFNC Expert
Working Distance	workingDistance	Working Distance indicates the distance from the laser window of the device to the top of resized measurement AOI.	1.00 DFNC Expert

Output X-Axis Descriptions



Display Name	Feature & Values	Description	Device Version & View
Uniform X Step Size	uniformXStepSize	Specifies the Interval between horizontal samples. This value is used only when "3D Data Type" is set to "UniformX Z".	1.00 DFNC Beginner
Uniform X Offset	uniformXOffset	Horizontal offset where measurement data starts.	1.00 DFNC Beginner
Uniform X Points Per Profile Mode	uniformXPointsPerProfileMode	Selects how the "Points Per Profile" will be determined. When set to "UseMeasurementAOI" the "Points Per Profile" will be calculated based on AOI settings. When set to "Manual" the user must set the "Points Per Profile" value.	1.00 DFNC Guru
Use Measurement AOI	*UseMeasurementAOI*	*Uses the width of the MeasurementAOI to determine the number of points per profile.*	
Manual	*Manual*	*The number of Points per profile is set by the user.*	
Uniform X Interpolation Limit	uniformXMaxInterpolationLimit	Specifies the maximum interpolation zone along the X-axis. Only Z-values inside of this zone are used for interpolation when re-sampling for uniform spacing.	1.00 DFNC Guru

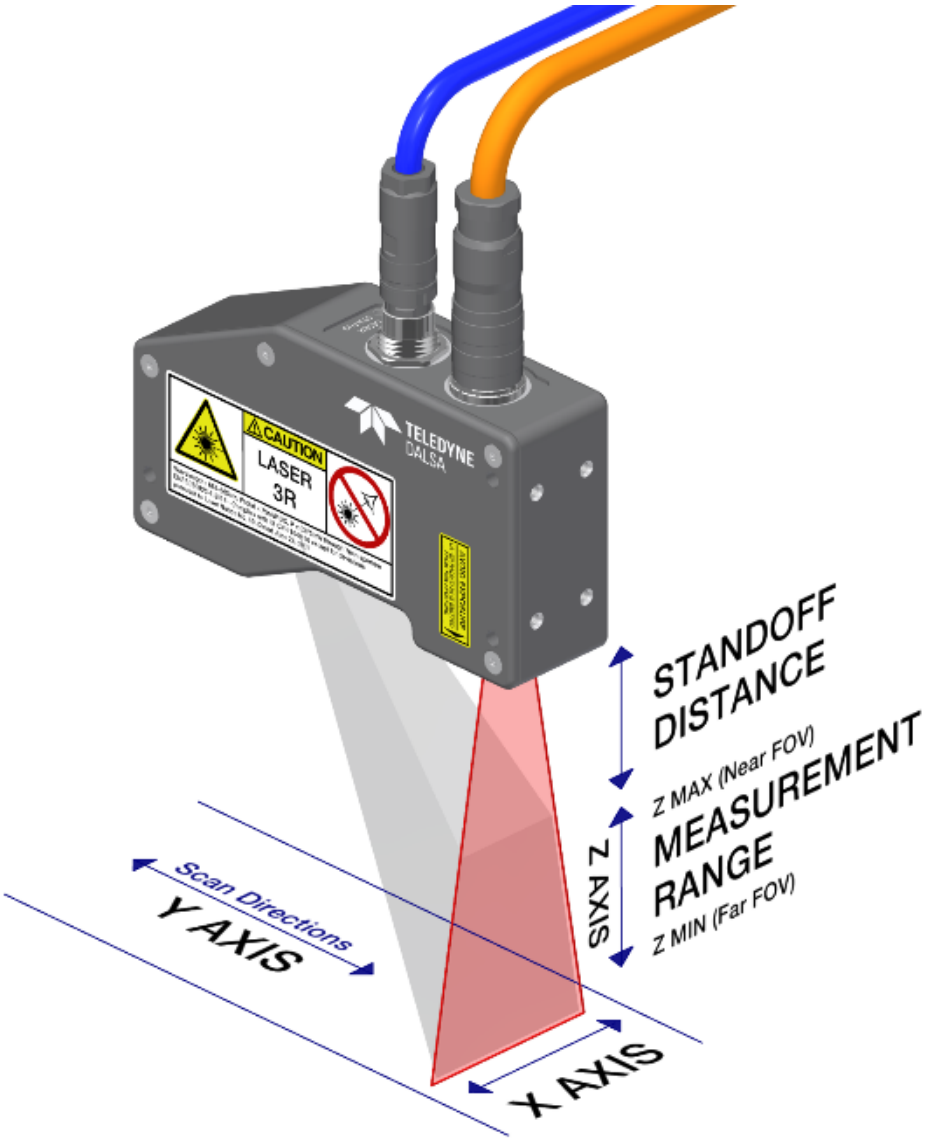
Output 2D Descriptions



Display Name	Feature & Values	Description	Device Version & View
Image Sensor Frame Rate (Hz)	imageSensorFrameRate	Specifies the camera internal frame rate of the sensor, in Hz.	1.00 DFNC Guru
Image Sensor Frame Drop Count	internalAcquisitionFrameDropCount	Indicates the number of 2D frames dropped from the image sensor in areascan mode to respect the maximum GigE transfer bandwidth. This preserves the image sensor settings like Exposure Time, to be the same as when in "Linescan3D".	1.00 DFNC Guru
Effective Transfer Frame Rate (Hz)	resultingTransferFPS	Indicates the transfer frame rate, based on the current "Image Sensor Frame Rate" and Image "Sensor Frame Drop Count"	1.00 DFNC Guru
Image Sensor Offset X	imageSensorOffsetX	Indicates horizontal offset from the image sensor origin. Read only when the output format is set to "Linescan3D" mode. Read/Write when the output format is set to "Areascan" Mode. Manually changing this value can cause inconsistencies in the 3D measurement AOI.	1.00 DFNC Guru
Image Sensor Offset Y	imageSensorOffsetY	Indicates Vertical offset from the image sensor origin. Read only when the output format is set to "Linescan3D" mode. Read/Write when the output format is set to "Areascan" Mode. Manually changing this value can cause inconsistencies in the 3D measurement AOI.	1.00 DFNC Guru
Image Sensor Width	imageSensorWidth	Indicates the number of horizontal pixels acquired from the image sensor. Read only when the output format is set to "Linescan3D" mode. Read/Write when the output format is set to "Areascan" Mode. Manually changing this value can cause inconsistencies in the 3D measurement AOI.	1.00 DFNC Guru
Image Sensor Height	imageSensorHeight	Indicates the number of lines acquired from image sensor. Read only when the output format is set to "Linescan3D" mode. Read/Write when the output format is set to "Areascan" Mode. Manually changing this value can cause inconsistencies in the 3D measurement AOI.	1.00 DFNC Guru

Overview of the Real World Measurement Reference Point

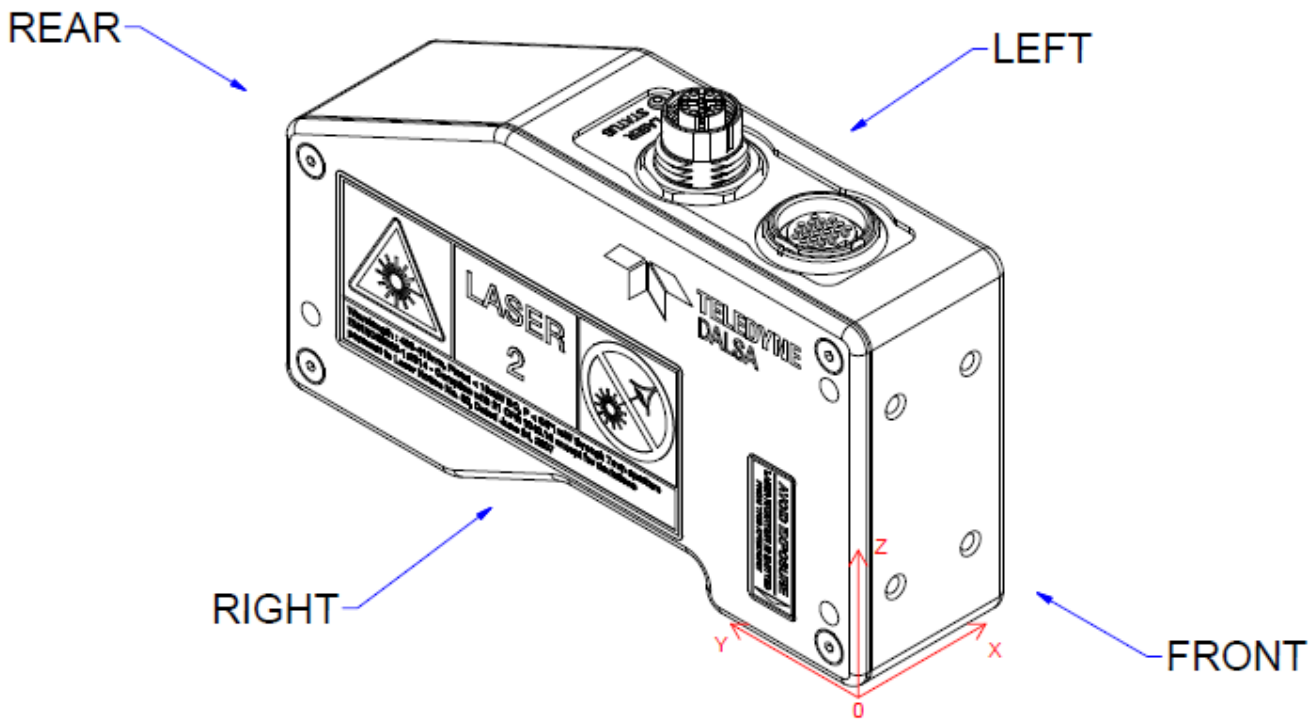
Definition of Z-Trak Measurement Zones



Location of the Reference Point

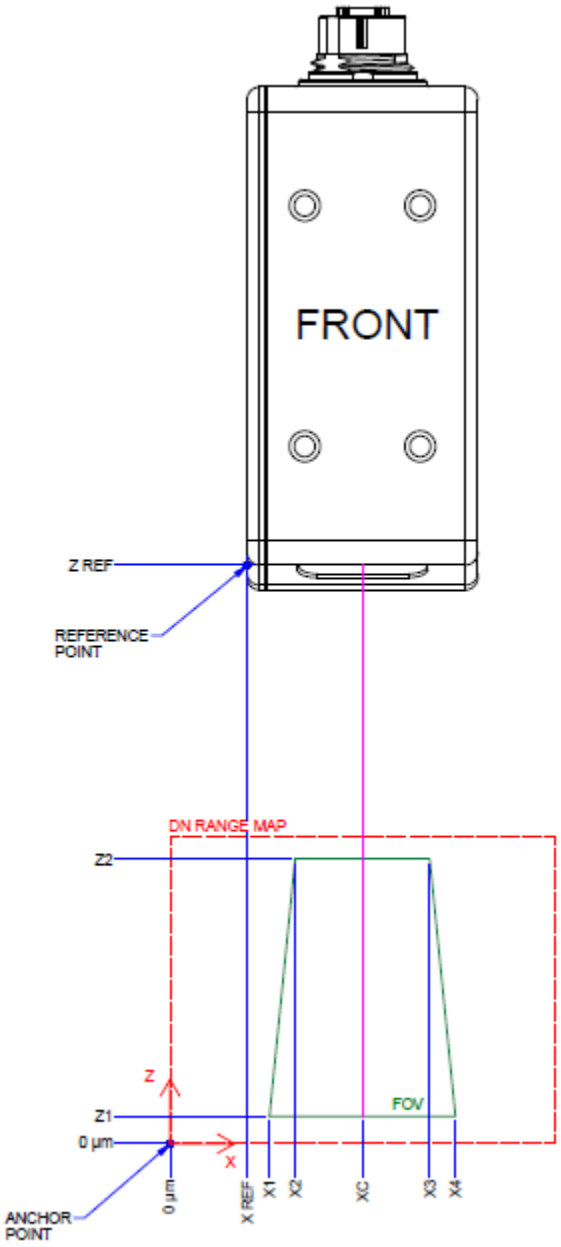
The lower left corner of the DN range map is considered the Anchor point (i.e. origin 0,0) which is the reference point for real world measurements. The Right bottom corner of the Front side is defined as the Reference point on the profiler body. This corner is on the “lowest” mechanical edge of the profiler. Real distances between Anchor and points along X and Z axes are shown on the pictures below (one for each available Z-Trak model).

Note that the actual MR is the area in free space located under the profiler’s laser.



Models with MR/DOF of 40mm

OFFSET CALCULATION FOR DOF 10 and 40mm

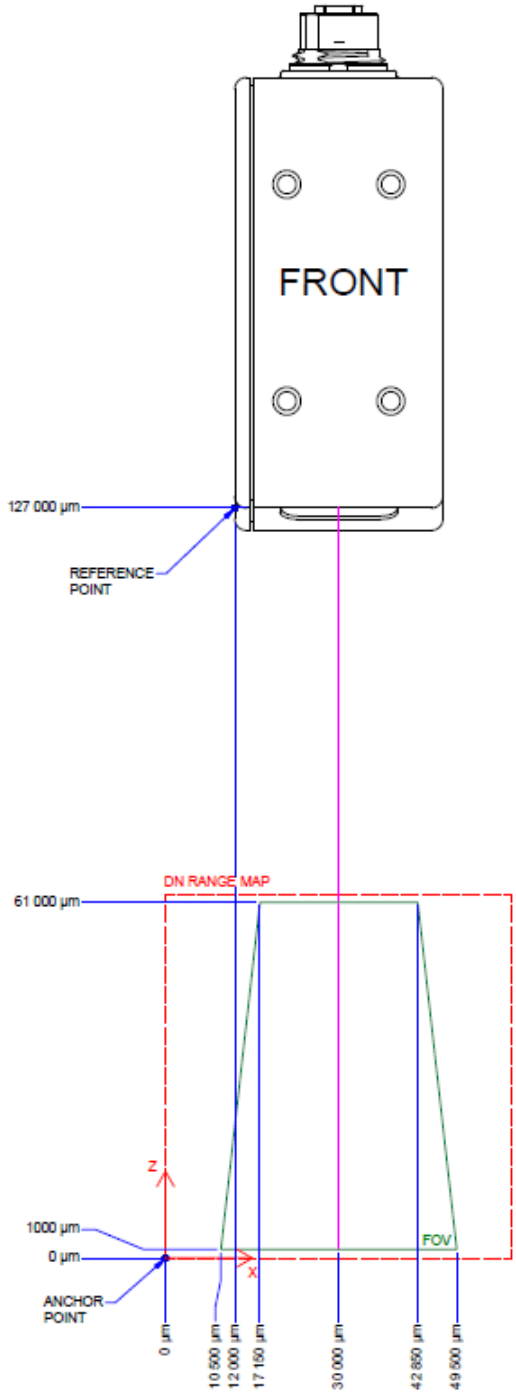


DOF	X1	X2	X3	X4	Xc	Xref	Z1	Z2	Zref
10mm	25150	25800	34200	34850	30000	12000	500	10500	46500
40mm	16200	20000	40000	43800	30000	12000	500	40500	85500

Note: all values are in micrometers and are typical values.

Models with MR/DOF of 60mm

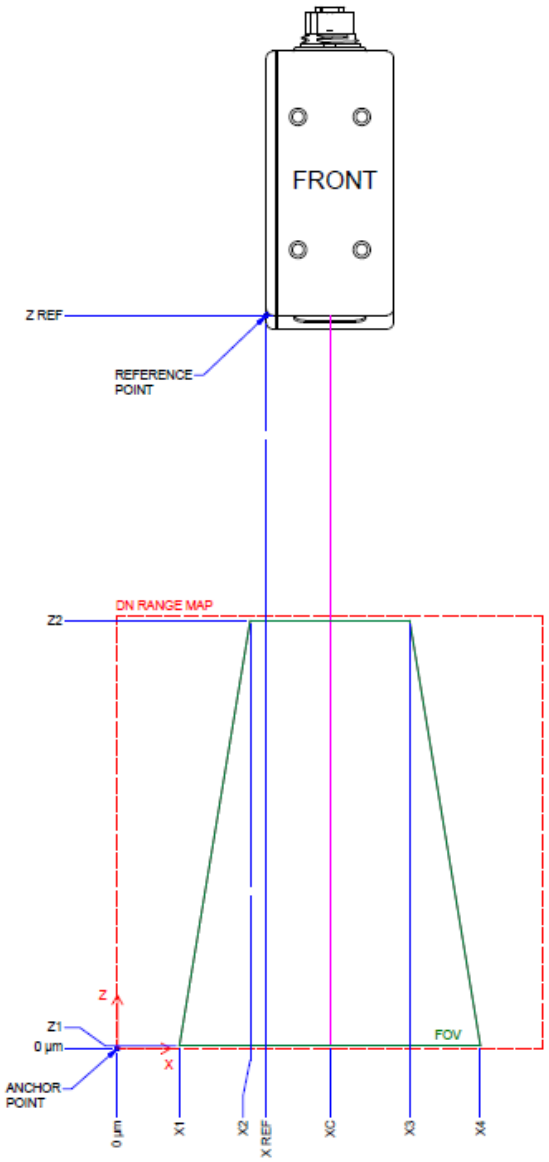
OFFSET CALCULATION FOR DOF 60mm



DOF	X1	X2	X3	X4	Xc	Xref	Z1	Z2	Zref
60mm	10500	17150	42850	49500	30000	12000	1000	61000	127000
Note: all values are in micrometers and are typical values.									

Z-Trak LP1 Models with 120, 200, 250, 400, 800 and 1100mm measurement range

OFFSET CALCULATION FOR DOF 120, 200, 250, 400, 800 and 1100mm



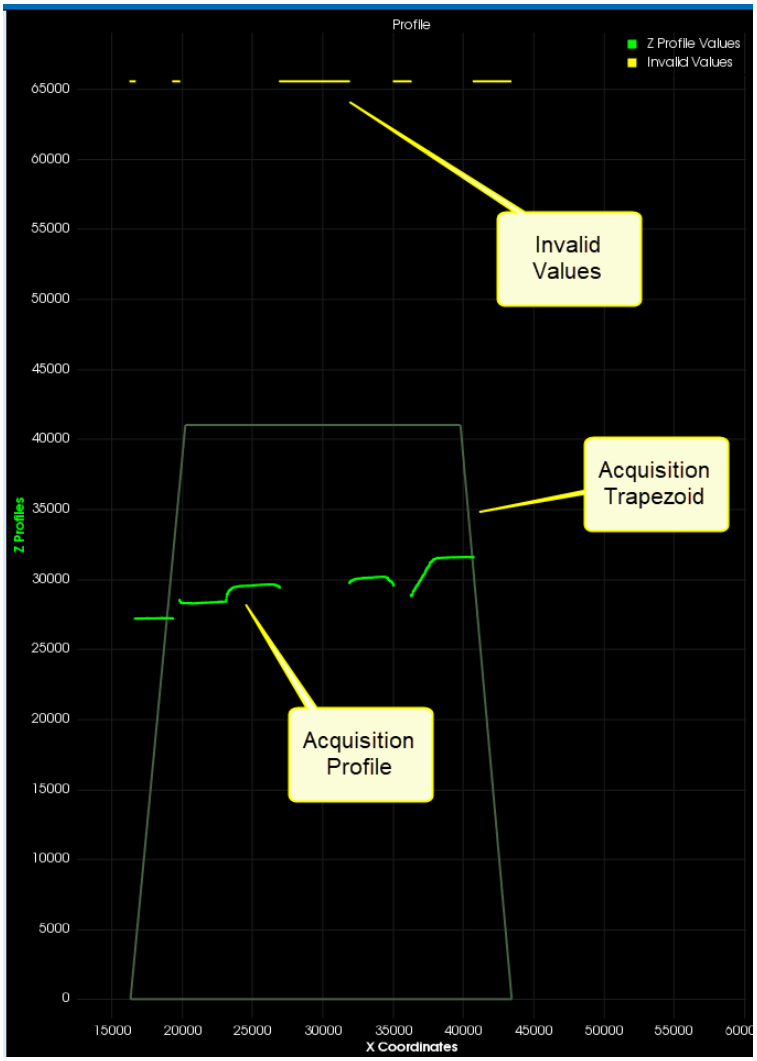
DOF	X1	X2	X3	X4	Xc	Xref	Z1	Z2	Zref
120mm	19600	38600	81400	100400	60000	42000	1000	121000	207000
200mm	22550	58150	121850	157450	90000	72000	3000	203000	353000
250mm	46000	114000	246000	31400	180000	162000	3000	253000	428000
400mm	100000	248500	471500	620000	360000	342000	3000	403000	653000
800mm	77500	400000	800000	1122500	600000	582000	5000	805000	1205000
1100mm	200	754500	1165500	1720000	960000	942000	5000	1105000	1355000
Note: all values are in micrometer and are typical values.									

Visualizing the Acquisition Trapezoid with Z-Expert

Z-Trak provides features allowing defining the boundaries to the profile trapezoid. Z-Expert provides a graphical tool to visualize the ROI with live profile acquisitions.

Note: The ROI visualized is of the non-linear X dimension and Z-acquisition data. Refer to section How to Calculate Real World Values for additional details.

Categories	Parameter	Value
Profiler Management	Measurement AOI Start (Z)	0.00
Built-In Diagnostics	Measurement AOI Height	41000.00
Info	Near FOV Start (X)	20180.00
Profile Intensity	Near FOV Width	19565.00
Data Output	Far FOV Start X (X)	16275.00
Format	Far FOV Width	27118.00
AOI	Measurement Range Max	41000.00
X-Axis	Enclosure Height	74500.00
2D	Standoff Distance	45000.00
Encoder Input	Working Distance	45000.00
Trigger Input		

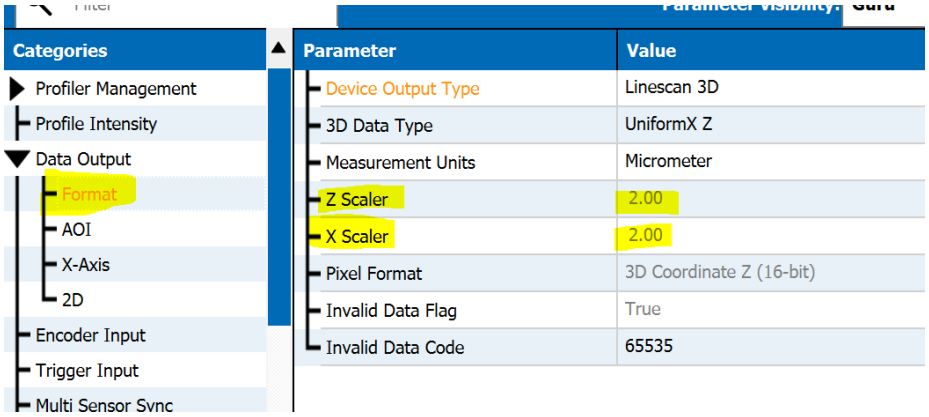


Output Format: 3D Data Type Descriptions

Display Name: 3D Data Type - Feature Name: Scan3dOutputMode

This section provides detailed information on the Z-Trak output 3D data types (*feature Scan3dOutputMode*) allowing the user to choose the format applicable to the measurement requirements. All 3D data types output factory calibrated measurements in units set by the Measurement Units (*feature Scan3dDistanceUnit*).

Use Z-Expert to find out the scaling factor for the model being used:



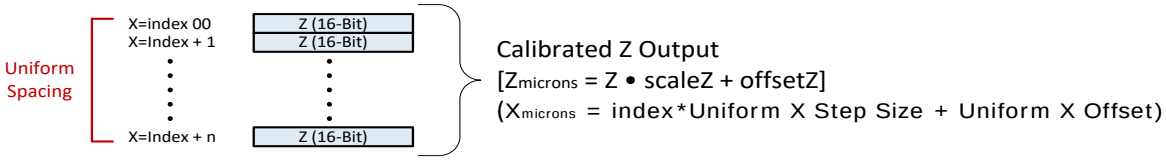
How to find Z scaling factor (example using Z-Trak LP1 120mm model

Display Name: UniformX Z - Feature Name: RectifiedC

The Z data has been resampled to a uniform sampling pattern in the X direction.

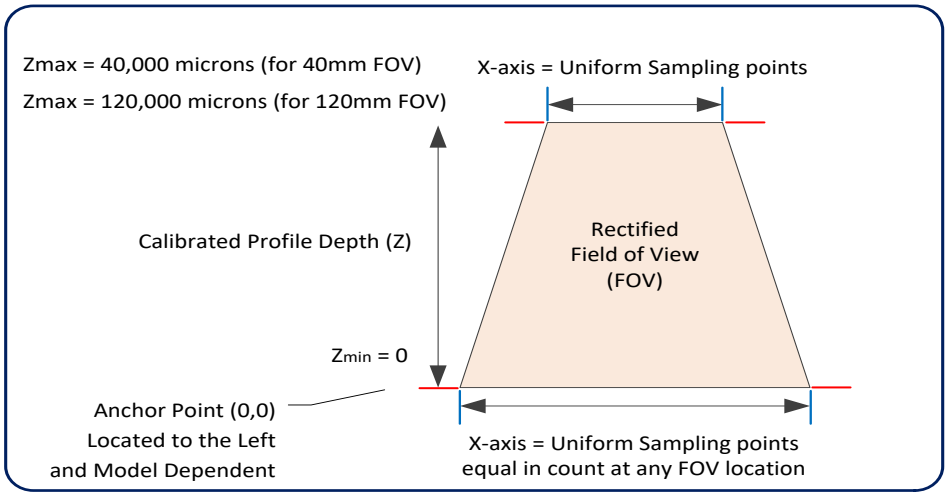
The X direction distance data has been rectified to a uniform sampling pattern. The calibrated output data is depth (Z) only. The specifics are:

- Output data is 16-bit of calibrated Z profile data.



- The DN values of Z data are calibrated and then multiplied by a scale factor before being read as microns. Z data values below the FOV (i.e. <0) will return as invalid.
- For the 40mm MR profiler model, the maximum DN=40,000 and the scale factor multiplier is 1; therefore the measurement range is 0 to 40,000 µm.
- For the 120mm MR profiler model, the maximum DN=60000 and the scale factor multiplier is 2; therefore the measurement range is 0 to 120,000 µm.
- Other models will have different Z ranges.

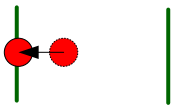
- The DN values of X-axis data are resampled to uniformly spaced points providing an unvarying scale for the Z data in any location of the MR. These uniformly spaced X points have a somewhat higher count than the 1024 raw index points (absolute point count is model dependent) from the profiler.
- The trapezoidal shape of the MR effectively becomes a linear rectangle area for accurate profile measurements.
- Profile resolution is constant at any point of the MR but there are fewer sample points in the upper area of the MR relative to bottom.
- Z-Expert graphs the calibrated Z data (multiplied by the scale factor) at each X index point where floating the mouse over the profile will show the calculated real world X measurement relative to the left MR edge. Use the Display Settings to change the X axis labels to these transformed X values.

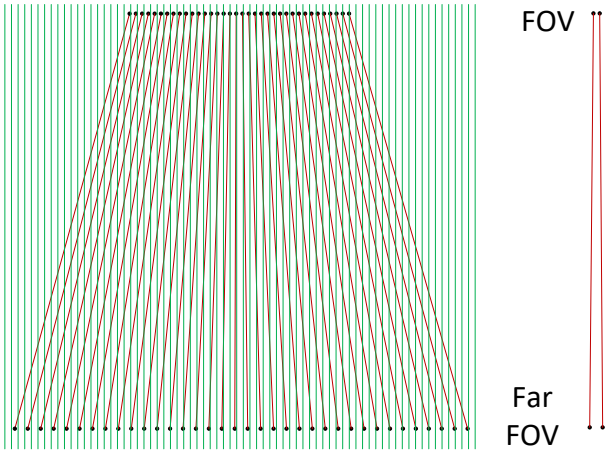


Resampling Points in X Details

Maximum resolution between real points is at near FOV (without resampling)

The rectified output Z-points are an interpolation between the closest left and right real pixel

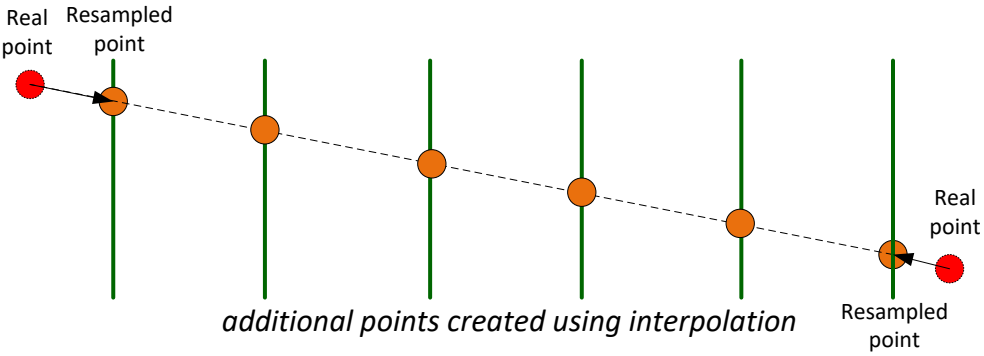




Additional Interpolated X Points are Dependent on the Scale Factor

Since FOV width is fixed, the X scale determines:
- *distance between output points in microns*
- *number of output points*

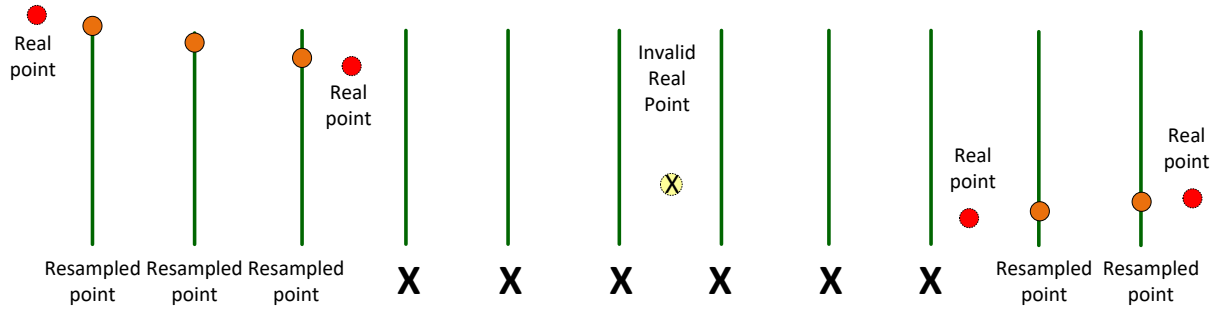
If the number of output points (set by Z-Trak, not by the user) is greater than the number of real points (dependent on the scale factor), those new points are created by interpolation between real points.



Resample Z-points are calculated based on adjacent real points.

Possibility of Invalid Interpolated Points

If there is an invalid point between valid real points, all interpolated points created between the two valid real points are also invalid.

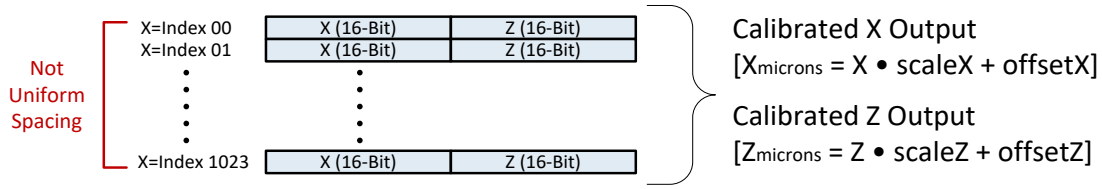


Display Name: XZ – Feature Name: CalibratedAC

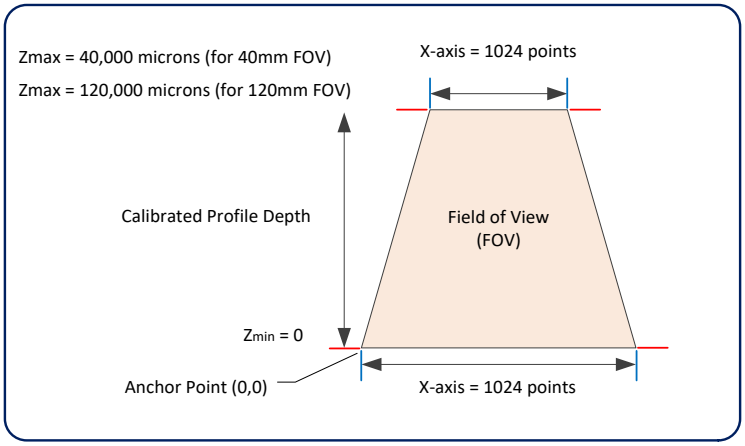
Each profile consists of calibrated X and Z values in a 32-bit data format.

The Calibrated XZ mode outputs profile data as measurement points of profile height for each index X point also output. The specifics are:

- Output data is a 32-bit word of calibrated X data (16-bit) and Z data (16-bit). There are 1024 32-bit output data words indexed by the 1024 X-axis points (model dependent).



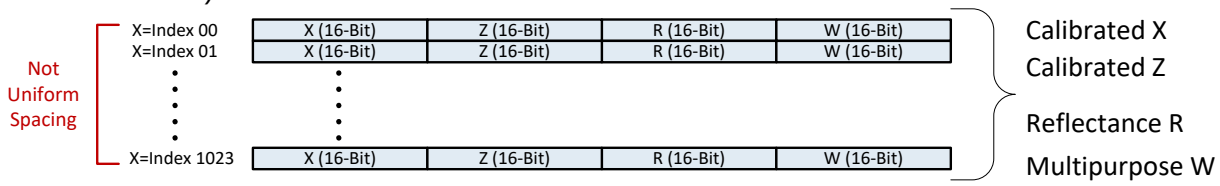
- The DN values of Z data (16-bit) are calibrated and then multiplied by a scale factor before being read as microns. Z data values below the FOV (i.e. <0) will return as invalid.
- For the 40mm MR profiler model, the maximum DN=40,000 and the scale factor multiplier is 1; therefore the measurement range is 0 to 40,000 µm.
- For the 120mm MR profiler model, the maximum DN=60000 and the scale factor multiplier is 2; therefore the measurement range is 0 to 120,000 µm.
- Other models will have different Z ranges.
- Note that the upper part of the MR provides a higher profile X resolution that the lower MR area.
- The DN values of X-axis data (16-bit) are within the 32-bit output data word. These points are not evenly spaced due to the optical system.
- Real world X data is obtained by multiplying the X DN by the scale factor of the profiler used (as described above for calibrated Z data). See feature *Scan3dCoordinateScale* for the scale multiplier.
- Z-Expert graphs the calibrated Z data (multiplied by the scale factor) at each X index point where floating the mouse over the profile shows the X real world measurement relative to the left MR edge. Use the Display Settings to change the X axis labels to these X values.



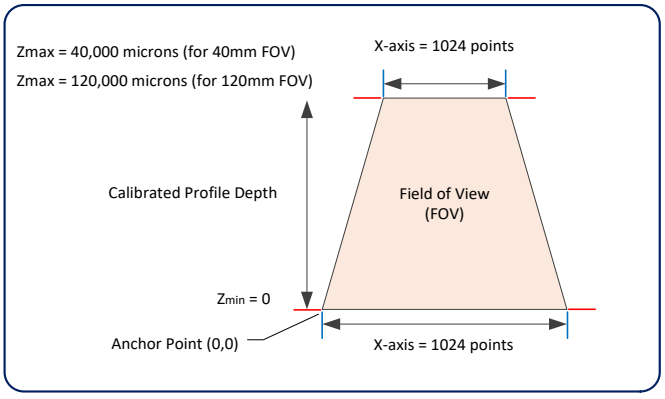
Display Name: XZRW – Feature Name: CalibratedACRW

Each profile consists of calibrated X, Z, R (reflectance) and W (peak width) values in a 64-bit data format. The first two 16-bit fields are as the calibrated XZ, The third and fourth 16-bit fields contain the R and W data.

- Output data is 64-bit of calibrated X data and Z data plus R data (Reflectance) and W (peak width or custom).



- The DN values of Z data are calibrated and then multiplied by a scale factor before being read as microns. Z data values below the FOV (i.e. <0) will return as invalid.
- For the 40mm MR profiler model, the maximum DN=40,000 and the scale factor multiplier is 1; therefore the measurement range is 0 to 40,000 µm.
- For the 120mm MR profiler model, the maximum DN=60000 and the scale factor multiplier is 2; therefore the measurement range is 0 to 120,000 µm.
- Other models will have different Z ranges.
- Note that the upper part of the MR provides a better profile X resolution that the lower MR area.
- The DN values of X-axis data are just 1024 index points (model dependent). These points are not evenly spaced due to the optical system. Real world X data is obtained by multiplying the X DN by the scale factor of the profiler used (as described above for calibrated Z data). See feature *Scan3dCoordinateScale* for the scale multiplier.
- Z-Expert graphs the calibrated Z data (multiplied by the scale factor) at each X index point where floating the mouse over the profile shows the X real world measurement relative to the left MR edge. Use the Display Settings to change the X axis labels to these X values.
- The DN value I for Reflectance is a 16-bit number representing the objects reflectance at reflected point (peak). This R data is not scaled to any real world unit such as lumens.
- The current implementation of the DN value (W) represents peak width of the reflected point. This 16-bit value is a multipurpose field which may represent other acquisition data under consideration.



How to Calculate Real World Values

Real world measurement data is calculated from the data acquired by the profiler with the formulas shown below. It is important to note that the profiler capture data buffer has scaled down values only and requires multiplication to represent full scale values. The profiler values are read by the features described below.

Output Mode	Real World Formulas
"RectifiedC"	$\mathbf{Z_{microns} = Z \times [Z\ Scaler]}$ $\mathbf{X_{microns} = index \bullet [Uniform\ X\ Step\ Size] + [Uniform\ X\ Offset]}$
"RectifiedAC"	$\mathbf{Z_{microns} = Z \times [Z\ Scaler]}$ $\mathbf{X_{microns} = X \times [X\ Scaler]}$
"CalibratedACRW"	$\mathbf{Z_{microns} = Z \times [Z\ Scaler]}$ $\mathbf{X_{microns} = X \times [X\ Scaler]}$

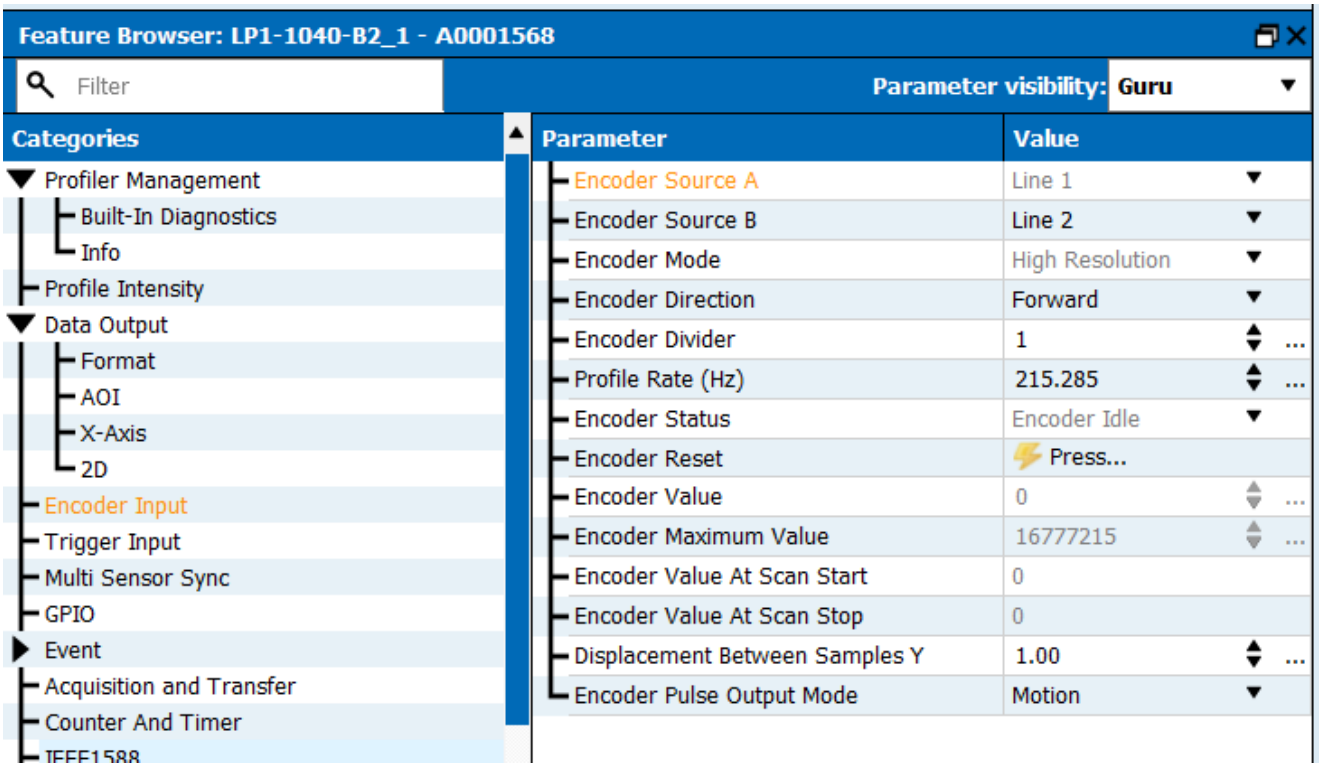
Where the variables are described as in the table below:

Variables	Description
X	X coordinate of the raw pixel read from the profiler capture data buffer
Z	Z coordinate of the raw pixel read from the profiler capture data buffer
index	index of the profiler capture data buffer in the X direction

Features are described in 3D Output Control Feature Descriptions. These formulas expressing X and Z in microns provide real world measurements with respect to the Anchor point as shown in Overview of the real-world Measurement Reference Point.

Encoder Control Category

The Encoder Controls as shown by Z-Expert has parameters used to configure the Z-Trak shaft encoder inputs. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.



Encoder Input Feature Descriptions

The following table describes these parameters along with their view attribute and. The Device Version column indicates which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Encoder Source A	EncoderSourceA	Select the signal source for Encoder Input A.	1.00 Expert
Line 1	*Line1*	*Encoder A input is Input Line 1.*	
Encoder Source B	EncoderSourceB	Select the signal source for Encoder Input B.	1.00 Expert
Off	*Off*	*Encoder Source B is off.*	
Line 2	*Line2*	*Encoder B is Input Line 2. Helps determine position of the encoder and direction of the motion.*	
Encoder Mode	EncoderMode	Indicates the Encoder modes.	1.00 Expert
High Resolution	*HighResolution*	*Any change in encoder phase A or B will change the encoder value.*	
Encoder Count Mode	encoderCountMode	Sets if the Encoder Value increments or decrements for each encoder pulse. This feature is available when Encoder B Input (Quadrature mode) is not being used.	1.00 DFNC Expert
Increment	*Increment*	*Encoder value increments for each encoder pulse.*	
Decrement	*Decrement*	*Encoder value decrements for each encoder pulse.*	
Encoder Direction	encoderDirection	When Encoder Source A and B are used, this feature sets the direction which the encoder must be moving for the profile triggers to be generated. This feature is only available when both phases of the encoder are used.	1.00 DFNC Expert
Forward	*Forward*	*Profile triggers are generated when the encoder is moving in the Forward direction. The forward direction of the encoder is determined by the phase A leading B.*	
Reverse	*Reverse*	*Profile triggers are generated when the encoder is moving in the Reverse direction. The reverse direction of the encoder is determined by the phase B leading A.*	
Encoder Divider	EncoderDivider	Selects the number of input pulses to get before generating "Profile Trigger".	1.00 Expert
Profile Rate (Hz)	profileRate	Specifies the profile rate of the sensor, in Hz.	1.00 DFNC Beginner
Encoder Status	EncoderStatus	Indicates whether the encoder is moving forward, reverse or idle. When encoder phase A and B are used, the direction is determined automatically.	1.00 Expert
Encoder Forward	*EncoderUp*	*The encoder is moving in the forward direction. Phase A leads Phase B.*	
Encoder Reverse	*EncoderDown*	*The encoder is moving in the reverse direction. Phase B leads Phase A.*	
Encoder Idle	*EncoderIdle*	*The encoder is not moving.*	
Encoder Reset	EncoderReset	Resets the "Encoder Value" to 0.	1.00 Expert

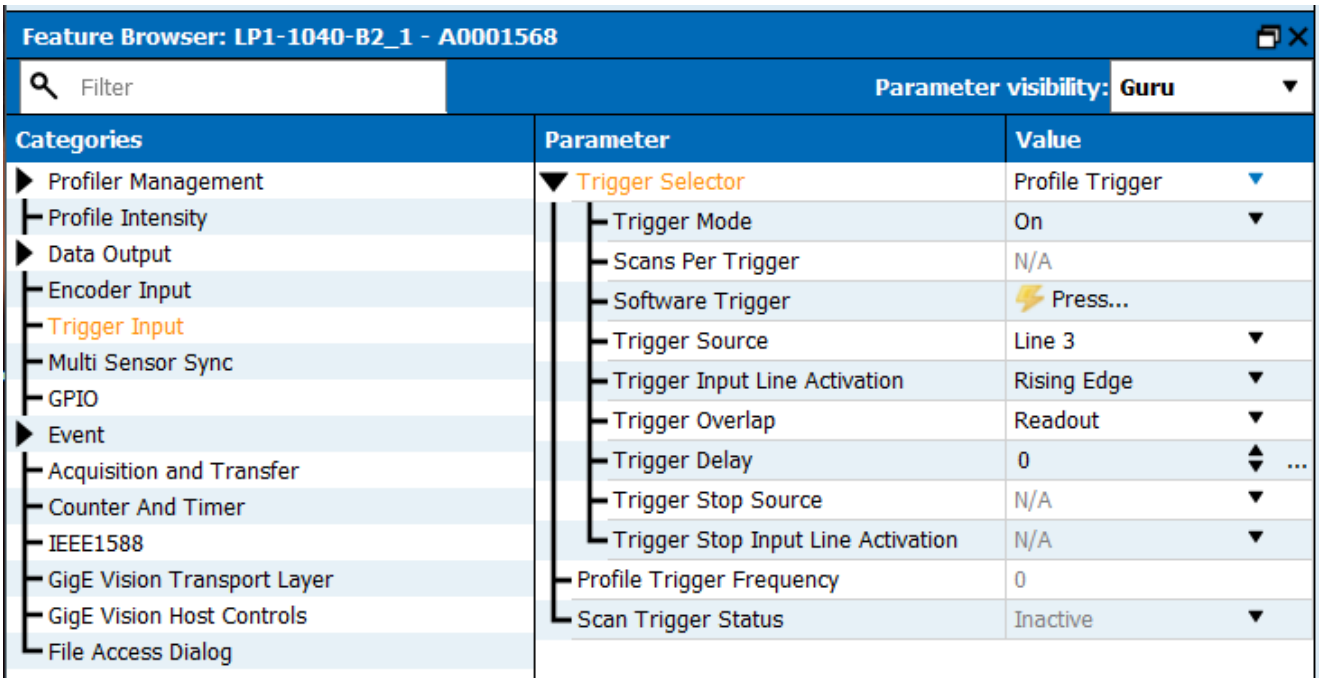
Encoder Value	EncoderValue	Indicates the current encoder counter value. In quadrature mode, the Encoder value automatically increments in the forward direction (phase AB) and decrements in the reverse direction (phase BA). In single phase mode, the Encoder Count Mode feature determines whether the Encoder Value will increment or decrement.	1.00 Expert
Encoder Maximum Value	encoderMaximumValue	Indicates the maximum value of the encoder counter. When this value is reached, the counter wraps-around to 0.	1.00 DFNC Guru
Encoder Value At Scan Start	encoderValueAtScanStart	Indicates the encoder counter value at the start of every new scan.	1.00 DFNC Expert
Encoder Value At Scan Stop	encoderValueAtScanStop	Indicates the encoder counter value at the stop of every scan.	1.00 DFNC Expert
Displacement Between Samples Y	displacementY	Displacement between samples Y (um, mil, mm).	1.00 DFNC Expert
Encoder Pulse Output Mode	EncoderOutputMode	Selects how encoder pulses will generate profile triggers.	1.00 Expert
Position	*Position*	*When the encoder moves in the opposite direction as defined by Encoder Direction, the current position is recorded. No profile triggers are generated until that position is passed again.*	
Direction	*Direction*	*In quadrature mode, The profile triggers are only generated when the motion of the encoder is in the same direction set by the Encoder Direction feature.*	
Any Direction	*AnyDirection*	*Profile triggers are generated regardless of the direction of motion.*	

Encoder Status Feature Note:

The "*EncoderStatus*" feature is set to "*EncoderIdle"* if no motion signal is detected for 65ms from the shaft encoder inputs. The "*EncoderStatus*" feature will change to either "*EncoderUp*" or "*EncoderDown*" as soon as motion is detected.

Trigger Input Category

The Z-Trak Input features are used to configure external inputs. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via a user application.



Trigger Feature Descriptions

The following table describes these features along with their view attribute and firmware version. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (indicated by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Trigger Mode Selector	TriggerSelector	Selects the type of trigger to configure.	1.00 Beginner
Profile Trigger	*ProfileTrigger*	*Acquires a single profile when "Trigger Start Input Line Activation" is asserted.*	
Variable Scan	*VariableScan*	*Acquires profiles when "Trigger Start Input Line Activation" is asserted and stops when "Trigger Stop Input Line Activation" is asserted.*	
Fixed Scan	*FixedScan*	*Acquires the number of profiles indicated by "Profiles Per Scan" when "Trigger Start Input Line Activation" is asserted.*	
Trigger Enable	TriggerMode	Turns the selected Trigger On or Off.	1.00 Beginner
Off	*Off*	*The selected trigger is off.*	
On	*On*	*The selected trigger is active.*	
Scans Per Trigger	AcquisitionBurstFrameCount	Sets the number of scans to acquire when Fixed Scan Trigger is enabled.	1.00 Beginner
Software Trigger	TriggerSoftware	Writing this feature Generates an internal profile trigger.	1.00 Beginner
Trigger Start Source	TriggerSource	Selects the start source to use for the trigger input. The source can be an internal or external signal.	1.00 Beginner
Encoder	*Encoder1*	*The Profile trigger is generated by the Encoder.*	
Line 3	*Line3*	*The trigger is generated by the Line 3. Not available for Profile Trigger if Line2 is used by Encoder Source B.*	
Line 4	*Line4*	*The trigger is generated by the Line 4.*	
Multi Sensor Sync	*MultiSensorSync*	*Sets the Multi Sensor Sync as the profile trigger source.*	
Software	*Software*	*The Profile trigger is generated by the Software Trigger command.*	
Timer 1 End Event	*Timer1End*	*The Profile trigger is generated by the Timer End Event.*	
Counter 1 End Event	*Counter1End*	*The Profile trigger is generated by the Counter End Event.*	
Timestamp Modulo Event	*timestampModuloEvent*	*The Profile trigger is generated by the Timestamp modulo Event.*	
Trigger Start Input Line Activation	TriggerActivation	Selects the activation mode for the Trigger Input. This is applicable only for external line inputs.	1.00 Beginner
Falling Edge	*FallingEdge*	*The trigger is considered valid when the line source signal goes from high to low.*	
Rising Edge	*RisingEdge*	*The trigger is considered valid when the line source signal goes from low to high.*	
Any Edge	*AnyEdge*	*The trigger is considered valid for any transition on the line source signal.*	
Level High	*LevelHigh*	*The trigger is considered valid while the line source signal is high.*	

Trigger Overlap	TriggerOverlap	Selects if a new trigger will be accepted (or latched) while the previous one is still being processed.	1.00 Guru
Off	*Off*	*No trigger overlap is permitted.*	
ReadOut	*ReadOut*	*Profile Trigger is accepted immediately after the start of the image sensor readout.*	
Trigger Delay	TriggerDelay	Specifies the delay before the profile integration starts or the scan starts. For profile trigger mode, this value specifies the delay in µSec. For scan trigger modes, this value specifies the delay in the number of profiles to skip before starting the scan.	1.00 Beginner
Trigger Stop Source	triggerStopSource	Variable scan stops when the trigger stop source is activated.	1.00 DFNC Beginner
Line 3	*Line3*	*The variable scan is stopped when Line 3 is activated.*	
Line 4	*Line4*	*The variable scan is stopped when Line 4 is activated.*	
Trigger Stop Input Line Activation	triggerStopActivation	Select the activation mode for the "Trigger Stop Source". This is applicable only for external line inputs.	1.00 Beginner
Falling Edge	*FallingEdge*	*The trigger is considered valid when the line source signal goes from high to low.*	
Rising Edge	*RisingEdge*	*The trigger is considered valid when the line source signal goes from low to high.*	
Any Edge	*AnyEdge*	*The trigger is considered valid for any transition on the line source signal.*	
Level High	*LevelHigh*	*The trigger is considered valid while the line source signal is high.*	
Profile Trigger Frequency	profileTriggerFrequency	Indicates the measured profile rate in Hz.	1.00 DFNC Guru
Scan Trigger Status	frameBurstState	Indicates the current status of Scan Trigger signal	1.00 DFNC Expert
Inactive	*Inactive*	*The scan is waiting for a trigger or the grab to start.*	
Active	*Active*	*The scan is active and acquiring profiles.*	
Delay Active	*DelayActive*	*The scan trigger has been activated and is delayed by the number of profiles specified by the Trigger Delay feature.*	

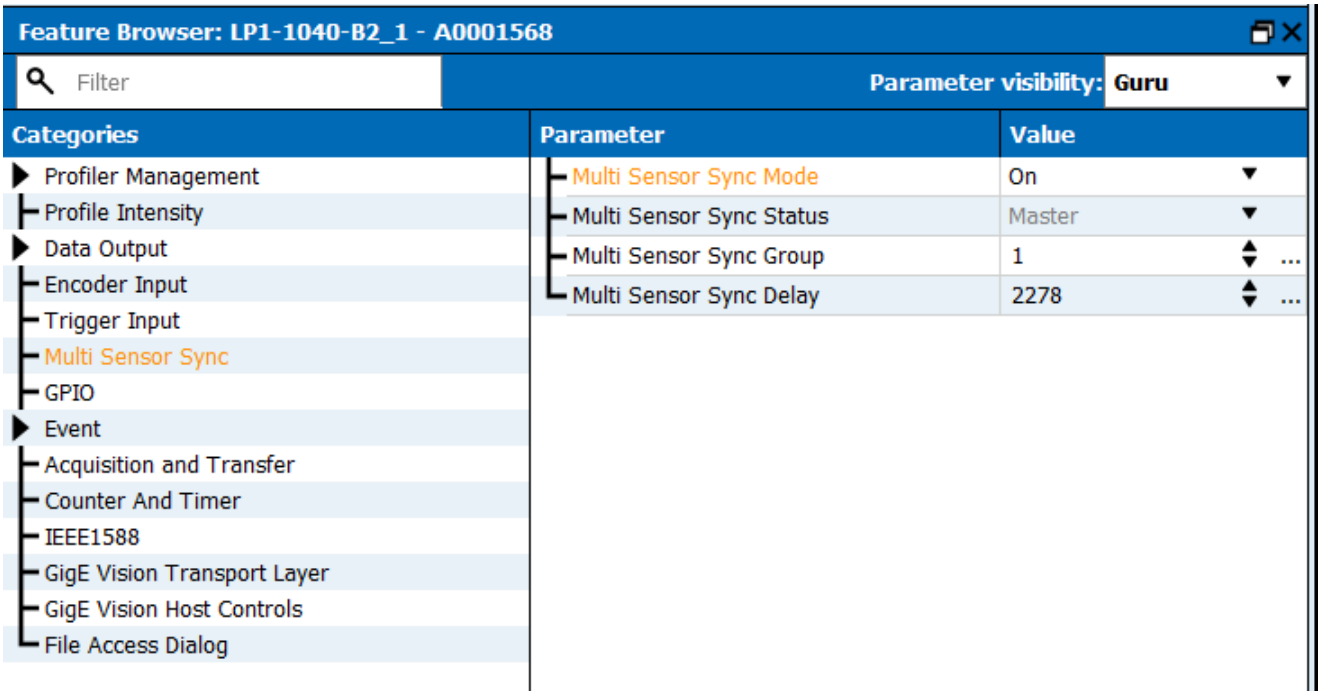
Trigger Mode Details

Profile exposures are initiated by a trigger event such as an external signal (shaft encoder or external trigger – see I/O Connector Details) or the profiler's internal clock used in free running mode. Additionally a software trigger event from an application can acquire profiles.

- **Free running (Trigger Mode=Off)**: The profiler free-running acquisition mode has programmable internal timers for profile rate and exposure period. See Trigger Input Category for feature descriptions.
- **External trigger (Trigger Mode=On)**: Exposures are controlled by an external trigger signal where the specific input line is selected by the **Trigger Source** feature as escribed in the table above. External signals are isolated with a time programmable debounce circuit from the GPIO Control Category features.

Multi Sensor Sync Category

Multiple Z-Trak devices are synchronized with these features. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via a user application. Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



Multi Sensor Sync Feature Descriptions

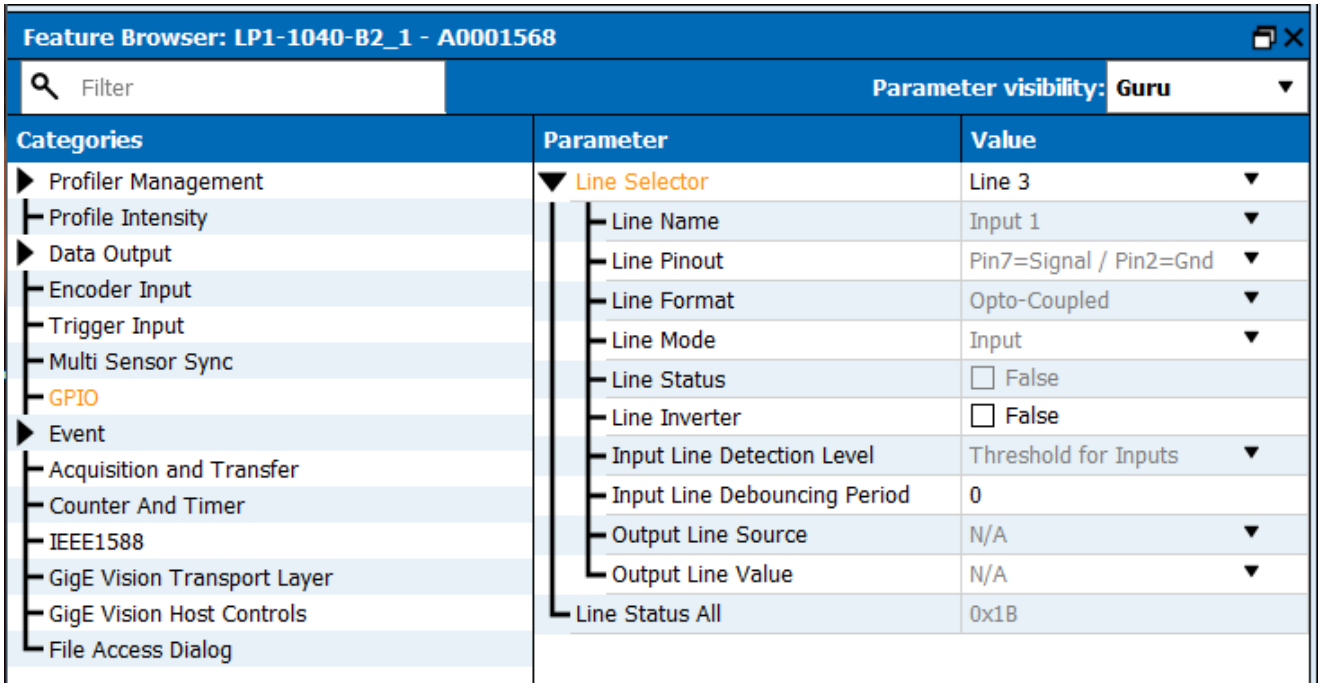
The following table describes these features along with their view attribute and firmware version. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (indicated by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Multi Sensor Sync Mode	multiSensorSyncMode	Turns multi-sensor synchronization on/off. The master sensor must have a trigger source set to any value other than "Multi-Sensor-Sync". All slave sensors must have their "Trigger Source" set to "Multi-Sensor-Sync". Only one master is allowed per "Multi Sensor Sync Group".	1.00 DFNC Expert
Off	*Off*	*Turns Off multi-sensor synchronization.*	
On	*On*	*Turns On synchronization between multiple sensors.*	
Multi Sensor Sync Status	multiSensorSyncStatus	Indicates if the selected device is a multi-sync master or a slave.	1.00 DFNC Expert
Master	*Master*	*Indicates the device will generate synchronization signals that will be used by other devices in the network.*	
Slave	*Slave*	*Indicates the device will receive synchronization signals from the master.*	
Multi Sensor Sync Group	multiSensorSyncGroup	Selects an ID for the Multi Sensor Sync group.	1.00 DFNC Guru
Multi Sensor Group Trigger Delay	multiSensorSyncDelay	Specifies the sensor group trigger delay for all slaves.	1.00 DFNC Expert

GPIO Control Category

The Z-Trak General Purpose Input/Output control has features used to configure external input and output signals. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via a user application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



GPIO Feature Descriptions

The following table describes these features along with their view attribute and firmware version. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (indicated by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Line Selector	LineSelector	Selects the I/O line.	1.00 Beginner
Line 1	*Line1*	*Source A+ is on Pin 13 and A- is on Pin 21 of the M16 24-pin I/O connector.*	
Line 2	*Line2*	*Encoder Source B+ is on Pin 20 and B- is on Pin 22 of the M16 24-pin I/O connector. Line 2 and input Line 4 cannot be used at the same time.*	
Line 3	*Line3*	*Line 3 is on Pin 7 of the M16 24-pin I/O connector.*	
Line 4	*Line4*	*Line 4 is on Pin 16 of the M16 24-pin I/O connector. Line 2 and input Line 4 cannot be used at the same time.*	
Line 5	*Line5*	*Line 5 is on Pin 3 of the M16 24-pin I/O connector.*	
Line 6	*Line6*	*Line 6 is on Pin 12 of the M16 24-pin I/O connector.*	
Line Name	lineName	Indicates the name assigned to the selected line.	1.00 Beginner DFNC
Encoder Source A	*EncoderSourceA*	*Associated with the logical line Encoder Source A*	
Encoder Source B	*EncoderSourceB*	*Associated with the logical line Encoder Source B*	
Input 1	*Input1*	*Associated with the logical line Input 1*	
Input 2	*Input2*	*Associated with the logical line Input 2.*	
Output 1	*Output1*	*Associated with the logical line Output 1*	
Output 2	*Output2*	*Associated with the logical line Output 2*	
Line Pinout	linePinAssociation	Indicates the pin numbers on the connector associated to the selected line.	1.00 Guru DFNC
Pin13=EncoderA+ / Pin21=EncoderA-	*Pin13EncoderApos_Pin21EncoderAneg*	*Pin 13 is the Encoder Source A+ and Pin 21 is the Encoder Source A- on the I/O connector.*	
Pin20=EncoderB+ / Pin22=EncoderB-	*Pin20EncoderBpos_Pin22EncoderBneg*	*Pin 20 is the Encoder Source B+ and Pin 22 is the Encoder Source B- on the I/O connector.*	
Pin7=Signal / Pin2=Gnd	*Pin7Signal_Pin2Gnd*	*Pin 7 is the Input Signal and Pin 2 is the common Ground on the I/O connector.*	
Pin16=Signal / Pin2=Gnd	*Pin16Signal_Pin2Gnd*	*Pin 16 is the Input Signal and Pin 2 is the common Ground on the I/O connector.*	
Pin3=Signal / Pin4=Pwr	*Pin3Signal_Pin4Pwr*	*Pin 3 is the Output Signal and Pin 4 is the common output power on the I/O connector.*	
Pin12=Signal – Pin4=Pwr	*Pin12Signal_Pin4Pwr*	*Pin 12 is the Output Signal and Pin 4 is the common output power on the I/O connector.*	
Line Format	LineFormat	Specify the current electrical format of the selected physical input or output.	1.00 Expert
Opto-Coupled	*OptoCoupled*	*The line is opto-Coupled.*	
LVDS	*LVDS*	*The line is LVDS.*	
Line Mode	LineMode	Indicates if the physical Line is an Input or Output signal.	1.00 Expert

EncoderSource	*EncoderSource*	*The line is an encoder source.*	
Input	*Input*	*The line is an input line.*	
Output	*Output*	*The line is an output line.*	
Line Status	LineStatus	Indicates the current status of the selected input or output line.	1.00 Expert
Line Inverter	LineInverter	Inverts the polarity of the selected line.	1.00 Beginner
Input Line Detection Level	lineDetectionLevel	Specifies the voltage threshold required to recognize a signal transition on an input line.	1.00 Beginner DFNC
Threshold for Inputs	*Threshold_for_Inputs*	*A signal below 5.5V will be detected as a Logical LOW and a signal greater than 8.9V will be detected as a Logical HIGH on the selected input line.*	
Input Line Debouncing Delay	lineDebouncingPeriod	Specifies the minimum delay (in microseconds) to allow the input line voltage to stabilize before determining signal transition.	1.00 Beginner DFNC
Output Line Source	outputLineSource	Selects which internal signal to output on the selected line.	1.00 Beginner DFNC
Off	*Off*	*Line output is Open*	
Software Controlled	*SoftwareControlled*	*The Output Line Value feature changes the state of the selected output pin.*	
Output Line Value	outputLineValue	Sets the output state of the selected Line. OutputLineSource must be SoftwareControlled.	1.00 Beginner DFNC
Active	*Active*	*Sets the output state to active.*	
Inactive	*Inactive*	*Sets the output state to inactive.*	
Line Status All	LineStatusAll	Returns the current status of all available line signals, at the time of polling, in a single bit field. The order is Line1, Line2, ...	1.00 Expert

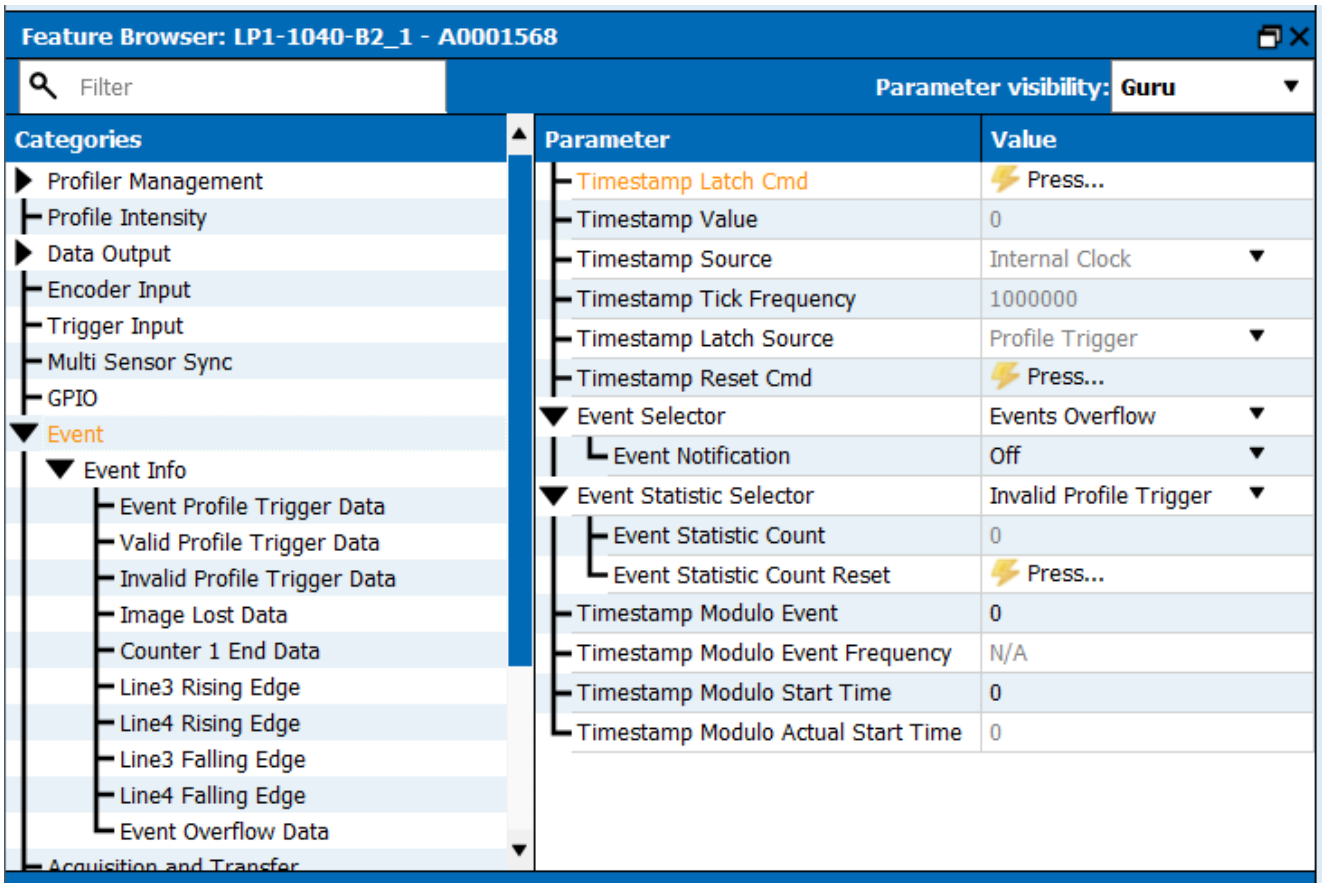
Output Line Details

See I/O Connector Details for pinout information and Output Signals Electrical Specifications for output signal electrical capabilities.

Event Control Category

The Event controls as shown by Z-Expert, has parameters used to configure device Event related features. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



Event Feature Descriptions

The following table describes these parameters along with their view attribute and minimum firmware version required. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

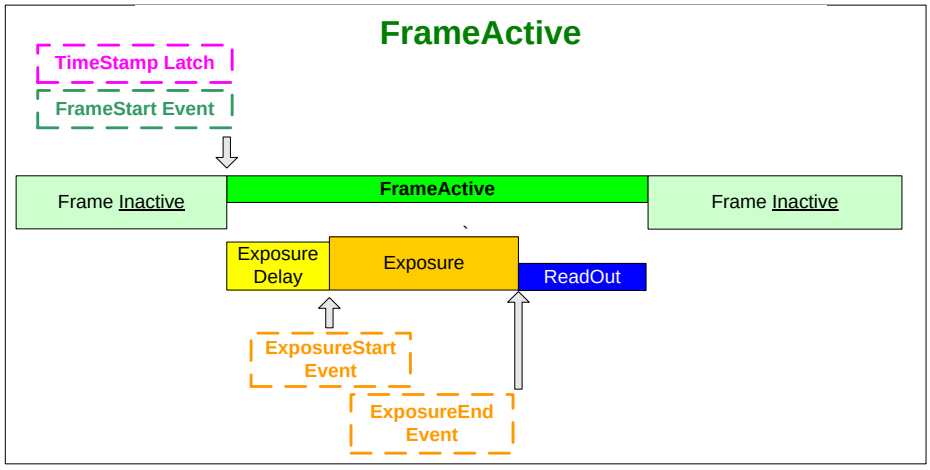
Display Name	Feature & Values	Description	Device Version & View
Timestamp Latch Cmd	timestampControlLatch	Latch the current timestamp internal counter value in the timestampValue feature.	1.00 Expert DFNC
Timestamp Value	timestampValue	Returns the 64-bit value of the timestamp, which is the internal Clock timer or the PTP clock timer, depending on the Timestamp Source selection.	1.00 Expert DFNC
Timestamp Source	timestampSource	Specifies the source used as the incrementing signal for the Timestamp register.	1.00 Expert DFNC
Internal Clock	*InternalClock*	*The timestamp source is generated by the device internal clock. Refer to the timestampTickFrequency feature for the time base.*	
IEEE1588	*IEEE1588*	*The timestamp source is controlled by the network IEEE1588 protocol. This source is automatically selected when PTP mode is enabled.*	
Timestamp Tick Frequency	timestampTickFrequency	Indicates the number of timestamp ticks (or increments) during 1 second (frequency in Hz). This feature changes depending on the TimeStamp Source.	1.00 Expert DFNC
Timestamp Latch Source	timestampLatchSource	Specifies the internal event or signal that will latch the timestamp counter into the timestamp buffer.	1.00 Expert DFNC
Line Start	*LineStart*	*The timestamp is latched on profile trigger.*	
Timestamp Reset Cmd	timestampControlReset	Resets the timestamp counter to 0. This Feature resets both the internal Clock timer and the PTP clock timer. Note that the PTP Mode must be disabled first to reset the PTP clock timer.	1.00 Expert DFNC
Event Selector	EventSelector	Select the Event to enable/disable with the EventNotification feature.	1.00 Expert
Start of Profile	*LineStart*	*Event sent on control channel on an Active Profile. This occurs with the start of the exposure delay.*	
Valid Profile Trigger	*ValidLineTrigger*	*Event sent on control channel when a valid profile trigger is generated.*	
Invalid Profile Trigger	*InvalidLineTrigger*	*Event sent on control channel when a profile trigger occurs in an invalid Trigger region. Therefore the trigger is rejected and no profile acquisition occurs.*	
Image Lost	*ImageLost*	*Event sent on control channel when an image is lost due to insufficient memory.*	
Counter 1 End	*Counter1End*	*Event sent when counter 1 has reached the counterDuration count.*	
Line3 Rising Edge	*Line3RisingEdge*	*Event generated when a Rising Edge is detected on Line 3.*	
Line3 Falling Edge	*Line3FallingEdge*	*Event generated when a Falling Edge is detected on Line 3.*	
Line4 Rising Edge	*Line4RisingEdge*	*Event generated when a Rising Edge is detected on Line 4.*	

Line4 Falling Edge	*Line4FallingEdge*	*Event generated when a Falling Edge is detected on Line 4.*	
Events Overflow	*eventsOverflow*	*Event sent on control channel when all previous active events have been disabled because the device cannot send them fast enough, generating in internal message overflow. All required events must be re-enabled manually.*	
Event Notification	EventNotification	Enable Events for the event type selected by the EventSelector feature.	1.00 Expert
Off	*Off*	*The selected event is disabled.*	
On	*On*	*The selected event will generate a software event.*	
Event Statistic Selector	eventStatisticSelector	Selects which Event statistic to display.	1.00 Expert DFNC
Invalid Profile Trigger	*InvalidLineTrigger*	*Counts the Profile trigger occurring in an invalid Trigger region.*	
Image Lost	*ImageLost*	*Image is acquired but lost before it's been transferred.*	
Packet Resend	*PacketResend*	*Counts the number of individual packets that are resent.*	
Packet Resend Request Dropped	*PacketResendRequestDropped*	*Counts the number of packet resend requests dropped. The device queues the packet resend requests until they are processed. There is a limit to the number of requests that can be queued by the camera. When a new request is received and the queue is full, the request is dropped but this statistic is still incremented.*	
Ethernet Pause Frame Received	*EthernetPauseFrameReceived*	*Counts the number of Ethernet Pause Frame received.*	
Event Statistic Count	eventStatisticCount	Display the count of the selected Event.	1.00 Expert DFNC
Event Statistic Count Reset	eventStatisticCountReset	Reset the count of the selected Event.	1.00 Expert DFNC
Timestamp Modulo Event	timestampModulo	Specifies the additional interval between the current timestamp tick and the event generated. This interval has a 80ns accuracy. Note that the value zero disables the event generator.	1.00 Expert DFNC
Timestamp Modulo Event Frequency	timestampModuloFrequency	Returns the frequency of the timestamp Modulo Event (in Hz).	1.00 Expert DFNC
Timestamp Modulo Start Time	timestampModuloStartTime	Specifies the timestamp value that must be exceeded by the incrementing timestamp counter before the modulo event starts. This Feature is also used for a "Future" Frame Acquisition.	1.00 Expert DFNC
Timestamp Modulo Actual Start Time	timestampModuloActualStartTime	Displays the actual modulo event start time as used by the device. When the user specified "timestampModuloStartTime" is in the future, timestampModuloActualStartTime = timestampModuloStartTime. When the user specified "timestampModuloStartTime" has already past, the profile sensor automatically recalculates a future value for "timestampModuloStartTime" using the user set "timestampModulo" feature value. This new start time is reported by "timestampModuloActualStartTime".	1.00 Expert DFNC
Profile Trigger Event ID	EventLineStart	Represents the event ID to identify the Event Profile Trigger software Event.	1.00 Guru
Event Profile Trigger Data	EventLineStartData	Data of the profile trigger event	1.00 Guru

Profile Trigger Event Timestamp	EventLineStartTimestamp	Timestamp of the Event Profile Trigger event.	1.00 Guru
Valid Profile Trigger Event ID	EventValidLineTrigger	Generate an event on valid profile trigger.	1.00 Guru
Valid Profile Trigger Data	EventValidLineTriggerData	Data of the valid profile trigger event.	1.00 Guru
Valid Profile Trigger Event Timestamp	EventValidLineTriggerTimestamp	Timestamp of the Valid profile trigger event.	1.00 Guru
Invalid Profile Trigger Event ID	EventInvalidLineTrigger	Generate an event on invalid profile trigger.	1.00 Guru
Invalid Profile Trigger Data	EventInvalidLineTriggerData	Data of the invalid profile trigger event.	1.00 Guru
Invalid Profile Trigger Event Timestamp	EventInvalidLineTriggerTimestamp	Timestamp of the invalid profile trigger event.	1.00 Guru
Image Lost Event ID	EventImageLost	Generate an event on image lost.	1.00 Guru
Image Lost Data	EventImageLostData	Data of the image lost event.	1.00 Guru
Image Lost Event Timestamp	EventImageLostTimestamp	Timestamp of the image lost event.	1.00 Guru
Counter 1 End ID	EventCounter1End	Generate an event on Counter 1 End.	1.00 Guru
Counter 1 End Data	EventCounter1EndData	Data of the Counter1 End event.	1.00 Guru
Counter 1 End Event Timestamp	EventCounter1EndTimestamp	Timestamp of the Counter 1 End event.	1.00 Guru
Line3 Rising Edge ID	EventLine3RisingEdge	Generate an event on Line3 rising edge.	1.00 Guru
Line3 Rising Edge	EventLine3RisingEdgeData	Data of the Line3 rising edge event.	1.00 Guru
Line3 Rising Edge Event Timestamp	EventLine3RisingEdgeTimestamp	Timestamp of the Line3 rising edge event.	1.00 Guru
Line4 Rising Edge ID	EventLine4RisingEdge	Generate an event on Line4 rising edge.	1.00 Guru
Line4 Rising Edge	EventLine4RisingEdgeData	Data of the Line4 rising edge event.	1.00 Guru
Line4 Rising Edge Event Timestamp	EventLine4RisingEdgeTimestamp	Timestamp of the Line4 rising edge event.	1.00 Guru
Line3 Falling Edge ID	EventLine3FallingEdge	Generate an event on Line3 falling edge.	1.00 Guru
Line3 Falling Edge	EventLine3FallingEdgeData	Data of the Line3 falling edge event.	1.00 Guru
Line3 Falling Edge Event Timestamp	EventLine3FallingEdgeTimestamp	Timestamp of the Line3 falling edge event.	1.00 Guru
Line4 Falling Edge ID	EventLine4FallingEdge	Generate an event on Line4 falling edge.	1.00 Guru
Line4 Falling Edge	EventLine4FallingEdgeData	Data of the Line4 falling edge event.	1.00 Guru
Line4 Falling Edge Event Timestamp	EventLine4FallingEdgeTimestamp	Timestamp of the Line4 falling edge event.	1.00 Guru
Events Overflow Event ID	EventeventsOverflow	Represents the event ID to identify the Events Overflow Event software Event.	1.00 Guru
Event Overflow Data	EventeventsOverflowData	Data of the event overflow event	1.00 Guru
Events Overflow Event Timestamp	EventeventsOverflowTimestamp	Timestamp of the EventeventsOverflow event.	1.00 Guru
Gev Timestamp Latch	GevtimestampControlLatch	Latch the current timestamp internal counter value in the timestampValue feature.	1.00 Invisible
Gev Timestamp Value	GevtimestampValue	Returns the 64-bit value of the timestamp counter.	1.00 Invisible
Gev Timestamp Tick Frequency	GevtimestampTickFrequency	Indicates the number of timestamp ticks (or increments) during 1 second (frequency in Hz).	1.00 Invisible
Gev Timestamp Reset	GevtimestampControlReset	Resets the timestamp counter to 0.	1.00 Invisible

Basic Exposure Events Overview

The following timing graphic shows the primary events related to a simple acquisition.



Examples using Timestamp Modulo Event for Acquisitions

The Timestamp Modulo event is used to synchronize multiple device acquisitions and automate repetitive acquisitions based on either the profiler's internal Timestamp counter or a system wide PTP counter. The Z-Trak internal Timestamp clock has a 1µs tic, while the PTP clock has 8 nanosecond tics (PTP: IEEE1588–Precise Time Protocol).

Both Timestamp counters increment continuously but can be reset to zero with 'timestampControlReset' if 'ptpMode=Off', else only the internal device Timestamp counter resets.

Case Examples Overview

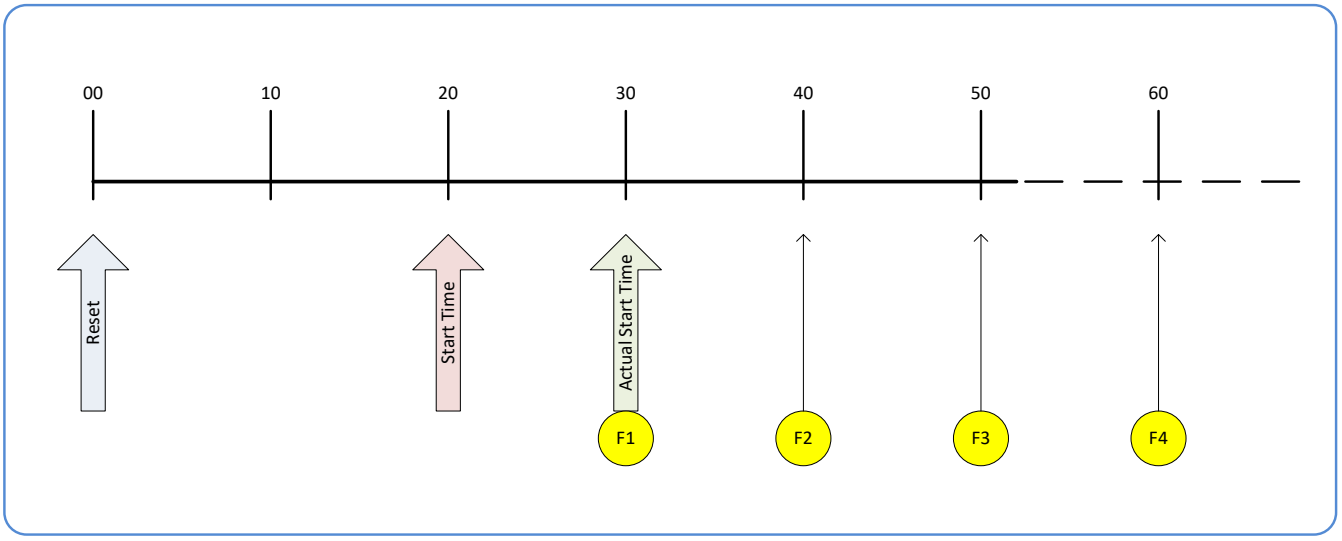
The following case examples use a simplified Timestamp timeline, which for clarity is shown with 4 time tics from 00 to 60 without units. A timeline scale based on real time is not required to describe the usage concepts. These examples also apply equally to using an internal Timestamp clock or a system PTP clock.

Case 1: Simple Repeating Acquisitions as Upcoming Events

Conditions:

- initial timestampControlReset resets Timestamp counter
- timestampModuloStartTime at 20
- timestampModulo = 10
- timestampModuloActualStartTime = First Event generated (F1)

After the Timestamp Reset, the first acquisition is made when the Modulo reaches the +10 tick Timestamp count, following the programmed start time. Acquisitions repeat at every +10 Timestamp tick until stopped.

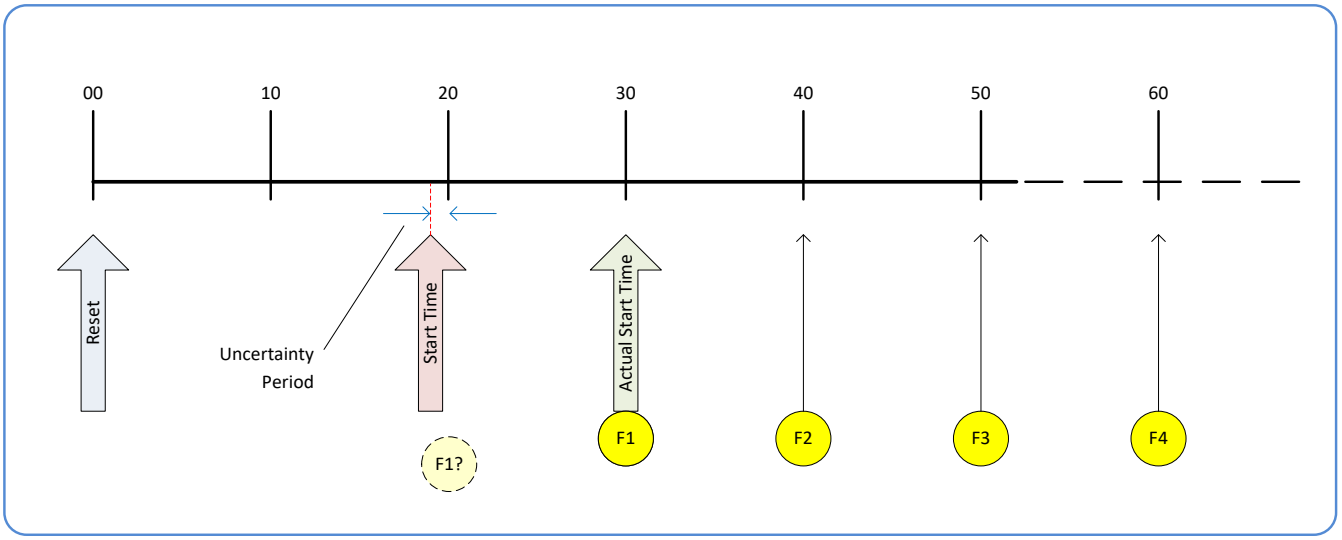


Case 2: Potential Uncertainness to the Start Time

Conditions:

- initial timestampControlReset resets Timestamp counter
- timestampModuloStartTime at < 20
- timestampModulo = 10
- timestampModuloActualStartTime = first event (F1)

Case 2 differs only from case 1 by showing that there is a period of uncertainty if the start time is too close to the first modulo count that follows. The first frame acquisition may occur at the first modulo count time or at the following. The actual value for the uncertainty period may vary with different profiler and network conditions.



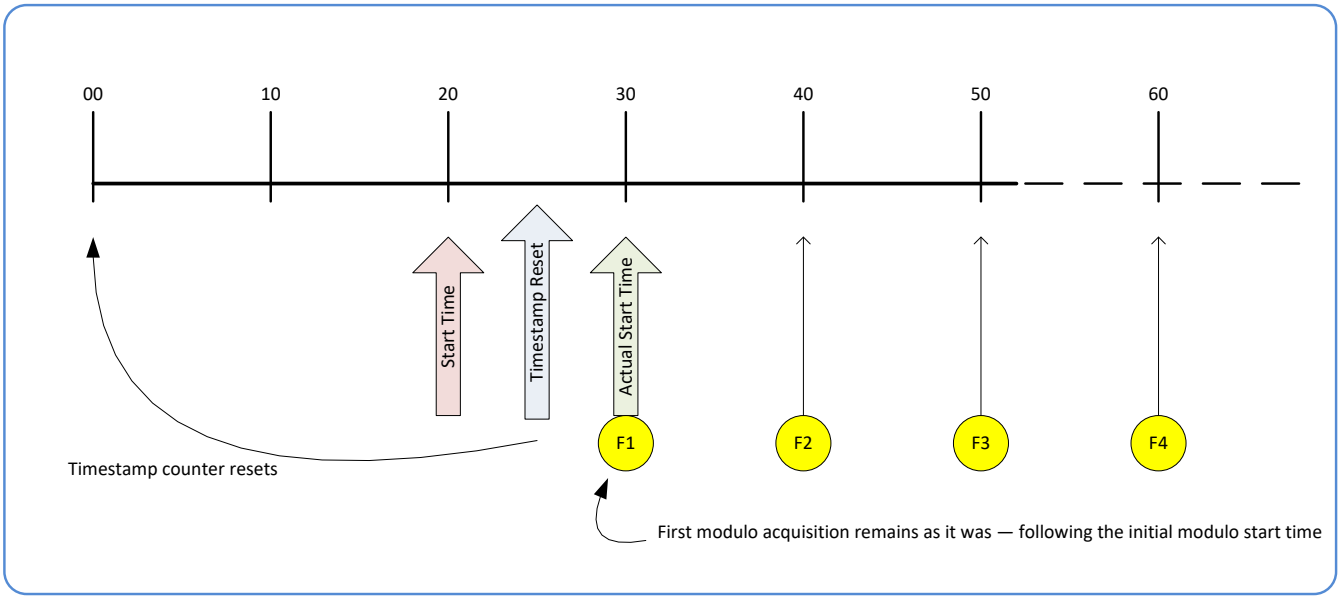
Case 3: Timer Reset before the Actual Start Time

Conditions:

- initial timestampControlReset resets Timestamp counter
- timestampModuloStartTime at 20
- timestampModulo = 10
- second timestampControlReset at count 25
- timestampModuloActualStartTime = first event (F1)

After the initial Timestamp Reset which starts the Timestamp counter, the Modulo start time is at 20. The Modulo 10 actual start time for the first acquisition is at Timestamp 30 (as described in Case 1).

Now if a new Timestamp reset happens between the Start Time and acquisition Actual Start Time, the Timestamp counter will restart from time 00, but the Start Time value has already been stored, thus the modulo Actual Start Time remains at 30. In this condition the Actual Start Time did not reset as might be expected.



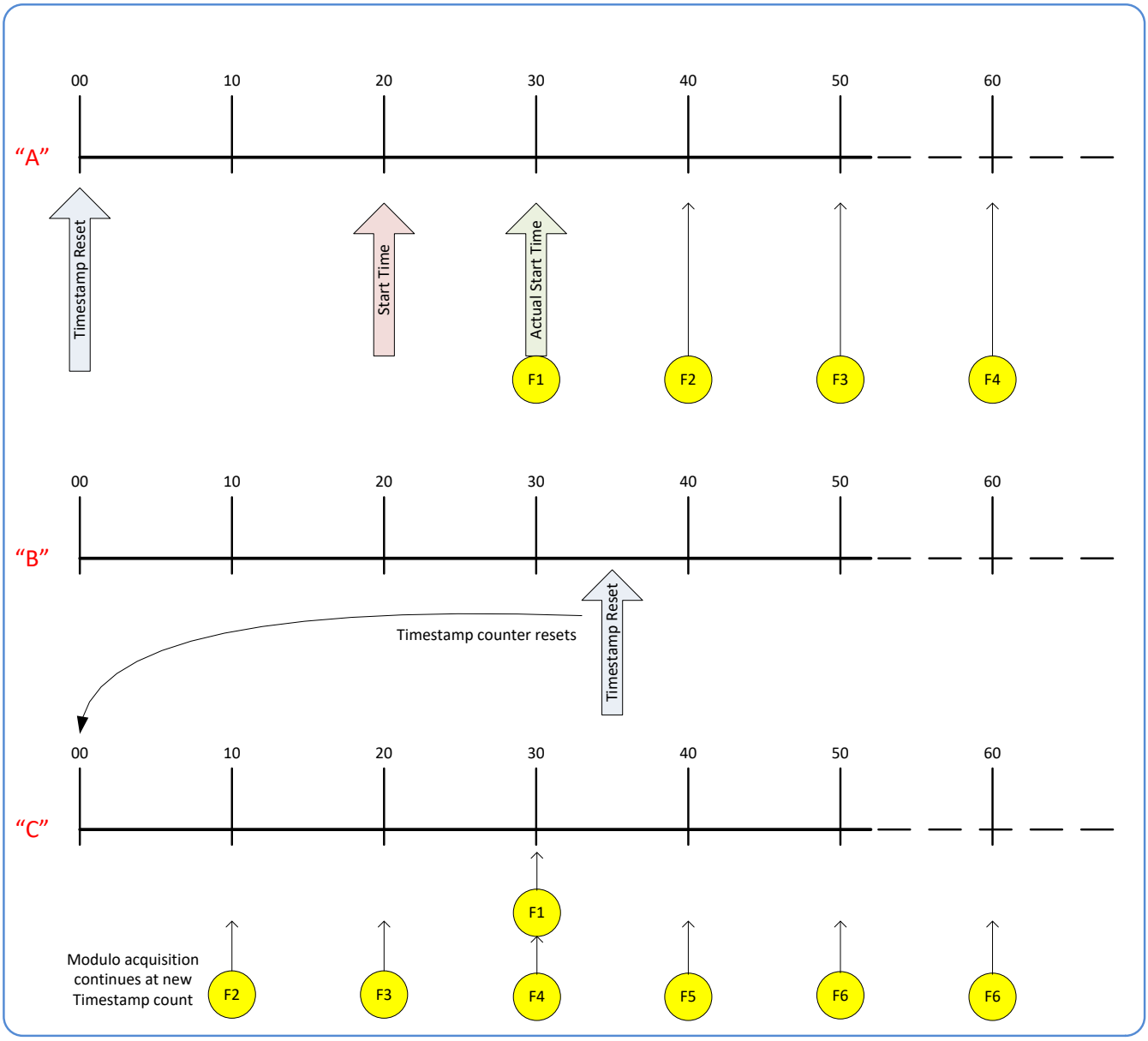
Case 4: Timer Reset after the Actual Start Time

Conditions:

- initial timestampControlReset resets Timestamp counter
- timestampModuloStartTime at 20
- timestampModulo = 10
- timestampModuloActualStartTime = first event (F1)
- second timestampControlReset at 35

This case describes the Modulo process if there is a Timestamp counter reset after a modulo controlled acquisition occurs.

- "**A**" shows the initial conditions with the first acquisition (F1) at the actual start time.
- "**B**" shows a Timestamp reset occurring after the first acquisition.
- "**C**" shows that acquisitions then continue at the first modulo 10 time after the reset due to acquisitions already in progress compared to the example case 3 above.

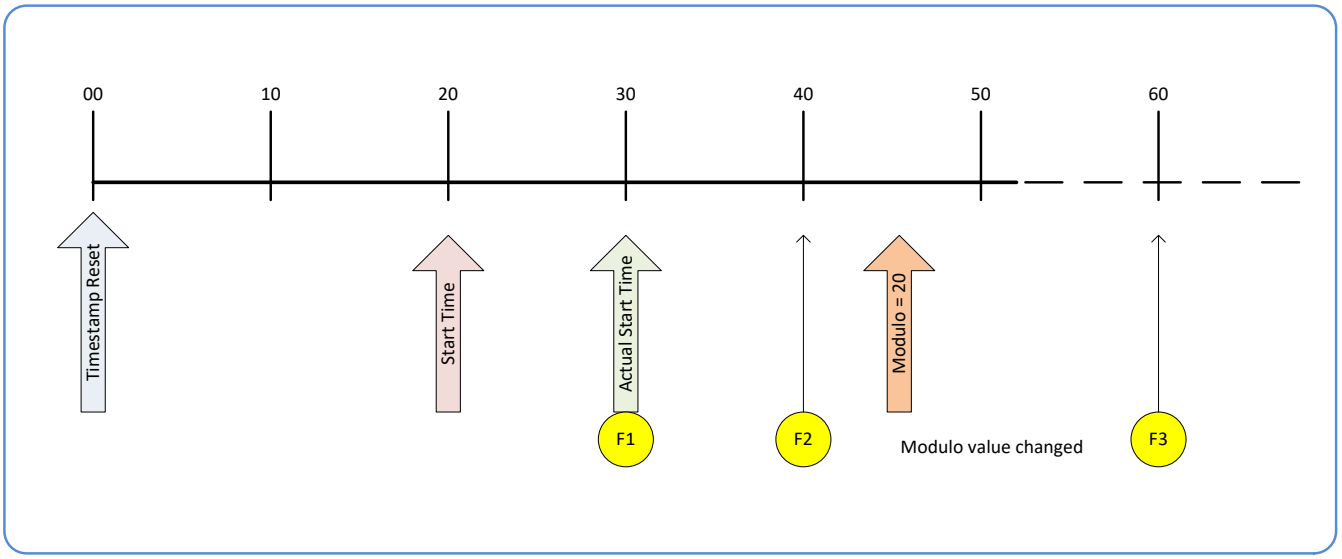


Case 5: Changing 'timestampModulo' during Acquisitions

Conditions:

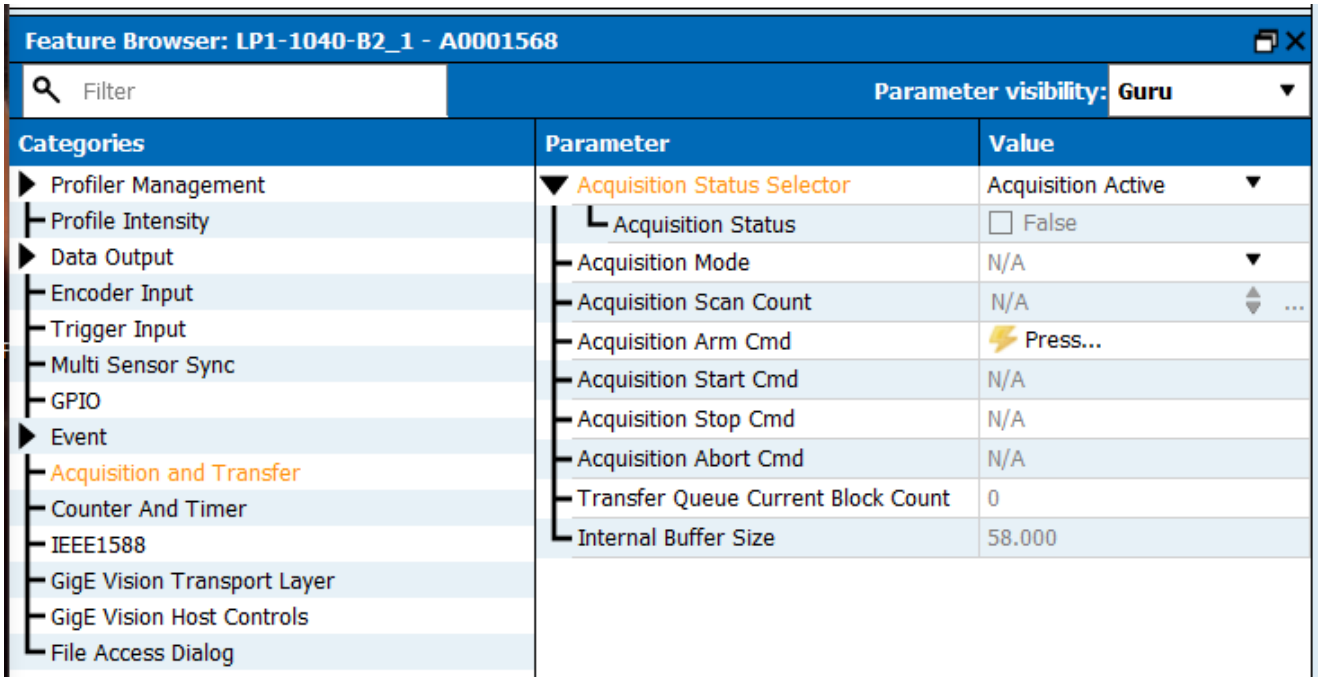
- initial timestampControlReset resets Timestamp counter
- timestampModuloStartTime at 20
- timestampModulo = 10
- timestampModuloActualStartTime = first event (F1)
- timestampModulo changes to 20

Case 5 shows that the Modulo value can be changed dynamically. Using the simple example of case 1, after the second acquisition (F2) the Modulo value is changed from 10 to 20. The third acquisition now occurs at modulo 20 time following the previous acquisition.



Acquisition and Transfer Category

The Acquisition and Transfer Controls as shown by Z-Expert, has parameters used to configure the optional acquisition modes of the device. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.



Acquisition and Transfer Feature Descriptions

The following table describes these parameters along with their view attribute and. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

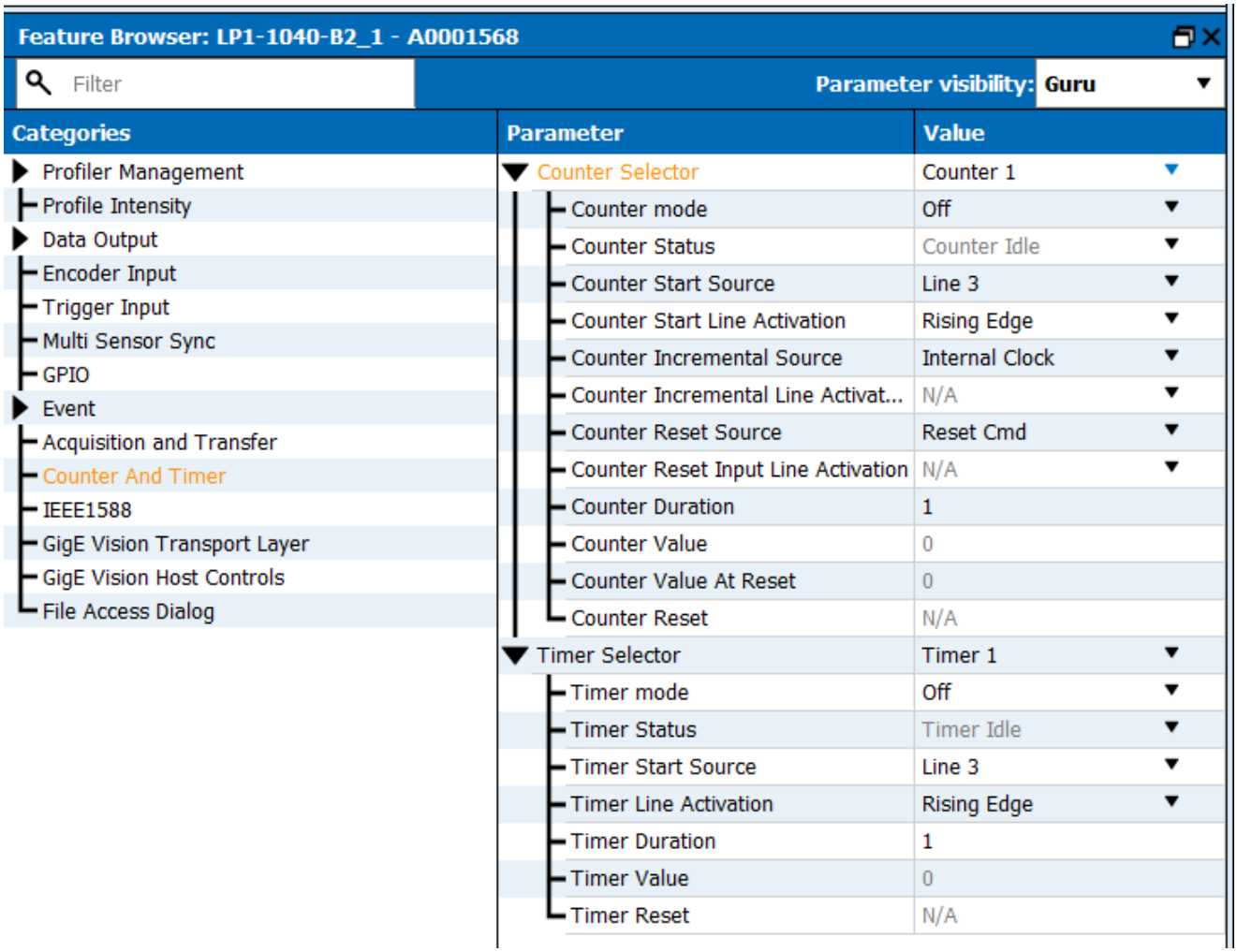
Display Name	Feature & Values	Description	Device Version & View
Acquisition Status Selector	AcquisitionStatusSelector	Selects what status "Acquisition Status" to monitor.	1.00 Expert
Acquisition Active	*AcquisitionActive*	*Device is currently doing an acquisition of one or many profiles.*	
Acquisition Trigger Wait	*AcquisitionTriggerWait*	*Device is currently waiting for a trigger to start the acquisition.*	
Acquisition Status	AcquisitionStatus	Reads the state of the internal acquisition signal selected using the “Acquisition Status Selector” feature.	1.00 Expert
Acquisition Mode	AcquisitionMode	Set the acquisition mode of the device. It defines the number of frames to capture during an acquisition and the way the acquisition stops.	1.00 Beginner

Single Scan	*SingleFrame*	*One scan is captured for each AcquisitionStart Command. An AcquisitionStop occurs at the end of the Active Scan.*	
Multi-Scan	*MultiFrame*	*A sequence of scans is captured for each AcquisitionStart Command. The number of scans is specified by AcquisitionFrameCount feature. An AcquisitionStop occurs at the end of the Active Scan(s)*	
Continuous	*Continuous*	*Scans are captured continuously with AcquisitionStart until stopped with the AcquisitionStop command.*	
Acquisition Scan Count	AcquisitionFrameCount	Number of scans to be acquired in Multiscan acquisition mode.	1.00 Beginner
Acquisition Arm Cmd	AcquisitionArm	Arms the device before an AcquisitionStart command. This optional command validates all the current features for consistency and prepares the device for a fast start of the acquisition. If not used explicitly, this command is automatically executed at the first AcquisitionStart but will not be repeated for subsequent ones unless a data transfer related feature is changed in the device.	1.00 Guru
Acquisition Start Cmd	AcquisitionStart	Start scan capture using the currently selected acquisition mode. The number of scans captured is specified by AcquisitionMode feature.	1.00 Beginner
Acquisition Stop Cmd	AcquisitionStop	Stops the Acquisition of the device at the end of the current profile.	1.00 Beginner
Acquisition Abort Cmd	AcquisitionAbort	Aborts the acquisition immediately. This will end the capture without completing the current scan or aborts waiting on a trigger. If no acquisition is in progress, the command is ignored.	1.00 Beginner
Transfer Queue Current Block Count	transferQueueCurrentBlockCount	Returns the current number of blocks in the transfer queue.	1.00 DFNC Expert
Internal Buffer Size	transferQueueMemorySize	Indicates the amount of device memory (in MBytes) available for internal image frame accumulation in the transfer queue. Increasing or decreasing memory reserved by devicePacketResendBufferSize will affect total memory available here.	1.00 DFNC Guru

Counter and Timer Category

The Counter and Timer controls as shown by Z-Expert, has parameters used to configure acquisition counters and timers for various inputs. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



Counter and Timer Feature Description

The following table describes these parameters along with their view attribute and firmware version. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (indicated by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

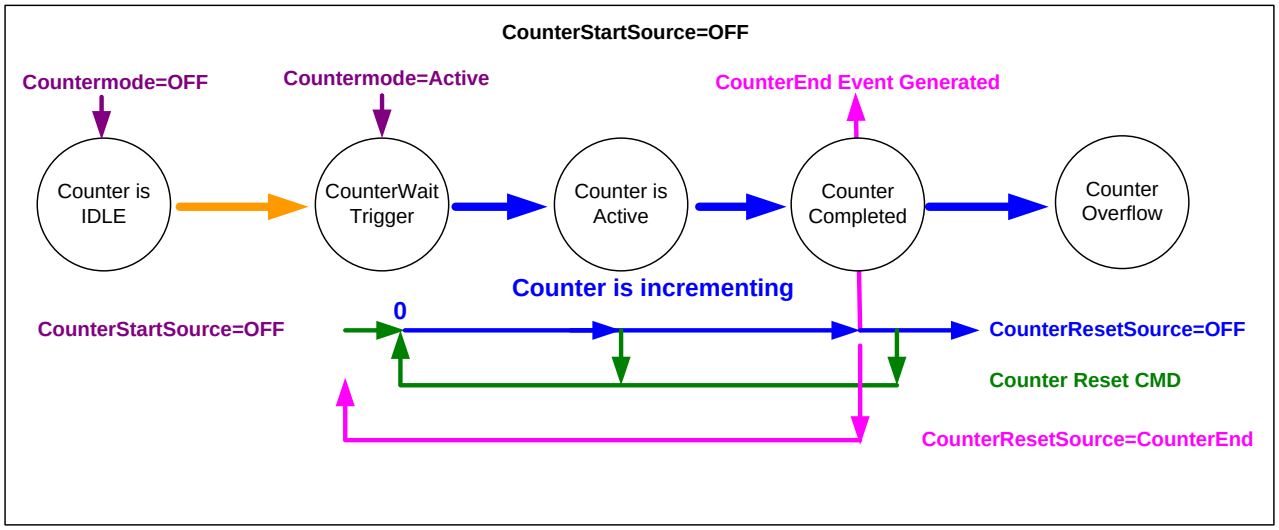
Display Name	Feature & Values	Description	Version & View
Counter Selector	counterSelector	Selects the counter to configure.	1.00 Expert DFNC
Counter 1	*Counter1*	*Select counter 1*	
Counter mode	counterMode	Selects the counter mode. The selected Counter is either Active or Disabled. When Disabled, the Counter can be configured.	1.00 Expert DFNC
Off	*Off*	*The selected Counter is Disabled*	
Active	*Active*	*The selected Counter is Enabled*	
Counter Status	counterStatus	Returns the current state of the counter.	1.00 Expert DFNC
Counter Idle	*CounterIdle*	*The counter is idle.* *The counterStartSource feature is set to off.*	
Counter Trigger Wait	*CounterTriggerWait*	*The counter is waiting for a start trigger.*	
Counter Active	*CounterActive*	*The counter is counting for the specified duration.*	
Counter Completed	*CounterCompleted*	*The counter reached the CounterDuration count.*	
Counter Overflow	*CounterOverflow*	*The counter reached its maximum possible count.*	
Counter Start Source	counterStartSource	Select the counter start source. Counter increments from 0 to the value of the counterDuration feature.	1.00 Expert DFNC
Off	*Off*	*Counter is stopped.*	
Acquisition Start	*AcquisitionStart*	*Counter starts on the reception of the Acquisition Start event.*	
Acquisition End	*AcquisitionEnd*	*Counter starts on the reception of the Acquisition End event.*	
Exposure Start	*ExposureStart*	*Counter starts on the reception of the Exposure Start event*	
Exposure End	*ExposureEnd*	*Counter starts on the reception of the Exposure End event.*	
Readout Start	*ReadoutStart*	*Counter starts on the reception of the Readout Start event.*	
Readout End	*ReadoutEnd*	*Counter starts on the reception of the Readout End event.*	
Profile Start	*LineStart*	*Counter starts on the reception of the Profile Trigger event.*	
Valid Profile Trigger	*ValidLineTrigger*	*Counter starts on the reception of the Valid Profile Trigger.*	
Rejected Profile Trigger	*InvalidLineTrigger*	*Counter starts on the reception of the Invalid Profile Trigger.*	
Multi Sensor Sync	*MultiSensorSync*	*The Multi Sensor Sync signal will start the counter.*	
Line 3	*Line3*	*Counter starts on the specified transitions on Line 3*	
Line 4	*Line4*	*Counter starts on the specified transitions on Line 4*	
Timer 1 End	*Timer1End*	*Counter starts on the reception of the Timer 1 End event.*	
Counter 1 End	*Counter1End*	*Counter starts on the reception of the Counter 1 End event.*	

Counter Start Line Activation	counterStartLineActivation	Selects the activation mode of the input line trigger which starts the counter. This is only applicable when the counterStartSource feature selects a physical Line.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Starts counting on rising edge of the selected Line.*	
Falling Edge	*FallingEdge*	*Starts counting on falling edge of the selected Line.*	
Any Edge	*AnyEdge*	*Starts counting on the falling or rising edge of the selected Line.*	
Counter Incremental Source	counterIncrementalSource	Select the event source which increments the counter.	1.00 Expert DFNC
Off	*Off*	*Counter is stopped.*	
Acquisition Start	*AcquisitionStart*	*Counts the number of Acquisition Start events.*	
Acquisition End	*AcquisitionEnd*	*Counts the number of Acquisition End events.*	
Exposure Start	*ExposureStart*	*Counts the number of Exposure Start events.*	
Exposure End	*ExposureEnd*	*Counts the number of Exposure End events.*	
Readout Start	*ReadoutStart*	*Counts the number of Readout Start events.*	
Readout End	*ReadoutEnd*	*Counts the number of Readout End events.*	
Profile Triggert	*LineStart*	*Counts the number of Profile Trigger events.*	
Valid Profile Trigger	*ValidLineTrigger*	*Counts the number of Valid Profile Triggers.*	
Rejected Profile(s) Trigger	*InvalidLineTrigger*	*Counts the number of Rejected Profile(s) Trigger.*	
Line 3	*Line3*	*Counts the number of transitions on Line 3 (based on the counterIncrementalLineActivation feature setting)*	
Line 4	*Line4*	*Counts the number of transitions on Line 4 (based on the counterIncrementalLineActivation feature setting)*	
Internal Clock	*InternalClock*	*The internal clock increments the counter value.*	
Timer 1 End	*Timer1End*	*Counts the number of Timer 1 End events.*	
Counter Incremental Line Activation	counterIncrementalLineActivation	Selects the counter signal activation mode. The counter increments on the specified signal edge or level.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Increment the counter on the rising edge of the selected I/O Line.*	
Falling Edge	*FallingEdge*	*Increment the counter on the falling edge of the selected I/O Line.*	
Any Edge	*AnyEdge*	*Increment the counter on the falling or rising edge of the selected I/O Line.*	
Counter Reset Source	counterResetSource	Selects the signal source to reset the counter. After a reset the counter waits for the next countStartSource signal or event.	1.00 Expert DFNC
Reset Cmd	*Off*	*Reset on reception of the Reset Icommand.*	
Acquisition Start	*AcquisitionStart*	*Reset on reception of the Acquisition Start.*	
Acquisition End	*AcquisitionEnd*	*Reset on reception of the Acquisition End*	
Exposure Start	*ExposureStart*	*Reset on reception of the Exposure Start event.*	
Exposure End	*ExposureEnd*	*Reset on reception of the Exposure End event.*	
Readout Start	*ReadoutStart*	*Reset the counter on the reception of the Readout Start event.*	
Readout End	*ReadoutEnd*	*Reset the counter on the reception of the Readout End event.*	
Profile Trigger	*LineStart*	*Reset on reception of the Profile Trigger.*	
Valid Profile Trigger	*ValidLineTrigger*	*Reset on reception of the Valid Profile Trigger.*	
Rejected Profile Trigger	*InvalidLineTrigger*	*Reset on reception of the Invalid Profile Trigger.*	
Line 3	*Line3*	*Reset counter on the specified transition on line 3.*	
Line 4	*Line4*	*Reset counter on the specified transition on line 4.*	
Timer 1 End	*Timer1End*	*Reset on reception of the Timer End.*	
Counter 1 End	*Counter1End*	*Reset on the reception of the Counter 1 end.*	

Counter Reset Input Line Activation	counterResetLineActivation	Specify the edge transition on the selected line that will reset the selected counter.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Reset counter on rising edge of the selected signal.*	
Falling Edge	*FallingEdge*	*Reset counter on falling edge of the selected signal.*	
Any Edge	*AnyEdge*	*Reset counter on the falling or rising edge of the selected signal*	
Counter Duration	counterDuration	Sets the terminal value of the counter; when the "Counter Value" reaches this value a CounterEnd event is generated.	1.00 Expert DFNC
Counter Value	counterValue	Read the current value of the selected counter.	1.00 Expert DFNC
Counter Value At Reset	counterValueAtReset	Reads the counter value of the selected counter when it was reset by a trigger or by an explicit Counter Reset command.	1.00 Expert DFNC
Counter Reset	counterReset	Resets the selected counter to zero. The counter starts immediately after the reset. To temporarily disable the counter, set the Counter Event Source feature to Off.	1.00 Expert DFNC
Timer Selector	timerSelector	Selects which timer to configure.	1.00 Expert DFNC
Timer 1	*Timer1*	*Timer 1 selected*	
Timer Mode	timerMode	Select the Timer mode. The selected Timer is Active or Disabled. When Disabled, the Timer can be configured.	1.00 Expert DFNC
Off	*Off*	*The selected Timer is Disabled.*	
Active	*Active*	*The selected Timer is Enabled.*	
Timer Status	timerStatus	Returns the current state of the timer.	1.00 Expert DFNC
Timer Idle	*TimerIdle*	*The timer is idle. The counterStartSource feature is set to off.*	
Timer Trigger Wait	*TimerTriggerWait*	*The timer is waiting for a start trigger.*	
Timer Active	*TimerActive*	*The timer is counting for the specified duration.*	
Timer Completed	*TimerCompleted*	*The timer reached the timerDuration count.*	
Timer Start Source	timerStartSource	Select the trigger source to start the timer.	1.00 Expert DFNC
TimerReset Cmd	*Off*	*Starts with the reception of the TimerReset Icommand.*	
Acquisition Start	*AcquisitionStart*	*Start Timer on Acquisition Start event.*	
Acquisition End	*AcquisitionEnd*	*Start Timer on Acquisition End event*	
Exposure Start	*ExposureStart*	*Start Timer on Exposure Start event.*	
Exposure End	*ExposureEnd*	*Start Timer on Exposure End event.*	
Readout Start	*ReadoutEnd*	*Start Timer on Readout Start event.*	
Readout End	*ReadoutStart*	*Start Timer on Readout End event.*	
Profile Trigger	*LineStart*	*Start Timer on Profile Trigger event.*	
Valid Profile Trigger	*ValidLineTrigger*	*Start Timer on Valid Profile Trigger event.*	
Multi Sensor Sync	*MultiSensorSync*	*Multi Sensor Sync*	
Line 3	*Line3*	*Start Timer on a transition of I/O Line 3 event.*	
Line 4	*Line4*	*Start Timer on a transition of I/O Line 4 event.*	
Timer 1 End	*Timer1End*	*Start Timer on Timer End event.*	
Counter 1 End	*Counter1End*	*Start Timer on Counter 1 End event.*	
Timer Line Activation	timerStartLineActivation	Select the trigger activation mode which starts the timer.	1.00 Expert DFNC
Rising Edge	*RisingEdge*	*Starts counter on rising edge of the selected signal.*	

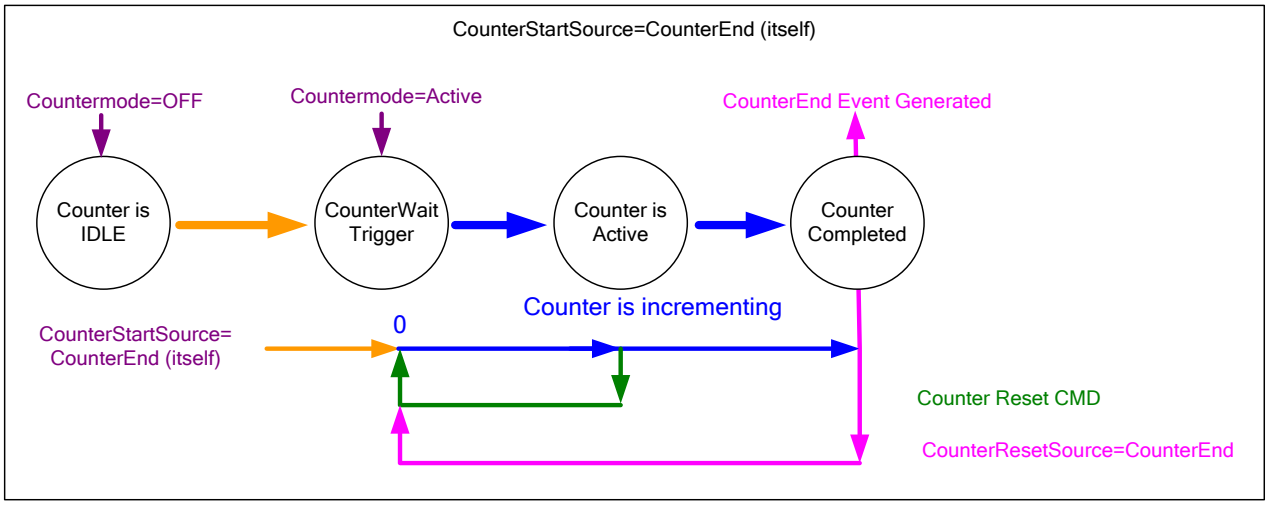
Falling Edge	*FallingEdge*	*Starts counter on falling edge of the selected signal.*	
Any Edge	*AnyEdge*	*Starts counter on the falling or rising edge of the selected signal.*	
Timer Duration	timerDuration	Sets the duration (in microseconds) of the timer pulse.	1.00 Expert DFNC
Timer Value	timerValue	Reads the current value (in microseconds) of the selected timer.	1.00 Expert DFNC
Timer Reset	timerReset	Resets the timer to 0.	1.00 Expert DFNC

Example: Counter Start Source = OFF



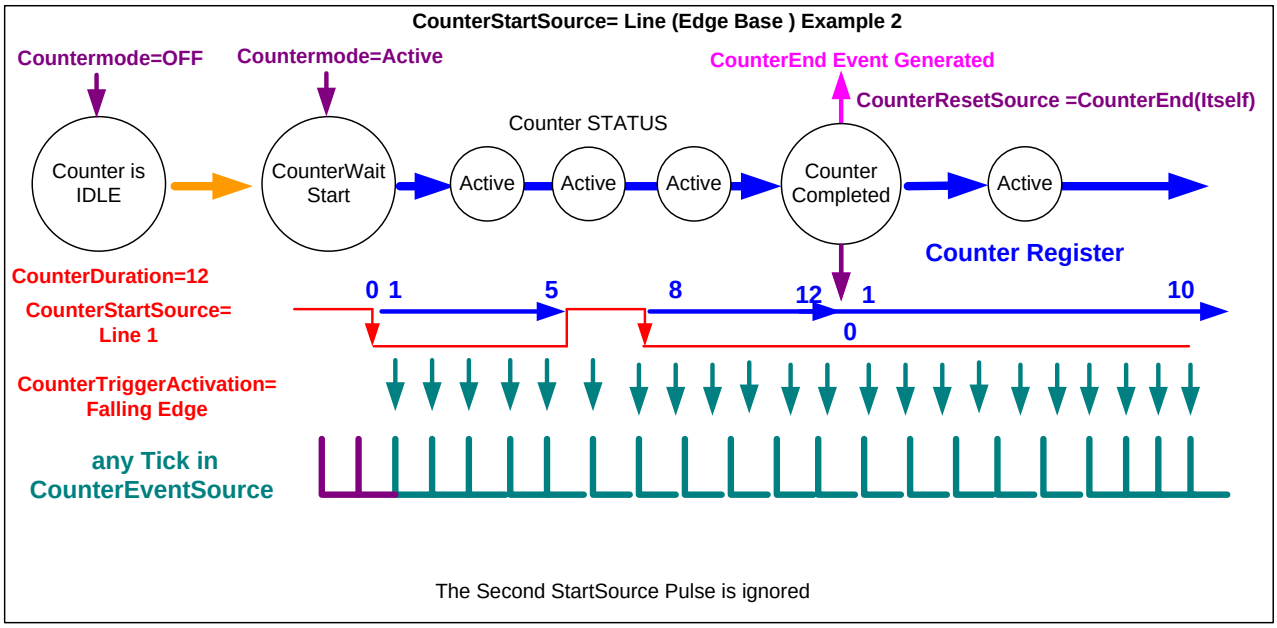
- The counter starts on the **counterReset Cmd**.
- The counter continues unless a new **counterReset Cmd** is received, which then restarts the counter at 00.

Example: Counter Start Source = CounterEnd (itself)



- Counter starts when Counter Mode is set to Active.
- A **Counter Reset CMD** will reset the counter to 00 and it then continues counting.
- **counterResetSource** must be set to **CounterEnd**. When the counterValue feature reaches the counterDuration value an event is generated and the counter is reset to 00, then continues.

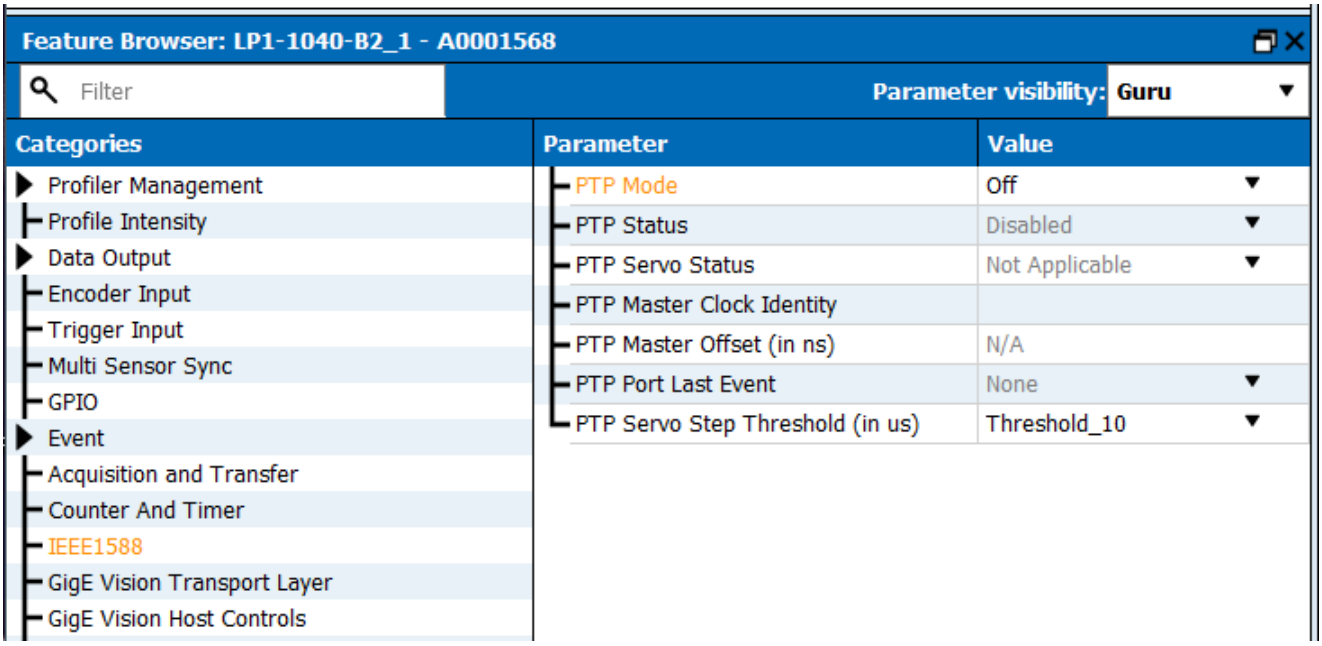
Example: CounterStartSource = Line (Edge Base) Example



IEEE1588 Category

The IEEE1588 controls as shown by Z-Expert, has parameters used to configure the Precision Time Protocol function. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



IEEE1588 Feature Descriptions

The following table describes these parameters along with their view attribute and. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Version & View
PTP Mode	ptpMode	Specifies the PTP (IEEE-1588: Precision Time Protocol) operating mode implemented. If multiSensorSyncMode is not Off, ptpMode cannot be put to Off.	1.00 Expert DFNC
Off	*Off*	*PTP is disabled on the device.*	
Automatic	*Automatic*	*PTP is enabled on the device. The camera can become a Master or Slave device. The Master device is automatically determined as per IEEE-1588.*	
Slave	*Slave*	*Device will operate in PTP slave-only mode.*	

PTP Status	ptpStatus	Specifies dynamically the current PTP state of the device. (ref: IEEE Std 1588-2008)	1.00 Expert DFNC
Initializing	*Initializing*	*The port initializes its data sets, hardware and communication facilities. No port of the clock shall place any PTP messages on its communication path. If one port of a boundary clock is in the INITIALIZING state, then all ports shall be in the INITIALIZING state.*	
Faulty	*Faulty*	*The fault state of the protocol. A port in this state shall not place any PTP messages except for management messages that are a required response to another management message on its communication path. In a boundary clock, no activity on a faulty port shall affect the other ports of the device. If fault activity on a port in this state cannot be confined to the faulty port, then all ports shall be in the FAULTY state.*	
Disabled	*Disabled*	*The port shall not place any messages on its communication path. In a boundary clock, no activity at the port shall be allowed to affect the activity at any other port of the boundary clock. A port in this state shall discard all PTP received messages except for management messages.*	
Listening	*Listening*	*The port is waiting for the announceReceiptTimeout to expire or to receive an Announce message from a master. The purpose of this state is to allow orderly addition of clocks to a domain. A port in this state shall not place any PTP messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message.*	
PreMaster	*PreMaster*	*The port shall behave in all respects as though it were in the MASTER state except that it shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, signaling, or management messages.*	
Master	*Master*	*The port is behaving as a master port.*	
Passive	*Passive*	*The port shall not place any messages on its communication path except for Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up, or signaling messages, or management messages that are a required response to another management message.*	
Uncalibrated	*Uncalibrated*	*One or more master ports have been detected in the domain. The appropriate master port has been selected, and the local port is preparing to synchronize to the selected master port. This is a transient state to allow initialization of synchronization servos, updating of data sets when a new master port has been selected, and other implementation-specific activity.*	
Slave	*Slave*	*The port is synchronizing to the selected master port.*	
GrandMaster	*GrandMaster*	*The port is in the Grand Master state (i.e. has the best clock). The device can become GrandMaster only if the PTP Mode=Automatic and there's another device on the network that was Master.*	
Error	*Error*	*One or more ports have an error state.*	
PTP Servo Status	ptpServoStatus	Specifies the IEEE1588 servo status.	1.00 Expert DFNC
Unlocked	*Unlocked*	*The servo is not yet ready to track the master clock.*	

Synchronizing	*Synchronizing*	*The servo is unlocked and synchronizing to the master clock.*	
Locked	*Locked*	*The servo is adjusting (syntonizing) to the master clock.*	
Not Applicable	*NotApplicable*	*The servo state is currently not applicable.*	
PTP Master Clock Identity	ptpMasterClockId	Port identity of the current best master. The clock ID is an Extended Unique Identifier (EUI)-64 64-bit ID, converted from the 48-bit MAC address, by inserting 0xfffe at the middle of the MAC address.	1.00 Guru DFNC
PTP Master Offset	ptpMasterOffsetNs	Dynamically returns the 64-bit value of the PTP offset with the master. This value is the input for clock corrections for the slave device clock servo algorithms.	1.00 Guru DFNC
PTP Port Last Event	ptpPortLastEvent	Logs the last PTP changed state event defining the last current status.	1.00 Guru DFNC
None	*None*	*None*	
Power up	*Powerup*	*Power up*	
Initialize	*Initialize*	*Initialize*	
Designated Enabled	*DesignatedEnabled*	*Designated Enabled*	
Designated Disabled	*DesignatedDisabled*	*Designated Disabled*	
Fault Cleared	*FaultCleared*	*Fault Cleared*	
Fault Detected	*FaultDetected*	*Fault Detected*	
State Decision Event	*StateDecisionEvent*	*State Decision Event*	
Qualification Timeout Expires	*QualificationTimeoutExpires*	*Qualification Timeout Expires*	
Announce Receipt Timeout Expires	*AnnounceReceiptTimeoutExpires*	*Announce Receipt Timeout Expires*	
Synchronization Fault	*SynchronizationFault*	*Synchronization Fault*	
Master Clock Selected	*MasterClockSelected*	*Master Clock Selected*	
Recommended State Master	*RS_Master*	*Recommended State Master*	
Recommended State Grand Master	*RS_GrandMaster*	*Recommended State Grand Master*	
Recommended State Slave	*RS_Slave*	*Recommended State Slave*	
Recommended State Passive	*RS_Passive*	*Recommended State Passive*	
PTP Servo Step Threshold (in us)	ptpServoStepThreshold	Specifies the servo step threshold (in us). When the clock offset with the master exceeds the threshold, the servo unlocks and offset adjustment is started.	1.00 Guru DFNC
Threshold_10	*Threshold_10*		
Threshold_20	*Threshold_20*		
Threshold_100	*Threshold_100*		
Threshold_500	*Threshold_500*		
Threshold_1000	*Threshold_1000*		
Threshold_2000	*Threshold_2000*		

Overview of Precision Time Protocol Mode (IEEE 1588)

PTP Mode = Precision Time Protocol

- The PTP protocol synchronizes the Timestamp clocks of multiple devices connected via a switch on the same network. The switch must support PTP.
- For optimal clock synchronization the imaging network should use one Ethernet switch. Daisy-chaining multiple small switches will degrade device clock syncs.
- Additionally the Ethernet switch connecting devices to the imaging network should implement "PTP Boundary Clock" hardware.
- To use a multi-port NIC adapter or computer with multiple NIC ports instead of a switch, that multiport NIC must be capable to be configured as the common Master PTP source for all its networks. Such a configuration requires using the multi-port NIC's configuration software.
- Z-Trak devices can automatically organize themselves into a master-slave hierarchy, or the user application configures a device master with n-number of slaves. The auto-configuration process typically happens within 2 seconds.
- The automatic organizing procedure is composed of steps (as defined by IEEE 1588) to identify the best clock source to act as master. When only Z-Trak devices are used, since they are equal, the last selection step identifies the lowest MAC address as the clock master.
- The feature *TimeStamp Source* is automatically changed to *IEEE1588* when *PTP Mode* is enabled. This timestamp tick (in ns) cannot be reset by the user.

PTP Master Clock Identity

The clock ID of the current best master is an Extended Unique Identifier (EUI)-64 "64-bit ID", converted from the 48-bit MAC address, by inserting 0xfffe at the middle of the MAC address.

- The standard MAC address in human-friendly form is six groups of two hexadecimal digits as this example shows (excluding spaces): "0a 1b 2c 3d 4e 5f"
- The Extended Unique Identifier format is (excluding spaces): "0a 1b 2c fffe 3d 4e 5f"

An Example with two Z-Trak Devices

The following basic steps configure two profilers connected to one computer via an Ethernet switch, configured with two instances of Z-Expert, to grab a frame every second, controlled by a modulo event via PTP.

For each profiler set features as follows:

I/O Controls — select Trigger Mode=ON, Tigger Source=Timestamp Modulo Event

Event Controls — select PTP Mode=Automatic

- Note how one device automatically becomes Master while the other becomes Slave

Event Controls — to have a modulo event every second, set Timestamp Modulo Event=1000000000

Click Grab on each instance of Z-Expert. With the two profilers aimed at the same moving object, you see that each grabs line profiles at the same time.

IEEE 1588 Reference Resources

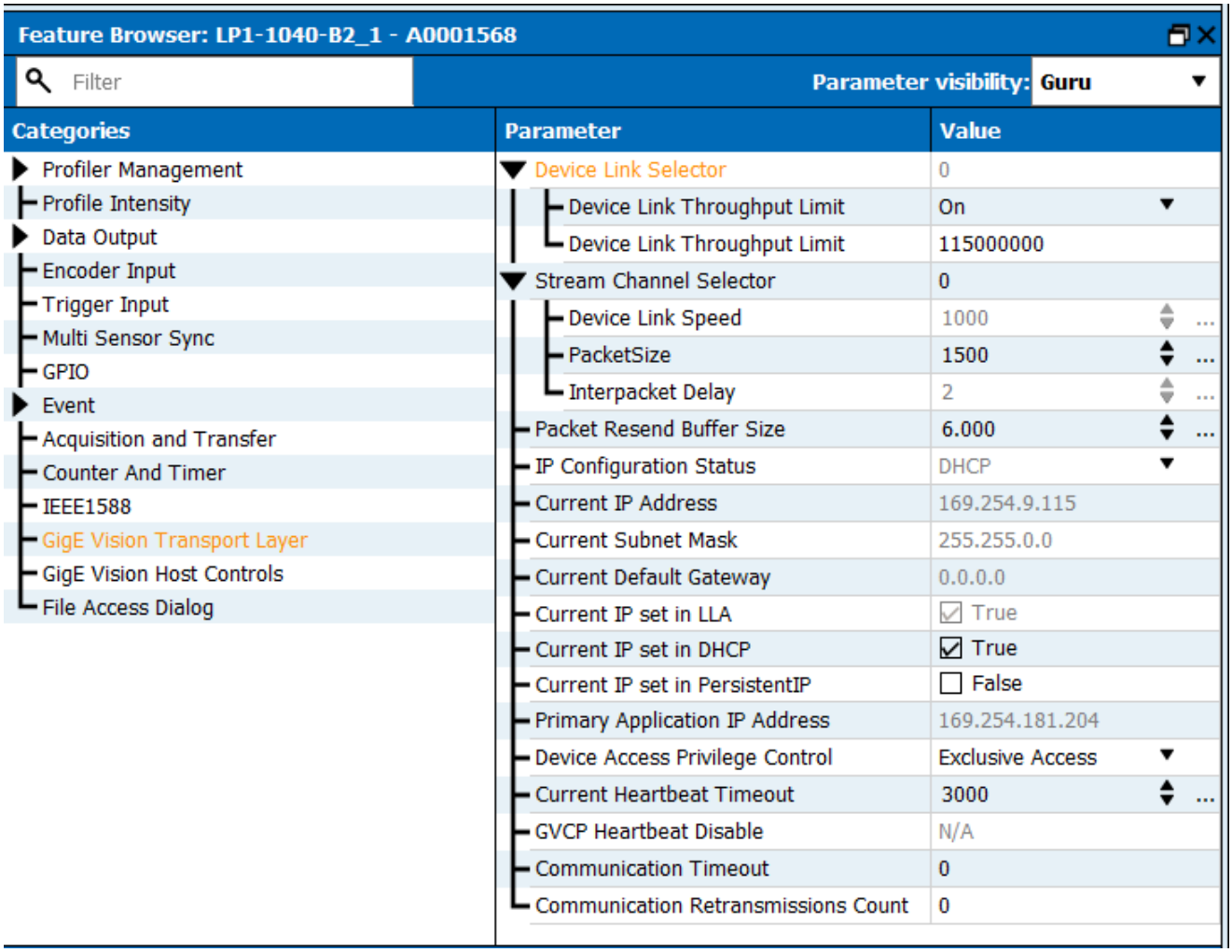
For additional information: http://standards.ieee.org

PTP Standard Reference: IEEE Std 1588-2008 — IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems

GigE Vision Transport Layer Control Category

The GigE Vision Transport Layer control, as shown by Z-Expert, has parameters used to configure features related to GigE Vision specification and the Ethernet Connection. Parameters in gray are read only, either always or due to another parameter being disabled. Parameters in black are user set in Z-Expert or programmable via an imaging application.

Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



GigE Vision Transport Layer Feature Descriptions

The following table describes these parameters along with their view attribute and minimum firmware version required. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	Device Version & View
Device Link Selector	DeviceLinkSelector	Selects which Link of the device to control	1.00 Expert
Device Link Throughput Limit	DeviceLinkThroughputLimitMode	When disabled, lower level TL specific features are expected to control the throughput. When enabled, DeviceLinkThroughputLimit controls the overall throughput.	1.00 Guru
Off	*Off*	*Disables the DeviceLinkThroughputLimit feature.*	
On	*On*	*Enables the DeviceLinkThroughputLimit feature.*	
Device Link Throughput Limit	DeviceLinkThroughputLimit	Limits the maximum bandwidth of the data that will be streamed out by the device.	1.00 Guru
Stream Channel Selector	GevStreamChannelSelector	Selects the stream channel to control.	1.00 Expert
Device Link Speed	GevLinkSpeed	Indicates the transmission speed negotiated by the given network interface.	1.00 Expert
PacketSize	GevSCPSPacketSize	Specifies the stream packet size in bytes to send on this channel.	1.00 Expert
Interpacket Delay	GevSCPD	Indicates the delay (in µs) to insert between each packet for this stream channel. Note that Interpacket delay becomes a Read-Only value when the feature “Device Link Throughput Limit” is enabled.	1.00 Expert
Packet Resend Buffer Size	devicePacketResendBufferSize	Indicates the amount of memory to reserve in Mbytes for the packet resend buffer. Increasing or decreasing this value affects the value returned by transferQueueMemorySize	1.00 DFNC Guru
IP Configuration Status	GevIPConfigurationStatus	Reports the current IP configuration status.	1.00 Guru
None	*None*	*Device IP Configuration is not defined.*	
PersistentIP	*PersistentIP*	*Device IP Address Configuration is set to Persistent IP (static).*	
DHCP	*DHCP*	*Device IP Address Configuration is set to DHCP (Dynamic Host Configuration Protocol). Network requires a DHCP server.*	
LLA	*LLA*	*Device IP Address Configuration is set to LLA (Link-Local Address). Also known as Auto-IP. Used for unmanaged networks including direct connections from a device to a dedicated NIC.*	
ForceIP	*ForceIP*	*Device IP Address Configuration is set to ForceIP. Used to force an IP address change.*	
Current IP Address	GevCurrentIPAddress	Reports the IP address for the given network interface.	1.00 Beginner

Current Subnet Mask	GevCurrentSubnetMask	Reports the subnet mask of the given interface.	1.00 Beginner
Current Default Gateway	GevCurrentDefaultGateway	Reports the default gateway IP address to be used on the given network interface.	1.00 Beginner
Current IP set in LLA	GevCurrentIPConfigurationLLA	Controls whether the LLA (Link Local Address) IP configuration scheme is activated on the given network interface.	1.00 Guru
Current IP set in DHCP	GevCurrentIPConfigurationDHCP	Controls whether the DHCP IP configuration scheme (Dynamic Host Configuration Protocol) is activated on the given network interface.	1.00 Guru
Current IP set in PersistentIP	GevCurrentIPConfigurationPersistentIP	Controls whether the PersistentIP configuration scheme is activated on the given network interface.	1.00 Guru
Primary Application IP Address	GevPrimaryApplicationIPAddress	Returns the IP address of the device hosting the primary application.	1.00 Guru
Device Access Privilege Control	deviceCCP	Controls the device access privilege of an application.	1.00 Guru DFNC
Exclusive Access	*ExclusiveAccess*	*Grants exclusive access to the device to an application. No other application can control or monitor the device.*	
Control Access	*ControlAccess*	*Grants control access to the device to an application. No other application can control the device.*	
Control Access Switchover Active	*ControlAccessSwitchoverActive*	*Enables another application to request control access to the device.*	
Current Heartbeat Timeout	GevHeartbeatTimeout	Indicates the current heartbeat timeout in milliseconds.	1.00 Guru
GVCP Heartbeat Disable	GevGVCPHeartbeatDisable	Disables the GVCP (GigE Vision Control Protocol) heartbeat monitor. This allows control switchover to an application on another device.	1.00 Expert
Communication Timeout	GevMCTT	Provides the transmission timeout value in milliseconds.	1.00 Guru
Communication Retransmissions Count	GevMCRC	Indicates the number of retransmissions allowed when a message channel message times out.	1.00 Guru
Discovery Acknowledge Delay	GevDiscoveryAckDelay	Indicates the maximum randomized delay the device will wait to acknowledge a discovery command.	1.00 Guru
Gev GVSP Extended ID Mode	GevGVSPExtendedIDMode	Enables the extended ID mode.	1.00 Expert
Fire Test Packet	GevSCPSFireTestPacket	When this feature is set to True, the device will fire one test packet.	1.00 Invisible
Payload Size	PayloadSize	Provides the number of bytes transferred for each image or chunk on the stream channel.	1.00 Invisible
MAC Address	GevMACAddress	MAC address of the network interface.	1.00 Invisible
Current Camera IP Configuration	GevCurrentIPConfiguration	Current device IP configuration of the selected interface.	1.00 Invisible
LLA	*LLA*	*Link-Local Address Mode*	
DHCP	*DHCP*	*Dynamic Host Configuration Protocol Mode. Network requires a DHCP server.*	
PersistentIP	*PersistentIP*	*Persistent IP Mode (static)*	
Persistent IP Address	GevPersistentIPAddress	Persistent IP address for the selected interface. This is the IP address the device uses when booting in Persistent IP mode.	1.00 Invisible
Persistent Subnet Mask	GevPersistentSubnetMask	Persistent subnet mask for the selected interface.	1.00 Invisible

Persistent Default Gateway	GevPersistentDefaultGateway	Persistent default gateway for the selected interface.	1.00 Invisible
Primary Application Socket	GevPrimaryApplicationSocket	Returns the UDP (User Datagram Protocol) source port of the primary application.	1.00 Invisible
Device Access Privilege Control	GevCCP	Controls the device access privilege of an application.	1.00 Invisible
Open Access	*OpenAccess*	*OpenAccess*	
Exclusive Access	*ExclusiveAccess*	*Grants exclusive access to the device to an application. No other application can control or monitor the device.*	
Control Access	*ControlAccess*	*Grants control access to the device to an application. No other application can control the device.*	
Control Access Switchover Active	*ControlAccessSwitchoverActive*	*Enables another application to request control access to the device.*	
Interface Selector	GevInterfaceSelector	Selects which physical network interface to control.	1.00 Invisible
Number Of Interfaces	GevNumberOfInterfaces	Indicates the number of physical network interfaces supported by this device.	1.00 Invisible
Message Channel Count	GevMessageChannelCount	Indicates the number of message channels supported by this device.	1.00 Invisible
Stream Channel Count	GevStreamChannelCount	Indicates the number of stream channels supported by this device (0 to 512).	1.00 Invisible
Gev Supported Option Selector	GevSupportedOptionSelector	Selects the Gev option to interrogate for existing support.	1.00 Invisible
	IPConfigurationLLA *IPConfigurationDHCP* *IPConfigurationPersistentIP* *StreamChannelSourceSocket* *MessageChannelSourceSocket* *CommandsConcatenation* *WriteMem* *PacketResend* *Event* *EventData* *PendingAck* *Action* *PrimaryApplicationSwitchover* *ExtendedStatusCodes* *DiscoveryAckDelay* *DiscoveryAckDelayWritable* *TestData* *ManifestTable* *CCPApplicationSocket* *LinkSpeed* *HeartbeatDisable* *SerialNumber* *UserDefinedName* *StreamChannel0BigAndLittleEndian* *StreamChannel0IPReassembly* *StreamChannel0UnconditionalStreaming* *StreamChannel0ExtendedChunkData*	*IPConfigurationLLA* *IPConfigurationDHCP* *IPConfigurationPersistentIP* *StreamChannelSourceSocket* *MessageChannelSourceSocket* *CommandsConcatenation* *WriteMem* *PacketResend* *Event* *EventData* *PendingAck* *Action* *PrimaryApplicationSwitchover* *ExtendedStatusCodes* *DiscoveryAckDelay* *DiscoveryAckDelayWritable* *TestData* *ManifestTable* *CCPApplicationSocket* *LinkSpeed* *HeartbeatDisable* *SerialNumber* *UserDefinedName* *StreamChannel0BigAndLittleEndian* *StreamChannel0IPReassembly* *StreamChannel0UnconditionalStreaming* *StreamChannel0ExtendedChunkData*	
Gev Supported Option	GevSupportedOption	Returns TRUE if the selected Gev option is supported.	1.00 Invisible

LLA Supported	GevSupportedIPConfigurationLLA	Indicates if LLA (Auto-IP) is supported by the selected interface. The LLA method automatically assigns the device with a randomly chosen address on the 169.254.xxx.xxx subnet. After an address is chosen, the link-local process sends an ARP query with that IP onto the network to see if it is already in use. If there is no response, the IP is assigned to the device, otherwise another IP is selected, and the ARP is repeated. Note that LLA is unable to forward packets across routers. LLA is the recommended scheme when only one NIC is connected to GigE devices; ensure only one NIC is using LLA on your PC, otherwise IP conflicts will result.	1.00 Invisible
DHCP Supported	GevSupportedIPConfigurationDHCP	Indicates if DHCP is supported by the selected interface. This IP configuration mode requires a DHCP server to allocate an IP address dynamically over the range of some defined subnet. The device must be configured to have DHCP enabled. This is the factory default settings. The DHCP server is part of a managed network. Windows itself does not provide a DHCP server function therefore a dedicated DHCP server is required. The DALSA Network Configuration Tool can be configured as a DHCP server on the NIC used for the GigE Vision network.	1.00 Invisible
Persistent IP Supported	GevSupportedIPConfigurationPersistentIP	Indicates if Persistent IP is supported by the selected interface. This protocol is only suggested if the user fully controls the assignment of IP addresses on the network and a GigE Vision device is connected beyond routers. The GigE Vision device is forced a static IP address. The NIC IP address must use the same subnet otherwise the device is not accessible. If the device is connected to a network with a different subnet, it cannot be accessed.	1.00 Invisible
GVCP Extended Status Codes	GevGVCPExtendedStatusCodes	Enables generation of extended status codes.	1.00 Invisible
PENDING_ACK Enable	GevGVCPPendingAck	Enables the generation of PENDING_ACK	1.00 Invisible
PENDING_ACK Test	TestPendingAck	Tests the device's pending acknowledge feature.	1.00 Invisible
GVCP Pending Timeout	DeviceLinkCommandTimeout	Indicates the maximum response time of the device for a GVCP command.	1.00 Invisible
GVCP Pending Timeout	GevGVCPPendingTimeout	Indicates the longest GVCP command execution time before a device returns a PENDING_ACK.	1.00 Invisible
Gev MCP HostPort	GevMCPHostPort	Indicates the port to which the device must send messages.	1.00 Invisible
Gev MCDA	GevMCDA	Indicates the destination IP address for the message channel.	1.00 Invisible
Gev MCSP	GevMCSP	This feature indicates the source port for the message channel.	1.00 Invisible
Stream Channel Interface Index	GevSCPInterfaceIndex	Index of network interface.	1.00 Invisible
Gev SCP HostPort	GevSCPHostPort	Indicates the port to which the device must send the data stream.	1.00 Invisible
Gev SCDA	GevSCDA	Indicates the destination IP address for this stream channel.	1.00 Invisible
Gev SCSP	GevSCSP	Indicates the source port of the stream channel.	1.00 Invisible

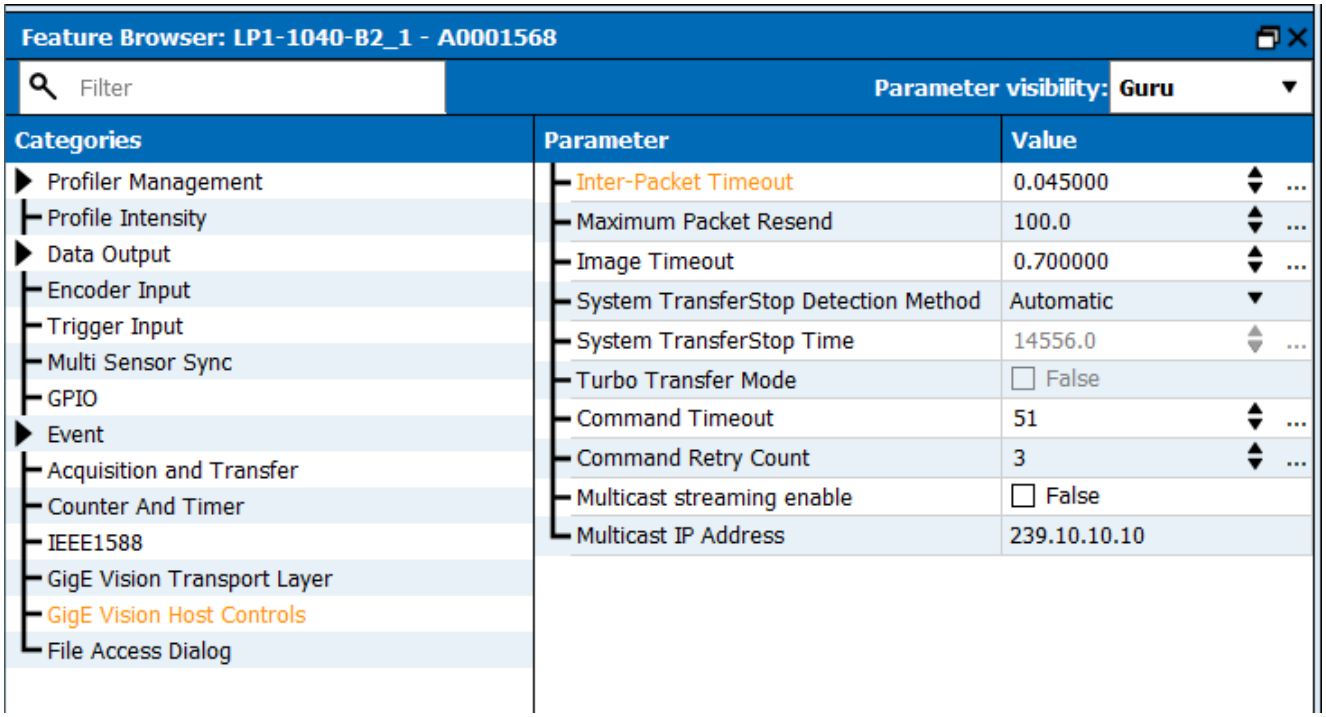
Gev First URL	GevFirstURL	Indicates the first URL to the XML device description file.	1.00 Invisible
Gev Second URL	GevSecondURL	Indicates the second URL to the XML device description file.	1.00 Invisible
Gev Major Version	GevVersionMajor	Major version of the specification.	1.00 Invisible
Gev Minor Version	GevVersionMinor	Minor version of the specification.	1.00 Invisible
Manifest Entry Selector	DeviceManifestEntrySelector	Selects the manifest entry to reference.	1.00 Invisible
XML Major Version	DeviceManifestXMLMajorVersion	Indicates the major version number of the XML file of the selected manifest entry.	1.00 Invisible
XML Minor Version	DeviceManifestXMLMinorVersion	Indicates the Minor version number of the XML file of the selected manifest entry.	1.00 Invisible
XML SubMinor Version	DeviceManifestXMLSubMinorVersion	Indicates the SubMinor version number of the XML file of the selected manifest entry.	1.00 Invisible
Schema Major Version	DeviceManifestSchemaMajorVersion	Indicates the major version number of the Schema file of the selected manifest entry.	1.00 Invisible
Schema Minor Version	DeviceManifestSchemaMinorVersion	Indicates the minor version number of the Schema file of the selected manifest entry.	1.00 Invisible
Manifest Primary URL	DeviceManifestPrimaryURL	Indicates the first URL to the XML device description file of the selected manifest entry.	1.00 Invisible
Manifest Secondary URL	DeviceManifestSecondaryURL	Indicates the second URL to the XML device description file of the selected manifest entry.	1.00 Invisible
Device Mode Is Big Endian	GevDeviceModeIsBigEndian	Endianess of the device registers.	1.00 Invisible
Device Mode CharacterSet	GevDeviceModeCharacterSet	Character set used by all the strings of the bootstrap registers.	1.00 Invisible
	reserved1 *UTF8* *reserved2*	*reserved1* *UTF8* *reserved2*	
GevSCPSDoNotFragment	GevSCPSDoNotFragment	This feature state is copied into the “do not fragment” bit of IP header of each stream packet.	1.00 Invisible
Gev SCPS BigEndian	GevSCPSBigEndian	Endianess of multi-byte pixel data for this stream.	1.00 Invisible

GigE Vision Host Control Category

The GigE Vision Host controls as shown by Z-Expert, has parameters used to configure the host computer system GigE Vision features used for networking management. None of these parameters are stored in the profiler device.

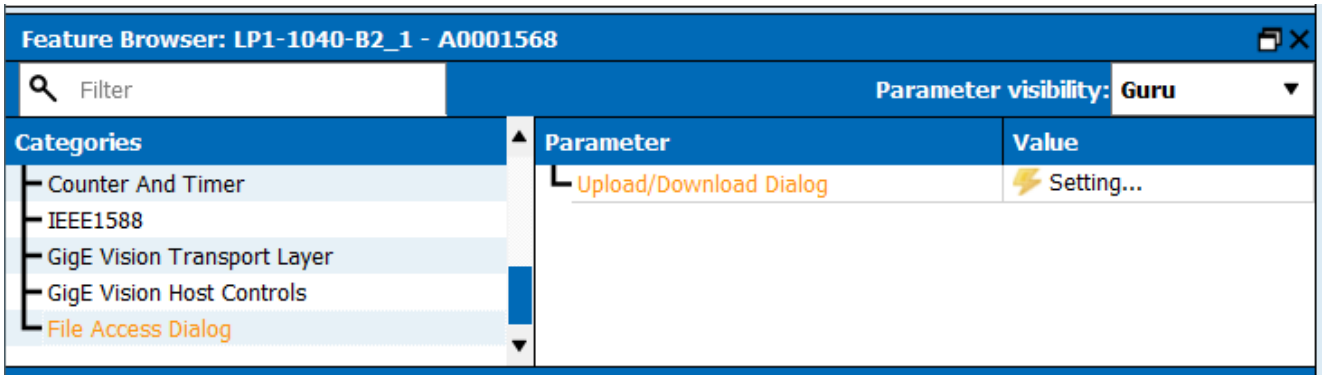
These features allow optimizing the network configuration for maximum data bandwidth. Settings for these parameters are highly dependent on the number of profilers connected to a NIC, the data rate of each and the trigger modes used.

Information on these features is found in the **Teledyne DALSA Network Imaging Module User Manual**.



File Access Control Category

The File Access control in Z-Expert allows the user to quickly upload firmware files to the Z-Trak. Features listed in the description table but tagged as *Invisible* are usually for Teledyne DALSA or third party software usage—not typically needed by end user applications.



File Access Control Feature Descriptions

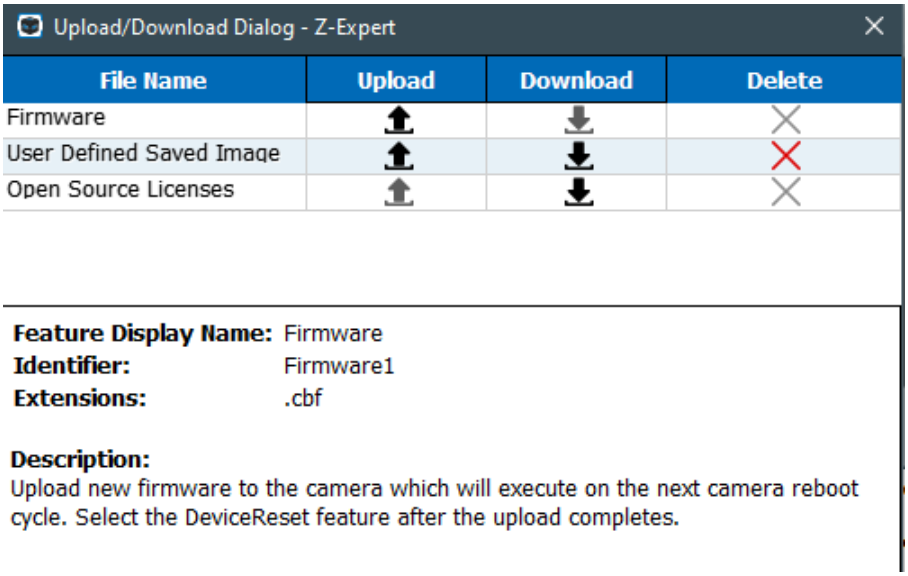
The following table describes these parameters along with their view attribute and minimum firmware version required. Additionally the Device Version column will indicate which parameter is a member of the DALSA Features Naming Convention (denoted by DFNC), versus the GenICam Standard Features Naming Convention (SFNC tag is not shown).

Display Name	Feature & Values	Description	
File Selector	FileSelector	Selects the file to access. The file types which are accessible are device-dependent.	1.00 Guru
Firmware	*Firmware1*	*Upload new firmware to the device which will execute on the next device reboot cycle. Select the DeviceReset feature after the upload completes.*	
User Defined Saved Image	*userDefinedSavedImage*	*Upload and download an image in the device.*	
Open Source Licenses	*SoftwareLicenses*	*Open Source Software Licenses.*	
File Operation Selector	FileOperationSelector	Selects the target operation for the selected file in the device. This operation is executed when the File Operation Execute feature is called.	1.00 Guru
Open	*Open*	*Select the Open operation – executed by FileOperationExecute.*	
Close	*Close*	*Select the Close operation – executed by FileOperationExecute*	
Read	*Read*	*Select the Read operation – executed by FileOperationExecute.*	
Write	*Write*	*Select the Write operation – executed by FileOperationExecute.*	
Delete	*Delete*	*Select the Delete operation – executed by FileOperationExecute.*	
File Operation Execute	FileOperationExecute	Executes the operation selected by File Operation Selector on the selected file.	1.00 Guru
File Open Mode	FileOpenMode	Selects the access mode used to open a file on the device.	1.00 Guru
Read	*Read*	*Select READ only open mode*	
Write	*Write*	*Select WRITE only open mode*	

File Access Buffer	FileAccessBuffer	Defines the intermediate access buffer that allows the exchange of data between the device file storage and the application.	1.00 Guru
File Access Offset	FileAccessOffset	Controls the mapping offset between the device file storage and the file access buffer.	1.00 Guru
File Access Length	FileAccessLength	Controls the mapping length between the device file storage and the file access buffer.	1.00 Guru
File Operation Status	FileOperationStatus	Displays the file operation execution status.	1.00 Guru
Success	*Success*	*The last file operation has completed successfully.*	
Failure	*Failure*	*The last file operation has completed unsuccessfully for an unknown reason.*	
File Unavailable	*FileUnavailable*	*The last file operation has completed unsuccessfully because the file is currently unavailable.*	
File Invalid	*FileInvalid*	*The last file operation has completed unsuccessfully because the selected file in not present in this device model.*	
File Operation Result	FileOperationResult	Displays the file operation result. For Read or Write operations, the number of successfully read/written bytes is returned.	1.00 Guru
File Size	FileSize	Represents the size of the selected file in bytes.	1.00 Guru
Device User Buffer	deviceUserBuffer	Unallocated memory available to the user for data storage.	1.00 DFNC Invisible
FTP File Access	ftpFileAccessSupported	Shows whether File Access is supported over FTP.	1.00 DFNC Invisible
User Defined Saved Image Max Size	userDefinedSavedImageMaxSize	Maximum size of the user Defined Saved Image.	1.00 DFNC Invisible
Save Last Image to Flash	saveLastImageToFlash	Command that saves the last acquired image to device flash memory. Use the file transfer feature to read the image from device. Maximum image size is 1024x768 pixels in the Z-Trak's model maximum pixel (monochrome).	1.00 DFNC Invisible

Updating Firmware via File Access in Z-Expert

- Click on the “Setting…” button to show the file selection menu.

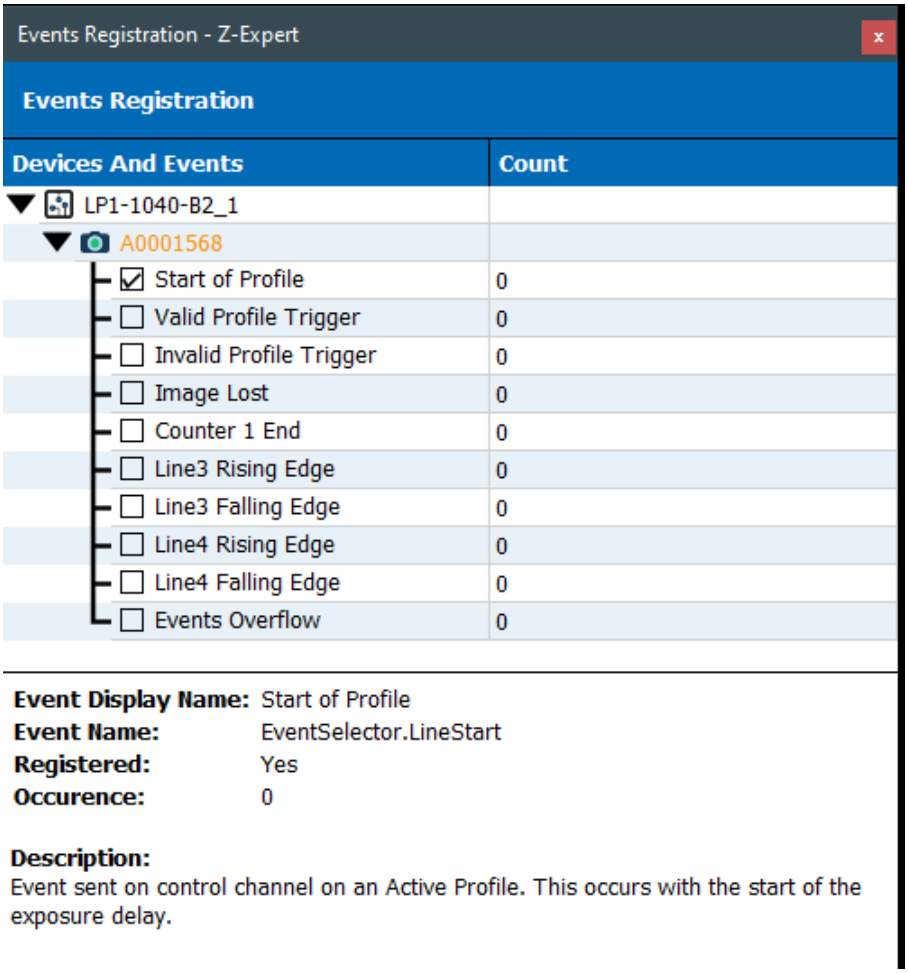


- Click the **Firmware Upload** button.
- From the Windows file dialog, select the new profiler firmware to upload and click OK.
- Reset Z-Trak when prompted after the file transfer completes.

Event Registration Dialog

Z-Expert provides a dialog to easily monitor common events in real time.

- From the Z-Expert menu bar, click **View** and select **Events Registration** to open the monitor selection menu.



- Select the event or multiple events to monitor during Z-Trak operation. In the example shown above the 'Start of Profile' event is selected.
- Drag the event window to the side of the Z-Expert window or to a second video monitor to observe the event count updates in real time.
- Note that the event count will continue even if the window is closed but the event itself remains selected.

Troubleshooting

Overview

In rare cases an installation may fail or there are problems in controlling and using the profiler. The Sapera GigE Server status provides visual information on possible problems. The three states are shown in the following table.

	Device Not Available	Device IP Error	Device Available
GigE Server Tray Icon:			
Note: It will take a few seconds for the GigE Server to refresh its state after any change.	A red X will remain over the GigE server tray icon when the device is not found. This indicates a network issue where there is no communication, ***or in the simplest case***, the Z-Trak is not connected.	The GigE server tray icon shows a warning when a device is connected but there is some type of network or IP error.	This GigE server tray icon indicates that the device is found. The Z-Trak has obtained an IP address and there are no network issues.

Important:
10/100 Mb Ethernet is not supported by the Z-Trak series of profilers. The Status LED will show that it acquired an IP address (solid Blue) but the Z-Trak will not function at these slower connections.

Possible Problem Types

Z-Trak problems are either installation types where the device is not found on the network or setup errors where the device is found but not controllable. The following information will help in determining the issue.

 **Device Not Available**

A red X over the GigE server tray icon indicates that the device is not found. This indicates either a major device fault, a condition such as disconnected power, or a network issue where there is no communication.

- Review section Network and Computer Overview to verify the installation steps.
- Refer to the **Teledyne DALSA Network Imaging** manual and **Network Optimization Guide** to review networking details. These documents are supplied with Sapera LT.
- In multiple NIC systems where the NIC for the Z-Trak is using LLA mode, ensure that no other NIC is in LLA mode. Preferably use the Teledyne DALSA DHCP server provided with Sapera LT. Enabled the server on the NIC used with Z-Trak.
- Verify that your NIC is running the latest driver available from the manufacturer.

 **Device IP Error**

The GigE server tray icon shows a warning with IP errors. Review the following topics on network IP problems to identify and correct the condition.

Please refer to the Teledyne DALSA Network Imaging Package manual for information on the Teledyne DALSA **Network Configuration tool** and network optimization for GigE Vision devices.

Multiple Profiler Issues

- When using multiple profilers with a computer with multiple NIC ports, confirm each device has been assigned an IP address by checking the GigE server.
- When using multiple profilers connected to a VLAN Ethernet switch, confirm that all cameras are on the same subnet setup on that switch. See the Teledyne DALSA Network Imaging package manual for more information.
- Verify that your NIC is running the latest driver available from the manufacturer.

Before Contacting Technical Support

review this Troubleshooting section. To aid Teledyne DALSA personnel when support is required, the following should be included with the request for support.

- From the Start menu, go to **Start • Teledyne Dalsa Sapera LT** and run the **Sapera Log Viewer** program. From its File menu click on **Save Messages** to generate a log text file.
- Report the version of Z-Trak driver and Sapera LT version used (must be version 8.60 or later).

Firmware Updates

As a general rule any Z-Trak installation must include the firmware update procedure (see Updating Firmware via File Access in Z-Expert).

Power Failure during a Firmware Update–Now What?

Don’t panic! There is far greater chance that the host computer OS is damaged during a power failure than any permanent problems with the Z-Trak. When electrical power returns and the host computer system has rebooted, follow this procedure.

- Connect power to the profiler. The profiler knows that the firmware update failed.
- The profiler boots with the previous version of firmware and will operate normally.
- The Self Status feature (deviceBISTStatus) will return that the last firmware update failed.
- Perform the firmware update procedure again.

Revision History

Revision	Date	Major Change Description
R:001	March 4, 2019	Initial Manual Release
R:002	May 30, 2019	Feature updates based on firmware release V1.01
R:003	October 28, 2019	Revisions and addition to the feature set
R:004	October 30, 2019	Additional revision to I/O signal descriptions
R:005	October 19, 2020	Revisions and reference additions plus the new Z-Expert tool

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Submit any support question or request via our web site:

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