Polytec

Process automation with EtherNet/IP

Length and speed gauges with enhanced connectivity

Application note

Sensors and acutators in automated, PLC-controlled processes

The use of sensors and actuators in a complex, automated, PLC-controlled environment makes it necessary and easier for the automation engineer if the devices are equipped with fieldbus interfaces such as PROFINET or EtherNet/IP. With just a few clicks fieldbus interfaces enable easy integration of actuators and sensors to production control systems.

Polytec has offered gateways for PROFIBUS, PROFINET and EtherNet/IP for many years. With PROFINET and EtherNet/IP now integrated into the LSV sensor head, the interface allows not only the cyclic measurement data acquisition in real time, but also the acyclic writing of parameters and control of the laser.

This application note describes the exemplary integration of a ProSpeed® LSV-2100 sensor featuring an Ethernet/IP interface into an Allen-Bradley CompactLogix 5380 controller and the configuration software type Studio 5000 LogixDesigner 32.

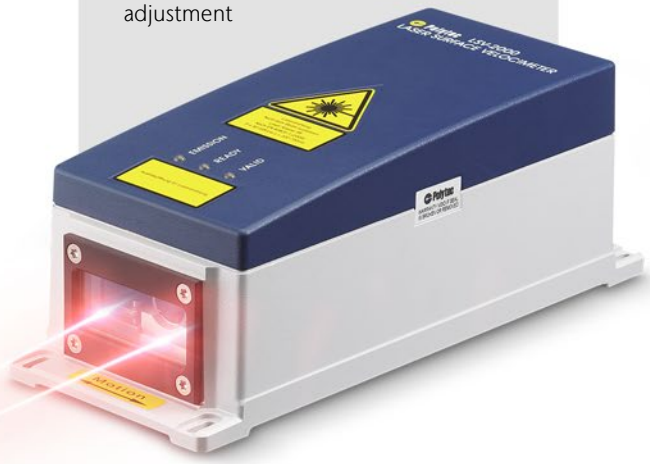
ProSpeed® LSV sensors
Control production processes anywhere, anytime

In the production of continuous material and piece goods, the exact knowledge of length as well as speed is an important factor for cost and process optimization. LSV Laser Surface Velocimeters from Polytec enable highly accurate process control in manufacturing through precise and reliable optical measurement of these metrics. Applications include cut to length control, length verification of pre-cut pieces, determination of total roll length as well as speed measurement for positioning or integration with defect detection systems.

The ProSpeed® sensors are unique with their high measurement depth of field regardless of the working distance. The extended connectivity of this sensor generation offers transparency - accessible anywhere and anytime: with touch display, parameter setup via web interface, as well as multi-user access for up to four users simultaneously via Ethernet and serial interface. The ProSpeed® LSV-2100 offers standstill and direction detection and measures reliably even in harsh environments with working distances of up to 3 m. For extreme environments, the uncompromising thermo-protective housing (TPH) provides additional robustness.

Highlights

- Non-contact, laser precise length & speed measurement
- Simple process integration with flexible interface concept
- Robust sensor technology (IP 66 and IP 67) for harsh and hot enviroments with tested impact and vibration restistance
- High flexibility with up to 3 m working distances
- Visible laser for easy on-site adjustment



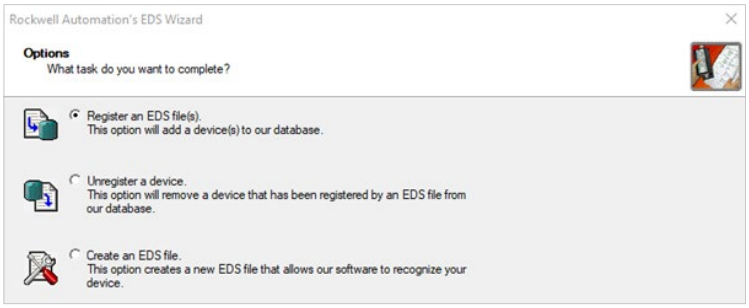
A Cyclic data exchange:

Integrating the ProSpeed® LSV sensor with Ethernet/IP

The scope of delivery of the ProSpeed® LSV-2100 Laser Surface Velocimeter includes an EDS file, which can be registered in the project in LogixDesigner using the Hardware Installation Tool.

1

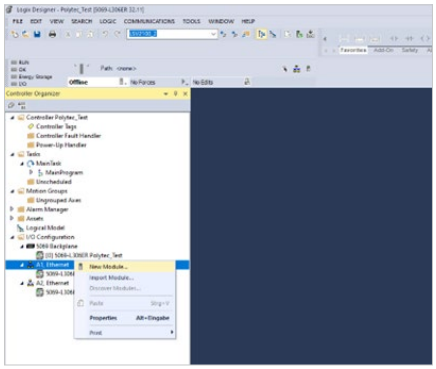
Registration wizard for EDS file



After registering the EDS file, which is included in the software package of the included in the scope of delivery, the the LSV-2100 can be imported as an Ethernet can be imported. Use the right mouse button on the corresponding Ethernet interface of the controller, a new module is created.

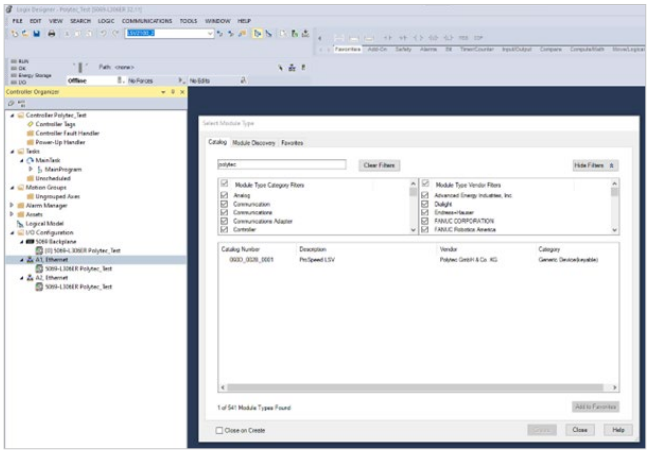
2

Creation of a new hardware module of type LSV-2100



3

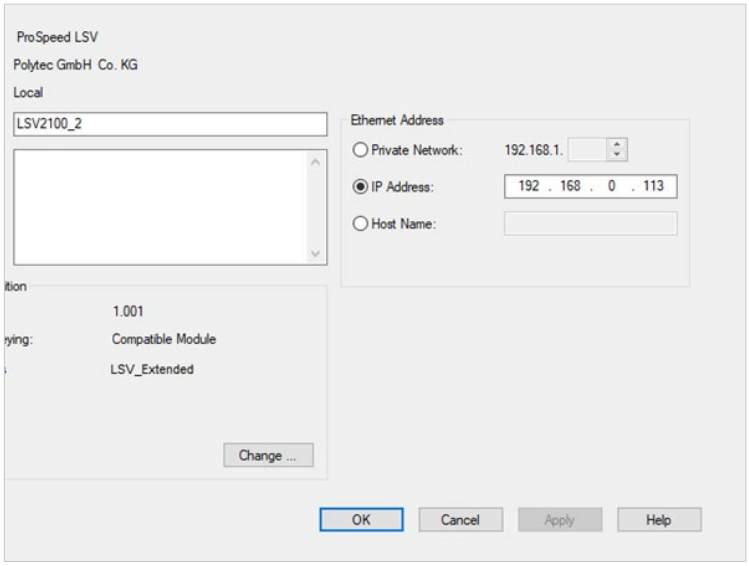
Selecting the sensor in hardware catalogue



By entering 'Polytec' in the search bar of the hardware catalogue, the LSV-2100 appears for selection.

4

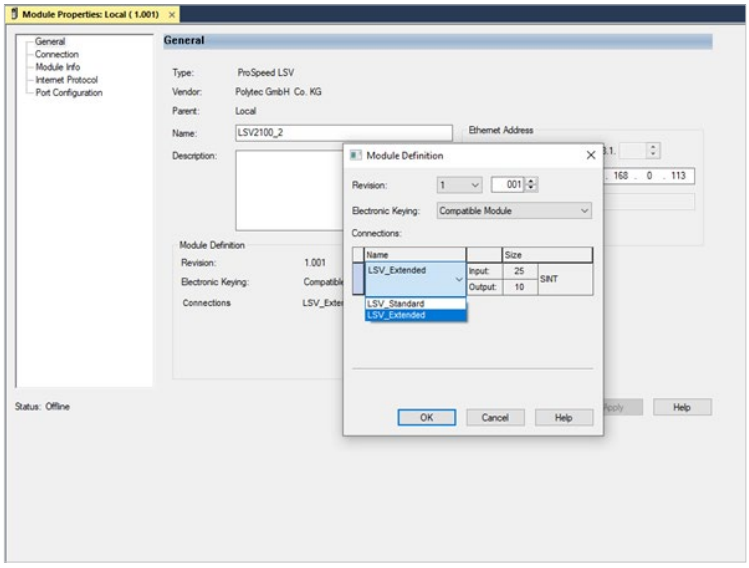
IP address of optical sensor ProSpeed® LSV-2100



In the properties dialogue of the newly created Ethernet device, you can assign either the standard or extended module in addition to the IP address of the LSV. The standard module includes all measurement data and status bits that the LSV cyclically makes available to the fieldbus and that are read out by the control system. The extended module also contains control bits and parameterization words for laser control and length specifications for the cut mode.

5

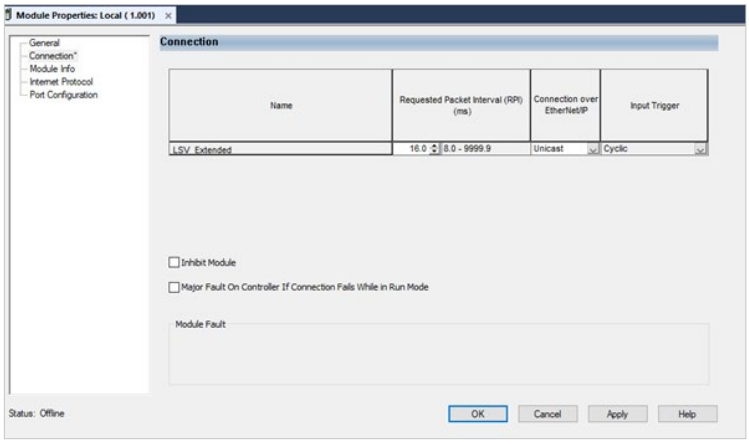
Properties of the ProSpeed® LSV-2100 in the engineering software



The cycle time can be set from 8ms to 512ms in 2^n steps:

6

Setting the cycle time



7
Tag table standard module inputs

Name	Value	Force Mask	Style	Data Type	Description
LSV2100_2:I.Data	{...}	{...}	Decimal	SINT[25]	
LSV2100_2:I.Data[0]	0		Decimal	SINT	Statusbyte
LSV2100_2:I.Data[0].0	0		Decimal	BOOL	TimingError
LSV2100_2:I.Data[0].1	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[0].2	0		Decimal	BOOL	LengthMeasurementRunning
LSV2100_2:I.Data[0].3	0		Decimal	BOOL	LengthMeasurementFinished
LSV2100_2:I.Data[0].4	0		Decimal	BOOL	Valid
LSV2100_2:I.Data[0].5	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[0].6	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[0].7	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[1]	0		Decimal	SINT	Statusbyte
LSV2100_2:I.Data[1].0	0		Decimal	BOOL	LaserOff
LSV2100_2:I.Data[1].1	0		Decimal	BOOL	ShutterClosed
LSV2100_2:I.Data[1].2	0		Decimal	BOOL	TemperatureWarning45°
LSV2100_2:I.Data[1].3	0		Decimal	BOOL	TemperatureError50
LSV2100_2:I.Data[1].4	0		Decimal	BOOL	LaserTempOutOfRange
LSV2100_2:I.Data[1].5	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[1].6	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[1].7	0		Decimal	BOOL	Reserved
LSV2100_2:I.Data[2]	0		Decimal	SINT	WriteNotAllowed
LSV2100_2:I.Data[3]	0		Decimal	SINT	Velocity
LSV2100_2:I.Data[4]	0		Decimal	SINT	Velocity
LSV2100_2:I.Data[5]	0		Decimal	SINT	Velocity
LSV2100_2:I.Data[6]	0		Decimal	SINT	Velocity
LSV2100_2:I.Data[7]	0		Decimal	SINT	Length
LSV2100_2:I.Data[8]	0		Decimal	SINT	Length
LSV2100_2:I.Data[9]	0		Decimal	SINT	Length
LSV2100_2:I.Data[10]	0		Decimal	SINT	Length
LSV2100_2:I.Data[11]	0		Decimal	SINT	LengthFinishedCounter
LSV2100_2:I.Data[12]	0		Decimal	SINT	LengthFinishedCounter
LSV2100_2:I.Data[13]	0		Decimal	SINT	SINAD
LSV2100_2:I.Data[14]	0		Decimal	SINT	SINAD
LSV2100_2:I.Data[15]	0		Decimal	SINT	SINAD
LSV2100_2:I.Data[16]	0		Decimal	SINT	SINAD
LSV2100_2:I.Data[17]	0		Decimal	SINT	DataRate
LSV2100_2:I.Data[18]	0		Decimal	SINT	DataRate
LSV2100_2:I.Data[19]	0		Decimal	SINT	SignalQuality
LSV2100_2:I.Data[20]	0		Decimal	SINT	Temperature
LSV2100_2:I.Data[21]	0		Decimal	SINT	LastLength
LSV2100_2:I.Data[22]	0		Decimal	SINT	LastLength
LSV2100_2:I.Data[23]	0		Decimal	SINT	LastLength
LSV2100_2:I.Data[24]	0		Decimal	SINT	LastLength

The sequence of the data and the individual data types are automatically added in a variable table (controller tag table) as shown below after the LSV is created in the I/O configuration. For better allocation, it is recommended to fill in the column with the respective descriptions.

Extended module

In addition to the standard module, the extended module can be used to make full use of the new field bus interface and control the LSV cyclically with specific data.

8

Tag table extended module outputs

◢ LSV2100_2:O	{...}	{...}		_060D:002B_0001_138...	
◢ LSV2100_2:O.Data	{...}	{...}	Decimal	SINT[10]	
◢ LSV2100_2:O.Data[0]	0		Decimal	SINT	SensorControl
LSV2100_2:O.Data[0].0	0		Decimal	BOOL	ActivateLaser
LSV2100_2:O.Data[0].1	0		Decimal	BOOL	OpenShutter
LSV2100_2:O.Data[0].2	0		Decimal	BOOL	EnableAutoShutdown
LSV2100_2:O.Data[0].3	0		Decimal	BOOL	EnableAutoRestart
LSV2100_2:O.Data[0].4	0		Decimal	BOOL	Reserved
LSV2100_2:O.Data[0].5	0		Decimal	BOOL	Reserved
LSV2100_2:O.Data[0].6	0		Decimal	BOOL	Reserved
LSV2100_2:O.Data[0].7	0		Decimal	BOOL	LockParameterWrite
▶ LSV2100_2:O.Data[1]	0		Decimal	SINT	StartLengthMeasurement
▶ LSV2100_2:O.Data[2]	0		Decimal	SINT	CutLength
▶ LSV2100_2:O.Data[3]	0		Decimal	SINT	CutLength
▶ LSV2100_2:O.Data[4]	0		Decimal	SINT	CutLength
▶ LSV2100_2:O.Data[5]	0		Decimal	SINT	CutLength
▶ LSV2100_2:O.Data[6]	0		Decimal	SINT	NotifyLength
▶ LSV2100_2:O.Data[7]	0		Decimal	SINT	NotifyLength
▶ LSV2100_2:O.Data[8]	0		Decimal	SINT	NotifyLength
▶ LSV2100_2:O.Data[9]	0		Decimal	SINT	NotifyLength

Output addresses of the control unit are read cyclically by the LSV sensor; value changes in the current cycle are adopted by the LSV.

9

Copy the cyclic data into target format

The individual measurement data records, which are available as 1-byte single integer, must be compiled into the respective data formats of the measured variable. For example, 4 single integers of the Velocity data set are combined into a 4-byte REAL format and stored as new variable table (Local Tag Table).

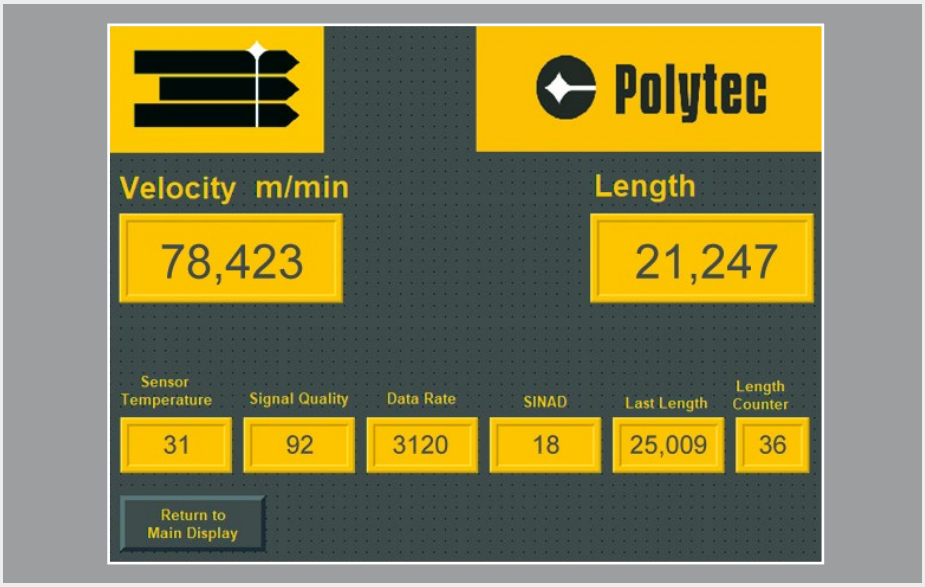
10

Excerpt of the tag table

Program Parameters and Local Tags - MainProgram | MainProgram - Cyclic_Measurem

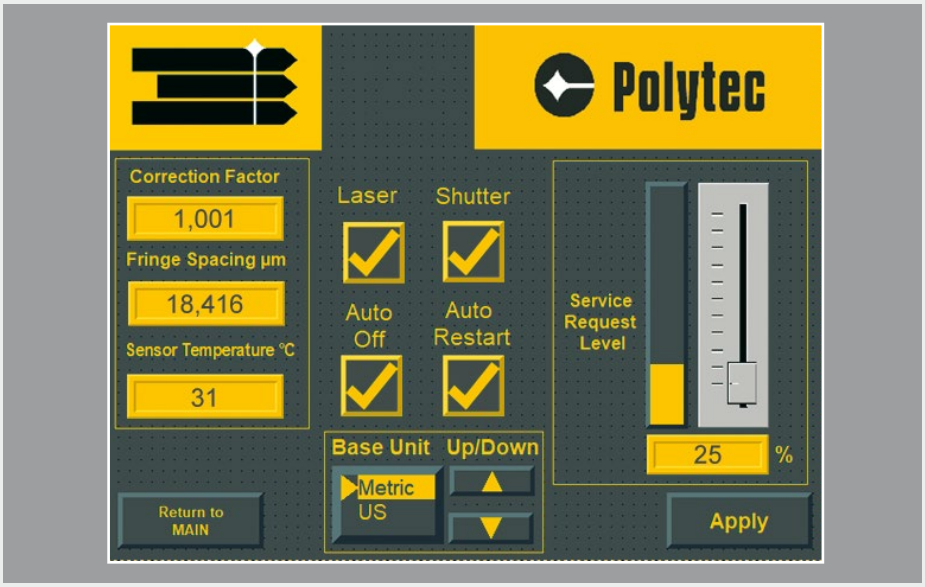
Scope: MainProgram | Show: All Tags

Name	Usage	Ali	Bas	Data Type
_DataRate	Local			INT
_LastLength	Local			REAL
_LENGTH	Local			REAL
_SensorTemperature	Local			SINT
_SignalQuality	Local			SINT
_SINAD	Local			REAL
_VELOCITY	Local			REAL



11
Display of measurement valus of the HMI

The cyclic measurement data of the inputs can thus be linked via the variable table and displayed on an HMI (human machine interface), for example.



12
Sensor parametrization via HMI

This also allows direct access to cyclic control data, such as laser or shutter control, via a Human Machine Interface (HMI).

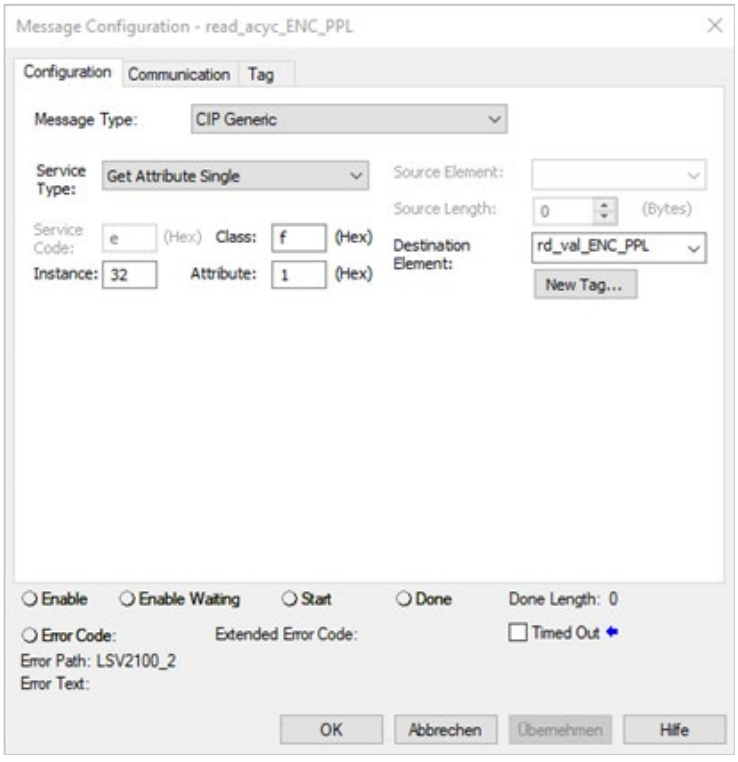
B Acyclic data exchange:

Read and write parameters of the ProSpeed® LSV

Acyclic process data is processed in parallel and in addition to cyclic process data transmission. The acyclic process data is not normally used continuously, but upon request. They are used for parameterizing the ProSpeed® LSV sensor or for querying parameters. In addition to the obligatory CIP classes, the ProSpeed® LSV sensor supports the parameter object class. Individual instances of this class correspond to individual parameters of the ProSpeed® LSV.

The CIP class "Parameter" (0x0F) contains a selection of commonly required configuration parameters for the ProSpeed® LSV series. Each instance corresponds to its own parameter. The parameter value can be queried or written using a message block.
The following configuration of the message module is required to query a parameter:

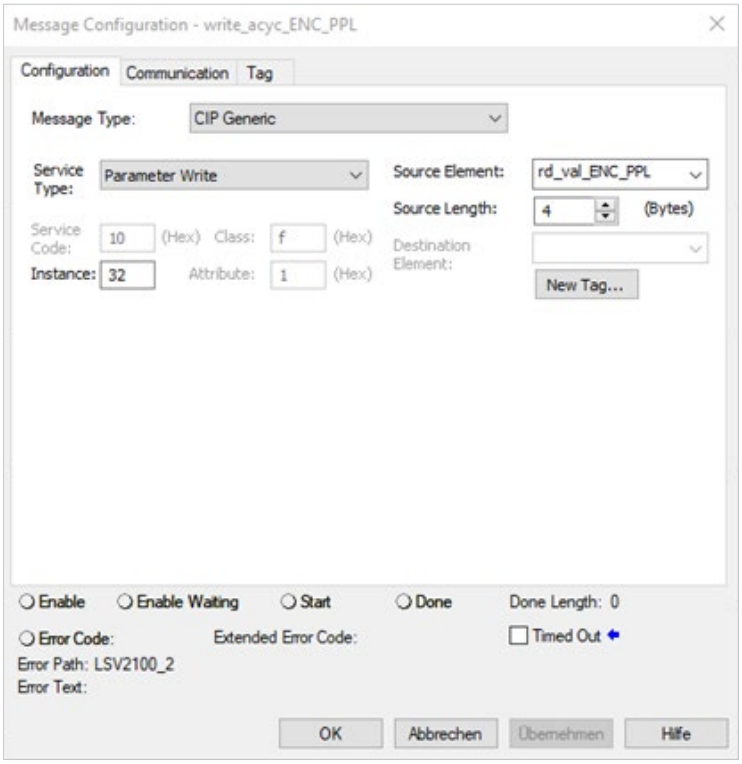
Service Type: Get Attribute Single
Class: 0x0F
Attribute: 0x01
Instance: 0x01 – 0x25 (HEX) resp. 1-37 (DEZ)



13
Configuration of the message instruction: Read parameter

The following configuration requires writing the parameters as follow:

Service Type: Parameter Write
Source length: Number of Bytes
Class: 0x0F
Attribute: 0x01
Instance: 0x01 – 0x24 (HEX) resp. 1-36 (DEZ)

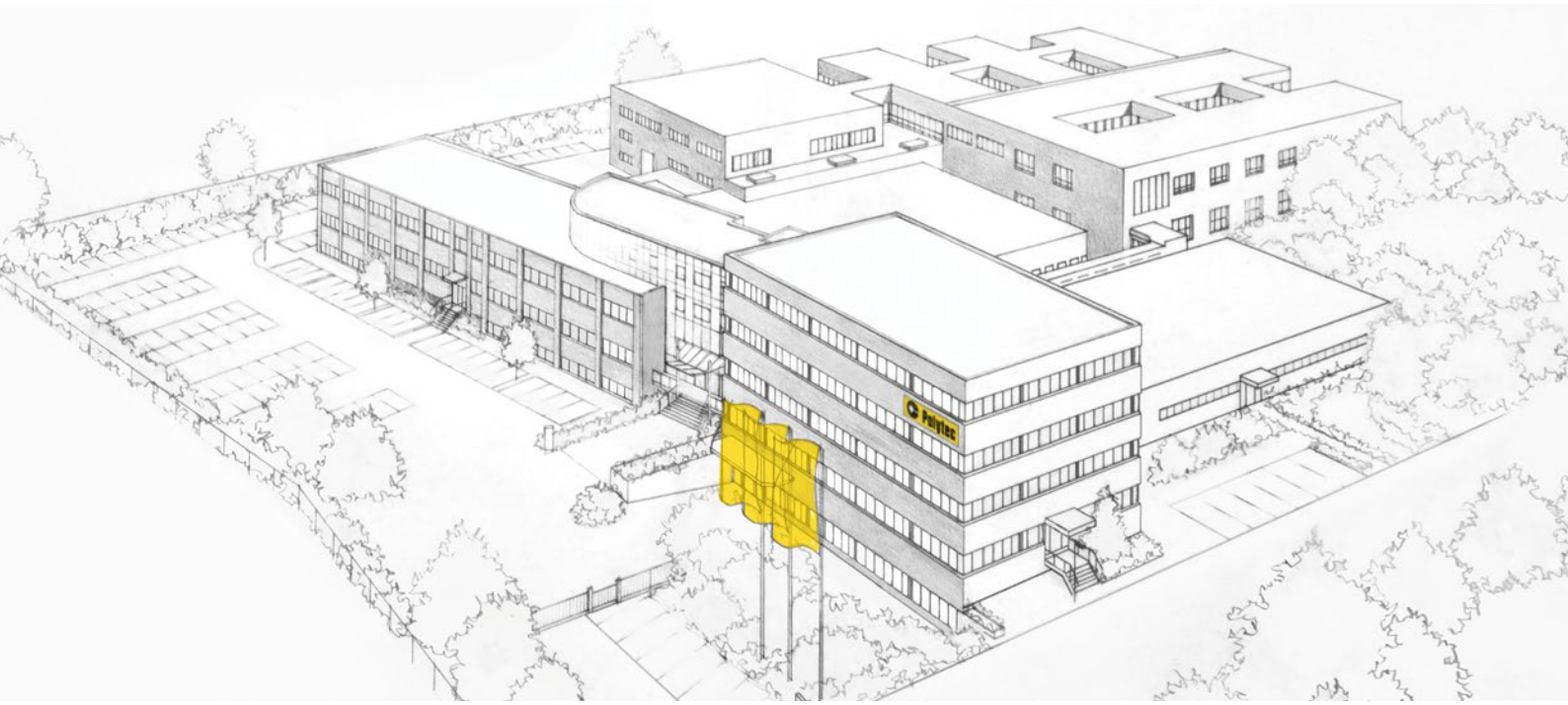


14
Configuration of the message instruction: Write parameter

The assignment of the instance numbers to the respective LSV parameters is shown in table 15.

15 Assignment of instances for sensor parameters

Parameter no.	Parameter/ command	Read/ write	Data type	Description
0x01	UNIT:BASE	rw	INT	Standard units for length and speed values
0x02	ACQ:ENZERO	rw	INT	Setting a zero zone
0x03	ACQ:VMIN	rw	FLOAT	Sets the minimum speed for the zero zone
0x04	ACQ:AVG	rw	INT	Number of samples N for the main filter to be averaged
0x05	ACQ:RANGE	rw	INT	Sets the measuring range M, R for the speed measurement
0x06	ACQ:HOLDV	rw	INT	Sets the speed for invalid measured values
0x07	LEN:TRIGSRC	rw	INT	Selecting the trigger source for length measurement
0x08	LEN:OFFS	rw	FLOAT	Offset length for length measurement
0x09	LEN:INT	rw	INT	Order of interpolation for length measurement
0x0A	LEN:SYNC	rw	INT	Sets the "Activate outputs with trigger" function
0x0B	LEN:TRACK	rw	INT	Sets the delay time in ms
0x0C	LEN:HOLD	rw	INT	Sets the delay time in ms
0x0D	MAT:LEVEL	rw	INT	Sets the comparator threshold
0x0E	MAT:POL	rw	INT	Sets the polarity of the trigger signals
0x0F	MAT:HOLD	rw	INT	Sets the hold time in ms
0x10	EXTTRIG:ARM	rw	INT	Trigger behavior of the LSV
0x11	EXTTRIG:LOGIC	rw	INT	Sets the logical link between the two trigger signals
0x12	EXTTRIG:MODE	rw	INT	Sets the trigger mode
0x13	EXTTRIG:POL1	rw	INT	Sets the trigger polarity at trigger input 1
0x14	EXTTRIG:POL2	rw	INT	Sets the trigger polarity at trigger input 2
0x15	CUT:LEN	rw	FLOAT	Length at which the material is to be cut (Cut Length)
0x16	CUT:NOTIFY	rw	FLOAT	Länge, bei der ein Vorwarnsignal gesetzt werden soll (Notify Length)
0x17	CUT:SIGNAL	rw	INT	Parameters of the output signal
0x18	CUT:DELAY1	rw	INT	Pulse width 1
0x19	CUT:DELAY2	rw	INT	Pulse width 2
0x1A	CAL:DELTA	r	FLOAT	Fringe spacing (read only)
0x1B	CAL:CORR	rw	FLOAT	Correction factor
0x1C	CAL:TCOEF	r	FLOAT	Temperature coefficient (read only)
0x1D	SENS:TEMP	r		Current temperature of the sensor with a resolution of 0.01°C
0x1E	SENS:QMIN	rw	INT	Threshold in % for service request function
0x1F	ENC:ENA	rw	INT	Enable encoder interface
0x20	ENC:PPL	rw	FLOAT	Number of pulses per length
0x21	ENC:VMAX	rw	FLOAT	Maximum speed
0x22	ID	r	STRING	Device identification
0x23	SN	r	STRING	Serial number of the device
0x24	LOCK:ENA	rw	INT	Locking function of the ProSpeed® LSV



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