Operator's manual

TruConvert AC 3025, TruConvert System Control

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TruConvert AC 3025, TruConvert System Control

Original operator's manual

Edition **2020-03-12**

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TruConvert AC 3025, TruConvert System Control
Edition 2020-03-12
Document number A67-0141-00.BKEN-001-04

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For "partly completed machinery" in accordance with the EC Machinery Directive, this document corresponds to the assembly instructions.

Good to know

Need help? Provide the **serial number** when you contact the Service department. The serial number can be found on the name plate of the device.

How to reach our Service department:

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E-mail **Service.Elektronik@de.trumpf.com**

Table of contents

1. Safety

1.1 Storing the operating instructions

These operating instructions contain safety notices that must be observed during installation and maintenance. Therefore, keep the operating instructions in a safe place for the entire life cycle of the device.

Include the operating instructions if you sell the device or set it up at another location.

1.2 Warning signs

Certain activities can cause danger during operation. Corresponding warning signs concerning the dangers should precede instructions concerning the activities. Danger signs are located on the device.

A warning sign contains signal words which are explained in the following table:

Signal word	Description
DANGER	Indicates a major danger. If it is not avoided, serious injuries or death will result.
WARNING	Indicates a dangerous situation. If it is not avoided, it may lead to serious injuries.
CAUTION	Indicates a potentially dangerous situation. If it is not avoided, injuries may occur.
NOTICE	If such a situation is ignored, material damage may result.

Description of the signal words Tab. 1

1.3 Using the device

Typical fields of application

The device is a bidirectional inverter. It is used for charging a DC link from a three-phase grid and for feeding the grid from the DC link's energy.

- The power and the energy flow direction are adjustable.
- The device draws sinusoidal current from the mains or delivers sinusoidal current to the mains. The power factor cosφ is adjustable.
- The DC link voltage is balanced to earth.

Liability exclusion

Any use not listed under "Typical fields of application" contravenes the intended purpose. TRUMPF is not liable for any ensuing damages, in particular for property damage, personal injury and loss of production. The operator bears all risks. The warranty is rendered null and void.

Impermissible uses

Impermissible uses include, for example:

- Use of incorrect components.
- Operation on mains voltage outside the specification.
- Faulty installation (e.g., cables reversed).
- Use in unauthorized installation position.
- Misuse by untrained personnel.
- Use in unsuitable environmental conditions:
  - Condensation, icing.
  - Conductive soiling.
  - Corrosive conditions (e.g. battery fumes, salt spray).
  - Voltages outside of overvoltage category III (max. 4 kV impulse withstand voltage).
  - Operation at more than 2000 m above sea level.
  - Outdoors.
  - Failure to observe pollution degree 2 environmental condition.
  - In an explosive environment.

1.4 Authorized personnel

Installation, operation, configuration and maintenance work may only be performed by authorized, trained and instructed personnel.

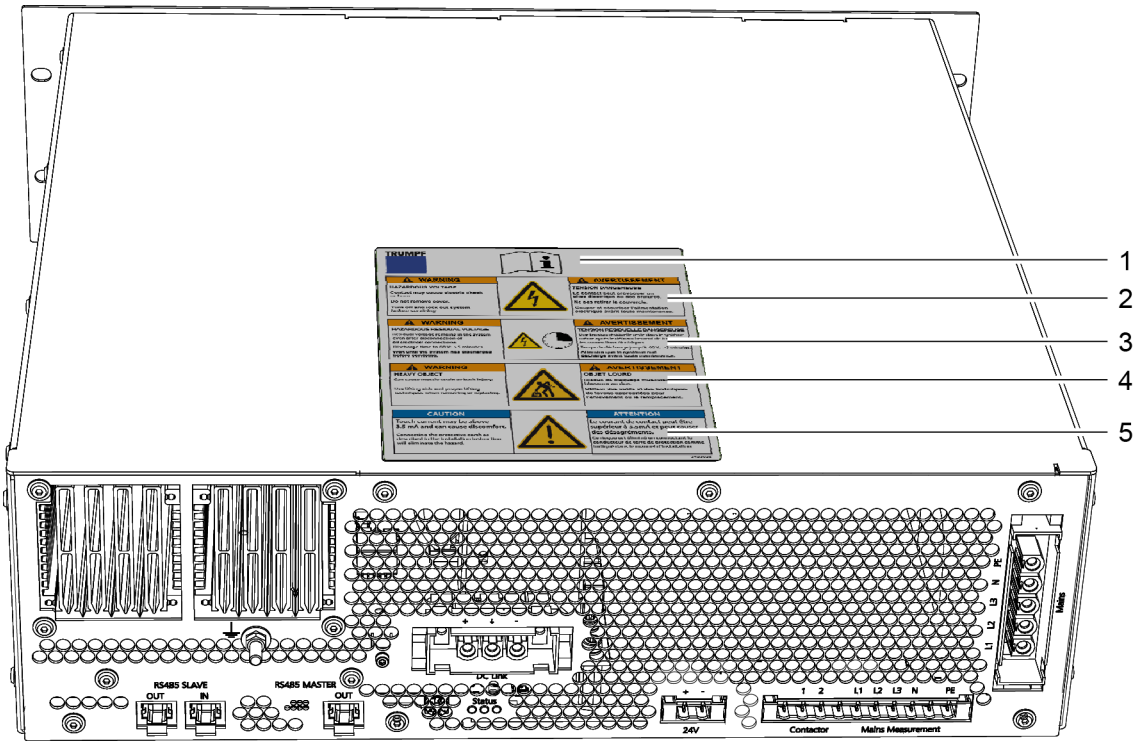
Authorized persons must be trained and be familiar with the standards and regulations relevant to their tasks.

It is the duty and responsibility of the operator to maintain the qualifications of the authorized personnel. The authorized personnel must therefore be trained at regular intervals.

The following activities may only be performed by authorized persons:

- Setting up the AC-DC module.
- Connecting the AC-DC module.
- Commissioning the AC-DC module.
- Dismantling the AC-DC module.
- Operating the AC-DC module.

1.5 Warning signs on the AC-DC module



1 Read operating instructions	3 Dangerous residual voltage	5 Danger due to contact current
2 Dangerous voltage	4 Danger due to the weight of the device	

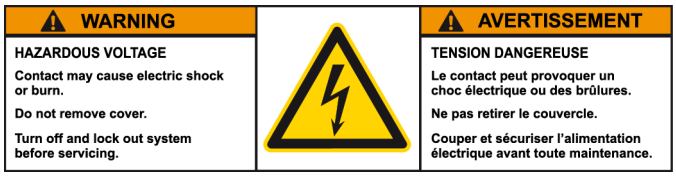
Warning signs on the AC-DC module Fig. 1

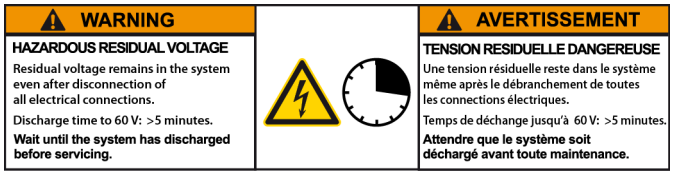
1.6 What you must know as an operator

Note

All warning signs must be present and legible.

If one or more of these warning signs is missing or not legible, contact TRUMPF to request new warning signs.

Warning sign	Meaning
	This sign indicates that the operating instructions must be read.
	Sign warns of hazardous voltage.

Warning sign	Meaning
	Sign warns of hazardous residual voltage.
	This sign warns of dangers that arise from the weight of the device.
	Sign warns of contact current.

Meaning of the warning signs Tab. 2

1.7 Dangers from high voltages

⚠ WARNING

Life threatening voltage!

The voltages present at the AC-DC module are life-threatening.

- ➢ Only have work on the AC-DC module performed by authorized, trained and instructed personnel.

The AC-DC module produces voltages that can endanger human life and health. These voltages occur both in the AC-DC module as well as at the outputs of the AC-DC module.

The AC-DC module's connection cables carry voltages that are life-threatening.

A person who comes into contact with live AC-DC module parts may be killed or severely injured.

⚠ WARNING

Simultaneous control via web-based user interface and Modbus is possible!

Power transmission stopped using the user interface can be started again and reversed via Modbus.

- ➢ Before carrying out work on the device, deenergize all supply lines and secure against reenergizing.
- ➢ Make sure that the device is controlled via one channel only (user interface or Modbus).

Protective measures taken by the manufacturer

The AC-DC module is installed in an enclosed metal casing.

1.8 What you must know as an operator

1. The AC-DC module must not be opened.
   There are no parts within the device that can be serviced by the user.
2. Only operate the AC-DC module within the conditions described in chapter "Technical specifications".
3. Only operating personnel **without** pacemaker or implants may work in the operational site.
4. For the electrical connection, use only cables that are in perfect condition and have the correct dimensions.
5. Periodically retest acc. to DGUV regulation 3 (DGUV = Deutsche Gesetzliche Unfallversicherung – German Statutory Accident Insurance Association).

2. Description

2.1 Fields of application

The fields of application are described in chapter **Safety**, (see "Typical fields of application", pg. 4).

Control

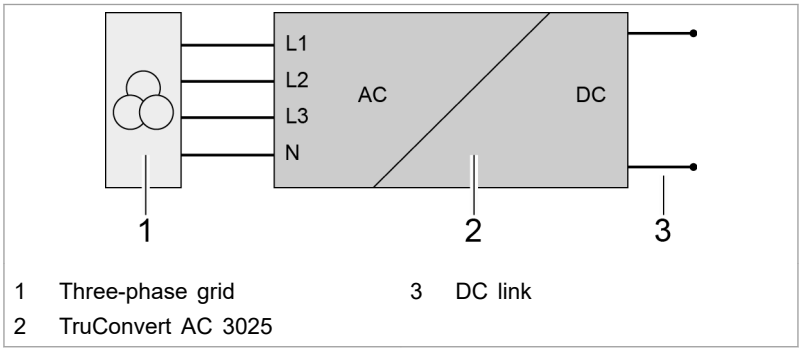
The **TruConvert System Control** external control must be used to monitor and control the AC-DC module.

2.2 Function description

Operation modes

- The AC-DC module draws energy from a three-phase grid and feeds it into a DC link.
- The AC-DC module draws energy from a DC link and feeds it into a three-phase grid.

Description of principle



1 Three-phase grid
2 TruConvert AC 3025
3 DC link

Description of principle Fig. 2

Operation

The AC-DC module can be operated:

- with a PC with a web browser
- via Modbus

In both cases, the **TruConvert System Control** control device must be connected upstream (see "Fig. 3", pg. 10).

2.3 Configurations

Permissible configurations

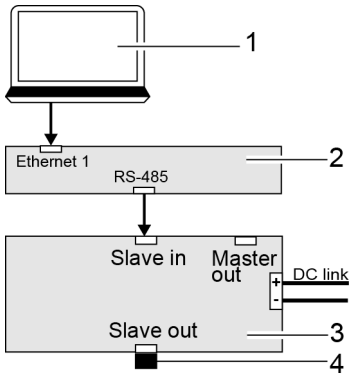
- The TruConvert AC 3025 must always be operated together with a TruConvert System Control.
- TruConvert AC 3025 can be operated on its own on a DC link ("DC link").

- Multiple TruConvert AC 3025 units can be operated simultaneously on the DC link.
- One TruConvert AC 3025 can be operated together with up to 16 TruConvert DC 1008.

Impermissible configurations

- The connection of other DC voltage converters is only permissible in consultation with TRUMPF.
- The parallel connection of TruConvert AC 3025 with other bidirectional inverters on the DC link side is permissible only in consultation with TRUMPF.

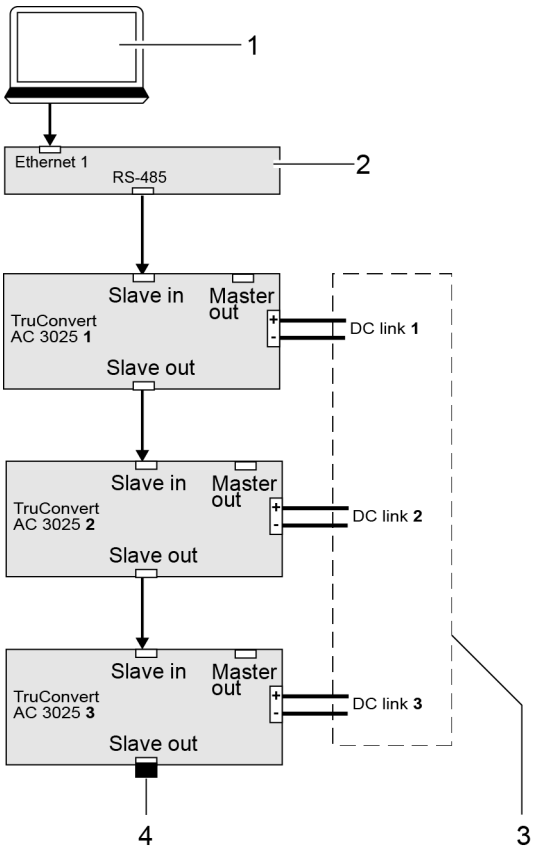
One TruConvert System Control controls one TruConvert AC 3025



1	PC	3	TruConvert AC 3025
2	TruConvert System Control	4	Terminating resistor

1 x TruConvert System Control, 1 x TruConvert AC 3025 Fig. 3

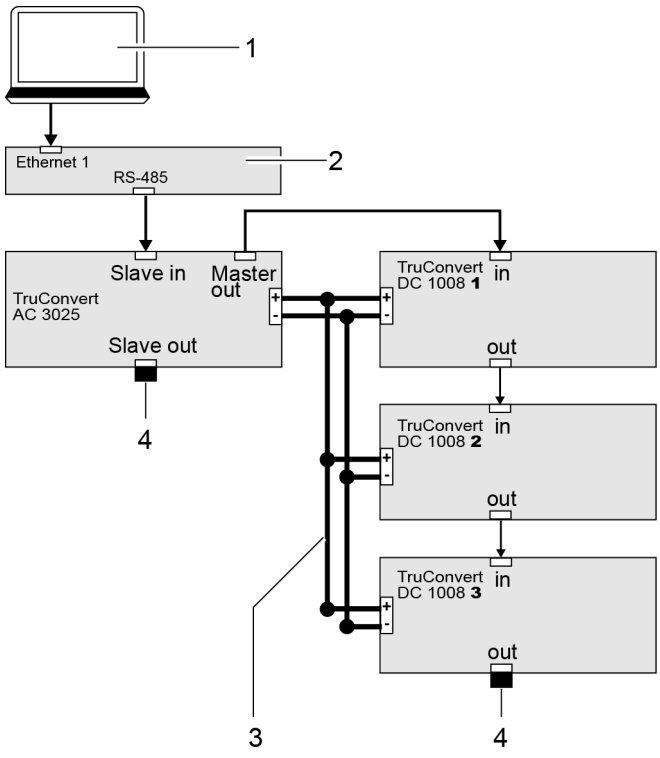
One TruConvert System Control controls several TruConvert AC 3025



1 PC with web browser or Modbus master
2 TruConvert System Control
3 DC link
4 Terminating resistor

1 x TruConvert System Control, n x TruConvert AC 3025 Fig. 4

One TruConvert System Control controls one TruConvert AC 3025 and several TruConvert DC 1008



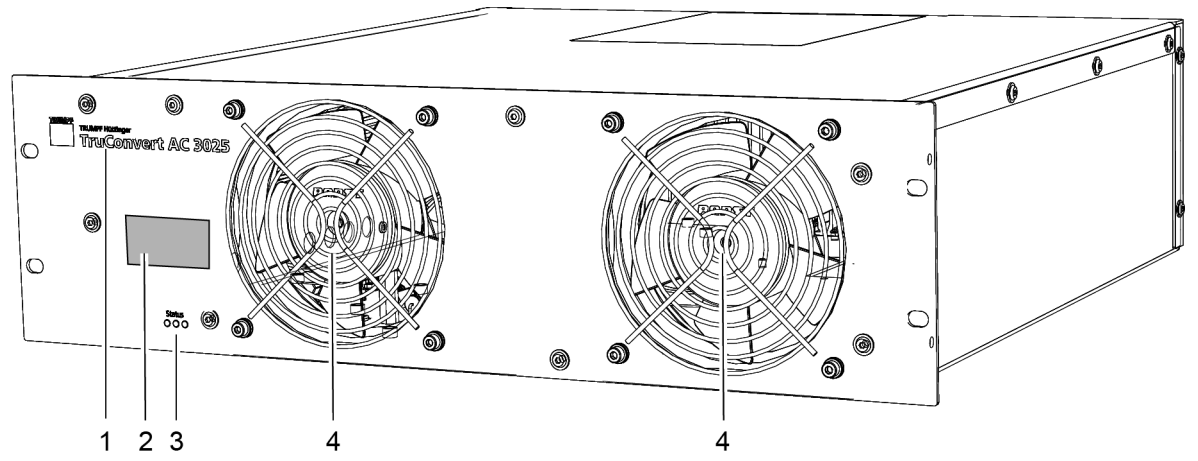
1	PC	3	DC-Zwischenkreis
2	TruConvert System Control	4	Terminating resistor

One TruConvert System Control controls one TruConvert AC 3025 and m x TruConvert DC 1008 Fig. 5

2.4 Construction

The AC-DC module is housed in an enclosed 19-inch metal housing.

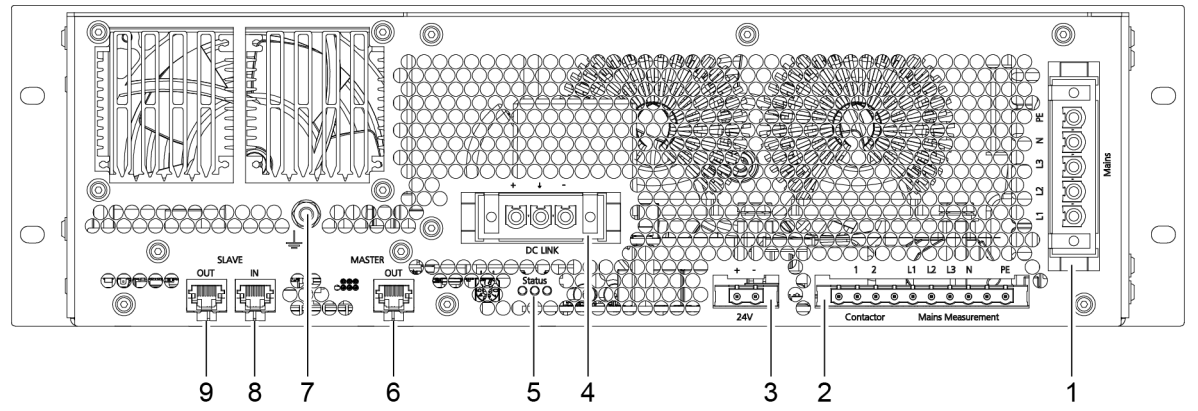
Overview



1 Device name
2 Name plate
3 Status LEDs
3 Fan (air is sucked)

Overall view of the TruConvert AC 3025 Fig. 6

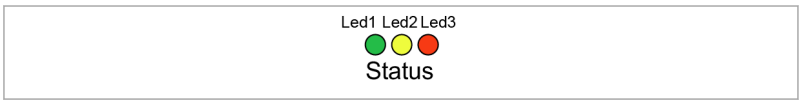
Rear side



1 Mains input ("Mains")
2 Contactor release contact and mains voltage measurement ("Contactor / Mains Measurement")
3 24 V supply voltage
4 DC link voltage ("DC Link")
5 LED status display
6 Data cable "MASTER OUT"
7 Threaded bolts for potential equalization
8 Data cable "SLAVE IN"
9 Data cable "SLAVE OUT"

TruConvert AC 3025 rear side Fig. 7

Display elements



Status LEDs on TruConvert AC 3025 and TruConvert System Control Fig. 8

	Device condition				
LED	**Bootloader**	**Initialize**	**Errors**	**Idling**	**Operation**
1 (green)	on	Flashing	off	Flashing	Flashing
2 (yellow)	Flashing	Flashing	off	off	LED indicates the energy direction. ▪ Illuminates if the energy flows from mains to the DC link. ▪ Flashes if the energy flows from the DC link to mains.
3 (red)	on	Flashing	Flashing	off	off

Status LEDs Tab. 3

3. Technical specifications

3.1 Data TruConvert AC 3025

Entire device

Description	Value
Max. efficiency	98 %
Voltage supply	24 VDC ± 10 % / 8 A **Note** Observe for external fuse: switch-on current is briefly three times the nominal current.
Reaction time (change in energy direction)	< 10 ms

Entire device Tab. 4

Mains connection data

Description	Value
Mains voltage range (3 phases)	380 V -10 % … 480 V +10 %
Maximum permitted mains voltage	528 V
Mains frequency range	45 Hz to 65 Hz
Nominal mains frequency	50 Hz / 60 Hz
Charging/discharging nominal apparent power	25 kVA
Asymmetrical load	Up to 8.3 kVA/phase
Charging/discharging power factor (cosφ)	-1 to 1 Inductive and capacitive phase shift
Nominal current for listed voltage	380 V: 38 A 400 V: 37 A 415 V: 35 A 440 V: 33 A 460 V: 32 A 480 V: 31 A
Overload capacity 125% (10 min)	32 kVA[1]
Overload capacity 150% (1 min)	38 kVA[1]
Excess current capacity 300% (0.5 s isolated operation)	114 A[1]
Distortion due to harmonics in nominal power	< 5 %
Max. switch-on current	< nominal current

1 At ambient temperatures of: charging: -5°C to 35°C, discharging: -5°C to 40°C.

Description	Value
Recommended external fuses	380 V: 3 x 50 A 400 V: 3 x 50 A 415 V: 3 x 50 A 440 V: 3 x 40 A 460 V: 3 x 40 A 480 V: 3 x 40 A ▪ For region EN / IEC – EN60127-1/EN60269-1: gG ▪ For region UL / CSA – UL248: Class J time-delay
Mains type	TN-S, TN-C-S, TN-C, 3-phase + N N conductor and PE conductor are not connected in the TruConvert AC 3025. N conductor and PE conductor must be connected outside of the TruConvert AC 3025.
Ground leakage current	< 3 mA (If residual current circuit breakers are used: use type B.)

Mains connection data Tab. 5

DC link

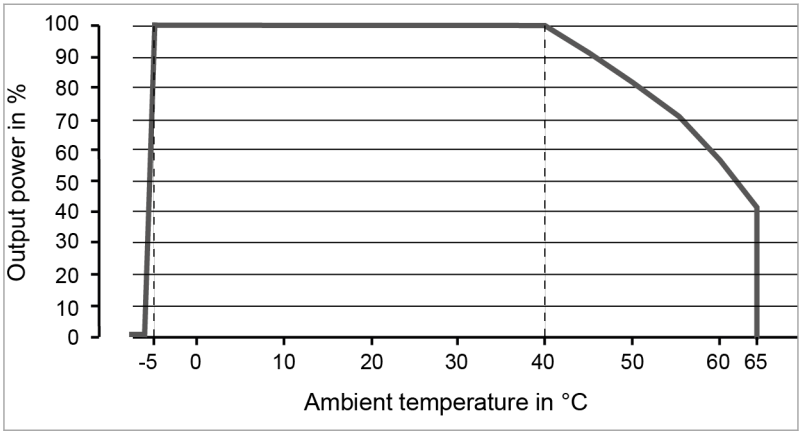
Description	Value
Nominal power charging/discharging (at 40°C / 104°F)	25 kW
Position to ground potential	The DC link is balanced to earth.
DC link nominal current at:	750 V: 36 A 800 V: 33 A 850 V: 31 A 900 V: 30 A 950 V: 28 A

Description	Value
Maximum output voltage	950 VDC, balanced to earth Deviations possible upon consultation with TRUMPF
Recommended external fuses	The DC fuses must be provided on-site by the customer. No DC fuses are required for installations with max. 4 TruConvert DC 1008. The parameters required for dimensioning the fuses depend on the installation situation in the customer system. The following system parameters form the basis for dimensioning: ▪ Internal resistances of the sources present in the DC link ▪ Capacitances present in the DC link ▪ Inductivities present in the DC link Taking into account aging and peak current effects yields the following dimensioning of the rated fuse current: $I_{Fuse} = I_{Rated}$ x 1.56 = 36 A x 1.56 = 56.16 A The permissible operating voltage of the fuse must be higher than the DC link voltage. Fuse ratings: $U_{Operation}$ = 1000 VDC I_{Rated} = 63 ADC Suitable model, e.g.: EATON Bussmann PV-63ANH1, size NH1 with suitable holders.

DC link Tab. 6

Derating operation

At ambient temperatures > 40 °C, the output apparent power is reduced.



Derating Fig. 9

Interfaces

Description	Connection
DC link	▪ DC Link – PCB plug connector, 3-pin
24 V supply voltage (DC)	▪ 24V – PCB plug connector, 2-pin
Mains power connection	▪ L1, L2, L3, N, PE – PCB plug connector, 5-pin
Measurement of mains voltage and contact for contactor release	▪ Contactor Mains Measurement – PCB plug connector, 10-pin Recommended external fuses ▪ Circuit breaker, 4-pin ▪ Current [I]: 1 A ▪ For region EN / IEC – Voltage [V]: 400 V – Rated switching capacity acc. to IEC/EN60947-2: 10 kA ▪ For region UL / CSA – Voltage [V]: 480Y/277 V – Rated switching capacity acc. to UL489: 10 kA
Data output master	▪ MASTER – RJ-45
Data output slave	▪ SLAVE OUT – RJ-45
Data input slave	▪ SLAVE IN – RJ-45

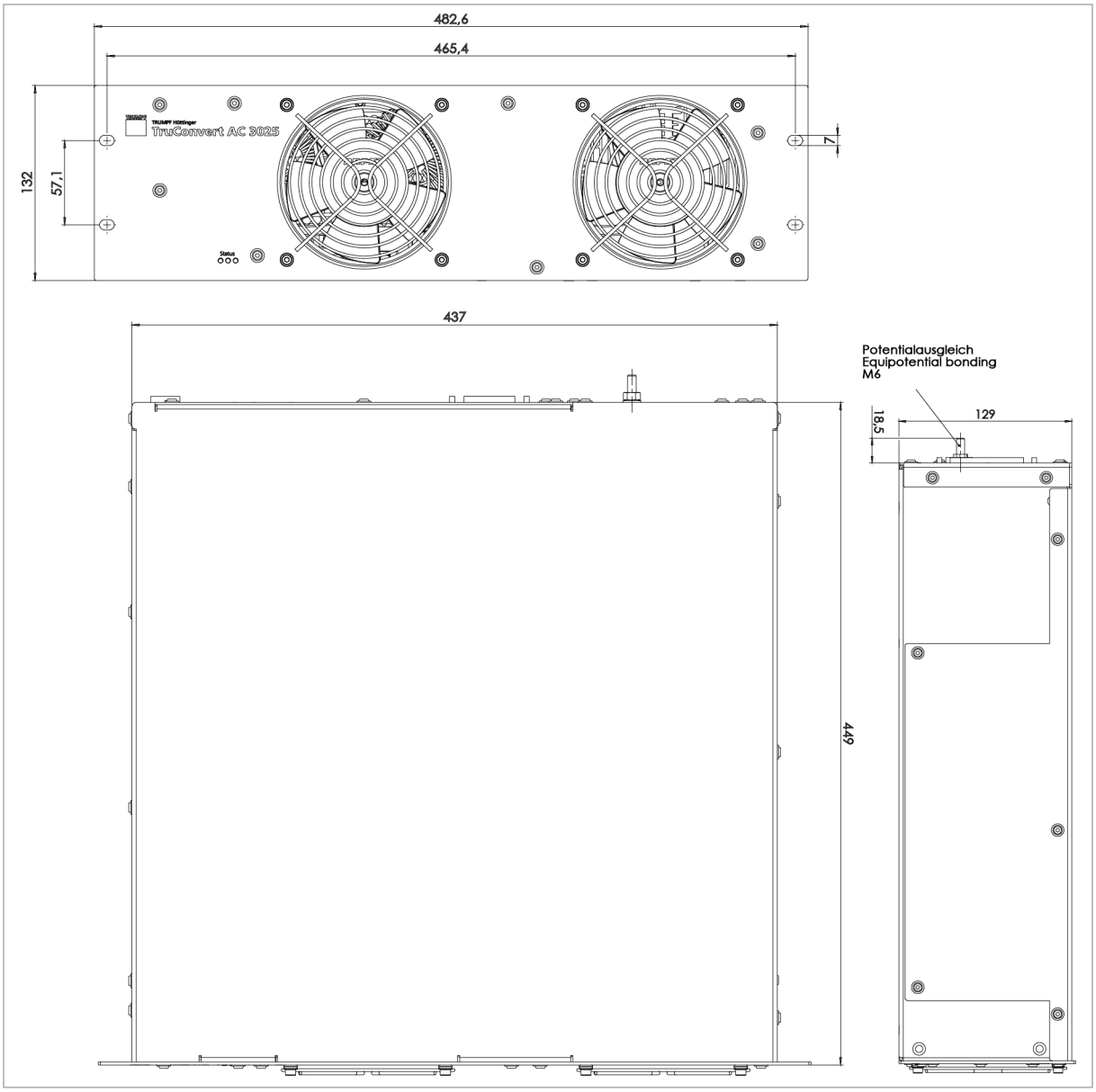
Interfaces Tab. 7

Housing

Description	Value
Dimensions W x H x D (without connection components)	437 mm x 129 mm x 500 mm
Dimensions of front panel W x H	482 mm x 132 mm
Weight	27 kg
Housing material	Galvanized sheet steel
Protection class	IP 20

Housing Tab. 8

Dimensional drawing



Dimensional drawing Fig. 10

Environmental conditions

Condition	Temperature	Humidity [2]	Air pressure	Contamination Micro-environment complies with IEC 62109-1
Rated operation	-5 °C to +40 °C +23 °F to +104 °F	5 … 90 %	Up to approx. 78 kPa (≙ 2000 m high above sea level)	Pollution degree 2
Limited power operation	+40 °C to +65 °C +104 °F to +149 °F			
Storage	-20 °C to +80 °C -4 °F to +176 °F	5 … 90 %		
Transport	-20 °C to +80 °C -4 °F to +176 °F	< 90 %		

Environmental conditions Tab. 9

3.2 TruConvert System Control data

Interfaces

Description	Value
24 V supply voltage, DC	24 V DC ± 10 % / 250 mA PCB plug connector, 2-pin
Ethernet interface 1	▪ Connection for web-based user interface or Modbus TCP/UDP ▪ RJ-45
RS-485 interface	▪ Connection for TruConvert AC 3025 or TruConvert DC1008 ▪ RJ-45
Reset button	Resetting the IP address
Display	3 status LEDs

TruConvert System Control interfaces Tab. 10

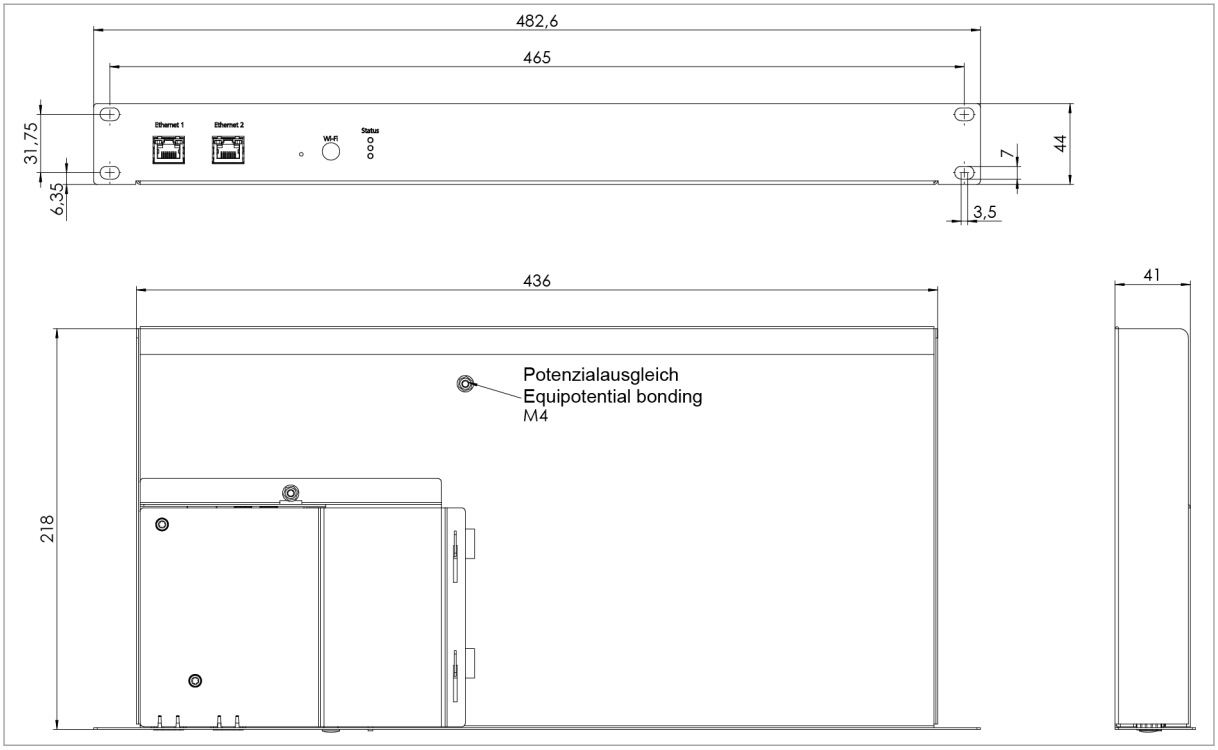
Housing

Description	Value
Dimensions W x H x D	Approx. 435 mm x 44.5 mm x 253 mm Approx. 17.13" x 1.75" x 10"
Dimensions of front panel	Approx. 482 mm x 44.5 mm Approx. 19" x 1.75"

Housing Tab. 11

2 No condensation or icing

Dimensional drawing



Dimensional drawing Fig. 11

Environmental conditions

Condition	Temperature	Humidity [3]	Air pressure	Contamination Micro-environment complies with IEC 62109-1
Operation	-5 °C to +65 °C 23 °F to +149 °C	5 … 90 %	Up to approx. 78 kPa (≙ 2000 m high above sea level)	Pollution degree 2
Storage	-20 °C to +80 °C -4 °F to +176 °F	5 … 90 %		
Transport	-20 °C to +80 °C -4 °F to +176 °F	< 90 %		

Environmental conditions Tab. 12

3 No condensation or icing

4. Interfaces

4.1 Mains power connection

View

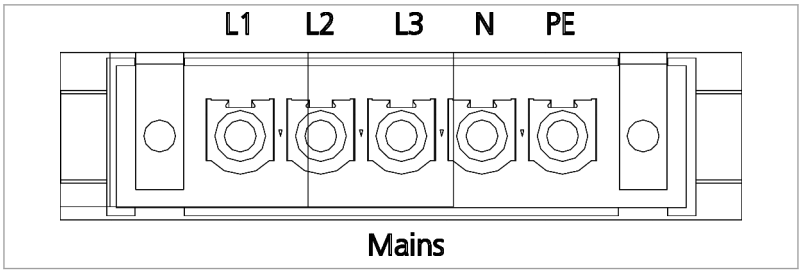


Fig. 12

Connection

- On AC 3025 module: Phoenix PCB plug connector
- Required counterpart: 5-pin connector, 76A, IPC 16/ 5-STF-10, 16

Cable requirement

	For region EN / IEC	For region UL / CSA
With 50 A external fuse	5 x 10 mm^2	5 x AWG 8
With 40 A external fuse	5 x 6 mm^2	5 x AWG 10

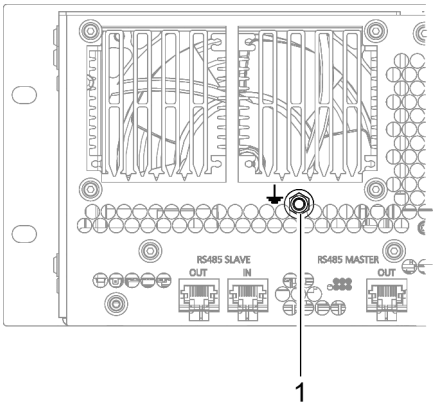
Cable requirement for mains connection Tab. 13

The information applies to:

- Ambient temperature 30 °C, 86 °F
- Cable operating temperature: 90 °C, 194 °F
- Installation type: Open air
- If the environmental conditions differ from those listed above, contact TRUMPF Service.

4.2 Potential equalization

View



1 Threaded bolts for potential equalization

Potential equalization Fig. 13

Connection

- M6 threaded bolt, torque: **5 Nm**

Cable requirement

- 1 x 4 mm^2 / 1 x AWG 10

4.3 DC link

View

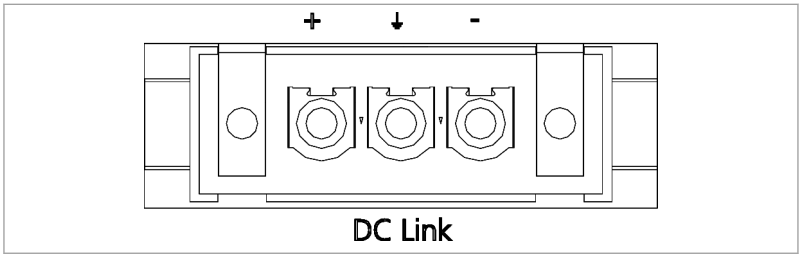
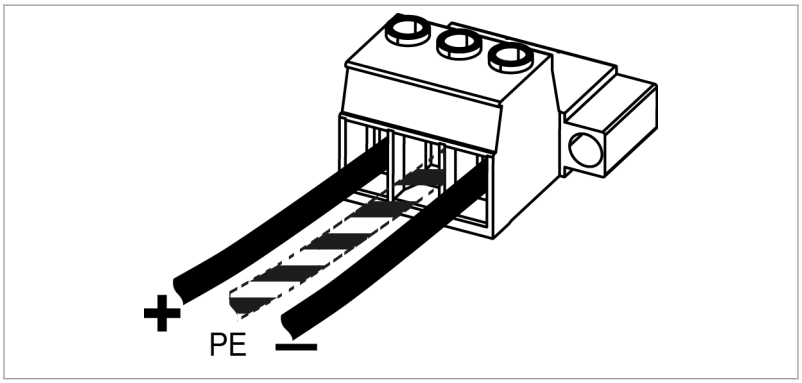


Fig. 14

Connection

- At the AC-DC module: Phoenix PCB plug connector
- Required counterpart: connector, 3pin, 76 A, IPC 16/ 3-STF-10.16



Connector for DC link voltage Fig. 15

Cable requirement

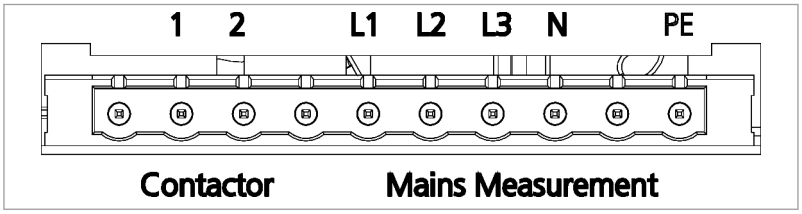
- For region EN / IEC: 3 x 6 mm²
- For region UL / CSA: 3 x AWG 10
- The information applies to:
  - Ambient temperature 30 °C, 86 °F
  - Cable operating temperature: 90 °C, 194 °F
  - Installation type: Open air
  - If the environmental conditions differ from those listed above, contact TRUMPF Service.

Note

To keep inductivity at a minimum cables should be twisted.

4.4 Contactor release contact and mains voltage measurement

View



Contactor release contact and mains voltage measurement ("Contactor / Mains Measurement") Fig. 16

Connection

- On AC 3025 module: Phoenix PCB plug connector
- Required counterpart: 10-pin connector, 16A, GMSTB 2.5 HCV/ 10-ST-7.62-LR

Cable requirement

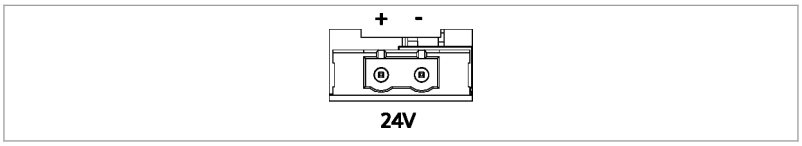
- 10 x 1.5 mm^2 / 10 x AWG 16

4.5 24 V supply voltage (DC)

Note

The negative terminal of the supply voltage is **not** connected to PE in the AC-DC module. Grounding must be performed by the customer, as close to the housing as possible.

View



24 V supply voltage (DC) Fig. 17

Connection

- At the AC-DC module: Phoenix PCB plug connector
- Required counterpart: 2-pin connector, 16A, GMSTB 2.5 HCV/ 2-ST-7.62-LR

Cable requirement

- 2 x 1.5 mm^2 / 2 x AWG 16

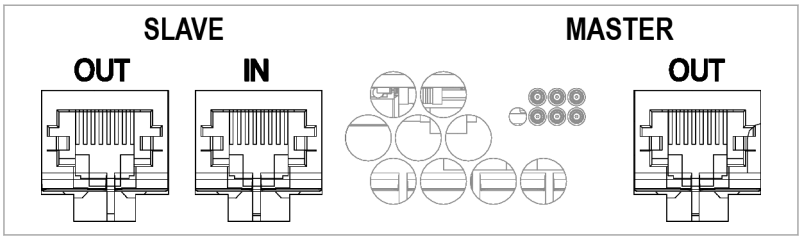
Use

The 24V supply voltage is necessary for supplying the following components of the AC-DC module:

- Control
- Fan
- Driver of power stages

4.6 Communication interfaces

View



Communication interfaces Fig. 18

Connection

- RJ-45

Cable requirement

- Twisted pair patch cable in accordance with standard TIA/ EIA-568A/B
- CAT 5 or higher
- Max. length: 30 m

Use The use of the communication interfaces is dependent on the configuration (see "Configurations", pg. 9).

Example Connect system control (RS-485 connection) to the AC-DC module (RS-485 SLAVE IN connection).

Connect the AC-DC module (RS-485 SLAVE OUT connection) to the supplied terminating resistor.

A DC-DC module (RS-485 IN connection) is connected from the AC-DC module (RS-485 MASTER connection).

If further DC-DC modules are operated, the RS-485 OUT connection of the preceding DC-DC module is connected to the RS-485 IN connection of the following DC-DC module.

Notes

- The total length of the data cable from the system control to the last DC-DC module via the AC-DC module must not exceed 30 m.
- If no further DC-DC module is connected to the DC-DC module, the RS-485 OUT connection must be terminated with a terminating resistor.

4.7 Interfaces on the system control

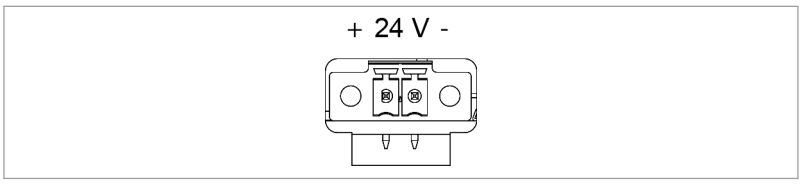
TruConvert System Control These interfaces are located on the system control TruConvert System Control.

24 V supply voltage (DC)

Note

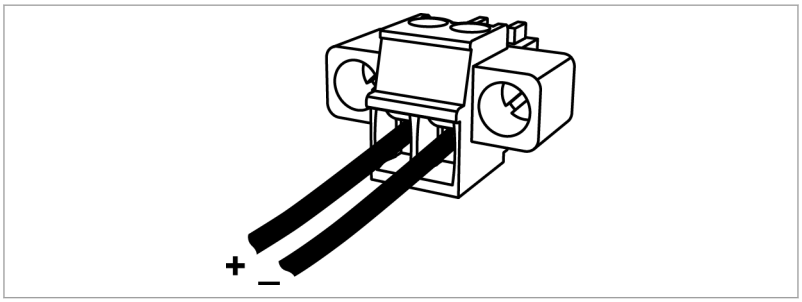
The negative terminal of the supply voltage is **not** connected to PE in the TruConvert System Control. Grounding must be performed by the customer, as close to the housing as possible.

View



24 V supply voltage (DC) Fig. 19

Connection



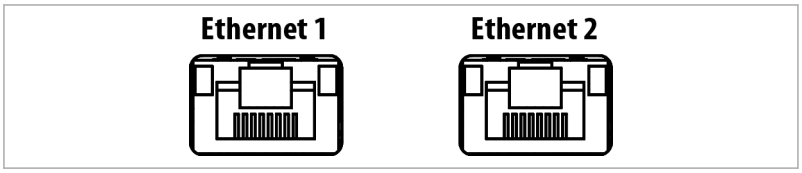
Connector for 24 V supply voltage (DC) Fig. 20

- On the device: Phoenix PCB plug connector
- Required counterpart: connector, 2-pin, 8A, CS 3.5 mm

Fuse External fuse protection must be provided by the customer.

Ethernet

View



Ethernet data connection Fig. 21

Connection

- RJ-45 male connector

Cable requirement

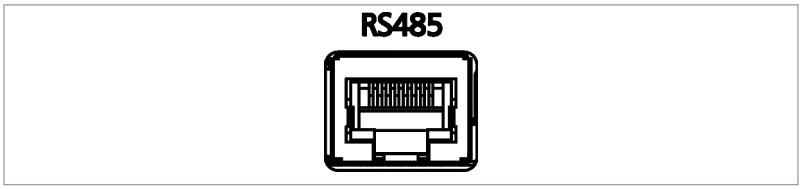
- Twisted pair patch cable in accordance with standard TIA/EIA-568A/B
- CAT 5 or higher
- Max. length: 30 m

Note

The total length of the data cable must not exceed 30 m from the PC to the last system control.

RS-485

View



RS-485 data connection Fig. 22

Connection

- RJ-45 male connector

Cable requirement

- Twisted pair patch cable in accordance with standard TIA/EIA-568A/B
- CAT 5 or higher
- Max. length: 30 m

5. Standards and directives

5.1 CE certification

EU directives:

- Low-voltage directive 2014/35/EU
- Electromagnetic compatibility directive 2014/30/EU

Standards taken into account:

- EN 62040-2: 2006/AC class C2
- EN 62109-1:2010
- UL 1741

5.2 EU declaration of conformity TruConvert AC 3025

TRUMPF

EU Declaration of Conformity

in accordance with
Low Voltage Directive 2014/35/EU
Directive relating to electromagnetic compatibility 2014/30/EU

We hereby declare that the following device complies with all the relevant requirements of the EU directives listed above.

Device:	TruConvert AC 3025
Serial number:	≥ 204298566
Applied harmonized standards, in particular:	EN 62109-1:2010, EN 62040-2:2006/AC Klasse C2
Party authorized to compile the technical file:	Benedikt Röser

Town / Date / Signature Freiburg im Breisgau, 11.12.2019

Benedikt Röser
Quality Director

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www.trumpf.com
TE172sc
V 2019 - 11

en

EU declaration of conformity TruConvert AC 3025 Fig. 23

6. Installation

6.1 Inspecting the delivery

1. Check the device immediately as soon as it is delivered for completeness in accordance with the delivery note and also for visible damages incurred during transport.
2. In order to retain the right of recourse, report any shipping damages immediately in writing to the forwarding agent, the insurance company and TRUMPF.

6.2 Disposing of packaging material

If you do not want to keep the packaging material for a subsequent transport:

➢ Dispose of all packaging materials in compliance with the relevant regional waste disposal regulations.

6.3 Transport

⚠ CAUTION

Risk of injury due to the weight of the AC-DC module

➢ Do not carry or lift the AC-DC module **alone**.

➢ Use suitable transport aid.

6.4 Storage conditions

If you do not install the device immediately following delivery:

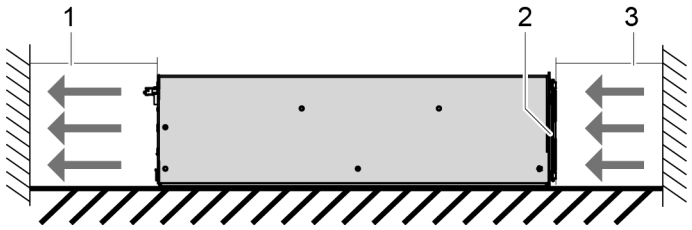
1. Store the device in original packaging.
2. Ensure that the specified environmental conditions are maintained.

6.5 Requirements for the site

Installation indoors Operation is permissible indoors only.

Air intake and air outlet

Sufficient space must be present for air intake and air outlet.



1 Minimum distance for air outlet: 300 mm
2 Fan
3 Minimum distance for air intake: 200 mm

Air circulation intervals Fig. 24

Maximum back pressure

Sufficient cooling of the module is only ensured if a sufficient air flow rate up to a maximum permissible back pressure is provided.

In addition, note that the air flow rate must be multiplied by the number of devices if several modules are operated.

Air short circuits and mutual interference of the modules must be prevented.

Number of modules	Air flow rate	Maximum back pressure in the air duct
1	400 m³/h	20 Pa
n	n x 400 m³/h	20 Pa

Maximum back pressure Tab. 14

Mains separation device

Access to the external mains separation device must not be obstructed by the device.

Fuses

Fuses must be provided on-site by the customer (see "Mains connection data", pg. 15).

6.6 Electrical connection

⚠ DANGER

Connection cables carry life-threatening voltage.

- Do not work under voltage.
- Before connecting, check mains cables to ensure that they are not electrically live.
- Before connecting, check DC link (DC Link) voltage cables to ensure that they are not electrically live.

⚠ DANGER

Danger of fire

- ➢ Observe the installation regulations of the installation site.
- ➢ Fuse the DC link connection (DC Link) with 40 ADC.

NOTICE

Failure to observe the torques can damage the AC-DC module.

- ➢ Note torques when screwing.

Establishing electrical connection

Condition

- Components to be provided by the customer are installed (see "Connection diagram", pg. 36).

Means, Tools, Materials

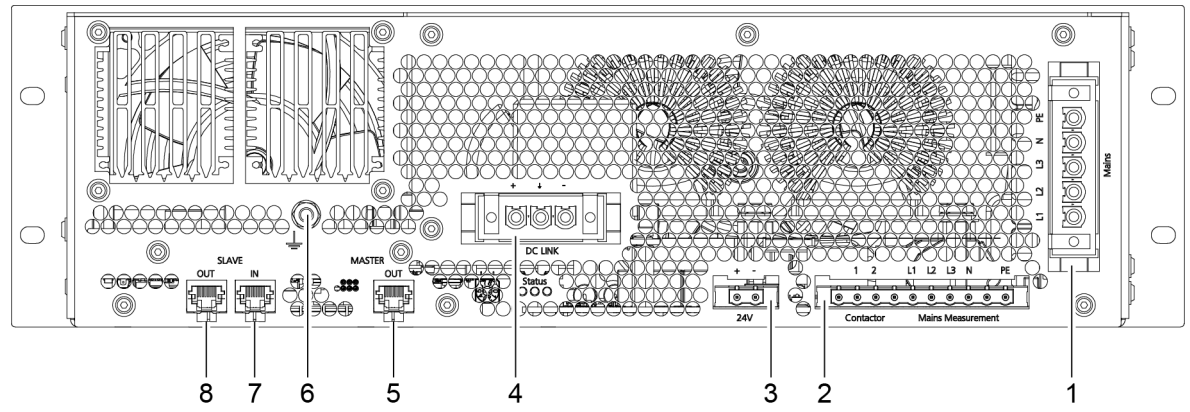
- Terminating resistor for the data output (provided).
- The following connectors are provided on request:
  - Connector "Mains", 5-pin
  - Connector "Contactor / Mains Measurement", 10-pin
  - Connector "DC Link", 3-pin
  - Connector "24V", 2-pin

Note

Observe regional requirements for the mains connection!

The regional requirements must be clarified at the customer's location with the mains operator before the device is connected and commissioned.

Connect mains supply



1 Mains input ("Mains")
2 Contactor release contact and mains voltage measurement ("Contactor / Mains Measurement")
3 24 V supply voltage
4 DC link voltage ("DC Link")
5 Data cable "MASTER OUT"
6 Threaded bolts for potential equalization
7 Data cable "SLAVE IN"
8 Data cable "SLAVE OUT"

Connection points Fig. 25

1. Attach the 5-pin connector to the 5-wire mains cable. Assignment (see "Mains power connection", pg. 22).
2. Plug male connector into "Mains" (1).

   Screw the connector securely to the flange using the two screws.

Connect mains synchronization and contactor release contact

3. Attach the 10-pin connector to the lines for the contactor release contact, mains voltage measurement and PE. Assignment (see "Contactor release contact and mains voltage measurement", pg. 24).
4. Plug male connector into "Contactor Mains Measurement" (2).

   Make sure that the automatic locking mechanism engages.

Connect 24 V supply voltage

5. Attach the 2-pin connector to the 24 V line. Assignment (see "24 V supply voltage (DC)", pg. 25).
6. Plug male connector into "24V" (3).

   Make sure that the automatic locking mechanism engages.
7. Switch on 24 V supply voltage on the AC-DC module.

Connecting DC link

⚠ DANGER

Connection cables carry life-threatening voltage.

- ➢ Do not work under voltage.
- ➢ Before connecting, check DC link voltage cables to ensure that they are not electrically live.

8. Attach the 3-pin connector to the DC link line and PE line. Assignment (see "DC link", pg. 23).
9. Plug male connector into "DC Link" (4).

   Screw the connector securely to the flange using the two screws.

Connecting protective earth to AC-DC module

10. Optionally, a potential equalization conductor can be screwed onto the potential equalization bolt (5). Max. torque: 5 Nm.

Connecting protective earth to system control

11. Screw protective earth on TruConvert System Control. Max. torque: 2 Nm.

Connecting data cable

12. Connect data connection "RS-485" of the TruConvert System Control with data input "SLAVE IN"(7) of the AC-DC module.
13. Either
    - ➢ Connect the terminating resistor to the "SLAVE OUT"(8) data output of the AC-DC module.

    or

    - ➢ Connect the "SLAVE OUT" data output (8) to the "SLAVE IN" data input (7) of the next AC-DC module.
14. Connect the data output "MASTER OUT" (5) of the AC-DC module to the data input of the DC-DC module.
15. Connect the TruConvert System Control to the master (Modbus master or PC with web browser)

Connecting 24 V supply voltage to system control

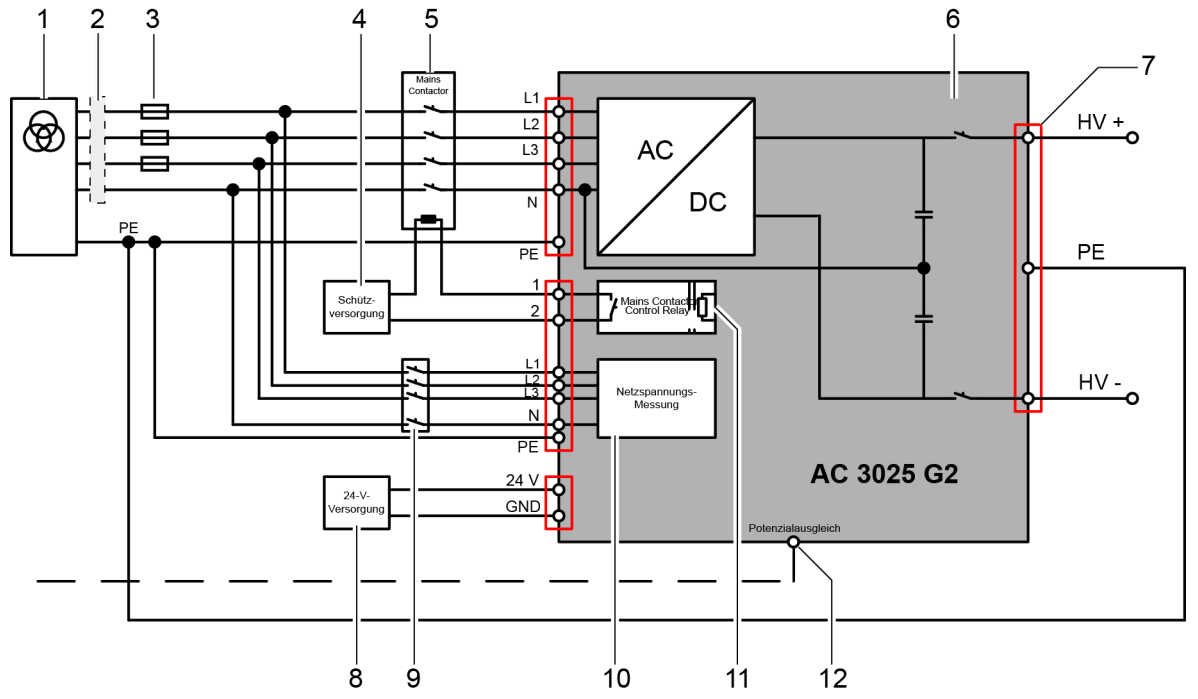
16. Connect and switch on 24 V supply voltage to TruConvert System Control.

    If the system control does not recognize the AC-DC module:

    - ➢ For the system control to detect the AC-DC module, first supply 24 V to the AC-DC module and then to the system control.
    - ➢ Alternatively, simultaneously apply the 24 V supply voltage to the system control and to the AC-DC module.

LED1 (green) flashes and shows that the AC-DC module is operational (see "Display elements", pg. 14).

Connection diagram



1	Mains	5	Mains contactor	9	Fuses for mains voltage measurement
2	Mains and system protection	6	AC-DC module	10	Mains voltage measurement
3	Fuses	7	DC link	11	Contact for contactor release
4	Contactor supply	8	24 V supply voltage (DC)	12	Potential equalization

Electrical connection Fig. 26

Customer area

The following components are not part of the AC-DC module, but must rather be provided by the customer:

- Mains and system protection
  (If residual current circuit breakers are used: use type B.)
- Fuses
- 24 V supply voltage (DC).
- Circuit breaker.
  - Dielectric strength corresponding to mains voltage: 400 / 480 V ±10%
    Current-carrying capacity: 64 A
    Operation mode: AC-3
    Device-internal switching contact to switch circuit breaker on and off: 24 – 60 VDC, 5 A // 85 –277 VAC, 5 A.
- Contactor for mains separation.
- Contactor supply (the 24 V supply voltage (DC) can be used for the contactor supply).

Note

Observe regional requirements for the mains connection!

The regional requirements must be clarified at the customer's location with the mains operator before the device is connected and commissioned.

6.7 Setting grid codes

Grid codes define rules that generation systems must obey in order to gain access to the mains grid. In particular, these rules regulate behavior in the event of mains fluctuations.

The mains operator determines the behavior of systems in the event of undervoltage, overvoltage and frequency deviation, and also defines the connect and disconnect conditions.

Conditions

- Initial commissioning was performed (see "Commissioning", pg. 46).
- AC-DC module is in idling condition ("Activate power stage" = 0).

NOTICE

Do not change grid codes!

➢ Set the grid codes **only** in consultation with the mains operator.

Open the "Grid code settings" tab to make entries

1. Select >*Operation* >*Grid code settings*.
2. In the "Grid code password and save settings" area, enter the password.

   The settings for the grid codes can now be made.

Enabling/disabling grid code functions

The grid codes are used in several functions. These functions can be enabled/disabled individually. The settings for the respective function are entered in the correspondingly named area.

3. In the "Grid code mode" area under "Activate grid code", select whether grid code is to be used globally:
   - 1 : enabled.
   - 0 : disabled.
4. In the "Grid code mode" area, select the individual functions to be used if grid code is enabled:
   - "Activate Q-mode"
   - "Activate ramp rate mode"
   - "Activate RT frequency mode"
   - "Activate RT voltage mode"

Presetting fixed power factor

The "Activate Q-mode" function is used to preset a constant power factor.

5. Select >*Operation* >*Device control AC-DC*.
6. Enter the desired value under "Power factor (CosPhi)".
7. Select >*Operation* >*Grid code settings*.
8. Under "Activate QMode", enable/disable the function:
   - Enabled: 2
   - Disabled: 0 / "Reactive power mode": 1

   As soon as power output has been enabled at the AC-DC module ("Activate power stage" = 1), the entered power factor is adopted and can no longer be changed during operation.

   Only the sign (+/-) of the power factor can be changed during operation. If a different value with the same sign is entered, the entry is ignored. If a different value with a different sign is entered, only the sign is changed.

Switching on "Reactive power mode"

This function enables reactive power to be drawn from the mains or fed into the mains.

Requirement:

- The mains voltage is ≤ 268.7 V (97 % U_{nom}) or ≥ 285.3 V (103 % U_{nom}).

  U_{nom}: Nominal mains voltage.

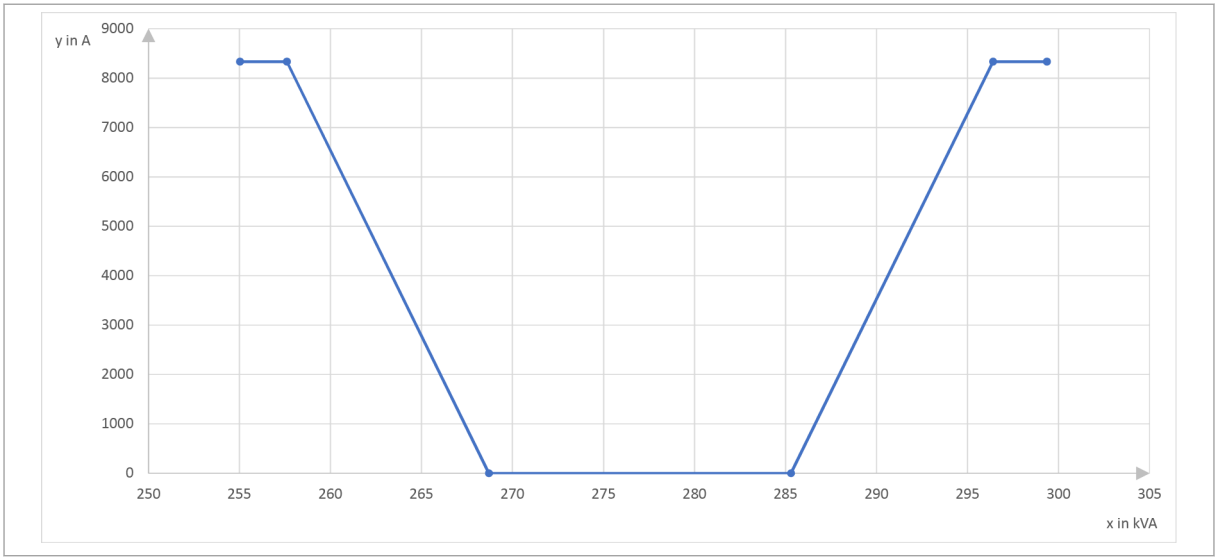
Function:

- The values for reactive power as a function of output voltage (U_{rms}) are fixed. They correspond to the curve (see "Fig. 27", pg. 39).
- The maximum reactive power (Q_{max} = 25 kVA) is reached at 107 % U_{nom} and 93 % U_{nom}.
- If the function is active, the user cannot change the output apparent power, power factor or phase position (inductive/capacitive).

9. Under "Activate QMode", enable/disable the function:
   - Enabled: 1
   - Disabled: 0 / "Fixed power factor": 2

Current/reactive power characteristic curve:
x-axis: reactive power per phase as a function of nominal mains

voltage
y-axis: current per phase



Current/reactive power characteristic curve for ranges in which reactive power compensation occurs. Fig. 27

If the mains voltage is higher than 103 % U_{nom}, the phase is set to inductive.

If the mains voltage is lower than 97 % U_{nom}, the phase is set to capacitive.

In order to achieve the desired reactive power, the power factor is first reduced to 0 and then the output apparent power is increased.

Activating / deactivating ramp

With this function, the output apparent power can be increased with a preset slope to the set value.

Requirement:

- The mains voltage is in the range from 271.46 V (98 % U_{nom}) to 282.54 V (102 % U_{nom}).
- The power factor is ≥ 0.
- The entered set value is greater than the actual value.
  (If the set value is small, the change is adopted immediately.)

10. Im Bereich "Grid code mode" under "Activate ramp rate mode", enable/disable the power-on ramp:
    - Enabled: 1
    - Disabled: 0
11. Under "Ramp rate slope", specify the slope in kVA/s:
    - Minimum slope: 0.1 kVA/s
    - Maximum slope: 833 kVA/s

Ride-through in the case of frequency fluctuations: setting values

The "RT frequency mode" function controls the behavior of the AC-DC module in the event of frequency fluctuations on the

mains grid. The AC-DC module remains connected to the mains for a preset period of time and then disconnects from the mains.

In order to support the mains frequency, 5 operating ranges are defined:

- Underfrequency: 2 ranges
- Nominal frequency: 1 range
- Overfrequency: 2 ranges

If the mains frequency is in the nominal frequency range, the AC-DC module behaves normally.

If the mains frequency is in one of the underfrequency or over-frequency ranges, some entries made by the user will be ignored because the mains-supporting measures have priority.

A time period can be defined for each underfrequency and over-frequency range.

For each range, it is additionally possible to specify which mode the AC-DC module is to remain in while connected to the mains:

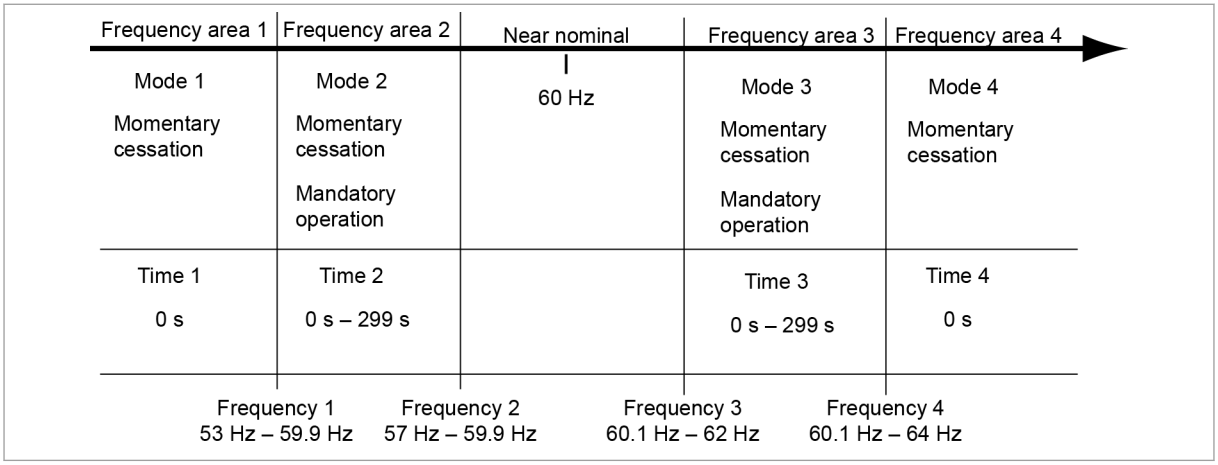
- "Mandatory operation"

  The AC-DC module attempts to maintain the output apparent power.
- "Momentary cessation"

  The AC-DC module reduces the output apparent power to 0.

In both modes, the AC-DC module attempts to maintain the power factor and phase position (inductive/capacitive). If one of the modes is active, these values cannot be changed.

All 3 phases are considered separately.



Possible frequency ranges and the corresponding parameters Fig. 28

12. In the "RT frequency settings" area under "Frequency 1 [Hz]" to "Frequency 5 [Hz]", enter the frequency values to define the frequency ranges.

The frequency values must increase from "Frequency 1" to "Frequency 5": "Frequency 1" < "Frequency 2" < "Frequency 3" < "Frequency 4" < "Frequency 5".

13. Under "Mode 1" to "Mode 5", select the mode:
    - "Mandatory operation"
    - "Momentary cessation"
14. Under "Time 1" and so on, specify the time period in seconds.
15. In the "Grid code mode" area under "Activate RT frequency mode", activate/deactivate the "RT frequency mode" function:
    - 1 : enabled.
    - 0 : disabled.

    The value applied in the system is then displayed to the right next to the input field.

Ride-through in the case of mains drops: setting values

The "RT voltage mode" function controls the behavior of the AC-DC module in the event of undervoltage and overvoltage on the mains grid. The AC-DC module remains connected to the mains for a preset period of time and then disconnects from the mains. The alarm message is displayed: "Grid code ride through time exceeded".

In order to support the mains grid, 6 operating ranges are defined:

- Undervoltage: 3 ranges
- Nominal voltage: 1 range
- Overvoltage: 2 ranges

If the mains voltage is in the nominal voltage range, the AC-DC module behaves normally.

If the mains voltage is in one of the undervoltage or overvoltage ranges, some entries made by the user will be ignored because the mains-supporting measures have priority.

A time period can be defined for each undervoltage and overvoltage range.

For each range, it is additionally possible to specify which mode the AC-DC module is to remain in while connected to the mains:

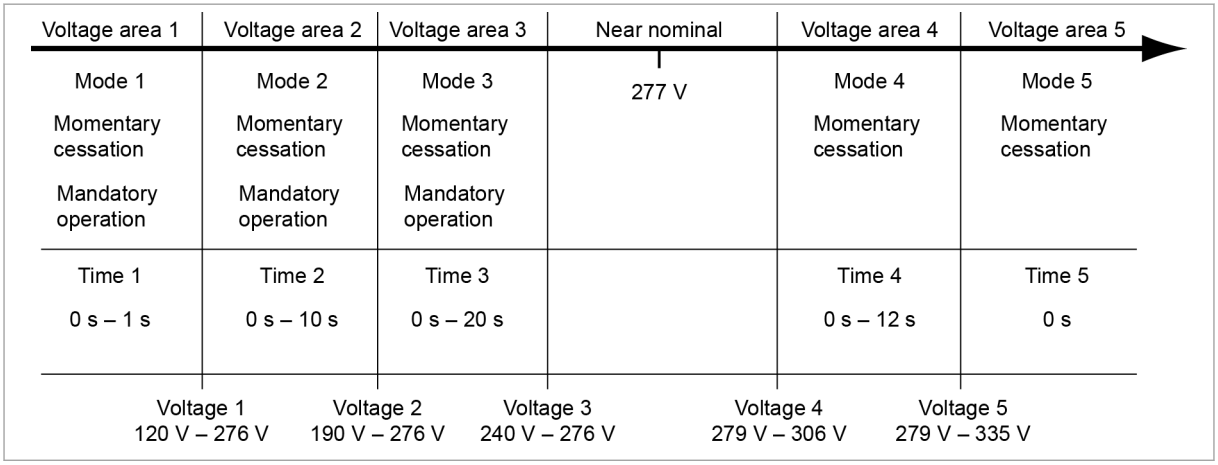
- "Mandatory operation"

  The AC-DC module attempts to maintain the output apparent power.
- "Momentary cessation"

  The AC-DC module reduces the output apparent power to 0.

In both modes, the AC-DC module attempts to maintain the power factor and phase position (inductive/capacitive). If one of the modes is active, these values cannot be changed.

All 3 phases are considered separately.



Possible voltage ranges and the corresponding parameters Fig. 29

Requirement:

- The output voltage is ≥ 15 % U_{nom}.
- With an output voltage below 15 % U_{nom}, the AC-DC module disconnects from the mains.

16. In the "RTV settings" area under "Voltage 1 [V]" to "Voltage 5 [V]", enter the voltage values to define the undervoltage and overvoltage ranges.

    The voltage values must increase from "Voltage 1" to "Voltage 5": "Voltage 1" < "Voltage 2"< "Voltage 3" < "Voltage 4" < "Voltage 5".

17. Under "Mode 1" to "Mode 5", select the mode:
    - "Mandatory operation"
    - "Momentary cessation"

    If the system is in one of the undervoltage ranges and the "Mandatory operation" mode is selected, the output apparent power is not constant. The output apparent power is reduced relative to the mains voltage so that the current is maintained at a constant level.

18. Under "Time 1" and so on, specify the time period in seconds.
19. In the "Grid code mode" area under "Activate RT voltage mode", activate/deactivate the "RT voltage mode" function:
    - 1 : enabled.
    - 0 : disabled.

    The value applied in the system is then displayed to the right next to the input field.

Setting switch-on/switch-off conditions

The mains voltage and mains frequency must move within a defined range for a certain period of time; only then can the AC-DC module be connected. An appropriate alarm message is displayed ("Grid does not match grid code requirements.").

If the "RT frequency mode" function or the "RT voltage mode" function is used, this function is enabled automatically. The limit

values for connecting the AC-DC module to the mains must be entered.

Parameter	Default value	Area
Voltage, min.	263.15 V	250 V / 276 V
Voltage, max.	290.85 V	278 V / 300 V
Frequency, min.	59.3 Hz	58 Hz / 59.9 Hz
Frequency, max.	60.5 Hz	60.1 Hz / 61 Hz
Time	10 s	0 s - 300 s

Possible parameter values Tab. 15

20. In the "Switch on/off settings" area under "Voltage min [V]" and "Voltage max [V]": Enter the minimum and maximum value for the mains voltage.
21. Under "Frequency min [Hz]" and "Frequency max [Hz]": Enter the minimum and maximum value for the mains frequency.
22. Under "Time [s]": Enter the time period.

Detecting isolated operation (anti-island detection)

If inadvertent isolated operation is detected, the AC-DC module is switched off within 2 s.

This function is always switched on if "Mains-connected system" is selected.

23. Select *>Operation >AC-DC module settings*.
24. Under "Grid voltage", enter the mains voltage and mains frequency as well as the operating mode:
    - 400 V / 50 Hz, 480 V / 60 Hz, ...
    - Mains-connected or isolated operation

Adopting grid code settings in system

25. Select *>Operation >Grid code settings*.
26. In the "Grid code password and save settings" area, press "Save grid code settings" to save the entries and to adopt them in the system control.

    The values adopted in the system are displayed on the right next to the input fields.

    This completes entry of the grid code data; you are logged out automatically. If further changes need to be made to the grid codes, please log in again.

6.8 Dismantling

⚠ WARNING

Connection cables carry life threatening voltage!

- ➢ Open the external mains separation device between mains and the power connection of the device.
- ➢ De-energize the cable between mains and the mains synchronization connection.
- ➢ De-energize the connection cables to the DC link voltage.
- ➢ Maintain discharging time: at least 5 min.

Removing residual voltages

1. Open external mains separation device.
2. De-energize the connection cables to the DC link voltage.
3. De-energize the connection cables to the 24 V supply voltage.

⚠ WARNING

Dangerous residual voltage

- ➢ Maintain discharging time: at least 5 min.

4. Check mains cable and DC link-voltage cable to ensure that they are not electrically live.

Unscrew or unplug cables

5. At power connection "Mains":
   - Undo the 2 screws on the flange.
   - Disconnect mains cable.
6. At DC link connection:
   - Undo the 2 screws on the flange.
   - Disconnect the DC link cable.
7. At connection for contactor release contact and mains voltage measurement "Contactor / Mains Measurement":
   - Release the automatic locking mechanism.
   - Disconnect the cable for mains voltage measurement / release contact.
8. 24 V supply voltage:
   - Release the automatic locking mechanism.
   - Disconnect the 24 V supply cable.
9. Disconnect data cable.
10. Unscrew and remove the equipotential bonding conductor if necessary.

6.9 Shipping the module

- Use packaging material which can withstand transport stresses to ship the module.

  If the original packaging is no longer available:
  Suitable packaging material can be purchased from TRUMPF.

6.10 Disposing of the module

- Observe the local regulations when disposing of the module.

7. Operation

7.1 Commissioning

Performing initial commissioning

Conditions

- PC on which one of the following browsers is installed:
  - Microsoft Internet Explorer from version 11.
  - Microsoft Edge.
  - Google Chrome from version 46.
  - Firefox from version 40.
- Ethernet cable for connecting PC and TruConvert System Control.

The initial commissioning of the device is only possible via the web-based user interface.

Establishing and testing the connection

1. Set the same IP Subnet Mask on the PC as on the TruConvert System Control.

   IP Subnet Mask of the TruConvert System Control on delivery: 255.255.255.0
2. Set the same address range on the PC as on the TruConvert System Control:
   192.168.1.-
3. On the PC, set the last block of the IP address.

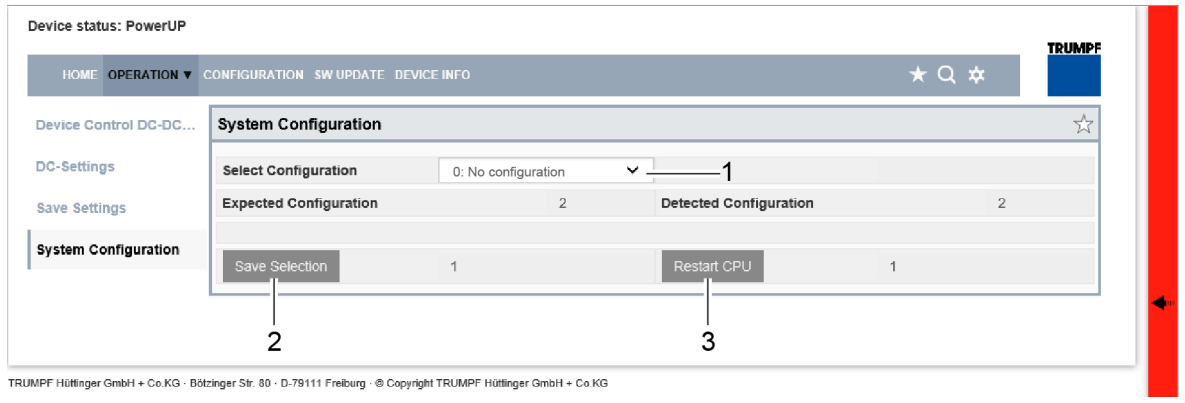
   Do not set the same address as on the TruConvert System Control!

   IP address of the TruConvert System Control on delivery: 192.168.1.2

   Do not set 0!
4. Connect PC and TruConvert System Control with Ethernet cable.
5. To switch on the system control and the AC-DC module: switch on the 24 V supply voltage.

   All 3 status LEDs flash to display the "Initialization" state.
6. Open the web browser on the PC.
7. Enter IP address of the TruConvert System Control in the address line.

   IP address of the TruConvert System Control on delivery: 192.168.1.2



1 System configuration 2 Save settings 3 Restart system control

Initial commissioning display Fig. 30

The browser displays the user interface of the TruConvert System Control and the connected modules.

Several system controls are used in one system?

➢ Connect one system control after another to the PC and change the default IP address to a unique IP address.

Set configuration

8. Select >*Operation* >*System Configuration*.
9. In "Select Configuration", select the present system configuration:
   - 0: No configuration

     This configuration only occurs in the event of an error, e.g., if there is no connection to the modules (check cables) or if an incorrect module type was detected (check alarm messages).
   - 1: Simulator

     The system control alone is used and connected modules are simulated.
   - 2: DC-DC only

     Only DC-DC modules are connected to the system control.
   - 3: n (AC-DC + m DC-DC)

     AC/DC and DC/DC modules are connected to the system control.
10. To save the selection: press "Save Selection".
11. To restart the TruConvert System Control: press "Restart CPU".

1 Display of the current device status
2 Main operating parameters (start page)
3 Device configuration (time and network settings)
4 Software update
5 Device identification (display only)
6 Submenu
7 Sidebar (alarm, warning and event messages)

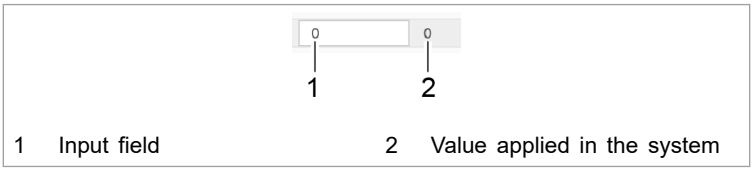
Start screen Fig. 31

The system control balances the set system configuration with the actually connected modules. If both values match, the start screen of the web-based user interface is displayed.

If the set system configuration ("Expected Configuration") differs from the automatically detected system configuration ("Detected Configuration"), the initial commissioning screen is displayed again and a message output. Press sidebar (7) to display the messages.

Setting process set values (AC settings)

12. Select >*Operation* >*AC-DC module settings*.
13. Every input in the following steps must be confirmed with the enter key ↵.



1 Input field 2 Value applied in the system

Confirm input Fig. 32

The value applied in the system is then displayed to the right next to the input field.

14. To ensure that the settings apply to all AC-DC modules:

- User interface:

  For "Slave module selection" enter "0".
- Modbus:

  Enter the number of the slave to be addressed = "0" .

15. Under "Grid voltage", enter the mains voltage and mains frequency as well as the operating mode:
    - 400 V / 50 Hz, 480 V / 60 Hz, ...
    - Mains-connected or isolated operation
16. In the "Power factor convention", select operation mode:
    - "Producer": producer reference arrow system.

      Positive sign for cosφ means: energy flows from DC link towards mains.

      Negative sign for cosφ means: energy flows from mains towards DC link.
    - "Consumer": consumer reference arrow system.

      Positive sign for cosφ means: energy flows from mains towards DC link.

      Negative sign for cosφ means: energy flows from DC link towards mains.
17. Under "Grid contactor delay", enter the maximum delay time in ms that may elapse between the "Close contactor" command and the actual closing of the contactor.

    If there is no feedback within the delay time, an alarm is output.

Start transmission of power

18. Check the device status in the upper left corner of the user interface:
    - "Device status: Idle": Idle: The device is ready for use.
    - "Device status: Error, Power Up": Error: The device is not ready for use. An alarm message is pending (see "Displaying and resetting messages", pg. 61).

    or

    ➢ Check status LED 1 on the AC-DC module and system control:
    - LED flashes green: The device is ready for use.
    - LED flashes red: The device is not ready for use. An alarm message is pending (see "Displaying and resetting messages", pg. 61).
19. Select *>Operation >Device control AC-DC*.
20. In the "Device control AC-DC" area, enter in "Power factor (CosPhi)":
    - Value between: -1 to +1 (in increments of 0.01)
    - Note the selected reference arrow system and set the sign accordingly.
21. Under "DC link precharge config", set from which side the DC link voltage is to be precharged:

- 0 = DC link voltage is not loaded from the AC-DC module.
- 1 = DC link voltage is loaded from the AC-DC module.

22. To start the transmission of power:
    - For "Activate power stage [bit]", enter = "1".
    - Press key ↵.

    The status changes from "Idle" to "Operation".

    The status LEDs on the AC-DC module and system control light up orange. The contactor connects the mains.

Stop transmission of power

23. To stop the transmission of power:
    - For "Activate power stage [bit]", enter = "0".
    - Press key ↵.

    The status changes from "Operation" to "Idle".

    The status LEDs on the AC-DC module and system control light up green. The contactor disconnects the mains.

The initial commissioning is completed.

The device can now continue to be operated via the web-based user interface or via Modbus.

Tip

The Modbus register provides an overview of the set default values (see "Modbus Register Map", pg. 54).

7.2 Operation via web-based user interface

Calling up the web-based user interface

Condition

- Initial commissioning was performed (see "Commissioning", pg. 46).

1. To switch on the TruConvert System Control and the connected modules: switch on the 24 V supply voltage.
2. Open the web browser on the PC.
3. Enter IP address of the TruConvert System Control in the address line.

   IP address of the TruConvert System Control on delivery: 192.168.1.2

1 Display of the current device status
2 Main operating parameters (start page)
3 Device configuration (time and network settings)
4 Software update
5 Device identification (display only)
6 Submenu
7 Sidebar (alarm, warning and event messages)

Start screen Fig. 33

The browser displays the user interface of the TruConvert System Control and the connected modules.

4. Every value entered in the user interface must be confirmed with enter key ↵.

1 Input field 2 Value applied in the system

Confirm input Fig. 34

The value applied in the system is then displayed to the right next to the input field.

Menu structure

Main menu	Submenu	Description
>HOME	—	Start screen (see "Calling up the web-based user interface", pg. 50)
>OPERATION	*>Device control AC-DC*	(see "User interface: displaying and resetting messages", pg. 61)
	>AC-DC module settings	(see "Setting process set values (AC settings)", pg. 48)
	>DC-DC module settings	Menu item only present if the DC-DC modules are also connected to the AC-DC module. See "TruConvert DC 1008" operating instructions.
	>Save settings	(see "Saving data", pg. 67)
	>System configuration	(see "Setting the system configuration", pg. 68)
>CONFIGURATION	—	Base settings for the TruConvert System Control: (see "Setting the system time", pg. 70) (see "Changing network settings", pg. 70)
>SOFTWARE UPDATE	—	(see "Perform software update", pg. 71)
>DEVICE INFO	—	Information on device identification

Menu structure of the web-based user interface Tab. 16

7.3 Operation via Modbus

Protocol: TCP/UDP.

Differences for Modbus – user interface

Note

Operation via Modbus is the standard method of operation for regular operation.

Configuration, initial commissioning and software update of the TruConvert System Control and the connected modules can be performed via the user interface.

Function	User interface	Modbus
Operation	x	x
System configuration	x	x
Software update	x	—
Changing the IP address	x	—
Data backup	x	—

Differences in operation Tab. 17

Establishing a connection

Condition

- Initial commissioning was performed (see "Commissioning", pg. 46).

1. Connect the TruConvert System Control to the Modbus master with an Ethernet cable.
2. To switch on the system control and the modules: switch on the 24 V supply voltage.

The PCS (Power Conversion System) is ready for communication via Modbus.

Addressing modules directly in Modbus register

Within a configuration consisting of the system control, multiple AC-DC modules and multiple DC-DC modules, it is possible to address a specific module directly in the Modbus register. To do so, the address of the module must be specified in the "Slave-ID" field of the Modbus register.

Structure of the module address ("Slave-ID"):

- The slave ID has max. 3 digits (0 to 169).
- Slave ID = 1 to 16: The command is transmitted to the explicitly named slave (AC-DC module).
- Slave ID = 0: The command is transmitted to all connected slaves.
- Accesses to a slave register with slave IDs > 16 are ignored.
- Addressing of subslaves (DC-DC modules):
  - Slave ID = (slave number x 10) + subslave number: The command is transmitted to the explicitly named subslave.
  - Slave ID = 0: The command is transmitted to all connected subslaves.
  - Accesses to a subslave register with slave IDs < 10 or > 169 are ignored.

"Slave-ID"	Register for	Slave no.	Sub slave no.	Description
3	Slave	3	–	To slave 3.
0	Slave	0	–	To all slaves.
14	Subslave	1	4	To subslave 4 from slave 1.

"Slave-ID"	Register for	Slave no.	Sub slave no.	Description
164	Subslave	16	4	To subslave 4 from slave 16.
10	Subslave	1	0	To all subslaves from slave 1
160	Subslave	16	0	To all subslaves from slave 16
0	Subslave	0	0	To all subslaves.

Examples: Structure of slave ID Tab. 18

Modbus Register Map

- Base settings: address range 1000 to 1999
- Info system: address range 2000 to 2399
- Alarm and warning messages: address range 2400 to 3999
- Process set values: address range 4000 to 4999
- Process actual values: address range 5000 to 5999

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
Settings											
1000	Date	dd.mm.yyyy					UINT32	Register	2	03	16
1002	Time	hh:mm:ss					UINT32	Register	2	03	16
1004	IP address	xxx.xxx.xxx.xxx		0xC0A80102	1	0xFFFFFFFF	UINT32	Register	2	04	
1006	Subnet	xxx.xxx.xxx.xxx		0xFFFFFF00	1	0xFFFFFFFF	UINT32	Register	2	04	
1008	Gateway	xxx.xxx.xxx.xxx		0xC0A80101	1	0xFFFFFFFF	UINT32	Register	2	04	
1010	Reset parameters to factory settings	-	1.0	0	0	1	UINT16	Coil	1	01	05
1016	BMS communication timeout	s	1.0	10	1		UINT16	Register	1	03	06
1017	Setting this flag will restart the CPU (only in idle or error state)	-	1.0	0	0	1	UINT16	Coil	1	01	05

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
1018	Setting for connected system configuration: No config = 0, Simulator = 1, DC-DC only = 2, n*AC-DC m*DC-DC = 3	-	1.0	0	0	6	UINT16	Register	1	03	06
1028	Variable to save or reset customer values: 1: save parameter -1: restore default settings	-	1.0	0	-1	1	INT16	Register	1	03	06
Information system											
2000	Serial number system control	String					UINT32	Register	2	04	16
2008	Serial number AC-DC module	-	1.0		0		UINT32	Register	2	03	16
Nominal values											
4000	Power stage configuration: 1 = power stage on 0 = power stage off	-	1.0	0	0	1	UINT16	Coil	1	01	05
4001	Configuration nominal values AC for phases L1 - L3: 1 = symmetric 0 = asymmetric (individual configuration possible)	-	1.0	1	0	1	UINT16	Coil	1	01	05
4002	Resets current alarm and warning messages	-	1.0	0	0	1	UINT16	Coil	1	01	05
4005	Precharge DC link configuration: 0 = device waits for external precharge of DC link 1 = device precharges external DC link to necessary start-up voltage 2 = behaviour similar to 1 with additional support of DC submodules (necessary for island operation)	-	1.0	1	0	2	UINT16	Register	1	03	06
4006	Sets reference frame convention (0 = producer reference frame; 1 = consumer reference frame)	-	1.0	0	0	1	UINT16	Register	1	03	06
4007	Specifies the slave that will be addressed (0 = broadcast / same values for all slaves)	-	1.0	0	0	16	UINT16	Register	1	03	06

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
4008	Error handling policy for systems with multiple slaves: 0 = relaxed (System keeps running even if some slaves are in error state.); 1 = strict (System shuts down as soon as one component is in error state.)	-	1.0	0			UINT16	Register	1	03	06
4009	Grid type: 0 = grid-tied, 400V, 50Hz 1 = grid-tied, 480V, 60Hz 2 = island mode, 400V, 50Hz 3 = island mode, 480V, 60Hz 4 = grid-tied, 380V, 60Hz	-	1.0	0	0	1	UINT16	Register	1	03	06
4010	Specifies the subslave that will be addressed (0 = broadcast / same values for all subslaves)	-	1.0	0	0	16	UINT16	Register	1	03	06
4011	Use the modbus slave ID for addressing	-	1.0	0	0	1	UINT16	Coil	1	01	05
4012	Error policy for subslaves, 0 = strict (AC-DC module switches to error state if at least one submodule is in error state) 1 = relaxed (AC-DC module switches to error state if all sub modules are in error state) 2 = off (if possible AC-DC module continues onperation even if all sub modules are in error state)	cnt	1.0	0	0	2	UINT16	Register	1	03	05
4195	Signed power nominal value AC (sign influences cos phi)	kVA	0.001	0	-32000	32000	INT16	Register	1	03	06
4196	Signed power nominal value AC L1 (sign influences cos phi)	kVA	0.001	0	-12500	12500	INT16	Register	1	03	06
4197	Signed power nominal value AC L2 (sign influences cos phi)	kVA	0.001	0	-12500	12500	INT16	Register	1	03	06
4198	Signed power nominal value AC L3 (sign influences cos phi)	kVA	0.001	0	-12500	12500	INT16	Register	1	03	06
4199	Power nominal value AC	kVA	0.001	0	0	37500	UINT16	Register	1	03	06

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
4200	Power nominal value AC L1	kVA	0.001	0	0	12500	UINT16	Register	1	03	06
4201	Power nominal value AC L2	kVA	0.001	0	0	12500	UINT16	Register	1	03	06
4202	Power nominal value AC L3	kVA	0.001	0	0	12500	UINT16	Register	1	03	06
4203	Maximum grid current RMS L1 (charging and discharging)	A	0.01	8000	0	8000	UINT16	Register	1	03	06
4204	Maximum grid current RMS L2 (charging and discharging)	A	0.01	8000	0	8000	UINT16	Register	1	03	06
4205	Maximum grid current RMS L3 (charging and discharging)	A	0.01	8000	0	8000	UINT16	Register	1	03	06
4206	nominal value cos phi L1	-	0.01	100	-100	100	INT16	Register	1	03	06
4207	nominal value cos phi L2	-	0.01	100	-100	100	INT16	Register	1	03	06
4208	nominal value cos phi L3	-	0.01	100	-100	100	INT16	Register	1	03	06
4213	Phase L1 inductive/capacitive (TRUE = inductive)	-	1.0	1	0	1	UINT16	Coil	1	01	05
4214	Phase L2 inductive/capacitive (TRUE = inductive)	-	1.0	1	0	1	UINT16	Coil	1	01	05
4215	Phase L3 inductive/capacitive (TRUE = inductive)	-	1.0	1	0	1	UINT16	Coil	1	01	05
4216	Phases are inductive/capacitive (TRUE = inductive)	-	1.0	1	0	1	UINT16	Coil	1	01	05
4217	Nominal value cos phi for L1-L3	-	0.01	100	-100	100	INT16	Register	1	03	06
4218	Nominal value sin phi L1-L3	-	0.01	0	-100	100	INT16	Register	1	03	06
4219	Nominal value sin phi L1	-	0.01	0	-100	100	INT16	Register	1	03	06
4220	nominal value sin phi L2	-	0.01	0	-100	100	INT16	Register	1	03	06
4221	Nominal value sin phi L3	-	0.01	0	-100	100	INT16	Register	1	03	06
4300	Configuration DC stage: 0 = DC module is off, power electronic circuit is deactivated, battery voltage can be measured; 1 = DC module is active and the power distribution according to parameters 4303 is active;	-	1.0	1	0	4	UINT16	Register	1	03	06
4303	Power distribution DC-DC module	%	0.1	0	0	1000	UINT16	Register	1	03	06

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
4306	0 = power distribution, 1 = current distribution, 2 = auto	-	1.0	2	0	2	UINT16	Register	1	03	06
ActualValues											
5000	State of device: 0 = Power up, 1 = Alarm, 2 = Idle, 3 = Operation, 4 = Maintenance	-	1.0	-1	-2	10	INT16	Register	1	04	
5001	Number of connected slave modules	cnt	1.0	0		16	UINT16	Register	1	04	
5002	Number of connected sub slave modules	cnt	1.0	0	0	5	UINT16	Register	1	04	
5020	Nominal grid frequency	Hz	0.1	500			UINT16	Register	1	04	
5021	Nominal grid voltage	V	1.0	400			UINT16	Register	1	04	
5022	Nominal apparent power capability	VA	1.0	25000			UINT16	Register	1	04	
5023	Actvie grid type: 0 = grid-tied, 400V, 50Hz 1 = grid-tied, 480V, 60Hz 2 = island mode, 400V, 50Hz 3 = island mode, 480V, 60Hz 4 = grid-tied, 380V, 60Hz	-	1.0	0	0	1	UINT16	Register	1	04	
5130	Apparent power L1	kVA	0.001		0		UINT16	Register	1	04	
5131	Apparent power L2	kVA	0.001		0		UINT16	Register	1	04	
5132	Apparent power L3	kVA	0.001		0		UINT16	Register	1	04	
5133	Overload capacity L1	%	0.1	0	0	1000	UINT16	Register	1	04	
5134	Overload capacity L2	%	0.1	0	0	1000	UINT16	Register	1	04	
5135	Overload capacity L3	%	0.1	0	0	1000	UINT16	Register	1	04	
5140	Active power L1	kW	0.001				INT16	Register	1	04	
5141	Active power L2	kW	0.001				INT16	Register	1	04	
5142	Active power L3	kW	0.001				INT16	Register	1	04	
5150	Grid current RMS L1	A	0.01		0	8800	UINT16	Register	1	04	
5151	Grid current RMS L2	A	0.01		0	8800	UINT16	Register	1	04	

Addr	Description	Unit	Resolution	Default	Min	Max	Datatype	Type	Length	FCr	FCw
5152	Grid current RMS L3	A	0.01		0	8800	UINT16	Register	1	04	
5160	Grid voltage RMS L1	V	0.1		0	3100	UINT16	Register	1	04	
5161	Grid voltage RMS L2	V	0.1		0	3100	UINT16	Register	1	04	
5162	Grid voltage RMS L3	V	0.1		0	3100	UINT16	Register	1	04	
5170	cos phi L1	-	0.01		-100	100	INT16	Register	1	04	
5171	cos phi L2	-	0.01		-100	100	INT16	Register	1	04	
5172	cos phi L3	-	0.01		-100	100	INT16	Register	1	04	
5200	Grid frequency (If outside of 45-65Hz range or Vg_rms below 35 V, -1 will be promted.)	Hz	0.01	0	-100	7000	INT16	Register	1	04	
5210	Intern DC link voltage upper half	V	1.0	0	0	1100	UINT16	Register	1	04	
5211	Intern DC link voltage lower half	V	1.0	0	0	1100	UINT16	Register	1	04	
5212	Extern DC link voltage upper half	V	1.0	0	0	1100	UINT16	Register	1	04	
5213	Extern DC link voltage lower half	V	1.0	0	0	1100	UINT16	Register	1	04	
5220	Voltage internal N to PE	V	0.1	0			INT16	Register	1	04	
5221	Voltage external N to PE	V	0.1	0			INT16	Register	1	04	
5500	Inlet air temperature	°C	0.1	0			INT16	Register	1	04	
Alarms and warnings											
2402	Count of pending warnings	Count					UINT16	Register	1	04	
2403 – 2422	Warning code of Warning 1 to Warning 20						UINT16	Register	1	04	
2404							UINT16	Register	1	04	
2808	Alarms have changed	bit			0	1	UINT16	Coil	1	01	
2809	Count of pending alarms	Count					UINT16	Register	1	04	
2810 – 2829	Error codes of Alarm 1 to Alarm 20						UINT16	Register	1	04	
3215	Events have changed	bit			0	1	UINT16	Coil	1	01	

Modbus Tab. 19

7.4 Transmission of power

Switching the transmission of power on/off

Conditions

- Initial commissioning was performed (see "Commissioning", pg. 46).
- Operation via web-based user interface and/or Modbus.

Enter process set values

1. Selection of an AC-DC module (only relevant if multiple modules are connected to a TruConvert System Control).
   - User interface:
     Select >*Operation* >*Device control AC-DC*.
     Select a module in the "Device control AC-DC" area for "Slave module selection".
   - Modbus:
     Enter the number of the slave to be addressed .

   Note

   User interface and Modbus may have different scaling. For Modbus parameters, the resolutions specified in the Modbus Register Map must be taken into account (see "Modbus Register Map", pg. 54).

   For example:
   Enter 100 A for parameter "Max. charging current, DC module 1" with resolution 0.1:
   Input via web interface: 100.0
   Transfer via Modbus: 1000.
2. Enter set value for the apparent power in kVA.
   - User interface:
     Select >*Operation* >*Device control AC-DC*.
     Under "Set value AC [kVA]", enter the value[4].
   - Modbus:
     .
3. For "Power factor (CosPhi)", enter:
   - User interface:
     Value between: -1 to +1 (in increments of 0.01)[4]
   - Modbus:
     Value between: -100 to +100 (in increments of 1)
   - Note the selected reference arrow system and set the sign accordingly.
4. Under "Phase position", select:

4 In the user interface, a period character is used as the decimal separator.

- "inductive" (default setting)
- "capacitive"

5. For "DC link precharge config", enter: `1`.

Start transmission of power

6. Start transmission of power.
   - User interface:
     Select >*Operation* >*Device control AC-DC*.
     For "Activate power stage [bit]", enter = "1".
     Press key ↵.
   - Modbus:
     For the address for power operation, set bit = 1.

Stop transmission of power

7. To stop the transmission of power:
   - User interface:
     For "Activate power stage [bit]", enter = "0".
     Press key ↵.
   - Modbus:
     For the address for power operation, set bit = 0.

Starting/stopping power transmission for other AC-DC modules

8. Starting/stopping power transmission for other AC-DC modules
   - ➢ Select another AC-DC module (via user interface or slave address via Modbus) and perform the previous steps again.

   or

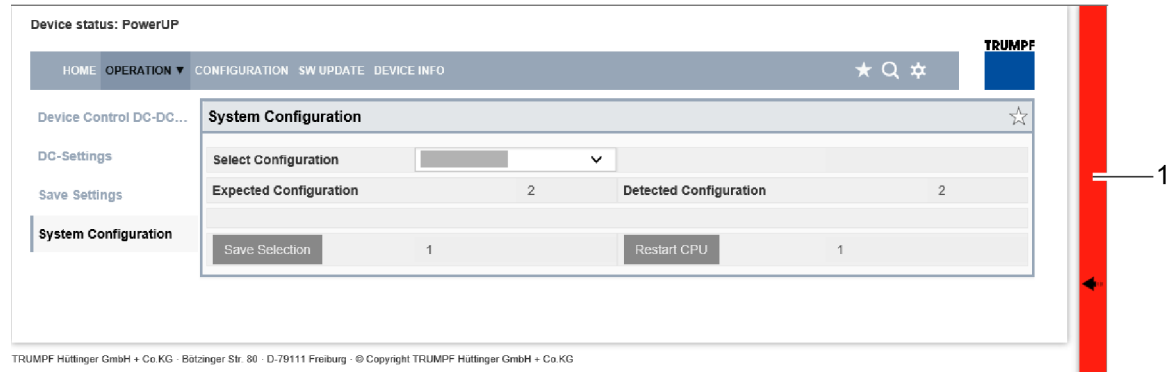
   - ➢ To switch on all AC-DC modules simultaneously:
   - User interface:
     For "Slave module selection" enter "0".
   - Modbus:
     Enter the number of the slave to be addressed = "0" .
   - ➢ Start transmission of power.

7.5 Displaying and resetting messages

User interface: displaying and resetting messages

Displaying messages

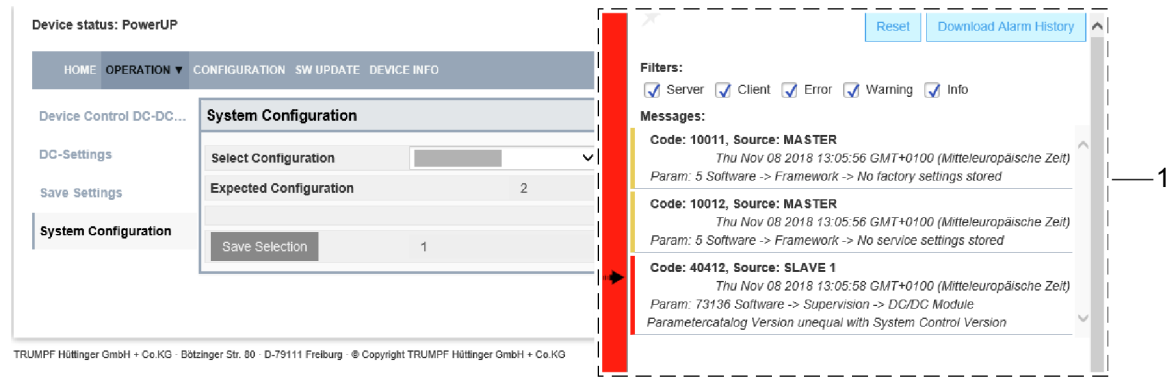
If a message is pending, the sidebar is colored orange or red. If only warnings are pending, the sidebar is orange. If at least one alarm is pending, the sidebar is colored red.



1 Sidebar

Sidebar, collapsed Fig. 35

1. Click on the sidebar to display the messages.



1 Displayed messages

Sidebar, expanded Fig. 36

A message consists of 3 components: "Code" (message number), "Source" (originator) and message text.

The module that has caused the message is indicated by the description and number in the "Source" field.

MASTER = System control

SLAVE = AC-DC module and/or DC-DC module

Each slave number has 4 digits. The first 2 digits stand for the slaves (AC-DC modules) connected to the system control, and the 3rd and 4th digits stand for the subslaves (DC-DC modules).

Example:
Source: Slave 0204 → A subslave 04 (DC-DC module) is connected to slave 02 (AC-DC module). DC-DC module number 4 has caused the message.

If TRUMPF Service is to be contacted, it is recommended to note down the message number.

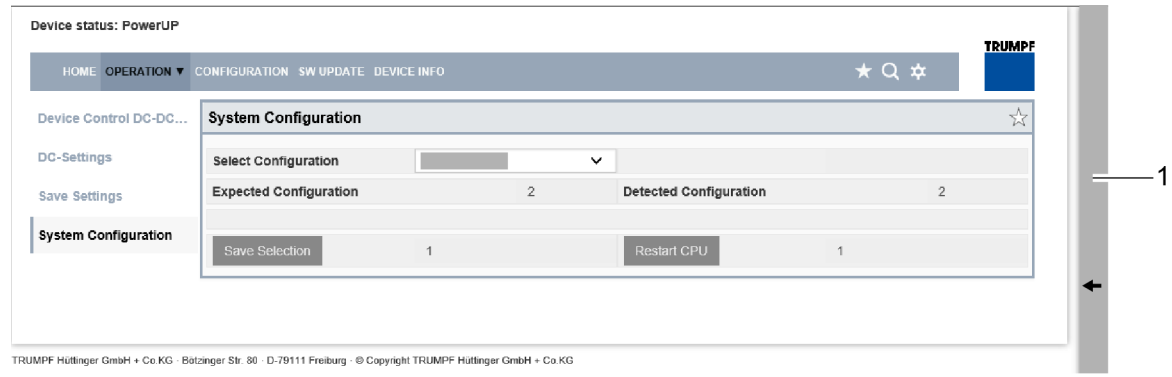
Download alarm list

2. To download a list of all alarm messages that have occurred:

- Press the "Download Alarm History" button.
- Save as a csv file.

Reset messages

3. Reset messages:
   - Select *>Operation >Device control AC-DC mode*.
   - For "Reset alarm [bit]", enter = "1".
   - Press key ↵.
   - or
   - If messages are displayed, press "Reset".



1 Sidebar

Sidebar, collapsed, no messages Fig. 37

The sidebar turns white again. All messages are reset.

If the message is not reset:

- ➢ If MASTER is displayed under "Source", enter `0` under "Slave module selection". All messages are reset, including the messages from the master (system control).
- ➢ If SLAVE 1 is display under "Source", enter `1` under "Slave module selection" in order to reset only the messages from slave 1 and its subslaves.

Modbus: displaying and resetting messages

There are three different types of message: alarm, warning and info.

The number of pending messages can be queried by message type and the message numbers read out.

Displaying the number of pending messages

1. Read out the number of current alarm/warning/info messages that have occurred on the entire system .

   The number of all messages that occurred in the system is output.

Reading out message numbers

2. Read out message numbers (alarm/warning/info messages 1 to 20) that have occurred on the entire system.

   All message numbers of the messages that occurred in the system are output in an overview list. The message numbers are output in the order in which they occurred. The corresponding texts are listed in the message table(see "Messages", pg. 75).

Reset messages

3. Reset all messages, slave ID = 0 .

   All messages are reset. No further messages are pending.

   If the cause of a message persists, this message is displayed again.

7.6 Overload

To permit load peaks when starting up motors or when starting devices, the AC-DC modules can be operated in overload operation. This method of operation is permissible only for a short time and is regulated accordingly by the system.

The overload is monitored and regulated separately for each phase.

Operating with overload

Note

Overload operation is possible only in the following ambient temperature ranges:

– Charging: -5°C to 35°C.

– Discharging: -5°C to 40°C.

1. Increase the maximum values for the apparent power.

   Increase the apparent power up to max. 37.5 kVA.

   - User interface:

     >Operation >Device control AC-DC under "Power set value AC [kVA]"
   - Modbus:

2. Start transmission of power.

Status bar for the overload capacity (user interface) Fig. 38

As soon as a higher phase current and AC power that is higher than the nominal apparent power is called, the system can supply this for a certain time span.

During overload operation, the overload capacity is reduced continuously. The still remaining overload capacity is displayed on the user interface in percent in the form of a status bar. As soon as the overload capacity has dropped to "0%", only operation at nominal apparent power is possible.

To restore the overload capacity, the AC-DC module must be operated for a period of time at less than 90% or less than 80% of the nominal power.

Examples: Reduce and then again increase overload capacity

Reduce overload capacity from 100% to 0%

The overload capacity drops from 100% to 0% if the system is operated at overload with:

- AC power set value between 100% and 125%.
  For 10 minutes.
  or
- AC power set value between 125% and 150%.
  For 1 minute.

Increase overload capacity again from 0% to 100%

The overload capacity increases again from 0% to 100% if the system is operated under normal load with:

- AC power set value of <90%.
  For 20 minutes.
  or
- AC power set value of <80%.
  For 10 minutes.

7.7 Actual values

Display actual values

Display AC values

➢ Display the current values at the mains connection of the AC-DC module.

- User interface:

  Select >*Operation* >*Device control AC-DC*.

  In the "Status AC modules" area, enter the desired module under "Slave module selection". Or enter `0` in order to display the generally applicable or sum values of all modules (0 is displayed in the case of values that cannot be summed).

  Read the actual values in the "Status AC modules" area.

  DC link voltage is displayed under "DC link voltage +" and "DC link voltage -" in V.

  The apparent power output/draw of the individual phases (L1, L2, L3) are displayed under "Apparent power Lx" in kVA.

  The effective power output/draw of the individual phases (L1, L2, L3) is displayed under "Real power Lx" in kW.

  The voltages of the individual phases (L1, L2, L3) are displayed under "Grid Vvltage Lx" in V.

  The currents of the individual phases (L1, L2, L3) are displayed under "Phase curent Lx" in A.

  The frequency is displayed under "Grid frequency" in Hz.

  The overload capacity of the individual phases (L1, L2, L3) is displayed under "Overload capacity Lx" in %.

- Modbus:

  Read actual values .

7.8 Process set values

Set process set values

➢ Set the process set values via the web-based user interface: (see "Setting process set values (AC settings)", pg. 48).

or

➢ Set the process set values via Modbus: .

7.9 Data backup

Saving data

The general settings can be exported and then imported into another device.

Conditions

- Operation via web-based user interface
- Settings to be stored were entered under >*Operation* >*AC-DC module settings* with "Slave module selection" = "0" and "Subslave module selection" = "0".

1. Select >*Operation* >*Save settings*.
2. In the "Save settings" area under "Save settings", select "Save current settings" to save the current settings in the TruConvert System Control.
3. In the "Save settings" area, select "Restore factory settings" to again restore the factory settings.
4. Press "Export settings" to save the current settings as a CSV file on a hard drive of the PC.

   If the data is displayed in the browser, instead of being saved as CSV file:

   - ➢ Select and copy all text (<Ctrl> + <A>, <Ctrl> + <C>).
   - ➢ Open a text editor.
   - ➢ Insert data (<Ctrl> + <V>).
   - ➢ Place the cursor at the end of the file (after: "END;;;"). Press the enter key ↵ once to insert a new line.
   - ➢ Save data as file with extension "csv" on the PC.

5. Press "Select files" in the "Import settings" area to search for and select a CSV file on a hard drive of the PC.
6. In order to load the selected CSV file to the system control and restart the system control:
   - − Press "Update".
   - − Select >*Operation* >*System configuration* and press "Restart CPU".

     Or switch the 24 V supply voltage off and on again.

7.10 System configuration

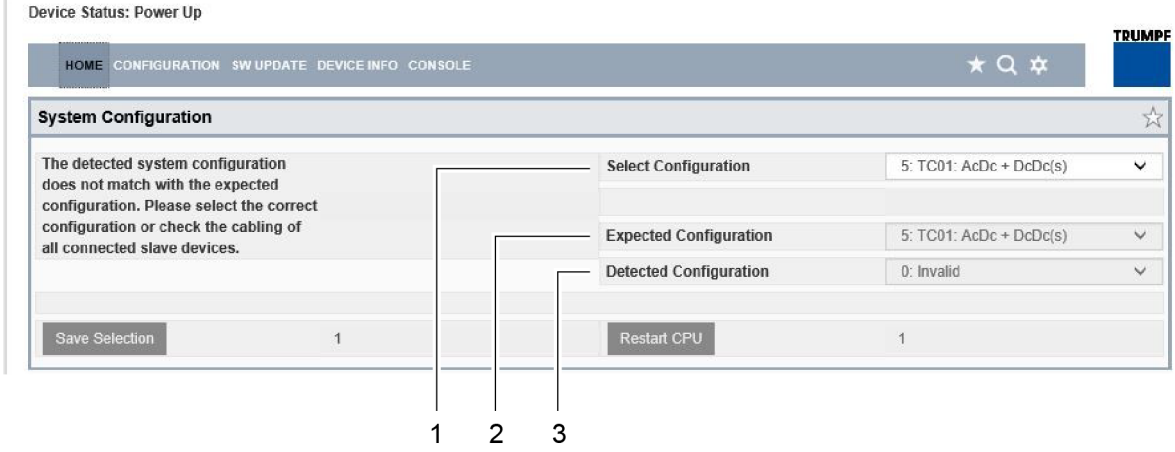
If the combination of devices connected to the system control is changed, the new system configuration must then be entered via the web-based user interface.

Setting the system configuration

Conditions

- Operation via web-based user interface
- Devices (AC-DC module, DC-DC modules) are connected to the system control

1. To switch on the system control and the modules: switch on the 24 V supply voltage.



1 Most recently saved configuration is displayed as the suggested value.
2 Most recently saved configuration
3 Most recently saved configuration does not match the detected configuration.

Input screen "System Configuration" Fig. 39

The input screen "System configuration" is displayed.

The connected devices do not match the expected configuration, i.e. the most recently saved configuration.

Status LEDs on the system control: All 3 LEDs flash synchronously.

Status LEDs on the AC-DC module: The green and red LEDs light up and the yellow LED flashes.

2. In "Select configuration", select the present system configuration:
   - 0: No configuration

     This configuration only occurs in the event of an error, e.g., if there is no connection to the modules (check cables) or if an incorrect module type was detected (check alarm messages).
   - 1: Simulator

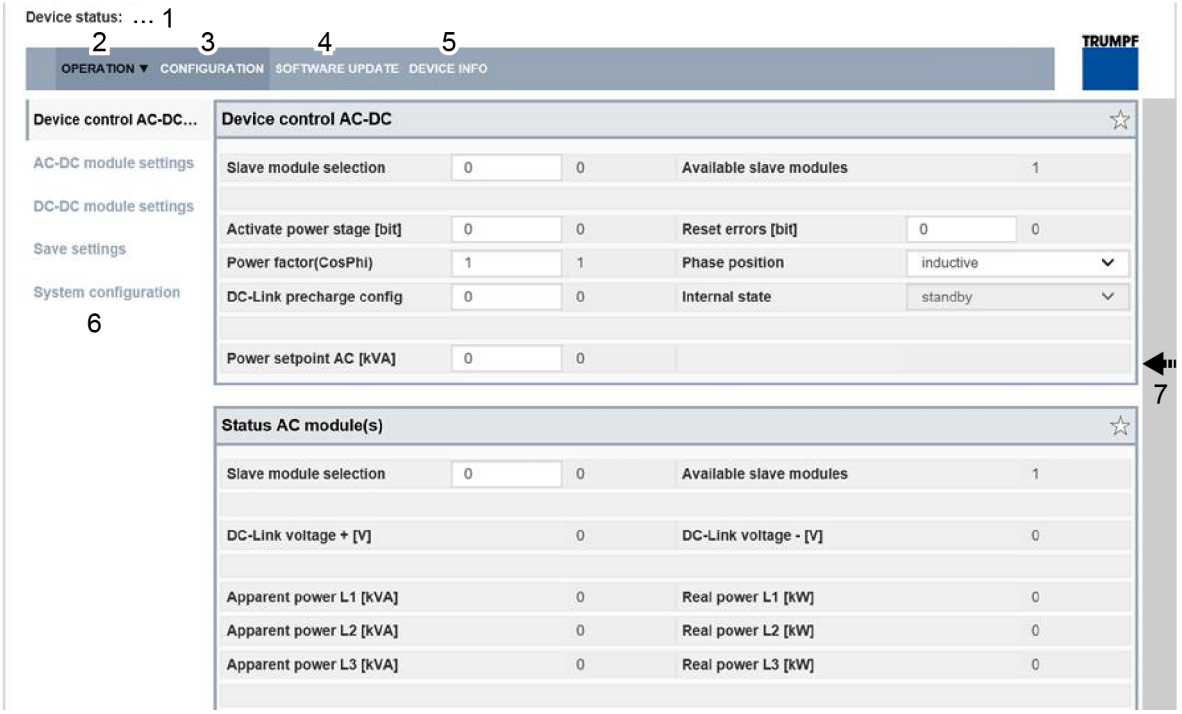
     The system control alone is used and connected modules are simulated.

- 2: DC-DC only

  Only DC-DC modules are connected to the system control.
- 3: n (AC-DC + m DC-DC)

  AC/DC and DC/DC modules are connected to the system control.

3. To save the selection: press "Save selection".
4. To restart the TruConvert System Control: press "Restart CPU".



1 Display of the current device status
2 Main operating parameters (start page)
3 Device configuration (time and network settings)
4 Software update
5 Device identification (display only)
6 Submenu
7 Sidebar (alarm, warning and event messages)

Start screen Fig. 40

Status LEDs on the AC-DC module and system control: The LEDs remain off immediately after the restart. The green LED begins to flash after a few seconds.

The system is ready for operation: It is in "Idle" mode and the start screen is displayed.

The system control balances the set system configuration with the actually connected modules. If both values match, the start screen is displayed.

If the set system configuration ("Expected configuration") differs from the automatically detected system configuration ("Detected configuration"), the input screen "System configu-

ration" is displayed again and a message output. Press sidebar (7) to display the messages.

7.11 System control

Setting the system time

User interface

As soon as the system control is connected to the PC, the local time of the PC is converted to UTC and adopted in the system control as system time.

In addition, adoption of the system time can also be triggered manually.

1. Select >*CONFIGURATION* >*Server Configuration*.
2. To adopt the system time from the PC for the system control TruConvert System Control, press "Fill in current time".

   Then press "Submit Time Configuration".

   The system time of the PC is displayed on the user interface and transferred to the system control.

Modbus

3. Enter new values for date and time .

Changing network settings

Changing the IP address

Note

The IP address can only be changed via the user interface.

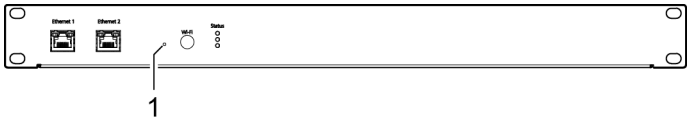
1. Select >*CONFIGURATION* >*Server Configuration*.
2. Enter new values in "IP Adresse".

   (IP address of the TruConvert System Control on delivery: 192.168.1.2)
3. Note the new IP address so as to be able to access the system control via the user interface or via Modbus.
4. Press "Submit IP Configuration".

   The network settings are transferred to the system control.

Using the Reset button to reset the IP address

If the IP address of the system control was changed and is not known, the IP address can be reset to the factory settings with the help of the Reset button.



1 Opening for reset button

Reset button on the system control Fig. 41

5. Insert a small pen tip or piece of wire into the opening for the Reset button and press and hold down the Reset button for 3 seconds.
6. Switch 24 V supply voltage off and back on again to restart the system.

   The IP address of the TruConvert System Control is reset to: 192.168.1.2

Changing the IP subnet and gateway

7. To change the network settings:
   - User interface:

     Enter new values for "IP Subnet Mask", "IP Host" and "IP Gateway".

     Press "Submit IP Configuration".
   - Modbus:

     Enter new values for IP subnet and IP gateway .

   The network settings are transferred to the system control.

7.12 Software update

Perform software update

Conditions

- Operation via web-based user interface
- Zip file with new software stored on PC.

1. Select >*SOFTWARE UPDATE* .
2. Use "Select file" to search for the zip file.
3. Use "Update" to upload the zip file.

   If the update was performed successfully, the system control automatically performs a restart.

7.13 Device information

Displaying device information

System control

1. Select >*DEVICE INFO*.
2. In the "Software package" area, read the details on the installed software package.

   Relevant details are: "Integration level" and "Buildnumber".
3. In the "System control" area, read off the individual items of information for the system control:
   - Under "Software version application" and "Software version bootloader": the software versions on the system control (part of the "Software package").
   - Under "Serial number": the serial number of the system control.

DC-DC only: Read off software version and serial number

4. In the "DC-DC module" area, read off the number of available DC-DC modules under "Available slave modules".

   The DC-DC module, which is directly connected to the system control with the data cable, is "Slave" = 1. The next DC-DC module, which is connected to data output "OUT" of slave 1, is "Slave" = 2.
5. Under "Slave module selection", enter the desired DC-DC module.
6. Under "Software version application" and "Software version bootloader", read off the software versions on the DC-DC module (part of the "Software package").
7. Under "Serial number", read off the serial number of the DC-DC module.

n (AC-DC + m DC-DC): Read off software version and serial number of AC-DC modules

8. In the "AC-DC module" area, read off the number of available AC-DC modules under "Available slave modules".

   The AC-DC module, which is directly connected to the system control with the data cable, is "Slave" = 1. The next DC-DC module, which is connected to data output "OUT" of slave 1, is "Slave" = 2.
9. Under "Slave module selection", enter the desired AC-DC module.
10. Under "Software version application" and "Software version bootloader", read off the software versions on the AC-DC module (part of the "Software package").
11. Under "Serial number", read off the serial number of the AC-DC module.

n (AC-DC + m DC-DC): Read off software version and serial number of DC-DC modules

12. Under "Slave module selection", enter the AC-DC module to which the desired DC-DC module is connected.

13. In the "DC-DC module" area, read off the number of available DC-DC modules under "Available sub slave modules".

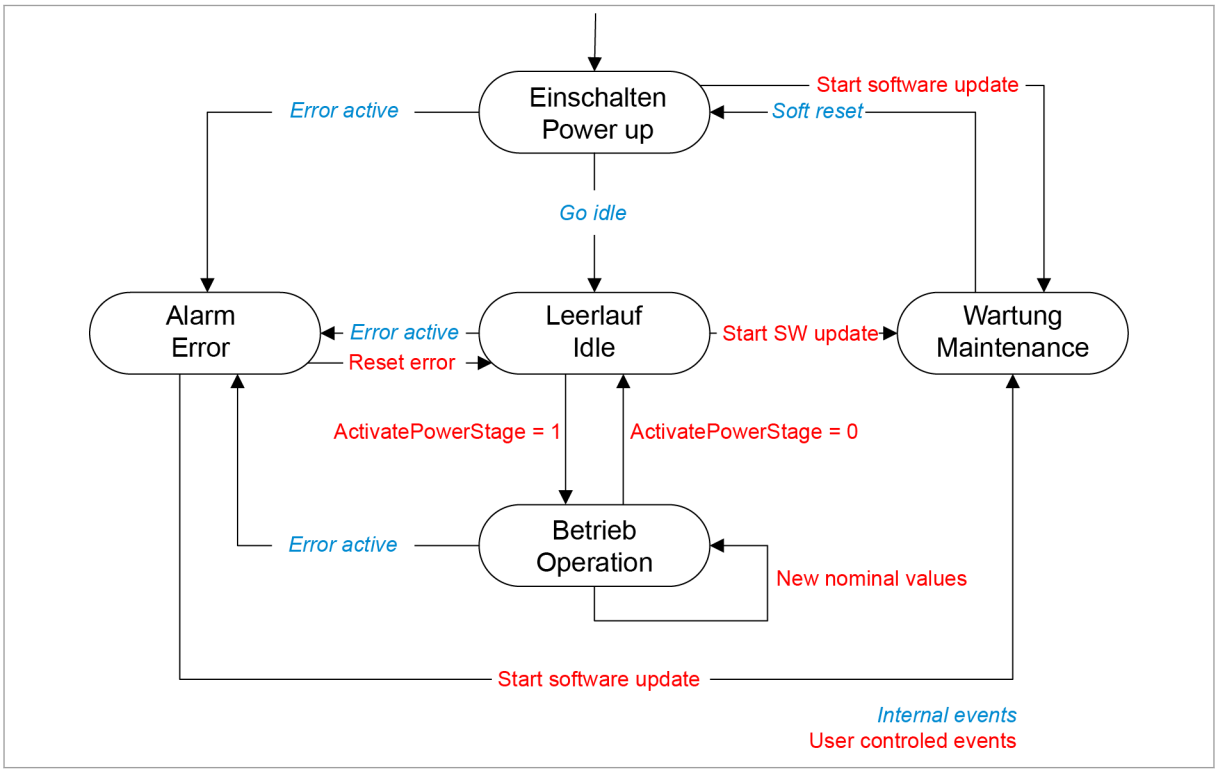
    The DC-DC module, which is directly connected to the AC-DC module with the data cable, is "Sub slave" = 1. The next DC-DC module, which is connected to data output "OUT" of subslave 1, is "Sub slave" = 2.

14. Under "Sub slave module selection", enter the desired DC-DC module.
15. Under "Software version application" and "Software version bootloader", read off the software versions on the DC-DC module (part of the "Software package").
16. Under "Serial number", read off the serial number of the DC-DC module.

Tip

The serial numbers of the system control and the modules can also be queried via Modbus .

7.14 State diagram



State machine Fig. 42

8. Maintenance

8.1 Periodic check of the environmental conditions

In the event of poor environmental conditions, e.g. air with oil, dust and conductive parts, the fans may draw in particles that damage the module. The environment should therefore be kept as clean as possible.

8.2 Cleaning

If necessary, clean the module with a dry cloth.

8.3 Exchanging fans

TRUMPF recommends replacing the ventilator after an operation lifetime of 6 years.

- Only have fans exchanged by TRUMPF personnel or trained staff.

8.4 Performing software updates

Software updates can only be made via the user interface.

- Have software updates for the PCS performed by TRUMPF personnel only; if you perform the updates yourself, consult with TRUMPF personnel beforehand.

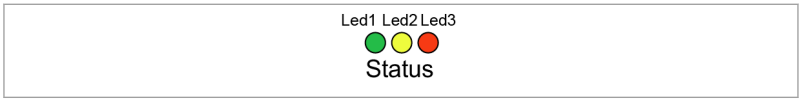
9. Troubleshooting

9.1 Fault indication and messages

Faults are displayed at different positions:

- Status LEDs on the AC-DC module.
- Status LEDs on the TruConvert System Control.
- On the web-based user interface.
- Via the Modbus.

Fault indication with the LEDs



Status LEDs on TruConvert AC 3025 and TruConvert System Control — Fig. 43

LED	Errors
1 (green)	off
2 (yellow)	off
3 (red)	Flashing

Display of the status LEDs in the event of a fault — Tab. 20

9.2 Messages

A distinction is made between alarm messages and warning messages.

Alarm message

Power operation is automatically shut off if serious errors occur. The PCS switches to the alarm state and outputs an alarm message. Power operation can only be restarted after the cause of the alarm has been removed and the alarm message has been reset (see "State diagram", pg. 73).

Warning message

In case of less severe faults, the power operation is not interrupted, but a warning message is issued.

Display of alarm and warning messages

The messages that are output always consists of an alarm or warning number and a message text.

When operating the device with the web-based user interface, the alarm and warning numbers are displayed together with the

message text. In case of control with Modbus, only the numbers and no text are transmitted.

Resetting alarm and warning messages

(see "Displaying and resetting messages", pg. 61)

List of alarm and warning messages

The following tables show the most important alarm and warning messages, with notes on error causes and how to correct them.

If a message reappears repeatedly after resetting and restarting the device, please contact TRUMPF Service.

If a message appears whose number is not listed in the table, please also contact TRUMPF Service.

Alarm messages

Number	Message
40302	BMS communication timeout has occured.
40303	RS-485 communication alarm.
40412	Software versions of system control and module(s) do not match.
40413	Software versions of system control and module(s) do not match.
40414	Software versions of system control and module(s) do not match.
40415	Software versions of system control and module(s) do not match.
40416	Software versions of system control and module(s) do not match.
40304	No slave module was found, please check RS-485 connection(s).
40305	Number of or combination of connected slave types not supported.
50000	Overtemperature IGBT bridge 1.
50001	Overtemperature IGBT bridge 2.
50002	Overtemperature IGBT bridge 3.
50003	Overtemperature balancer.
50004	Ambient temperature over allowed range.
50005	Overcurrent L1.
50006	Overcurrent L2.
50007	Overcurrent L3.
50008	Overcurrent balancer.
50009	Overvoltage grid L1.
50010	Overvoltage grid L2.
50011	Overvoltage grid L3.
50012	Overvoltage filter capacitor L1.
50013	Overvoltage filter capacitor L2.
50014	Overvoltage filter capacitor L3.
50015	Overvoltage DC link positive part.
50016	Overvoltage DC link negative part.
50080	Overvoltage grid N to PE.
50081	Overvoltage internal DC link.
50082	Overvoltage internal N to PE.
50083	Overvoltage external DC link positive part.
50084	Overvoltage external DC link negative part.
50085	Overvoltage external DC link.
50086	Overvoltage external DC link star point to PE.
50087	Wrong polarity on DC link detected.
50088	Overvoltage external auxiliary supply 24 V.
50089	Undervoltage external auxiliary supply 24 V.
50018	Overcurrent L1 hardware.
50019	Overcurrent L2 hardware.
50020	Overcurrent L3 hardware.
50021	Overcurrent balancer hardware.
50095	AC-DC module hardware protection alarm.
50096	DC link precharge unit alarm.

Number	Message
50097	DC link discharge unit alarm.
50098	DC link could not be charged.
50099	DC link control alarm.
50100	DC link relay could not be closed.
50101	DC link relay was forced to disconnect.
50102	Fan alarm.
50030	DC current component L1 too high.
50031	DC current component L2 too high.
50032	DC current component L3 too high.
50033	Grid frequency too high.
50034	Grid frequency too low.
50036	Synchronization to grid failed.
50037	DC link voltage too low for operation.
50038	DC link unbalanced.
50041	Overcurrent L1 RMS.
50042	Overcurrent L2 RMS.
50043	Overcurrent L3 RMS.
50044	Overcurrent balancer RMS.
50047	Overvoltage L1 RMS.
50048	Overvoltage L2 RMS.
50049	Overvoltage L3 RMS.
50050	Undervoltage L1 RMS.
50051	Undervoltage L2 RMS.
50052	Undervoltage L3 RMS.
50053	Grid contactor could not be closed.
50115	Overvoltage filter capacitor L1 RMS.
50116	Overvoltage filter capacitor L2 RMS.
50117	Overvoltage filter capacitor L3 RMS.
50118	Anti-island detection alarm L1.
50119	Anti-island detection alarm L2.
50120	Anti-island detection alarm L3.
50121	Missmatch of internal and external N.
50131	Grid code ride through time exceeded.
50132	Grid does not match grid code requirements.
50068	Subslave communication alarm.
50069	Master communication alarm.
50130	DC link relay disconnect not allowed - DC link voltage unstable.
60090	Battery overvoltage.
60093	DC link overvoltage.
60102	DC link voltage to low for operation.
60700	Auxiliary supply overvoltage.
60142	Battery undervoltage.
60703	Auxiliary supply undervoltage.
60145	Wrong polarity on DC terminal detected.

Number	Message
60132	RS485 communication alarm.
60129	Battery voltage under threshold setting.
60150	Battery voltage over threshold setting.
60168	Ambient temperature over allowed range.
60186	Ambient temperature under allowed range.
60192	Fan defective or stuck.
10016	Power failure of 24-V auxiliary power supply has been detected.

Alarm messages Tab. 21