Interface description

Fieldbus interfaces of the CPX

CPX V3, CPX V4 and CPX V20

TRUMPF

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CPX V3, CPX V4 and CPX V20

Edition **2024-03**

Order Information

Please specify when ordering this document:

Interface description

Fieldbus interfaces of the CPX

Edition 2024-03
Document number 18-22-91-A1-BAen

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Good to know

This interface description informs you about:

- which fieldbus interfaces are available for laser control via the central processor CPX version 3, CPX version 4 and CPX version 20.
- the features of the fieldbus interfaces.
- the way the fieldbus interfaces are configured and used.
- the way a laser device is controlled via fieldbus interfaces.

Target group This interface description is intended for system integrators and system administrators who are entrusted with integrating a laser device into a system environment.

Supplementary documents

Document		Doc. No.
Technical information	TRUMPF LaserNetwork (TLN and TLN-fc)	21-01-38-CP
	PFP Control and PierceLine	21-A0-61-CP
	Energy Save Concept	21-A0-71-CP
	TruControl 1000 for new users	21-A0-57-CP
Software manual	TruControl 1000	10-06-80-A1-CR
	TruControl 1000 for PFO 14, PFO 20, PFO 33, PFO 33 (KF023), PFO 3D, PFO 3D-2 PO, SFO	12-12-14-A2-CR
	VisionLine OCT Check online in HTML format on MyTRUMPF (www.trumpf.com/mytrumpf)	83-01-07-A0-CR
Operator's manual	VisionLine	22-50-12-A0-CR
	SeamLine Remote (SE18)	83-01-04-A0-CR
	Programmable motor-driven focusing (PMF)	22-50-01-A369-CR
	Rotary module for shield gas guidance	22-50-01-A419-CR
Interface description	Interfaces of the laser devices with CPX V3	20-06-01-A3-BA
	Interfaces of the laser devices with CPX V4	18-23-03-A1-BA
	Interfaces of the TruMicro laser devices with CPX V20	20-20-01-A1-BA
	OPC UA for CPX	09-14-11-A6-BA
	VisionLine Interface – TruControl 1000 Ethernet interface for image processing	12-12-40-A4-BA

Tab. 1

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1. Introduction

1.1 Functions of a fieldbus interface

By using a fieldbus interface and an external control (e.g. PLC), the user can:

- request the laser device.
- switching on and off.
- Select the laser program.
- define the light path and laser parameters during the runtime of a laser program.
- start and end a selected laser program.
- synchronize the sequence of a laser program to external events.
- synchronize the external sequences to the sequence of a laser program.
- evaluate important status signals of the laser device.
- switch the laser off in case of an external fault.
- acknowledge monitoring messages of the laser device.
- re-initialize of the control unit of the laser device after a fault.
- switch the pilot laser (if available) on and off.

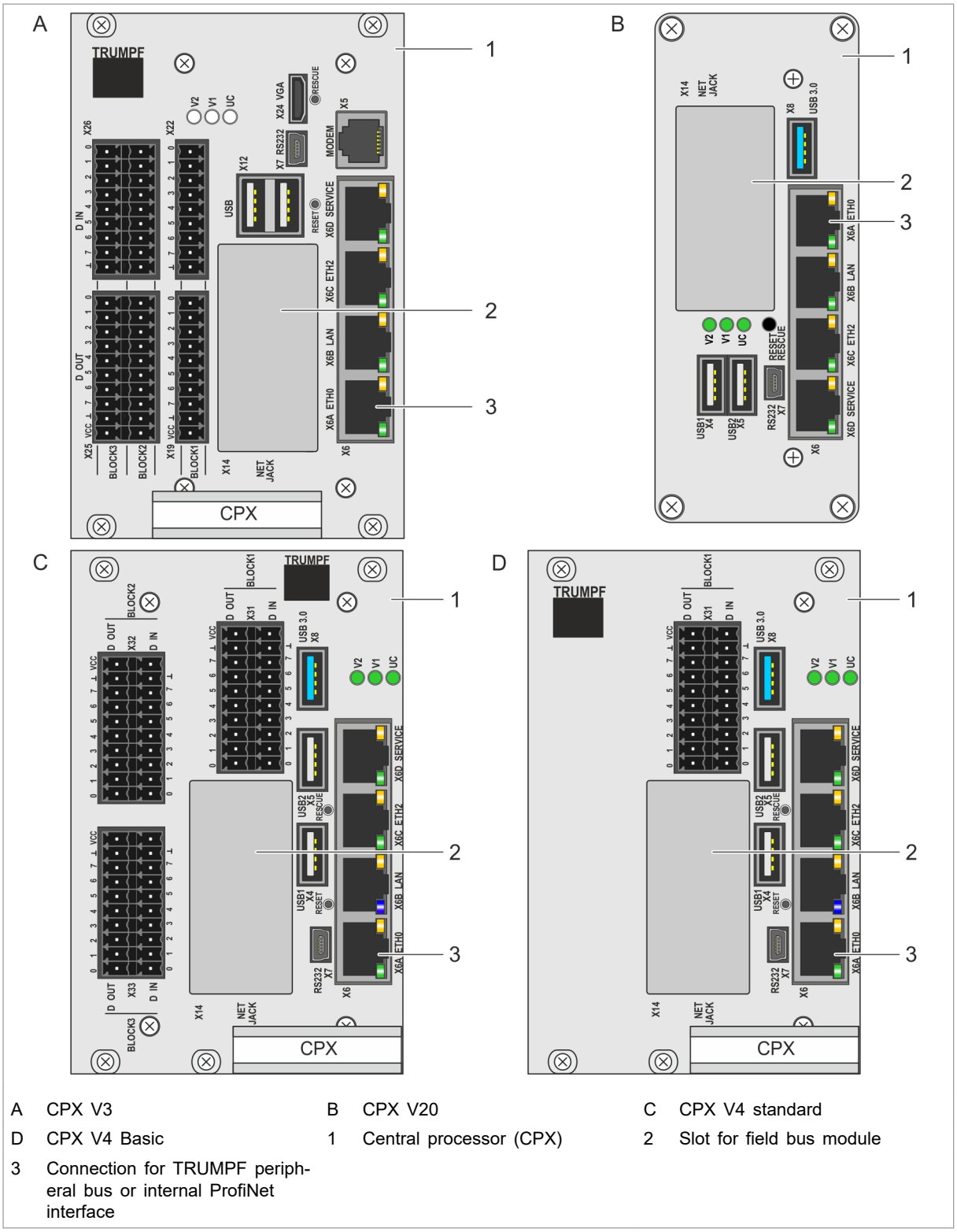
1.2 Fieldbus interfaces in the laser device



Fieldbus module for CPX V3, V4 and V20, example ProfiNet Fig. TE-02331

TRUMPF laser devices can be controlled by the external control units (e.g. PLC) of a processing station) via optional fieldbus modules. A fieldbus module can be plugged directly into the central processor (CPX). Alternatively, an internal ProfiNet interface can be used.
The figure below shows the following:

- The slot for a fieldbus module in the central processor.
- The connection for the TRUMPF peripheral bus.
- The internal ProfiNet interface.



A CPX V3
B CPX V20
C CPX V4 standard
D CPX V4 Basic
1 Central processor (CPX)
2 Slot for field bus module
3 Connection for TRUMPF peripheral bus or internal ProfiNet interface

Front plate of the central processor CPX V3, V20, V4 Standard and V4 Basic Fig. 142471

The fieldbus module can be plugged into the recess in the front panel of the central processor. The fieldbus module is fastened to the recesses on the pcb of the central processor by means of retaining springs. The electrical contacts for power supply and signals are established on the fieldbus module via contact springs and on the pcb of the central processor via contact surfaces.

The following interfaces are available as fieldbus modules:

▪ Profibus DP slave	▪ ProfiNet IO Device (Slave)
▪ DeviceNet slave	▪ EtherCAT (slave)
▪ POWERLINK Controlled Node	▪ Ethernet/IP adapter (slave)

Tab. 2

Alternatively, an internal ProfiNet interface (option) is available.

Notes

- The "Internal ProfiNet interface" option can be activated with an activation code.
- The options "Internal ProfiNet interface" and "TRUMPF peripheral bus" cannot be used together because only one network interface for these two options is available: X6A ETH0.
- Further optional fieldbus interfaces can be connected to the laser control unit via "TRUMPF Peripheral Bus" interface. Further information: Interface description "TRUMPF Peripheral Bus", Doc.-No. 18-22-12-A1-BA.
- If the laser device is used in a fieldbus-coded TRUMPF LaserNetwork (TLN-fc), the external controls are connected to the laser control unit via TRUMPF Peripheral Bus. Further information: Technical information "TRUMPF LaserNetwork (TLN and TLN-fc)", Doc.-No. 21-01-38-CP.

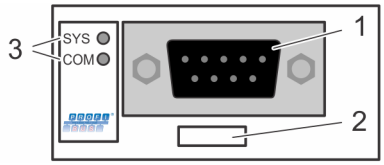
1.3 Order information

Designation	Material no.
Profibus DP slave NJ 100EN-DP/DPS	1720873
DeviceNet slave NJ 100EN-DN/DNS	1736397
POWERLINK Controlled Node (slave) NJ 100EN-RE/PLS	1758956
ProfiNet IO Device (slave) NJ 100EN-RE/PNS	1784844
EtherCAT (slave) NJ 100EN-RE/ECS	2706811
Ethernet/IP-Adapter (slave) NJ 100EN-RE/EIS	2706825

Order information for the fieldbus modules Tab. 3

2. Technical Data

2.1 Profibus DP slave



1 Sub-D socket, 9-pole 2 Unlocking lever 3 Status LEDs SYS, COM

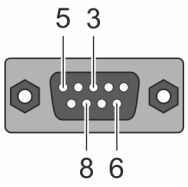
Profibus DP slave, front view Fig. TE-02332

LED status indicators

LED		Color	State	Status
	SYS	Yellow	Illuminated	Initialization, stage 1.
		Green/ yellow	flashing	Initialization, stage 2.
		Green	Illuminated	Firmware is started.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	COM	Green	Illuminated	RUN, cyclic communication.
		Red	Illuminated	Incorrect Profibus DP configuration.
			flashing	STOP no communication, connection error.
			Irregular flashing	The fieldbus module is not configured.

Status displays of the LEDs SYS and COM Tab. 4

Pin assignment of the connector

Pin no.		Direction[1)]	Signal	Comment
	3	|↔	PB+	Profibus input/output
	5		PB_GND[2)]	Profibus reference potential
	6		PB_+5V[2)]	Profibus +5 V voltage
	8	|↔	PB-	Profibus input/output inverted
	1, 2, 4, 7, 9		NC	Not assigned

1) Direction: |↔ = Input/Output
2) Terminal resistors can be connected (see "Terminating the Profibus", pg. 171).

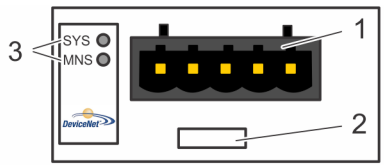
Pin assignment of the connector for Profibus DP slave Tab. 5

Technical Data

Bus system	Profibus DP (standard)
Variant	Slave
Transmission rate	9.6 kbit/s ... 12 mbit/s, Factory setting = 1.5 mbit/s. The transmission rate can be set in the operating software.
Interface	RS-485, electrically decoupled, Sub-D socket connector, 9-pin.
Profibus address	1 ... 127, Factory setting = 3. The Profibus address can be set in the operating software.
Max. input address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words. TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words.
Max. output address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words. TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words.
File length	TruControl 1000 Version < 1.84.0: 3 ... 16 words. TruControl 1000 Version ≥ 1.84.0: 3 ... 64 words. can be set in TruControl 1000. Factory setting = 4.
Status	2 status displays using LEDs.
Voltage supply	via the internal PCI-E bus
Current consumption	typically 560 mA at 3.3 V.
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm (without Sub-D socket).
Weight	approx. 0.68 N (68 g)
Module installation	without any tools.
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +70 °C (in operation)
Vibration / impact resistance	in accordance with EN 60068-2-6 / EN 60068-2-27.
Signal interference resistance	in accordance with EN 61131-2:2003.
Emission	in accordance with CISPR 11 (EN 55011), Class A.
Protection class / approval	IP 40/CE
GSD file	**GSD**: **G**eneral **S**tation **D**escription The GSD file contains an electronic data sheet with all necessary parameterization data. For the operation of this Profibus DP slave interface, the GSD file must be loaded to the system configuration of the Profibus system.
File name and storage location of the GSD file	Show directory in the Explorer: \\<IP address of the laser device>\public\profibus\CpxModule File name: CPX_0D83.GSD Example: \\172.29.3.1\public\profibus\CpxModule\CPX_0D83.GSD For more information on selecting the GSD file for your module, refer to the README.txt file (\\<IP address of laser device>\public\profibus\CpxModule\README.txt).
Order of the input and output words	*Note for the Profibus system programmer*: Note that, for this fieldbus module, the input words are configured first and the output words second.

Technical data of a Profibus DP slave Tab. 6

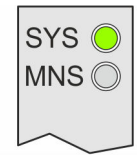
2.2 DeviceNet slave



1 COMBICON socket, 5-pin 2 Unlocking lever 3 Status LEDs SYS, MNS

DeviceNet slave, front view Fig. TE-02333

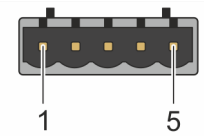
LED status indicators

LED		Color	State	Status
	SYS	Yellow	Illuminated	Initialization, stage 1.
		Green/ yellow	flashing	Initialization, stage 2.
		Green	Illuminated	Fieldbus module is ready for operation.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	MNS[1)]	Green	Illuminated	Fieldbus module is online and a connection has been established to the DeviceNet master.
			flashing	Fieldbus module is online and a connection has not been established to the DeviceNet master.
		Red	Illuminated	Fieldbus module has detected a network error, e.g. duplicate MAC-ID.
			flashing	Connection monitoring time has expired.
		Gray	not illuminated	After starting the device and during the check for duplicate MAC-ID.
		Green/red /gray	flashing	Self-test is active after voltage on. Green on 0.25 s, then red on 0.25 s, then off.

1) MNS: **M**odule and **N**etwork **S**tatus

Status displays of the LEDs SYS and MNS Tab. 7

Pin assignment of the connector

Pin no.		Direction[1)]	Signal	Comment
	1		V-	Reference potential of the +24 V supply
	2	|↔	DATA-[2)]	DeviceNet input/output, inverted
	3		DRAIN	Shield connection
	4	|↔	DATA+[2)]	DeviceNet input/output
	5	|←	V+	+24 V supply

1) Direction: |← = Input, |↔ = Input/Output
2) Terminal connectors can be connected (see "Completing DeviceNet", pg. 175).

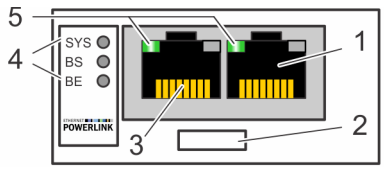
Pin assignment of the connector for a DeviceNet slave Tab. 8

Technical Data

Bus system	DeviceNet
Variant	Slave
Transmission rate	125 kbit/s, 250 kbit/s or 500 kbit/s, Factory setting = 500 kbit/s. The transmission rate can be set in the operating software.
Interface	ISO 11898, electrically decoupled, COMBICON socket, 5-pin. Connector is provided in delivery.
DeviceNet bus address	0 ... 63, Factory setting = 1. The DeviceNet address (MAC-ID) can be set in the operating software.
Max. input address range	TruControl 1000 Version < 1.88.0: 20 bytes/10 words. TruControl 1000 Version ≥ 1.88.0: 128 bytes/64 words.
Max. output address range	TruControl 1000 Version < 1.88.0: 20 bytes/10 words. TruControl 1000 Version ≥ 1.88.0: 128 bytes/64 words.
File length	TruControl 1000 Version < 1.88.0: 3 ... 10 words. TruControl 1000 Version ≥ 1.88.0: 3 ... 64 words. can be set in TruControl 1000. Factory setting = 4.
Status	2 status displays using LEDs.
Voltage supply	via the internal PCI-E bus
Current consumption	typically 590 mA at 3.3 V.
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm
Weight	approx. 0.54 N (54 g)
Module installation	without any tools
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +65 °C (in operation)
Vibration / impact resistance	in accordance with EN 60068-2-6 / EN 60068-2-27.
Signal interference resistance	in accordance with EN 61131-2:2003.
Emission	in accordance with CISPR 11 (EN 55011), Class A.
Protection class / approval	IP 40/CE
EDS file	**EDS**: **E**lectronic **D**ata **S**heet The EDS file contains an electronic data sheet with all necessary parameterization data. For the operation of this DeviceNet slave interface, the EDS file must be read in the system configuration of the DeviceNet bus system.
File name and storage location of the EDS file	Show directory in the Explorer: \\<IP address of the laser device>\public\devicenet\CpxModule File name: NETJACK_x_W.EDS x_W stands for the number of input and output words. Example of file name and storage location of an EDS file with 3 input and output words: \\172.29.3.1\public\devicenet\CpxModule\NETJACK_3_W.EDS. Further information: README.txt (\\<IP address of the laser device>\public\devicenet\CpxModule\README.txt).

Technical data of a DeviceNet slave — Tab. 9

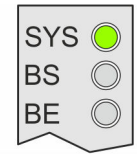
2.3 POWERLINK Controlled Node



1	RJ45 socket, channel 1	3	RJ45 socket, channel 0	5	Status LEDs Link/Activity (L/A)
2	Unlocking lever	4	Status LEDs SYS, BS, BE		

POWERLINK Controlled Node, front view Fig. TE-02306

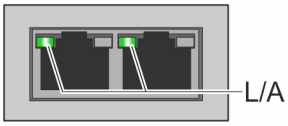
LED status indicators

LED		Color	State[1)]	Status
	SYS	Yellow	Illuminated	Device is initialized, stage 1.
		Green/ yellow	flashing	Device is initialized, stage 2.
		Green	Illuminated	Firmware is started.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	BS	Green	flashing	Device has status Stopped.
		Green	Illuminated	Device has status Operational.
			flashes 3x	Device has status ReadyToOperate.
			flashes 2x	Device has status Pre-Operational 2.
			flashes 1x	Device has status Pre-Operational 1.
			Flickering	Device is in Ethernet normal state.
		Gray	not illuminated	Device is being initialized.
	BE	Red	Illuminated	Device has detected an error.
		Gray	not illuminated	Device has no error.
1) The LED statuses are described in the following table.				

Status displays of the LEDs SYS, BS and BE Tab. 10

LED status	Description
flashing	The LED flashes at a frequency of 2.5 Hz.
Flickering	The LED flickers at a frequency of 10 Hz.
flashes 1x	The LED shows a brief flash (200 ms), followed by a long pause (1000 ms).
flashes 2x	The LED shows a sequence of two brief flashes (200 ms each, with a pause of 200 ms), followed by a long pause (1000 ms).
flashes 3x	The LED shows a sequence of three brief flashes (200 ms each, with pauses of 200 ms), followed by a long pause (1000 ms).

Description of the statuses for the LEDs SYS, BS, BE and Link/Activity (L/A) Tab. 11

LED		Color	State	Status
	L/A[1)]	Green	Flickering	Activity (A): Device sends/receives data.
		Green	Illuminated	Link (L): There is a connection to the Ethernet.
		Gray	not illuminated	Device has no connection to the Ethernet.
	1) One Link/Activity (L/A) LED per channel.			

Status displays of the LEDs Link/Activity (L/A) Tab. 12

Connector

Connector	RJ45
Cable	Category CAT5, length max. 100 m

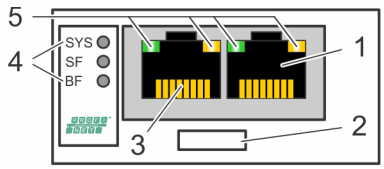
Connector and connection cable for POWERLINK Tab. 13

Technical Data

System	POWERLINK Controlled Node
Variant	Slave
Ethernet POWERLINK version	2
Interface	2 x RJ45 socket
Node ID	1 .. 239, Factory setting = 1 The POWERLINK address (node ID) can be set in the operating software.
Cyclic data	Max. 2980 bytes (1490 bytes input and output data each)
Acyclic data	SDO up-/download
Functions	SDO via ASND and UDP
Transmission rate	100 mbit/s, half duplex, 100 BASE TX.
Characteristics	Auto-negotiation, cross-over, no Slave-to-Slave communication.
Data transport layer	Ethernet II, IEEE 802.3
Max. input address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words
Max. output address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words
File length	TruControl 1000 Version < 1.84.0: 3 ... 16 words TruControl 1000 Version ≥ 1.84.0: 3 ... 64 words can be set in TruControl 1000. Factory setting = 4.
Status	5 status displays using LEDs.
Voltage supply	via the internal PCI-E bus
Current consumption	typically 746 mA at 3.3 V.
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm (without RJ45 sockets).
Weight	approx. 0.6 N (60 g)
Module installation	without any tools
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +65 °C (in operation)
Vibration / impact resistance	in accordance with EN 60068-2-6 / EN 60068-2-27.
Signal interference resistance	in accordance with EN 61131-2:2003.
Emission	in accordance with CISPR 11 (EN 55011), Class A.
Protection class / approval	IP 40/CE
XDD file	**XDD**: **X**ML **D**evice **D**escription The XDD file contains an electronic data sheet with all necessary parameterization data. For the operation of this POWERLINK interface, the XDD file must be loaded to the system configuration of the POWERLINK bus system.
File name and storage location of the XDD file	Show directory in the Explorer: \\<IP address of the laser device>\public\powerlink\CpxModule File name: 00000044_NJ_100XX_RE_PLS_TRUMPF.xdd Example: \\172.29.3.1\public\powerlink\CpxModule \00000044_NJ_100XX_RE_PLS_TRUMPF.xdd For more information on selecting the XDD file for your module, refer to the README.txt file (\\<IP address of the laser device>\public\powerlink \CpxModule\README.txt).

Technical data of a POWERLINK Controlled Node Tab. 14

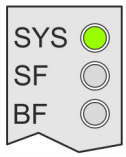
2.4 Profinet IO device (slave), fieldbus module



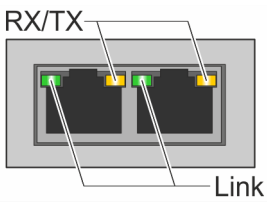
1	RJ45 socket, channel 1	3	RJ45 socket, channel 0	5	Status LEDs Link
2	Unlocking lever	4	Status LEDs SYS, SF, BF		and Receive/Transmit (RX/TX)

ProfiNet IO Device (Slave), front view Fig. TE-02328

LED status indicators

LED		Color	State	Status
	SYS	Yellow	Illuminated	Device is initialized, stage 1.
		Green/ yellow	flashing	Device is initialized, stage 2.
		Green	Illuminated	Firmware is started.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	SF	Red	Illuminated	▪ Watchdog Timeout. ▪ Channel-, generic or advanced diagnostics. ▪ System error.
			flashes at 2 Hz, for 3 s	DCP signal service is triggered via the bus.
		Gray	not illuminated	No error.
	BF	Red	Illuminated	Bus error: ▪ No configuration. ▪ Slow physical connection. ▪ No physical connection.
			flashes at 2 Hz	No data exchange.
		Gray	not illuminated	No error

Status displays of the LEDs SYS, SF and BF Tab. 15

LED		Color	State	Status
	Link[1)]	Green	Illuminated	There is a connection to the Ethernet.
		Gray	not illumi-nated	Device has no connection to the Ethernet.
	RX/TX[1)]	Yellow	flashing	Receive/Transmit Device is sending / receiving Ethernet frames.
	1) One LED per channel.			

Status displays of the LEDs Link and Receive/Transmit (RX/TX) Tab. 16

Connector

Connector	RJ 45 plug
Cable	Category CAT5, length max. 100 m

Connector and connection cable for ProfiNet IO Tab. 17

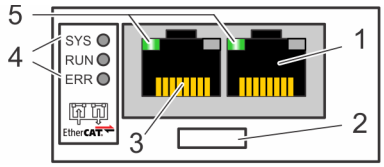
Technical Data

System	ProfiNet IO Device (Slave)
Firmware / stack version	V3.4.x.x
Interface	2 x RJ45 socket
Transmission rate	100 mbit/s
Data transport layer	Ethernet II, IEEE 802.3
Supported protocols	▪ PROFIenergy, if TruControl 1000 Version ≥ 2.00 ▪ RTC – Real Time Cyclic Protocol, Class 1 and 2 (unsynchronized), Class 3 (synchronized) ▪ RTA – Real Time Acyclic Protocol ▪ DCP – Discovery and configuration Protocol ▪ CL-RPC – Connectionless Remote Procedure Call ▪ LLDP – Link Layer Discovery Protocol ▪ SNMP – Simple Network Management Protocol
Protocols used (subset)	▪ UDP – User Datagram Protocol ▪ IP – Internet Protocol ▪ ARP – Address Resolution Protocol ▪ ICMP (Ping) – Internet Control Message Protocol
Minimum cycle time	1 ms for RTC1 und RTC2 250 µs for RTC3
Max. input address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words
Max. output address range	TruControl 1000 Version < 1.84.0: 32 bytes/16 words TruControl 1000 Version ≥ 1.84.0: 128 bytes/64 words
File length	TruControl 1000 Version < 1.84.0: 3 ... 16 words TruControl 1000 Version ≥ 1.84.0: 3 ... 64 words can be set in TruControl 1000. Factory setting = 4.
Status	5 status indicators using LEDs
Voltage supply	via the internal PCI-E bus
Current consumption	typically 746 mA at 3.3 V
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm (without RJ45 socket)
Weight	approx. 0.6 N (60 g)
Module installation	without any tools
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +65 °C (in operation)
Vibration / impact resistance	in accordance with EN 60068-2-6 / EN 60068-2-27
Signal interference resistance	in accordance with EN 61131-2:2003
Emission	in accordance with CISPR 11 (EN 55011), Class A

Protection class / approval	IP 40/CE
GSDML file	**GSDML**: **G**eneric **S**tation **D**escription **M**arkup **L**anguage The GSDML file contains an electronic data sheet with all necessary parameterization data. For the operation of this ProfiNet interface, the GSDML file must be read in the system configuration of the ProfiNet controllers.
Storage location of the GSDML file with example	Show directory in the Explorer: \\<IP address of the laser device>\public\profinet\CpxModule Example: \\172.29.3.1\public\profinet\CpxModule\GSDML-V2.2-TRUMPF-CPX_PNS-20130204.xml
Restrictions	The following devices are not supported: ▪ RT over UDP ▪ Multicast communication ▪ More than one instance per device ▪ Dynamic Host Configuration Protocol (DHCP) ▪ RT class 2 synchronized ("flex") ▪ Fast Startup ▪ Media redundancy (except MRP Client) ▪ Access to the granular submodule status bytes (IOCS) ▪ Supervisor AR (Supervisor DA AR is supported). ▪ More than one input CR ▪ More than one output CR ▪ Multiple write accesses The amount of input / output data configured affects the achievable minimum cycle time. Using the LSB-MSB byte order for cyclical data instead of the default order MSB-LSB can have a negative effect on the achievable minimum cycle time.

Technical data of a ProfiNet IO device (slave) Tab. 18

2.5 EtherCat (slave) interface



1 RJ45 socket, channel 1	3 RJ45 socket, channel 0	5 Status LEDs Link/Activity (L/A)
2 Unlocking lever	4 Status LEDs SYS, RUN, ERR	

EtherCat, front view Fig. 122606

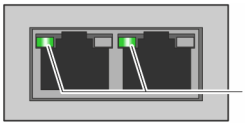
LED status indicators

LED		Color	State	Status
	SYS	Yellow	Illuminated	Device is initialized, stage 1.
		Green/ yellow	flashing	Device is initialized, stage 2.
		Green	Illuminated	Firmware is started.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	RUN	Green	On	Device is in Operational status.
			flashes at 2 Hz, for 3 s	Device is in Pre-operational status.
			flashes 1x	Device is in Safe Operational status.
		Gray	not illuminated	Device is being initialized.
	ERR	Red	flashes at 2.5 Hz	General configuration error. Possible cause: A status change prescribed by the master is not possible due to tab or object settings.
			flashes 2x	Process data watchdog timeout. Possible cause: Sync manager watchdog timeout.
			flashes 1x	Local error: The slave device application has independently changed the EtherCAT status. Possible cause 1: Host watchdog timeout. Possible cause 2: Synchronization error, the device automatically switches to Safe Operational status.
		Gray	not illuminated	The device's EtherCAT communication is in operation.

Status displays of the LEDs SYS, RUN and ERR Tab. 19

LED status	Description
flashing	The LED flashes at a frequency of 2.5 Hz.
Flickering	The LED flickers at a frequency of 10 Hz.
flashes 1x	The LED shows a brief flash (200 ms), followed by a long pause (1000 ms).
flashes 2x	The LED shows a sequence of two brief flashes (200 ms each, with a pause of 200 ms), followed by a long pause (1000 ms).

Description of the statuses for the LEDs SYS, RUN, ERR and Link/Activity (L/A) Tab. 20

LED		Color	State	Status
	L/A[1)]	Green	Flickering	Activity (A): Device sends/receives data.
		Green	Illuminated	Link (L): There is a connection to the Ethernet.
		Gray	not illuminated	Device has no connection to the Ethernet.
	1) One LED per channel.			

Status displays of the LEDs Link/Activity (L/A) Tab. 21

Connector

Connector	RJ 45 plug
Cable	Category CAT5, length max. 100 m

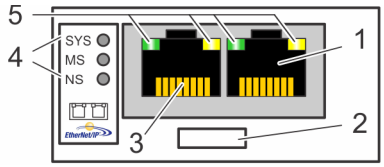
Connector and connection cable for EtherCAT Tab. 22

Technical Data

System	EtherCat (slave)
Firmware / stack version	V4.9.x.x
Interface	2 x RJ45 socket
Transmission rate	100 mbit/s
Data transport layer	Ethernet II, IEEE 802.3
Acyclical communication	SDO, SDO Master-Slave or SDO Slave, depending on the Master functionality
Type	Complex Slave
Functions	Emergency
FMMUs	3
SYNC Manager	4
Distributed Clocks (DC)	Supported, 32 Bit
File length	3...64 words, can be set in TruControl 1000. Factory setting = 4.
Status	5 status indicators using LEDs
Voltage supply	via the internal PCI-E bus
Current consumption	typically 746 mA at 3.3 V
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm (without RJ45 socket)
Weight	approx. 0.6 N (60 g)
Module installation	without any tools
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +65 °C (in operation)
Vibration / impact resistance	as per EN 60068-2-6 Fc/EN 60068-2-27 Ea
Signal interference resistance	in accordance with EN 61131-2:2003
Emission	in accordance with CISPR 11 (EN 55011), Class A
Protection class / approval	IP 40/CE
Restrictions	LRW is not supported.

Technical data of an EtherCAT bridge (slave) Tab. 23

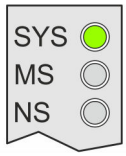
2.6 Ethernet/IP adapter



1	RJ45 socket, channel 1	3	RJ45 socket, channel 0	5	Status LEDs Linkand Activity
2	Unlocking lever	4	Status LEDs SYS, MS, NS		

Ethernet/IP adapter, front view Fig. 124333

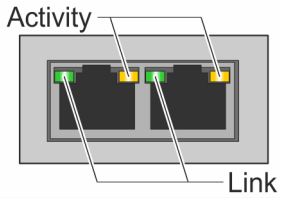
LED status indicators

LED		Color	State	Status
	SYS	Yellow	Illuminated	Device is initialized, stage 1.
		Green/ yellow	flashing	Device is initialized, stage 2.
		Green	Illuminated	Firmware is started.
		Gray	not illuminated	No supply voltage, or hardware is defective.
	MS	Green	Illuminated	The device is ready for operation.
			flashing	Device is not configured and is in standby.
		Red	Illuminated	Device has detected a serious error.
			flashing	Device has detected a simple error. A faulty or inconsequential configuration, for example, is classified as a simple error.
		Red/ Green	flashing	Device performs a self test.
		Gray	not illuminated	Device is switched off.
	NS	Green	Illuminated	Device has at least one existing connection (also to the message router).
			flashing	Device has no existing connections but has received an IP address.
		Red	Illuminated	The used IP address is already in use.
			flashing	One or more connections to the device are in timeout. This status is only terminated when all connections have been restored or when the device has been reset.
		Red/ Green	flashing	Device performs a self test.
		Gray	not illuminated	Device is switched off or has no IP address.

Status displays of the LEDs SYS, MS and NS Tab. 24

LED status	Description
flashing	The LED flashes at a frequency of 2.5 Hz.

Description of the statuses for the LEDs SYS, MS, NS, Link and Activity Tab. 25

LED		Color	State	Status
	Link[1)]	Green	Illuminated	There is a connection to the Ethernet.
		Gray	not illuminated	Device has no connection to the Ethernet.
	Activity[1)]	Yellow	flashing	The device is sending/receiving Ethernet frames.
	1) One LED per channel.			

Status displays of the LEDs Link and Activity Tab. 26

Connector

Connector	RJ 45 plug
Cable	Category CAT5, length max. 100 m

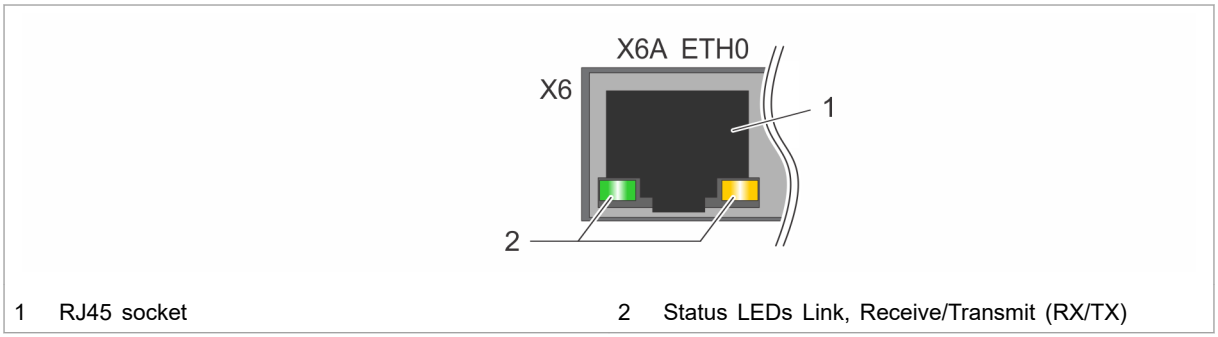
Connector and connection cable for Ethernet/IP adapter Tab. 27

Technical Data

System	Ethernet/IP adapter (slave)
Firmware / stack version	V2.6.x.x
Interface	2 x RJ45 socket
Transmission rate	10 and 100 MBit/s
Data transport layer	Ethernet II, IEEE 802.3
I/O connection types (implicit)	1 "Exclusive Owner", 1 "Lists Only", 1 "Input only"
I/O connection trigger types	"Cyclic", minimal 1 ms[1)] "Application Triggered", minimal 1 ms[1)] "Change of State", minimal 1 ms[1)] 1) Depending on the number of connections used and the quantity of input and output data used.
Explicit Messages	"Connected and unconnected"
Maximum number of connections	8, "explicit" and "implicit" connections
Predefined standard objects	Identity Object Message Router Object Assembly Object Connection Manager DLR Object QoS Object TCP/IP Object Ethernet Link Object
Reset services	Identity Object Reset Service: Type 0 and 1
Maximum number of user-specific objects	20
Supported properties	Quick connect DLR V2 (ring topology) ACD (Address Conflict Detection) DHCP BOOTP Unconnected Message Manager (UCMM)
Duplex mode	Half duplex, Full duplex, Auto negotiation
MDI mode	MDI, MDI-X, Auto-MDIX
Switch function	Integrated
File length	3...64 words, can be set in TruControl 1000. Factory setting = 4.
Status	5 status indicators using LEDs
Voltage supply	via the internal PCI-E bus
Current consumption	typically 746 mA at 3.3 V
Dimensions (W x H x D)	50.4 mm x 19.2 mm x 60 mm (without RJ45 socket)
Weight	approx. 0.6 N (60 g)
Module installation	without any tools
Module mating cycles	Max. 10
Permissible ambient temperature	-20 °C ... +65 °C (in operation)
Vibration / impact resistance	as per EN 60068-2-6 Fc/EN 60068-2-27 Ea
Signal interference resistance	in accordance with EN 61131-2:2003
Emission	in accordance with CISPR 11 (EN 55011), Class A
Protection class / approval	IP 40/CE
Restrictions	CIP Sync services not implemented TAGs not supported.

Technical data for EtherNet/IP adapter (slave) Tab. 28

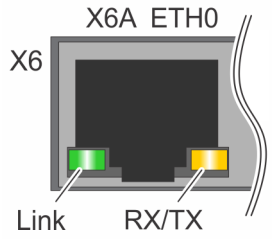
2.7 Internal ProfiNet interface (option)



1 RJ45 socket 2 Status LEDs Link, Receive/Transmit (RX/TX)

Internal ProfiNet interface Fig. 142472

LED status indicators

LED		Color	State	Status
	Link	Green 1)	Illuminated	There is a connection to the Ethernet.
		Gray	not illuminated	Device has no connection to the Ethernet.
	RX/TX	Yellow	flashing	Receive (RX)/Transmit (TX) Device is sending/receiving Ethernet frames.
	1) for CPX V4 or V20 blue.			

Status displays of the LEDs Link and Receive/Transmit (RX/TX) Tab. 29

Connector

Connector	RJ 45 plug
Cable	Category CAT5, length max. 100 m

Connector and connection cable for ProfiNet Tab. 30

Technical Data

System	ProfiNet IO Device (Slave)
ProfiNet specification	V2.42
Interface	X6A ETH0
Type	RJ45 socket
Transmission rate	100 mbit/s
Data transport layer	Ethernet II, IEEE 802.3
Supported protocols	▪ RTC – Real Time Cyclic Protocol, Class 1 and 2 (unsynchronized), Class 3 (synchronized) ▪ RTA – Real Time Acyclic Protocol ▪ DCP – Discovery and configuration Protocol ▪ CL-RPC – Connectionless Remote Procedure Call ▪ LLDP – Link Layer Discovery Protocol ▪ SNMP – Simple Network Management Protocol
Protocols used (subset)	▪ UDP – User Datagram Protocol ▪ IP – Internet Protocol ▪ ARP – Address Resolution Protocol ▪ ICMP (Ping) – Internet Control Message Protocol
Minimum cycle time	1 ms
Max. input address range	128 bytes/64 words
Max. output address range	128 bytes/64 words
File length	3...64 words, can be set in TruControl 1000. Factory setting = 4.
Status	2 status indicators using LEDs
GSDML file	**GSDML**: **G**eneric **S**tation **D**escription **M**arkup **L**anguage The GSDML file contains an electronic data sheet with all necessary parameterization data. For the operation of this ProfiNet interface, the GSDML file must be read in the system configuration of the ProfiNet controllers.
Storage location of the GSDML file with example	Show directory in Explorer: \\ <IP address of the laser device>\public\profinet\Internal Example: \\172.29.3.1\public\profinet\Internal\GSDML-V2.42-TRUMPF-TRUCONTROL_LCU_PNIO-20220713.xml
Restrictions	The following devices are not supported: ▪ Dual Port ▪ Device Access AR ▪ Shared Device ▪ IO Supervisor Supported ▪ PROFIEnergy

Technical data of the internal ProfiNet interface Tab. 31

3. Input and output words

3.1 Input words

The laser device is controlled by means of the input words sent from a fieldbus master, e.g. an external control (e.g. PLC) of a processing station, to a fieldbus slave in the control unit of the laser device.

The control of the laser device:

- accepts the data of the received input words.
- interprets the data and converts it into:
  - control commands
  - Parameters for laser programs

Parameters for laser programs

The signals for the input words 3 ... 63 can be used in the laser programs (see "Input words 3 ... 63: parameters for laser programs", pg. 33).

Signals of the input words which have been freely parameterized may not be used in laser programs.

Freely parameterizable input words

The signals of the input words 3 ... 63 can be freely assigned in the *>Setup >Interface parameters* dialog (see "Input words 3 ... 63: Further input parameters", pg. 35).

Input words which transmit signals for laser programs may not be freely parameterized.

Input mask

Which input signals of the MPI slot are forwarded to the laser control can be set in the >*Input mask* dialog. If an input signal is deactivated, this signal is not forwarded to the laser control.

The following input signals can be masked:	
▪ EXT_ACTIVATION ▪ LOCK_OPERATING_PANEL ▪ LASER_ON ▪ LASER_STANDBY (Only for laser device with Laser-Standby-Modus) ▪ PSTART_STATICAL ▪ PSTART_DYN ▪ PROG_STOP ▪ RESET	▪ FAULT_EXT ▪ INQUIRY_1 ▪ INQUIRY_2 ▪ Reserved (bit 12 always 1) ▪ Reserved (bit 11 always 1) ▪ UNSYNC_PSTART ▪ PILOT_LASER_ON ▪ REQUEST_LASER

Tab. 32

Factory setting 0xFFFF: The input signals are activated and are forwarded to the laser control.

Configuration of the input mask (see "Configuring interfaces", pg. 157).

Inverting mask

Which input signals of the MPI slot are forwarded in inverted form to the laser control can be set in the >*Inverting mask* dialog. If an input signal is activated, this signal is forwarded to the laser control in inverted form.

The following input signals are invertible:	
▪ EXT_ACTIVATION ▪ Reserved (bit 6 always 0) ▪ LASER_ON ▪ LASER_STANDBY (Only for laser device with Laser-Standby-Modus) ▪ PSTART_STATICAL ▪ PSTART_DYN ▪ PROG_STOP ▪ RESET	▪ FAULT_EXT ▪ INQUIRY_1 ▪ INQUIRY_2 ▪ Reserved (bit 12 always 0) ▪ Reserved (bit 11 always 0) ▪ UNSYNC_PSTART ▪ PILOT_LASER_ON ▪ REQUEST_LASER

Tab. 33

Factory setting 0x0000: The inverting mask is deactivated. The input signals are forwarded in non-inverted form.

Configuration of the inverting mask (see "Configuring interfaces", pg. 157).

Overview of the input words

Word no.	Functions
0	**Basic laser functions** External activation, laser on, program start, program stop, reset, request laser, unsynchronized start
1	**Number of light path and program** Selection of light path and number of the laser program to be started.
2	**Number of the application data** Application data for the monitoring of focusing optics (CFO or BEO smart). **Number of the laser device** The control of the laser device checks whether the correct laser is being activated.
3 : 9	**Input words 3 ... 9: IW3 ... IW9** Set value for a laser parameter or freely configurable input parameters
10 : 13	**Input words 10 ... 13: IW10 ... IW13**[1)] Set value for a laser parameter or freely configurable input parameters.
14 15	**Input word 14 and 15: IW14 and IW15**[1)] Advance laser functions, if system parameter **PLC_ExtendBaseloFunction** = 1 **or** if system parameter **PLC_ExtendBaseloFunction** = 0 Set value for a laser parameter, or freely configurable input parameters.
16 : 63	**Input words 16 ... 63: IW16 ... IW63**[1)] if TruControl 1000 version ≥ 1.84.0 Set value for a laser parameter or freely configurable input parameters.
1) The input words 10 ... 63 are available for fieldbus module DeviceNet slave, providing TruControl 1000 version ≥ 1.88.0.	

Input words 0 to 63 Tab. 34

Input word 0: laser base functions

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
0.15	EXT_ACTIVATION	**External control** The laser device is controlled via the fieldbus.
0.14	LOCK_ OPERATING_PANEL	**Locking the operating panel** The operating panel can only be used as display.
0.13	LASER_ON	**Switching on the laser** The laser power supply is turned on.
0.12	LASER_STANDBY	**Activating the laser Standby mode** Only required for laser devices with laser Standby mode.
0.11	PSTART_STATICAL	**Static program start** Static start of a laser program defined in input word 1.
0.10	PSTART_DYN	**Dynamic program start** Dynamic start of a laser program defined in input word 1.
0.9	PROG_STOP	**Cancel / stop laser program** A laser program started with “PSTART_DYN” is cancelled or stopped.
0.8	RESET	**Reset** Fault and monitoring messages are acknowledged. In case of fault, the control unit of the laser device is reinitialized.
0.7	FAULT_EXT	**External fault** The laser is switched off and active laser programs are cancelled.
0.6	INQUIRY_1	**Query inputs 1 and 2** The procedure of a laser program is synchronized to the state of one of these signals if the wait functions "W1H", "W2H", "W1L" or "W2L" are used in the laser program.
0.5	INQUIRY_2	
0.4	LOCK_PROG_PARAM	▪ Only for TruMicro: Lock operating point parameters. ▪ **Reserved** for all other laser devices.
0.3	SIMULATION	**Simulation mode** The simulation mode is activated.
0.2	UNSYNC_PSTART	**Unsynchronized activation** A program start is accepted at the earliest possible time without synchronization to the LASER_READY signal.
0.1	PILOT_LASER_ON	**Switching on the pilot laser** The pilot laser is always switched on even if the laser device has not been assigned.
0.0	REQUEST_LASER	**Requesting the laser** The laser device is requested by an external control unit.
Description (see "Signals of input word 0", pg. 52).		

Tab. 35

Input word 1: light path and laser program number

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
1.15 : 1.8	LIGHT_PATH_No: bit 7 : LIGHT_PATH_No: bit 0	**Number of the selected light path (bits 7 ... 0)** An external control defines the light path to be used by the laser device for laser power output. Number of light path numbers: max. 255 dec = FF hex Format: hexadecimal. Example: light path no. 19 dec = 0001 0011 = 13 hex
1.7 : 1.0	PROGRAM_No: bit 7 : PROGRAM_No: bit 0	**Number of the selected laser program (bits 7 ... 0)** An external control defines the number of the laser program to be run. Number of laser programs: max. 200 dec = C8 hex, without program number 0. Format: hexadecimal. Example: program no. 25 dec = 0001 1001 = 19 hex
Description (see "Signals of input word 1", pg. 62).		

Tab. 36

Input word 2: application data set and laser device number

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
2.15 : 2.8	AD_No: bit 7 : AD_No: bit 0	**Number of the application data set (bits 7 ... 0)** An external control unit defines the number of the application data set whose data is to be used for monitoring a focusing optics (CFO or BEO Smart). Number of selectable application data sets: max. 255 dec = FF hex Format: hexadecimal. Example: Application data set no.: 69 dec = 0100 0101 bin = 45 hex
2.7 : 2.0	LASER_No: bit 7 : LASER_No: bit 0	**Number of the selected laser device (bits 7 ... 0)** An external control unit defines the number of the laser device from which to request laser power. Number of laser device numbers: max. 255 dec = FF hex Format: hexadecimal. Example: Laser device no. 53 dec = 0011 0101 bin = 35 hex
Description (see "Signals of input word 2", pg. 64).		

Tab. 37

Input words 3 ... 63: parameters for laser programs

Word no.	Parameter
3 ... 9	**Parameters for laser programs**
10 ... 13	**Parameter for laser programs**[1)]
14 + 15	**Parameters for laser programs**,if system parameter **PLC_ExtendBaseloFunction** = 0[1)].
16 ... 63	**Parameter for laser programs**, if TruControl 1000 version ≥ 1.84.0[1)].
1) For DeviceNet slave, the input words IW10 .. 63 are available, providing TruControl 1000 version ≥ 1.88.0.	

Tab. 38

The parameters for laser programs are listed in the following table.

A signal is active if the bit value is = "1".

Parameters for laser programs			
Laser parameters			
– Frequency	– Number of pulses	– Start ramp	– Pulse duration
– PK pulse number	– Pulse gap power	– End ramp	
– Laser power			
PFP Control and PierceLine			
– Pulse power (IW3)	– Average laser power (IW4)	– Frequency (IW5)	– PLS parameters (IW6 + IW7)
PCP			
– Monitoring	– Fault		
TruFiber			
– Pulse modulation • frequency • pulse duration	– BrightLine Mode[1)] • power core • power ring	– VariMode[1)]	
TruMicro			
– Base frequency	– Energy level	– Short pulse duration	– Short pulse count
– Work frequency	– Beam splitter	– Burst pattern	
PFO program			
– PFO program number	– PFO coordinate X, Y, Z	– PFO scaling X, Y	– Image processing mode
– PFO transformation X, Y, Z	– Scan width X, Y (only for PFO 20-2 PO)	– PFO coordinate Defokus	– PFO program runs
– PFO fieldbus control	– PFO rotation	– Simple Coordination on-the-fly mode • X, Y, Z feed	• Start delay
Process characteristic curve (PCC)			
– PCC →	– PCC #		
SeamLine Remote (SL)			
– SL: Feed rate	– SL: Configuration	– SL: Seam number	– SL: Control
BrightLine Weld / FusionLine,if a component FCM is available in the light path			
– Processing	– Power share core (for BrightLine Weld only)		
Cutting parameters for CW laser and laser with **CutAssist module**			
– Cutting speed	– Max. cutting speed	– Cutting parameter set number	
TPC program			
– Temperature when TPC mode = Temperature direct			
Motorized beam splitter			
– Beam splitter position			
PMF			
– Focus position / lens position	– RM: Position		
Traceability data			
– Seam ID • Start address • Number of words	– Workpiece serial number[2)] • Start address • Number of words	– Workpiece ID[2)] • Start address • Number of words	
1) With laser devices of the TruFiber P Series (FD89)			
2) In the properties of a laser program (see "Parameter transfer to the laser program settings", pg. 74).			
Description (see "Parameters for laser programs", pg. 65).			

Tab. 39

Input words 3 ... 63: Further input parameters

Word-No.	Parameter
3 : 9	▪ Default value If the parameter has been defined as the default value, it can be used for laser programs. ▪ Other input parameters: – PLC input (CV) x words[1], x = 6, 8 or 16 – Pause (ESC)[2] – Line laser (PFO) – FCU&PCU lid state – PLC input (VLCK) 13 words[3] – Sensor Relay Input x Words, x = 9, 16, 32 or 48
10 : 13	▪ Default value[4] ▪ Other input parameters[4]
14 15	If system parameter **PLC_ExtendBaseIoFunction** = 0[4]: ▪ Default value ▪ Other input parameters
16 : 63	If TruControl 1000 version ≥ 1.84.0[4] ▪ Default value ▪ Other input parameters
1) Parameter for the image processing system VisionLine. 2) Requirement: Technical Information "Energy Save Concept", doc.-No. 21-A0-71-CP 3) Parameter for the image processing system VisionLine OCT Check with focusing optics BEO and OCT sensor, available from TruControl 1000 version 3.46 on. 4) In case of DeviceNet-Slave: input words IW10 .. 63 available, if TruControl 1000 version ≥ 1.88.0.	
Beschreibung (see "Other input parameters", pg. 76).	

Tab. 40

Alternative input words 14 and 15: Extended laser functions

Note

The advanced laser functions of the input words 14 and 15 are available if the system parameter **PLC_ExtendBaseloFunction** = 1

For fieldbus module DeviceNet slave, the advanced laser functions of the input words 14 and 15 are available if TruControl 1000 version ≥ 1.88.0 and system parameter **PLC_ExtendBaseloFunction** = 1.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
14.15 : 14.5	--	**Reserved**
14.4	MACHINE_COOLING_ON	**Switching on external cooling** The external control requests the laser control to switch on the external cooling, for example, of a TRUMPF laser machine.
14.3	ENERGY_SAVE_ON[1)]	**Activate optimized standby mode[1)]** The external control requests the laser control to switch the laser device to optimized standby mode (OSB 3).
14.2	POWER_GATE	**POWER_GATE** The laser beam is suppressed.
14.1	ENERGY_SAVE_OFF[1)]	**End optimized standby mode[1)]** The external control requests the laser control to end optimized standby mode (OSB 3).
14.0	LASER_CONTROL_OFF	**Switching off the laser control unit** The external control unit sends a signal to the laser control to switch off.
15.15 : 15.0	--	**Reserved**

1) Prerequisites:

- CPX V3 or V4 is available.
- The input **24 V_STDBY** at X1 of the PBT board is supplied with voltage.
- LCU_EnergySaveMode > 0

For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

Not available for laser devices with CPX V20.

Description (see "Signals of the alternative input words 14 and 15", pg. 78).

Tab. 41

3.2 Output words

Using output words, the laser device provides:

- Status information.
- Calculated values supported by measurements for:
  - Average power
  - Pulse energy.

Output mask

In the *>Output mask* dialog you can set which internal laser signals are forwarded by the laser control to the outputs of an MPI slot, even if the laser device is not assigned to the MPI slot, i.e. **LASER_ASSIGNED** is not active.

The following output signals can be masked:	
▪ EXT_ACTIVATION_ACTIVE	▪ **SET3**
▪ LASER_IS_ON	▪ SIK_OPEN
▪ LASER_READY	▪ **MONITORING**
▪ PROG_ACTIVE	▪ **FAULT_LASER**
▪ PROG_COMPLETED	▪ LASER_ASSIGNED
▪ **PROG_CANCELLED**	▪ **POWER_LIMIT**
▪ **SET1**	▪ **PILOT_LASER_IS_ON**
▪ **SET2**	▪ **LASER_WARNING_LAMP_IS_ON**

Tab. 42

Factory setting 0xB707: The output mask is active for all signals in **bold**. These signals are forwarded by the laser control to the outputs of the MPI slot, even if the laser device is not assigned to the MPI slot.

Configuration of the output mask (see "Configuring interfaces", pg. 157).

Freely parameterizable output words

The signals of the output words 2 ... 63 can be freely assigned in the *>Setup >Interface parameters* dialog (see "Output words 2 ... 63: Other output parameters", pg. 49).

Overview of the output words

The overview of the output words contains the parameters preset by TRUMPF (default values).

Word no.	Functions
0	**Laser device status** External actuation active, laser is on, laser is ready, program is active, program exited, laser malfunction, laser assigned.
1	**Light path and laser program number** Number of the light path and laser program set in the laser device.
2	**Status of focusing optics and position of the shutter switches**
3	**Number and status of the laser device**
4	**Message code ID and NUM, if output word 3, bit 0 = "0"** These message codes signal the component (ID) and, in the case of multiple identical components, the component in question (NUM). **or** **Measured value identifier if output word 3, bit 0 = "1"** The measured value identifier indicates which measured value is transmitted via output word 5 (e.g. distance from the focusing plane to the surface of the workpiece).
5	**Message code CODE, if output word 3, bit 0 = "0"** These message codes specify component monitoring or a component malfunction. **or** **Measured value if output word 3, bit 0 = "1"** Measured value, whose identifier is transmitted in output word 4 (e.g., distance from the focusing plane to the surface of the workpiece).
6	**Laser power** **CW laser:** Measured laser power **Pulsed laser:** Calculated value of the average power
7	**Pulsed laser: pulse energy** The pulse energy is a calculated value. **CW laser:** Not used
8 9	**Reserved for additional output parameters**
10 : 13	**Reserved for additional output parameters**[1)]
14 15	**Other status signals of the laser device** if system parameter **PLC_ExtendBaseIoFunction** = 1[1)]: Optimized standby mode is on, laser control is on, machine cooling is on **or** **Reserved for additional output parameters** if system parameter **PLC_ExtendBaseIoFunction** = 0[1)].
16 : 63	**Reserved for additional output parameters** if TruControl 1000 version ≥ 1.84.0[1)].
1) For fieldbus module DeviceNet slave, the output words 10 ... 63 are available, if TruControl 1000 version ≥ 1.88.0.	

Output words 0 to 63 Tab. 43

Output word 0: Standard output signals

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
0.15	EXT_ACTIVATION_ACTIVE	**External activation is active** The laser device can be controlled by an external control (e.g. PLC) via a MPI slot, e.g. parallel I/O interface, fieldbus interface or OPC.
0.14	LASER_IS_ON	**The laser of the laser device is switched on** The laser can now generate laser light.
0.13	LASER_READY	**The laser of the laser device is ready** The laser programs can be started.
0.12	PROG_ACTIVE	**Laser program is active** A laser program has been started and is being executed.
0.11	PROG_COMPLETED	**Laser program is completed** A laser program has been run and is completed.
0.10	PROG_CANCELLED	**Laser program has been cancelled** A laser program has been cancelled during execution.
0.9 : 0.7	SET_1 : SET_3	**Set outputs 1 ... 3** External sequences can be synchronized with the sequence of a laser program if set functions (S1H, S1L, S2H, S2L, S3H, S3L) are used in the laser programs.
0.6	SIK_OPEN	**The safety circuit (SIK) is open** The safety circuit (SIK) of a shutter or of a shutter switch in the selected light path is interrupted.
0.5	MONITORING	**A monitoring message of the laser device is active** A limit value for monitoring has been exceeded.
0.4	FAULT_LASER	**A fault message of the laser device is active** A limit value for fault has been exceeded.
0.3	LASER_ASSIGNED	**The laser device is assigned to an external control unit** Acknowledgement of the input signal "REQUEST_LASER".
0.2	POWER_LIMIT	**The power limit of the laser has been reached** (only with pulsed lasers) The state can be corrected by adapting the laser parameters.
0.1	PILOT_LASER_IS_ON	**Pilot laser is switched on** At least one pilot laser is switched on.
0.0	LASER_WARNING_LAMP_ IS_ON	**The laser warning light is on** The capacitors of the laser device contain enough energy to allow laser light to be generated.
Description (see "Signals of output word 0", pg. 82).		

Tab. 44

Output word 1: light path and laser program number

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
1.15 : 1.8	LIGHT_PATH_No: bit 7 : LIGHT_PATH_No: bit 0	**Acknowledgement of the number of the currently set light path (bits 7 ...0)** The control of the laser device outputs the number of the currently set light path. This enables an external control unit to check if the requested light path corresponds to the light path that has been set. Format: hexadecimal. Example: light path no. 19 dec = 0001 0011 = 13 hex
1.7 : 1.0	PROGRAM_No: bit 7 : PROGRAM_No: bit 0	**Acknowledgement of the number of the laser program selected (bits 7 ... 0)** The control of the laser device outputs the number of the currently set laser program. This enables an external control unit to check if the requested laser program corresponds to the laser program that has been set. Format: hexadecimal. Example: program no. 25 dec = 0001 1001 bin = 19 hex
Description (see "Signals of output word 1", pg. 91).		

Tab. 45

Output word 2: Status of the focusing optics, slot messages and positions of the shutter switches

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
2.15	PROTECTIVE_GLASS_ LIFETIME_REACHED[1)]	**Limit value MAX2 of the protective glass contamination has been reached** The 2nd monitoring message of the protective glass contamination according to the application data set has been reached (orange range).
2.14	PROTECTIVE_GLASS_ CONTAMINATED[1)2)]	**Limit value MAX1 of the protective glass contamination has been reached** The 1st monitoring message of the protective glass contamination according to the application data set has been reached (yellow range).
2.13	APPLICATION_VALUES_ IN_RANGE[1)]	**Application values crossjet pressure, exhaustion and shielding gas are in the admissible range** All values monitored according to the application data record are within the admissible limits (green zone).
2.12	FOCUSING_OPTICS_READY/ LIGHTPATH_COMP_READY[1)]	**The focusing optics or light path component is ready for operation.**
2.11	FOCUSING_OPTICS_ AVAILABLE/LIGHTPATH_ COMP_AVAILABLE[1)]	**Focusing optics or light path component is enabled.** A focusing optics or light path component must be enabled via the dialog *>Technology >Light path*. Further information: Software manual "TruControl 1000", Dok.-Nr. 10-06-80-A1-CR. **Note:** The signals of the bits 15 ... 12 of output word 2 are only valid if the output signal **FOCUSING_OPTICS_AVAILABLE** is active.
2.10	–	**Reserve**
2.9	MONITORING_ SLOT	**A local monitoring has occurred for this slot** The external control unit connected to the slot must reset the monitoring via the input signal **RESET**.
2.8	FAULT_SLOT	**A local fault has occurred for this slot** The external control unit connected to the slot must reset the fault via the input signal **RESET**.
2.7 : 2.0	SHUTTER_SWITCH 8 (VW8) : SHUTTER_SWITCH 1 (VW1)	**Position of the shutter switches** The control unit of the laser device outputs the available shutter switches. The position of the shutter switches can be evaluated by an external control unit. 1 = shutter switch closed 0 = shutter switch open
1) These signals indicate the current status of focusing optics or a light path component in the selected light path. 2) **PROTECTIVE_GLASS_CONTAMINATED** signal is not available for focusing optics of series **BEO Smart**.		
Description (see "Signals of output word 2", pg. 92).		

Tab. 46

Output word 3: Number and extended status of the laser device

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
3.15 : 3.8	LASER_No: bit 7 : LASER_No: bit 0	**Number of the laser device (bits 7 ... 0)** The control of the laser device outputs the number which is assigned to the laser device. This enables an external control unit to check if the requested laser device has responded. Format: hexadecimal. Example: laser device no. 25 dec = 0001 1001 bin = 19 hex
3.7	–	**Reserve**
3.6	–	**Reserve**
3.5	EXT_COOLING_ CIRCUIT_IS_ON	Functionality A): External cooling circuit is switched on. Functionality B): The laser device requires cooling water.
3.4	ALIVE_TICK	**Laser control is active** With this signal an external control can determine that the laser control is switched on.The signal changes status between High and Low with a frequency of 1 Hz.
3.3	CALIBRATION/SELF_TEST	**The laser is being calibrated** or **Laser selftest is active**
3.2	–	**Reserve**
3.1	MAINTENANCE	**Maintenance of the laser device is required**
3.0	MEASURING_VALUE_OUT_ ACTIVE	**Output word 4 outputs measured value ID** Output of the corresponding measured value is made via output word 5.
Description (see "Signals of output word 3", pg. 96).		

Tab. 47

Output word 4: Message code byte 1 (ID), byte 2 (NUM)

The control unit of the laser device shows via bit 0 of output word 3 which data is transferred via output word 4:

- Bit 0 of output word 3 = "0" (inactive): the message code byte 1 (ID) and byte 2 (NUM) is transferred via output word 4.
- Bit 0 of output word 3 = "1" (active): the alternative output word 4 is used to transfer a measured value ID.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
4.15 : 4.8	MESSAGE_ID: bit 7 : MESSAGE_ID: bit 0	**Message code ID (bits 7 ... 0)** The control unit of the laser device uses the message code (ID) to output the code of the component that has resulted in a message. The message code can be evaluated by an external control unit. Format: Hexadecimal. Example: 0Exx hex = ASV 3 (VW) has resulted in a message.
4.7 : 4.0	MESSAGE_NUM: bit 7 : MESSAGE_NUM: bit 0	**Message code NUM (bits 7 ... 0)** If there are several components of the same type, the control unit of the laser device uses the message code (ID) to output the NUM that indicates the component that has resulted in the message. The message code can be evaluated by an external control unit. Format: Hexadecimal. Example: xx08 hex = The 4th component of the same type has resulted in a message.
Description (see "Signals of output word 4", pg. 99).		

Tab. 48

Alternative output word 4: measured value ID

The control unit of the laser device shows via bit 0 of output word 3 which data is transferred via output word 4:

- Bit 0 of output word 3 = "0" (inactive): the message code byte 1 (ID) and byte 2 (NUM) is transferred via output word 4.
- Bit 0 of output word 3 = "1" (active): the alternative output word 4 is used to transfer a measured value ID.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
4.15 : 4.0	MEASURING_VALUE_ID: bit 15 : MEASURING_VALUE_ID: bit 0	**ID of the measured value in the output word 5 (bits 15 ... 0)** The control unit of the laser device outputs the identification of the measured value being transferred in output word 5. This enables an external control unit to determine the measured value transmitted in output word 5. Format: Hexadecimal.
Description (see "Signals of alternative output word 4", pg. 101).		

Tab. 49

Output word 5: Message code byte 3 and byte 4

The control unit of the laser device shows via bit 0 of output word 3 which data is transferred via output word 5:

- Bit 0 of output word 3 = "0" (inactive): the message code byte 3 and byte 4 is transferred via output word 5.
- Bit 0 of output word 3 = "1" (active): the alternative output word 5 is used to transfer a measured value.

  The control unit of the laser device transfers the measured value ID that indicates the type of measured value being transferred via the alternative output word 4.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
5.15 : 5.0	MESSAGE_CODE: bit 15 : MESSAGE_CODE: bit 0	**Message code of the reporting component (bits 15 ...0)** The control unit of the laser device outputs the message code of the reporting component. The message code can be evaluated by an external control unit. Format: Hexadecimal. **Note:** For messages, the message codes are also displayed on the operating panel.
Description (see "Signals of output word 5", pg. 102).		

Tab. 50

Alternative output word 5: Measured value

The control unit of the laser device shows via bit 0 of output word 3 which data is transferred via output word 5:

- Bit 0 of output word 3 = "0" (inactive): the message code byte 3 and byte 4 is transferred via output word 5.
- Bit 0 of output word 3 = "1" (active): the alternative output word 5 is used to transfer a measured value.

  The control unit of the laser device transfers the measured value ID that indicates the type of measured value being transferred via the alternative output word 4.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
5.15 : 5.0	MEASURING_VALUE: bit 15 : MEASURING_VALUE: bit 0	**Measured value of the measured value ID transmitted in the output word 4 (bits 15 ... 0)** The control unit of the laser device outputs the identification of the measured value being transferred in output word 4. An external control unit can evaluate the transferred measured value and use it e.g. for correction purposes. Format: Hexadecimal. Example: Distance between focal point plane and workpiece surface.
Description (see "Signals of alternative output word 5", pg. 103).		

Tab. 51

Output word 6: Laser power

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
6.15 : 6.0	LASER_POWER: bit 15 : LASER_POWER: bit 0	**CW laser: laser power (bits 15 ... 0)** The control unit of the laser device outputs the measured laser power. Format: Hexadecimal. Significance of the bits is defined: ▪ Bit 15 = high. ▪ Bit 0 = low. Resolution: 1 W/digit Value range: 0 W ... 65535 W. **Pulsed lasers: average power (bits 15 ... 0)** The average laser power value, calculated on the basis of measurements, is output by the control unit of the laser device. An external control unit can evaluate this laser parameter and use it for optimization of the laser utilization. Format: Hexadecimal. Significance of the bits is defined: ▪ Bit 15 = high. ▪ Bit 0 = low. Resolution: 0.1 W/digit Value range: 0.0 W ... 6553.5 W. The system parameter **PLC_PowerOutTick** can be used to set the interval at which the value is updated. PLC_PowerOutTick = 0: In case of normal utilization of the system, the value is updated approx. every 0.2 s. PLC_PowerOutTick ≥ 20 ms: In case of normal utilization of the system, the value is updated at the interval given.
Description (see "Signals of output word 6", pg. 104).		

Tab. 52

Output word 7: Pulse energy

Pulse energy is only available with pulsed laser devices.

In CW lasers and with TruMicro series lasers this output word is not used in the standard assignment.

A signal is active if the bit value is = "1".

Word.Bit	Signal name	Functions
7.15 : 7.0	ENERGY: bit 15 : ENERGY: bit 0	**Pulse energy (bits 15 ... 0)** The pulse energy value of a laser device, calculated on the basis of measurements, is output by the control unit of the laser device. An external control unit can evaluate this laser parameter and use it for optimization of the laser utilization. Format: Hexadecimal. Significance of the bits is defined: ▪ Bit 15 = high. ▪ Bit 0 = low. Resolution: 0.01 J/digit Value range: 0.00 J ... 655.35 J In case of normal utilization of the system, the measured values are updated approx. every 0.5 s. The pulse energy of the last measured pulse is output and this value then remains present until the next change.
Description (see "Signals of output word 7", pg. 105).		

Tab. 53

Output words 2 ... 63: Other output parameters

Word no.	Parameter
2 ... 7	▪ **Default value**: In the preceding sections, you will find an overview of the default values preset by TRUMPF. ▪ Other output parameters
8 9	▪ Reserve ▪ Other output parameters
10 ... 13	▪ Reserve ▪ Further output parameters[1)]
14 15	▪ Reserve ▪ Further output parameters if the system parameter **PLC_ExtendBaseIoFunction** = 0[1)].
16 ... 63	▪ Reserve ▪ Further output parameters if TruControl 1000 version ≥ 1.84.0[1)].
1) For DeviceNet slave, the output words 10 ... 63 are available, providing TruControl 1000 version ≥ 1.88.0.	

Tab. 54

The other output parameters are listed in the following table.

Parameter		
PLC output (CV) x words[1], x = 6, 8, 16, 32, 40, 48 or 56		Device level (ESC)[2]
Slot level (ESC)[2]	Slot RTTO (ESC)[2]	Slot state (ESC)[2]
Power regulation average value (LLR)	Protective glass contamination (CFO)	Power average filtered (LMP)
Exhaustion pressure (CFO)	Shielding gas flow (CFO)	Pulse energy count (LMP)
PPC measured power	Conductivity (CLK)	Pulse energy
Input word 0 ... Input word 63	Active PFO program number	Temperature base plate (SBO)
IP address ETH2	Active workplace	State for fieldbus (SBO)
IP address LAN	Energy laser program	Pulse energy 1kJ
IP address SERVICE	Energy laser program 10J	Pulse energy 1mJ
Laser power nominal	Request laser slot 1-16	Pulse power average
Laser type	Request laser slot 17-32	Melt travel monitoring state (PFO)
Measured power (PCP)	EM pulse divider (DLC)	TPC state
SeamLine Remote result (7 words)	Amplifier pulse repetition rate (DLC)	Process light sensing status (DLC)
SeamLine Remote status	XVar.1 .... XVar.32	Actual temperature (TPC)
Focus or lens position (PMF)	Laser power EM digits (DLC)	Nominal temperature (TPC)
Rotary module orientation (PMF)	Protective glass contamination (PGM)	FCU/PCU lid state
Crossjet pressure (CFO)	Pulse counter	Short pulse duration (PDC)
BEO application number (MIO/ PGM)	Shielding gas flow (MIO)	MDE gas flow (MIO)
Crossjet Pressure (MIO)	Purging gas flow (MIO)	Power portion core (FCM)
Burst pattern (DLC/WPCI)	Base frequency (DLC/WPCI)	Operating frequency (DLC/WPCI)
Energy level (WPCI)	PFO fieldbus control state	Purging gas pressure (CRDS)
VariMode state (HPCC/SCPR)	PLC output (VLCK) 04 words[3]	Protective glass contamination (PFO)
Conductivity (CCB/ECC/CCR)	VisionLine Check Status[3]	PCP measurement
Sensor Relay Output x Words, x = 9, 16, 32 or 48		

1) Parameter for the image processing system VisionLine.

2) Requirement: Technical information "Energy Save Concept", document no.: 21-A0-71-CP.

3) Parameter for the image processing system VisionLine OCT Check, available from TruControl 1000 version 3.46.

Description (see "Other output parameters", pg. 106).

Other output parameters Tab. 55

Alternative output words 14 and 15: Further standard output signals

Note

The other standard output signals of the output words 14 and 15 are available if the system parameter **PLC_ExtendBaseIo-Function** = 1.

For fieldbus module **DeviceNet slave**, the other standard output signals of the output words 14 and 15 are available, if **TruControl 1000 version** ≥ 1.88.0 and system parameter **PLC_ExtendBaseloFunction** = 1.

Word.Bit	Signal name	Functions
15.15 ... 15.0 14.15 ... 14.8	–	**Reserve**
14.7	COOLING_ LOCKED	If this signal is active the external cooling water supply must be stopped.
14.6	EMISSION_ON	Signal is active if power > 0 W, i.e. if power is emitted. **Requirements** If a central shutter (VZ) is available, it must be open. The signal can only be evaluated if the pulse duration and the pulse gap are twice as large as PLC_PowerOutTick. Example: PLC_PowerOutTick = 80 ms → pulse duration and pulse gap ≥ 160 ms.
14.5	ALIGNMENT_ RECOMMENDED	On laser devices with LLK-U (option) the beam alignment must be corrected if this signal is active.
14.4	MONITORING_ PROCESS	A monitoring message has appeared at the allocated MPI slot during the machining process. Check the quality of the machined workpiece. This message can be acknowledged with RESET.
14.3	FAULT_ PROCESS	A malfunction occurred at the allocated MPI slot during the machining process. Check the quality of the machined workpiece. This message must be acknowledged with RESET.
14.2	MACHINE_ COOLING_ READY	**External cooling unit is active** External cooling (e.g. of a TRUMPF laser machine) is active. Cooling water flow is present.
14.1	ENERGY_SAVE_ IS_ON[1)]	Optimized standby mode (OSB 3) of the laser control is on.[1)].
14.0	LASER_ CONTROL_IS_ON	Laser control is on

1) Prerequisites:

- CPX V3 or V4 is available.
- The input **24 V_STDBY** at X1 of the PBT board is supplied with voltage.
- LCU_EnergySaveMode > 0

For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

Not available for laser devices with CPX V20.

Description (see "Signals of the alternative output words 14 and 15", pg. 116).

Tab. 56

4. Signal descriptions

4.1 Signals of input word 0

EXT_ACTIVATION

Function	Input signal determines if the laser is controlled: ▪ from the operating panel (OP). ▪ by an external control unit (e.g. PLC).
Active signal	The laser can be operated by an external control unit. The following functions can be executed via the operating panel: ▪ it is NOT possible to start laser programs. ▪ laser parameters can be transferred to the laser device. ▪ messages can be acknowledged.
Feedback	With active input signal **EXT_ACTIVATION**, the output signal **EXT_ACTIVATION_ACTIVE** is activated.
Information	A laser device is only assigned to an external control unit if it is requested via the input signal **REQUEST_LASER**. When, additionally, the **LOCK_OPERATING_PANEL** input signal is active, laser parameters can no longer be transferred to the laser device via the operating panel.

Tab. 57

FAULT_EXT

Function	The external control reports an error in the environment of the installation.
Active signal	The laser device carries out the following actions: ▪ The central shutter is closed. ▪ The laser has been switched off. ▪ Laser pulses are interrupted immediately. ▪ The active laser program is cancelled. ▪ The power supply to the following components is switched off: – Pump sources – Cooling unit – Optical components ▪ Laser standby mode is ended (only for laser devices with laser standby mode).
Feedback	A monitoring message is displayed. The output signal **MONITORING** becomes active.
Information	The laser device can only be controlled again via the interface when the **RESET** input signal has been activated. If TruControl version ≥ 3.10.0, the input signal **FAULT_EXT** must be deactivated beforehand. **Note:** A fault message is **not** displayed, and the output signal **FAULT_LASER** is **not** activated.

Tab. 58

INQUIRY_1 and INQUIRY_2

Function	Both input signals **INQUIRY_1** and **INQUIRY_2** allow synchronization of the sequence of a laser program to external sequences.
Information	If a line of the laser program contains a maintenance instruction (W1H, W1L, W2H or W2L), this line is not processed until the respective input signal **INQUIRY_1** (with W1H, W1L) or **INQUIRY_2** (with W2H, W2L) adopts the required state (high or low).

Tab. 59

LASER_ON

Functions	The laser power supply is turned on.
Active signal	The laser power supply is switched on. Laser light is not yet generated.
Feedback	About 5 – 10 s after activation of the **LASER_ON** input signal, the output signals **LASER_IS_ON** and **LASER_READY** are activated simultaneously. **Laser device with laser standby mode:** About 8 – 15 s after activation of the **LASER_ON** input signal, the **LASER_IS_ON** output signal is activated.
Information	The laser power supply remains switched on as long as the input signal **LASER_ON** is active. If the output signal **LASER_READY** is active, a laser program can be started. **Notes:**: ▪ The laser must not be switched on and off cyclically (multiple times per minute). Switching off and on in succession is allowed once, e.g. if ALIGNMENT_RECOMMENDED is active (see "ALIGNMENT_RECOMMENDED", pg. 116). ▪ The laser device is also switched on by the signal **LASER_ON** if: – the external activation is not active (output signal **EXT_ACTIVATION_ACTIVE** is inactive). – the laser device is not assigned to the external control unit (output signal **LASER_ASSIGNED** is inactive). ▪ **TruDisk, TruDiode** When the cooling water temperature of the series TruDisk and TruDiode laser devices is below a certain threshold value, the laser cannot be switched on within the time mentioned above. The cooling water can be heated up to reduce the waiting time. Heating of the cooling water is activated automatically by the **LASER_ON** signal or via the *Laser* button in the *>Manual mode* main operation. Heating of the cooling water is aborted or not activated if the switching function *Force manual operation* is active or if a user is registered at the laser control with user level ≥ 70. The main operation *>Manual mode* and the function *Force manual operation* are described in the Software manual "TruControl 1000", doc. no. 10-06-80-A1-CR. ▪ **Laser device with laser standby mode:** If the **LASER_IS_ON** output signal is active, the laser device can be switched to the laser standby mode by activating the **LASER_STANDBY** input signal. About 2 – 5 s after activation of the **LASER_STANDBY** input signal, the **LASER_READY** output signal is activated.

Tab. 60

LASER_STANDBY

Functions	**Activating the laser standby mode.** The laser power is stabilized in the laser standby mode. This signal is only required for laser devices with laser standby mode.
Active signal	The laser power defined for the laser standby mode is generated without regulation and conducted from the central shutter into the absorber.
Feedback	About 2 – 5 s after activation of the **LASER_STANDBY** input signal, the **LASER_READY** output signal is activated.
Using the signal	On the basis of the following case description you can find out whether the data about the laser standby mode are relevant for your situation: ▪ When a laser device with CPX control without laser standby mode is prepared for its use, the information on the laser standby mode in this interface description can be ignored. ▪ When a laser device with CPX control with laser standby mode is prepared for its use, please observe the information on the laser standby mode in this interface description. ▪ You replace an older laser device with LCU control and laser standby mode with a laser device with CPX control without laser standby mode. Their task is to adapt existing control programs to an external control (e.g. PLC). – In this case, you are often able to continue using the existing control programs without change, in particular if you wait for the LASER_READY signal to continue a process. The LASER_STANDBY signal is inactive. – The standby line must be removed in laser programs which you want to copy from the old to the new laser device. The opening and closing of the central shutter must be programmed explicitly. Further information: Technical information "TruControl 1000 for new users", Doc.-No. 21-A0-57-CP.
Information	▪ If the **LASER_READY** output signal is active, a laser program can be started. The laser standby mode remains active as long as the signal **LASER_STANDBY** is active. ▪ The function **Stdby** has been automatically entered in the first line of the second column of a laser program. ▪ The service life of the pump sources (lamps or laser diodes) can be increased and the power required by the laser can be reduced if laser standby mode is switched off during long waiting times between laser programs. ▪ The laser device is also switched to the laser standby mode by the signal **LASER_STANDBY** if: – the external activation is not active (**EXT_ACTIVATION_ACTIVE** inactive). – the laser device has not been assigned to the external control unit (output signal **LASER_ASSIGNED** inactive).

Tab. 61

LOCK_OPERATING_PANEL

Functions	The laser device cannot be controlled any longer via the operating panel (OP).
Active signal	The following functions can be executed via the operating panel: ▪ laser parameters can no longer be transferred to the laser device. ▪ messages can further be acknowledged.
Feedback	None
Information	An active input signal **LOCK_OPERATING_PANEL** is only considered if the input signal **EXT_ACTIVATION** is active and if the laser device has been assigned.

Tab. 62

LOCK_PROG_PARAM

Functions	Only for TruMicro: Disables the changing of operating point parameters as long as the signal is active.
Active signal	▪ If the signal is active when the program starts, the parameters of the default operating point are applied. ▪ If the signal is active during a line change, the parameters of the last active operating point are applied.
Inactive signal	▪ If the signal is not active when the program starts, the INIT line is executed again and the changed operating point parameters are applied. ▪ If the signal is not active during a line change, the parameters are applied from the new operating point when the operating point is switched.

Tab. 63

PROG_STOP

Functions	Running laser programs can be ended or canceled.
Active signal	**Canceling laser program:** A running laser program is canceled when the following conditions are fulfilled: ▪ The input signal **PROG_STOP** is activated for > 1 ms **and** ▪ in the laser program **Pulse type** ≠ "Continuous wave" (for CW lasers) and **Pulse number** ≠ ∞ ("Continuous") are set. **Ending laser program:** A running laser program is ended when the following conditions are fulfilled: ▪ The input signal **PROG_STOP** is activated for > 1 ms **and** ▪ in the laser program **Pulse type** ≠ "Continuous wave" (for CW lasers) **Pulse number** = ∞ ("Continuous") are set.
Feedback	**Laser program canceled:** ▪ Output signal **PROG_ACTIVE** becomes inactive. ▪ A monitoring message is displayed. ▪ The output signals **MONITORING** and **PROG_CANCELLED** become active. The output signal **PROG_COMPLETED** is not activated because the laser program has not been completely executed. **Laser program completed:** The **PROG_ACTIVE** becomes inactive and the **PROG_COMPLETED** output signal becomes active for approx. 6 s. If, before the 6 s have expired, a change in assignment takes place, and the **PLC_ClearProgCompletedOnSlotChange** system parameter is 1, the **PROG_COMPLETED** signal will be set to inactive.
Information	A canceled laser program cannot be continued. When the **PROG_STOP** input signal is active, and a laser program is supposed to be started: ▪ a monitoring message is displayed. ▪ the output signal **MONITORING** becomes active. ▪ the laser program is not started.

Tab. 64

PILOT_LASER_ON

Functions	Switching the pilot laser of the laser device on and off.	
Active signal	The pilot laser is switched on.	
Inactive signal	Pilot laser is switched off.	
Feedback	The **PILOT_LASER_IS_ON** output signal becomes active when a pilot laser of the laser device is switched on.	
Information	The input signal **PILOT_LASER_ON** and the software function "Pilot laser on" in the dialog are linked by OR.	
	Different hardware types can exist in a laser device as pilot laser. The existing hardware type is defined as follows in the dialog *>Setup >System settings >PilotLaserType*: 1 = Central pilot laser 2 = Pilot laser in shutter switch (VW..) 3 = Pilot laser in central shutter (VZ)	
	The following pilot laser modes can be selected in dialog *>Setup >System settings >PilotLaserMode* for a pilot laser of the hardware type 2 (pilot laser in shutter switch):	
	0 =	Pilot laser is constantly off.
	1 =	The pilot laser is on when the shutter switch is in the neutral position.
	2 =	The pilot laser is on when the safety circuit is open.
	3 =	When the shutter switch is closed, the pilot laser is switched on: ▪ via the dialog *>Producing >Light path overview >Pilot laser overview* ▪ **or** or when the **PILOT_LASER_ON** input signal is active.
	4 =	Pilot laser is switched on when the safety circuit is open: ▪ via the dialog *>Producing >Light path overview >Pilot laser overview* ▪ **or** or when the **PILOT_LASER_ON** input signal is active.
	5 =	The pilot laser is switched on: ▪ via the dialog *>Producing >Light path overview >Pilot laser overview* ▪ **or** or when the **PILOT_LASER_ON** input signal is active.
General condition	The following boundary condition additionally applies with pilot laser modes 3 ... 5: ▪ An external control sends a valid program number to the control unit of the laser device via a Multi-PLC interface (fieldbus, OPC or parallel I/O interface) – with fixed preset light path in the laser program (e.g. light path = 2). – **or** with external preset light path (light path = IW) and defines the number of the light path in the input word 1. The following boundary condition additionally applies to the pilot laser mode 4: ▪ The safety circuit (SIK) is open. **Exceptions:** If an external control: ▪ sends a program no. "0", the last program no. unequal "0" will be used. ▪ sends a light path no. "0", the last light path no. unequal "0" will be used.	
	The pilot laser is switched off irrespective of the pilot laser mode set if the 1-channel safety circuit (ASV3, X24 connector) is used for internal functions (e.g. protection of laser light cable in the user's compartment) **and** this is interrupted.	

Tab. 65

PSTART_DYN

Functions	Laser programs can be started by a short impulse of > 1 ms.
Active signal	A laser program is started by the ascending edge of the **PSTART_DYN** input signal when the **LASER_READY** output signal is active. The program number is read at the start of the laser program. To do so the program number must be continuously available to the inputs signals **PROGRAM_No: bit 0 ... bit 7**. **Notes:**: ▪ If an attempt is made to start a laser program while the **LASER_READY** output signal is inactive, a monitoring message is displayed and the **MONITORING** output signal is activated. ▪ The **PSTART_DYN** input signal is triggered by the signal edges and starts a laser program only once. Before starting a program again, the input signal must be switched to inactive for at least 50 ms.
Feedback	The **PROG_ACTIVE** output signal is activated if a laser program is started and remains active until the laser program is completed or canceled. The **PROG_COMPLETED** output signal is activated for approx. 6 s after the laser program has been completed. The **PROG_COMPLETED** output signal becomes prematurely inactive if, before the 6 s have expired, ▪ a laser program is started again. ▪ a change in assignment takes place, and the **PLC_ClearProgCompletedOnSlotChange** system parameter is 1. The output signals **MONITORING** and **PROG_CANCELLED** become active if a laser program is canceled.
Information	The delay in time from the activation of the **PSTART_DYN** input signal to the delivery of the laser power at the processing point is called laser delay time (LEZ). **LEZ for pulsed lasers:** 35 ... 55 ms, if optical components are moved, depending on the optical components used. 15 ... 20 ms, if the optical components are already set correctly. < 1 ms depending on the times set per software for delay and debouncing time if the functions of the real-time interface are used. **LEZ for laser devices with laser Standby mode:** 35 .. 55 ms (opening time of the shutter) If the input signal **PSTART_DYN** or **PSTART_STATCAL** is activated during the execution of a laser program: ▪ a fault message will be displayed. ▪ the output signals **MONITORING** and **FAULT_LASER** will be activated. ▪ the running laser program will be cancelled. ▪ the output signal **PROG_CANCELLED** will be activated. **Note:** If **Pulse type** = "Continuous wave" (for CW lasers) or **Pulse number** = ∞ ("Continuous") are set within the laser program, the laser program can only be ended by activating the input signals **PROG_STOP**.

Tab. 66

PSTART_STATICAL

Function	Laser programs can be started, ended or cancelled.
Active signal	A laser program is started when: ▪ the input signal **PSTART_STATICAL** for > 1 ms is activated. ▪ **and** the output signal **LASER_READY** is active. The program number is read at the start of the laser program. To do so the program number must be continuously available to the inputs signals **PROGRAM_No: bit 0 ... bit 7**. **Note:** If an attempt is made to start a laser program while the **LASER_READY** output signal inactive, a monitoring message is displayed and the **MONITORING** output signal is activated.
Setting signal to inactive	**Ending a laser program:** A laser program started with **PSTART_STATICAL** is ended when: ▪ the **PSTART_STATICAL** input signal is set to inactive prior to the end of the laser program ▪ **and** in the laser program **Pulse type** ≠ "Continuous wave" (for CW lasers) **Pulse number** = ∞ ("Continuous") is set. **Canceling a laser program:** A laser program started with **PSTART_STATICAL** is cancelled when: ▪ the **PSTART_STATICAL** input signal is set to inactive prior to the end of the laser program ▪ **and**in the laser program **Pulse type** ≠ "Continuous wave" (for CW lasers) and **Pulse number** ≠ ∞ ("Continuous") is set.
Feedback	The **PROG_ACTIVE** output signal is activated if a laser program is started and remains active until the laser program is completed or canceled. The **PROG_COMPLETED** output signal is activated after the laser program has ended. The output signals **MONITORING** and **PROG_CANCELLED** become active if a laser program is canceled.
Information	The delay in time from the activation of the **PSTART_STATICAL** input signal to the delivery of the laser power at the processing point is called laser delay time (LEZ). **LEZ for pulsed lasers:** 35 ... 55 ms if optical components are moved depending on the used optical components. 15 .. 20 ms if optical components are already set correctly. < 1 ms, depending on the times set per software for delay and debouncing time if the functions of the real-time interface are used. **LEZ for laser devices with laser Standby mode:** 35 .. 55 ms (opening time of the shutter) When the **PSTART_DYN** input signal is activated while a laser program that was started with the **PSTART_STATICAL** input signal is running: ▪ no static program start is executed. ▪ a monitoring message is displayed. ▪ the output signal **MONITORING** becomes active.

Tab. 67

REQUEST_LASER

Functions	request the laser device.
Active signal	The laser device is requested by an external control unit.
Feedback	If the laser device has been assigned to the requesting external control unit, the output signal **LASER_ASSIGNED** becomes active.
Information	**The laser device is connected to only one external control unit:** If only one external control unit is connected to the laser device, the input signal **REQUEST_LASER** must be activated by an external control unit as long as the external control unit controls the laser device. The **REQUEST_LASER** signal can also be set to permanently active in this case. **The laser device is connected with two or more external controls via additional Multi PLC interfaces (e.g. fieldbus or OPC):** If two or more external controls are connected to the laser device, the input signal **REQUEST_LASER** must be activated by an external control for as long as the laser device is controlled by the external control. This guarantees that the laser device can be assigned to other external control units. **Assignment procedure** The assignment of the laser is carried out according to priority and in case of the same priority according to the round robin algorithm. Further Information: (see "LASER_ASSIGNED", pg. 83) The following parameters can be used to output a bit-coded overview showing which MPI slots have requested the laser using the **REQUEST_LASER** signal: ▪ Request Laser Slot 1-16 for MPI slots 1 to 16. ▪ Request Laser Slot 17-32 for MPI slots 17 to 32. Both parameters must be assigned to an output word in the *>Setup >Interface parameters* dialog. The bit for its own MPI slot number is not set. Further information: (see "Other output parameters", pg. 106). **Sleep mode** If the system parameter **LCU_Sleep_1_Timeout** > 0, the input signal **LASER_ON** is active and the input signal **REQUEST_LASER** remains inactive for this time, the Sleep mode 1 is activated. For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP. An external control unit can start a laser program of type "No pulse triggering", even if the laser device is not assigned to the external control unit.

Tab. 68

RESET

Functions	Acknowledges laser device messages and initializes the laser device control again when a malfunction has occurred.
Active signal	The Reset function is carried out when the **RESET** input signal is active for > 1 ms.
Requirement	IF TruControl version ≥ 3.10.0 then **EXT_ACTIVATION** must be set and **FAULT_EXT** must not be set.
Feedback	With “Monitoring”: ▪ Output signal **MONITORING** becomes inactive. ▪ The displayed monitoring message is deleted. ▪ The laser program is continued. With "Monitoring" and "Program cancelled": ▪ Output signal **MONITORING** becomes inactive. ▪ The displayed monitoring message is deleted. ▪ Output signal **LASER_READY** becomes active. ▪ The laser programs can be started. With “Monitoring” and “Laser fault”: The laser control unit is reinitialized. **Note:** If no fault has occurred during initialization, the laser can be switched on again via the interface and the operation can be continued.
Information	The signal **RESET** and the message behavior are influenced by different system parameters. Further information: (see "Messaging and RESET behavior", pg. 143). If the frequency of monitoring and fault messages increases, maintenance and repair measures may be necessary.

Tab. 69

UNSYNC_PSTART

Functions	Switching on the mode for unsynchronized triggering.
Active signal	The mode for an unsynchronized triggering has been switched on.
Feedback	None
Information	In the mode for unsynchronized triggering, the laser device activates the output signal **LASER_READY**, even if the laser device has not been assigned. An active output signal **LASER_READY** means in case of active input signal **UNSYNC_PSTART**: ▪ The start of a laser program is possible. ▪ The laser device can also be assigned to another external control unit. ▪ The safety circuit SIK is closed. ▪ The laser is in the laser standby mode (only laser devices with laser standby mode). ▪ No fault of the laser device has been detected. ▪ A laser program has not been cancelled and acknowledged via the output signal **PROG_CANCELLED**. Further information: Activation of the laser device (see "Triggering", pg. 119). Timing diagram(see "Unsynchronized Triggering of a laser device", pg. 135).

Tab. 70

SIMULATION

⚠ WARNING

Laser light may be emitted in the simulation mode if the safety circuit is closed.

Laser light can irreparably damage your eyes.

Laser light can burn your skin.

- Before working in the simulation mode, make sure that the safety circuit is open and cannot be closed by unauthorized persons!
- Make sure that all persons in the dangerous area will wear laser safety goggles suitable for the wave length of the laser light (see notice signs).
- If there are persons within the danger area, surround the processing point with a protective cover.
- If you work within the danger area, do not reach between focusing optics and workpiece.
- If you notice troubles with your eyes or burnt skin, please contact a physician even if you are not able to determine laser light as the direct cause.

Functions	Activates the simulation mode
Active signal	The external control unit requests the laser control unit of the laser device to activate the simulation mode.
Requirement	A central shutter (VZ) must be available in the laser device. For laser devices without a central shutter this signal remains ineffective.
Feedback	The LASER_READY output signal also becomes active with open SIK.
Information	The simulation mode closes the central shutter. The laser beam is guided into the absorber of the central shutter. Laser light is **not** emitted in this case. In simulation mode, a laser program can be also started with open SIK. The sequence of a laser program can be observed on the workpiece in combination with a pilot laser. For further information: see software manual "TruControl 1000", doc. no. 10-06-80-A1-CR. The simulation mode can also be activated in the >*Setup* dialog.

Tab. 71

4.2 Signals of input word 1

LIGHT_PATH_No: Bit 7 ... Bit 0

Functions	The 8 input signals **LIGHT_PATH_No: bit 7 ... bit 0** are used to select the light path through which the laser device is to output laser power.
Coding of the light path no.	The significance of the 8 input signals is defined from **LIGHT_PATH_No: bit 7** (high) to **LIGHT_PATH_No: bit 0** (low). Format: Hexadecimal. Number of selectable light path numbers: 255 dec = FF hex. Example: light path no. 25 dec = 0001 1001 bin = 19 hex
Feedback	Via the output signals **LIGHT_PATH_No: bit 7 ... bit 0** the control of the laser device acknowledges output 1, the number of the currently set light path.
Information	**Without ILN (Interface LaserNetwork)** The number of the light path must be predefined by the external control unit. The numbers of the light paths assigned to the laser device are defined in the dialog *>Technology >Light path*. **With ILN:** The light path number must be identical to the number which is transmitted from the laser device to the processing station via the LLK coding cable assigned to the light path. Further information: Interface description "ILN3", Dok.-Nr. 30-72-69-A1-BA. **With TLN-fc (TRUMPF LaserNetwork fieldbus coded)**: The light paths are fieldbus coded. External control units do not need to predefine a light path. The light paths are assigned via the dialog *>Setup >Multi PLC interface (MPI)*. Further information: Technical information "TRUMPF LaserNetwork (TLN and TLN-fc)", Doc.-No. 21-01-38-CP.

Tab. 72

PROGRAM_No: bit 7 ... bit 0

Functions	Using the 8 input signals **PROGRAM_No: Bit 7 ... Bit 0** the laser program to be started is selected.
Coding of the program no.	The significance of the 8 input signals is defined from **PROGRAM_No: bit 7** (high) to **PROGRAM_No: bit 0** (low). Format: Hexadecimal. Laser programs with special function ▪ 240 dec ... 250 dec (F0 hex ... FA hex), examples: – 240 dec. (F0 hex): BeamCalibration, available if the laser device is equipped with option LLK-U (see "ALIGNMENT_RECOMMENDED", pg. 116). – 244 dec. (F4 hex): lamp factor optimization (LFO) – 245 dec. (F5 hex): Laser self test ▪ 0 dec. (0 hex): Program number 0 is used to set the laser device to a defined status if all signals are set to 0. For a laser program to be created with program number 0, the system parameter **min. program no.** in the *>Setup >Program setting* menu must be set to 0. Inadmissible values: ▪ 201 dec ... 239 dec (C9 hex ... EF hex) ▪ 251 dec ... 255 dec (FB hex ... FF hex) Number of selectable laser programs: 200 dec = C8 hex, without program number 0.
Feedback	If, during program start, an inadmissible program number is applied by the input signals **PROGRAM_No: bit 7 ... bit 0**: ▪ a monitoring message is displayed. ▪ the output signal **MONITORING** becomes active. ▪ no laser program is started.
Information	▪ The input signals **PROGRAM_No: bit 7 ... Bit 0** are read when the input signal **PSTART_STATICAL** or **PSTART_DYN** has been activated. ▪ The next program number may already be created when the **PROG_ACTIVE** output signal is active after the start of a laser program. ▪ If the **PROG_COMPLETED** signal becomes active after the completion of a laser program and the new program number has already been applied, the control unit keeps the **LASER_READY** signal inactive until the optical components are set to the light path of the new laser program. ▪ If in a laser device of the TruMicro 5000 series the basic frequency in the new laser program was changed, the signal **LASER_READY** will remain active until the new basic frequency has been set, which may take up to 30 sec. ▪ If the program number of a laser program of the type "No pulse triggering" has been created, the signal **LASER_READY** is active and the laser program can be started without assignment. ▪ An active laser program is canceled if, during the program number change, the program type changes as follows: – From "Standard" to "No pulse triggering" – From "No pulse triggering" to "Standard" ▪ If a laser program of the type "No pulse triggering" is started by the external control unit with assignment, the **Program active**  symbol is not displayed on the user interface of TruControl 1000. ▪ If an external control unit without assignment wants to start a laser program of the type "Standard", the laser program is not started and no message is output.

Tab. 73

4.3 Signals of input word 2

AD_No: bit 7 ... bit 0

Functions	The 8 input signals **AD_No: bit 7 ... bit°0** are used to select the number of the application data set with whose data a connected focusing optics is monitored.
Coding of the application data set no.	The significance of the 8 input signals is defined from **AD_No: bit 7** (high) to **AD_No: bit 0** (low). Format: Hexadecimal. Number of selectable data sets: 1 ... 255 dec = 01 ... FF hex. Example: application data set no. 55 dec = 0011 0111 bin = 37 hex. Monitoring of the connected focusing optics is switched off by selecting the number "0".
Feedback	Status of the focusing optics via bits 15 ... 8 of the output word 2.
Information	The dialog >*Setup* >*Application data* allows to create new application data records and to modify application data.

Tab. 74

LASER_No: bit 7 ... 0

Function	The 8 input signals **LASER_No: bit 7 ... bit 0** are used by an external control unit to select the number of the laser device which is expected to provide laser power.
Coding of the laser device no.	The significance of the 8 input signals is defined from **LASER_No: bit 7** (high) to **LASER_No: bit 0** (low). Format: Hexadecimal. Number of the selectable laser devices: 255 dec = FF hex. Example: laser device no. 12 dec = 0000 1011 bin = 0C hex.
Feedback	The control of the laser device supplies the number assigned to the laser device via the output signals **LASER_No: bit 7 ... bit 0** of output word 3.
Information	In the case of laser devices with LaserNetwork interface (ILN), the numbers of the laser devices are transmitted from the laser device to external control units by means of connected LLK coding cables. Without ILN, the external control units must define the numbers of the laser devices. If the variable "MPI_CheckLaserNumber" is set to TRUE in the dialog >*Setup* >*System settings* >*Field bus*: ▪ the control of the laser device compares the laser number at the inputs **LASER_No: bit 7 ... bit 0** with the number assigned to the laser device. ▪ the control unit of the laser device indicates a fault if the laser numbers compared are not identical. The comparison of the laser number is switched off, if the variable "MPI_CheckLaserNumber" is set to FALSE. The laser number is assigned to a laser device via the dialog >*Setup* >*System settings* >*Fieldbus* of the variable "MPI_LaserNumber".

Tab. 75

4.4 Parameters for laser programs

For the parameter transfer during the laser program runtime the following can be transmitted:

- Input words IW3 ... IW13.
- Input words IW14 and IW15 if system parameter **PLC_ExtendBaseIoFunction** = 0.
- Input words IW16 ... IW63,
  if TruControl 1000 version ≥ 1.84.0.

For DeviceNet slave, the input words IW10 .. IW63 are available if TruControl 1000 version ≥ 1.88.0.

A placeholder can be entered in the laser program for the transmission of parameters instead of a fixed value. It defines the input word starting from which the value has to be loaded during the runtime of a laser program.

These values can be changed during the program run. For example the laser power can be changed while the laser program is running.

The period between the time when a power value is enabled at the fieldbus interface and the moment it becomes effective at the workpiece lasts for approx. 5 ms. For OPC, the time of effectiveness depends on the system utilization.

The value of the data bits 15 ... 0 is defined from 15 (high) to 0 (low).

In the following tables, possible parameters and their resolution are listed, which can be transmitted to the control of the laser device via input words IW3 ... IW63.

For further information: see software manual "TruControl 1000", doc. no. 10-06-80-A1-CR.

Parameter	Definition	Note
Laser power	1 W/Digit	For laser devices of the TruMicro series, the laser power is given in steps of 0.1 % of the rated power (see "Tab. 87", pg. 71).
Frequency	0.1 Hz/digit	The actual frequency at the set value 0 Hz and the behavior in case of a frequency change depend on the following criteria: ▪ For TruControl 1000 version ≥ 1.74.0 and the DLC versions starting from DLC_0822, DLCD1225, DLCD1610, DLCM1220 and DLCM1701 – A frequency change will become effective immediately after the end of the current laser pulse. The duration of the next pulse gap is already calculated using the new frequency. – If the frequency = 0 Hz is set, the actual frequency is 0 Hz. No laser pulse is emitted. For this reason, the laser can be triggered with the help of the frequency. ▪ For TruControl 1000 version < 1.74.0, or older DLC versions: – A frequency change will become effective after the pulse pause. – If the frequency = 0 Hz is set, the actual frequency is 0.1 Hz. A laser pulse is emitted every 10 seconds.
Pulse duration	1 µs/digit 10 µs/digit 100 µs/digit 1000 µs/digit	The resolution depends on the system parameter PLC_PulseDurationResolution. Presetting: 10 µs/digit
Number of pulses	Number	Number of laser pulses.
Start ramp	1 %/digit	For pulsed lasers only possible if pulse number > 1
End ramp	1 %/digit	
PK pulse number	1/digit	Number of pulses for monitoring of the pulse counter. PK pulse number is available with CW lasers if pulse counter check = "With monitoring" or = "With fault".
Pulse gap power	1 W/digit	Power in the pulse gap. Pulse gap power is available with CW lasers if pulse gap parameter = With power specification and pulse type = rectangle or pulse shape.

Parameters for all laser devices Tab. 76

Parameter	Definition	Note
Beam splitter position	1 increment/ digit	Position of the variable beam splitter. The beam splitter position does not equate to the splitting ratio. The position of the beam splitter must be determined by the user via the application. The position of the variable beam splitter is only changed if a line is changed in the laser program.

Parameters for motor-driven beam splitters (TM) Tab. 77

Parameter	Definition	Remark
Pulse power	1 W/Digit	Set value for the pulse power
Average power	1 W/Digit	Set value for the average power
Frequency	1 Hz/Digit	Set value for the frequency
PLS parameters	Parameters for PierceLine - PLS start - PLS number - Material thickness	
Further information: Technical Information "PFP-Control and PierceLine", Doc.-No. 21-A0-61-CP.		

Parameters for PFP Control and PierceLine Tab. 78

Parameter	Definition	Note
Monitoring	0.1 %/Digit	Limit value for monitoring message.
Errors	0.1 %/Digit	Limit value for fault message.

PCP parameters Tab. 79

Parameter	Definition	Remark
PFO Program number	Number and parameter	Bit 0 : Bit 9 If IPFO bit = 0: PFO program number, value range: 1 ... 999 dec. If IPFO bit = 1: IPFO job number, value range: 1 ... 32 dec. Bit 10 IPFO: If IPFO = 0, bits 0 - 9 = PFO program number. If IPFO = 1, bits 0 - 9 = IPFO job number. Bit 11 ExtEn: If ExtEn = 1 the job lines marked with "P" ("Active") and "P V.Aktiv" ("VarActive") will be executed with laser power. If ExtEn = 0 the job lines marked with "P" ("Active") and "P V.Aktiv" ("VarActive") will be executed without laser power. Bit 12 SeamLine: seam tracking Bit 13 RETRY: program mode selection If RETRY = 0, normal, complete execution of the PFO program. If RETRY = 1, execution starts at the time that the PFO program with the same number is aborted after being called up just before. Bit 14 ERROR_SV_LIMITER: If ERROR_SV_LIMITER = 1, a fault message is generated when the scanning volume is exceeded. If ERROR_SV_LIMITER = 0, a warning message is generated when the scanning volume is exceeded (factory setting). Bit 15 RTS: RealTimeStart (only for PFO programs) If RTS = 1, the PFO positions the scanner mirror to the start position and waits for the digital input "RealTimeStart". If RTS = 0, the PFO program is executed normally. The start is performed via the laser program.
PFO coordinate X	10 µm/Digit[1)]	With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO coordinate Y	10 µm/Digit[1)]	With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO coordinate Z	10 µm/Digit[1)]	With PFO 3D, ab PFO_3003. With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO coordinate for defocus	10 µm/Digit[1)]	With PFO 3D, ab PFO_3003. With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO Trans X	10 µm/Digit[1)]	With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO Trans Y	10 µm/Digit[1)]	With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].
PFO Trans Z	10 µm/Digit[1)]	With PFO 3D, ab PFO_3003. With PFO 3D-2, ID=0x4E: 1 µm/Digit[1)].

1) The resolution can be set in the *>Laser program editor >Laser program settings* menu with parameter *PFO ext. setting*.

Note
If parameter *PFO ext. setting* is set to 1 µm and the PFO works with a resolution of 10 µm, the set value in the laser control will be automatically converted.

Parameter	Definition	Remark
PFO Rotation[1]	The resolution depends on the system parameter **FO_PFO_TransRotationResolution**:	
	0.1°/digit	= 0: Angle in degrees. Value range: -180° ... +180°
	1 step = 0.0055°/digit[1]	= 1: Angle in steps[1] or 0.0055 °/Digit value range: 0 ... 65535 steps corresponds 0° ... 360°
	0.1°/digit or 1 step[1]	= 2: Selection in the laser program The rotation can be specified in degrees (0.1°/digit) or in increments[1] in the laser program for each line.
PFO rotation X[1]	For PFO 3D-2, ID=0x4E. Value ranges and resolution, see PFO Rotation.	
PFO rotation Y[1]		
PFO program runs	Quantity	Value range: 1 ... 65535 dec.
PFO scaling X	100 or -100	Only reflection (value 100 or -100) is allowed. PFO scaling X and Y parameters not available for a PFO 20-2 PO with command version ≥ 145.
PFO scaling Y		
PFO: scan width X	1 µm	For PFO 20-2 PO with command version ≥ 145 and TruControl version ≥ 2.78.0: width of the hardening track if laser program parameter "PFO: scan width" ≠ "No specification".
PFO: scan width Y		
Parameter for on the fly mode	If PFO parameter: on the fly = Simple Coordination: Simple linear motion by specifying the axis speeds.	
PFO: feed X	1 mm/s	If the PFO needs to be moved then the feed rates must be specified as positive. If the workpiece needs to be moved then the feed rates must be specified as negative. Value range: -1000 mm/s - 1000 mm/s
PFO: feed Y		
PFO: feed Z		
PFO: Start delay	0.1 ms	If it is not started directly at the processing point then the start can be delayed with the **Start delay** parameter. Value range: 0 ms - 6000 ms
Wobble program parameter[2]	If Wobble program - parameter specification = Yes is set in the laser program, the following parameters can be set externally via the Multi-PLC-interface:	
Wobble program		Number of the wobble program. Value range: 1 to 100.
Wobble width	1 µm/digit	Width of the wobble geometry. value range: 0.1 mm to 10 mm.
Length	1 µm/digit	Length of the wobble geometry. value range: 0.1 mm to 10 mm.
Frequency	1 Hz/Digit	Frequency of the wobble movement. Value range: ▪ Minimum value: 10 % of the set frequency in the wobble program, min. 1 Hz. ▪ Maximum value: set frequency in the wobble program, max. 1000 Hz.

1) If a PFO does not support the specification in increments and the system parameter **FO_PFO_TransRotationResolution** is > 0, the message 0000 E4AC is displayed during start-up of the system.
If an existing laser program has another resolution than programmed in the system setting, the selection is displayed as soon as the existing laser program is edited. This selection can no longer be subsequently changed in the laser program.
If the specification in increments is selected, the corresponding angle is calculated and displayed in the laser program.

2) Available from TC 3.36 on, if the PFO supports wobbling.
Which parameters are available depends on the wobble shape selected in the wobble program.
Further information: Software manual "TruControl 1000 for PFO 14, PFO 20, PFO 33, PFO 33 (KF023), PFO 3D, PFO 3D-2 PO, SFO", Dok.-Nr. 12-12-14-A2-CR

Parameter	Definition	Remark
PFO: fieldbus control		If in the laser program **PFO: fieldbus control** = is set to yes, new PFO program data sets are already provided during the active PFO program cycle via the selected input word **PFO: fieldbus control - Input signals** for the next PFO program cycle. The parameters **Store Values 1 and 2** signal that new PFO program data sets are available. If new data sets are made available, the values of the output signals **PFODataRdy 1 and 2** from the selected output word **PFO fieldbus control state** must be mirrored in the input signals **StoreValues 1 and 2** so that the new data sets are used by the laser control unit. The combination **PFO:fieldbus control** = Yes and **PFO: real-time start** = Yes is not permitted.
Bit 0	Store Values 1	
Bit 1	Store Values 2	

PFO parameters Tab. 80

Parameter	Definition	Remark
Focus position/lense position	10 µm/digit	Set value for the focus/lens position for programmable motorized focusing (PMF), with TruControl 1000 version < 2.34.0: CCM (**C**ontrol **C**ollimation **M**otor). **Notes** If FO_CollimationMotor system parameter: = 0, set value for the focus position = 1: set value for the lens position The actual value should be synchronized with the set value by the external control (e.g. PLC). The set value can only be specified by the assigned slot. The recipient of the set value is the PMF used in the laser program. While the PMF is moving to a new position, the emission of laser light is suppressed if the set values are permanently defined in the laser program. Further information: Operator's manual of the PMF, doc.-no. 22-50-01-A369-CR.
RM: Position	Set value and setting	Position and mode of the direction of rotation of the rotary modules (Rotary Module, RM) of the programmable motorized focusing (PMF), with TruControl 1000 version < 2.34.0: CCM (**C**ontrol **C**ollimation **M**otor). Bit 15: mode of the direction of rotation = 0 automatic smallest angle of rotation = 1 bit 14 is evaluated bit 14: direction of rotation, if bit 15 = 1 = 0 counterclockwise (positive) = 1 clockwise, in top view bits 8 ... 0: set value for the orientation, 0 ... 360 degrees absolute If the value is > 360 degrees, a fault message is output . **Notes** If an unassigned slot activates a laser program with rotary module, the information light path and RM position of the first line are used to move the rotary module. The actual value should be synchronized with the set value by the external control (e.g. PLC). Interface parameters **Byte swap** must be taken into account. Further information: Operator's manual of the PMF, doc.-no. 22-50-01-A369-CR. Operator's manual of the rotary module, doc-no. 22-50-01-A419-CR.

PMF parameters Tab. 81

Parameter	Definition	Remark
PCC →	Set value	Set value for the laser power, which is converted to laser power using the specified process characteristic curve.[1)]. Value range: 0 ... 32767
PCC #	Number	Number of the process characteristic curve which is used to convert the set value into laser power[1)].
1) Requirement: System parameter **ProcessCharacteristic** = 1 and the parameter *Pulse type* is set to *Process characteristic curve* in the laser program.		

Parameters for process characteristic curve (PCC) Tab. 82

Parameter	Definition	Note
Temperature	0.1 °C/digit	Process temperature during TPC mode = Temperature direct.

Parameters for TPC programs Tab. 83

Parameter	Remark
Parameters for the SeamLine Remote (SL) option for seam position control when welding with PFO, if system parameter **FO_PFO_ScanLine** = 1 and laser program parameter *PFO mode* = *SeamLine Basic*.	
SL: Feed rate	Feed rate in mm/s
SL: Configuration	SL configuration: SL_CONFIG_NO: Number of the SeamLine Remote configuration. Value range: 0 ... 65535.
SL: Seam number	SL seam number: SL_JOIN_NO
SL: Control	SL control: Bit 0: SL_WORKPIECE_START Welding process with seam position control is started.
SeamLine Remote additionally uses parameters **workpiece serial number** (see "Parameter transfer to the laser program settings", pg. 74)). Further information: operator's manual "SeamLine Remote (SE18)", doc no. 83-01-04-A0-CR.	

Parameters for SeamLine Remote Tab. 84

Parameter	Remark				
If an FCM (Focus Change Motor-driven) component is present in the light path, the laser beam is divided with the FCM and fed into a 2-in-1 LLK or 3-in-1-LLK. The division of the laser power between the core and the ring is set as follows:					
Processing	**Value**	**Power density distribution**	**Default in TruControl**	**Use**	**LLK**
	0	100 % core	Core	Arbitrary.	2-in-1. 3-in-1.
	1	100 % ring 1	Ring	Arbitrary.	2-in-1. 3-in-1.
	2	100 % ring 2	Ring 2	FusionLine.	3-in-1.
	3	**Power share core** parameter	BrightLine Weld	BrightLine Weld.	2-in-1.
Power share core	If the parameter **Processing** = *3* the power share of the core is set with this parameter. Value range: 10% ... 90%, increment: 1%, from TruControl 1000 Version 3.28: Value range 0% ... 100%.			BrightLine Weld.	2-in-1.
For further information: see software manual "TruControl 1000", doc. no. 10-06-80-A1-CR.					

Parameters for BrightLine Weld and FusionLine Tab. 85

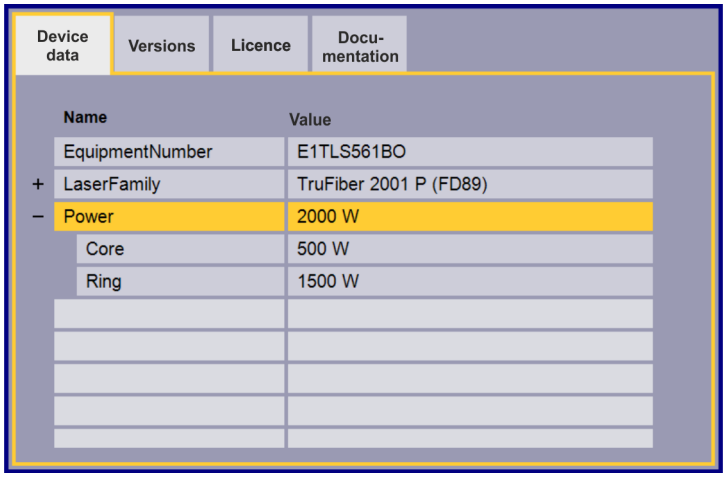
Parameter	Definition	Note
Cutting parameter set number	Number	Value range: 1 ... 200 dec.
Cutting speed	0.01 m/min/digit	
Max. cutting speed	0.01 m/min/digit	

Additional parameters for CW lasers and laser devices with CutAssist module Tab. 86

Parameter	Definition	Remark
Laser power	0.1 %/digit	Laser power in steps of 0.1 % of the rated power
Base frequency[1)]	1 Hz/digit 10 Hz/digit 100 Hz/digit 1000 Hz/digit	The resolution for the base frequency can be set using the system parameter PLC_BaseFrequencyResolution [1)]. Presettings: ▪ TruMicro 8000: 10 Hz/digit ▪ TruMicro 7000: 10 Hz/digit ▪ TruMicro 6000: 1000 Hz/digit ▪ TruMicro 5000: 1000 Hz/digit ▪ TruMicro 2000: 1000 Hz/digit
Beam splitter[1)]	1/digit	Valid values: ≥ 1[1)].
Work frequency [1)]	kHz	Set value of the work frequency between 0 Hz and the base frequency[1)]. The base frequency is used if work frequency = max. The base frequency depends on the set operating point.
Burst pattern		When Burst Mode option is activated, the burst pattern can be specified with this parameter. The highest-value bit must always be 1, i. e. Burst pattern ≥ 0x8000 hex...
Short pulse duration	1 fs/digit	Short pulse duration when the "Pulse duration flexible" option is activated.
Short pulse count	1 pulse/digit	Number of ultra-short pulses for laser devices in the family 20-20-xx-xx (FU11).
Energy level	µJ	With laser devices of the 20-20-xx-xx (FU11) family, the energy level determines the energy of a single short pulse with laser power = 100%**).
1) Depending on the laser device, the following parameters are available: ▪ Base frequency and splitter Work frequency = base frequency/beam splitter ▪ Work frequency		
Further information: See the operator's manual of the laser device.		

Additional parameters for laser devices of the TruMicro series Tab. 87

Parameter	Definition	Remark
Pulse modulation		
Pulse duration	1 µs/Digit	System parameter PulseModulationDuration_Step
Frequency	10 Hz/digit	System parameter PulseModulationRate_Step
VariMode[1)]	0 or 1	Switching on VariMode If the VariMode option[1)] is available, this option is switched on with Bit 0 = 1. If VariMode is switched on, the fiber is squeezed to change the beam properties. The laser is switched off during the switch-over of VariMode. If a program line is active, VariMode cannot be switched over. The switch-over takes place during a line change.
Laser power[1)]	Distribution of laser power in LLK core and LLK Ring if the BrightLine Mode option[1)] is used.	
Power core	1 W/digit	Power in LLK core
Power ring	1 W/digit	Power in the LLK ring
	The maximum possible set values for the power in the core and ring can be found under *>Help >Device data >Power* from TC 3.40 on.	



1) Available, e.g. for laser devices in the TruFiber P series (FD89), laser device family 20-14-01-xx.

Additional parameters for laser devices of the TruFiber series Tab. 88

Parameter	Remark					
Seam ID						
Start address	Start address for the seam ID.					
Number of words	Number of input words for the seam ID. The seam ID must be given in the ASCII format. If the seam ID is shorter than the specified number of words, the rest of the input words must each be filled with "0x0000". The central processor CPX transmits the seam ID to the focusing optics and VisionLine OCT Check. Example: seam ID: "**SeamID123**", Start address: **IW14**, number of words: **6**					
	Input word	**Value, hex**	**Character**	**Input word**	**Value, hex**	**Character**
	IW14	0x5365	Se	IW17	0x3132	12
	IW15	0x616D	on	IW18	0x3300	3
	IW16	0x4944	ID	IW19	0x0000	
workpiece series number	Description (see "Parameter transfer to the laser program settings", pg. 74)					
Workpiece ID						

Traceability data Tab. 89

Examples

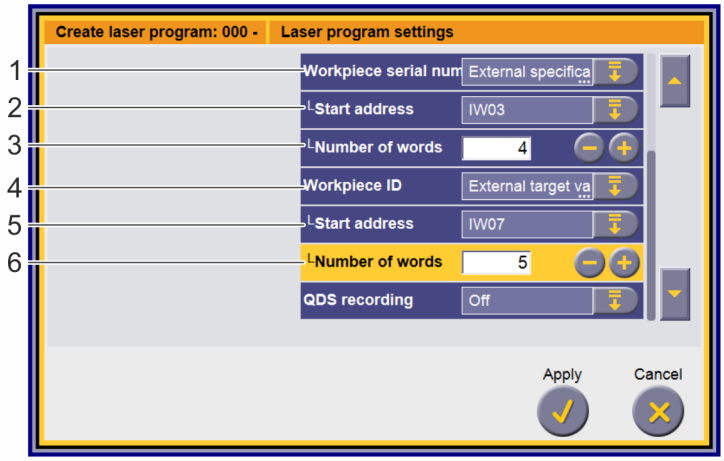
Parameter	Value	Resolution:	Data word, hexadecimal
Laser power	600 W	1 W/digit	0258
Pulse duration	5,000 µs	10 µs/digit	01F4
Frequency	45.0 Hz	0.1 Hz/digit	01C2
Start ramp	30 %	1 %/digit	001E
PFO program number	550	1/digit	0226
PFO rotation	270.5°	0.1°/digit	0A91
PFO coordinate X	5.00 mm	10 µm/digit	01F4
Cutting parameter set number	150	1/digit	0096
Cutting speed	3 m/min	10 mm/min	012C
Focal position/lens position (PMF)	1.24 mm -1.24 mm	10 µm/digit	007C FF84
Wobble program			
Wobble program	22	1/digit	0016
Wobble width	5.0 mm	1 µm/digit	1388
Length	1.0 mm	1 µm/digit	03E8
Frequency	200 Hz	1 Hz/Digit	00C8

Tab. 90

Parameter transfer to the laser program settings

The following parameters can be transmitted in the laser program settings:

- Workpiece serial number
- Workpiece ID



1	External specification of the workpiece number	4	External specification of the workpiece ID
2	Start address	5	Start address
3	Number of input words	6	Number of input words

Configuring specification of the workpiece serial number and ID in the laser program settings

Fig. TE-00133

The workpieces serial number and ID are used for different applications. Examples:

- For using focusing optics with TPC sensor, e.g. **PFO 20-2 PO**.

  Further information: Operator's manual "Programmable focusing optics PFO 20-2 PO", doc no. 12-12-21-A5-CR.
- When using focusing optics with SeamLine Remote, e.g. PFO with SeamLine Remote.

  Further information: Operator's manual "SeamLine Remote (SE18)", doc no. 83-01-04-A0-CR.
- When using a focusing optics with VisionLine OCT Check, e.g. PFO with OCT sensor.

  Further information: Software manual "VisionLine OCT Check", doc. no. 83-01-07-A0-CR.

The central processor CPX transfers the workpiece serial number and ID to the focusing optics and to VisionLine OCT Check. The quality data of the focusing optics is recorded on a QDS PC. The QDS PC receives the workpiece serial number and ID for the corresponding quality data about the OPC from the central processor CPX.
The **workpiece serial number** (1) can be set externally. To do so, the start address (2), the serial number and the number of the input words (3) are entered in the laser program settings.

The workpiece serial number must be specified in the ASCII format. If the workpiece serial number is shorter than the specified number of words, the rest of the input words must each be filled with *0x0000*.
Example:
Workpiece serial number: "WPSN12"
Start address: IW06
Number of words: 4

Input word	Value, hex	Character
IW06	0x5750	WP
IW07	0x534E	SN
IW08	0x3132	12
IW09	0x0000	

Workpiece serial number, example Tab. 91

The **workpiece ID** (4) can be specified externally as well. To do so, the start address (5) and the number of input words (6) is entered.
The workpiece ID must be specified in the ASCII format. If the workpiece ID is shorter than the specified number of words, the rest of the input words must each be filled with *0x0000*.
Example:
Workpiece serial number: "WPID90"
Start address: IW10
Number of words: 4

Input word	Value, hex	Character
IW10	0x5750	WP
IW11	0x4944	ID
IW12	0x3930	90
IW13	0x0000	

Workpiece ID, example Tab. 92

The laser program settings are called up in the laser program editor with the *Change properties* button.
Further information: Software manual "TruControl 1000", Dok.-Nr. 10-06-80-A1-CR.

4.5 Other input parameters

If TruControl 1000 version ≥ 1.88.0, the following input words can be freely assigned in the dialog >*Setup* >*Interface parameters*, tab >*Inputs*:

- Input words 3 ... 13 and 16 ... 63.
- Input words 14 and 15 if system parameter **PLC_ExtendBaseloFunction** = 0.

For further information: software manual "TruControl 1000", doc. no. 10-06-80-A1-CR.

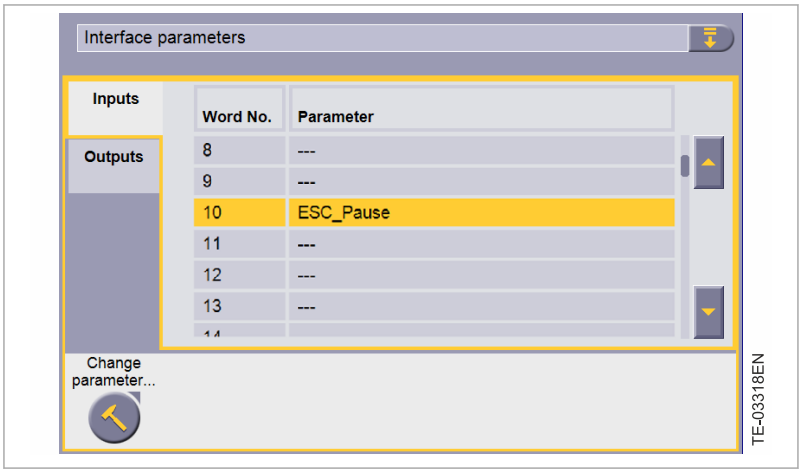


Fig. TE-03318

	If you want to assign another input parameter to an input word, select *Change parameter*.

Tab. 93

If for the input words 2 .. 63 the parameter **Default value** is selected, then the input words 2 ... 63 can be used for laser programs.

The following table contains the description of the other input parameters.

Parameter	Description
PLC input (CV) x words[1)]	Parameter for the image processing system VisionLine, x = 6, 8 or 16 input words.
Pause (ESC)	Parameter "Pause (ESC)" contains the signal ESC_PAUSE. The ESC_PAUSE signal is used to put the laser device in an energy-saving state or to exit this state (see "ESC_PAUSE", pg. 77).
Line Laser (PFO)	Switches on line laser of a PFO. The input word is bit-coded with the following assignment: Bit 0: PFO 1 ... Bit 7: PFO 8.
FCU/PCU lid state	Parameter for opening or closing the lid of an FCU or PCU. High byte: numbers of the CLI with FCU. Low byte: numbers of the CLI with PCU. The number is specified according to the NUM scheme. Example: In order to open the PCU lid of the CLI with NUM = 0x04, the sequence 0x0004 must be transferred in the input word. All other lids of the available FCU or PCU are closed if these were open.
PLC input (VLCK) 13 words[2)]	Parameter for option VisionLine Check with focusing optics BEO and OCT sensor: ▪ Word 1: VLCK-Control: – Bit 0: PreTrigger – Bit 1: InTrigger ▪ Word 2,3: X-position, 4 bytes ▪ Word 4,5: Y-position, 4 bytes ▪ Word 6,7: Z-position, 4 bytes ▪ Word 8,9: A-rotation, 4 bytes ▪ Word 10,11: B-rotation, 4 bytes ▪ Wort 12,13: C-rotation, 4 bytes
Sensor Relay Input x Words	Input data of the sensor relay, x = 9, 16, 32 or 48 (see "Configuring the sensor relay", pg. 185)
1) Parameter PLC input (CV) x words are not available to the VisionLine interface. 2) Available from TruControl 1000 version 3.46 on, further information: Software manual "VisionLine OCT Check", Doc.-no. 83-01-07-A0-CR.	
The availability of these parameters depends on the configuration of the laser device.	

Tab. 94

ESC_PAUSE

Functions	Input signal **ESC_PAUSE**.
Active signal	▪ If ESC_PAUSE > 0 and ESC_PAUSE < 65535 (= 0xFFFF): The external control sends "Start pause" with a specification of the pause time in seconds. The corresponding Energy Save Level is switched to depending on the pause time. ▪ If ESC_PAUSE = 65535 (= 0xFFFF): The external control sends "End Pause" to end the pause. The laser control changes to the status "Ready_To_Operate". ▪ If ESC_PAUSE = 0: The external control acknowledges the receipt of the output signals. The laser control status does not change.
Information	Technical information "Energy Save Concept", doc.-no. 21-A0-71-CP.

Tab. 95

4.6 Signals of the alternative input words 14 and 15

Note

The input words 14 and 15 are available for DeviceNet slave if TruControl 1000 version ≥ 1.88.0.

ENERGY_SAVE_ON

Functions	Switches on the energy-saving mode (Sleep mode 3) of the laser control.
Active signal (positive edge)	By applying the positive edge of the signal, the external control unit requests the laser control to switch the laser device to the energy-saving mode.
Requirement	This input signal is only available if the following conditions have been met: ▪ System parameter **PLC_ExtendBaseIoFunction** = 1. ▪ System parameter **LCU_EnergySaveMode** > 0. ▪ CPX V3 or V4 is available and the input **24 V_STDBY** at X1 of the PBT board is supplied with voltage. If the system parameter **ESC_Enable** is active, the laser devices switch between Energy Save Level and Ready_To_Operate with the signals ESC_Pause > 0 and ESC_Pause = 0 . In this case, you should not use the signal ENERGY_SAVE_ON.
Information	The laser device must not be assigned to the external control. The laser device and all laser control components except for the CPX and PBT are switched off. Optimized standby mode is ended with the signal **ENERGY_SAVE_OFF**. For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP. Not available for laser devices with CPX V20.
Feedback	The following output words indicate that the energy-saving mode has been switched on: ▪ LASER_CONTROL_IS_ON = FALSE ▪ ENERGY_SAVE_IS_ON = TRUE

Tab. 96

ENERGY_SAVE_OFF

Functions	Switches off the energy-saving mode (Sleep mode 3) of the laser control.
Active signal (positive edge)	By applying the positive edge of the signal, the external control unit requests the laser control to switch itself on and to terminate the energy-saving mode.
Requirement	This input signal is only available if the following conditions have been met: ▪ System parameter **PLC_ExtendBaseIoFunction** = 1. ▪ System parameter **LCU_EnergySaveMode** > 0. ▪ CPX V3 or V4 is available and the input **24 V_STDBY** at X1 of the PBT board is supplied with voltage. The main switch is set to "On". If the system parameter **ESC_Enable** is active, the laser devices switch between Energy Save Level and Ready_To_Operate with the signals ESC_Pause > 0 and ESC_Pause = 0. In this case, you should not use the signal ENERGY_SAVE_OFF.
Information	The laser device does not have to be assigned to the external control unit. After switch-on, the laser control performs a device reset. For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP. Not available for laser devices with CPX V20.
Feedback	The following output signals indicate that the laser control has been switched on and is not in the optimized standby mode: ▪ LASER_CONTROL_IS_ON = TRUE ▪ ENERGY_SAVE_IS_ON = FALSE

Tab. 97

LASER_CONTROL_OFF

Function	Switch off laser device. OSB 4 is activated.
Active signal	The external control requests the laser control to switch off the laser device.
Prerequisite	This input signal is only available if the system parameter **PLC_ExtendBaseIoFunction** = 1. The laser is assigned to the external control; the output signal **LASER_ASSIGNED** is active. The laser control is switched on; the output signal **LASER_CONTROL_IS_ON** is active.
Feedback	All output signals will be inactive.

Tab. 98

MACHINE_COOLING_ON

Functions	Switch on external cooling.
Active signal	The external control requests the laser control to switch on the external cooling.
Requirement	This input signal is only available if the system parameter **PLC_ExtendBaseIoFunction** = 1.
Information	This input signal is required, for example, if a TRUMPF laser machine and the integrated laser device use the cooling of the laser machine jointly. The signal is OR-linked via all MPI slots. This means that as soon as an external control (e.g. PLC) has set the signal, the external cooling will be switched on.
Feedback	The output signal **MACHINE_COOLING_READY** becomes active.

Tab. 99

POWER_GATE

Functions	**POWER_GATE** via Multi PLC interface (e.g. fieldbus or OPC)
Active signal	The laser power is suppressed if this input is active.
Requirement	This input signal is only available if the system parameter **PLC_ExtendBaseloFunction** = 1.
Information	The system parameter RTI_PULSE_INTERLOCK_MODUS must be set in the dialog >*Setup* >*System setting* >*Real-time interface* via fieldbus to the following value: 5 = POWER_GATE via fieldbus. **RTI_PULSE_INTERLOCK_MODUS** = 1 is set ex works. Further information: ▪ Digital I/O interface of the CPX – Parallel I/O, Real time, sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard, Doc. no. 18-22-91-A2-BA. ▪ Real-time and Sync I/O interface of the CPX V4 Basic, Doc.-No. 18-23-04-A1-BA. ▪ Parallel I/O, Real-time and Sync I/O interface of the CPX, Doc. no.: 18-21-85-A1-BA (for CPX V1 and V2). The signal **POWER_GATE** reacts as follows: ▪ If the system parameter RTI_LEVEL_SETTING = 0: – Bit not set: Laser power is off. – Bit set: Laser power is on. ▪ If the system parameter RTI_LEVEL_SETTING = 1: – Bit not set: Laser power is on. – Bit set: Laser power is off. If the system parameter **RTI_POWER_GATE_FAST** = TRUE, signal changes up to 5 kHz are possible. For this option, no PLCView data is recorded for the RTI. Requirement for signal changes up to 5 kHz: System parameter **RTI_PULSE_INTERLOCK_MODUS** = 4, POWER_GATE mode or = 5, POWER_GATE mode via fieldbus. If the laser power is to be triggered with a frequency > 1 kHz, system parameter **FG_TriggerOnSetValue** = 3, automatic pulse mode, must be used. Here, there is automatic switching between pulse mode and modulation mode. Further information: (see "Configuring interfaces", pg. 157). If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Tab. 100

4.7 Signals of output word 0

EXT_ACTIVATION_ACTIVE

Function	Acknowledgement signal of the **EXT_ACTIVATION** input signal.
Active signal	The laser device can be controlled via the Multi PLC interface (fieldbus, OPC or parallel I/O interface).
Information	As long as the **LOCK_OPERATING_PANEL** input signal is not active, laser parameters and laser programs can continue to be modified on the operating panel (OP).

Tab. 101

FAULT_LASER

Functions	The output signal indicates a fault of the laser device.
Active signal	The laser device control activates the **FAULT_LASER** output signal when a fault limit value for electrical or optical components has been exceeded.
Information	The displayed message indicates possible causes of the fault. By activating the **RESET** input signal: ▪ the displayed message is reset. ▪ the output signals **MONITORING** and **FAULT_LASER** are set to inactive. ▪ the control unit of the laser device is initialized again. **Note:** If a fault occurs repeatedly, the cause of the fault must be eliminated first. The message behavior and the RESET signal are influenced by different system parameters. Further information: (see "Messaging and RESET behavior", pg. 143).

Tab. 102

LASER_ASSIGNED

Functions	Acknowledgement signal of the **REQUEST_LASER** input signal.
Active signal	The laser device is assigned to the requesting external control unit. The external control unit receives in the output words status data from the laser.
Assignment process	The assignment of the laser is carried out according to priority and in case of the same priority according to the round robin algorithm. A priority parameter is assigned to every MPI slot. The value range of the **Priority** parameter is from 0 to 255. The higher the value, the higher the priority of the MPI slot. Further information: (see "Configuring interfaces", pg. 157). If several MPI slots with different priorities have activated the REQUEST_LASER signal, the MPI slot with the highest priority is assigned. If several MPI slots with the same priority have activated the REQUEST_LASER signal, the assignment is performed in accordance with the round robin algorithm: in the numerical order of the MPI slots. The assignment process starts at MPI slot 1. As soon as the assignment has finished processing the MPI slots used, it starts again at MPI slot 1. Example for the round robin algorithm: The laser is assigned to the external control unit at the MPI slot 1. The MPI slots 1, 2, 3 and 5 have the same priority value. The external control units at the MPI slots 2, 5 and 3 request the laser one after another. As soon as the external control unit releases the laser at MPI slot 1, the external control unit receives the assignment at MPI slot 2. If this control unit releases the laser, the external control unit at MPI slot 3 is processed and not the external control unit at MPI slot 5. The external control unit at MPI slot 5 receives the assignment as soon as the external control unit at MPI slot 3 releases the laser. If the external control unit at MPI slot 1 sends a request to the laser in the meantime, this request is processed only after release of the external control unit at MPI slot 5.
Information	When the **LASER_READY** output signal is also active, the external control unit can start laser programs. An external control unit can start a laser program of type "No pulse triggering", even if the laser device is not assigned to the external control unit. The output mask can be used to define what status signals of the laser are received by the external control even if the **LASER_ASSIGNED** signal is not active. Further information: (see "Output words", pg. 37).

Tab. 103

LASER_IS_ON

Functions	Acknowledgement signal of the **LASER_ON** input signal.
Active signal	The laser is on.
Information	The output signal remains active as long as the laser is switched on. If there is a fault with the laser device, the laser device is automatically switched off. **Note** The output signal remains inactive as long as the output signal **CALIBRATION/SELF_TEST** is active. If the **LASER_READY** output signal is also active, laser programs can be started. **Laser device with laser standby mode:** The laser device can be switched to the laser standby mode by activating the **LASER_STANDBY** input signal. **Energy Save Concept** or **Sleep mode** If the laser control unit activates an Energy Save Level or Sleep mode, the output signals **LASER_READY** and **LASER_IS_ON** are deactivated. For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

Tab. 104

LASER_READY

Functions	Output signal shows whether laser programs can be started.
Active signal	The laser programs can be started.
Information	After the start of a laser program, the signal becomes inactive until the laser program has been ended and a new laser program can be started. The **LASER_READY** output signal becomes inactive when the safety circuit is opened because the laser device, for reasons of safety, becomes disabled to give out laser power. If an attempt is made to start a laser program while the **LASER_READY** output signal is inactive: ▪ a monitoring message is displayed. ▪ the output signal **MONITORING** becomes active. ▪ the laser program is not started. If a PCU is available, the output signal **LASER_READY** is only activated if the PCU is also ready. An external control can start a laser program of the type "No pulse release", even if the laser device is not assigned to the external control. The **LASER_READY** signal becomes active as soon as the program number of a "No pulse release" type laser program is applied. **Laser with optical components:** If the program number of another laser program is given after the execution of a laser program, an already active **LASER_READY** output signal is set to inactive again (approx. 35 ms ... 40 ms) until the laser control has set the optical components to the light path specified in the laser program. The output signal **LASER_READY** can only be evaluated once the new program number and light path number (see "LIGHT_PATH_No: Bit 7 ... Bit 0", pg. 91) have been reported to the interface. **TruMicro 5000:** If, after execution of a laser program, the program number of another laser is given, an already active **LASER_READY** output signal is again changed to inactive until the new basic frequency has been set, which may take up to 30 sec. **Laser device with laser standby mode:** The **LASER_READY** output signal becomes active approx. 2 ... 5 s active after the laser has been switched into laser standby mode. **Energy Save Concept** or **Sleep mode** If the laser control unit activates an Energy Save Level or Sleep mode, the output signals **LASER_READY** and **LASER_IS_ON** are deactivated. For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP. If system parameter **CV_Beam_Tracker** = 1: After switching on the laser, **LASER_READY** is not set until the beam position check is complete.

Tab. 105

LASER_WARNING_LAMP_IS_ON

Functions	The output signal shows whether the laser warning light is switched on.
Active signal	The control unit activates the **LASER_WARNING_LAMP_IS_ON** output signal when the laser: ▪ is ready to generate laser power. ▪ is generating laser power.
Information	**Note:** The output signal becomes active when the voltage of a lamp or diode power supply exceeds 40 V and stays active until the voltage drops below 40 V.

Tab. 106

MONITORING

Functions	The output signal indicates when a monitoring message was emitted during operation.
Active signal	The **MONITORING** output signal becomes active when the control unit of the laser device has detected a condition that: ▪ can lead to switching off the laser device. ▪ has led to switching off the laser device.
Information	If, in connection with the output signal **MONITORING**, the output signals **PROG_CANCELLED**, **SIK_OPEN** and **FAULT_LASER** are also evaluated, the causes for a monitoring can be determined more exactly. **MONITORING active:** A condition was detected by the laser device control that has not yet led to the switching off of the laser device. The displayed message gives hints about the possible causes (e.g., the conductivity of the DI water has exceeded the monitoring limit value). **MONITORING + SIK_OPEN active:** A monitoring message was emitted because a safety circuit has been interrupted (see "SIK_OPEN", pg. 90). **MONITORING + FAULT_LASER active:** The laser device was switched off due to a malfunction of the laser device (see "FAULT_LASER", pg. 82). **MONITORING + PROG_CANCELLED active:** A running laser program has been cancelled, for example using the input signal **PROG_STOP** or **FAULT_EXT** (see "PROG_CANCELLED", pg. 88). The message behavior and the RESET signal are influenced by different system parameters. Further information: (see "Messaging and RESET behavior", pg. 143).

Tab. 107

PILOT_LASER_IS_ON

Function	Acknowledgement signal of the **PILOT_LASER_ON** input signal.
Active signal	The **PILOT_LASER_IS_ON** output signal becomes active when a pilot laser is switched on.
Information	**Notes:** Pilot laser in shutters and shutter switches are controlled by the ASV3 boards of the laser control.

Tab. 108

POWER_LIMIT

Functions	The output signal indicates when the power limit of the laser device has been reached (only with pulsed lasers).
Active signal	The power limit of the laser device has been reached. The following parameters influence reaching the power limit of the laser device: ▪ Pulse power ▪ Pulse duration ▪ Pulse repetition frequency
Information	When the power limit is reached: ▪ a monitoring message is displayed that must be acknowledged by means of RESET before work with the laser device can be continued. ▪ the power limit of the laser device can be met by adapting the parameters pulse power, pulse duration and pulse repetition frequency.

Tab. 109

PROG_ACTIVE

Functions	Acknowledgement of the input signals **PSTART_STATICAL** or **PSTART_DYN**.
Active signal	A laser program has been started and is being executed.
Information	The output signal **PROG_ACTIVE** remains active as long as the laser program is run.

Tab. 110

PROG_CANCELLED

Functions	The output signal indicates that the laser program was aborted.
Active signal	The output signal **PROG_CANCELLED** becomes active if a laser program was not completely executed. The following actions proceed: ■ a monitoring message is displayed. ■ The output signal **MONITORING** becomes active. **Note:** Laser programs can only be restarted if the message was reset by activating the input signal **RESET**.
Information	Laser programs are aborted under the following conditions: ■ Input signal **PSTART_STATICAL** became inactive before a statically started laser program elapsed, if **Pulse type** ≠ "Continuous Wave" (for CW lasers) and **Pulse number** ≠ ∞ ("Continuous") are set. ■ Input signal PROG_STOP was activated during the sequence of a laser program, if **Pulse type** ≠ "Continuous Wave" (for CW lasers) and **Pulse number** ≠ ∞ ("Continuous") are set. ■ Laser control has detected a malfunction. ■ Input signal **FAULT_EXT** was activated. ■ Safety or EMERGENCY STOP circuit was interrupted during the running of a laser program. The output signal **PROG_CANCELLED** remains after an assignment change at the affected MPI slot. The output signal **PROG_CANCELLED** must be reset at the affected MPI slot, independent of the assignment. If there is a change in assignment, the output signal **LASER_ASSIGNED** changes from one MPI slot to another. If the output signal **PROG_CANCELLED** is set in the output mask, the output signal is output at this MPI slot even if this MPI slot is not assigned. This makes sense when, for example, a superordinate system control reacts to this signal. Further information: (see "Output words", pg. 37).

Tab. 111

PROG_COMPLETED

Functions	The output signal indicates the end of a laser program.
Active signal	The **PROG_COMPLETED** output signal is: ▪ active if a laser program has been executed completely. ▪ **not** active when a laser program was canceled.
Information	The timing of the output signal depends on whether a laser program has been started statically with the input signal **PSTART_STATICAL** or dynamically with the input signal **PSTART_DYN**. **Program start static:** ▪ Infinite laser program (Pulse type ≠ "Continuous wave" (for CW lasers) and Pulse number ≠ ∞ ("Continuous")): After the end of a laser program, the **PROG_COMPLETED** output signal becomes active and remains active until the **PSTART_STATICAL** input signal is switched to inactive. ▪ Endless laser program (Pulse type = "Continuous wave" (for CW lasers) Pulse number = ∞ ("Continuous")): If the laser program is finished by setting the **PSTART_STATICAL** input signal inactive, the **PROG_COMPLETED** output signal will be activated for approx. 6 seconds[1]. When **PROG_COMPLETED** becomes active, current values of the parameters **PLC output (CV) x words** are available. **Program start, dynamically:** After the end of a laser program, the **PROG_COMPLETED** output signal becomes active for approx. 6 s[1].
1) The **PROG_COMPLETED** output signal becomes prematurely inactive if, before the 6 s have expired, ▪ a laser program is started again (PSTART_STATICAL or PSTART_DYN). ▪ a change in assignment takes place, and the **PLC_ClearProgCompletedOnSlotChange** system parameter is 1.	

Tab. 112

SET_1 ... SET_3

Functions	The 3 output signals **SET_1 ... SET_3** can be used to synchronize an external control unit (e.g. PLC) with the sequence of a laser program.
Active signal	The output signals can be set to active (S1H, S2H, S3H) or inactive (S1L, S2L, S3L) by commands in the program lines of a laser program.
Information	Output signals **SET_1 ... SET_3** activated by a laser program remain active and are only set to inactive if: ▪ a laser program is started again. ▪ a cancelled laser program is reset with the **RESET** input signal. ▪ they are set to inactive by commands (S1L, S2L, S3L) within a laser program. **Note:** The output signals **SET_1 ... SET_3** can also be used to monitor the sequence of a laser program externally.

Tab. 113

SIK_OPEN

Function	The output signal indicates that a safety circuit of the laser device is interrupted.
Active signal	The **SIK_OPEN** output signal becomes active, when the safety circuit is open: ▪ of the central shutter (VZ). ▪ of the currently selected light path.
Information	When the **SIK_OPEN** output signal is active, no laser program can be started. **Determining the safety circuit status** The **SIK_OPEN** output signal is updated continuously for all external controls (slots), even if they have not bee assigned. There are two different cases: ▪ The light path is preset in the laser program. ▪ The light path is predefined externally. **The light path is permanently defined in the laser program** In this case, the SIK_OPEN output signal is determined for all light paths that occur in the laser program. **SIK_OPEN = "0",** if the safety circuits of all light paths given in the laser program are closed. **SIK_OPEN = "1",** if a safety circuit is open that is included in the laser program. **The light path is predefined externally** For this case, the SIK_OPEN output signal is only determined for the externally predefined light path. **SIK_OPEN = "0",** if the safety circuit of the externally predefined light path is closed. **SIK_OPEN = "1",** if the safety circuit of the externally predefined light path is open.

Tab. 114

4.8 Signals of output word 1

LIGHT_PATH_No: Bit 7 ... Bit 0

Functions	The 8 output signals **LIGHT_PATH_No: bit 7 ... bit 0** are used by the laser to output the light path number which is set for the emission of laser light.
Coding of the light path no.	The value of the 8 output signals is defined from **LIGHT_PATH_No: bit 7** (high) to **LIGHT_PATH_No: bit 0** (low). Format: Hexadecimal. Number of selectable light paths: max. 255 dec = FF hex
Information	Depending on the output number of the light path, an external control unit can: ▪ check whether the set light path is correct. ▪ keep a record of the light path used. **Note:** If an external control is connected to the laser device via a fieldbus-coded TRUMPF Laser-Network (TLN-fc), the light path number set in the dialog *>Setup >Multi PLC interface (MPI)* will be transmitted.

Tab. 115

PROGRAM_No: Bit 7 ... Bit 0

Function	Acknowledgement of the program number of the laser program set by means of the output signals **PROGRAM_No: bit 7 ... bit 0**.
Coding of the program no.	The significance of the 8 output signals is defined from **PROGRAM_No: bit 7** (high) to **PROGRAM_No: bit 0** (low). Format: Hexadecimal. Permitted program numbers: 0 ... 200 dec (0 ... C8 hex) Program numbers for special functions: 240 ... 250 dec (F0 ... FA hex) Program number 0 is only available if system parameter **min. program no.** = 0.
Information	Depending on the output number of the program, an external control unit can: ▪ check whether the right laser program has been selected. ▪ keep a record of the laser program used.

Tab. 116

4.9 Signals of output word 2

APPLICATION_VALUES_IN_RANGE

Functions	Status signal indicating that the application values crossjet pressure, exhaustion and shielding gas are in the admissible range.
Active signal	The output signal **APPLICATION_VALUES_IN_RANGE** is active when the application values for crossjet pressure, exhaust system and shielding gas are within the admissible range (green zone). **Notes:** The output signal becomes inactive if the input signals **AD_No: Bit 7 ... Bit 0** of the input word 2 send the following values: ▪ Application data set no. "0" was sent: the monitoring of the focusing optics was switched off. ▪ An invalid application data set no. was sent.
Information	In the *>Programming >CFO data* or *>BEO app.data* dialog it is possible to: ▪ set the limit values for crossjet pressure, exhaustion and shielding gas. ▪ activate and deactivate monitoring of crossjet pressure, exhaustion and shielding gas. Before starting a program, you can check if the application values are within the admissible range and the focusing optics is ready for operation. For this purpose, a valid application data set no. and a light path no. must be selected 50 ms before starting a program. If a valid application data set no. has been defined, the control unit of the laser device needs max. 50 ms until the output signals **APPLICATION_VALUES_IN_RANGE** and **FOCUSING_OPTICS_READY** are valid.

Tab. 117

PROTECTIVE_GLASS_LIFETIME_REACHED

Functions	Status signal for limit value MAX2 of the protective glass contamination.
Active signal	The output signal **PROTECTIVE_GLASS_LIFETIME_REACHED** becomes active when the limit value MAX2 (orange zone) of the protective glass contamination has been reached.
Information	In the *>Programming >CFO data* or *>BEO app.data* dialog it is possible to: ▪ set the limit value MAX2 of the protective glass contamination. ▪ to switch the monitoring of the protective glass contamination on and off.

Tab. 118

PROTECTIVE_GLASS_CONTAMINATED

Functions	Status signal for limit value MAX1 of the protective glass contamination.
Active signal	The output signal **PROTECTIVE_GLASS_CONTAMINATED** becomes active when the limit value MAX1 (yellow range) of the protective glass contamination has been reached.
Information	In the *>Programming >CFO data* or *>BEO app.data* dialog it is possible to: ▪ set the limit value MAX1 of the protective glass contamination. ▪ to switch the monitoring of the protective glass contamination on and off.

Tab. 119

FAULT_SLOT

Functions	The status signal indicates a local fault of this slot.
Active signal	The output signal **FAULT_SLOT** is active if a local fault occurs for this slot.
Information	The external control unit connected to the slot must reset a local fault via the input signal **RESET**. A RESET performed by the external control connected to the slot has the following effect: ▪ The local message is acknowledged if the laser device of the processing station has **not** been assigned. ▪ The local message and a monitoring or fault message are acknowledged if the laser device has been assigned to the external control unit. Possible causes of a local fault: ▪ A fault limit of the focusing optics at the light path selected has been reached during the run of a laser program. ▪ The attempt was made to start a laser program that does not exist. **Notes:**: ▪ In case of a local fault, the output signal **FAULT_LASER** is not activated automatically. ▪ Check the messages displayed on the operating panel for further details on local monitoring. ▪ With TLN-fc, one slot corresponds to the assigned light path. The message behavior and the RESET signal are influenced by different system parameters. Further information: (see "Messaging and RESET behavior", pg. 143).

Tab. 120

FOCUSING_OPTICS_AVAILABLE/ LIGHTPATH_COMP_AVAILABLE

Functions	Status signal for focusing optics or light path component registered in the light path.
Active signal	The output signal **FOCUSING_OPTICS_AVAILABLE** is active if focusing optics or a light path component is registered in the selected light path.
Information	Focusing optics or light path components can be activated or deactivated in the dialog >*Technology* >*Light path*. Further information : Software manual "TruControl 1000", doc.-no. 10-06-80-A1-CR. **Note:** Only if the output signal **FOCUSING_OPTICS_AVAILABLE** is active, are the signals of the bits 15 ... 12 of output word 2 active. If a programmable motor-driven focus setting (PMF) is present in the light path, then the signal can only become active once the PMF is enabled[1)].

Tab. 121

FOCUSING_OPTICS_READY/ LIGHTPATH_COMP_READY

Functions	Status signal: The focusing optics or light path is ready for operation.
Active signal	The output signal **FOCUSING_OPTICS_READY** is active if the focusing optics or light path component in the light path is ready for operation.
Information	Example: Focusing optics CFO is ready for operation if: ▪ **no** value for protective glass contamination, crossjet pressure, exhaustion and shielding gas reaches the fault limit values defined in the application data set (red range). ▪ **and** a protective glass cartridge is plugged in. ▪ and the focusing optics has **no** malfunction. ▪ **and** the cooling values of the focusing optics are within the admissible range. **Note:** If the focusing optics or light path component is not ready, details can be found in the messages displayed on the control panel. If a programmable motor-driven focus setting procedure (PMF) is in the light path, the signal can only be active if the PMF is ready for operation[1)].
1) Further information: Operator's manual "Programmable motor-driven focusing", doc no. 22-50-01-A369-CR.	

Tab. 122

Examples for focusing optics		Examples of light path components	
CFO	CONTROLLED FOCUSING OPTICS	TPC	TEMPERATURE PROCESS CONTROLLER
MFO	MANUAL FOCUSING OPTICS	PCU	POWER CALIBRATION UNIT
PFO	PROGRAMMABLE FOCUSING OPTICS	PMF	PMF: PROGRAMMABLE MOTORIZED FOCUSING

Examples of focusing optics and light path components Tab. 123

MONITORING_SLOT

Functions	The status signal indicates local monitoring of this slot.
Active signal	The output signal **MONITORING_SLOT** is active if local monitoring occurs for this slot.
Information	The external control unit connected to the slot must reset a local monitoring via the input signal **RESET**. A RESET performed by the external control connected to the slot has the following effect: ▪ The local message is acknowledged if the laser device of the processing station has **not** been assigned. ▪ The local message and a monitoring or fault message are acknowledged if the laser device has been assigned to the external control unit. **Notes:**: ▪ Check the messages displayed on the operating panel for further details on local monitoring. ▪ With TLN-fc, one slot corresponds to the assigned light path. The message behavior and the RESET signal are influenced by different system parameters. Further information: (see "Messaging and RESET behavior", pg. 143).

Tab. 124

SHUTTER_SWITCH 8 ... 1

Functions	Via the 8 output signals **SHUTTER_SWITCH 8 ... 1** the laser device outputs the positions of the available shutter switches.
Position of the shutter switches	The significance of the 8 output signals is defined from **SHUTTER_SWITCH 8** (high) to **SHUTTER_SWITCH 1** (low). The bit value of a closed shutter switch is "1". The bit value of an open shutter switch is "0". Format: Hexadecimal. Maximum value: 255 dec = FF hex, if: ▪ 8 shutter switches are available **and** ▪ all 8 shutter switches are closed.
Information	An external control can use the output signals SHUTTER_SWITCH 8 ... 1: ▪ check the positions of the available shutter switches. ▪ keep a record of the shutter switch positions.

Tab. 125

4.10 Signals of output word 3

ALIVE_TICK

Functions	The output signal indicates by means of the regular switching between High and Low that the laser control unit is active.
Active signal	With this signal an external control can determine that the laser control is switched on. The signal changes status between High and Low with a frequency of 1 Hz if system parameter PLC_AliveTick = 1000 ms.
Information	The **ALIVE_TICK** signal query should only be made after the **LASER_IS_ON** signal has been activated for the first time during the start-up phase of the laser control. This prevents an external control from triggering an emergency switch-off during the start-up phase of the laser control. An emergency switch-off by an external control unit due to the missing **ALIVE_TICK** signal should be triggered only for the local MPI slot, for example by opening the safety circuit for the light path in question. It may happen, for example, that the connection of an MPI slot to the superordinate control is interrupted even though work is carried out at a different workstation. If the EMERGENCY STOP circuit of the laser device is opened, the laser device stops sending laser light to all light paths. An external control must scan the ALIVE_TICK signal at double frequency. Scanning frequency = 2 Hz if the system parameter **PLC_AliveTick** = 1000 ms. The **ALIVE_TICK** signal is inactive, if the system parameter **PLC_AliveTick** = 0 ms.

Tab. 126

CALIBRATION/SELF_TEST

Functions	**Laser calibration/laser self test**
Active signal	**The laser is being calibrated**or **the laser self test is active**.
Information	Possible calibration procedures include, for example, lamp factor optimization (LFO) or pump module self-test (PMST) Lamp factor optimization (LFO) is started manually, automatically or by laser program 244. The laser self test is started by laser program 245. The LASER_READY signal is inactive as long as CALIBRATION/SELF_TEST is active. Further information on TruControl 1000 can be found in the TruControl 1000 software manual doc. no. 10-06-80-A1-CR.

Tab. 127

EXT_COOLING_CIRCUIT_IS_ON

This output signal is used in various ways.

Functionality A)

Functions	The output signal shows the state of the external cooling circuit.
Active signal	If the laser device controls the external cooling circuit, the active signal reports the following status of the external cooling circuit: ▪ Valve open ▪ Pump active
Requirement	TruControl 1000 ≥ 1.88.0 CMD version ≥ 2653 (command version BV ≥ 79)

EXT_COOLING_CIRCUIT_IS_ON, functionality A) Tab. 128

Functionality B)

Functions	The output signal indicates that the laser device requires external cooling water.
Active signal	If the superordinate system, e.g. laser machine, controls the external cooling circuit, then the active signal reports that the laser device requires cooling water.
Requirement	TruControl 1000 ≥ 3.14.0 CMD3 version ≥ CMD34908 (command version CV ≥ 6) CCB version ≥ CCB_2814 (command version CV ≥ 7) CCBM version ≥ CCBM3111 (command version CV ≥ 7)

EXT_COOLING_CIRCUIT_IS_ON, functionality B) Tab. 129

LASER_No: bit 7 ... 0

Function	Via the 8 output signals **LASER_No: bit 7 ... bit 0** the control of the laser device outputs the currently assigned number.
Coding of the laser device no.	The significance of the 8 output signals is defined from **LASER_No: bit 7** (high) to **LASER_No: bit 0** (low). Format: Hexadecimal. Number of the selectable laser devices: max. 255 dec = FF hex
Information	Depending on the output number of the laser, an external control unit can: ▪ check whether the requested laser program has responded. ▪ keep a record of the laser device used. **Note:** The laser number is assigned to the variable "MPI_LaserNumber" in the dialog *>Setup >System setting >Fieldbus*.

Tab. 130

MAINTENANCE

Functions	The output signal indicates due maintenance on the laser device.
Active signal	The output signal **MAINTENANCE** becomes active when maintenance on the laser device is required.
Information	An external control unit can evaluate the output signal **MAINTENANCE** and transfer it accordingly in order to initiate the execution of maintenance work on the laser device. In the dialog *>Maintenance/Commissioning* of the operating software of the laser device: ▪ you can see which maintenance work is due. ▪ you have to acknowledge maintenance work that has been carried out.

Tab. 131

MEASURING_VALUE_OUT_ACTIVE

Functions	The output signal indicates the output of a measured value via the output words 4 and 5.
Active signal	The output signal **MEASURING_VALUE_OUT_ACTIVE** becomes active when the output word 4 receives a measured value ID.
Information	When the output signal **MEASURING_VALUE_OUT_ACTIVE** is active, : ▪ the output word 4 receives a measured value ID. ▪ the output word 5 receives the measured value assigned to the measured value ID (e.g. the distance between focal point plane and workpiece surface).

Tab. 132

4.11 Signals of output word 4

MESSAGE_ID: bit 7 ... bit 0

Functions	The 8 output signals **MESSAGE_ID: bit 7... bit 0** are used by the laser device to output the message code (ID) of the component which triggered a message.
Coding of the message code (ID)	The significance of the 8 output signals is specified by **MESSAGE_ID: bit 7** (high) to **MESSAGE_ID: bit 0** (low). Format: Hexadecimal. Number of possible IDs: max. 255 dec = FF hex
Information	The output message code (ID) can be used by an external control unit to identify and log which component of the laser device has caused a message. A message code at the output words 4 and 5 is active for at least 200 ms. Before outputting a new message code, the value 0000 0000 is output at the output words 4 and 5 for approx. 5 ms. The message code is output individually at the MPI slots: ▪ In case of a slot fault/slot monitoring, the message code is output only at the relevant MPI slot. ▪ In case of a laser fault/laser monitoring, the message code is output at all MPI slots. Exceptions ▪ If output word 3 bit 0 signal MEASURING_VALUE_OUT_ACTIVE = 1, the message code is overwritten by a measured value, for example the distance of the focus level to the surface of the workpiece. ▪ If the output word 4 or 5 has been overwritten by the Multi PLC interface (e.g. field-bus), the message code is not displayed. The IDs of the most important components are listed in the following table. Components with multiple functions are assigned several IDs, for example component DLC: ID 06: DLC (ILV), ID 30: DLC (LMP), ...

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ID	Component (function)	ID	Component (function)	ID	Component (function)
00	Central processor	30	DLC (LMP)	D0	CFO
06	DLC (ILV)	34	CMD (INV)	D8	CLI
0A	ASV3 (V)	37	DLC (LLR)	E3	IIO..
0B	ASV3 (SW)	38	CMD (CLK)	E4	PFO
0D	ASV3 (VZ)	3C	LLKM	EB	CPSP
0E	ASV3 (VW)	4A	DLC (FGD)	F6	MPI
0F	ASV3 (SZ)	4E	PFO version 2		
18	DMB	90	SFO		

Component IDs, examples

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MESSAGE_NUM: bit 7 ... bit 0

Functions	The 8 output signals **MESSAGE_NUM: bit 7 ... bit 0** are used by the laser device to output the message code (NUM) that indicates, in case of several components of the same type, which component has triggered a message.
Coding of the message code (NUM)	The value of the 8 output signals is defined by the **MESSAGE_NUM: bit 7** (high) to **MESSAGE_NUM: bit 0** (low). Format: binary (bit coded). Number of possible NUM: 8 (hex: 01, 02, 04, 08, 10, 20, 40, 80)
Information	On the basis of the output message code (NUM), an external control unit can: ▪ determine the component that has caused a message in case there are several components of the same type. ▪ keep a record of the message code (NUM) together with the signaling component. Example: MESSAGE_ID = 0E hex, MESSAGE_NUM = 04 hex. The third component of type ASV3 (VW) resulted in a message. A message code at the output words 4 and 5 is active for at least 200 ms. Before outputting a new message code, the value 0000 0000 is output at the output words 4 and 5 for approx. 5 ms. The message code is output individually at the MPI slots: ▪ In case of a slot fault / slot monitoring the message code is output only at the relevant MPI slot. ▪ In case of a laser fault / laser monitoring the message code is output at all MPI slots. Exceptions ▪ If output word 3 bit 0 signal MEASURING_VALUE_OUT_ACTIVE = 1, the message code is overwritten by a measured value, for example the distance of the focus level to the surface of the workpiece. ▪ If the output word 4 or 5 has been overwritten by the Multi PLC interface (e.g. fieldbus), the message code is not displayed.

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4.12 Signals of alternative output word 4

MEASURING_VALUE_ID: bit 15 ... bit 0

Functions	The 16 output signals **MEASURING_VALUE_ID: bit 15 ... bit 0** are used by the laser device to output the measured value ID, which indicates which measured value contains the output word 5.
Coding of the measured value ID	The value of the 16 output signals is defined by **MEASURING_VALUE_ID: bit 15** (high) to **MEASURING_VALUE_ID: bit 0** (low). Format: Hexadecimal. **Definition:** The output word 4 contains: ▪ with MEASURING_VALUE_ID: bit 15 ... bit 8 = FF hex: measured value ID (see below). or ▪ with MEASURING_VALUE_ID: bit 15 ... bit 8 ≠ FF hex: message code (ID and NUM) (see "Signals of output word 4", pg. 99). Identifications of the measured values output via output word 5: ▪ FF01 hex: – Distance between the focal point plane and workpiece surface. ▪ FF02 hex ... FFFF hex: – Reserve
Information	**Note:** The output word 4 contains a measured value ID if the output signal **MEASURING_VALUE_ACTIVE** (bit 0) of the output word 3 is active.

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4.13 Signals of output word 5

MESSAGE_CODE: bit 15 ... bit 0

Functions	The laser device outputs the message code of a reporting component via the 16 output signals **MESSAGE_CODE: bit 15 ... bit 0**.
Coding of the message code	The significance of the 16 output signals is defined from **MESSAGE_CODE: bit 15** (high) to **MESSAGE_CODE: bit 0** (low). Format: Hexadecimal. The value range of monitoring and fault messages is defined: ▪ 0000 hex ... C7FF = fault message ▪ C800 hex ... FFFF = monitoring message
Information	The imessage code is composed of: ▪ the MESSAGE ID of the component causing the message. ▪ MESSAGE_ NUM of the component causing the message if several components of the same type exist. ▪ MESSAGE_CODE indicating the cause of a message. Example of a message code structure XXYY ZZZZ: ▪ XX = message code MESSSAGE_ID (output word 4). ▪ YY = message code MESSAGE_NUM (output word 4). ▪ ZZZZ = message code MESSAGE_CODE for the cause of a message. A message code at the output words 4 and 5 is active for at least 200 ms. Before outputting a new message code, the value 0000 0000 is output at the output words 4 and 5 for approx. 5 ms. The message code is output individually at the MPI slots: ▪ In case of a slot fault / slot monitoring the message code is output only at the relevant MPI slot. ▪ In case of a laser fault / laser monitoring the message code is output at all MPI slots. Exceptions ▪ If output word 3 bit 0 signal MEASURING_VALUE_OUT_ACTIVE = 1, the message code is overwritten by a measured value, for example the distance of the focus level to the surface of the workpiece. ▪ If the output word 4 or 5 has been overwritten by the Multi PLC interface (e.g. fieldbus), the message code is not displayed.

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4.14 Signals of alternative output word 5

MEASURING_VALUE: bit 15 ... bit 0

Functions	The 16 output signals **MEASURING_VALUE_ID: bit 15 ... bit 0** are used by the laser device to output the measured value, which is assigned to the alternative output word 4.
Requirement	A teach cartridge has been plugged in into the focusing optics.
Coding of the measured value	The significance of the 16 output signals is defined from **MEASURING_VALUE: bit 15** (high) to **MEASURING_VALUE: bit 0** (low). Format: Hexadecimal. Neutral value range: 0 ... 65535 dec = 0000 ... FFFF hex The ranges of values for the measured values are defined depending on the measured variables.
Information	**Measured variable: focus position** The measured variable focus position specifies the distance between focal point plane and workpiece surface. Defined value range: -200 dec ... +200 dec with 0.1 mm/digit The value range corresponds to a distance between focal plane and workpiece surface from -20.0 mm (focal point in the workpiece) to +20.0 mm (focal point above the surface of the workpiece). Examples: Hex value = 0000 corresponding to 0.0 mm Hex value = FFFF corresponding to -0.1 mm Hex value = 0001 corresponding to +0.1 mm Measurements are made at intervals of 300 ms. **Note:** To enable transmission of a measured value to an external control unit (e.g. PLC), it must be known which light path of the laser device is assigned to the external control unit. For this purpose, the light path is used which is specified in the first line of the laser program. The external control specifies the number of the laser program used via the input word 1 of the Multi PLC interface. With TLN-fc, the light path is permanently assigned to an external control unit via the dialog *>Setup >Multi PLC interface (MPI)*.

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4.15 Signals of output word 6

LASER_POWER: bit 15 ... bit 0

Functions	Using the 16 output signals **LASER_POWER: bit 15 ... bit 0** the laser device: ▪ outputs the measured laser power value of CW lasers. ▪ outputs the average laser power value of pulsed lasers calculated on the basis of measurements.
Coding of the laser power	The value of the 16 output signals is defined from **LASER_POWER: bit 15** (high) to **LASER_POWER: bit 0** (low). Format: Hexadecimal. **With CW lasers:** Value range: 0000 hex ... FFFF hex equates to 0 W ... 65535 W Resolution: 1 W/digit **With pulsed lasers:** Value range: 0000 hex ... FFFF hex equates to 0.0 W ... 6553.5 W Resolution: 0.1 W/digit
Information	**For CW lasers:** The laser power measured by means of a power and energy measuring sensor (LEM) is binary-coded and output as a measured value. Example: Hex value = 0DAC corresponds to a laser power of 3500 W. **For pulsed lasers:** The value calculated from the measured pulse power, pulse duration and frequency is output as average laser power (P_{av}). Example: Hex value = 0BB8 corresponds to an average laser power of 300.0 W. The system parameter PLC_PowerOutTick can be used to set the interval at which the value is updated. PLC_PowerOutTick = 0: In case of normal utilization of the system, the value is updated approx. every 0.2 s. PLC_PowerOutTick ≥ 20 ms: In case of normal utilization of the system, the value is updated at the interval given. **For laser devices of the laser device family 20-20-xx-xx:** The resolution of the laser power is set with system parameter **PLC_LaserPowerResolution**: ▪ 0.000001 W/digit ▪ 0.001 W/digit ▪ 0.1 W/digit ▪ 1 W/digit (factory setting) ▪ 10 W/digit ▪ 100 W/digit ▪ 1000 W/digit

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4.16 Signals of output word 7

ENERGY: bit 15 ... bit 0

Functions	Via the 16 output signals **ENERGY: bit 15 ... bit 0** a pulsed laser outputs the calculation value based on measurements for the pulse energy of a laser pulse.
Coding of the pulse energy	The significance of the 16 output signals is defined from **ENERGY: bit 15** (high) to **ENERGY: bit 0** (low). Format: Hexadecimal. Value range: 0000 hex ... FFFF hex equates to 0.00 J ... 655.35 J Resolution: 0.01 J/digit
Information	**With CW lasers:** not used. **For pulsed lasers:** The value calculated from the measured pulse power and pulse duration is output as pulse energy. Example: Hex value = 1388 corresponds to a pulse energy of 50.00 J. In case of normal utilization of the system, the measured values are updated approx. every 0.5 s. The pulse energy of the last measured pulse is output and this value then remains present until the next change.

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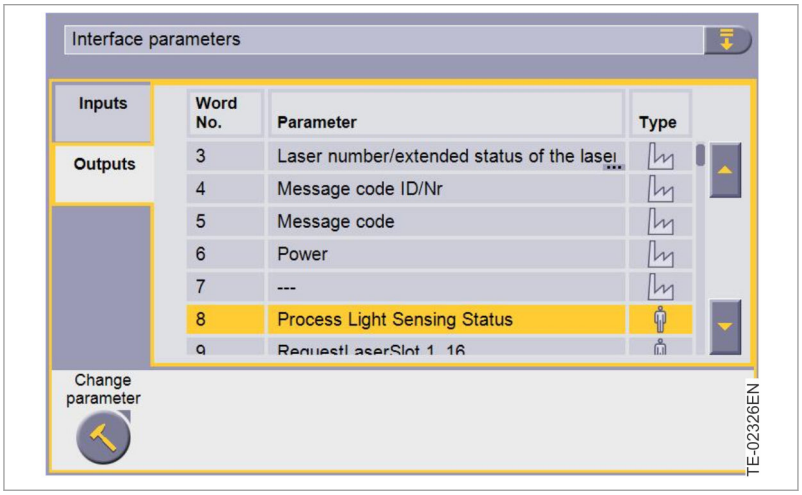
4.17 Other output parameters

The following output words can be freely assigned in the >*Setup* >*Interface parameters* dialog, >*Outputs* tab

- Output words 2 ... 13
- Output words 14 and 15 if system parameter **PLC_ExtendBaseIoFunction** = 0.
- Output words 16 ... 63
  if TruControl 1000 version ≥ 1.84.0.

For fieldbus module DeviceNet slave, the output words 10 ..... 63 are available, providing TruControl 1000 version ≥ 1.88.0.

For further information: software manual "TruControl 1000", doc. no. 10-06-80-A1-CR.



Interface parameters dialog Fig. TE-02326

Column Type	Description
	Default value: The output word is preset by TRUMPF.
	Other output parameters: The output word is set by the user.

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	If you want to assign another output parameter to an output word, select *Change parameter*.

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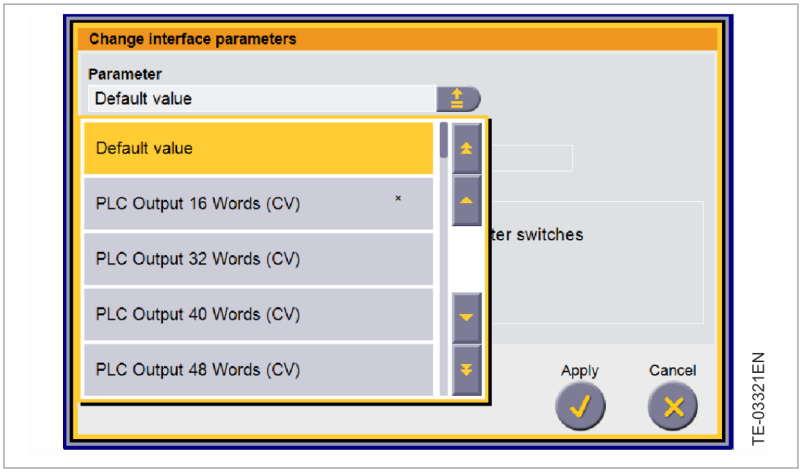


Fig. TE-03321

The output words 2 ... 7 are preset with defaults values (standard output parameters) by TRUMPF. They have been described in the preceding sections. If you assign any other value to these output words, the default values are no longer available.

If you select the **Default value** parameter for output word 7 of a CW laser, output word 7 is not used. If you select the the parameter **Default value** for the output words 8 ... 63, the output words 8 ... 63 are not used.

The following table contains the description of the other output parameters.

Parameter	Description	Type
Default value	The default values (standard output parameters) are described in the preceding sections.	
PLC output (CV) x words[1)]	Parameters for the VisionLine image processing system[1)], x = 6, 8, 16, 32, 40, 48 or 56 output words. The parameters **PLC output (CV) x words** are transferred in one block when **PROG_COMPLETED** is active (see "PROG_COMPLETED", pg. 89) Diagnostics: (see "Diagnostics Dynamic table (XVar)", pg. 152).	
Device level (ESC)	Contains signal ESC_DEVICE_LEVEL, bit 0 ...7 Energy Save Level of laser device (see "Device level (ESC)", pg. 114).	
Slot level (ESC)	Contains signal ESC_SLOT_LEVEL, bit 0 ...7 Energy Save Level of MPI slot(see "Slot level (ESC)", pg. 114).	
Slot RTTO (ESC)	Contains signal ESC_SLOT_RTTO, Bit 0 ... 15: Time until the MPI slot has reached the "Ready To Operate" state(see "Slot RTTO (ESC)", pg. 114).	
Slot state (ESC)	Contains the following status information on Energy Save Concept (see "Slot state (ESC)", pg. 115):	
Bit 0	ESC_AVAILABLE.	
Bit 1	ESC_ACCEPTED.	
Bit 2	ESC_NOT_ACCEPTED.	
1) Parameter PLC output x words (CV) are not available to the VisionLine interface.		

Parameter	Description	Type
Input word	**Input word 0 ... 15** if TruControl 1000 version ≥ 1.76.0. **Input word 0 ... 63** if TruControl 1000 version ≥ 1.84.0: The input word is output to the output word unchanged. In this way, the external control receives a confirmation that the content of the input word has been received by the laser control. The output word can also be used to synchronize with the external control.	
IP address ETH2	IP address of the Ethernet interface "ETH2". 2 output words. output format: — Example IP address 192.013.010.011. Word 1: low-order word. — 0x0A0B: 010.011. Word 2: high-order word. — 0xC00D: 192.013.	
IP address LAN	IP address of the "LAN" Ethernet interface: For description see IP Address ETH2.	
IP address SERVICE	IP address of the "SERVICE" Ethernet interface: For description see IP Address ETH2.	
Laser power nominal	Rated power of the laser device. Unit: Watt.	
Laser type	Coding of the laser device type: Byte 1: 2. Group of the laser device type. byte 2: 3. Group of the laser device type. Examples for the 2. group: 06: TruPulse. — 10: TruDisk. 09: TruMicro. — 11: TruDiode. Examle for laser type: TruDisk 6003 (6C), laser device family 20-10-03-A346: output value 10-03: 0x0A03. The first group of the device type is not output. For laser devices, it is always = 20. The fourth group is not output either.	
Measured power (PCP)	Laser power of the last measurement with Power Calibration Program (PCP). ▪ Parameter is output individually for each MPI slot. ▪ Parameter is set to 0xFFFF by the positive edge of PROG_ACTIVE. ▪ Parameter is output by the positive edge of PROG_COMPLETED. Resolution: 1 W. value range: 0 ... 65534 W. invalid value: 0xFFFF. Further information: Operator's manual CalibrationLine – Focus Calibration Program & Power Calibration Program, doc no. 07-12-12-A8-CR.	
SeamLine Remote status[1)]	Status of the seam position control: 0x0001: SL_WORKPIECE_IS_ACTIVE. 0x0002: SL_RESULT_OK. 0x0004: SL_RESULT_NOT_OK[1)].	
SeamLine Remote result (7 words)[1)]	Test result of seam position control for QDS. One bit is set per seam if the seam is OK. If the bit = 0, then the seam is not OK. Overall, 112 seams can be evaluated (7 words * 16 bits/word)[1)].	
1) Further information: Operator's manual "SeamLine Remote (SE18)", doc no. 83-01-04-A0-CR.		

Parameter	Description	Type
Melt travel monitoring state (PFO)	Current status of the melt travel monitoring in the light path. 0x0000 In the light path there is no melt travel monitoring or a reset has been carried out. 0x0001 Melt travel monitoring active. 0x0002 Melt travel monitoring ended successfully. 0x0004 Melt travel monitoring ended, limit violated. 0x0008 Melt travel monitoring aborted. 0x0020 Melt travel not reached. 0x0100 Start position blow limit value. 0x0200 Start position above limit value. 0x0400 Radiation duration below limit value. 0x0800 Radiation duration above limit value. 0x1000 Melt travel below limit value. 0x2000 Melt travel above limit value.	
TPC state	Current state of the temperature control (TPC) in the light path. 0x0000 There is no temperature control in the light path or reset has been carried out. 0x0001 Temperature control active. 0x0002 Temperature control ended successfully. 0x0004 Temperature control finished, limit value violated. 0x0008 Temperature control aborted. 0x0010 Heat-up temperature reached. 0x0100 Temperature below limit value. 0x0200 Temperature above limit value. 0x0400 Power below limit value. 0x0800 Power above limit value. 0x1000 Average temperature below limit value. 0x2000 Average temperature below limit value. 0x4000 Average power below limit value. 0x8000 Average power above limit value.	
Focus or lens position (PMF)	Current focus/lens position of the PMF in the light path, for TruControl 1000 version < 2.34.0: **CCM_MotColliPosLightPath**. If system parameter FO_CollimationMotor = 0, the focus position is output. If system parameter FO_CollimationMotor = 1, the lens position is output. Resolution: 10 µm. Invalid value: 0x7FFF: There is no PMF in the light path. Further information: Operator's manual of the PMF, doc.-nr.: 22-50-01-A369-CR.	
Rotary module orientation (PMF)	Current position of the rotary module of the PMF in the light path In case of TruControl 1000 Version < 2.34.0: **CCM_RotaryModulePosLightPath**. Bit 15 Rotary module ready. bits 0 ... 8 Orientation value in degrees, value range 0° ... 360°. Take Multi-PLC-interface parameter **Byte-Swap** into account. Invalid value: 0x7FFF: In the light path there is no PMF. Further information: operator's manual of the PMF, doc.-no.: 22-50-01-A369-CR.	
Crossjet pressure (CFO)	**Pressure Crossjet.** Resolution: 0.01 bar. Value range: -327.67 ... 327.66 bar. Invalid values: 0x7FFF and 0x8000.	
Exhaustion pressure (CFO)	**Pressure exhauster.** Resolution: 1 mbar. Value range: -32767 ... 32766 mbar. Invalid values: 0x7FFF and 0x8000	
Protective glass contamination (CFO)	**Protective glass contamination (CFO).** Invalid values: 0x7FFF and 0x8000	

Parameter	Description	Type
Shielding gas flow (CFO)	**Shielding gas flow.** Resolution: 0.1 l/min. Value range: -3276.7 ... 3276.6 l/min. Invalid values: 0x7FFF and 0x8000.	
Conductivity (CLK)	**Conductivity** of the cooling. Resolution: 0.5 µS. Value range: 0 ... 32767 µS. Invalid value: 0xFFFF.	
Conductivity (CCB/CCBM/EEC/CCR)	**Conductivity** of the cooling water. Invalid values: 0x7FFF and 0x8000. If a CCBM is installed, then the parameter Conductivity (CCB) does not contain any evaluable value. If a CCBM and an EEC are installed, then only Conductivity (ECC) contains evaluable values.	
Active PFO program number	**Number of the active PFO program**. Invalid value: 0x0000.	
Active workplace	**Number of the active external control (MPI slot).**	
Energy laser program	**Measured energy value** The entire emitted laser energy of a laser program is displayed. ▪ Available if the following conditions are met: – TruControl 1000 version ≥ 1.88.0. – Board DLC2: ≥ DLCD1226, command version ≥ 42 or – from CPX V3 board DLCA: ≥ DLCD1617, command version ≥ 129. or – Board DLCM: ≥ DLCM1733 and TruControl version ≥ 3.20.0. ▪ The measured value is set to zero by the positive edge of the PROG_ACTIVE signal. ▪ After program end, the value remains unchanged until the next program start. ▪ The system parameter LCU_EnergyLaserprogramCycleTime is used to set the time after which the value is updated. Resolution 1 J/Digit. Invalid value: 0x0000.	
Energy laser program 10J	Description: see Energy laser program. Resolution 10 J/Digit. Invalid value: 0x0000.	
Request laser slot 1-16 Bit 0 : Bit 15 | Slot 1 : Slot 16	Bit-coded information on MPI slots which have requested the laser via the signal **REQUEST_LASER** part 1: MPI slot 1 ... 16. The bit for the own slot is not set. Example: Slots 1, 2 and 3 have requested the laser. Output at the Multi-PLC interface: Slot 1: 0000 0000 0000 0110. Slot 3: 0000 0000 0000 0011. Slot 2: 0000 0000 0000 0101. Slot 4: 0000 0000 0000 0111.	
Request laser slot 17-32 Bit 0 : Bit 15 | Slot 17 : Slot 32	Bit-coded information on MPI slots which have requested the laser via the signal **REQUEST_LASER** part 2: MPI slot 17 ... 32. The bit for the own slot is not set. Example: Slots 17, 18 and 19 have requested the laser. Output at the Multi-PLC interface: Slot 17: 0000 0000 0000 0110. Slot 19: 0000 0000 0000 0011. Slot 18: 0000 0000 0000 0101. Slot 20: 0000 0000 0000 0111.	

Parameter	Description	Type
EM pulse divider (DLC)	Current pulse splitter, available with ultra-short pulse laser devices, laser device family 20-09-xx-xx. Invalid value: 0xFFFF.	
Amplifier pulse repetition rate (DLC)	Active short pulse frequency in the resonator, available with ultra-short pulse laser devices, laser device family 20-09-xx-xx. Invalid value: 0xFFFF.	
Laser power EM digits (DLC)	Currently output laser power, available with ultra-short pulse laser devices, laser device family 20-09-xx-xx Resolution, depending on the laser device family: 20-09-06-xx: 1 W/Digit. | 20-09-07-xx: 1 W/Digit. | 20-09-09-xx: 0.01 W/Digit. Invalid value: 0xFFFF.	
Process light sensing status (DLC)	**Status information for PierceLine.** Further information: Technical information "PFP-Control und PierceLine", doc.-no. 21-A0-61-CP.	
Pulse counter	**Pulse counter.** Resolution: 1. Value range: 0 ... 65534. Invalid value: 0xFFFF.	
Power regulation average value (LLR)	**Average control intervention.** Resolution: 1 %. Value range: -32767 ... 32766 %. Invalid value: 0x7FFF and 0x8000.	
Power average filtered (LMP)	**Average laser power.** Resolution: 1 W. Value range: 0 ... 65534 W. Invalid range: 0xFFFF. This parameter is available if the laser is used in the operating mode PFP control. Further information: "PFP-Control and PierceLine", doc no. 21-A0-61-CP.	
Pulse energy count (LMP)	**Number of pulses** that were averaged (for calculation of the average pulse energy). Invalid value: 0xFFFF.	
PPC measured power	**Laser power** measured with the power measurement cassette (PPC). Resolution: 1 W. Value range: 0 ... 65534 W. Invalid value: 0xFFFF.	
Pulse energy	**Pulse energy** calculated from measured pulse power and pulse duration. Resolution: 1 J. Invalid value: 0xFFFF.	
Pulse energy 1kJ	**Pulse energy** calculated from the measured pulse power and pulse duration. Resolution: 1 kJ. Invalid values: 0xFFFF.	
Pulse energy 1mJ	**Pulse energy** calculated from measured pulse power and pulse duration. Resolution: 1 mJ. Invalid value: 0xFFFF.	
Pulse power average	**Average value of laser power**, calculated from the measured pulse power, pulse duration and frequency. Resolution: 1 W. Value range: 0 ... 65534 W. Invalid value: 0xFFFF.	
Temperature base plate (SBO)	Temperature of a line optics base plate, monitored by the SBO board. Invalid values: 0x7FFF and 0x8000.	

Parameter	Description	Type
State for fieldbus (SBO)	SBO board status.	
XVar.1 ... XVar.32	**Output of the variables XVar.1 ... XVar.32:** With these variables, laser program parameters such as pulse power, pulse duration, frequency and PFO translation can be predefined. The variables are set via OPC items or the image processing interface. Further information: Interface description OPC UA for CPX, doc. no. 09-14-11-A6-BA Interface description VisionLine Interface – TruControl 1000 Ethernet interface image processing, doc. no. 12-12-40-A4-BA (see "Supplementary documents", pg. I). The updating of the parameters is done cyclically every 500 ms. The totality of all XVars is not compulsorily transmitted in one block. As an alternative, the parameters **PLC output (CV) x words** are available; these are transferred in one block. Diagnostics: (see "Diagnostics Dynamic table (XVar)", pg. 152)	
BEO application number (MIO/PGM)	Application data set number of a BEO smart.	
Protective glass contamination (PGM)	Protective glass soiling invalid values: 0x7FFF and 0x8000.	
Short pulse duration (PDC)	Short pulse duration resolution 1 fs/digit	
Actual temperature (TPC)[1)]	Current process temperature[1)]. Resolution: 0.1°C/Digit. Invalid value: 0xFFFF.	
Nominal temperature (TPC)[1)]	Process temperature to be regulated to[1)]. resolution: 0.1°C/Digit. Invalid value: 0xFFFF.	
FCU/PCU lid state	Status of the lid of an FCU or PCU. High byte: numbers of the CLI with FCU. Low byte: numbers of the CLI with PCU. The number is specified according to the NUM scheme. Example: The output word has the value 0x0120: FCU lid of the CLI with NUM = 0x01 is open. PCU lid of the CLI with NUM = 0x20 is open. All other lids of the available FCU or PCU are closed.	
Crossjet pressure (MIO)	Pressure Crossjet resolution: 0.1 bar. value range: -3276.7 ... 3276.6 bar. Invalid values: 0x7FFF and 0x8000.	
Purging gas flow (MIO)	Purging gas flow rate resolution: 0.1 l/min. value range: -3276.7 ... 3276.6 l/min. Invalid values: 0x7FFF and 0x8000.	
Power portion core (FCM)[1)]	Power distribution core/ring/BrightLine Weld (2-in-1- or 3-in-1-LLK)[1)]	
Byte 1	0: 100 % core | 1: 100 % ring 1 | 2: 100 % ring 2 3: BrightLine Weld: variable distribution core/ring 1 via byte 2.	
Byte 2	Power share of core in %. Invalid value: 0xFFFF.	

1) Output per slot and light path:
Slot with fixed light path allocation: Values from the components in the allocated light path.
Slot without light path allocation: Values from the components in the light path currently selected by the slot e.g. by a laser program or input word.
If a light path does not contain a component, value 0xFFFF (invalid) is sent.
Note byte swap parameter. Description applies for byte swap = False.

Parameter	Description	Type
MDE gas flow (MIO)	MDE gas flow rate resolution: 0.1 l/min. value range: -3276.7 ... 3276.6 l/min. invalid values: 0x7FFF and 0x8000.	
Shielding gas flow (MIO)	Shielding gas flow rate resolution: 0.1 l/min. value range: 0 ... 6553.5 l/min. invalid values: 0x7FFF and 0x8000.	
PFO fieldbus control state	If in the laser program **PFO: fieldbus control** = is set to yes, new PFO program data sets are already provided during the active PFO program cycle for the next PFO program cycle.	
Bit 0 and Bit 1	With the parameters **PfoDataRdy1** and **PfoDataRdy2** a signal is sent that the new data sets can be provided. **PFODataRdy 1** and **2** must be reflected in the input parameters **Store-Values 1** and **2**.	
Bit 2	Parameter PfoProgActive, indicates that a PFO-Program is active.	
Bit 3 - Bit 7	Reserved.	
Bit 8 - Bit 15	Parameter PstartCntr indicates, how many cycles the PFO program has currently run through.	
Purging gas pressure (CRDS)	Current pressure of the gas supply for the gas purge unit. Unit: mbar. Invalid value: 0xFFFF.	
VariMode state	VariMode state, for laser devices of the TruFiber P series (FD89), laser device family 20-14-01-xx 0 = VariMode is off 1 = VariMode is on If VariMode is switched on, the fiber is compressed to change the beam properties.	
Burst pattern (DLC/WPCI)[1)2)]	When Burst Mode option is activated, the burst pattern is output with this parameter.	
Base frequency (DLC/WPCI)[1)]	Base frequency	
Operating frequency (DLC/WPCI)[1)]	Operating frequency Invalid value: 0xFFFF.	
Energy level (WPCI)[1)2)]	Energy level	
VisionLine Check Status	Parameter for option VisionLine OCT Check with focusing optics PFO and OCT sensor[3)]: ▪ Bit 0: MeasuringReady ▪ Bit 1: SensorReady ▪ Bit 2: SeamOK ▪ Bit 3: SeamNotOK ▪ Bit 4: PartOK ▪ Bit 5: PartNotOK	
PLC output (VLCK) 04 words	Parameter for VisionLine Check OCT with focusing optics BEO and OCT sensor[3)]:	
Word 1	VLCK status, 2 bytes: see parameter VisionLine Check Status.	
Word 2	X-Position, 2 bytes	
Word 3	Y-Position, 2 bytes	
Word 4	Z-Position, 2 bytes	
Protective glass contamination (PFO)	Protective glass contamination (PFO) Invalid values: 0x7FFF and 0x8000.	

1) Further information: See the operator's manual of the laser device.

2) An operating point change is signaled by briefly setting *energy level (WPCI)* and *burst pattern (DLC/WPCI)* to zero.

3) Available from TruControl 1000 version 3.46 on, further information: Software manual "VisionLine OCT Check", Doc.-no. 83-01-07-A0-CR.

Parameter	Description		Type
PCP Measurement	Status of the PCP measurement		
Bit 0	= 1: Measurement is active	= 0: Measurement not active	
Bit 1	= 1: Measurement successful	= 0: Value has no meaning	
Bit 2	= 1: Measurement not successful	= 0: Value has no meaning	
Sensor Relay Output x Words	Output data of the relay sensor, x = 9, 16, 32 or 48 (see "Configuring the sensor relay", pg. 185)		
The availability of these parameters depends on the configuration of the laser device.			

Tab. 143

Device level (ESC)

Functions	The output word **Device level (ESC)** contains the output signal **ESC_DEVICE_LEVEL**.
Active signal	This byte returns the Energy Save Level which is currently active in the laser device.
Information	Technical information "Energy Save Concept", doc.-no. 21-A0-71-CP.

Tab. 144

Slot level (ESC)

Functions	The output word **Slot level (ESC)** contains the output signal **ESC_SLOT_LEVEL**.
Active signal	This byte contains the Energy Save Level which is set for the slot.
Information	Technical information "Energy Save Concept", doc.-no. 21-A0-71-CP.

Tab. 145

Slot RTTO (ESC)

Functions	The output word **Slot RTTO (ESC)** contains the output signal **ESC_SLOT_RTTO**.
Active signal	This word contains the Regular-Time-To-Operate (RTTO) in seconds for the slot. That is the time the laser device requires to change to the Ready_To_Operate status. The RTTO depends on the signal **ESC_SLOT_LEVEL** The external control unit must "wake up" the laser device at the ESC_SLOT_RTTO time before the start of production with ESC_PAUSE = 0xFFFF (END_PAUSE) (see "ESC_PAUSE", pg. 77).
Information	Technical information "Energy Save Concept", doc.-no. 21-A0-71-CP.

Tab. 146

Slot state (ESC)

Bit	Output signal
0	ESC_AVAILABLE
1	ESC_ACCEPTED
2	ESC_NOT_ACCEPTED
3 ... 15	Reserve

Signals of the output word slot state (ESC) Tab. 147

ESC_AVAILABLE

Functions	**ESC_AVAILABLE** output signal.
Active signal	This signal is active if Energy Save Concept for this slot has been activated in the Multi PLC interface settings.
Information	Technical information "Energy Save Concept", doc.-no. 21-A0-71-CP.

Tab. 148

ESC_ACCEPTED

Functions	Output signal **ESC_ACCEPTED**. Response to the input signal ESC_PAUSE.
Active signal	This signal becomes active if the pause time (ESC_PAUSE > 0) has been accepted.
Information	The signal becomes inactive if the pause time has been canceled (ESC_PAUSE = 0). For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

Tab. 149

ESC_NOT_ACCEPTED

Functions	Output signal **ESC_NOT_ACCEPTED**. Response to the input signal ESC_PAUSE.
Active signal	This signal becomes active if the sent pause time (ESC_PAUSE > 0) has not been accepted. The signal is sent in these cases: ▪ An external control unit has sent ESC_PAUSE > 0 (Start pause) while a laser program is active for the slot. ▪ The pause time is shorter than the pause time available in the device. ▪ The pause time is shorter than the pause time transmitted before. ▪ An external control (e.g. PLC) sends Start pause, although it has activated the optimized standby mode via the ENERGY_SAVE_ON (input word 14) signal .
Information	The signal becomes inactive if the pause time has been canceled (ESC_PAUSE = 0). For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

Tab. 150

4.18 Signals of the alternative output words 14 and 15

Note

For fieldbus module DeviceNet slave, the output words 14 and 15 are available if TruControl 1000 version ≥ 1.88.0.

ALIGNMENT_RECOMMENDED

Functions	Signal **ALIGNMENT_RECOMMENDED** indicates that a beam position correction is required.
Active signal	A beam position correction is required. The active process can be ended. To avoid a fault, switch the device off and then on again with LASER_ON, LASER_ON = 1 → 0 → 1 (see "LASER_ON", pg. 53).
Requirement	This output signal is only available if the following conditions have been met: ▪ Option LLK-U is used. ▪ TruControl Version ≥ 3.02 ▪ System parameter CV_HCFBC_Enable = 1.
Information	A beam position correction can also be started via the Multi PLC interface with laser program 240 ("BeamCalibration"), independent of system parameter CV_HCFBC_enable, if TruControl version ≥ 3.06 (see "PROGRAM_No: bit 7 ... bit 0", pg. 63).
1) HCFBC: Hollow Core Fiber Beam Calibration	

Tab. 151

COOLING_LOCKED

Functions	Signal **COOLING_LOCKED** indicates that the external cooling water supply must be stopped.
Active signal	The external cooling water supply should be stopped.
Requirement	This output signal is only available if the following conditions have been met: ▪ TruControl 1000 ≥ 3.14.0 ▪ CMD3 version ≥ CMD34908 (command version CV ≥ 6) ▪ CCB version ≥ CCB_2814 (command version CV ≥ 7) ▪ CCBM version ≥ CCBM3111 (command version CV ≥ 7)

Tab. 152

EMISSION_ON

Functions	Signal **EMISSION_ON** indicates that the laser is emitting power.
Active signal	The laser outputs power > 0 W.
Prerequisite	If a central shutter (VZ) is available, it must be open. This output signal can only be evaluated if the pulse duration and the pulse gap are twice as large as PLC_PowerOutTick. For example if PLC_PowerOutTick = 80 ms, the pulse duration and pulse gap must be at least 160 ms.

Tab. 153

ENERGY_SAVE_IS_ON

Functions	The output signal **ENERGY_SAVE_IS_ON** indicates that the laser device is in the optimized standby mode (OSB 3).Response to the input signal **ENERGY_SAVE_ON**.
Active signal	The laser device and all laser control components except for CPX and PBT are switched off.
Requirement	This output signal is only available if the following conditions have been met: ▪ System parameter **PLC_ExtendBaseIoFunction** = 1. ▪ System parameter **LCU_EnergySaveMode** > 0. ▪ CPX V3 or V4 is available and the input **24 V_STDBY** at X1 of the PBT board is supplied with voltage.
Information	The control can be switched on again with the signal **ENERGY_SAVE_OFF**, if the main switch is on "On". For further information: see technical information "Energy Save Concept", doc. no. 21-A0-71-CP. Not available for laser devices with CPX V20.

Tab. 154

FAULT_PROCESS

Function	Signal **FAULT_PROCESS** indicates when a fault message at the associated MPI slot was triggered during the machining process.
Active signal	Message which affects the process on the user side; examples: ▪ Excessive temperatures when using focusing optics with temperature control (TPC), e.g. PFO 20-2 PO. ▪ When using PFO with SeamLine Remote.
Information	Check the quality of the machined workpiece. The signal must be acknowledged with RESET.

Tab. 155

LASER_CONTROL_IS_ON

Functions	Signal **LASER_CONTROL_IS_ON** indicates that the laser control is switched on.
Active signal	The laser control is active.
Prerequisite	This output signal is only available if the system parameter **PLC_ExtendBaseloFunction** = 1.

Tab. 156

MACHINE_COOLING_READY

Functions	The output signal **MACHINE_COOLING_READY** indicates that the machine cooling is on. Response to the input signal MACHINE_COOLING_ON.
Active signal	The machine cooling is on. Cooling water flow is available.
Requirement	This output signal is only available if the system parameter **PLC_ExtendBaseloFunction** = 1.
Information	This output signal is required, for example, if a TRUMPF laser machine and the integrated laser device use the cooling unit of the TRUMPF laser machine jointly. The machine axes can be released.

Tab. 157

MONITORING_PROCESS

Function	Signal **MONITORING_PROCESS** indicates when a monitoring message at the associated MPI slot was triggered during the machining process.
Active signal	Message which affects the process on the user side; examples: ▪ Excessive temperatures when using focusing optics with temperature control (TPC), e.g. PFO 20-2 PO. ▪ When using PFO with SeamLine Remote.
Information	Check the quality of the machined workpiece. The signal can be acknowledged with RESET.

Tab. 158

5. Using interface

⚠ WARNING

Laser light can be emitted without warning following a malfunction in the energy supply (power failure) and restoration of the energy flow.

Serious injuries or extensive property damage can result.

- Condition external controls so they do not automatically or randomly send signals to the laser control to activate the laser following failure and restoration of the energy flow.

5.1 Triggering

The laser control system can be activated in two different ways:

- Synchronized triggering
- Unsynchronized triggering

Synchronized Triggering

The synchronized activation is the common activation of a laser device. It is characterized by a specified order of request and acknowledgement signals.

Example

1. An external control sets REQUEST_LASER.
2. The laser control responds with LASER_ASSIGNED.
3. The laser control indicates with LASER_READY that it is ready.
4. The external control starts the laser program.
5. The external control resets REQUEST_LASER.
6. Another external control sets REQUEST_LASER.
7. Steps 2 to 6 are repeated.

If a program start is activated without waiting for a previous acknowledgment signal, the laser control indicates a monitoring message or fault message.

If the assignment is changed with a static program start:

- the laser program is **not** started.
- a monitoring message F6xx DE28 is displayed.

The laser program is only started with the positive edge of the program start.

Note

The control unit does not report a fault if a laser program is started from a processing station to which the laser device is not assigned. The started laser program is not carried out.

Chronological sequence of the synchronized activation of two external control units (see "Alternating activation of a laser device", pg. 132).

Unsynchronized Triggering

The unsynchronized activation is intended for applications which require rapid switching between different external control units.

For continuous path control, a synchronization with the help of signals is limited. Acknowledgment signals can be ignored with an exact adjustment to external sequences.

Properties

With an unsynchronized triggering:

- the acknowledgment signals LASER_ASSIGNED and LASER_READY are no longer necessary.
- the signal for start of a laser program can be applied while the laser is not assigned yet.
- the central shutter remains open after execution of a laser program so that the laser is ready for the next request without any delay.

UNSYNC_PSTART in detail

In the UNSYNC mode, a start signal can already be applied before the laser has displayed the LASER_READY or LASER_ASSIGNED message.

If the UNSYNC_PSTART signal is fed constantly or simultaneously with the program start, no fault message is given if the laser is not ready. The laser only starts once it is ready for a program start.

This function can be used for rapid switching (about 80 ms) between various light paths.

Example:

Laser program 1 is active. The UNSYNC PSTART mode was already set at laser program start (**important**).

While the laser program is still active, the laser device is requested by another external control unit also in the UNSYNC_PSTART mode, and laser program 4 is started.

At the end of laser program 1, the central shutter will **not** be closed, but only the position of the shutter switches is adjusted to the new light path. Laser program 4 is started as soon as the switches are in the right position. The switchover time is approx. 80 ms.

Note

The switching to unsynchronized triggering already becomes active when **one** of the connected external control units has activated the UNSYNC_PSTART signal.

Mixed operation

When working with a mixed operation of unsynchronized and synchronized triggering, UNSYNC_PSTART must be deactivated by all connected external control units before the end of the last program in order to enable a synchronized triggering.

If a connected external control unit has activated UNSYNC_PSTART, they work all in the UNSYNC mode.

Switching from SYNC → UNSYNC

When switching from the synchronized to the unsynchronized triggering:

- the central shutter remains open after the program end.
- a laser program is started with the positive edge of LASER_READY if a program start is active.

Switching from UNSYNC → SYNC

When switching from unsynchronized to the synchronized triggering:

- the central shutter remains open after the program end.
- the external control unit is not allowed to carry out a program start with synchronized triggering if the laser device is not assigned.
- in case of an active program start and a not assigned laser device:
  - the laser program is not started.
  - a monitoring message is displayed.

Quitting the UNSYNC mode

The UNSYNC mode is closed if **none** of the connected external control units has activated UNSYNC_PSTART. With the falling edge of UNSYNC_PSTART, the central shutter is closed.

Starting time of UNSYNC_PSTART

If the program start takes place in the UNSYNC_PSTART mode while, for example, a laser program of another assigned external control unit is running, the starting time of the laser program depends on the end of the previous laser program.

It is not possible to define the moment for the use of the laser device by means of a program start. There is **no** time limit.

If the laser program is started in the UNSYNC_PSTART mode, the laser program does not start in the laser device unless:

- the laser device has been requested, assigned and is ready.
- the safety circuit is closed.
- a pump capacity optimization is finished (if active).
- a capacity check is terminated (if active).
- the laser program of the previous external control is finished.
- the laser device is released by the previous external control unit.

If another laser program is started in the UNSYNC mode before the end of the program, this start request is saved and carried out after the end of the running laser program.

Example:

In a laser program, the rampdown of the laser power is initiated with the **WPSL** function (Wait for Program Start "Low"). If a new start request is activated during the rampdown, the information is retained and carried out after the end of the rampdown.

Note

If a laser program is switched to the function WPSL by the Wait function via query inputs (e.g. W1H), the program duration must be reduced accordingly.

LASER_READY with UNSYNC_PSTART

When UNSYNC_PSTART is active, the PROGRAM_ACTIVE and LASER_ASSIGNED signals are **not** incorporated in the LASER _READY signal.
LASER_READY is only controlled by the following information:

- State of the safety circuits of the light paths specified by MPI and/or the laser program.
- A pump capacity optimization or a capacity check must not be active.
- Signals:
  - FAULT_LASER
  - PROG_CANCELLED
- Laser devices with laser standby mode: internal laser in the standby mode

PROG_COMPLETED with UNSYNC_PSTART

A laser program started in the UNSYNC mode does not activate the PROG_COMPLETED signal or only activates it for a short period of time at the end of the laser program if switching to another external control unit takes place immediately.

In this case, the external control must be synchronized, if necessary, to the deactivation of PROG_ACTIVE instead of PROG_COMPLETED.

Safety circuit is opened in the UNSYNC mode

If, in a light path that has just been selected, the safety circuit is opened, the laser control ends the UNSYNC mode and the central shutter is closed if present.

Note for practical use

Counting the PROG_ACTIVE signals

The number of program starts can be checked by counting the output signals PROG_ACTIVE. In the UNSYNC mode, it cannot be guaranteed by the laser device that each program request is carried out.

The chronological sequence of the unsynchronized triggering by means of two external control units is described in a separate section (see "Unsynchronized Triggering of a laser device", pg. 135).

5.2 Timing diagrams

The control of a laser device by means of one or several external controls (e.g. PLC) is explained using timing diagrams and a laser programming example with laser parameters of the external controls.
The external controls are connected to the control of the laser device by means of either a parallel I/O, fieldbus, TRUMPF peripheral bus or OPC interface.

Subsequently there are the timing diagrams for:

- Starting a finite laser program dynamically.
- Starting a finite laser program statically.
- Starting a continuous laser program dynamically.
- Starting a continuous laser program statically.
- Alternating activation of a laser device.
- Unsynchronized triggering of a laser device.
- Parallel activation of a laser device for the simultaneous execution of laser programs with and without pulse triggering (TruControl 1000 Version 1.78.0 and higher).

The shown timing diagrams refer to pulsed laser devices. They apply similarly to CW laser devices.

Start finite laser program dynamically

An external control unit requests the laser device, switches it on and starts the finite laser program number 5 dynamically via the PSTART_DYN input signal.

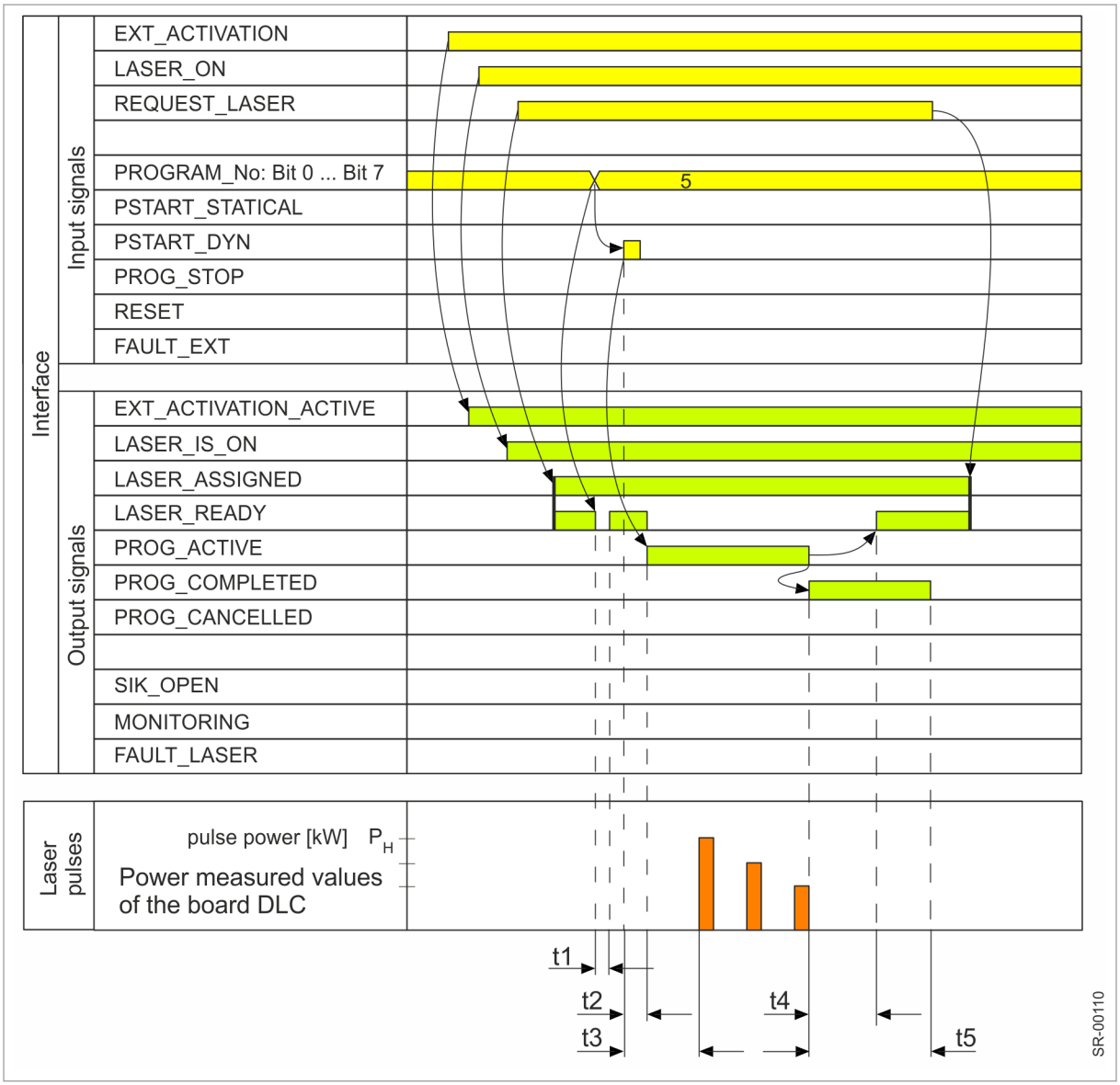


Fig. SR-00110

In laser program 5, 3 laser pulses are programmed with different laser power.

t1 The laser device control sets the **LASER_READY** output signal to inactive if it has to reset the light path when presetting the laser program. Setting of the light path may take up to 45 ms if several optical components are moved.

If in a laser device of the TruMicro 5000 series the basic frequency in the new laser program was changed, the signal **LASER_READY** will remain active until the new basic frequency has been set, which may take up to 30 sec.

t2 The time from the start of the laser program to the acknowledgement by the **PROG_ACTIVE** output signal is approx. 150 µs.

t3 The time from the start of the laser program to the emission of the first laser pulse lies within the range of:

- 15 – 20 ms, if no optical component is moved.
- 35 ms ... 55 ms, if an optical component is moved.

Note

The jitter between the call for the laser pulse and the executed laser pulse can be reduced for pulsed lasers to < ±40 µs by using a real-time interface.

t4 The time the laser needs after the end of a laser program before it is ready again.

The time t4 is determined by:

- the loading time of the capacitor in the laser device (only for pulsed lasers).
- the time needed for moving the optical components.

The loading time of the capacitor in the laser device depends on the pulse energy of the last laser pulse. Depending on the laser device, loading times for minimum to maximum pulse energy are in the range of 1 ms ... 1500 ms.

The time for moving an optical component after the end of a laser program is max. 40 ms. If several optical components are moved, the time is approx. 45 ms ... 55 ms.

The time t4 is at least as long as the longest individual time plus approx. 150 µs of program running time in the laser control.

t5 After the end of a laser program, the **PROG_COMPLETED** output signal becomes active for approx. 6 s.

The **PROG_COMPLETED** output signal becomes prematurely inactive if, before the 6 s have expired,

- a laser program is started again (with PSTART_STATICAL or PSTART_DYN).
- a change in assignment takes place, and the **PLC_ClearProgCompletedOnSlotChange** system parameter is 1.

Note

The times t1 ... t5 given describe exclusively the behavior of the laser device control. The runtimes of the field bus transmission depends on the configuration of a field bus.

Start finite laser program statically

An external control unit requests the laser device, switches the laser on and starts the finite laser program number 5 statically via the input signal PSTART_STATICAL.

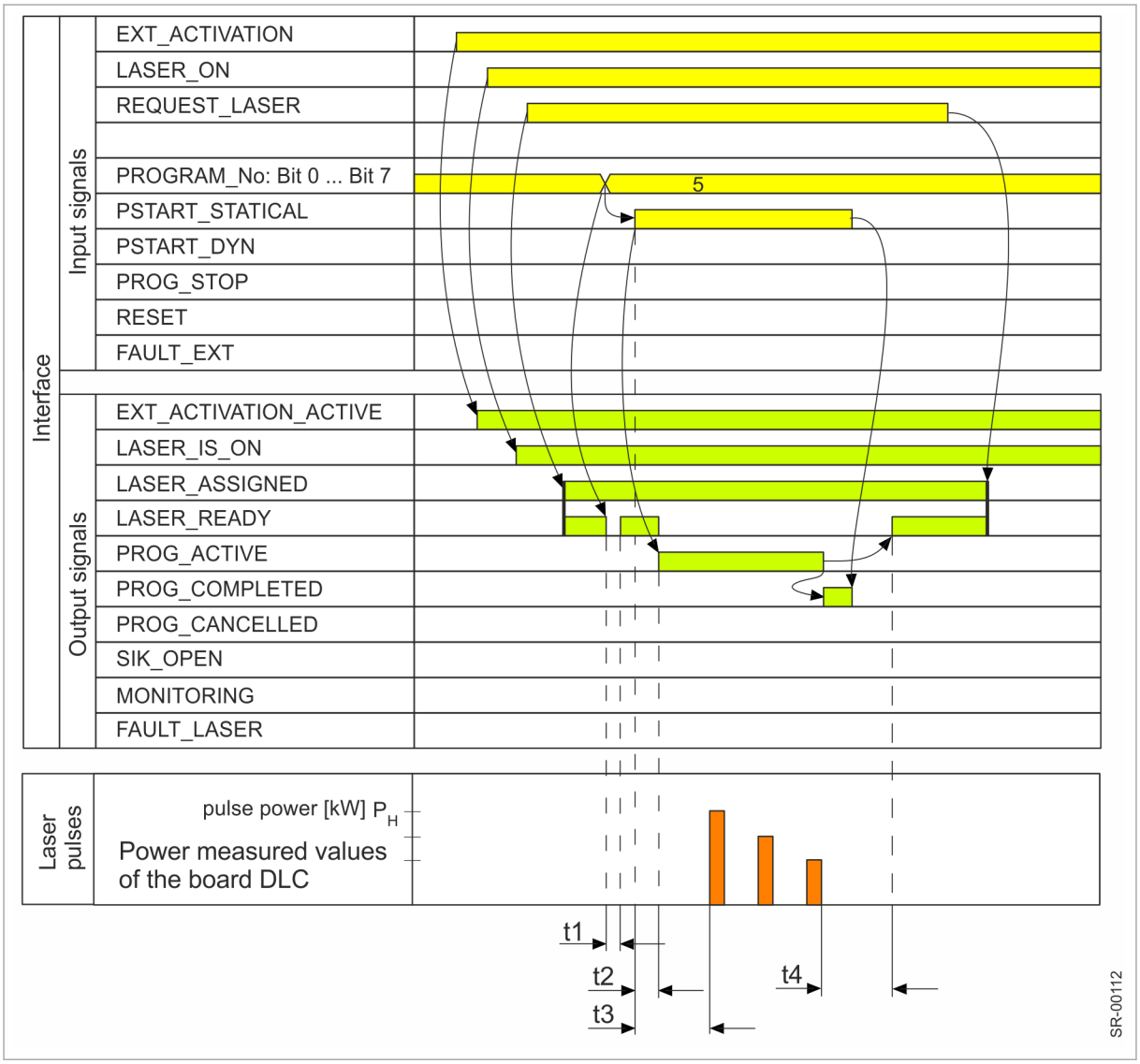


Fig. SR-00112

Note

The timely sequence of a laser program is identical if the laser program has been started dynamically or statically.

Start infinite laser program dynamically

An external control requests the laser device, switches on the laser and starts the infinite laser program No 7 dynamically via the input signal PSTART_DYN. A dynamically started laser program with pulse number = ∞ ("Continuous") or with pulse type = "Continuous wave" (with CW lasers) can stop an external control by means of the input signal PROG_STOP.

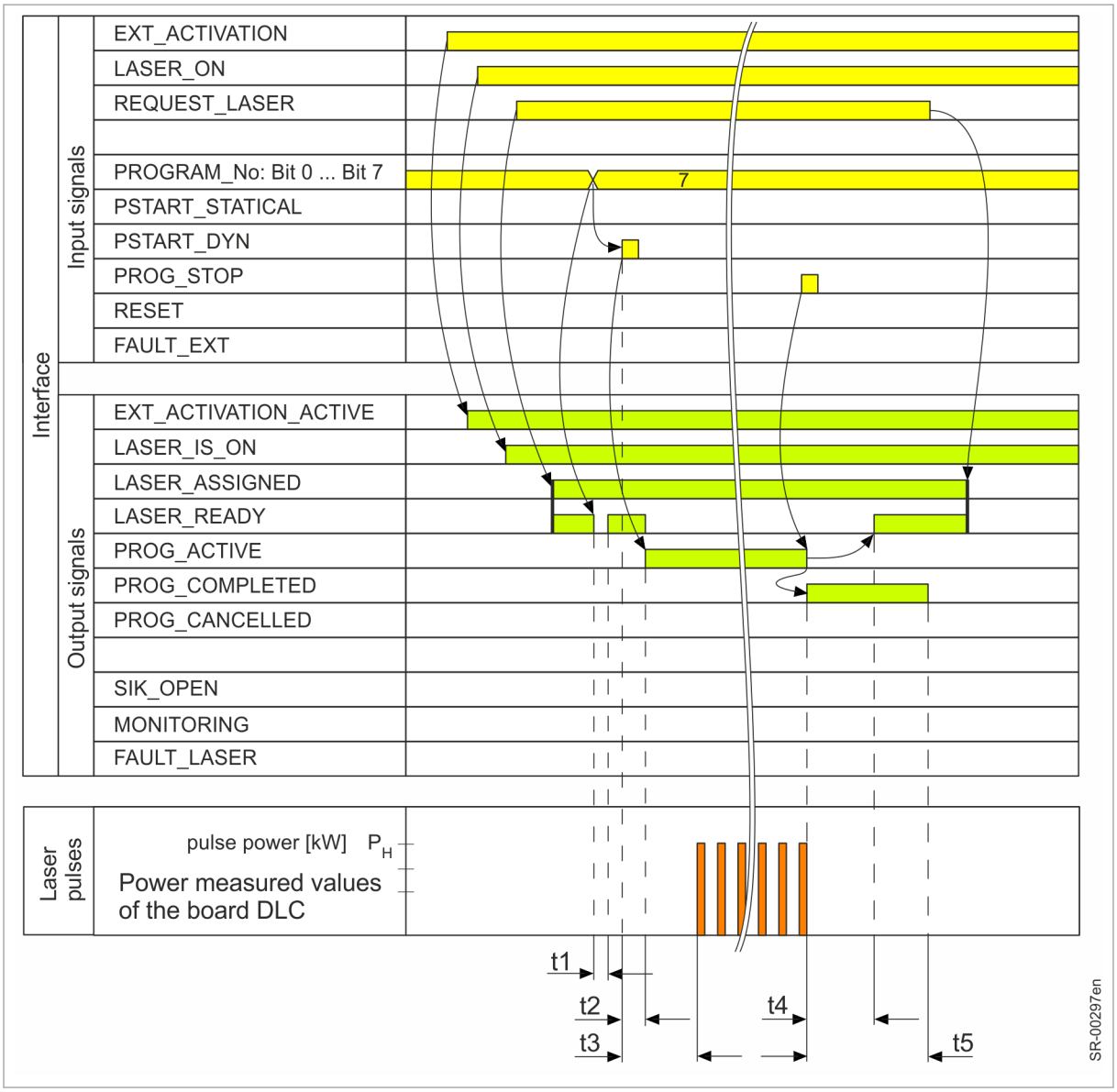


Fig. SR-00297

Start infinite laser program statically

An external control requests the laser device, switches the laser on and starts the infinite laser program No 7 statically via the input signal PSTART_STATICAL. A statically started laser program with pulse number = ∞ ("Continuous") or with pulse type = "Continuous wave" (with CW lasers) can stop an external control by means of the input signal PSTART_STATICAL.

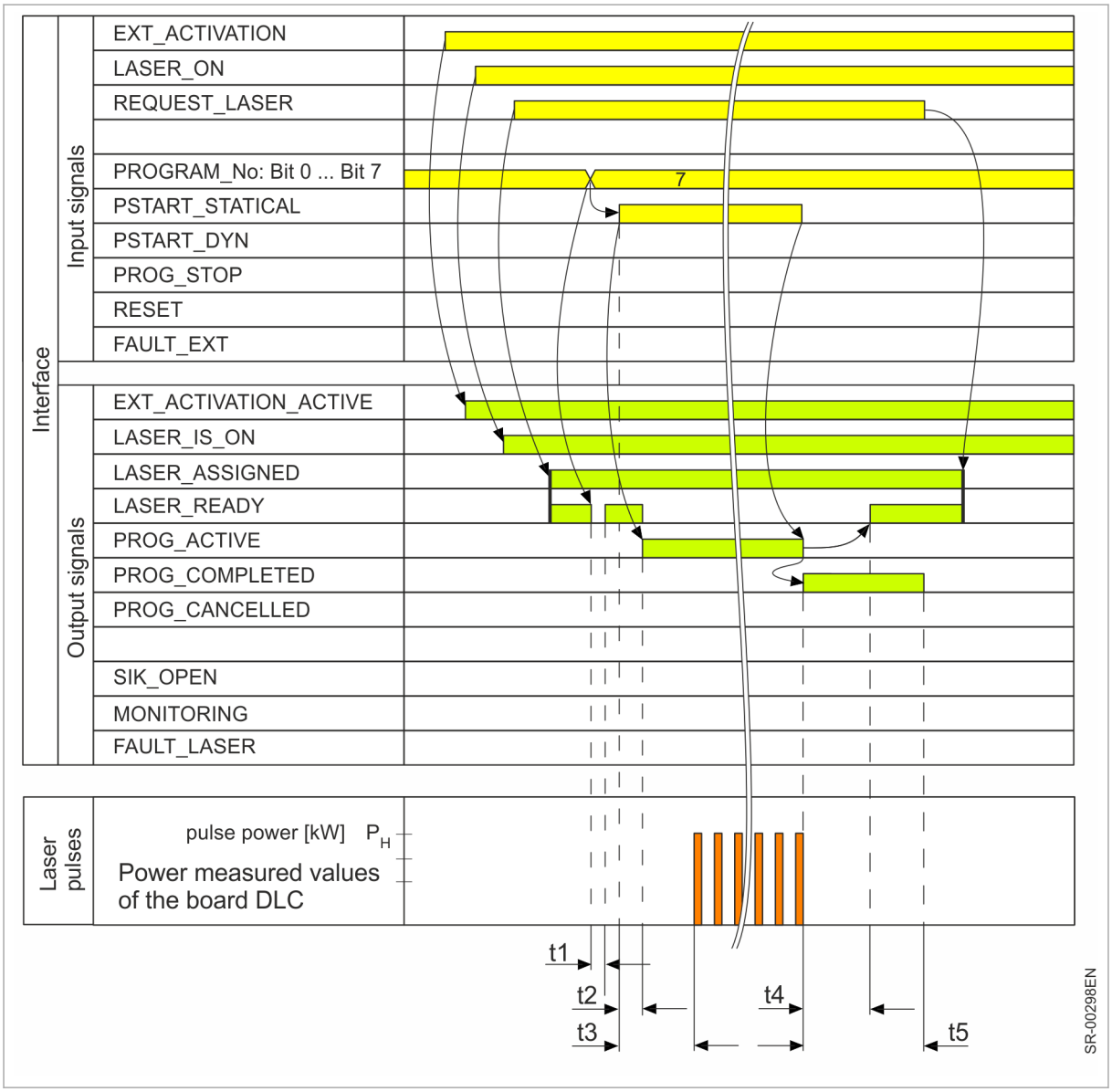
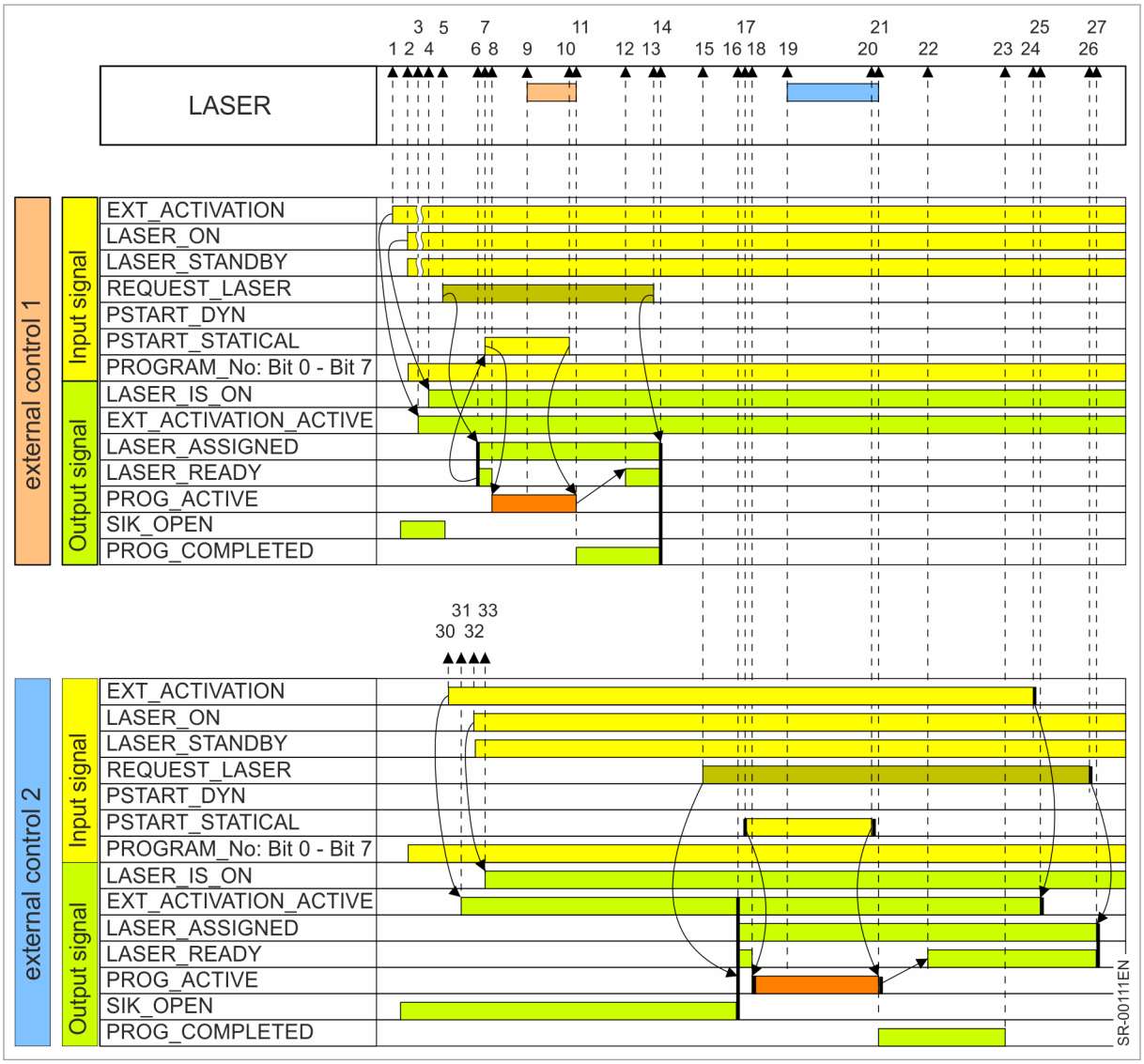


Fig. SR-00298

Alternating activation of a laser device

Two external controls request the laser device and wait for assignment and start an infinite laser program when being assigned. In the timing diagram shown below, the two controls are connected with the laser device via a Multi PLC interface (fieldbus, OPC or parallel I/O interface). The entered times are explained in the following table.



Example for an alternating activation of a laser device Fig. SR-00111

Time of event	Definition
1	The external control 1 activates the input signal EXT_ACTIVATION for an external control of the laser device.
2	The external control 1 activates the input signal LASER_ON and with laser devices with laser standby mode also the input signal LASER_STANDBY, so that it is ensured that the laser is already switched on when being requested.

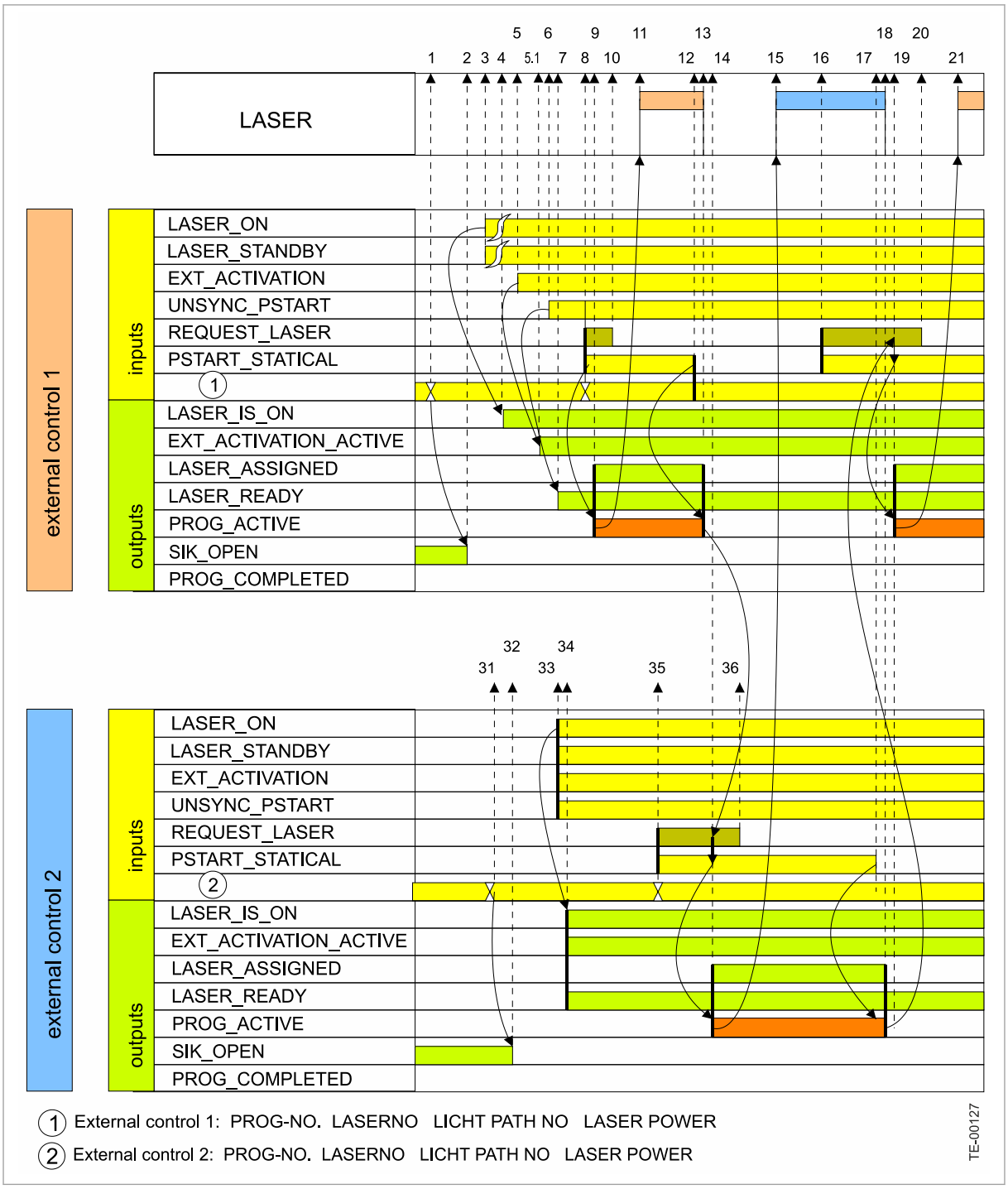
Time of event	Definition
3	The laser device acknowledges the external activation by the active output signal EXT_ACTIVATION_ACTIVE.
4	The laser device activates the output signal LASER_IS_ON.
5	The laser device is requested by the external control 1 using the active REQUEST_LASER input signal.
6	The laser device is assigned by the external control 1 and activates the LASER_ASSIGNED output signal. If the laser is ready (no fault, safety circuit closed), the laser device activates the output signal LASER_READY. A laser program can be started.
7	The external control 1 starts a laser program.
8	The laser device activates the output signal PROG_ACTIVE. If the central shutter is closed, it is opened via a command in the laser program.
9	Laser light is emitted via the preset light path.
10	The external control 1 sets the input signal PSTART_STATICAL inactive.
11	The laser control unit activates the output signal PROG_COMPLETED for approx. 6 s.
12	The laser device activates the LASER_READY output signal. The central shutter can be closed via a command in the laser program.
13	The control 1 sets the input signal REQUEST_LASER inactive.
14	The laser device sets the output signal LASER_ASSIGNED inactive. The output signal PROG_COMPLETED is likewise deactived if system parameter PLC_ClearProgCompletedOnSlotChange = 1.
30	The external control 2 activates the input signal EXT_ACTIVATION for an external control of the laser device.
31	The laser device acknowledges the external activation by the active output signal EXT_ACTIVATION_ACTIVE.
32	The external control 2 activates the input signal LASER_ON and with laser devices with laser standby mode also the input signal LASER_STANDBY, so that it is ensured that the laser is already switched on when being requested.
33	The laser device activates the output signal LASER_IS_ON.
15	The laser device is requested by the external control 2 using the active REQUEST_LASER input signal.
16	The laser device is assigned by the external control 2 and activates the LASER_ASSIGNED output signal. If the laser is ready (no fault, safety circuit closed), the laser device activates the output signal LASER_READY. A laser program can be started.
17	The external control 2 starts a laser program.
18	The laser device activates the output signal PROG_ACTIVE. If the central shutter is closed, it is opened via a command in the laser program.
19	Laser light is emitted via the preset light path.
20	The external control 2 sets the input signal PSTART_STATICAL inactive.
21	The laser control activates the output signal PROG_COMPLETED.
22	The laser device activates the LASER_READY output signal. The central shutter can be closed via a command in the laser program.
23	The output signal PROG_COMPLETED is deactivated approx. 6 seconds after the end of the laser program.
24	The input signal EXT_ACTIVATION must be set inactive, if the laser device should to be controlled via the operating panel. The laser device can no longer be addressed via the Multi PLC interface (fieldbus, OPC or parallel-I/O interface).
25	The laser device set the output signal EXT_ACTIVATION_ACTIVE inactive. The laser device can be controlled via the operating panel.

Time of event	Definition
26	The external control 2 sets the input signal REQUEST_LASER inactive.
27	The laser device is no longer assigned to the external control 2.

Explanation of the times with alternating activation Tab. 159

Unsynchronized Triggering of a laser device

In unsynchronized triggering, a control unit requests the laser device and starts the laser program without waiting for the assignment (see "UNSYNC_PSTART", pg. 60).



Example for unsynchronized triggering of a laser device Fig. TE-00127

Time of event	Information
1	The light path number is created by the external control 1. The previously selected light path 0 is invalid.
2	The safety circuit of the currently selected light path is closed.
3	The external control unit 1 activates the signal LASER_ON and, for lasers with standby mode, also the signal LASER_STANDBY in order to make sure that the laser device is already on when it is requested.
4	The laser device responds with the LASER_IS_ON signal.
5 5.1	The external control unit 1 activates preliminarily the EXT_ACTIVATION signal. The laser device acknowledges by sending the EXT_ACTIVATION_ACTIVE signal. **Note** No preparatory activation of the EXT_ACTIVATION signal is necessary. It is recommended to do without a change in favor of the dynamic behavior.
6	The external control unit 1 activates the UNSYNC_PSTART (program start without laser being ready).
7	In the UNSYNC_PSTART mode, the laser is ready even if the interface has not been assigned. LASER_READY becomes active. **Note** In this mode, "LASER_READY" means: The program start is possible. The laser device may still be connected to another processing station. The safety circuit is closed. A laser device with laser standby mode works in the standby mode. No fault is present. There is not any program cancellation signalized by the PROG_CANCEL-LED signal.
8	The external control unit 1 simultaneously requests the laser device, selects the number of the laser program and starts a laser program. The light path number is not changed.
9	The laser device acknowledges: The laser device is assigned to the external control unit 1. The signals LASER_ASSIGNED, EXT_ACTIVATION_ACTIVE and PROG_ACTIVE are active. The laser program is performed. The LASER_READY signal remains active since in this mode an active laser program does not deactivate LASER_READY. The shutter is opened. If the central shutter is open, laser light will be emitted after about 60 ms.
10	The REQUEST_LASER signal is deactivated by the external control unit 1. The laser program is carried out as long as the PSTART_STATICAL signal is active. Another control unit can request the laser device and prevent the shutter from closing upon completion of the laser program. This allows a quick switch-over.
11	The shutter is open and laser light is emitted on the selected light path.
12	The PSTART_STATICAL signal is deactivated by the external control unit 1, the laser program is finished.
13	The REQUEST_LASER signal is deactivated by the laser device, since the laser device is no longer required by the external control unit 1. Laser light is no longer emitted.
:	
31	The external control 2 changes the light path number.
32	The safety circuit of the new light path is closed. The SIK_OPEN signal is deactivated by the laser device. **Note** In order for the laser control to be able to correctly determine the SIK_OPEN signal, the light path numbers, laser program and laser device must be constantly active. This optimizes the time sequence.

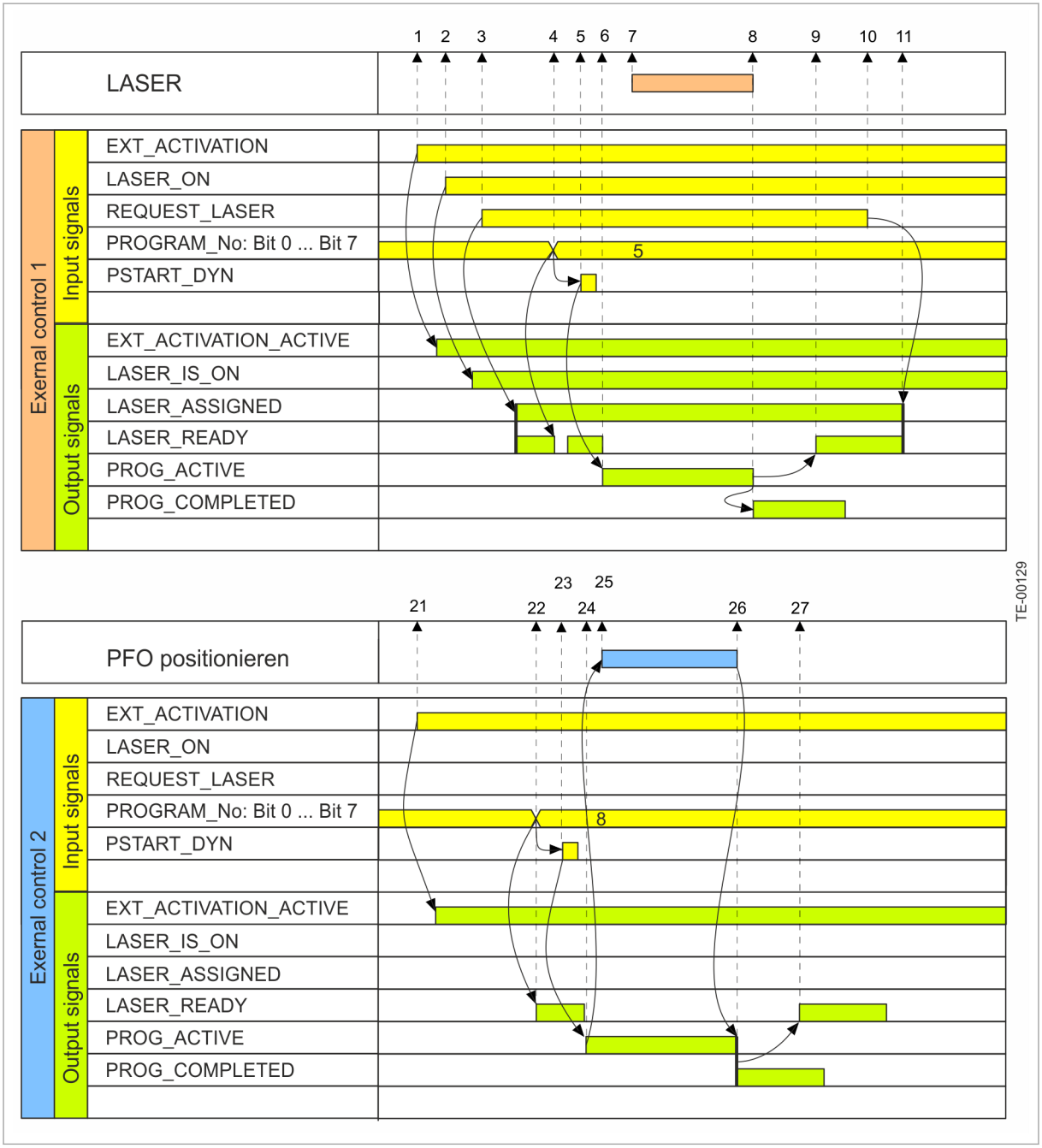
Time of event	Information
33	The external control unit 2 activates simultaneously the signals LASER_ON, EXT_ACTIVATION and UNSYNC_PSTART and, for lasers with a laser standby mode, also the LASER_STANDBY signal. The UNSYNC_PSTART mode is on.
34	The laser device is on and is ready in the UNSYNC_PSTART mode.
35	While a laser program is running from the external control unit 1, the external control unit 2 requests the laser device and activates the PSTART_STATICAL signal to start a laser program.
:	
14	The request and the program start of an external control unit 2 are processed. The acknowledgements are sent to the external control unit 2. The external control unit 2 receives the assignment and the laser program is started.
15	The laser light is emitted on the selected light path.
16	While a laser program is running from the external control unit 2, the external control unit 1 requests the laser device again and starts a laser program. The external control unit 1 activates the signals REQUEST_LASER and PSTART_STATICAL.
17	The PSTART_STATICAL signal is deactivated by the external control unit 2, the laser program is finished.
18	The REQUEST_LASER signal is deactivated by the laser device, since the laser device is no longer required by the external control unit 2. Laser light is no longer emitted.
19	The request and the program start of an external control unit 1 are processed. The acknowledgements are sent to the external control unit 1. The laser program is started. The laser device is assigned to the external control unit 1. The signals LASER_ASSIGNED, EXT_ACTIVATION_ACTIVE and PROG_ACTIVE are active. The laser program is performed. The LASER_READY signal remains active since in this mode an active laser program does not deactivate LASER_READY. The shutter remains open. The light path is switched over. The number of the laser program and the laser data are switched over. If the light path is set, laser light will again be emitted after about 60 ms.
20	The REQUEST_LASER signal is deactivated by the external control unit 1. The laser program is carried out as long as the PSTART_STATICAL signal is active. Another control unit can request the laser device and prevent the shutter from closing upon completion of the laser program. This allows a quick switch-over.
21	The laser light is emitted on the selected light path.

Tab. 160

Indicated times The times given do not include the times of the external bus systems as their basic times as well as cycle times are not known.

Parallel activation of a laser device

An external control unit has requested the laser device and started a laser program of the type "Standard" (with pulse triggering). During the laser processing, a different external control unit starts a laser program of the type "No pulse triggering", e.g. for positioning the PFO. In the timing diagram shown below, the two control units are connected with the laser device via a Multi PLC interface. The entered times are explained in the following table.



Example for parallel activation of a laser device Fig. TE-00129

Time of event	Definition
1	The external control 1 activates the input signal EXT_ACTIVATION for an external control of the laser device. The laser control unit activates the output signal EXT_ACTIVATION_ACTIVE.
2	The external control unit 1 activates the input signal LASER_ON. The laser control unit activates the output signal LASER_IS_ON.
3	The laser device is requested by the external control 1 using the active REQUEST_ LASER input signal. The laser control unit activates the output signals LASER_ASSIGNED and LASER_READY. The laser device is assigned to the external control unit 1 and the laser is ready.
4	The external control unit 1 sends the number of a laser program of the type "Standard", example: 5. The laser control unit shortly deactivates the output signal LASER_READY and activates the signal again.
5	The external control unit 1 starts the laser program (input signal PSTART_DYN).
6	The laser device activates the output signal PROG_ACTIVE and deactivates the output signal LASER_READY. If the central shutter is closed, it is opened via a command in the laser program.
7	Laser light is emitted via the preset light path.
8	The laser program is finished. The laser control unit deactivates the output signal PROG_ACTIVE and activates the output signal PROG_COMPLETED for approx. 6 s. No more laser light is emitted.
9	The laser control unit activates the signal LASER_READY.
10	The external control unit 1 deactivates the input signal REQUEST_LASER.
11	The laser control unit deactivates the signals LASER_ASSIGNED and LASER_READY. The laser device is no longer assigned to the external control unit 1 and the laser is no longer ready.
21	The external control 2 activates the input signal EXT_ACTIVATION for an external control of the laser device. The laser control unit activates the output signal EXT_ACTIVATION_ACTIVE.
22	The external control unit 2 sends the number of a laser program of the type "No pulse triggering", e.g. for positioning of a PFO, example: 8. The laser control unit activates the output signal LASER_READY. The laser program of the type "No pulse triggering" can be executed although the laser is assigned to the external control unit 1 and the laser light is emitted.
23	The external control unit 2 starts the laser program of the type "No pulse triggering".
24	The laser control unit deactivates the output signal LASER_READY and activates the output signal PROG_ACTIVE.
25	The PFO is positioned.
26	The positioning of the PFO is complete. The laser control unit deactivates the output signal PROG_ACTIVE and activates the output signal PROG_COMPLETED for approx. 6 s.
27	The laser control unit activates the signal LASER_READY.

Explanation of the times with parallel activation Tab. 161

Notes

- If an external control unit without assignment attempts to start a laser program of the type "Standard", this laser program is not executed. No message is displayed.
- An active laser program is cancelled if, during the program change, the laser program type changes as follows:

  - From "Standard" to "No pulse triggering".

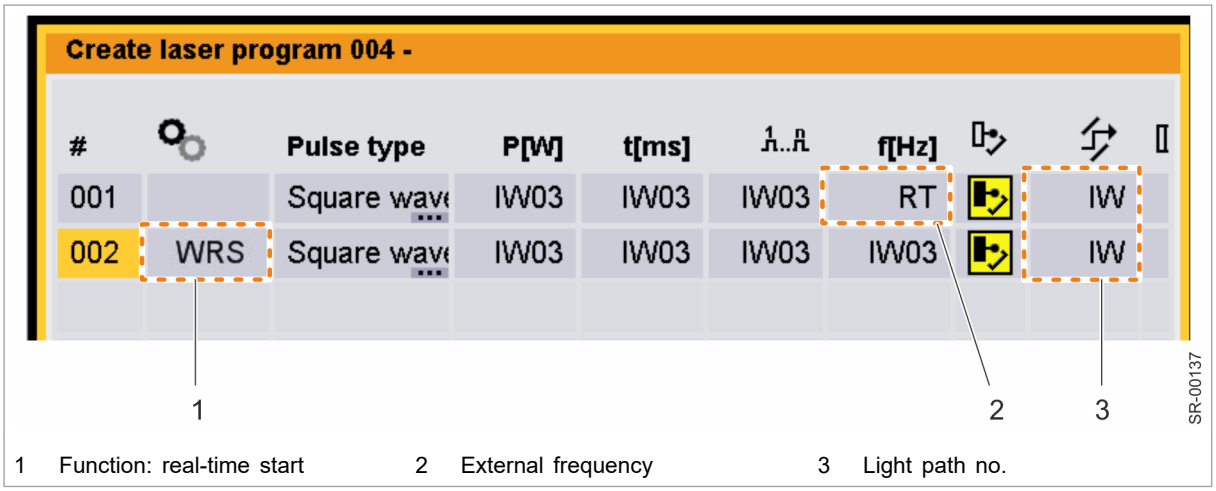
  - From "No pulse triggering" to "Standard".
- If the assigned control unit executes a laser program of the type "No pulse triggering", the symbol Program active is not displayed in the TruControl interface.
- From TruControl version 1.82.0, a laser program of the type "No pulse triggering" can be started in parallel with a laser program of the type "Standard" also during image processing with the two laser program functions WIP (Wait for Image Processing) and WIPJ (Wait for Image Processing Job).

  Further information:
  Operator's manual "VisionLine", Doc-no. 22-50-12-A0-CR
  Interface description "VisionLine Interface – TruControl 1000 Ethernet interface for image processing", doc-no. 12-12-40-A4-BA.

5.3 Using Input words for laser parameters

The input words to be interpreted as laser parameters by the fieldbus or OPC are defined in laser programs. For this purpose, the input word IW.. is entered in the laser program instead of the value of a laser parameter. This input word will then be used to transfer the laser parameter value.

In the following example, the values for pulse power, pulse duration, number of pulses and frequency are defined by means of the input words IW3 ... IW6. The light path no. is defined via IW (bit 15 ... bit 8 of the input word 1).



1 Function: real-time start 2 External frequency 3 Light path no.

Example: Laser program with laser parameters from the field bus or OPC Fig. SR-00137

The example shown above consists of 2 program lines:

- In program line 001:
  - the laser parameters are transferred using the input words IW03, IW04 and IW05.
  - is transmitted via IW (bit 15 ... bit 8 of the input word 1) of the light path no.
  - laser pulses are triggered externally via the **EXTERNAL_FREQUENCY** input signal of a real-time interface.
- In program line 002:
  - the laser parameters are transferred using the input words IW03, IW04, IW05 and IW06.
  - is transmitted via IW (bit 15 ... bit 8 of the input word 1) of the light path no.
  - laser pulses are triggered externally using the **REAL-TIME_START** signal of a real-time interface.

Laser parameters have to be transferred before starting a laser program if they are used as input words IW.. in a laser program.

If, for example, laser power parameters are transferred during the runtime of a laser program, it takes about 5 ms + transmis-

sion cycle of the external control unit (e.g. PLC) for the laser to be set to the new power values.

Further Information:

- Software manual "TruControl 1000", doc no. 10-06-80-A1-CR".
- Interface descriptions:
  - "Digital I/O interface of the CPX – parallel I/O, real-time, Sync I/O and decentralized I/O interface of the CPX V3 and CPX V4 standard",doc. no. 18-22-91-A2-BA
  - "Real-time and Sync I/O interface of the CPX V4 Basic",Doc.-No. 18-23-04-A1-BA
  - "Parallel I/O, Real-time and Sync I/O interface of the CPX",doc. no.: 18-21-85-A1-BA

Note

- If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

5.4 Messaging and RESET behavior

Notifications

There are four categories of messages which are output at the Multi PLC interface with the output word 4 and 5.

- Slot monitoring
  Signal **MONITORING_SLOT**, output word 2 bit 9
- Laser monitoring
  Signal **MONITORING**, output word 0 bit 5
- Slot fault
  Signal **FAULT_SLOT**, output word 2 bit 8
- Laser fault
  Signal **FAULT_LASER**, output word 0 bit 4

RESET

An external control must respond to messages with **RESET**, input word 0 Bit 8.

System parameter

These four message categories and RESET are influenced by the following system parameters:

- **PLC_Word_2_OutShutter**
  Assignment of output word 2
  - 0: Slot fault/-monitoring and status of the focusing optics
  - 1: Shutter position
- **LCU_GlobalLaserFaultReset**
  - 0: RESET for FAULT_LASER only possible from the assigned MPI slot.
  - 1: RESET for FAULT_LASER also possible from an unassigned MPI slot.
- **LCU_GlobalSlotReset**
  - 0: RESET for slot fault/monitoring only for the assigned MPI slot.
  - 1: RESET for slot fault/monitoring for all MPI slots
- **PLC_SeparatedSlotFault**
  - 0: with a slot fault, laser monitoring is also output.
  - 1: with a slot fault, no laser monitoring is output.

Status indicators

The following symbols show monitoring and fault messages in the status bar of TruControl 1000.

	Slot fault
	Laser monitoring
	Laser fault

Tab. 162

Slot monitoring

If slot monitoring is used, the message code (output words 4 and 5) and the output signal MONITORING_SLOT are output only at the relevant MPI slot.

Slot monitoring is output, for example when resetting REQUEST_LASER as long as the signal PROGRAM_START is still set.

If additional slot-/laser monitoring follow, then these are output at the Multi PLC interface.

Slot monitoring must be reset using RESET at the relevant MPI slot, irrespective of the assignment.

If the system parameter LCU_GlobalSlotReset = 1, all slot monitoring of the assigned MPI slot can be reset by means of RESET.

Laser monitoring

If laser monitoring is used, the message code (output word 4 and 5) and the output signal MONITORING is output at all MPI slots.

Laser monitoring is output, for example, if the level of the cooling water in the tank is too low.

If additional slot-/laser monitoring follow, then these are output at the Multi PLC interface.

If the system parameter LCU_GlobalLaserFaultReset = 0, a laser monitoring must be reset at the assigned MPI slot by means of RESET.

If the system parameter LCU_GlobalLaserFaultReset = 1, a laser monitoring must be reset at each assigned MPI slot by means of RESET.

Slot fault

If a slot fault occurs, the message code (output word 4 and 5) and the output signals FAULT_SLOT, MONITORING_SLOT and MONITORING are output only at the relevant MPI slot.

A slot fault is output, for example, if an attempt is made to start a non-existent laser program.

If additional slot-/laser monitoring or slot faults occur, then these are not output at the Multi PLC interface.

If the system parameter LCU_GlobalSlotReset is 0, a slot fault must be reset at the relevant MPI slot by means of RESET, irrespective of the assignment!

If the system parameter LCU_GlobalSlotReset = 1, all slot faults of the assigned MPI slot can be reset by means of RESET.

Laser fault

If a laser fault occurs, the message code (output words 4 and 5) and the output signals FAULT_LASER and MONITORING are output at all MPI slots.

A laser fault is output, for example, if an attempt is made to start a laser program which contains a deleted light path.

If additional slot-/laser monitoring or
slot-/laser faults occur, then these are not output at the Multi PLC interface.

If the system parameter LCU_GlobalLaserFaultReset = 0, a laser fault must be reset at the assigned MPI slot by means of RESET.

If the system parameter LCU_GlobalLaserFaultReset is 1, a laser fault can be reset at every MPI slot by means of RESET irrespective of the assignment!

Recommended system settings

We recommend configuring the system as follows:

Setting	System parameter
Output word 2 Output of the signals slot fault and monitoring	**PLC_Word_2_OutShutter** = 0
Reset of a slot fault/monitoring only for an MPI slot	**LCU_GlobalSlotReset** = 0
Reset of a laser fault only for the assigned MPI slot	**LCU_GlobalLaserFaultReset** = 0
Separation between laser fault and slot fault	**PLC_SeparatedSlotFault** = 1
Programmable output words 4 and 5	Default setting, i.e., the message code is output.
MPI settings output mask (see "Output mask", pg. 37)	**PROG_CANCELLED** = 0 **PILOT_LASER_IS_ON** = 0

Tab. 163

5.5 Save energy with Energy Save Concept or optimized standby modes 1-4

The Energy Save Concept allows the laser devices to be switched to different energy-saving states in different ways:

- PROFIenergy for ProfiNet.
- Pause concept for Multi PLC interfaces.

Which ways are available depends on the type of laser device and the configuration.

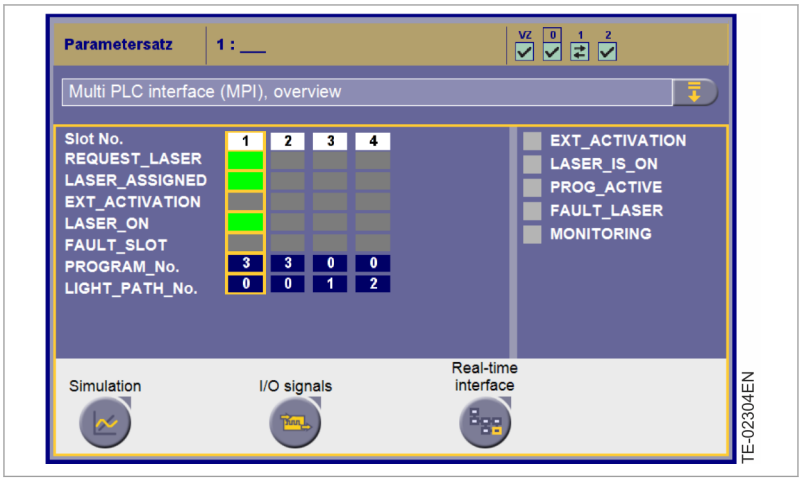
If the Energy Save Concept is not available, there are, depending on the laser device type and the configuration, up to four sleep modes.

Further information: Technical information "Energy Save Concept", Doc.-no. 21-A0-71-CP.

6. Testing options

6.1 Multi-PLC interface (MPI), overview

The dialog >*Produce* >*Multi-PLC interface (MPI), overview* can be displayed from any user level. The status of important signals, the pulse energy, the average laser power and the utilization of the laser device are shown to the user per assigned processing station (slot).



Multi PLC Interface (MPI), overview dialog Fig. TE-02304

When selecting a slot, buttons are displayed in the context bar which enable activation of further functions. Depending on the configuration the following buttons are available:

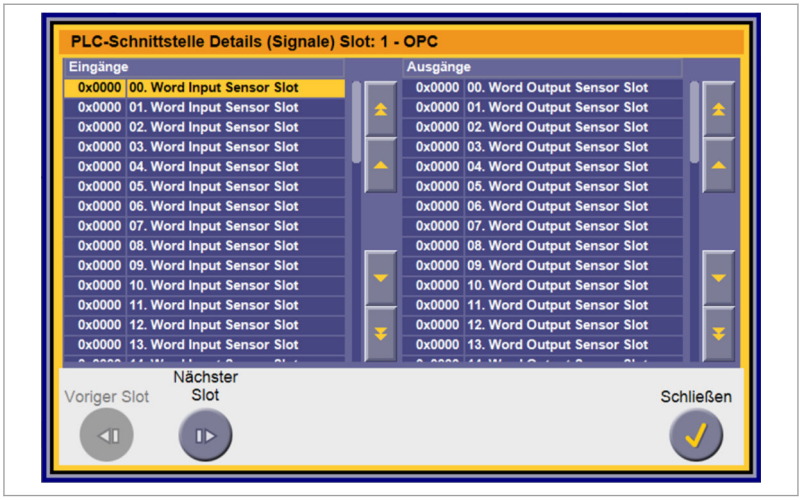
- Simulation
- I/O signals indicate the signals of the input and output words of the selected slot, e.g. the signals of a sensor relay (see "Diagnostics Sensor relay", pg. 149).
- Real-time interface.
- Manual focusing optics (option).

For further information: see software manual „TruControl 1000“, doc.-no. 10-06-80-A1-CR, chapter 5, „Diagnostics“.

Diagnostics Sensor relay

If a multi-PLC interface is defined as a sensor slot, the current values of the input and output words of the relay of the relay can be displayed in the dialog *>PLC interface details (signals).....*.

The dialog **PLC interface details (signals) ...** is displayed in the dialog *>Production >Multi-PLC interface (MPI), overview* by pressing *I/O signals*:

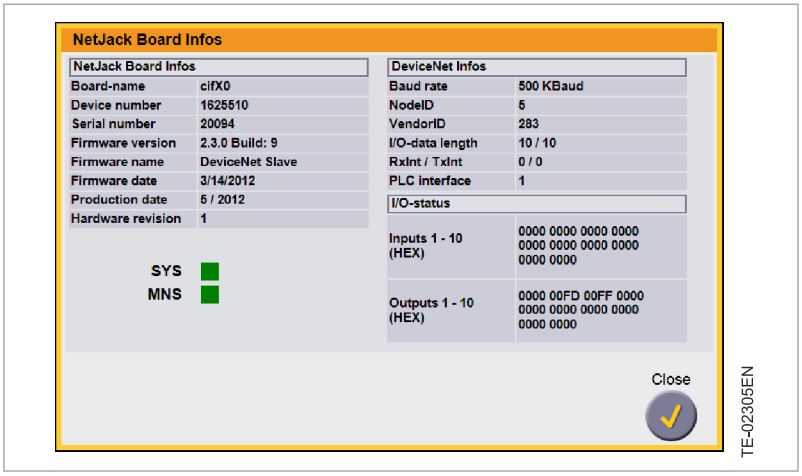


Sensor relay diagnostics, PLC interface details (signals) slot 1 - OPC Fig. 142469

6.2 Diagnostics of the fieldbus modules

The diagnosis of the fieldbus modules can be displayed with each user level in the dialog *>Diagnosis >TruControl Laser Control (CPX)* by tapping the fieldbus module (interface X14 NET JACK).

The following figure shows the diagnosis using the DeviceNet fieldbus module as an example.



Dialog NetJack diagnostics, example DeviceNet Fig. TE-02305

The following data is displayed:

- NetJack Board information (general):
  Serial number, firmware version, hardware revision, et.al.
- Status LED (module-specific):
  Figure showing the status LEDs of the fieldbus module.
  Note:
  There is not a real-time display. Read the status of the LEDs on the fieldbus module directly.
- Protocol status (module-specific, DeviceNet information here):
  Fieldbus module settings.
- I/O status (module-specific):
  Display of the input and output words (hexadecimal coded).

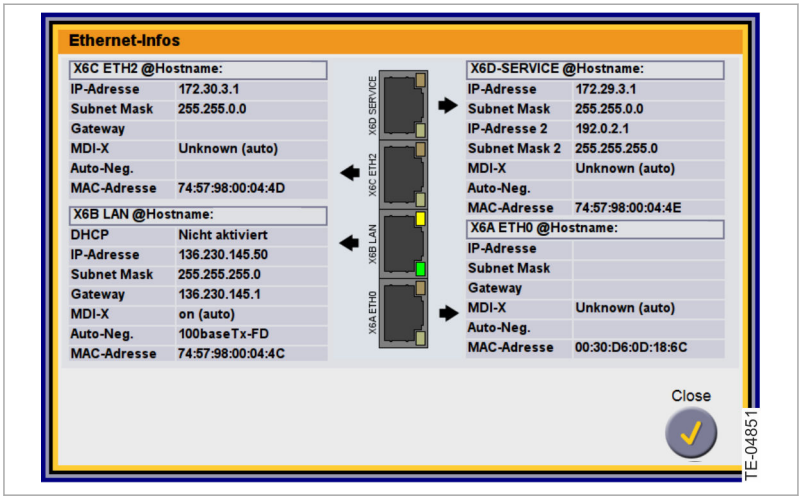
6.3 Diagnostics the internal ProfiNet interface (option)

If the internal ProfiNet interface option is activated, the interface X6A ETH0 is used as an internal ProfiNet interface.

The diagnostics of this interface can be displayed with each user level in the dialog *>Diagnostics >TruControl laser control (CPX)* by tapping one of the four network interfaces (X6).

The following figure shows the diagnostics of the four network interfaces (X6):

Ethernet interfaces diagnostics



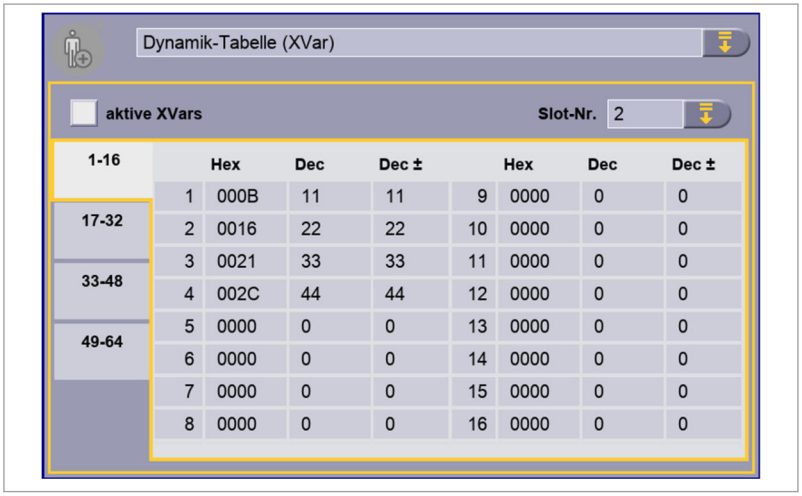
Ethernet interfaces diagnostics Fig. TE-04851

In the "Ethernet Infos" dialog, the following status information is presented for the four Ethernet interfaces:

- IP address
- Subnet mask
- IP address 2 (only X6D SERVICE)
- Subnet mask 2 (only X6D SERVICE)
- Gateway (only X6A ETH0, X6B LAN and X6C ETH2)
- MDI-X setting
- Auto-negotiation setting (auto-neg.)
- MAC address
- Connection status (LED LINK, green, blue)
- Communication status (LED ACT, yellow)

6.4 Diagnostics Dynamic table (XVar)

The diagnostics of the dynamic table (XVar) can be displayed in the dialog >*Diagnostics* >*Dynamic table (XVar)* with a user level ≥ 60 .
The XVar tables of the individual slots are active if the VL parameters "PLC Output (CV) X Words" are used in the output words of the interface parameters.



	Hex	Dec	Dec ±		Hex	Dec	Dec ±
1	000B	11	11	9	0000	0	0
2	0016	22	22	10	0000	0	0
3	0021	33	33	11	0000	0	0
4	002C	44	44	12	0000	0	0
5	0000	0	0	13	0000	0	0
6	0000	0	0	14	0000	0	0
7	0000	0	0	15	0000	0	0
8	0000	0	0	16	0000	0	0

Dynamic table diagnostics (XVar) Fig. 142470

- If XVar is transferred via OPC:
  - If no slot is assigned, the XVar will only be entered in the "active" XVar table.
  - If a slot is assigned, the XVars are entered in the "active" XVar table and the XVar table of the slot.
- If XVar is transferred from VisionLine:
  - Regardless of the assignment, the XVar is written into the XVar table of the slot which started the VL.
  - If the requesting slot is assigned, the XVar is also written into the "active" XVar table.
- If the assignment changes:
  - If a slot is assigned, the XVar of the slot's XVar table is copied to the "active" XVar table.
- If a laser program is started, the XVar is reset in the interface parameter "PLC output (CV) x words". The XVar table of the slot is not deleted. As a result, the display of the XVar table of the slot shows different values than the interface parameter "PLC output (CV) x words".

7. Installing / removing fieldbus modules

Electromagnetic compatibility (EMC)

To ensure that the electromagnetic compatibility (EMC) requirements of the laser device are met, fieldbus cables with shielding braid must be used and the shielding braid of the fieldbus cables in the laser device's cable entry system must be connected with the ground terminals.
If no cable entry system or ground terminals are available, fieldbus cables with electrically conductive plug housings must be used, e.g. for fieldbus cables with Sub-D connectors. The shielding braid on the fieldbus cable must be connected conductively to the plug housing.

7.1 Installing fieldbus

NOTICE

Electrical voltage

Electronic components in the fieldbus module can become destroyed if the power supply of the central processor (CPX) is on during installation.

- Before installing the fieldbus module, switch off the power supply of the central processor and secure it against being switched on again.
- Do not start work until you are certain that no voltage is active at the central processor.

NOTICE

Electrostatic discharges

Electronic components in the fieldbus module can become destroyed.

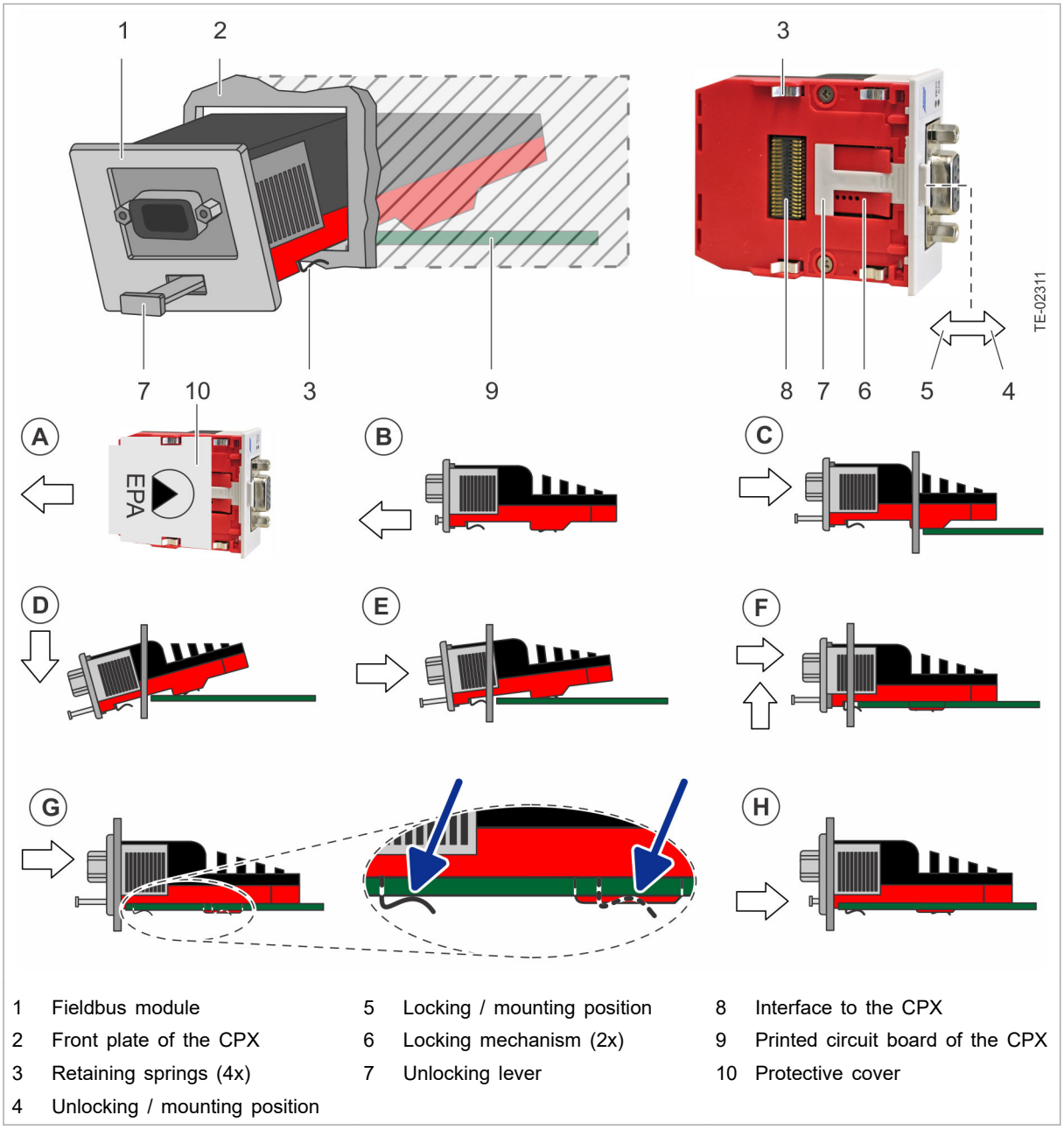
- Do not touch the contacts on the fieldbus module.
- Wear an ESD wrist strap.
- Work at a workstation protected against electrostatic charges, if possible.
- Store the fieldbus module in protective packaging when the fieldbus module is not in use.

No tools are required for installing the fieldbus module in the central processor. The fieldbus module is simply inserted into the recess in the front panel of the central processor, snapped into the printed circuit board of the central processor and fixed to the printed circuit board of the central processor by means of the unlocking lever.

1. If the recess for the fieldbus module on the front plate of the central processor is protected with a cover, remove the cover.

   Store the cover for later use.

   The installation of the fieldbus module is shown in the following figure.



1	Fieldbus module	5	Locking / mounting position	8	Interface to the CPX
2	Front plate of the CPX	6	Locking mechanism (2x)	9	Printed circuit board of the CPX
3	Retaining springs (4x)	7	Unlocking lever	10	Protective cover
4	Unlocking / mounting position				

Fig. TE-02311

Note

Improper installation can cause the retaining springs to bend.

2. Perform steps (A) to (H) carefully.
3. Store the protective cover (10) for later use.

The fieldbus module is assembled. The retaining springs fix the fieldbus to the PCB.

Now the fieldbus module must be configured (see "Configuring interfaces", pg. 157).

7.2 Removing the fieldbus module

NOTICE

Electrical voltage

Electronic components in the fieldbus module can become destroyed if the power supply of the central processor (CPX) is on during removal.

- Before removing the fieldbus module, switch off the power supply of the central processor and secure it against being switched on again.
- Do not start work until you are certain that no voltage is active at the central processor.

NOTICE

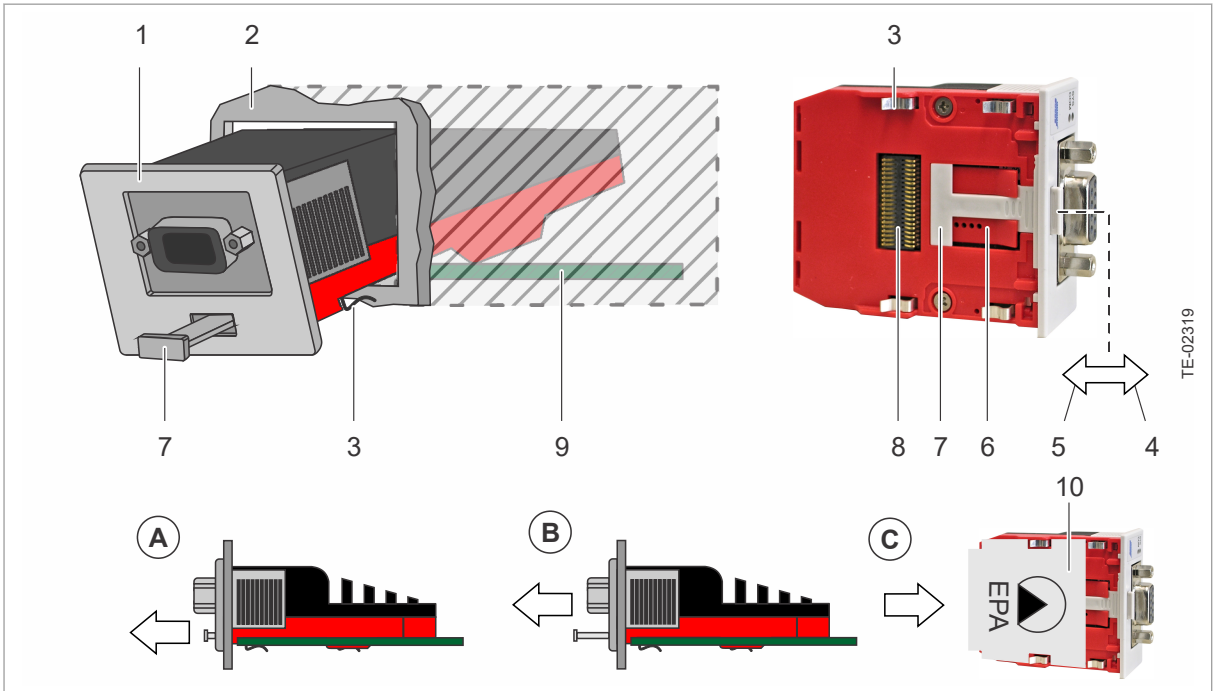
Electrostatic discharges

Electronic components in the fieldbus module can become destroyed.

- Do not touch the contacts on the fieldbus module.
- Wear an ESD wrist strap.
- Work at a workstation protected against electrostatic charges, if possible.
- Store the fieldbus module in protective packaging when the fieldbus module is not in use.

No tools are required for removing the fieldbus module from the central processor. The fieldbus module is simply unlocked and pulled out of the central processor.

The removal of the fieldbus module from the central processor is shown on the following figure.



1	Fieldbus module	5	Locking / mounting position	8	Interface to the CPX
2	Front plate of the CPX	6	Locking mechanism (2x)	9	Printed circuit board of the CPX
3	Retaining springs (4x)	7	Unlocking lever	10	Protective cover
4	Unlocking / mounting position				

Fig. TE-02319

1. Perform steps (A) and (B) carefully.

   This completes the removal of the fieldbus module from the central processor.
2. If the fieldbus module is not used any further, slide the protective cover (10) onto the fieldbus module (C) and store the fieldbus module in protective packaging.
3. If the fieldbus interface is not used any further:
   - Mount a cover on the recess of the front panel of the central processor.
   - Delete the fieldbus module from the configuration in the operating software. For further information: software manual "TruControl 1000", doc. no. 10-06-80-A1-CR.
4. If a different fieldbus module is to be used, the new fieldbus module can now be mounted (see "Installing fieldbus", pg. 153).

8. Configuring interfaces

The following settings are required for a fieldbus module in the operating software:

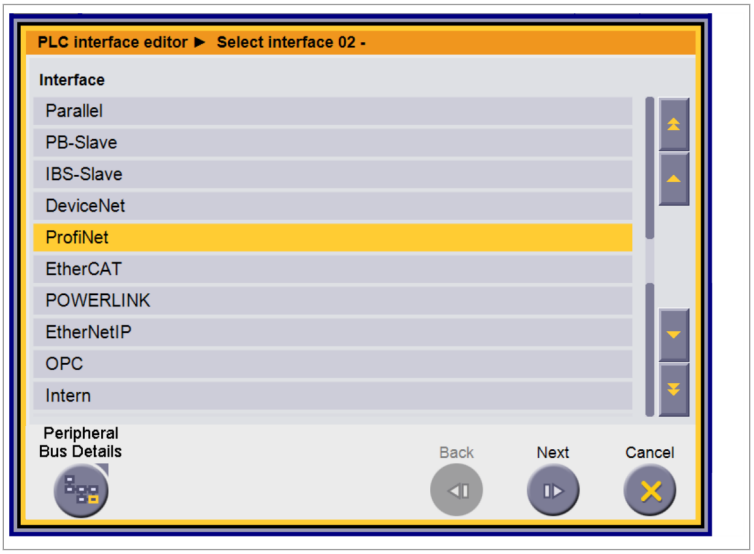
- Assign MPI slot and select fieldbus module.
- Configure fieldbus module.

8.1 Assign MPI slot and select fieldbus module

Condition

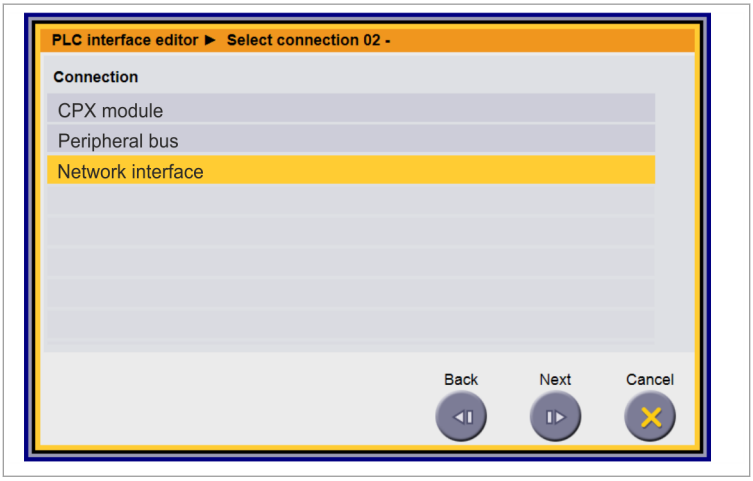
- User level ≥ 60

1. Select the >*Setup* >*Multi PLC interface (MPI)* dialog.
2. Mark the unassigned slot in the table.
3. Press the *New* button to start the Multi-PLC interface editor.



Selecting the interface Fig. TE-02309

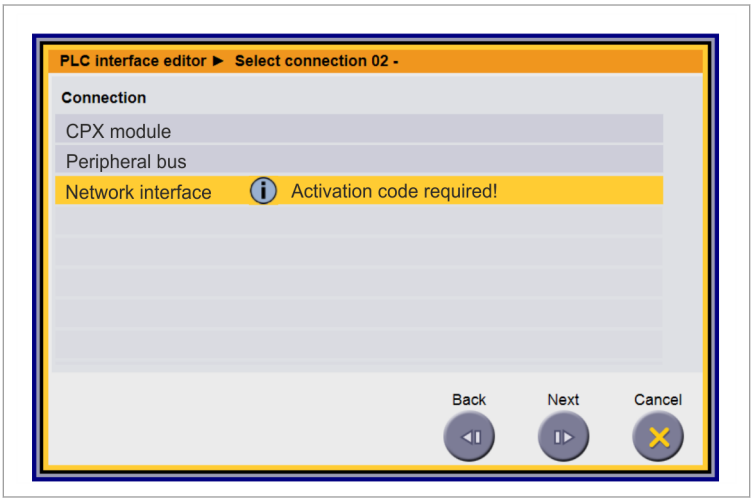
4. Mark the desired interface, for example ProfiNet (ProfiNet IO Device Slave).
5. Switch to the dialog >*Linking* using the >*Next* button.



Connection, example: ProfiNet IO Device Slave Fig. TE-02310

6. If the ProfiNet interface is to be configured as a fieldbus module, mark the line "CPX module" and press the *Next* button to change to the next dialog.
7. If the internal ProfiNet interface is to be configured, mark the "Network interface" line and press the *Next* button to change to the next dialog.
8. If the internal ProfiNet interface is not available: *Activation option required!* is displayed.

   You can purchase the activation code for this option from TRUMPF.



Network interface connection for internal ProfiNet IO Device Slave interface not available Fig. 142474

The configuration of the interfaces is described in the section below.

8.2 Configuring internal ProfiNet interface (option)

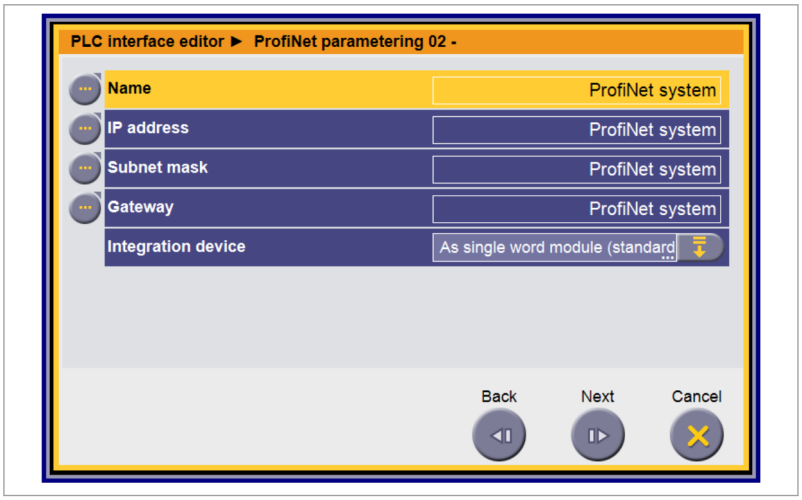


Fig. TE-02330

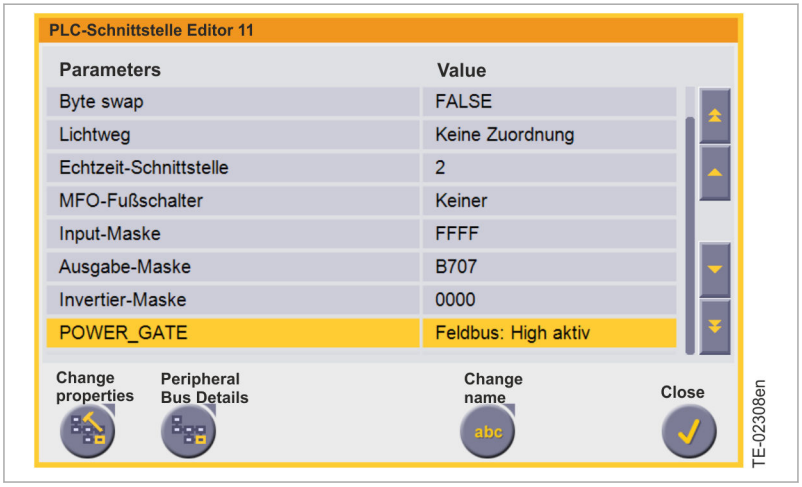
In the dialog >*Parameterize ProfiNet*, the parameter **Integration of device** can be set. This parameter defines how the data words are transferred between the laser device and the ProfiNet Master:

- **As single-word modules (default):**
  The data words are transmitted individually (ex-factory default setting).
- **As 10-word module (only for data length X * 10)**:
  10 data words are transmitted together. X ≤ 6[1)].
- **As 16-word module (only for data length X * 16)**:
  16 data words are transmitted together. X ≤ 4[1)].
- **As 32-word module (only for data length X * 32)**:
  32 data words are transmitted together. X ≤ 2[1)].
- **As 64-word module (only for data length X * 64)**:
  64 data words are transmitted together. X = 1[1)].

1) **Data length** parameter must be set accordingly.

The setting for the parameters **Name**, **IP address**, **Subnet mask** and **Gateway** is *from the ProfiNet system* and cannot be changed.

Switch to the parameter dialog by pressing the *Next* button.



Configuring the interface Fig. TE-02308

The following table lists the possible settings in the parameter dialog for the internal ProfiNet interface. The configuration is completed with the *Finish* button.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.** **Note:** Observe the parameter **Integration Device**.	4	3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not swapped. **Yes:** The two data bytes of the data word are swapped. This setting is required, for example for the external control units with Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...

Parameter	Functions	Default	Values
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. field-bus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
ProfiNet name	**Name in ProfiNet system** This parameter is transmitted by the ProfiNet Master.	by Profi-Net system	

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

Parameter	Functions	Default	Values
ProfiNet IP address	**IP address** This parameter is transmitted by the ProfiNet Master.	by Profi-Net system	
ProfiNet subnet mask	**Subnet mask** This parameter is transmitted by the ProfiNet Master.	by Profi-Net system	
ProfiNet gateway	**Gateway address** This Parameter is transmitted by the ProfiNet Master.	by Profi-Net system	
Integration Device	Setting device integration This parameter defines how many data words are transmitted together. Observe **data length** parameters.	As single-word module	As single-word modules As 10-word module (Only with data length X * 10) As 16-word module (Only with data length X * 16) As 32-word module (Only with data length X * 32) As 64-word module (Only with data length X * 64)
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI input / output
	Access control	Direct	Direct Shared
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP. PROFIenergy is not available at the internal ProfiNet interface.		
Sensor slot[1)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[1)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32
1) Further information: (see "Configuring the sensor relay", pg. 185). Diagnostics: (see "Diagnostics Sensor relay", pg. 149).			

Parameters of an internal ProfiNet IO Device (Slave) interface Tab. 164

8.3 Configuring the ProfiNet IO device (slave) interface, fieldbus module

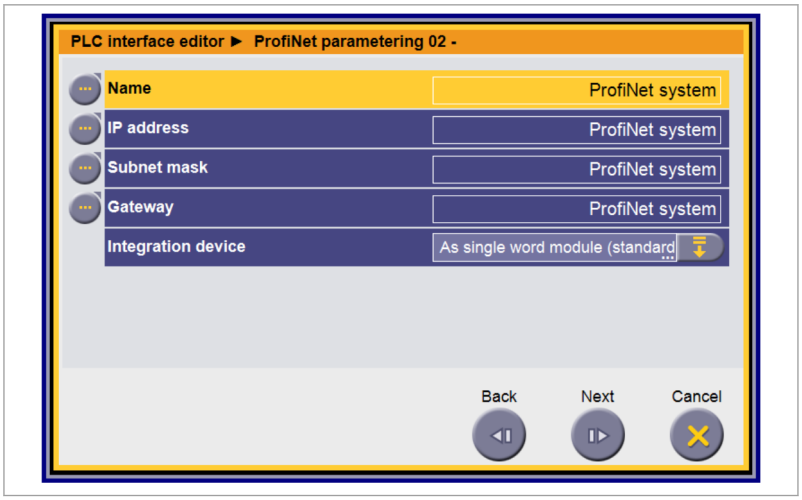


Fig. TE-02330

The following parameters are configured in the dialog >*Configure ProfiNet*:

- Name
- IP address
- Subnet mask
- Gateway
- Integration Device

The ex-factory setting for the parameters **Name**, **IP address**, **Subnet mask** and **Gateway** comes *from the Profinet system*. The parameters are transmitted from the Profinet master to the Profinet slave.

For test purposes, these parameters can be entered manually. If manual values have been entered here, these parameters will be transmitted to the ProfiNet IO device (slave) each time you restart TruControl and saved there. These manually set parameters do not correspond to the defaults in the ProfiNet standard.

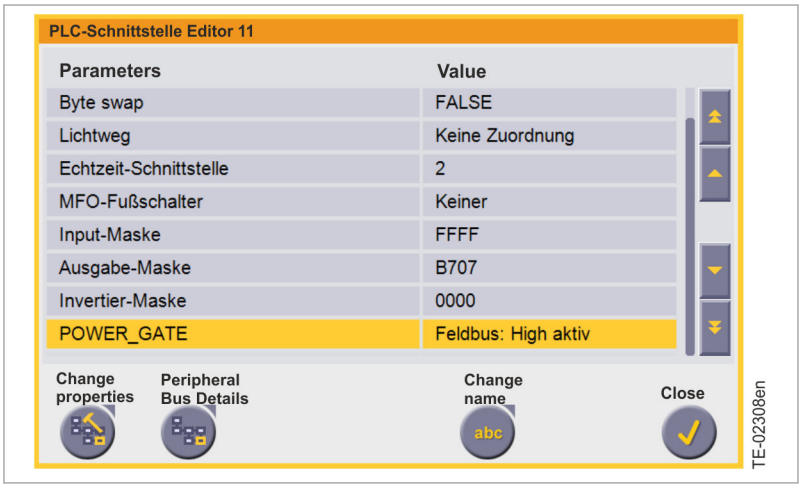
The parameter **Device integration** defines how the data words are transmitted between the laser device and the ProfiNet Master:

- **As single-word modules (default):**
  The data words are transmitted individually (ex-factory default setting).
- **As 10-word module (only for data length X * 10)**:
  10 data words are transmitted together. X = 1[1)].
- **TruControl 1000 version ≥ 1.84.0**: **Additional values** [2)]:
  - **As 10-word module (only for data length X * 10)**:
    10 data words are transmitted together. X ≤ 6[1)].
  - **As 16-word module (only for data length X * 16)**:
    16 data words are transmitted together. X ≤ 4[1)].
  - **As 32-word module (only for data length X * 32)**:
    32 data words are transmitted together. X ≤ 2[1)].
  - **As 64-word module (only for data length X * 64)**:
    64 data words are transmitted together. X = 1[1)].

1) Parameter **Data length** must be set correspondingly.
2) Not available for the following CPX variants:

- CPX V1 standard, 18-21-85-A1
- CPX V1 small, 18-22-21-A1
- CPX V2 standard, 18-21-85-A3
- CPX V2 small, 18-21-85-A4

Switch to the parameter dialog by pressing the *Next* button.



Configuring the interface Fig. TE-02308

The following table lists the settings for the Profibus IO device (slave) interface in the parameter dialog. Complete the configuration by pressing the *Finish* button.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.** **Note:** Observe the parameter **Integration Device**.	4	TruControl 1000 Version < 1.84.0: 3 ... 16. TruControl 1000 Version ≥ 1.84.0: 3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not swapped. **Yes:** The two data bytes of the data word are swapped. This setting is required, for example for the external control units with Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. fieldbus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Parameter	Functions	Default	Values
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
ProfiNet name	Setting the **name in the ProfiNet system**. This parameter is transmitted by the ProfiNet master in normal operation. The **Name in the ProfiNet system** can be set here manually.	by ProfiNet system	
ProfiNet IP address	Setting **IP address**. This parameter is transmitted by the ProfiNet master in normal operation. The **IP address** can be set here manually.	by ProfiNet system	
ProfiNet subnet mask	Setting the **Subnet mask**. This parameter is transmitted by the ProfiNet master in normal operation. The **Subnet mask** can be set here manually.	by ProfiNet system	
ProfiNet gateway	Setting **gateway address** This parameter is transmitted by the ProfiNet master in normal operation. The **Gateway address** can be set here manually.	by ProfiNet system	
Integration Device	Setting device integration This parameter defines how many data words are transmitted together. Observe **data length** parameters.	As single-word module	As single-word modules As 10-word module (Only with data length X * 10) As 16-word module (Only with data length X * 16) As 32-word module (Only with data length X * 32) As 64-word module (Only with data length X * 64)

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

Parameter	Functions	Default	Values
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI input / output PROFIenergy
	Access control	Direct	Direct Shared
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		
Sensor slot[1)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[1)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32
1) Further information: (see "Configuring the sensor relay", pg. 185). Diagnostics: (see "Diagnostics Sensor relay", pg. 149).			

Parameters of a ProfiNet IO Device (Slave) interface, NetJack fieldbus module Tab. 165

8.4 Configuring Profibus DP slave interface

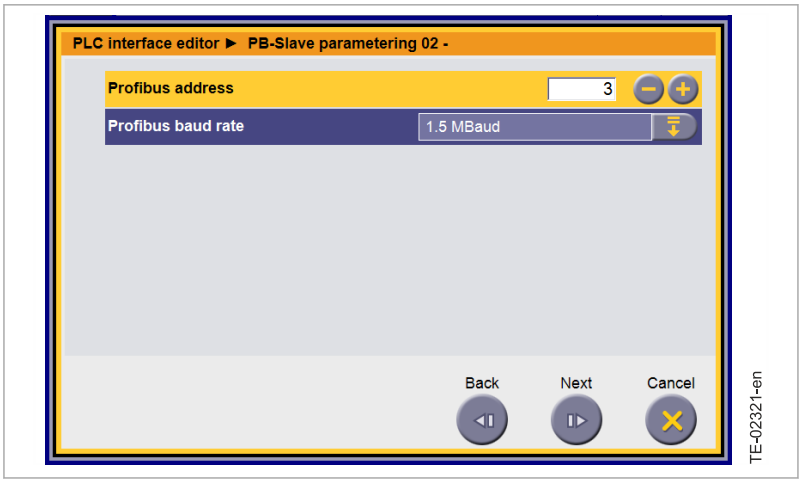


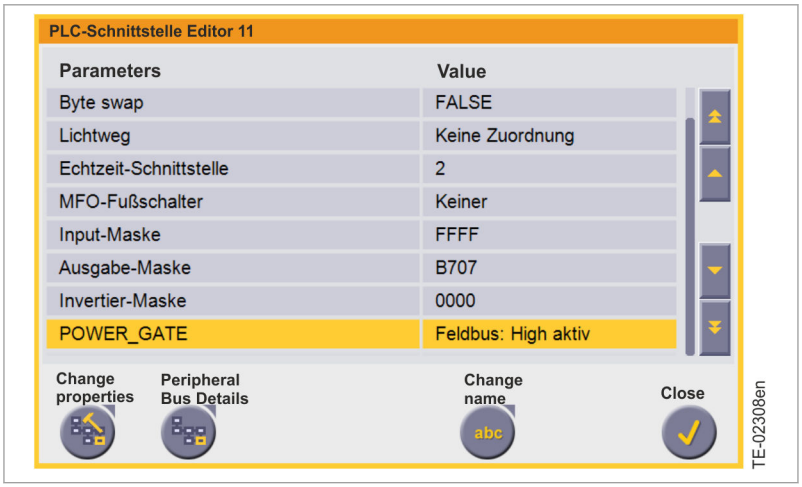
Fig. TE-02321

The following can be set in the dialog >*Configure PB-Slave*:

- the Profibus address
- the Profibus baud rate

Switch to the *Enter name* dialog by pressing the >*Continue* button.

A name must be input for the Profibus DP slave interface, e.g. PB1. Switch to the parameter dialog by pressing the *Next* button.



Configuring the interface

Fig. TE-02308

The following table lists the possible settings for the Profibus DP Slave interface. Complete the configuration by pressing the *Finish* button.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.** **Note:** Observe the parameter **Module size**.	4	TruControl 1000 Version < 1.84.0: 3 ... 16. TruControl 1000 Version ≥ 1.84.0: 3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not exchanged. **Yes:** The two data bytes of the data word are exchanged. This setting is required, for example, for external control units containing Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	FALSE	FALSE, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...
Real-time interface[1)]	**Selecting a real-time interface.** A free real-time interface of the CPX can be assigned to a Multi-PLC interface (e.g. fieldbus module). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF
Profibus address	**Setting the Profibus address** The address of the Profibus DP slave interface can be adjusted (1 ... 127).	3	1 ... 127
Profibus baud rate	**Setting the Profibus baud rate** The baud rate of the Profibus DP slave interface can be set in increments from 9600 baud to 12 Mbaud.	1.5 MBaud	9600 Baud, 93.75 kBaud, 187.5 kBaud, 500 kBaud, 1.5 MBaud, 3 MBaud, 6 MBaud, 12 MBaud

Parameter	Functions	Default	Values
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
Module size	**Setting the module size of the input and output words** **Module size** parameter defines the number of data words that can be transmitted together. Available: TruControl 1000 version ≥ 1.88.0.	One module	One module (module size = data length), 16-word modules (only with data length x * 16)
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI input / output
	Access control	Direct	Direct Shared
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		
Sensor slot[3)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[3)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

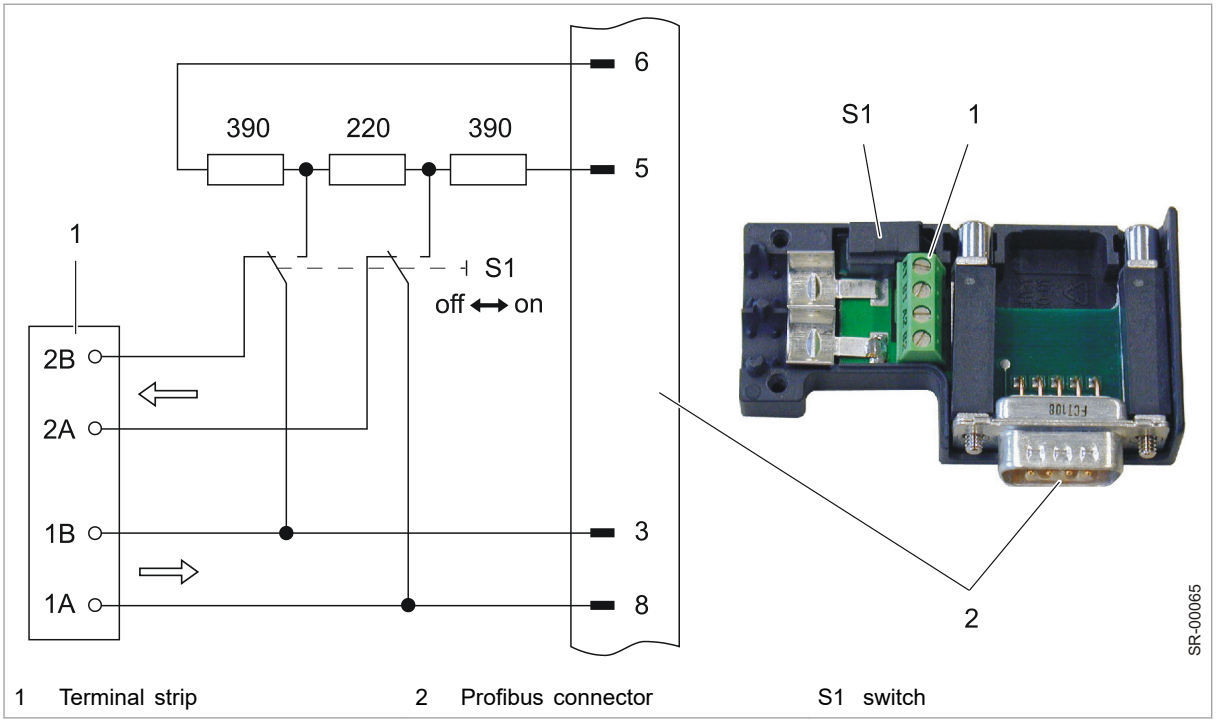
3) Further information: (see "Configuring the sensor relay", pg. 185).
Diagnostics: (see "Diagnostics Sensor relay", pg. 149).

Parameters of a Profibus DP Slave interface Tab. 166

Terminating the Profibus

The Profibus is terminated in the connector of the supply line. For this purpose, the data lines of the Profibus are wired through resistors.

The following shows how the Profibus is terminated in assembled connectors.



1 Terminal strip 2 Profibus connector S1 switch

Terminating Profibus Fig.

Switch S1 is used to switch between:

- Terminate Profibus: Position "on".
- Forward Profibus: Position "off".

Order information

Material description	ID no.	Material no.
Bus connection plug	16-98-21-51	0795280

Tab. 167

8.5 Configuring the DeviceNet slave interface

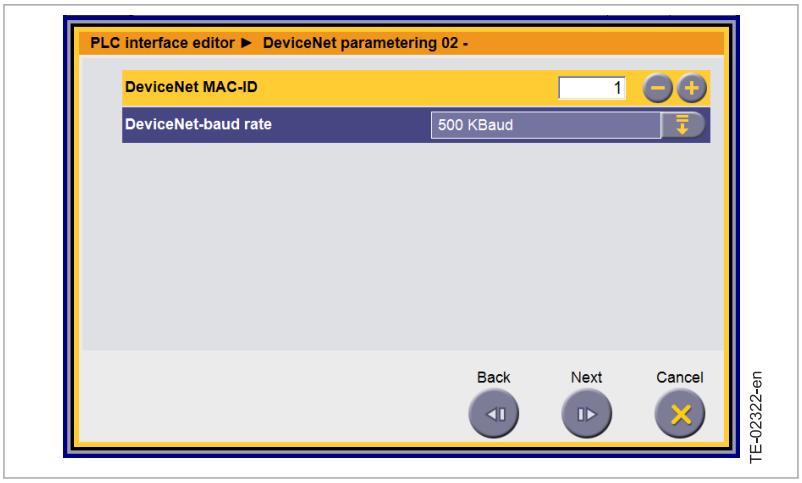


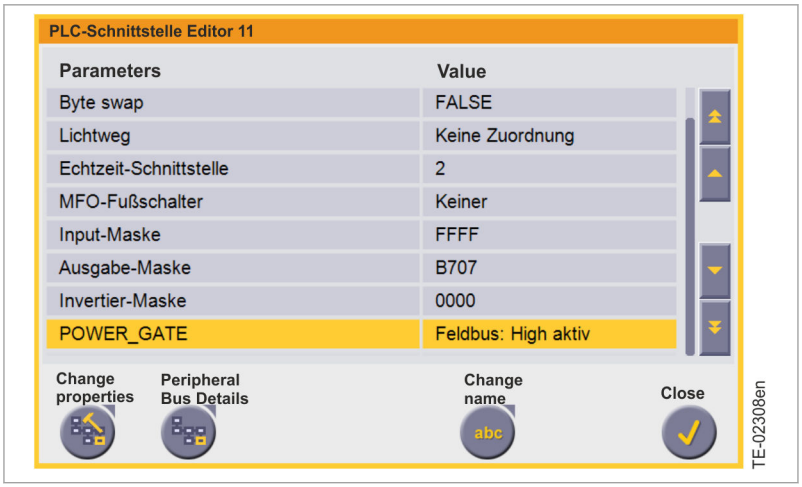
Fig. TE-02322

The following parameters can be set in the dialog >*Configure DeviceNet*:

- the DeviceNet MAC ID.
- the DeviceNet baud rate.

Switch to the *Enter name* dialog by pressing the >*Continue* button.

A name must be input for the DeviceNet slave interface, e.g. DN1. Switch to the parameter dialog by pressing the *Next* button.



Configuring the interface

Fig. TE-02308

The following table lists the settings that are possible for the DeviceNet slave interface.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.**	4	TruControl 1000 Version < 1.88.0: 3 ... 10. TruControl 1000 Version ≥ 1.88.0: 3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not exchanged. **Yes:** The two data bytes of the data word are exchanged. This setting is required, for example, for external control units containing Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. fieldbus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Parameter	Functions	Default	Values
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
DeviceNet-MAC-ID	**Setting the DeviceNet address (MAC ID)** The address of the DeviceNet-Slave interface can be adjusted (0 ... 63).	1	0 ... 63
DeviceNet bus baud rate	**Setting DeviceNet baud rate** The baud rate of the DeviceNet slave interface can be set in steps of 125 kbaud to 500 kbaud.	500 kbaud	125 kBaud, 250 kBaud, 500 kBaud
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI input / output
	Access control	Direct	Direct Shared
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		
Sensor slot[3)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[3)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32

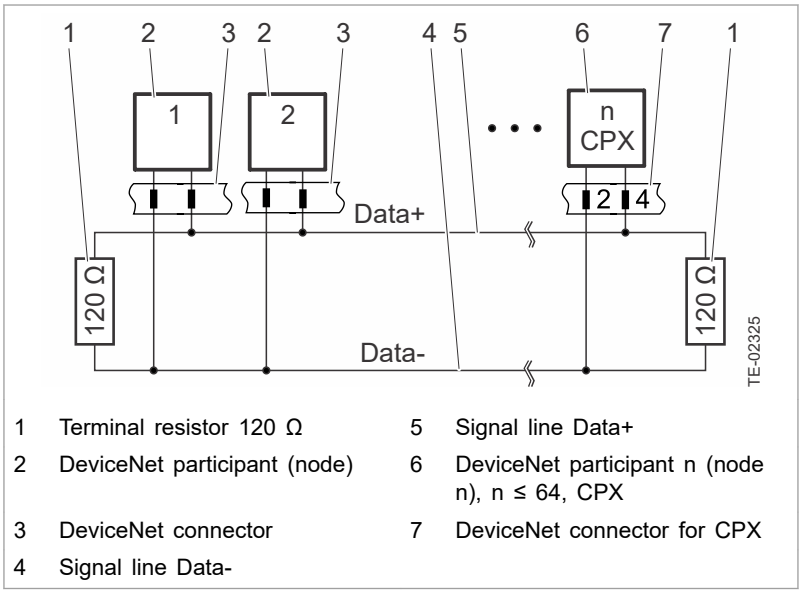
1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

3) Further information: (see "Configuring the sensor relay", pg. 185).
Diagnostics: (see "Diagnostics Sensor relay", pg. 149).

Parameters of a DeviceNet slave interface Tab. 168

Completing DeviceNet



1	Terminal resistor 120 Ω	5	Signal line Data+
2	DeviceNet participant (node)	6	DeviceNet participant n (node n), n ≤ 64, CPX
3	DeviceNet connector	7	DeviceNet connector for CPX
4	Signal line Data-		

DeviceNet terminal resistors, sample configuration with central processor CPX Fig. TE-02325

Both ends of the main cable must be terminated with a terminal resistor (1) with 120 Ω between **DATA-**(4) and **DATA+**(5). The ends of stub cables may **not** be terminated by a terminal resistor.

The pin assignment of the DeviceNet connector is described in a separate section (see "Pin assignment of the connector", pg. 13).

8.6 Configuring a POWERLINK interface

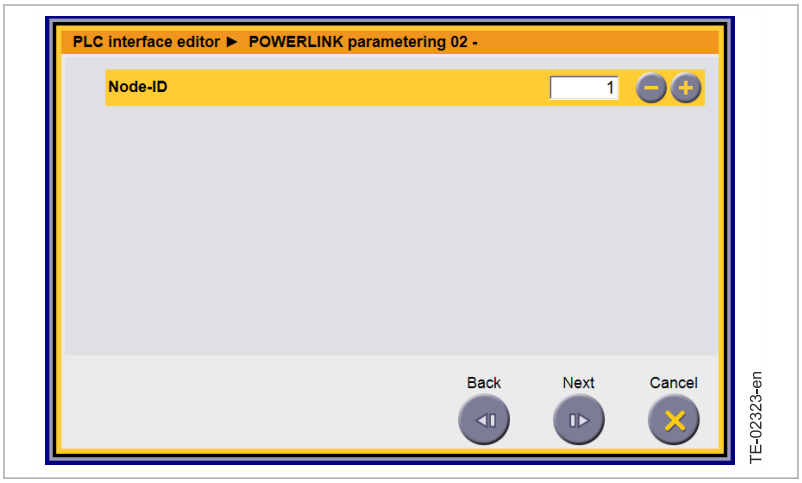
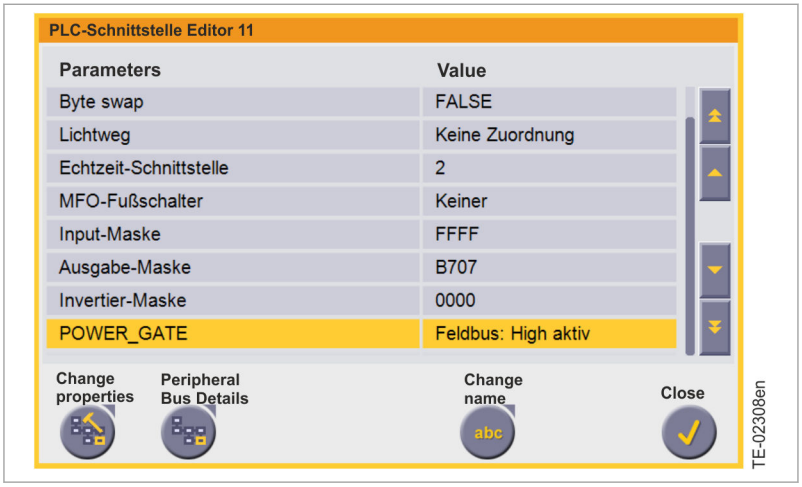


Fig. TE-02323

In the >*Configure POWERLINK* dialog, the node ID can be set.

Switch to the *Enter name* dialog by pressing the >*Continue* button.

A name must be input for the POWERLINK interface, e.g. PL1. Switch to the parameter dialog by pressing the *Next* button.



Configuring the interface

Fig. TE-02308

The following table lists the settings possible for the POWERLINK interface.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.**	4	TruControl 1000 Version < 1.84.0: 3 ... 16. TruControl 1000 Version ≥ 1.84.0: 3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not exchanged. **Yes:** The two data bytes of the data word are exchanged. This setting is required, for example, for external control units containing Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. fieldbus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Parameter	Functions	Default	Values
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
Node ID	**Setting the POWERLINK address** The address of the POWERLINK interface can be set from 1 to 239.	1	1 ... 239
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI input / output
	Access control	Direct	Direct Shared
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		
Sensor slot[3)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[3)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32

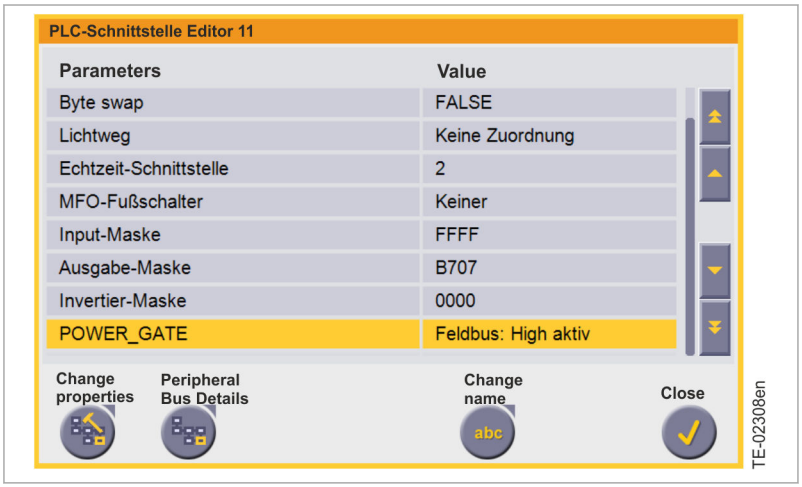
1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

3) Further information: (see "Configuring the sensor relay", pg. 185).
Diagnostics: (see "Diagnostics Sensor relay", pg. 149).

Parameters of a POWERLINK interface Tab. 169

8.7 Configuring EtherCat (slave) interface



Configuring the interface Fig. TE-02308

The following table lists the settings for the EtherCAT (slave) interface in the parameter dialog. Complete the configuration by pressing the *Finish* button.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.** **Note:** Observe the parameter **Integration Device**.	4	3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not swapped. **Yes:** The two data bytes of the data word are swapped. This setting is required, for example for the external control units with Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...

Parameter	Functions	Default	Values
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. field-bus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/ output	None MPI Input/Output or PROFIenergy
	Access control	Direct	Direct Shared
	The status of the PLC_ExtendBaseIoFunction system parameter is displayed.		
	For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Parameter	Functions	Default	Values
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2)] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1)] x[2)]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2)] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2)]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
Sensor slot[3)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[3)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32

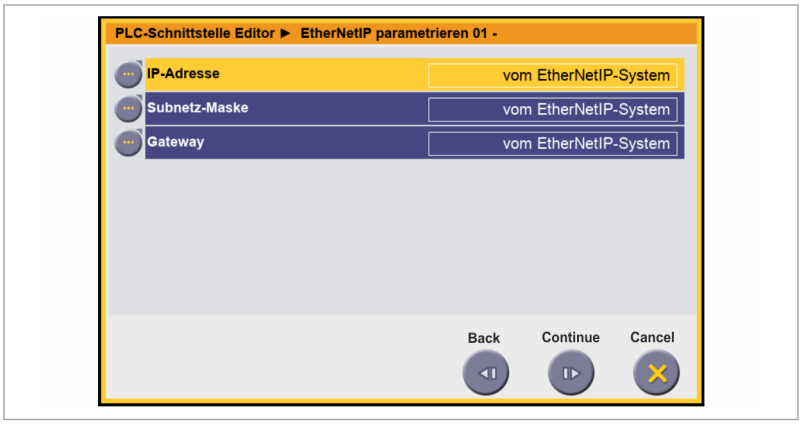
1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

3) Further information: (see "Configuring the sensor relay", pg. 185).
Diagnostics: (see "Diagnostics Sensor relay", pg. 149).

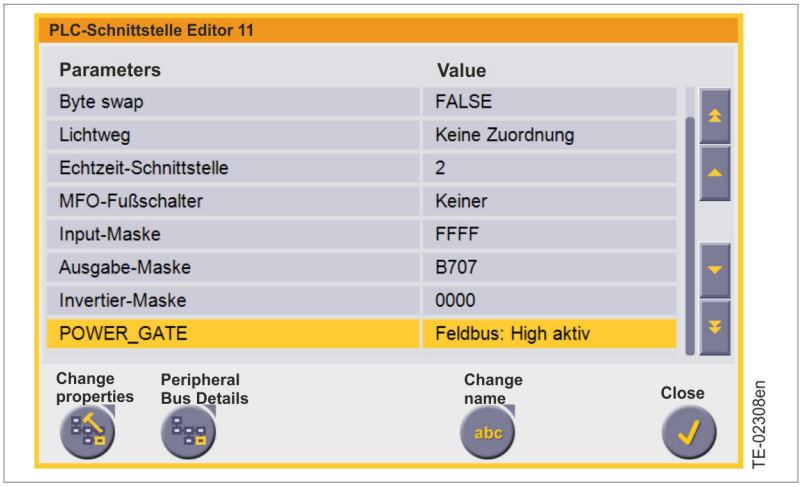
Parameters of an EtherCat (Slave) interface Tab. 170

8.8 Configuring the Ethernet/IP adapter



Configuring the Ethernet/IP adapter Fig. 124336

In the *>Parameterize EtherNetIP* the user can enter an IP address, a subnet mask and the IP address of the gateway for the Ethernet/IP adapter interface. Together with the factory pre-settings, these parameters are transmitted by the Ethernet/IP scanner and do not have to be entered manually. Switch to the dialog by pressing the *Next* button.



Configuring the interface Fig. TE-02308

The parameters for the Ethernet/IP adapter interface can be set in the *>PLC interface editor* dialog. The parameters are listed in the following table. Complete the configuration by pressing the *Close* button.

Parameter	Functions	Default	Values
File length	**Setting the data length of the interface.** **Note:** Observe the parameter **Integration Device**.	4	3 ... 64.
Byte swap	**Setting byte swap.** The data are interpreted and transmitted by the laser control unit word by word. The data bytes can be swapped within the data words. **No:** Default setting The two data bytes of the data word are not swapped. **Yes:** The two data bytes of the data word are swapped. This setting is required, for example for the external control units with Intel processors (Siemens PLC). **Note:** If you notice that the data do not arrive at the expected bit positions, you should change the "byte swap" value.	False	False, TRUE
Light path	**Assigning a light path.** A light path is permanently assigned to a Multi-PLC interface (e.g. fieldbus interface) of the laser device if a fieldbus-coded activation (TLN-fc) of the laser device is used. The coding of the light path at the ILN interface is not required for TLN-fc.	No allocation	No assignment, 0, 1, ...
Real-time interface[1)]	**Select real-time interface.** A free real-time interface of the CPX can be allocated to a Multi-PLC interface(e.g. fieldbus interface). Pin assignment and signals of the real-time interfaces are described in the following documents: ▪ Interface description "Digital I/O interface of the CPX – Parallel I/O, Real-time, Sync I/O and Decentralized I/O interface of the CPX V3 and CPX V4 standard", doc. no.: 18-22-91-A2-BA ▪ Interface description "Real-time and Sync I/O interface" for CPX V4 Basic, doc. no. 18-23-04-A1-BA.	None	None, 1, 2, 3
MFO	**Assigning the manual focusing optics.** An Multi-PLC interface (e.g. fieldbus interface) can be permanently assigned to a MFO.	None	None, 1 ... 8
Input mask	**Input mask** Description: (see "Input mask", pg. 29)	0xFFFF	0x1800 - 0xFFFF
Output mask	**Output mask** Description: (see "Output mask", pg. 37)	0xB707	0x0000 - 0xFFFF
Inverting mask	**Inverting mask** Description: (see "Inverting mask", pg. 29)	0x0000	0x0000 - 0xE7BF

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

Parameter	Functions	Default	Values
Priority	**Priority of the MPI slot** This parameter defines the priority of the MPI slot for the assignment, (see "LASER_ASSIGNED", pg. 83). The higher the value of the parameter, the higher is the priority of the MPI slot.	3	0 ... 255
IP address	**Setting IP address.** This parameter is transmitted in the normal operation by the Ethernet/IP network (e.g. DHCP server). The IP address can be set here manually.	from EthernetIP system	
Subnet mask	**Setting subnet mask.** This parameter is transmitted in the normal operation by the Ethernet/IP network (e.g. DHCP server). The subnet mask can be set here manually.	from EthernetIP system	
Gateway	**Setting gateway address** This parameter is transmitted in the normal operation by the Ethernet/IP network (e.g. DHCP server). The gateway address can be set here manually.	from EthernetIP system	
POWER_GATE	**Configuring POWER_GATE** The source and the signal level for the **POWER_GATE** signal can be set: ▪ Feldbus: High active Source: Fieldbus input word 14, bit 2, signal level High active ▪ Feldbus: Low active Source: Fieldbus input word 14, bit 2, signal level Low active ▪ RTI: Low active (RTI_LEVEL_SETTING_x[2] = 2) Source Signal PULSE_INTERLOCK of the real-time interface[1] x[2] ▪ RTI: High active (RTI_LEVEL_SETTING_x[2] = 1) Source Signal PULSE_INTERLOCK of the real-time interface[1] x[2]	Not active	Not active, Fieldbus: High active, Fieldbus: Low active, RTI: Low active (RTI_LEVEL_SETTING_x[2] = 2) RTI: High active (RTI_LEVEL_SETTING_x[2]) = 1
	Further Information: (see "POWER_GATE", pg. 81)		
Energy Save Concept	**Setting the Energy Save Concept** These parameters define how the Energy Save Concept is used.		
	Energy control	MPI input/output	None MPI Input/Output or PROFIenergy
	Access control	Direct	Direct Shared
	The status of the PLC_ExtendBaseIoFunction system parameter is displayed. For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.		

1) If the central processor CPX V20 is used, e.g. with a laser device from the TruMicro 2000 series (FU11), laser device family 20-20-xx-xx, no real-time interfaces are available.

2) x: Number of the Real-Time Interface, see Real-Time Interface parameters.
RTI: Real Time Interface, German Real-Time Interface

Parameters of an Ethernet/IP adapter interface, part 1 Tab. 171

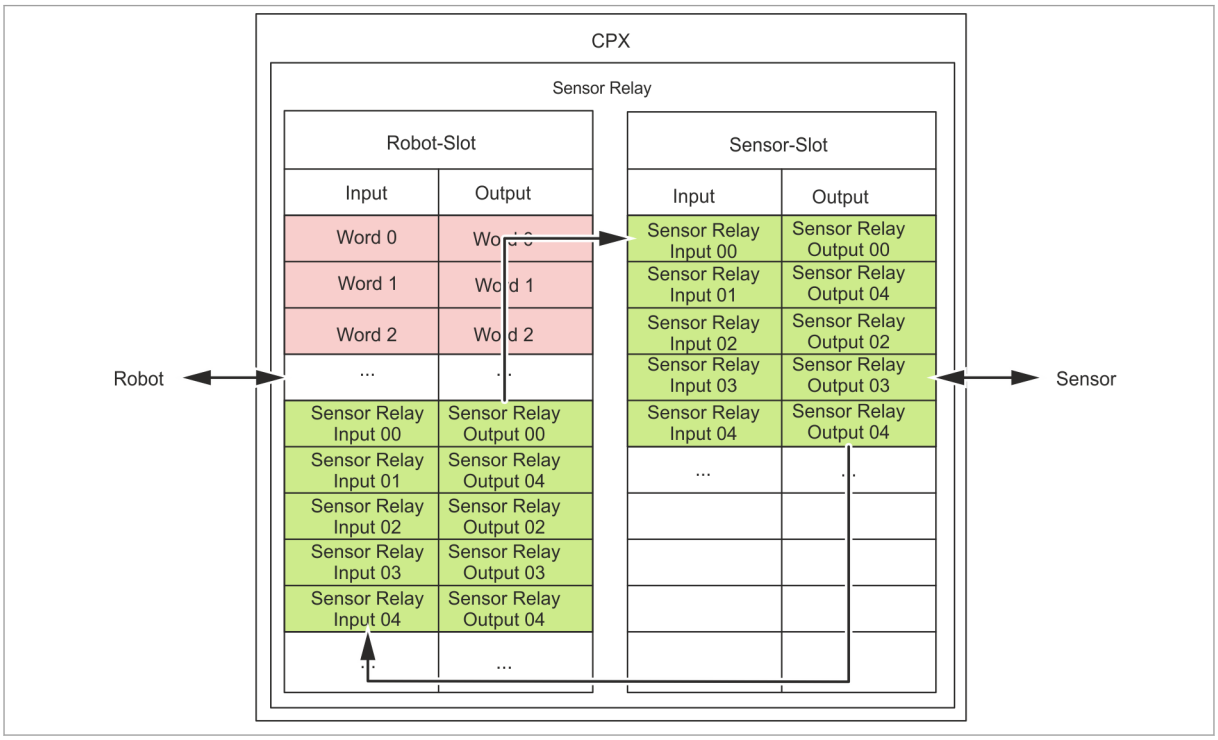
Parameter	Functions	Default	Values
Sensor slot[1)]	If "TRUE", this slot is being used for communication between the connected third-party device and an external control, e.g. robot control connected to another MPI slot.	FALSE	FALSE TRUE
Assigned sensor slot[1)]	Specifies the slot number of the third-party device with which the external control can communicate directly via the Multi PLC interface, e.g. robot control.	None	None, 1 ... 32
1) Further information: (see "Configuring the sensor relay", pg. 185). Diagnostics: (see "Diagnostics Sensor relay", pg. 149).			

Parameters of an Ethernet/IP adapter interface, part 2 Tab. 172

8.9 Configuring the sensor relay

If an external control, e.g. a robot control with a third-party device, wants to communicate via the multi-PLC interfaces, a sensor relay can be set up.

A sensor slot is assigned to the MPI slot on the external control, see "Assigned sensor slot" parameter. The MPI slot on the third-party device is set up as a sensor slot, see "Sensor slot" parameter. The parameters "Sensor Relay Input x Words" and "Sensor Relay Output x Words" must be configured in the input and output words of the interface parameters, x = 9, 16, 32 or 48.
Diagnostics: (see "Diagnostics Sensor relay", pg. 149).



Sensor relay Fig. 142468

9. Terms and abbreviations

ASV **A**rbeits- und **S**icherheits**v**erschluss (ASV) (operating and safety shutter)

Each safety circuit is connected to an ASV board located in the control unit of the laser device. The ASV board controls the laser in a way which prevents emission of laser light when the safety circuit is open.
The shutter switch (VW) of a light path is connected to the safety circuit (SIK) of this light path by means of an ASV board. The central shutter (VZ) is connected via ASV board to the safety circuit (SIK) for all light paths.

CDI **C**PX **D**LCA-**I**nterface

The CDI is an interface for the fast data transmission between the central processor CPX starting from V3 and the DLCA board. The components are connected internally using a ribbon cable.

CFO **C**ontrolled **F**ocusing **O**ptics

CFO is the name for a family of focusing optics. In the CFO, the degree of contamination of the protective glass is monitored.

CPX **C**entral **P**rocessor E**x**tendable

The CPX is the central board in the new generation laser control. Both the TruControl 1000 operating software and the plug-in control unit software of the central processor run in the operating system Linux on the CPX central processor.

DLC/DLCA **D**igital **L**aser **C**ontrol/**D**igital **L**aser **C**ontrol **A**dvanced
German: digitale Laserleistungsregelung/erweiterte digitale Laserleistungsregelung

The DLC or DLCA board contains an analog interface, as well as other components.

External cooling An external cooling unit is, for example, the machine cooling unit of a TRUMPF laser machine used jointly by the TRUMPF laser machine and the integrated laser device. In this case, the laser device does not contain a cooling unit. In this case, the laser device does not contain a cooling unit.

FRC **F**emto **R**ealtime **C**ontroller
Controller master unit of a TruMicro (FU11).

ESC **E**nergy **S**ave **C**oncept
The Energy Save Concept allows the laser devices to be switched to different energy-saving states in different ways. These ways are available depending on the laser device type and the configuration:

- PROFIenergy for ProfiNet[1]
- Pause concept for Multi-PLC interfaces.

If the Energy Save Concept is not available, there are, depending on the laser device type and the configuration, up to four sleep modes.
For further information: Technical information "Energy Save Concept", doc. no. 21-A0-71-CP.

ILN **I**nterface **L**aser**N**etwork:

Light path-related interface for transmission of laser number, light path number and safety circuit.

ILN3 is the current ILN version used in connection with the CPX control unit.

IW **I**nput **w**ord

The laser device is controlled by means of the input words sent from a fieldbus masterof an external control unit (e.g. PLC of a processing station) to a fieldbus slave in the control unit of the laser device.

Laser standby mode The laser power is stabilized in the laser standby mode. Only required for certain laser devices.
Further information: (see "LASER_STANDBY", pg. 54).

LEZ **L**aser**e**insatz**z**eit (laser delay time)

The delay in time from the activation of the **PSTART_DYN** or **PSTART_STATICAL** input signal to the delivery of the laser power at the processing point is called laser delay time (LEZ).

MPI **M**ulti**P**LC**I**nterface

The Multi PLC interface is a system component of the TRUMPF LaserNetwork (TLN). It is a software interface of the laser control system which allows different (max. 32) control units of machining station to request the laser power.
The control units are connected to the laser device via fieldbus, OPC or parallel I/O interfaces.

MIO **M**edia **I**nterface **O**ptics

Media Interface Optics Monitoring of assist gases for crossjet, purging gas, MDE gas and shielding gas for use with a BEO Smart.

1 Not available for the internal ProfiNet interface

OCT **O**ptical **C**oherence **T**omography

System to measure the distance by means of light. A wideband light source, two OCT scanner mirrors and an OCT sensor are used.

OLE **O**bject **L**inking and **E**mbedding

OPC **O**LE for **P**rocess **C**ontrol

OW **O**utput **w**ord

The laser device uses output words to provide the fieldbus master of an external control unit (e.g. the PLC of a processing station) with parameters and status information.
The signals are sent by the fieldbus slave in the control of the laser device to the fieldbus master.

PBT **P**ower **B**oard **T**iny

The PBT board supplies the laser control CPX version 3 or version 4 with electrical voltages.

PCC With the **P**rocess **C**haracteristic **C**urve option, the laser power can be specified via a process characteristic curve.

PCP parameters Parameters for the **P**ower **C**alibration **P**rogram function for measuring and correcting the laser power on the workpiece.
Further information "CalibrationLine FCP & PCP", doc.-no. 07-12-12-A8-CR.

PDC **P**ulse **D**uration **C**ontrol

PFO **P**rogrammable **F**ocusing **O**ptics

The PFO is focusing optics with two integrated pivoting mirrors (scanners). The mirrors can be activated electrically so that their angle position can be set to a set value. This allows you to guide a laser beam in geometric figures (straight lines, circular arcs etc.) along a workpiece.

PGM **P**rotective **G**lass **M**onitoring

Monitoring for protective glass contamination of BEO smart focusing optics.

PFP Control, PierceLine and PLS parameters

In **PFP Control** operating mode, a laser device is controlled by an external control unit (e.g. PLC) via a fieldbus with the following parameters:

- Pulse power
- Frequency
- Medium laser power

In PierceLine operating mode, an external control controls the piercing process of the laser beam into the workpiece via a fieldbus with PLS parameters.
PLS: **P**rocess **L**ight **S**ensor
Further information: Technical Information "PFP-Control and PierceLine", doc-no 21-A0-61-CP.

PLC **P**rogrammable **L**ogic **C**ontroller

PMF **P**rogrammable **M**otor-driven **F**ocusing, for TruControl 1000 version < 2.34.0: CCM (**C**ontrol **C**ollimation **M**otor).

PMF is a component of the modular system of the D70 focusing optics. The collimator lens of a D70 is moved with a motor when PMF is used. Shifting the collimator lens changes the focus position.
Further information: operator's manual "Programmable Motor-driven Focusing", doc.-no. 22-50-01-A369-CR.

QDS **Q**uality **D**ata **S**tore

TL Quality Data Store (TL QDS) is a software program for recording quality-relevant data during work with the laser device.
Further information: Software manual "TL Quality Data Store (TL QDS)", doc no 21-01-67-CR.

SBO Board **S**ensor **B**oard **O**ptics

The SBO board monitors the temperature of the base plate and the air pressure of line optics.

SeamLine Remote Seam position control is controlled with PFO during the welding process with the SeamLine Remote option.
Further information: Operator's manual "SeamLine Remote (SE18)", doc no. 83-01-04-A0-CR.

SIK **Si**cherheits**k**reis (safety circuit)

Current loop for monitoring of safety-relevant areas, for example access doors to the safety cabins.
The shutter switch (VW) of a light path is connected to the safety circuit (SIK) of this light path by means of an ASV board. The central shutter (VZ) is connected via ASV board to the safety circuit (SIK) for all light paths.

Slot also called: **MPI slot**

A slot within the Multi PLC interface (MPI) is a virtual slot for connection of an external control unit (e.g. PLC) of a processing station).

TLN TRUMPF LaserNetwork

The TLN is a composite of TRUMPF laser devices and workstations in industrial manufacturing systems and their control systems, for example robots and associated controls (e.g. PLC).
Further information: Technical information "TRUMPF LaserNetwork (TLN and TLN-fc)", doc.-no. 21-01-38-CP.

TLN-fc TRUMPF LaserNetwork fieldbus coded

TLN-fc is a variant of TRUMPF LaserNetwork.
Further information: Technical information "TRUMPF LaserNetwork (TLN and TLN-fc)", doc.-no. 21-01-38-CP.

TM Baugruppe Strahl**t**eiler **m**otorisch. English: motor-driven beam splitter assembly.

TPC **T**emperature **P**rocess **C**ontroller

TPC is used with a PFO 20-2 PO, for example.
Further information: operator's manual "PFO 20-2 PO", doc.-no. 12-12-21-A54-CR.

VLCK **V**ision**L**ine OCT **C**hec**k**

System for monitoring and control of the laser beam when welding by means of OCT sensor.
VisionLine OCT Check is used to monitor the welding depth and the seam quality.

VW **V**erschluss**w**eiche; english: shutter switch

The shutter switch is used to block the laser beam emission or enable it for individual light paths. If the shutter switch is locked, the laser beam is guided into the absorber of the shutter switch. The shutter switch of a light path is connected to the safety circuit (SIK) of this light path by means of an ASV board.

PMS Central shutter

The central shutter is used to block the laser beam emission or enable it for all light paths. If the central shutter is locked, the laser beam is guided into the absorber of the central shutter. The central shutter is connected to the safety circuit (SIK) by means of an ASV board.

WPCI **W**orking **P**oint **C**ontrol **I**nterface

Internal interface of the board FRC of a TruMicro (FU11).