Interface description

ISA board

Analog and real-time interfaces

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Analog and real-time interfaces

Edition **2012-10**

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Interface description

ISA board

Edition 2012-10
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Address for orders

TRUMPF Laser GmbH
Vertrieb
Aichhalder Straße 39
78713 Schramberg
Fon: +49 7422 515 - 0
Fax: +49 7422 515 - 436
Internet: http://www.trumpf-laser.com
E-Mail: info@de.trumpf-laser.com

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Before you proceed ...

The ISA board contains interfaces for the control of laser parameters by means of analog voltages or currents. Furthermore, a real-time interface is located on the board to control the laser with short reaction time. The digital signals have a TTL level.

The interface description is intended for integrators and users who integrate a laser device in a system and want to use analog signals for controlling the laser parameters.

More information is to be found in the following documents.

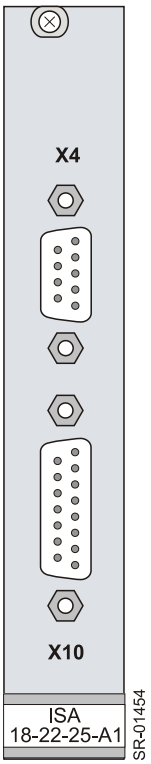
- TruControl 1000 software manual.
  Doc No.: 10-06-80-A1-CR01
- Interfaces of the laser device with CPX
  Doc. No: 20-06-01-A1-BA01
- Parallel I/O, real-time and Sync I/O interface of the CPX
  Doc. No: 18-21-85-A1-BA01
- Parallel I/O, real-time and Sync I/O interface of the CPX V3
  Doc. No: 18-22-91-A2-BA01

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1. ISA board, overview

The ISA board has 2 interfaces offering various possibilities to control the laser power and other laser parameters via analog voltages or currents.



Interfaces of the ISA board :

- Analog input interface X10 with 3 inputs for laser power, pulse duration and pulse frequency.
- Real-time interface X4 for:
  - the connection of an external scanner optics control system with real-time signals and an analog input
    or..
  - the definition of the laser power via an analog input, additionally 3 digital gate signals and a digital output.

The ISA board can only be used in CW laser devices manufactured in 2010 and later.

The laser power can be controlled by means of the interfaces on the ISA board in the following operating modes:

- Trigger on Set Value (laser power is triggered by the analog default value)
- Modulation

In the "Trigger on Set Value" mode the laser is switched off if the analog input signal does no longer reach the minimum power level.

In the "Modulation" mode, the laser remains under voltage and the minimum power is output.(see "Change in laser power by control via X4 or X10", pg. 10)

Module Cutassist

As soon as the Module Cutassist is enabled, the velocity of an external machine is read via the analog input for the laser power at X10 and the laser is activated in accordance with the predefined parameters for the optimum cutting process (see Technical Information “TruControl 1000 Module Cutassist”, document No. 21-A0-58-CP01).

AMUL

The analog input for the laser power at X10 is used for the AMUL function (**A**nalog **mul**tiplication) as a multiplicator for the preset laser power. AMUL can be used for each type of power default (laser program, external signal, ..) (see "X10: Inserting AMUL", pg. 17).

Signal level

The digital signas of the ISA board have TTL level (0 V .. 5 V).

If you need a real-time interface with a 24 volts level, the real-time interface of the CPX is available (see interface description “Parallel I/O-, realtime and sync I/O interface of the CPX”, document No. 18-21-85-A1-BA01).

2. Terms and abbreviations

AMUL AMUL is the abbreviation for a software function "Analog multiplication". Using AMUL it is possible to combine signal sequences with other analog signals. By doing this, further control circuits for the control and the regulation of laser power can be set.

CutAssist CutAssist is software module of the operating software TruControl 1000. CutAssist can be used to set the laser power for a cutting process automatically depending on the contour speed. Further information can be found in the TRUMPF document, doc. no. 21-A0-58-CP available at TRUMPF.

Gate "Gate" is designation of control signals that are able to enable or to block physical quantities such as laser power.

Modulation "Modulation" means a process during which the laser power is controlled by means of an analog signal without reducing the laser power to 0. Special circuits make sure that the laser power remains at L_{min} if the default value, that means the modulating signal, falls below the switch-off threshold. The other possibility is the "Trigger on Set Value" mode (→).

Trigger on Set Value "Trigger on Set Value" means that the laser power is triggered by the default value. During this mode, the laser is switched on and off by moving the default value above or below the switch-on or switch-off threshold. The other possibility is the "Modulation" mode (→).

TTL level "TTL" means "Transistor-Transitor logic". Electronique logic components in the TTL technology work in the voltage range from 0 V to 5 V. The logic levels are Low = 0 V and High = 5 V. The other possibilities are, for example, logic components with a 24 V level.

3. Technical data

Connections

Connector X4	D-SUB plug, 9-pole, pin
Connector X10	D-SUB plug, 15-pole, pin

Tab. 1

Analog inputs

Galvanic isolation	Yes
Type of signal	The individual analog inputs can be configured by means of jumpers: ▪ Voltage: 0 V - 10 V ▪ Current: 0 mA - 20 mA Upon delivery, all inputs are configured as voltage inputs.
Input resistance	For voltage input: 10 kΩ For current input: 100 Ω
Insulation voltage	200 V DC

Tab. 2

Digital inputs

Galvanic isolation	Yes
Input voltage (digital high)	5 V
Positive threshold voltage	2.2 V - 3.6 V
Negative threshold voltage	1.2 V - 2.3 V
Input resistance	Internal pull-up resistor, 10 kΩ
Insulation voltage	200 V DC

Tab. 3

Digital outputs

Galvanic isolation	Yes
Output voltage high level	4 V - 5 V
Output voltage low level	0 V - 2 V
Output current	20 mA
Output resistance	47 Ω
Insulation voltage	200 V DC

Tab. 4

Reference potentials

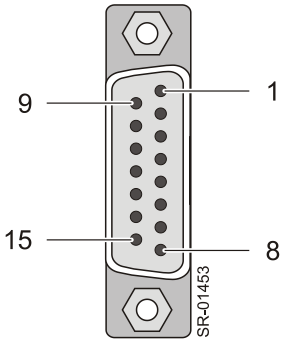
The reference potentials of the analog and digital signals at X4 and X10 are connected to each other but are separated from the reference potential of the laser control.

4. Interfaces

Signal directions

- |←: input
- |→: output

4.1 Analog input interface X10



The interface X10 includes analog inputs to define the following parameters:

- Laser power
- Pulse duration
- Pulse frequency

Depending on the laser type and the configuration, the change of the laser power with time can be influenced by a combination of these signals.

Laser power

Depending on the laser type and the configuration, the laser power is dermined by the parameters:

- Direct default value for the laser power
- Feed rate during cutting process when the CutAssist module is used
- Multiplicator for the AMUL function (see "X10: Inserting AMUL", pg. 17)

Pin	Direction	Signal	Function
8	|←	ANALOG_1	Analog input laser power or multiplicator signal for the AMUL function
14	-	GND	
7	|→	ANALOG_1_SENSE	Sense output for laser power
13	-	GND	Repetition of the input signal

Signals for the laser power Tab. 5

Pulse duration

Pin	Direction	Signal	Function
5	|←	ANALOG_2	Analog input pulse duration
12	-	GND	
4	|→	ANALOG_2_SENSE	Sense output for pulse duration
11	-	GND	Repetition of the input signal

Signals for pulse duration Tab. 6

Pulse frequency

Pin	Direction	Signal	Function
2	|←	ANALOG_3	Analog input pulse frequency
10	-	GND	

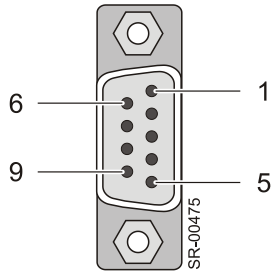
Pulse frequency

Pin	Direction	Signal	Function
1	|→	ANALOG_3_SENSE	Sense output pulse frequency
9	-	GND	Repetition of the input signal

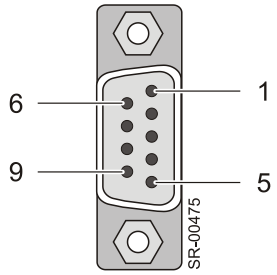
Signals for pulse frequency Tab. 7

Reserve The pins no. 3, 6 and 15 are not used.

4.2 Real-time interface X4



Pin	Direction	Signal	Function
1	|←	GATE_3	**Modulating gate:** High: laser power follows default value signal Low: laser power = L_{min}
2	|←	*GATE_1	**Switching gates:** Release: laser power follows the default value signal Lock: laser power = 0 The laser power is **released** if: ▪ the laser default “ISA-X4” is activated in the laser program, ▪ the signal level “low” is active at *GATE_1 (pin 2) **and** ▪ the signal level “high" is active at *GATE_2 (pin 3) In all other cases, the laser power is locked. (see "Change in laser power by control via X4 or X10", pg. 10) This activation mode by means of two digital signals *GATE_1 and GATE_2 avoids the unintentional emission of laser light in case of a cable breakage or a power failure of the external control unit. The external control unit must be set in a way that, in case of a fault, a safe state is created and both pins are set simultaneously to high or low.
3	|←	GATE_2	

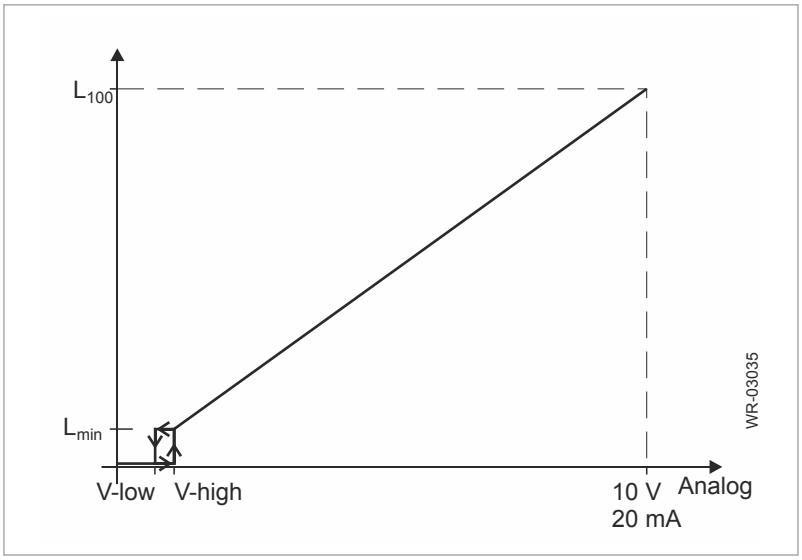


Pin	Direction	Signal	Function
4	|←	ANALOG	If the power default "ISA-X4" is activated in the laser program, the laser power is defined by the active analog signal in form of voltage or current. Maximum laser power (100 %): ▪ Voltage: 10 V ▪ Current: 20 mA According to the laser type (CW or Q-switch), the power or the pulse energy varies. The maximum power depends on the setting of the system parameter TriggerOnSetValue (see "Change in laser power by control via X4 or X10", pg. 10): ▪ 1, Trigger on Set Value mode: If the default value has fallen below the switch-off threshold (for voltage, approx. 150 mV), the laser is switched off (see "Fig. 1", pg. 8). ▪ 2, Modulation mode: If the default value has fallen below the switch-off threshold (for voltage, approx. 150 mV), the laser power remains at L_{min} (see "Fig. 2", pg. 9).
5	|→	*CLOCK	Reserved
6	-	GND	Reference voltage for pin 1, 2, 3, 5
7	-	GND	Reference voltage for pin 4

ISA, X4, signals Tab. 8

Reserve The pins no. 8 and 9 are not used.

TriggerOnSetValue mode (TriggerOnSetValue = 1)



Laser power via analog input value Fig. 1

Modulation mode (TriggerOnSetValue = 2)



Laser power via analog input value Fig. 2

4.3 Application example

RTC board of SCANLAB connected to X4

ISA X4		Direction	Scanlab RTC4 Laser connection socket VB3	
Pin	**Signal**		**Pin**	**Signal**
2	*GATE_1	←	2	*LASERON[2)]
3	GATE_2	←	3	LASER2
4	ANALOG	←	4	ANALOG OUT[2)]
6	GND[1)]	-	6	GND2
7	GND[1)]	-	7	GND2
1) Reference potential GND is internally connected.			2) Observe the RTC4 board configuration!	

RTC board of SCANLAB connected to X4 (example) Tab. 9

5. Change in laser power by control via X4 or X10

If the default value for the laser power is defined via X4 or X10, the change in laser power depends on the value of the system parameter **TriggerOnSetValue**.

TriggerOnSetValue = 1

TriggerOnSetValue is activated: **Trigger On Set Value mode**
If the analog default value is below the switch-off threshold, the laser is off. The laser power is 0. Therefore, it takes a little time until the laser power follows the default value when the switch-on threshold is exceeded.

TriggerOnSetValue = 2

TriggerOnSetValue is deactivated: **Modulation mode**
If the analog default value falls below the switch-off threshold, the laser power remains at L_{min}. The laser remains under voltage. After having exceeded the switch-on thresholdm the laser power can follow the default value after a short time.

Gates of X4

If the default value for the laser power is defined via X4, the change in laser power depends on the signal states *GATE_1, GATE_2 and GATE_3.

*GATE_1 and GATE_2 are "switching gates". If they are in the "Lock" state, the laser is switched off.

GATE_3 is a "modulating gate". If it is in the "Lock" state, the laser power remains at L_{min}.

Further information on the properties of the gate signals: (see "Tab. 10", pg. 11)

The gate signal functions described here are independent of the system parameter state TriggerOnSetValue.

Laser power controlled via X4

The following table describes the change of the laser power depending on the input signals of X4 and the TriggerOnSetValue parameter.

*GATE_1	GATE_2	GATE_3	Laser power
Low	Low	xx	P_{Laser} = 0 since GATE_2 = Low
Low	High	Low	P_{Laser} = L_{min}, if default value > switch-on threshold P_{Laser} = 0 if default value < switch-off threshold

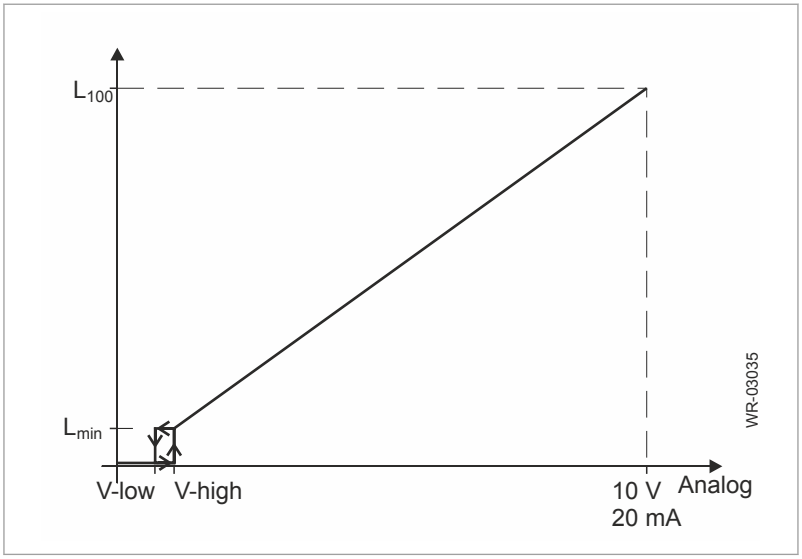
*GATE_1	GATE_2	GATE_3	Laser power
Low	High	High	P_{Laser} follows the default value at X4, if default value > switch-on threshold P_{Laser} = 0, if default value < switch-off threshold AND TriggerOnSeValue = 1 $P_{Laser} = L_{min}$, if default value < switch-off threshold AND TriggerOnSeValue = 2
High	xx	xx	P_{Laser} = 0 since *GATE_1 = High

Later power depending from signals at X4 Tab. 10

xx: Any signal state

5.1 Trigger on Set Value mode

TriggerOnSetValue = 1



Laser power via analog input value Fig. 3

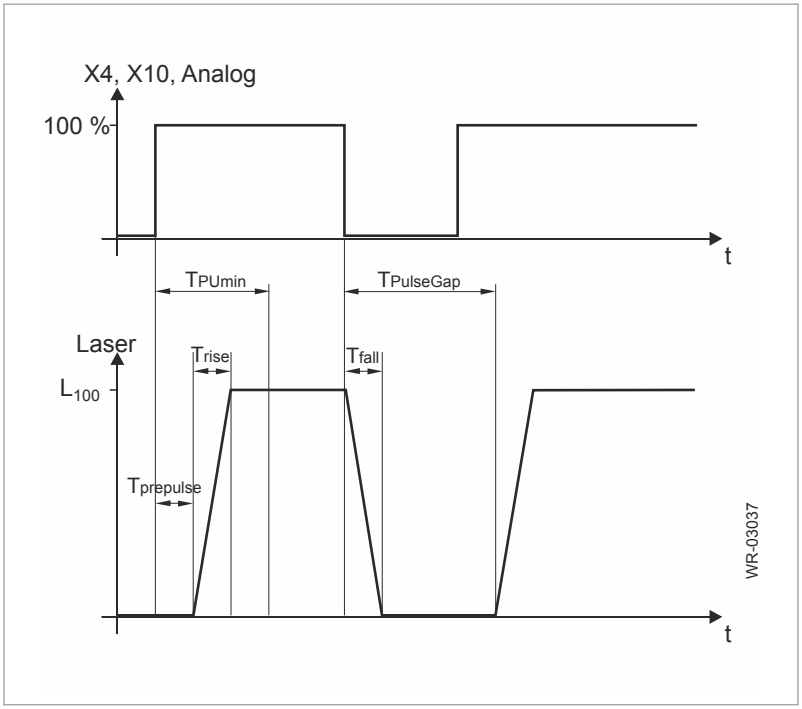
The diagram shows the change in laser power if the default value is sent in form of an analog signal at X4 or X10.

The value of TriggerOnSetValue = 1 has the following effect on the range of the switching thresholds:

If the default value falls **below the switch-off threshold**, the laser power is reduced to 0.

If the default value **exceeds the switch-on threshold**, the laser power follows the default value.

The change in time of the laser power in this situation is shown in the following diagram.



TriggerOnSetValue=1, change in laser power Fig. 4

$T_{Prepulse}$ Time between the begin of the default value rise and the start of the laser pulse

T_{rise} Rise time of the laser pulse until the default value is reached

T_{fall} Switch-off time of the laser pulse until the power 0 is reached

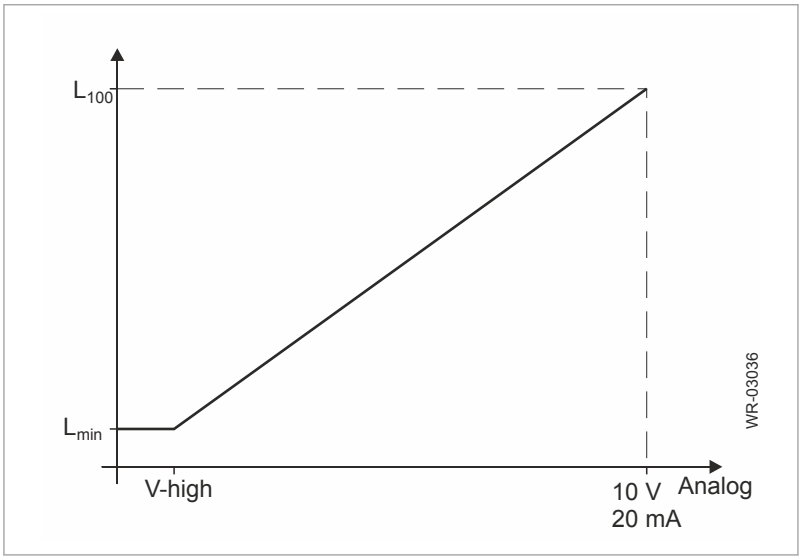
T_{PUmin} Minimum switch-on time: minimum time during which a default value pulse should be active in order to trigger a laser pulse. If the default value pulse is shorter, it is prolonged internally so that a laser pulse is triggered in any case. The duration of a laser pulse is then longer than the duration of the default value pulse.

$T_{PulseGap}$ Minimum pulse pause: minimum time between the falling edge of a default value pulse and the next rising edge. If the pulse pause is shorter, the laser is switched off and the next rising edge is ignored.

The times described above depend on the laser type. You can find the times set for your laser in a diagnosis dialog in TruControl 1000: (see "Diagnosis of the real-time interface X4", pg. 27).

5.2 Modulation mode

TriggerOnSetValue = 2



Laser power via analog input value Fig. 5

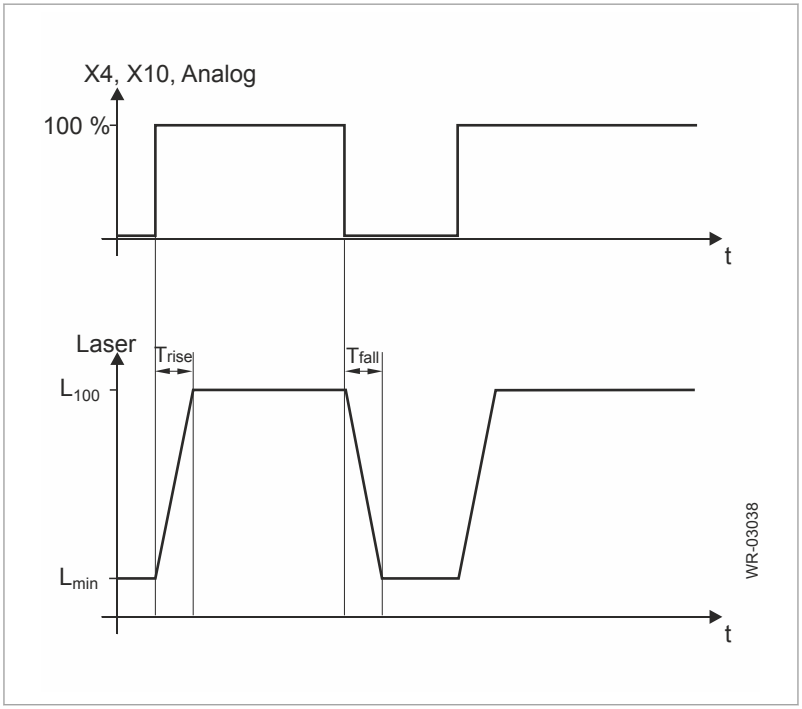
The diagram shows the change in laser power if the default value is sent in form of an analog signal at X4 or X10.

The value of TriggerOnSetValue = 2 has the following effect on the range of the switching thresholds:

If the default value **falls below the switch-off threshold**, the laser releases the power L_{min}.

If the default value **exceeds the switch-on threshold**, the laser power follows the default value.

The change in time of the laser power in this situation is shown in the following diagram.



TriggerOnSetValue = 2, Verlauf der Laserleistung Fig. 6

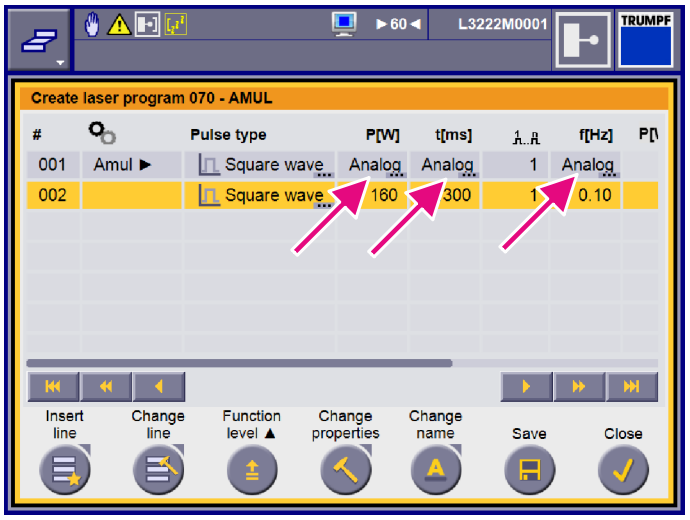
T_{rise} Rise time of the laser pulse until the default value is reached

T_{fall} Switch-off time of the laser pulse until the power 0 is reached

The times described above depend on the laser type. You can find the times set for your laser in a diagnosis dialog in TruControl 1000: (see "Diagnosis of the real-time interface X4", pg. 27).

6. Interface usage

6.1 X10: controlling laser power, pulse duration and pulse frequence



Laser program for analog value specification (example) Fig. 7

Laser power, pulse duration and pulse frequency can be controlled via the analog input interface X10. These parameters can be selected as individual default values in the laser program. In the laser programs, the source of the default values can be selected for every line.

In the following dialog of TruControl 1000, laser programs can be created or modified:
>Programming >Laser programm

User level ≥ 40 is required.

Example:(see "Fig. 7", pg. 15)

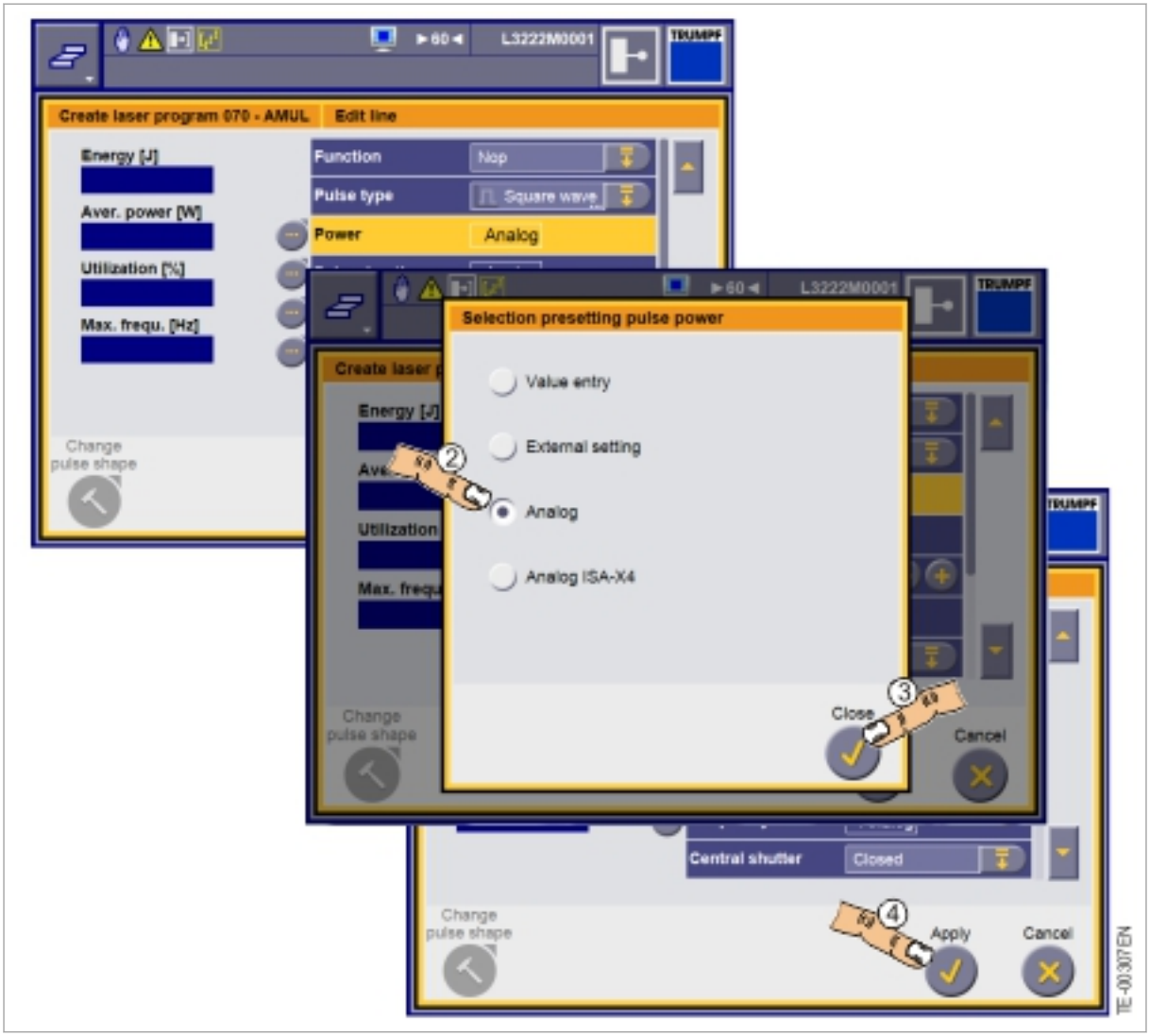
- Line 001:
  Laser power (P), pulse duration (t) and frequency (f) are defined via the analog interface X10.
- Line 002:

  Laser power (P), pulse duration (t) and frequency (f) are defined as fixed numerical values,

  here: laser power 102 W, pulse duration 0.2 ms and frequency 1.00 Hz.

The minimum and maximum values for the laser power, pulse duration and frequency depend on the type of laser device.

Selecting the "Analog" default value for the pulse power

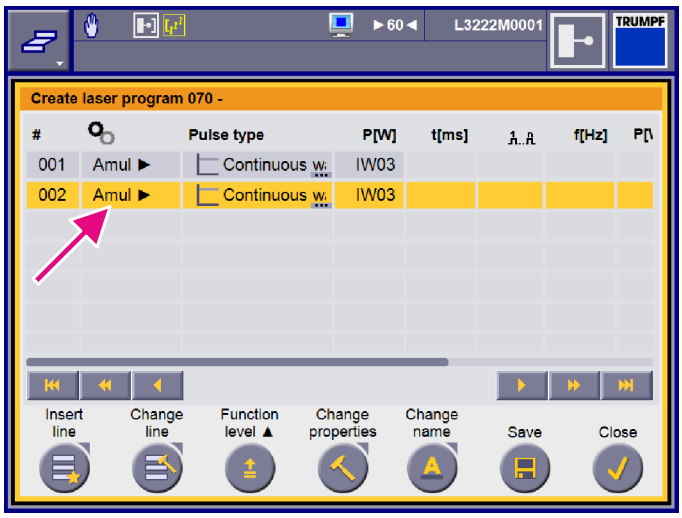


Select the specification for analog pulse power (example) Fig. 8

1. Select dialog >*Zeile bearbeiten (Edit line)* by pressing the button *Zeile einfügen... (Insert line…)* or *Zeile ändern... (Change line…)*
2. Select the selection dialog by pressing the button in front of the laser parameters pulse power, pulse duration or frequency.
3. Select “Analog” as default value.
4. Exit the dialog by pressing *Schließen (Close)*.
5. Repeat the 3 steps described above if the default value “Analog” is to be selected for more laser parameters.
6. Select the *Übernehmen (Apply)* button.

The edited line is transferred to the laser program.

6.2 X10: Inserting AMUL



001 Multiplication with analog signal is started.

002 Multiplication with analog signal is stopped.

Power default via field bus, use of AMUL (example) Fig. 9

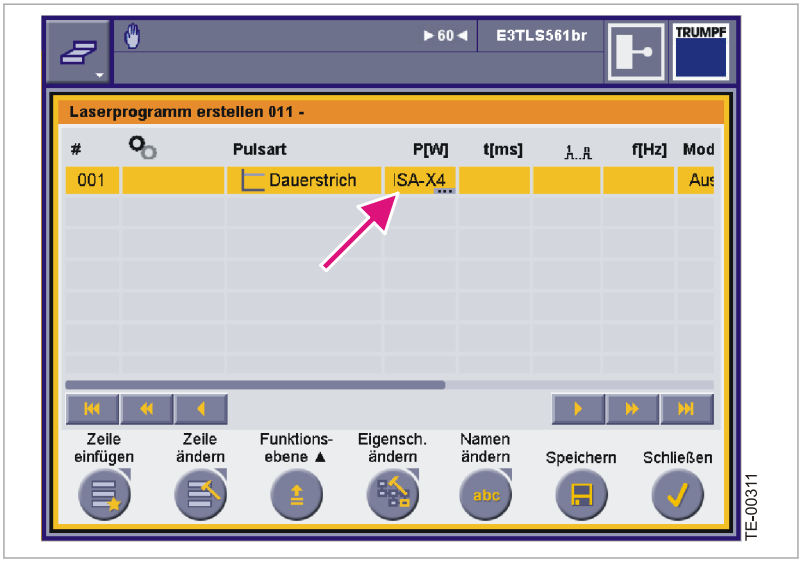
If the AMUL function (**A**nalog **Mul**tiplication is activated in the laser program, the power default is “multiplied” with the analog input X10 ANALOG_1 in real time.

The power can be defined via:

- a fixed value in the laser program...
- a fieldbus interface
- the X4 ANALOG input of the ISA board
- a programmable focusing optics (PFO).

Using AMUL, an external laser control can additionally influence the laser power.
Example: Temperature regulation when using scanner optics (PFO).

6.3 X4: Controlling the laser via real-time interface



Laser program, power default via X4 Fig. 10

Prerequisite

The real-time interface (analog ISA-X4) can only be activated in the pulse type **Dauerstrich** (Continuous wave).

Activating X4

The real-time interface X4 is active if in the laser program the option “Analog ISA-X4” is selected in *>Auswahl Vorgabe Laserleistung* (Sélection Default Laser power).

With external scanner optics

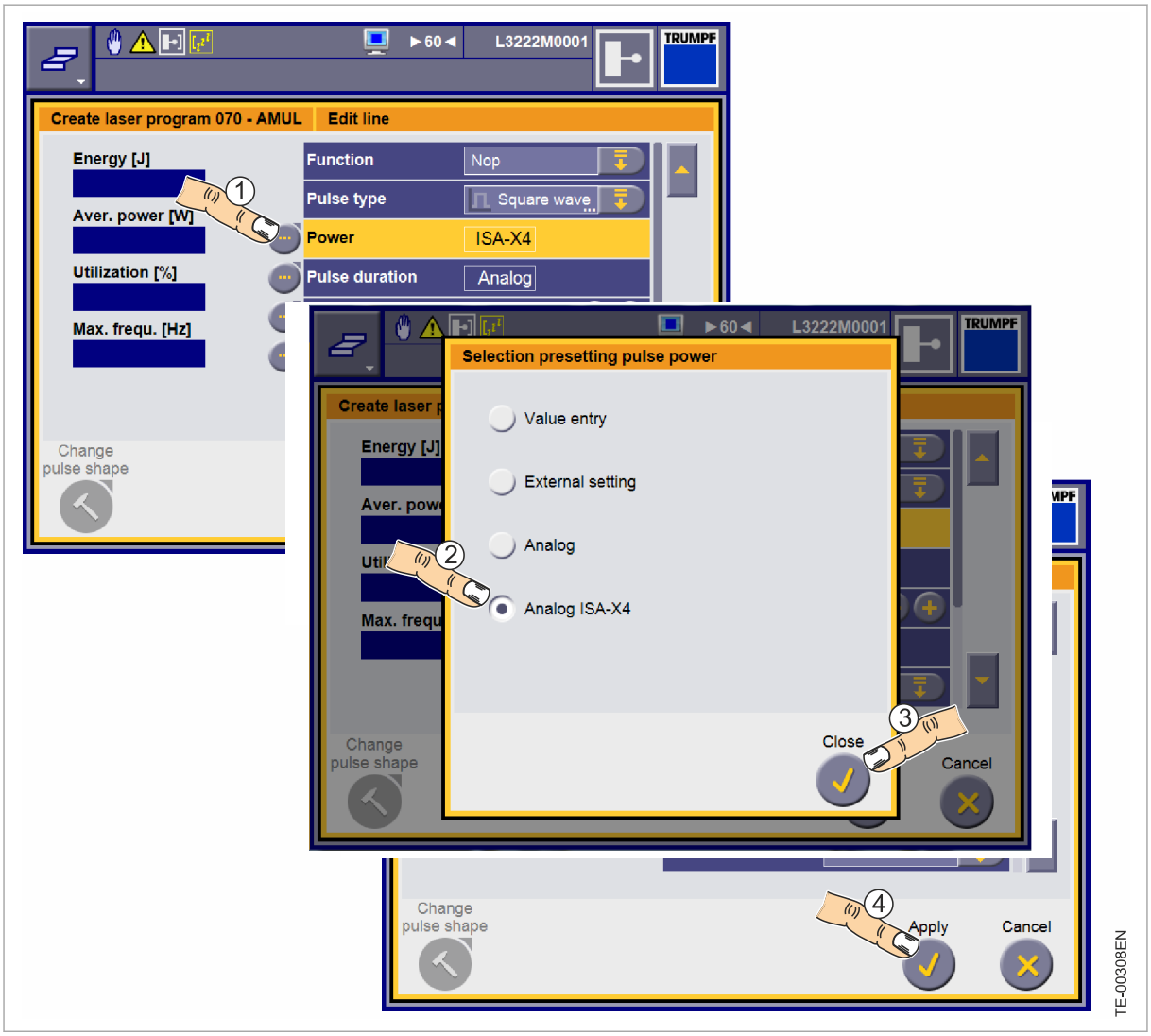
If the laser device is operated with an external scanner optics, the real-time interface X4 is connected to the external scanner control.

Without external scanner optics

If the laser device is operated without an external scanner optics, the laser power can be defined by means of an analog voltage or current signal via the analog input of the real-time interface. The laser power can be enabled or locked in real-time via the digital inputs.

Selecting the default value via X4

In the dialog *>Programmieren >Laserprogramm > Zeile ändern* (Programming >Laser program >Change line) in the parameter *Pulse power*, the real-time interface X4 for the laser power default can be chosen by selecting the option “Analog ISA-X4”.



Selection of ISA-X4 for the laser power definition Fig. 11

If the real-time interface X4 is selected in the laser program, the laser power can be activated or locked by means of digital signals (see "Change in laser power by control via X4 or X10", pg. 10).

7. Configuring interfaces

7.1 Configuration of analog inputs

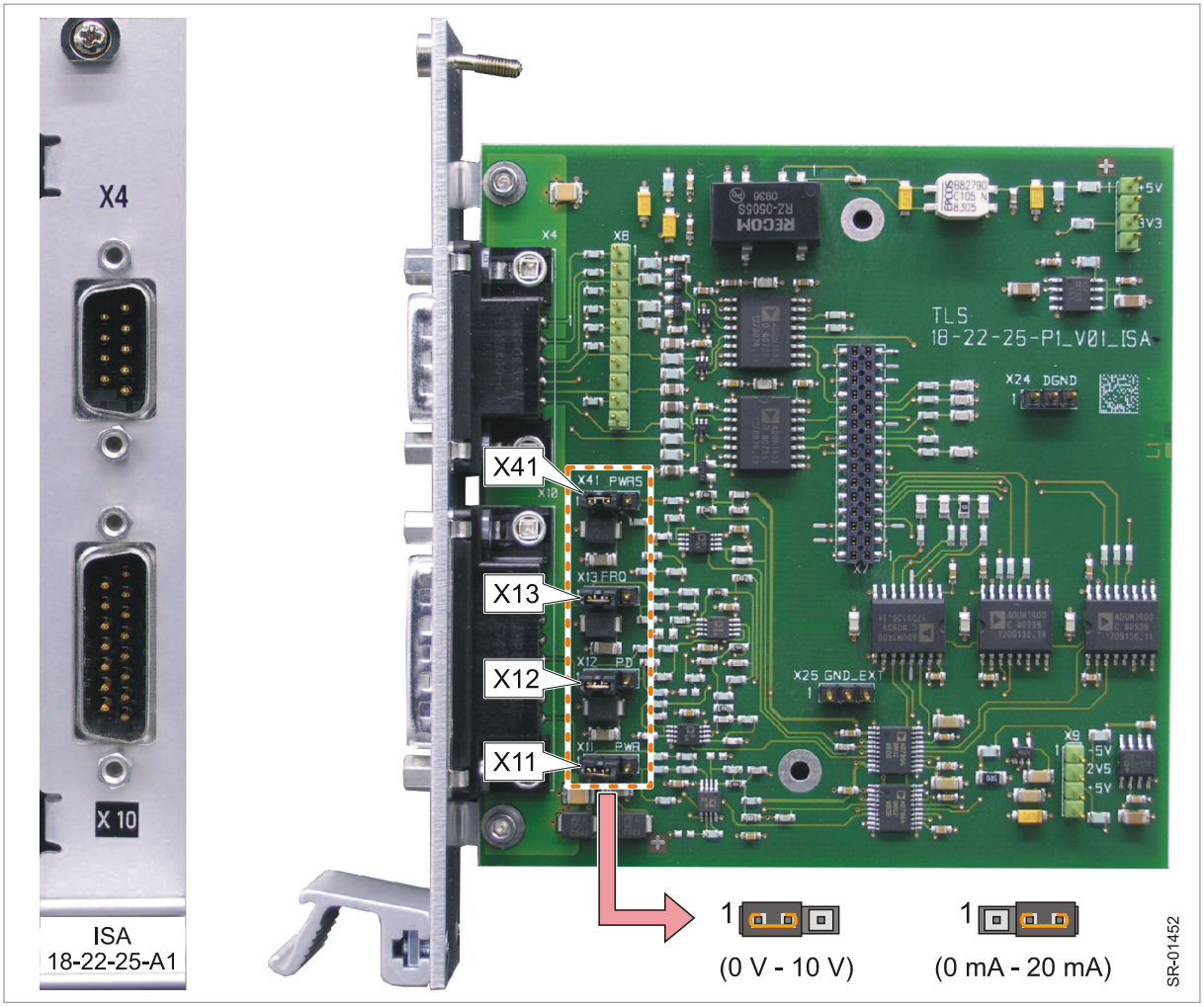


Fig. 12

All analog inputs of the ISA board can be configured using jumpers. Each analog input can be configured as voltage or current input.

The picture show how the jumpers have to be set in order to configure the respective input as a voltage or current input:

- Jumper on the left side: voltage input 0 V - 10 V
- Jumper on the right side: current input: 0 mA - 20 mA

Laser parameters	Interface / Pin	Jumper	Input laser progr.
Laser power	X10 / 7	X11	Analog
Pulse duration	X10 / 4	X12	Analog

Laser parameters	Interface / Pin	Jum-per	Input laser progr.
Pulse frequency	X10 / 1	X13	Analog
Laser power	X4 / 4	X41	Analog ISA-X4

Assignment: Jumpers to the analog input signals Tab. 11

All analog inputs are set ex works to a voltage signal of 0 - 10 V. This corresponds to the permitted ranges of the respective laser device between 0 % and 100 %. The behavior of the laser power in the range of small voltages is influenced by the setting of the system parameter TriggerOnSetValue (see "Change in laser power by control via X4 or X10", pg. 10).

In the mode „Trigger On Set Value”, the **laser power** is switched off after having fallen below the minimum power default L_Min. You will find a detailed description of this mode in the paragraph system settings FG_TriggerOnSetValue (see "System settings FG_TriggerOnSetValue", pg. 24).

The range of the **pulse duration** can be set in the dialog *>Einrichten >Systemeinstellung >Lasersteuerung (Setup >System settings >Laser control)*
via the variable **FG_AnalogPulseDurationRange** (see "Setting the maximum pulse duration", pg. 21).

The laser is limited to the minimum pulse duration so that pulse lengths of the duration "0" or a deactivation of the pulses via this signal is not possible.

The analog input is read only at the beginning of the pulse to calculate the pulse duration.

The range of the **pulse frequency** can be set in the dialog *>Einrichten >Systemeinstellung >Lasersteuerung (Setup >System settings >Laser control)*
via the variable FG_AnalogFrqRange (see "Setting the maximum pulse frequency", pg. 22).

If the value of the input voltage is below 0.2 V (2% of the maximum input level of 10 V), laser pulses are no longer triggered (frequency = 0).

The value is cyclically read and evaluated every 1 ms.

7.2 Setting the maximum pulse duration

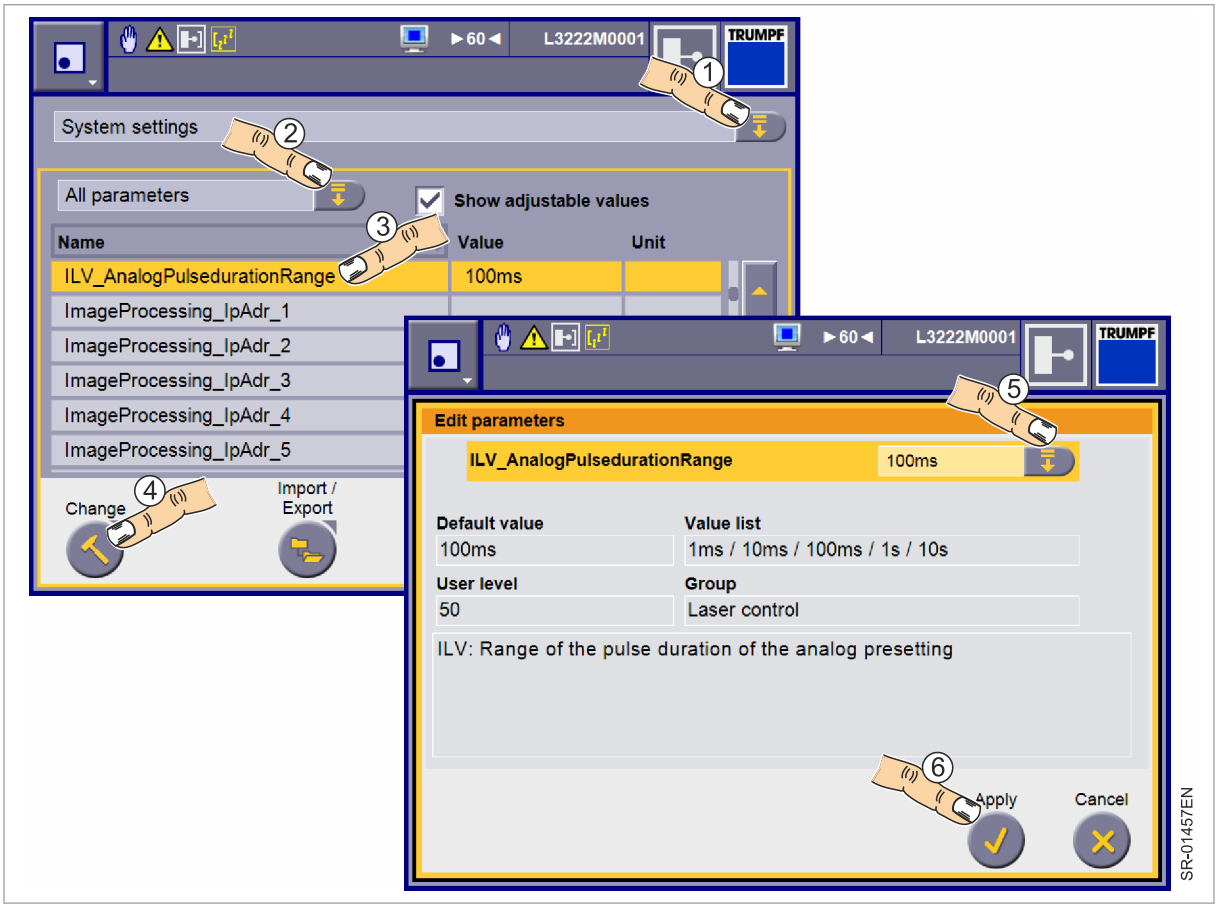
This setting defines the pulse duration which corresponds to the maximum input value at the analog input (10 V or 20 mA).

The minimum pulse duration depends on the type of the laser device.

Make sure that the minimum default value is not below 500mV. Otherwise the variations of the default value have the effect of a pulse duration fluctuation.

Condition

- User level ≥ 50



Pulse duration, setting the maximum value Fig. 13

1. Select the dialog >*Einrichten* >*Systemeinstellung* >*Lasersteuerung (Setup* > *System setting* >*Laser control)* in TruControl 1000.
2. Set the variable "ILV_AnalogPulsedurationRange" to the desired maximum value.

   The following values can be chosen: 1 ms, 10 ms, 100 ms, 1 s, 10 s.

7.3 Setting the maximum pulse frequency

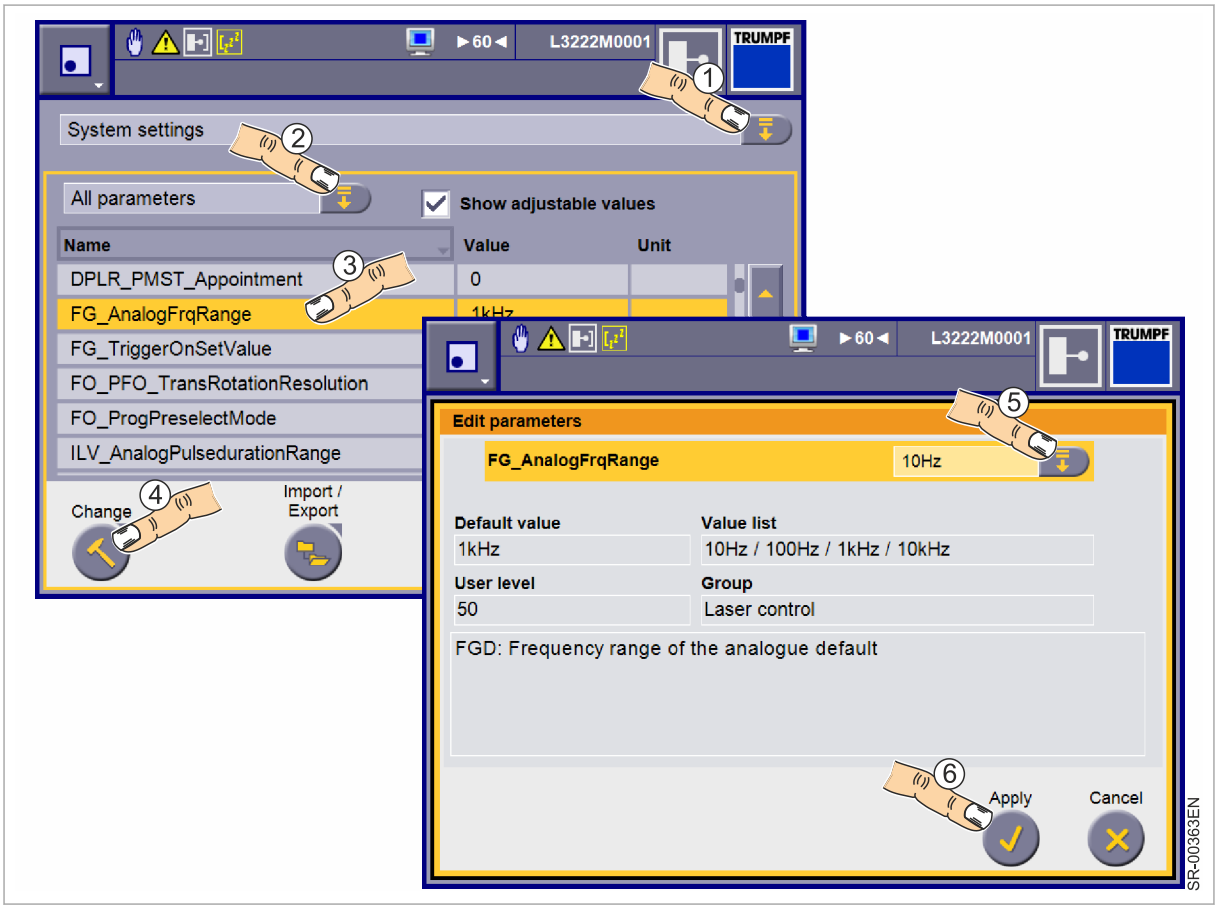
This setting defines the pulse frequency which corresponds to the maximum input value at the analog input (10 V or 20 mA).

The minimum pulse frequency is defined by the switch-off threshold of 2 % of the maximum pulse frequency, that means 0.2 V or 0.4 mA.

If the value of the input signal is below this limit, no laser pulses are triggered.

Condition

- User level ≥ 50

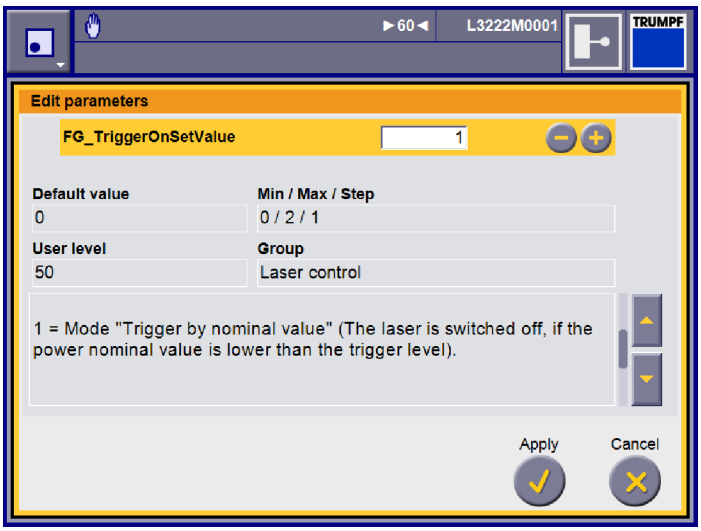


Pulse frequency, setting the maximum value Fig. 14

1. Select the dialog *>Einrichten >Systemeinstellung >Laser-steuerung (Setup > System setting >Laser control)* in Tru-Control 1000.
2. Set the variable "FG_AnalogFrqRange" to the desired maximum value.

   The following values can be chosen: 10 Hz, 100 Hz, 1 kHz, 10 kHz.

7.4 System settings FG_TriggerOnSetValue



FG_TriggerOnSetValue dialog Fig. 15

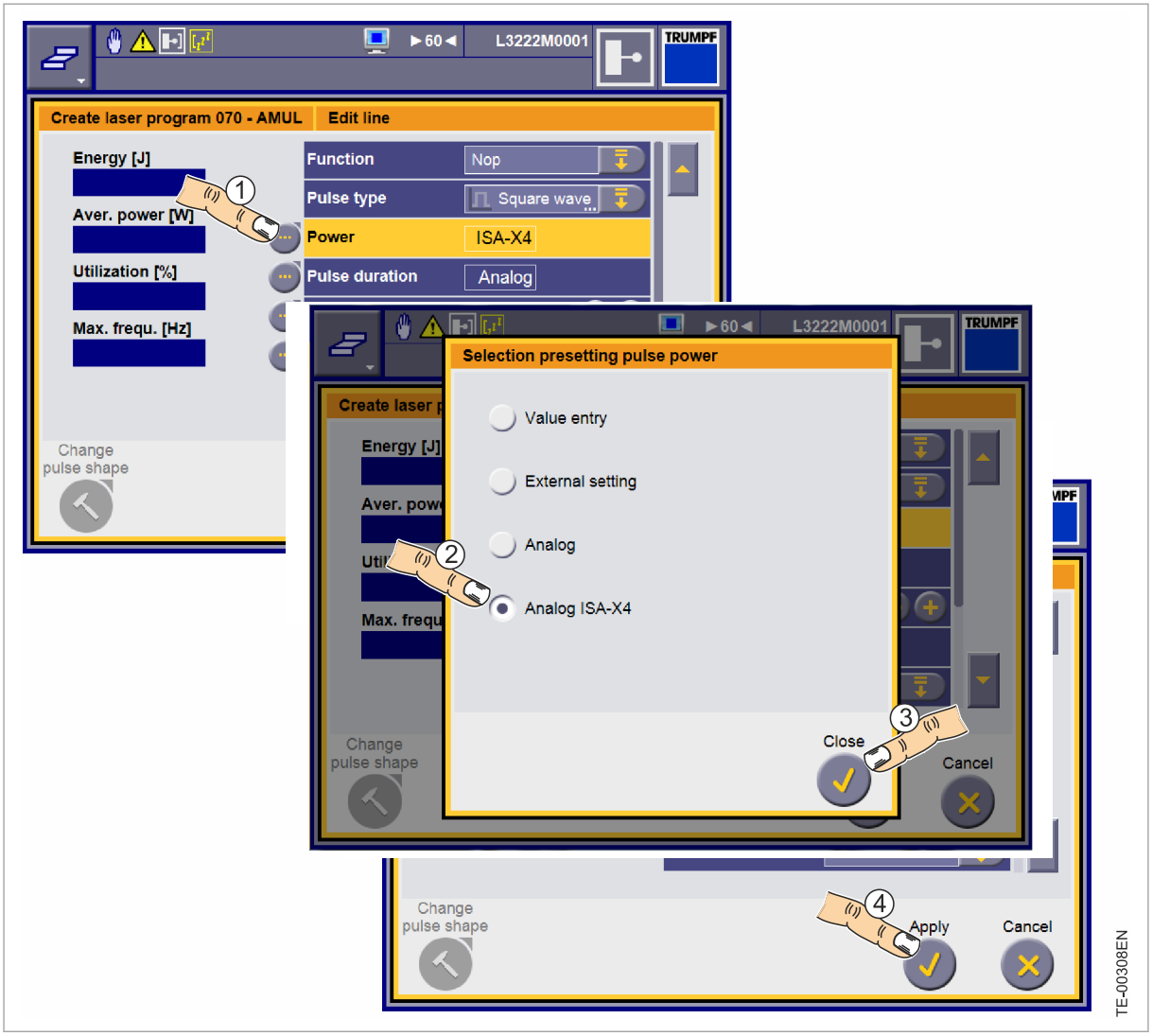
User level to change to the FG_TriggerOnSetValue: ≥ 50

Value	Description
0	The mode is not set by the system settings. The mode which is set upon delivery via internal parameters remains active.
1	**“TriggerOnSetValue“ mode is activated.** Standard CW lasers are operated in the “Trigger on Set Value” mode. In this mode, the laser power can be enabled or locked via the analog input signal X10 ANALOG_1 or X4 ANALOG. As soon as the laser power is enabled, the laser power is defined by these analog input signals. The laser power is increased to the default value set at X4 ANALOG or X10 ANALOG_1 as soon as the switch-on threshold (approx. 250mV) is exceeded. If the default value has fallen below the switch-off threshold (approx. 150 mV), the laser power is locked.
2	**“Modulation“ mode is activated.** If the analog default value at X4 ANALOG or at X10 ANALOG_1 has fallen below the switch-off threshold, the laser is operated with a minimum power (L_{min}). This corresponds to the function of the power input for laser devices equipped with a LCU or WinLas control.

System parameter FG_TriggerOnSetValue Tab. 12

8. Test and diagnostics

8.1 ISA board in the control unit?



If ISA is available, "Analog ISA-X4" can be selected Fig. 16

If the control unit is equipped with an ISA board, the option `Analog ISA-X4` is displayed in the laser program editor after having selected >*Vorgabe* >*Pulsleistung* (Default >Pulse power).

8.2 Diagnosis of the analog interface



Diagnosis Analog inputs Fig. 17

The dialog *>>Diagnose >Analog-Eingänge (Diagnosis >Analog inputs)* shows:

- the selected interface: AE-X1 or ISA-X10
- the active voltages at the analog inputs.
- the parameter values resulting from the voltages.
- the "Trigger on Set Value" mode (see "System settings FG_TriggerOnSetValue", pg. 24),
  - green: "Trigger on Set Value" is active
  - gray: "Modulation" mode is active

If the analog voltage defines nominal values that lie below or above the default values, the symbol “white flash on a red background" is shown on the left edge of the field in question.

The dialog can be accessed from any user level.

Analog default values

The analog default values are displayed as standardized voltage values. The analog input interface sends them as default values internally to the control unit of the laser device.

The display of the standardized voltage values is independent of the configuration as voltage or current input.

If an input is configured as **voltage input**, the displayed voltage value corresponds to the voltage that is active at the analog input.

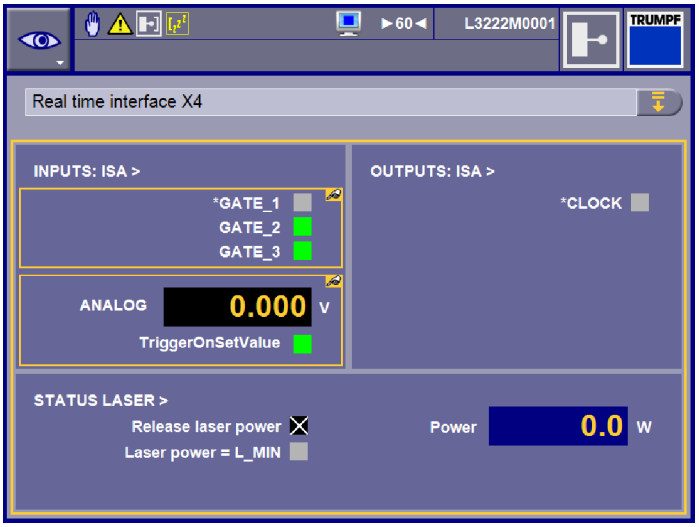
If the input is configured as **current input**, the standardized voltage value is calculated according to the active current.

AE-X1

If AE-X1 is displayed in the dialog, there is no ISA board available in the system. You will find more information on the AE-X1

interface in a separate document (see interface description Analog input for CPX, document No. 18-06-30-BA01).

8.3 Diagnosis of the real-time interface X4



Diagnosis of real-time interface X4 Fig. 18

The dialog *>Diagnose >Echtzeit-Schnittstelle X4 (Diagnosis >Real-time interface X4)* shows:

- the selected real-time interface: DLCM or ISA
- the active voltage at the analog input
- the system parameter state TriggerOnSetValue (see "System settings FG_TriggerOnSetValue", pg. 24):
  - green: "Trigger on SetValue" mode active
  - gray: "Modulation" mode active
- the states of the digital inputs and outputs
- the laser state
- the power resulting from the voltage.

If the analog voltage defines a default value that is below or above the allowed default value, the symbol gwhite flash on a red background" is shown on the left edge of the field in question.

The dialog can be accessed from any user level.

Analog default values

The analog default values are displayed as standardized voltage values. The analog input interface sends them as default values internally to the control unit of the laser device.

The display of the standardized voltage values is independent of the configuration as voltage or current input.

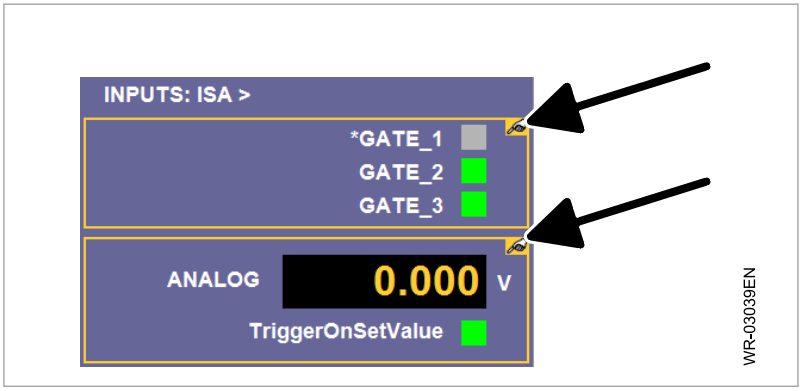
If an input is configured as **voltage input**, the displayed voltage value corresponds to the voltage that is active at the analog input.

If the input is configured as **current input**, the standardized voltage value is calculated according to the active current.

DLCM

If DLCM is displayed in the dialog, there is no ISA board available in the system. You will find more information regarding the real-time interface of the DLCM in a separate document, see interface description real-time and analog interface of the DLCM board (document No. 18-21-73-A3-BA01).

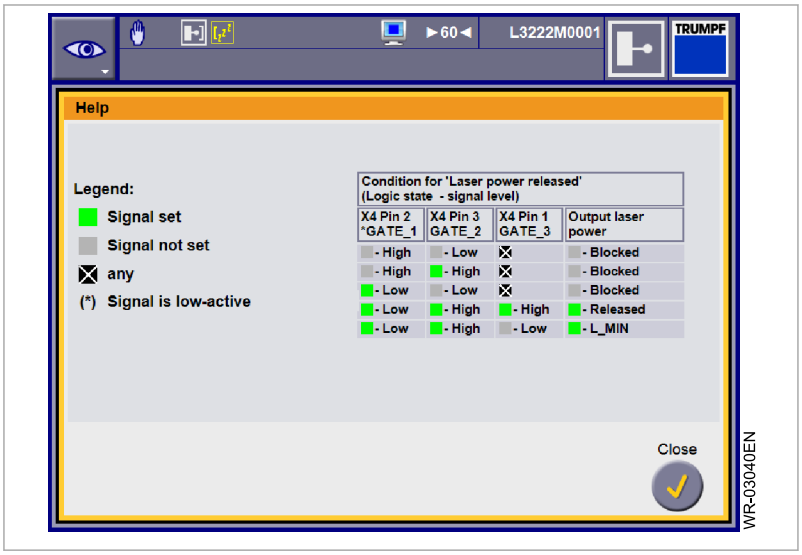
Help



Diagnosis X4, calling the help function (arrows) Fig. 19

The diagnostics dialogof the X4 interface, help dialogs can be called giving further information on the signal states and the power course. The help dialogs appear if you press the finger buttons (arrows).

By selecting the button in the field showing the gate states, the following screen appears:

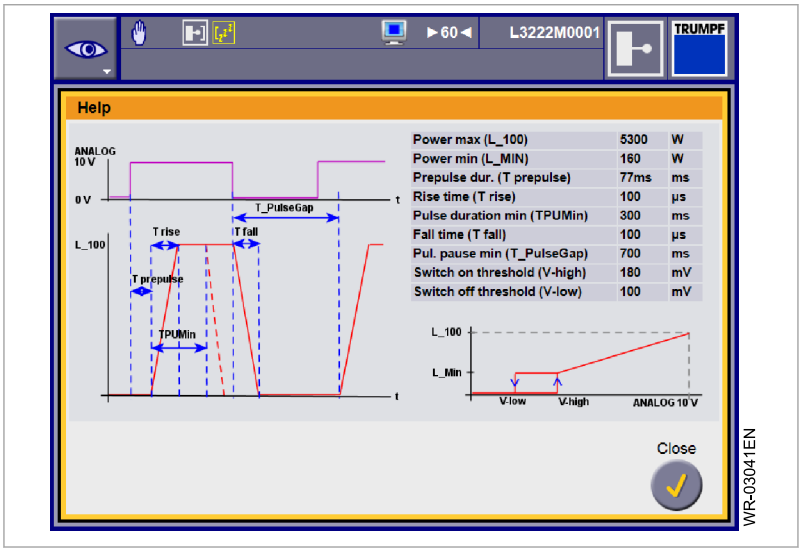


X4, diagnosis, state of the gates Fig. 20

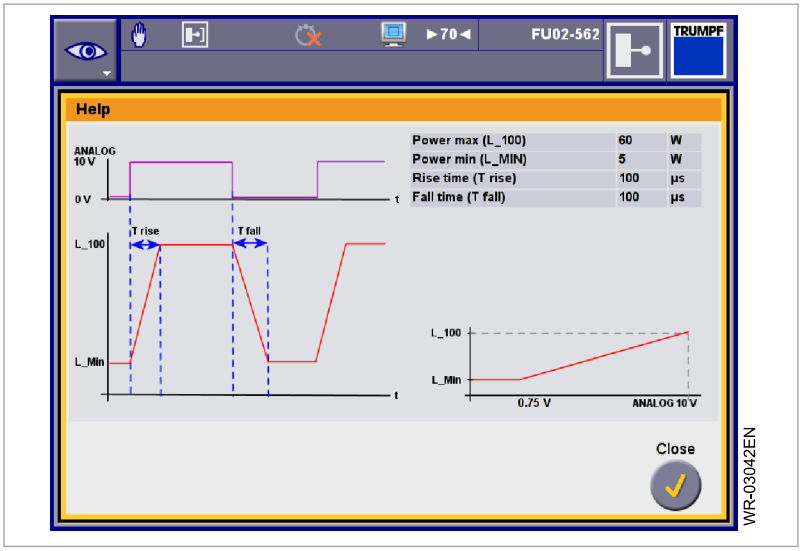
The table shows the value combinations at the gate inputs and the state of the laser resulting from them.

When selecting the button in the analog value field, the content of the appearing screen depends on the value of the system parameter TriggerOnSetValue:

- TriggerOnSetValue = 1: power course in the "Trigger on Set Value" mode (see "Fig. 21", pg. 29).
- TriggerOnSetValue = 2: power course in the "Modulation" mode (see "Fig. 22", pg. 29).

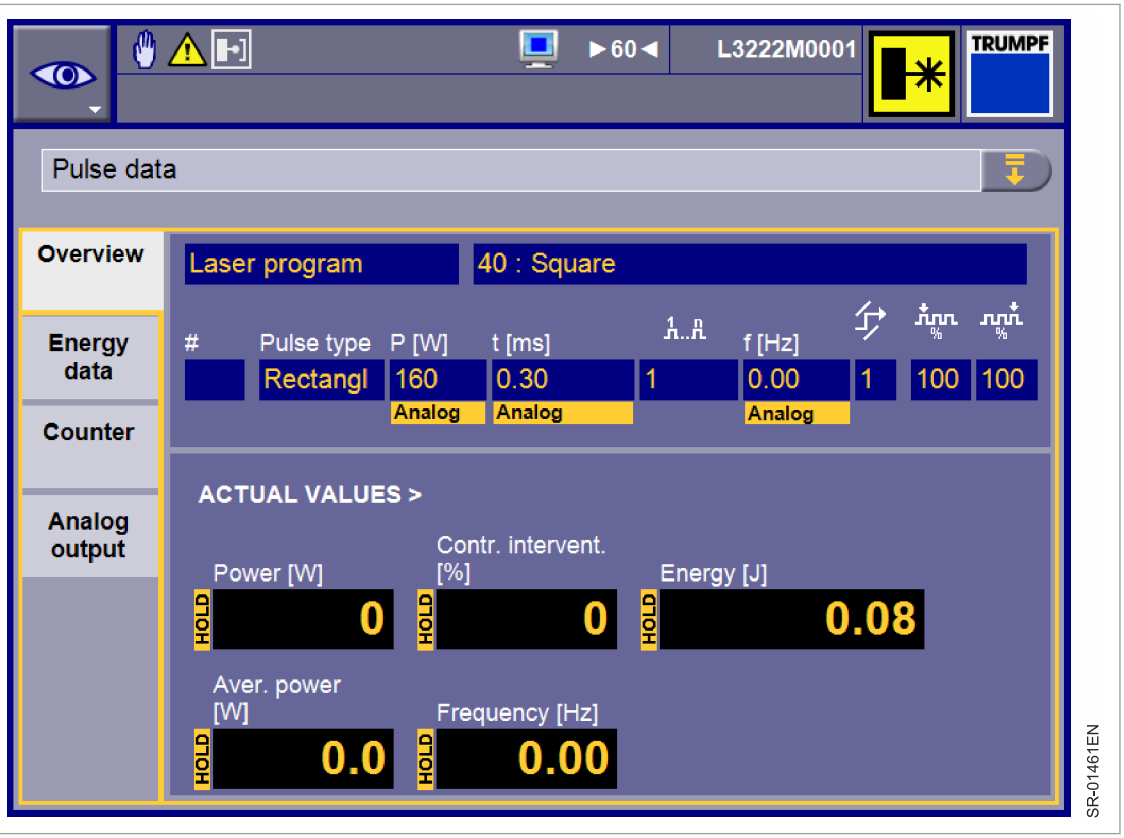


X4, diagnosis, power course for TriggerOnSetValue Fig. 21



X4, diagnosis, power course for modulation Fig. 22

8.4 Diagnosis of the pulse data



Diagnosis pulse data Fig. 23

The dialog **Diagnose >Pulsdaten >Übersicht (Diagnosis >Pulse data >Overview)** shows:

- the current line of the laser program.
- the actual values.

The dialog can be accessed from any user level.

9. Subsequent installation of the ISA board

The subsequent installation of an ISA board in the laser control unit is described in the mounting instructions 18-22-25-A1-AK. These mounting instructions are delivered with the ISA retrofitting set.