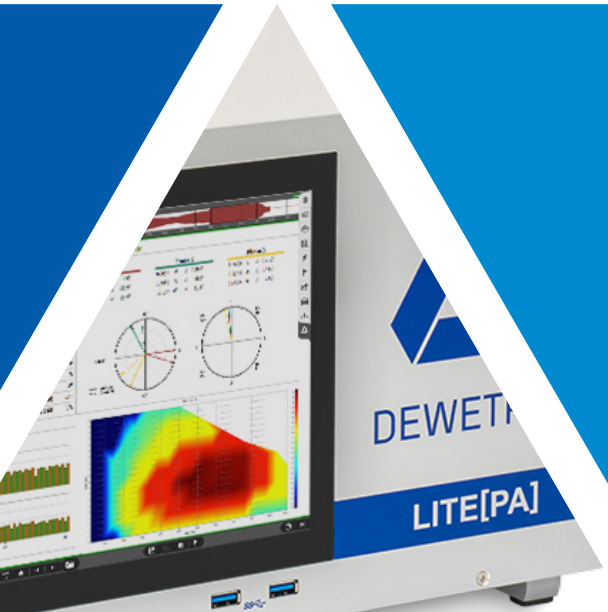
DEWETRON

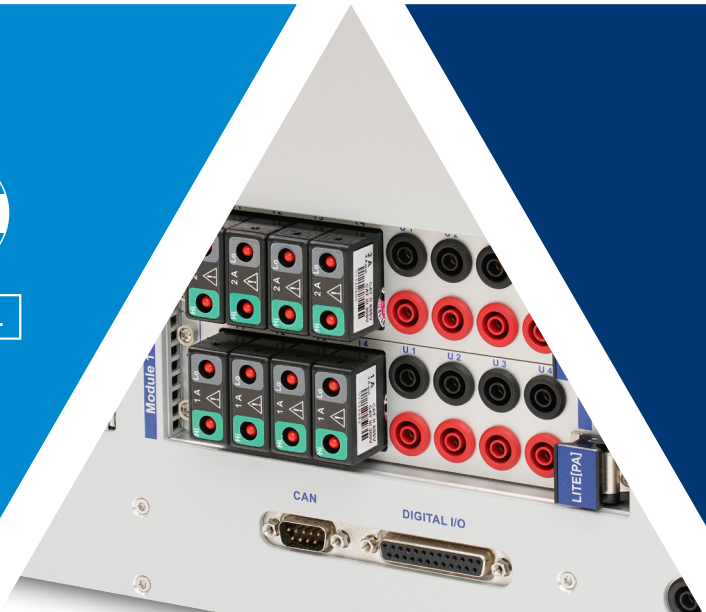
LITE[PA]

TECHNICAL REFERENCE



EN ISO 14001

ISO 9001



Preface

Thank you!

Thank you very much for your investment in DEWETRON‘s unique data acquisition systems. These are top-quality instruments which are designed to provide you years of reliable service. This guide has been prepared to help you get the most from your investment, starting from the day you take it out of the box, and extending for years into the future.

This guide includes important startup notes, as well as safety notes and information about keeping your DEWETRON system in good working condition over time. However, this manual cannot and is not intended to replace adequate training.

This documentation contains operating as well as safety and care instructions that must be observed by the user. Faultless operation can only be guaranteed by observing these instructions.

Intended use

The DEWETRON LITE[PA] is a valuable tool for electrical engineers, technicians, energy managers, and researchers involved in the design, operation, maintenance, and optimization of electrical power systems and equipment. It provides essential insights and data for improving energy efficiency, reliability, and performance while ensuring compliance with industry standards and regulatory requirements.

The instruments offers 2 slots for measurement boards which can be equipped with exchangable voltage or current sub-modules as required.

Contents

Safety

Safety instructions

The following section contains warning and safety instructions that must be observed by the user. Faultless operation can only be guaranteed if these instructions are observed.

General safety instructions

- Use this system under the terms of the specifications only to avoid any possible danger. If the unit is used in a manner not specified by the manufacturer the protection can be impaired.
- Maintenance is to be executed by qualified staff only.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, have it examined by authorized personnel only.
- Any other use than described above may damage your system and is attended with dangers such as short-circuits, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened (except for changing sub-modules).
- Reinstall filler panels of unused measurement board slots to guarantee proper cooling of the installed modules. The warranty is void if the modules overheat due to missing filler panels.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore, if
  - the system is damaged obviously or causes strange noises.
  - the system does not work anymore.
  - the system has been exposed to long storage in adverse environmental.
  - the system has been exposed to heavy shipment strain.
- The warranty is void if damages caused by disregarding this manual. For consequential damages NO liability will be assumed.
- The warranty is void if damages to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE). Exception: changing sub-modules.
- Prevent using metal bare wires as there is a risk of short-circuit and fire hazard.
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy overvoltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details refer to the specifications.
- Make sure that your hands, shoes, clothes and as well as the floor, the system or measuring leads, integrated circuits etc. are dry.
- Use measurement leads or measurement accessories aligned to the specification of the system only. Fire hazard in case of overload.
- Do not disassemble the system. There is a high risk of getting a perilous electric shock. Capacitors still might charged, even the system has been removed from the power supply.
- The measuring systems are not designed for use at humans and animals.
- Contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Handle the product with care. Shocks, hits and dropping it even from an already lower level may damage your system.
- Also consider the detailed technical reference manual as well as the security advices of the connected systems.

Electrical safety instructions

- With this product, only use the power cable delivered or defined for the host country.

- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- The system is grounded via a protective conductor in the power supply cord. To avoid electric shocks, the protective conductor has to be connected with the ground of the power network. Before connecting the input or output connectors of the system, make sure that there is a proper grounding to guarantee potential free usage. For countries, in which there is no proper grounding, refer to your local legally safety regulations for safety use.
- DC systems: Every DC system has a grounding connected to the chassis (yellow/green safety banana plug).
- Note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, carefully read and understand the corresponding specifications in the product manual.
- The inputs are not, unless otherwise noted (CATx identification), for connecting to the main circuits of category II, III and IV. The measurement category can be adjusted depending on module configuration.
- The power cord or the main power switch separates the system from the power supply. Do not block the power cord or main switch, since it has to be accessible for the users.
- Any direct voltage output is protected with a fuse against short-circuits and reverse-polarity, but is NOT galvanically isolated (except it is explicit marked on the system).
- Supply overvoltage category is II.
- The system must be connected and operated to an earthed wall socket at the AC mains power supply only (except for DC systems).
- DO NOT touch any exposed connectors or components if they are live wired. The use of metal bare wires is not allowed. There is a risk of short-circuits and fire hazard.
- The assembly of the system is equivalent to protection class I. For power supply, only the correct power socket of the public power supply must be used, except the system is DC powered.
- Be careful with voltages >25 V_{AC} or >35 V_{DC}. These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- Unless otherwise stated, the maximum input voltage for measuring cards is 70 V_{DC} and 46.7 V_{PEAK}
- The electrical installations and equipments in industrial facilities must be observed by the security regulations and insurance institutions.
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.

Ambient safety notices

- This product is intended for use in industrial locations. As a result, this product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interferences to the reception of radio and television broadcasts.
- Avoid operation in the immediate vicinity of:
  - high magnetic or electromagnetic fields
  - transmitting antennas or high-frequency generators
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Any use in wet rooms, outdoors or in adverse environmental condition is not allowed. Adverse environmental conditions are:
  - Moisture or high humidity
  - Dust, flammable gases, fumes or dissolver
  - Thunderstorm or thunderstorm conditions (except assembly PNA)
  - Electrostatic fields etc.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Direct exposure of any DEWETRON product to strong sunlight or other heat radiation shall be prevented, as this could excessively heat up the product and lead to permanent damage of the product.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.

Safety notices during operation

- During the use of the system, it might be possible to access another parts of a more comprehensive system. Read and follow the safety instructions provided in the manuals of all other components regarding warning and security advices for using the system.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not covered.

Standards and norms

This product has left the factory in safety-related flawless and proper condition.

In order to maintain this condition and guarantee safety use, the user has to consider the security advices and warnings in this manual.

EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally welltried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for protection of buildings, are excluded from the scope of IEC 61326-3-1.

Typographic conventions

Safety and warning notices

WARNING

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

Notices

NOTICE

This text indicates situations or operation errors which could result in property damage or data loss.

INFORMATION

This text indicates important information or operating instructions. Not observing these instructions could inhibit or impede you from successfully completing the tasks described in this documentation.

Symbols

Denotes a warning that alerts you to take precautions to avoid injury. When this symbol is shown on the product, refer to the technical reference manual (ISO 7000-4034; 2004-01).

Indicates hazardous voltages.

Observe precautions for handling electrostatic sensitive devices.

Indicates the chassis terminal (IEC 60417-5020; 2002-10).

Direct current (IEC 60417-5031; 2002-10)

Alternate current (IEC 60417-5032; 2002-10)

Both direct and alternating current (IEC 60417-5033; 2002-10)

Three-phase alternating current (IEC 60417-5032-1; 2002-10)

Protective conductor terminal (IEC 60417-5019; 2006-08)

Equipment protected throughout by double insulation or reinforced insulation (IEC 60417-5172; 2003-02)

On (power) (IEC 60417-5007; 2002-10)

Off (power) (IEC 60417-5008; 2002-10)

General information

Environmental considerations

The following information refers to the environmental impact of the product and the product end-of-life handling. Observe the following guidelines when recycling a DEWETRON system:

- System and components recycling

The production of these components has required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life. Recycle this product in an appropriate way to avoid an unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on Waste of Electrical and Electronic Equipment (WEEE). Further information about recycling can be found on the DEWETRON website (www.dewetron.com).

- Restriction of hazardous substances

  This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2011/65/EU RoHS Directive. This product is known to contain lead.

Problematic network stacks

Often intrusive IT software or network processes can interfere with the primary function of the DEWETRON system: to record data. Therefore we recommend strongly against the installation of IT/MIS software and running their processes on any DEWETRON data acquisition system, and cannot guarantee the performance of our systems if they are so configured.

Warranty information

A copy of the specific warranty terms applicable to your DEWETRON product and replacement parts can be obtained from your local sales and service office.

Legal information

Restricted rights legend

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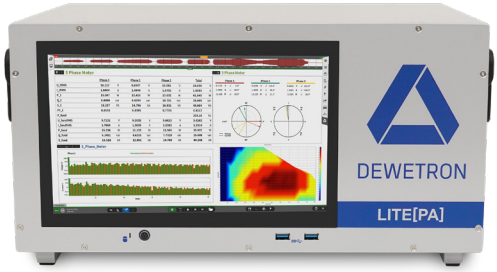
Printing history

Refer to the page bottom for printing version.

System setup

Key facts

- 4- or 8-phase high-precision power analyzer
  - 4 phases: LITE[PA]-4
  - 8 phases: LITE[PA]-8
- Voltage input: 1000 V_{RMS} / ±2000 V_{PEAK}
- Current input: 1 A_{RMS} / ±2 A_{PEAK} (others on request)
- Basic power accuracy: ±0.04 % of reading (0.5 Hz ... 1000 Hz)



System specifications

LITE[PA]			
General			
Input channels	4 or 8 high-voltage inputs		
	4 or 8 current inputs		
	4 motor inputs		
	1 CAN port		
Sampling rate	max. 2 MS/s		
Resolution	24-bit		
ADC	SAR (Successive Approximation Register)		
Fixed high-voltage inputs			
Input range	1000 V_{RMS} (±2000 V_{PEAK}) CF = 2		
Accuracy[1) 2) 3)]	DC	±0.02 % of reading ±0.02 % of range	(f: frequency in kHz)
	0.5 Hz to 1 kHz	±0.03 % of reading	
	1 kHz to 5 kHz	±0.15 % of reading	
	5 kHz to 10 kHz	±0.35 % of reading	
	10 kHz to 50 kHz	±0.6 % of reading	
	50 kHz to 300 kHz	±(0.02 % * f) of reading	
Gain drift	20 ppm/°C		
Offset drift	5 mV/°C		
Typical THD	-95 dB		
CMRR	>85 dB @ 50 Hz; >60 dB @ 1 kHz; >40 dB @ 100 kHz		
Bandwidth (-3 dB)	5 MHz		
Rated input voltage to earth according to EN 61010-2-30	600 V CAT IV / 1000 V CAT III		
Differential input (floating circuits)	600 V CAT IV / 1000 V CAT III / 2000 V_{DC}		
Common mode voltage	1000 V_{RMS}		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Overvoltage protection	4250 V_{PEAK} or 3000 V_{RMS} (1 min)		
Input resistance	5 MΩ; 2 pF		
Isolation/earth resistance	100 GΩ; 2.5 pF		
Connector	Safety banana sockets		

Tab. 1: System specifications

LITE[PA]				
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[mV]
0.1 kS/s	126	144	20.6	2.6
1 kS/s	123	140	20.1	4.5
10 kS/s	118	137	19.3	9.5
100 kS/s	110	134	18.0	27.2
1000 kS/s	100	134	16.3	92.5
2000 kS/s	82	132	13.3	134.0
Modular current inputs				
Input range	1 A_{RMS} (±2 A_{PEAK})			
Resolution	20 bit			
1 year accuracy (23 °C ±5 °C)[6]	DC	±0.02 % of reading ±80 µA[7]		(f: frequency in kHz)
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 30 kHz	±0.1 % of reading		
	30 kHz to 200 kHz	±(0.015 % * f) of reading		
	200 kHz to 300 kHz	±(0.1 % * f) of reading		
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity			
Bandwidth (-3 dB)	300 kHz			
Connector	Safety banana plugs			
Overcurrent protection	4 A_{PEAK} or 2 A_{RMS} (1 s)			
Thermal current limit	1 A_{RMS}			
Input resistance	500 mΩ			
Other current inputs on request	0.2 A_{RMS} (±0.4 A_{PEAK})		1 V_{RMS} (±2 V_{PEAK})	
	2 A_{RMS} (±4 A_{PEAK})		5 V_{RMS} (±10 V_{PEAK})	
	20 A_{RMS} (±40 A_{PEAK})		-	
Typical signal to noise ratio, spurious free SNR, effective number of bits[8]				
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[mV]
0.1 kS/s	131	149	21.5	1.4
1 kS/s	125	149	20.5	3.9
10 kS/s	116	144	19.0	12.6
100 kS/s	106	137	17.3	47.0
1000 kS/s	96	134	15.7	161.0
2000 kS/s	95	130	15.5	162.0
Power specifications				
Accuracy	DC	±0.03 % of reading ±0.03 % of range		(f: frequency in kHz)
	0.5 Hz to 1 kHz	±0.04 % of reading		
	1 kHz to 5 kHz	±0.2 % of reading		
	5 kHz to 10 kHz	±0.5 % of reading		
	10 kHz to 50 kHz	±(0.5 % +0.05 % * f) of reading		
Influence of power factor	Add 0.01 % * f/50 * √(1/PF²-1)			(f: frequency in Hz)

Tab. 1: System specifications

LITE[PA]	
Typ. channel-to-channel phase mismatch	<250 ns (0.1° @ 1 kHz, 0.005° @ 50 Hz)
Fundamental frequency – Range – Accuracy	 0.1 Hz–200 kHz (>500 kS/s: >0.2 Hz; >1 MS/s: >0.5Hz) ±0.005 % of reading ± 1 mHz
Low pass filter (-3 dB, digital and analog combined) – Filter order and characteristics	100 Hz to 600 kHz freely programmable or OFF 2nd, 4th, 6th, 8th Bessel or Butterworth
Filter delay compensation	Up to 15 µs the group delay of the selected filter will be automatically compensated. This works for: – 2nd order filter 15 kHz to 1 MHz – 4th order filter 30 kHz to 1 MHz – 6th order filter 60 kHz to 1 MHz
Motor inputs	
Counter inputs	2 advanced counters for speed sensors (encoders) 2 basic counters for torque inputs
Input signal	CMOS/TTL compatible digital inputs; weak pull-up via 100 kΩ
Overvoltage protection	±30 V_{DC}, 50 V_{PEAK} (100 ms)
Counter modes – Waveform timing – Sensor modes – Event counting	 Period, frequency, pulse width duty cycle and edge separation Encoder (angle and linear) Basic event counting, gated counting, up/down counting and encoder mode (X1, X2 and X4)
Counter resolution	32-bit
Counter time base	100 MHz
Time base accuracy	Typ. 2 ppm; max. 10 ppm
Max. input frequency	10 MHz
Sensor power supply	12 V (600 mA)
Connector	D-SUB-25 socket
Digital output	
Digital outputs	4 digital outputs (TTL)
Maximum current	25 mA continuously
Power-on default	Low
CAN	
Specification	CAN 2.0B (IN/OUT)
Physical layer	High-speed
Listen-only mode	Supported
Termination programmable	High impedance or 120 Ω
Common mode range	-2 V to +7 V
Bus pin fault protection	±36 V_{DC}
ESD protection IEC 61000-4-2	±8 kV air discharge, ±4 kV contact discharge
CAN transceiver	SN65HVD266D
Sensor power supply	5 V (100 mA) and 12 V (600 mA)
Connector	D-SUB-9 connector

Tab. 1: System specifications

LITE[PA]		
Software		
Raw data processing: Visualization / storage	Yes / no[9)]	
Cycle-by-cycle calculation U/I/P/Q/S/PF/W	Yes	
Analysis of (intermediate) harmonics (IEC 61000-4-7)	Yes	
High-frequency components	Yes	
Voltage fluctuations (IEC 61000-4-15)	Yes	
Flicker emissions (IEC 61400-21)	Yes	
D/Q analysis	Yes	
Mechanical power and efficiency map	Yes	
Rolling calculations	Optional	
Advanced math, i.e. formulas, filters, FFT etc.	Yes	
Reporting	Integrated reporting, many export data formats (*.xlsx, *.mat, *.dat, *.csv., etc.)	
Data sharing and offline analysis	Unlimited free VIEW licenses for workgroups (for multiple analysis PCs)	
Additional		
Temperature measurement	Via XR modules connected to CAN port	
Host system data connection: SCPI / UDP / CAN / XCP	Yes / yes / yes / optional	
System		
Display	11.6” multi-touch display	
Data storage	256 GB SSD	
Connectivity	10x USB, 2x display port, 1x DVI, 2x Gbit LAN Ethernet	
Power supply	100 to 240 V_{AC} (max. 90 to 264 V_{AC}), active PFC	
Power consumption	max. 280 W	
Dimensions without feet (w x d x h)	442 x 281 x 222 mm (17.4 x 11.1 x 8.7 in); 19’’, 5 U	
Weight	LITE[PA]-4: 9 kg (19.8 lb.)	LITE[PA]-8: 9.5 kg (21 lb.)
Environmental specifications		
Operating temperature	0 .. +50 °C	
Storage temperature	-20 .. +70 °C	
Humidity	10–80 % non condensing, 5–95 % rel. humidity	
Max. altitude	2000 m	
Sine vibration test; EN 60068-2-6:2008		
Shape	Sine	
Frequency range	10–150 Hz	
Acceleration	20 m/s²	
Sweep rate	Sweep 1 oct/min	
Duration test in 3 directions	20 cycles	

Tab. 1: System specifications

LITE[PA]	
Shocktests; EN 60068-2-27:2009	
Pulse form	Half-sine
Acceleration amplitude	15 g
Duration	11 ms
Direction	3 bumps each direction, 6 directions in total
Random vibration test; EN IEC 60721-3-2:2018; Class 2M4	
Total frequency range	10–2000 Hz
Frequency range – Spectral acceleration density	10 Hz–20 Hz 1.1 m/s² 2/Hz
Frequency range – Spectral acceleration density	500 Hz–2000 Hz 0.55 m/s² 2/Hz
RMS value of acceleration	3.4 g

Tab. 1: System specifications

1) The following accuracy conditions were applied: Temperature: 23 ±5 °C; humidity: 40 to 60 % rel. humidity; input waveform: sine wave; common mode voltage: 0 V; line filter: Auto (8th or Butterworth); sample rate: 2 MS/s; resolution: 24-bit; power factor: 1; after warm-up; after zero level,accuracy: Frequency (f) in [kHz] (12-month accuracy ± reading error and range error).

2) Add 0.02 % of reading with filter settings OFF

3) Below 1 % of range, add 10 ppm of range.

4) SFDR excluding harmonics

5) ENOB calculated from SNR

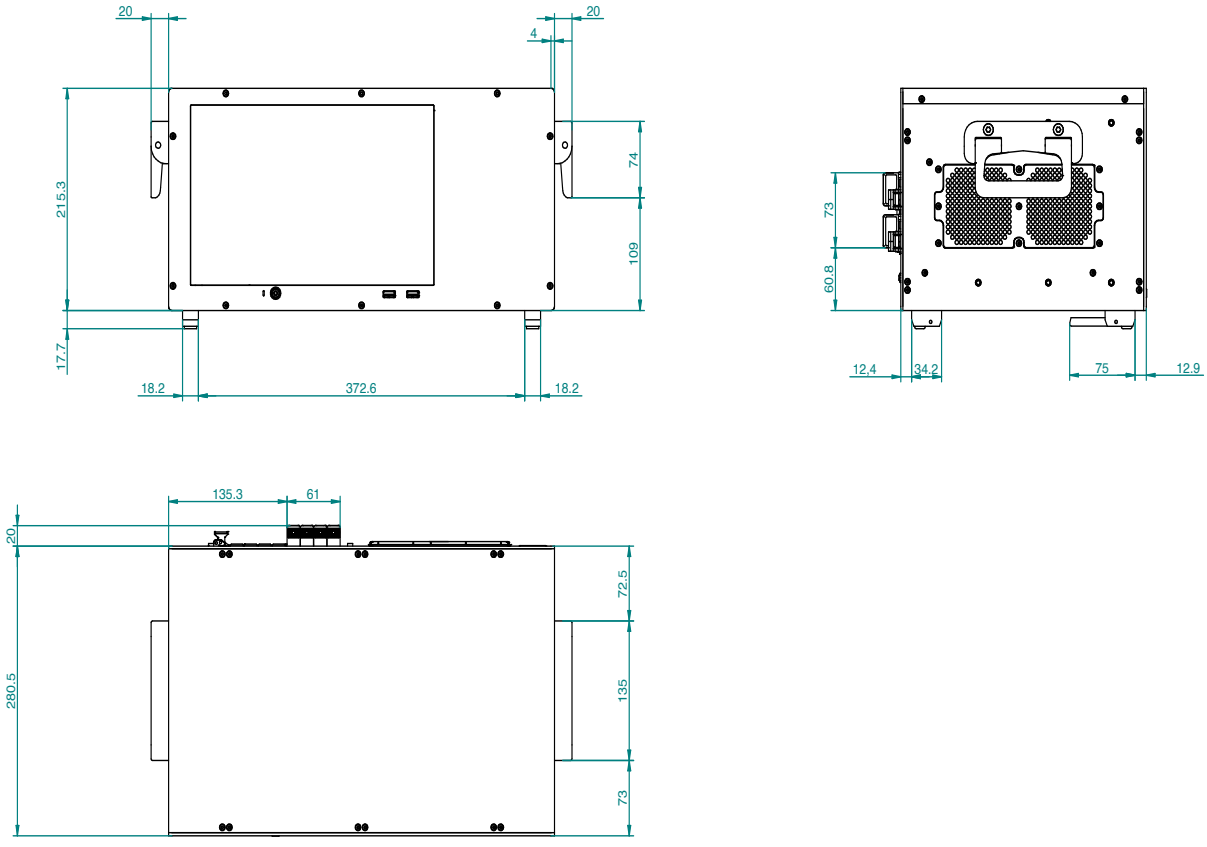
6) Below 1 % of range, add 25 ppm of range

7) Add 0.03 % of range with no zero level.

8) LP filter in auto mode

9) Channels can only be stored if sample rate is ≤ 1 kS/s. Channels whose sample rate exceed 1 kS/s will be automatically deactivated for storing.

Dimensions*



*) Dimensions in mm (1 inch = 25.4 mm)

Fig. 1: Dimensions LITE[PA]

Bessel/Butterworth filter characteristics for power analysis

The measurement board is equipped with DSP lowpass filters from 2nd to 8th order in Bessel or Butterworth configuration. The difference between these two filter types can be seen in the following figures.

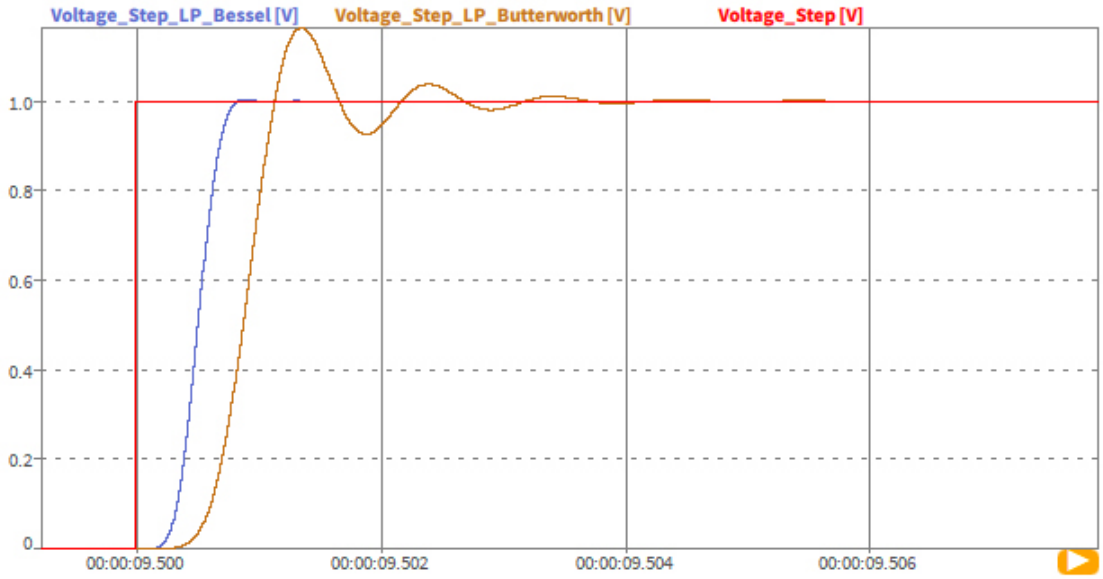


Fig. 2: Step response of filter with 1000 Hz cutoff frequency and 8th order.

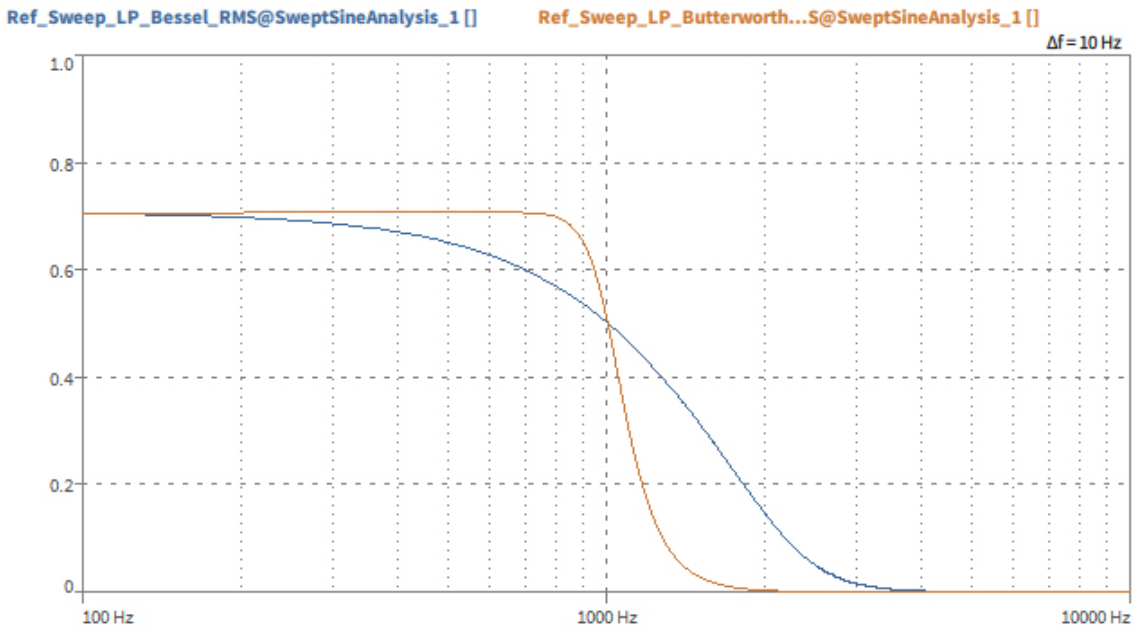


Fig. 3: Frequency response of filter with 1000 Hz cutoff frequency and 8th order

For magnitude accuracy (e.g. RMS accuracy), the Butterworth filter is more suitable than the Bessel filter. For step response (e.g. PWM signal monitoring), the Bessel filter is more suitable than the Butterworth filter.

Block diagram

The measurement board can be equipped with interchangeable inserts (SUB-modules) and expanded up to 8 channels in total.

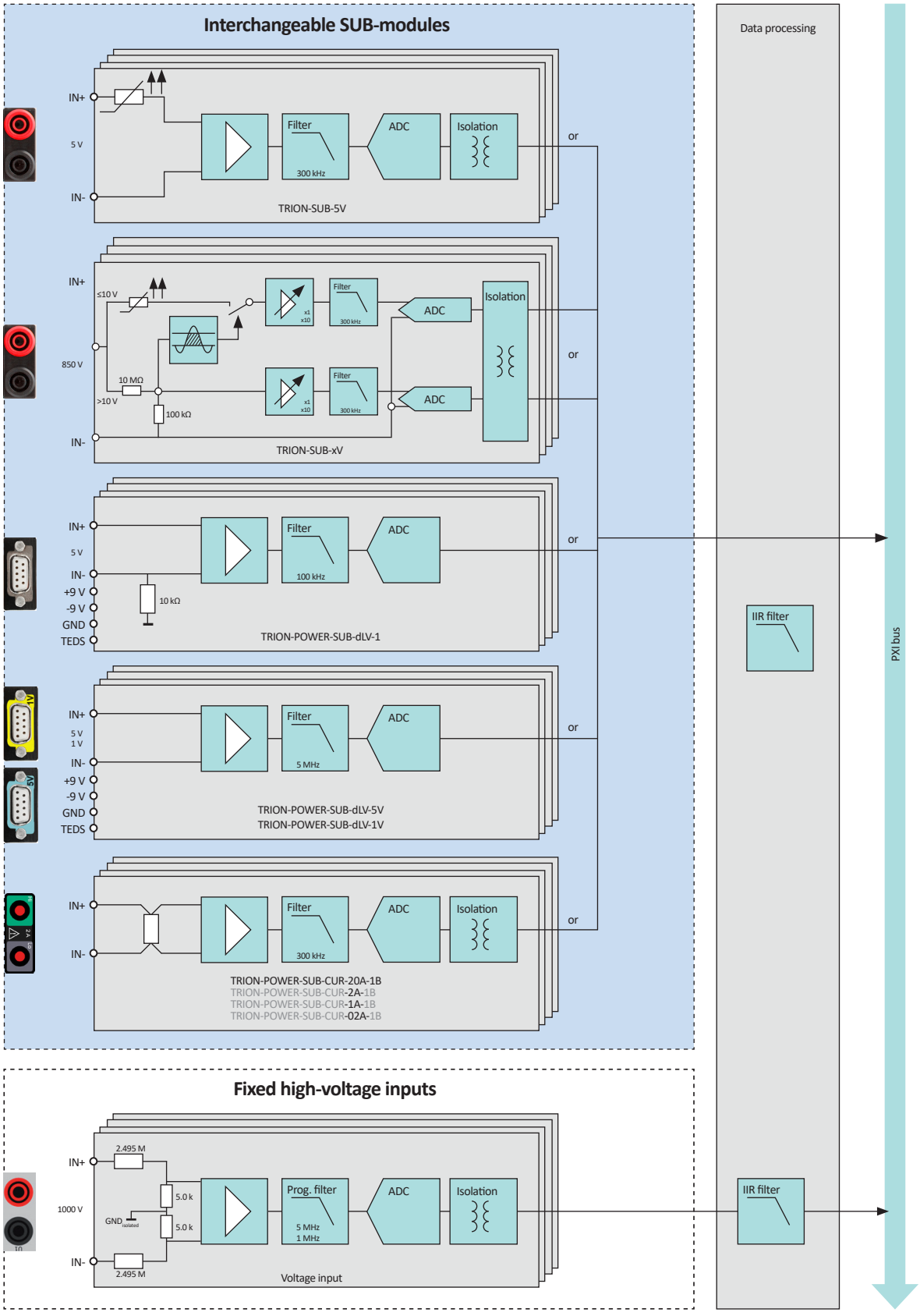


Fig. 4: Block diagram

Connections and ports

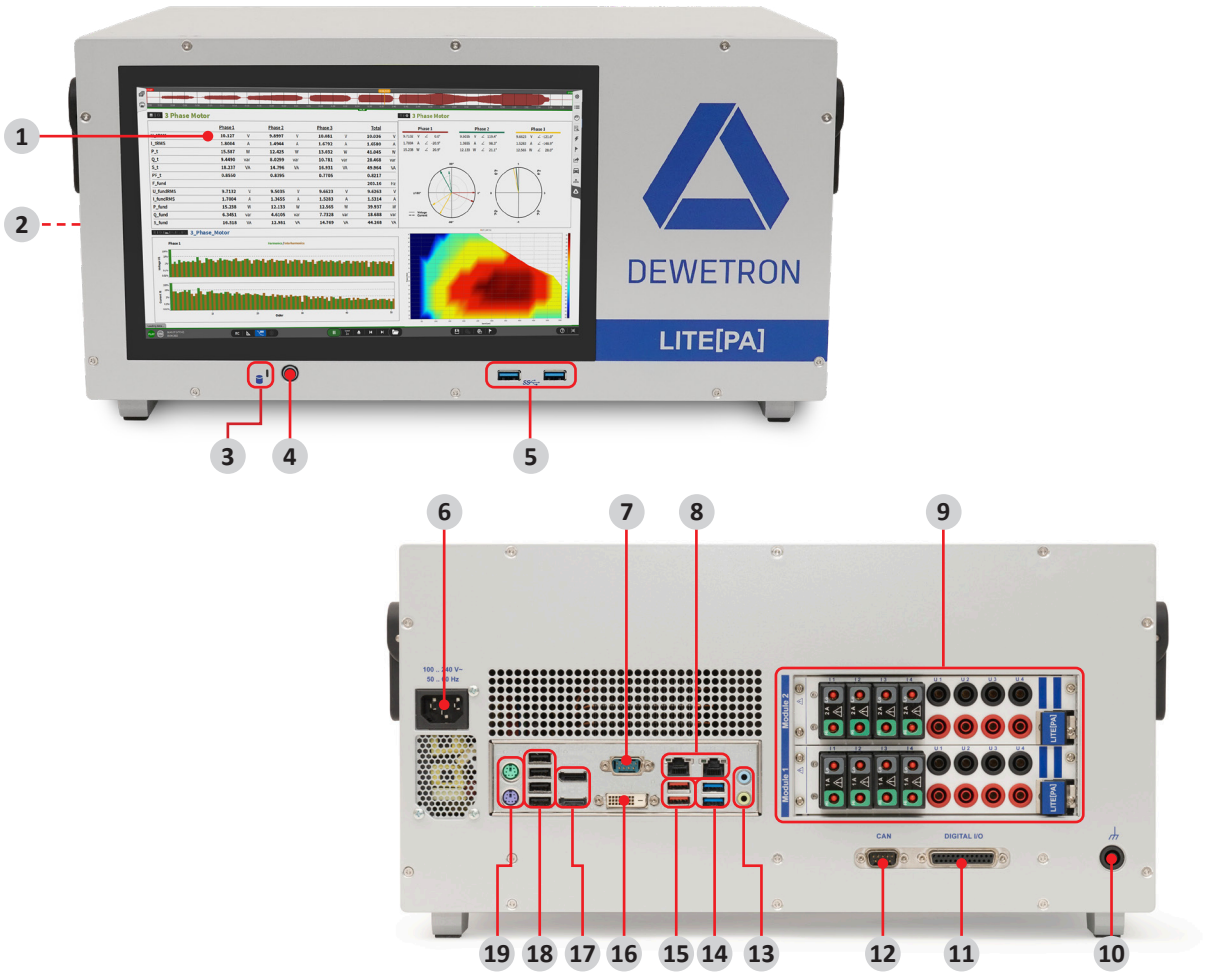


Fig. 5: LITE[PA] overview

1. 11.6” multi-touch display
2. Intake vent and filter pad
3. SSD activity LED
4. Power on/off button
5. USB interface connectors (3.2)
6. Main power supply input connector
7. RS-232 interface connector (COM 1+2)
8. Dual LAN GBit connector
9. 2x Slots for high-voltage and current inputs[1)]
10. Chassis terminal (ground connection)
11. Digital I/O connector (D-SUB-25)
12. CAN interface (D-SUB-9)
13. Audio I/O interface
14. USB interface connectors (3.1 GEN1)
15. USB interface connectors (3.1 GEN2)
16. DVI connector
17. Display port connectors
18. USB interface connectors (2.0)
19. PS/2 interface connector (mouse and keyboard)

1) The LITE[PA] is equipped with one (LITE[PA]-4) or two (LITE[PA]-8) LITE[PA] measurement boards. Any other TRION(3) measuring board types cannot be used in the system.

INFORMATION

The amount and location of the connectors might vary from system to system and depend on the system configuration.

Power supply

Power on/off button

When the mainboard is switched on, the on/off button lights up blue. To switch the system on, press the button. To shut it down, press the button again; to immediately switch it off, press the button for longer than 4 seconds.

Main power supply input connector

Input range: 100 .. 240 V_{AC} (power cord included).

Digital I/O connector

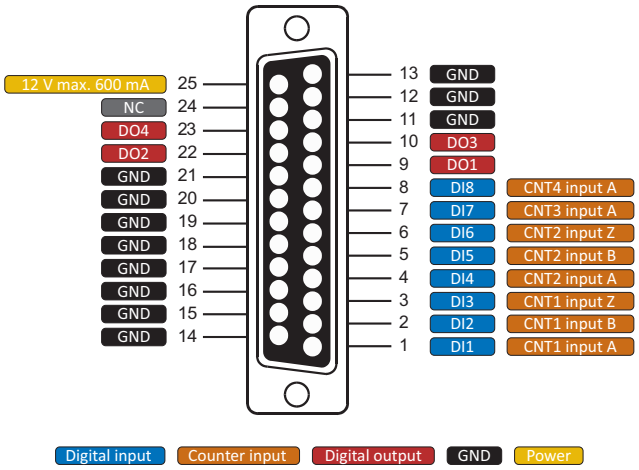


Fig. 6: Pin assignment D-SUB-25 connector

NOTICE

Combined load at D-SUB-9 socket CAN and D-SUB-25 socket digital I/O max. 600 mA at 12 V.

Advanced counter

The supports an advanced counter via the pins 1–8 of the digital I/O connector shown in *Fig. 6*. For information regarding advanced counters refer to *Functional description of advanced counter on page 189* of the *TRION(3) series modules manual*.

Counter and digital I/O

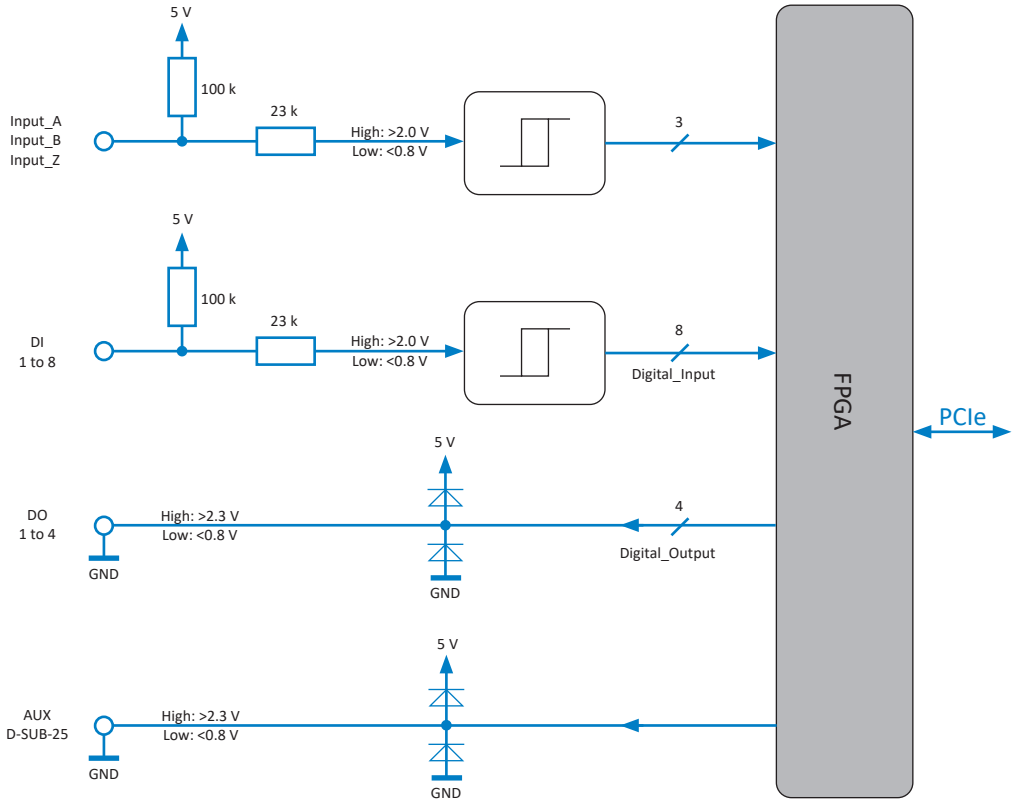


Fig. 7: Counter and digital I/O

CAN interface (D-SUB-9)

NOTICE

Combined load at D-SUB-9 socket CAN and D-SUB-25 socket digital I/O max. 600 mA at 12 V.

Connection

The measurement is carried out via D-SUB cord. The CAN bus is not isolated.

Fig. 8: D-SUB-9 CAN connector pin assignment

High-speed CAN

The high-speed CAN is a differential bus where complementary signals are sent over two wires. The voltage difference between the two wires defines the logical state of the bus. The differential CAN receiver monitors this voltage difference and outputs the bus state with a single-ended output signal.

The high-speed CAN bus topology as well as the possible cable lengths and the recommended termination resistors are specified in the standards ISO-11898 and CiA 102.

The high-speed CAN bus supports bit rates of up to 1 Mbit/s (or >125 kbit/s).

The schematic below will give you an overview of the high-speed CAN bus topology and the termination resistor placement.

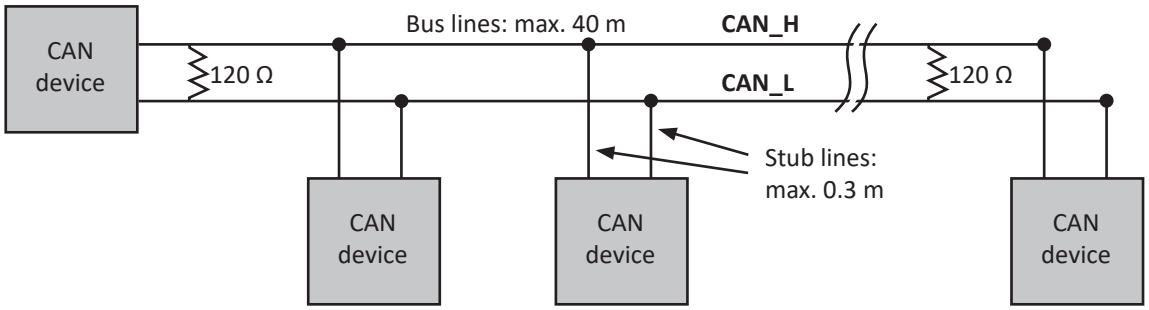


Fig. 9: High-speed CAN

Cable lengths for high-speed CAN bus

The cabling characteristics and the desired bit transmission rate affect the allowable cable length.
ISO-11898 standard specifies a maximum bus length of 40 m and a maximum stub length of 0.3 m with a maximum of 30 nodes for a bitrate of 1 Mbit/s. However, with careful design, users can have longer cables, longer stub lengths, and many more nodes to a bus. A large number of nodes requires a transceiver with high input impedance and each node should be analyzed for signal integrity problems.

Characteristics of two-wire differential bus:

- Impedance: 108 Ω min., 120 Ω nominal, 132 Ω max.
- Length-related resistance: 70 mΩ/m nominal
- Nominal specific propagation delay: 5 ns/m nominal

For further information see ISO-11898 and CiA 102 specifications.

Termination

CAN_H and CAN_L are transmission lines. If the transmission line is not terminated, each signal line causes reflections which can cause communication failures therefore both ends of the cable have to be terminated. If multiple devices are connected only the devices at the ends of the cable need to be terminated. Recommended termination resistors in a high-speed CAN bus topology (according to ISO-11898): 120 Ω.

The CAN interface offers a programmable termination resistance, either high impedance or 120 Ω.

Optional accessory

TRION-CBL-D9-OE-05-00

High quality cable from D-SUB-9 socket to open end, 5 m.

TRION-CBL-D9-CPAD-01-00

High-quality cable from D-SUB-9 socket to XR module, 1 m.

11.6” multi-touch display

The LITE[PA] is equipped with a bright 11.6“ wide screen multi-touch panel (1920 x 1080, Full HD) to control the instrument. Familiar gestures such as pinch and zoom are fully implemented within the operating system.

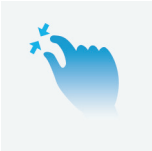
EXAMPLE Drag the sidebar from the right side across the screen to open the channel settings. All other gestures are listed below:

Tap

Tap once on something.

- Open, selects, or activates whatever you tap. Similar to clicking with a mouse.

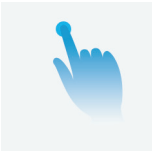
Pinch/stretch



Touch the screen with two fingers, and then move the fingers toward each other (pinch) or away from each other (stretch).

- Zooms in or out of a graph or data.

Tap and hold



Press your finger down and hold for about a second.

- Rearranges objects on your main screen.

Swipe/drag

Drag your finger on the screen.

- Scrolls through recorded data (like scrolling with a mouse).
- Drags the sidebar from the right side across the screen to open the channel setup.

USB interface connectors

The USB 3.1 and USB 2.0 interface connectors meet the standard USB pin assignment.

Intake vent and filter pad

Further information on how to remove filter pad refer to chapter *Filter pad cleaning on page 50*.

PS/2 interface connector (mouse and keyboard)

It is possible to connect an external PS/2 mouse and/or keyboard to the system. The connector meets standard pin assignment.

Display port connectors

Additional to the DVI connector interface the LITE[PA] offers two display port connectors with standard pin assignment.

Chassis terminal (ground connection)

For some kind of measurements, it is necessary to provide the system with an additional ground connection.

Slots for high-voltage and current inputs

The LITE[PA] is equipped with one (LITE[PA]-4) or two (LITE[PA]-8) LITE[PA] measurement boards. Any other TRION(3) measuring board types cannot be used in the system.

Audio I/O interface

The audio I/O interface provides the following connections:

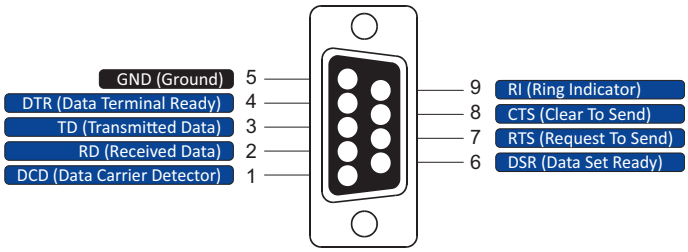
- Line in
- Line out

Dual LAN GBit connector

The LITE[PA] supports 10/100/1000 Dual LAN with standard RJ45 connector.

RS-232 interface connector (COM 1+2)

The RS-232 interface connector (male) is configured as standard RS-232 interface COM 1/COM 2 and can be used for peripheral units.



DVI connector

The DVI connector meets the standard DVI pin assignment.

SSD activity LED

The HDD activity LED illuminates whenever the solid state drive or is being read from or written to.

NOTICE

To avoid data loss, do not disconnect the device from the power supply while the operating system is still accessing files on the drive.

Working with the system

Hardware

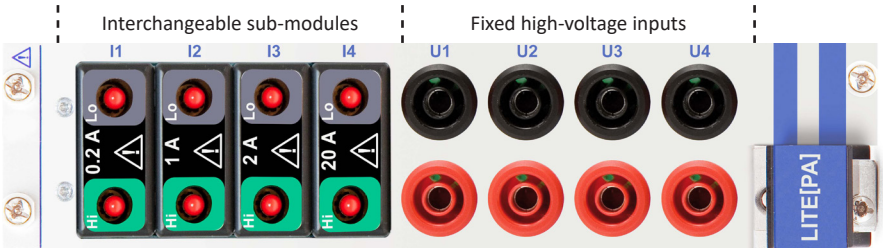
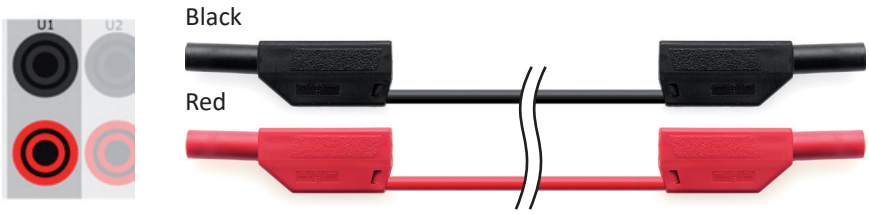


Fig. 10: Connection ports

Fixed high-voltage inputs

Fast sampling, high bandwidth and minimum capacity to earth are just a few outstanding performance qualities of the high voltage inputs. The high input impedance allows high continuous voltage levels with a very low temperature drift. Although small outline, the safety category is on a very high level (CAT III 1000V).



WARNING

Risk of injury due to electric shock

Voltage measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

Maximum input voltage

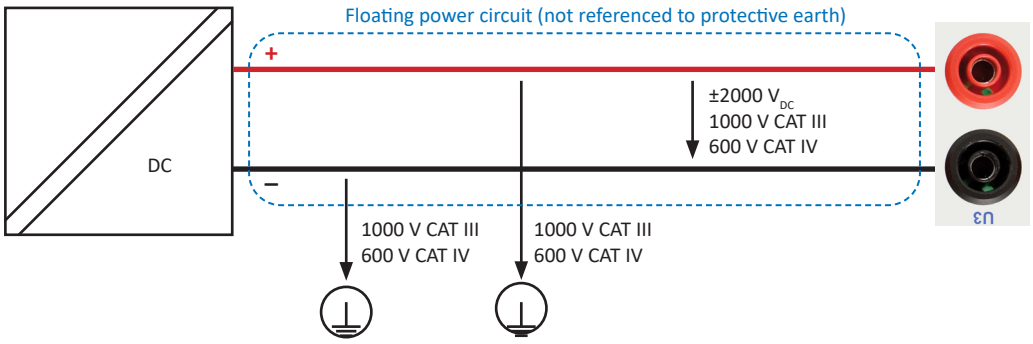


Fig. 11: Maximum input voltages

Interchangeable sub-modules

The measurement boards have 4 highly flexible voltage or current inputs. The 4 slots can be populated with four different direct current measurement modules or with three different D-SUB-9 modules to connect almost any kind of current transducer. Alternatively, this connector can also be used to measure any auxiliary ±10 V signal (e.g. such as windspeed or water flow).

If more than 4 voltage inputs are required, the 4 slots can be also populated with our latest interchangeable voltage input sub-modules. Choose from a low-voltage, isolated 5 V or an isolated, 600 V CATII rated sub-module.

The following sub-modules can be used with the LITE[PA] measurement boards.

Type	Range	Bandwidth	Isolated
TRION-SUB-5V	5 V_{RMS} (±10 V_{PEAK})	300 kHz	Yes
TRION-SUB-XV	600 V_{RMS} (±1000 V)[1)] 60 V_{RMS} (±100 V) 6 V_{RMS} (±10 V) 0.6 V_{RMS} (±1 V)	300 kHz	Yes
TRION-POWER-SUB-CUR-20A-1B	20 A_{RMS} (±40 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-2A-1B	2 A_{RMS} (±4 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-1A-1B	1 A_{RMS} (±2 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-CUR-02A-1B	0.2 A_{RMS} (±0.4 A_{PEAK})	300 kHz	Yes
TRION-POWER-SUB-dLV-1	5 V_{RMS} (±10 V_{PEAK})	100 kHz	No
TRION-POWER-SUB-dLV-5V	5 V_{RMS} (±10 V_{PEAK})	5 MHz	No
TRION-POWER-SUB-dLV-1V	1 V_{RMS} (±2 V_{PEAK})	5 MHz	No

Tab. 2: TRION sub-modules overview

[1)] Max. allowed input: 600 V CAT II (850 V_{PEAK}).

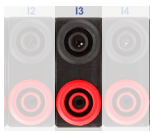
TRION-SUB-5V

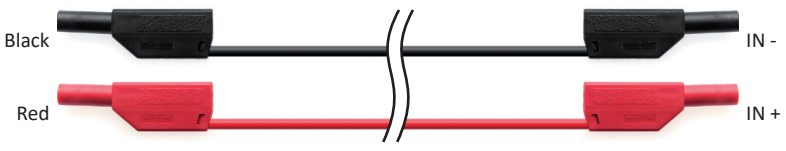
TRION-SUB-5V				
Input range	5 V_{RMS} (±10 V_{PEAK}) CF=2			
Resolution	20 bit			
1 year accuracy (23 °C ±5 °C)	DC	±0.02 % of reading ±0.005 % of range		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 100 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	100 kHz to 200 kHz	±(0.04 % * f) of reading	f: frequency in kHz	
Gain drift	20 ppm / °C			
Offset drift	1 µV / °C			
Typical THD	-102 dB			
Typical CMRR	>140 dB @ 50 Hz; >106 dB @ 10 kHz; >102 dB @ 100 kHz			
Bandwidth (-3 dB)	300 kHz			
Rated input voltage to earth according to EN 61010-2-30	300 V CAT III / 600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min); 35 kV/µs transient immunity			
Common mode voltage	600 V_{RMS}			
Overvoltage protection	1000 V_{PEAK} or 600 V_{RMS} (1 min)			
Input impedance	5 MΩ; 22 pF			
Isolation (earth) resistance	100 GΩ; 4 pF (IN- to GND)			
Connector	Safety banana sockets			
	SNR	SFDR[1)]	ENOB[2)]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µV]
0.1 kS/s	134	145	22.0	5
1 kS/s	126	148	20.6	14
10 kS/s	118	145	19.4	44
100 kS/s	109	138	17.8	155
1000 kS/s	98	135	16.1	596
2000 kS/s	98	132	16.1	598

Tab. 3: TRION-SUB-5V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Voltage measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

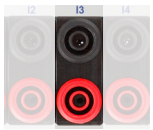
TRION-SUB-XV

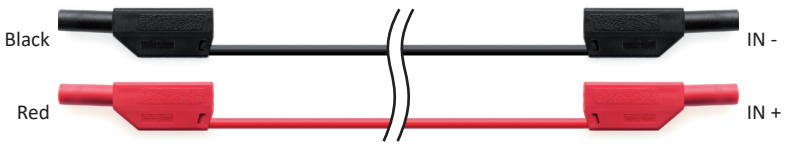
TRION-SUB-XV				
Input range	600 V_{RMS} (±1000 V)[1]	60 V_{RMS} (±100 V)	6 V_{RMS} (±10 V)	0.6 V_{RMS} (±1 V)
Resolution	16-bit			
1 year accuracy (23 °C ±5 °C)	DC (600 V, 60 V range)	±0.03 % of reading ±0.01 % of range		
	DC (6 V range)	±0.02 % of reading ±0.01 % of range		
	DC (0.6 V range)	±0.02 % of reading ±150 µV		
	0.5 Hz to 500 Hz	±0.03 % of reading		
	>500 Hz to 100 kHz	±(0.06 % * f) of reading		f: frequency in kHz
Gain drift	25 ppm / °C			
Offset drift	2 µV / °C			
Typical THD	-90 dB			
Typical CMRR	≤6 V range: >140 dB @ 50 Hz; >125 dB @1 kHz; >115 dB @ 10 kHz; >94 dB @ 100 kHz			
	>6 V range: >100 dB @ 50 Hz; >90 dB @ 1 kHz; >70 dB @ 10 kHz; >50 dB @ 100 kHz			
Bandwidth (-3 dB)	300 kHz			
Rated input voltage to earth acc. to EN 61010-2-30	300 V CAT III / 600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min); 35 kV/µs transient immunity			
Common mode voltage	600 V_{RMS}			
Overvoltage protection	1000 V_{PEAK} or 600 V_{RMS}			
Input impedance	10 MΩ; t.b.d. pF			
Isolation (earth) resistance	100 GΩ; 4 pF (IN- to GND)			
Connector	Safety banana sockets			

	0.6 V				6 V				60 V				600 V			
	SNR	SFDR[1]	ENOB[2]	Noise	SNR	SFDR[1]	ENOB[2]	Noise	SNR	SFDR[1]	ENOB[2]	Noise	SNR	SFDR[1]	ENOB[2]	Noise
Sample rate	[dB]	[dB]	[Bit]	[mV_{PP}]	[dB]	[dB]	[Bit]	[mV_{PP}]	[dB]	[dB]	[Bit]	[mV_{PP}]	[dB]	[dB]	[Bit]	[mV_{PP}]
0.1 kS/s	111.0	t.b.d	18.1	0.0	120.1	t.b.d	19.7	0.0	120.1	t.b.d	19.7	0.0	100.1	t.b.d	16.3	3.5
1 kS/s	109.4	t.b.d	17.9	0.1	111.0	t.b.d	18.1	0.1	111.0	t.b.d	18.1	0.1	113.5	t.b.d	18.6	9.0
10 kS/s	101.4	t.b.d	16.6	0.1	84.3	t.b.d	13.7	0.4	84.3	t.b.d	13.7	0.4	104.9	t.b.d	17.1	34.0
100 kS/s	92.9	t.b.d	15.1	0.3	94.7	t.b.d	15.4	1.1	94.7	t.b.d	15.4	1.1	95.2	t.b.d	15.5	110.0
300 kS/s	87.7	122.0	14.3	0.5	89.4	122.0	14.6	2.4	89.4	122.0	14.6	2.4	89.9	122.0	14.6	220.0
1 MS/s	83.4	122.0	13.6	1.3	82.3	t.b.d	13.4	4.7	82.3	t.b.d	13.4	4.7	83.0	122.0	13.5	470.0

Tab. 4: TRION-SUB-XV

1) Max. allowed input 600 V CAT II (850 V_{PEAK}) 2) SFDR excluding harmonics 3) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Voltage measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-CUR-20A-1B

TRION-POWER-SUB-CUR-20A-1B			
Range	20 A_{RMS} (±40 A_{PEAK})		
Resolution	20 bit		
1 year accuracy (23 °C ±5 °C)[1)2)]	DC	±0.02 % of reading ±0.02 % of range[3)]	
	0.5 Hz to 1 kHz	±0.03 % of reading	
	1 kHz to 5 kHz	±0.15 % of reading	
	5 kHz to 10 kHz	±0.35 % of reading	
	10 kHz to 50 kHz	±(0.3 % + 0.05 % * f) of reading	f: frequency in kHz
	50 kHz to 300 kHz	±(0.10 % * f) of reading	f: frequency in kHz
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II		
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity		
Bandwidth	300 kHz		
Connector	Safety banana plugs		
Overcurrent protection	50 A_{PEAK} or 40 A_{RMS} (1 s)		
Thermal current limit	20 A_{RMS}		
Input resistance	2 mΩ		

Typical signal to noise ratio, spurious free SNR, effective number of bits[4)]

	SNR	SFDR[5)]	ENOB[6)]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[mA]
0.1 kS/s	101	117	16.5	0.8
1 kS/s	100	119	16.3	1.4
10 kS/s	98	113	16.0	2.1
100 kS/s	93	110	15.2	3.9
1000 kS/s	85	110	13.8	10.3
2000 kS/s	84	107	13.7	10.9

Tab. 5: TRION-POWER-SUB-CUR-20A-1B

1) For self-generated heat caused by current input, add 0.00015 × I² % of reading + 20 × I² µA to the current accuracy. 'I' is the current reading [A]. The influence from self-generated heat continues until the temperature of the shunt resistor inside the DEWE2-Chassis lowers even if the current input changes to a small value.

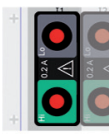
2) Below 1 % of range, add 10 ppm of range

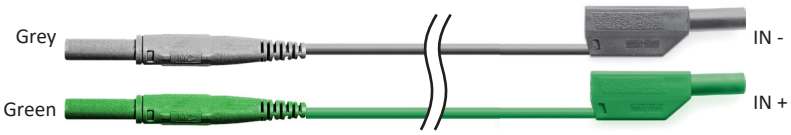
3) Add 0.03 % of range with no zero level.

4) LP filter in auto mode

5) SFDR excluding harmonics

6) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

WARNING

Risk of injury due to heat or fire

Always use the dedicated measurement leads which come with your module, or appropriate measurement leads, which are rated for at least 20 A continuous current.

TRION-POWER-SUB-CUR-2A-1B

TRION-POWER-SUB-CUR-2A-1B				
Range	2 A_{RMS} (±4 A_{PEAK})			
Resolution	20 bit			
1 year accuracy (23 °C ±5 °C)[1]	DC	±0.02 % of reading ±0.02 % of range[2]		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 30 kHz	±0.1 % of reading		
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz	
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity			
Bandwidth	300 kHz			
Connector	Safety banana plugs			
Overcurrent protection	10 A_{PEAK} or 5 A_{RMS} (1 s)			
Thermal current limit	3 A_{RMS}			
Input resistance	50 mΩ			
Typical signal to noise ratio, spurious free SNR, effective number of bits[3]				
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µA]
0.1 kS/s	110	125	18.0	34.8
1 kS/s	107	126	17.5	47.2
10 kS/s	105	122	17.1	78.2
100 kS/s	100	120	16.3	172.6
1000 kS/s	91	114	14.8	541.2
2000 kS/s	90	114	14.7	553.1

Tab. 6: TRION-POWER-SUB-CUR-2A-1B

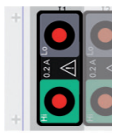
1) Below 1 % of range, add 25 ppm of range

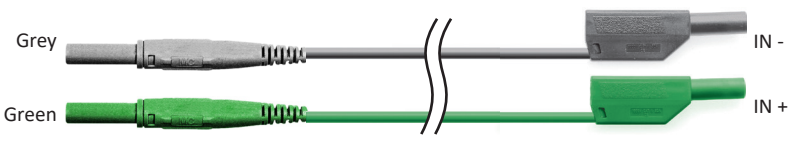
2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-CUR-1A-1B

TRION-POWER-SUB-CUR-1A-1B				
Range	1 A_{RMS} (±2 A_{PEAK})			
Resolution	20 bit			
1 year accuracy (23 °C ±5 °C)[1]	DC	±0.02 % of reading ±80 µA[2]		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 30 kHz	±0.1 % of reading		
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz	
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity			
Bandwidth	300 kHz			
Connector	Safety banana plugs			
Overcurrent protection	4 A_{PEAK} or 2 A_{RMS} (1 s)			
Thermal current limit	1 A_{RMS}			
Input resistance	500 mΩ			
Typical signal to noise ratio, spurious free SNR, effective number of bits[3]				
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µA]
0.1 kS/s	131	149	21.5	1.4
1 kS/s	125	149	20.5	3.9
10 kS/s	116	144	19.0	12.6
100 kS/s	106	137	17.3	47.0
1000 kS/s	96	134	15.7	161.0
2000 kS/s	95	130	15.5	162.0

Tab. 7: TRION-POWER-SUB-CUR-1A-1B

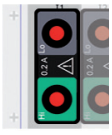
1) Below 1 % of range, add 25 ppm of range

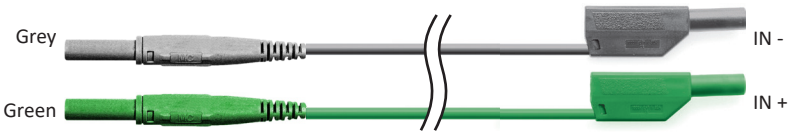
2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-CUR-02A-1B

TRION-POWER-SUB-CUR-02A-1B				
Range	0.2 A_{RMS} (±0.4 A_{PEAK})			
Resolution	20 bit			
1 year accuracy (23 °C ±5 °C)[1]	DC	±0.02 % of reading ±0.02 % of range[2]		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 30 kHz	±0.1 % of reading		
	30 kHz to 200 kHz	±(0.015 % * f) of reading	f: frequency in kHz	
	200 kHz to 300 kHz	±(0.1 % * f) of reading	f: frequency in kHz	
Rated input voltage to earth according to EN 61010-2-30	600 V CAT II			
Isolation voltage	3750 V_{RMS} (1 min), 35 kV/µs transient immunity			
Bandwidth	300 kHz			
Connector	Safety banana plugs			
Overcurrent protection	2 A_{PEAK} or 1 A_{RMS} (1 s)			
Thermal current limit	0.5 A_{RMS}			
Input resistance	500 mΩ			
Typical signal to noise ratio, spurious free SNR, effective number of bits[3]				
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µA]
0.1 kS/s	108	128	17.6	3.6
1 kS/s	107	123	17.5	5.6
10 kS/s	104	121	17.0	9.2
100 kS/s	99	114	16.2	17.3
1000 kS/s	91	114	14.8	51.3
2000 kS/s	90	114	14.7	54.9

Tab. 8: TRION-POWER-SUB-CUR-02A-1B

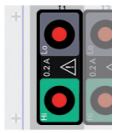
1) Below 1 % of range, add 25 ppm of range

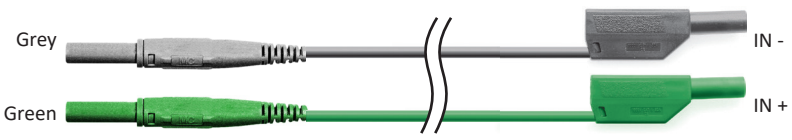
2) Add 0.03 % of range with no zero level.

3) LP filter in auto mode

4) SFDR excluding harmonics

5) ENOB calculated from SNR





WARNING

Risk of injury due to electric shock

Current measurement on lines above 33 V_{RMS}, 46.7 V_{PEAK} or 70 V_{DC} is only permitted with rated safety test leads.

TRION-POWER-SUB-dLV-1

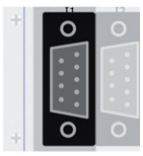
TRION-POWER-SUB-dLV-1				
Range	5 V_{RMS} (±10 V_{PEAK}) **NOT ISOLATED** ⚠			
Resolution	18-bit			
1 year accuracy (23 °C ±5 °C)[1]	DC	±0.02 % of reading ±0.02 % of range		
	0.5 Hz to 5 kHz	±0.03 % of reading		
	5 kHz to 30 kHz	±(0.01 % * f) of reading	f: frequency in kHz	
	30 kHz to 50 kHz	±(0.02 % * f) of reading	f: frequency in kHz	
	50 kHz to 100 kHz	±(0.1 % * f) of reading	f: frequency in kHz	
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Isolation voltage	None. Use with isolated current transducer.			
Overvoltage protection	±30 V_{DC}			
Bandwidth	100 kHz			
Connector	D-SUB-9			
Input resistance	1 MΩ			
Sensor supply (±9 V)	Max. 40 mA			

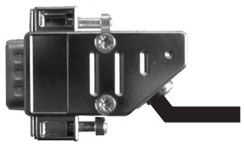
	SNR	SFDR[4]	ENOB[5]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µV]
0.1 kS/s	129	150	21.1	14.3
1 kS/s	119	142	19.5	45.3
10 kS/s	109	139	17.8	163.3
100 kS/s	99	131	16.2	590.1
1000 kS/s	94	124	15.3	1337.5
2000 kS/s	92	123	15.0	1375.7

Tab. 9: TRION-POWER-SUB-dLV-1

1) Below 1 % of range, add 25 ppm of range

2) Add 0.03 % of range with no zero level.





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-1 modules are not isolated.

TRION-POWER-SUB-dLV-5V

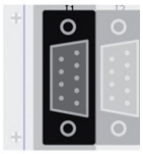
TRION-POWER-SUB-dLV-5V				
Range	5 V_{RMS} (±10 V_{PEAK}) **NOT ISOLATED** ⚠			
Sampling rate / resolution	100 S/s to 2 MS/s		24-bit	
1 year accuracy (23 °C ±5 °C)	DC	±0.015 % of reading ±200 µV		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 500 kHz	±(0.006 % * f) of reading		f: frequency in kHz
	500 kHz to 3000 kHz	±(0.006 % * f) of reading		f: frequency in kHz
Gain drift	10 ppm / °C			
Offset drift	10 µV / °C			
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Bandwidth (-3 dB)	5 MHz			
Isolation voltage	None. Use with isolated current transducer.			
Common mode voltage	±10 V_{DC}			
Overvoltage protection	±300 V_{DC}			
Connector	D-SUB-9			
Input impedance	5 MΩ, 15 pF			
Sensor supply (±9 V)	Max. 40 mA			

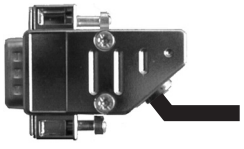
Sample rate	SNR [dB]	SFDR[1] [dB]	ENOB[2] [Bit]	$Noise_{PP}$ [µV]
0.1 kS/s	125	138	20.5	13
1 kS/s	122	135	20.0	21
10 kS/s	116	134	19.0	54
100 kS/s	108	134	17.7	152
1000 kS/s	99	134	16.2	489
2000 kS/s	96	134	15.7	712

Tab. 10: TRION-POWER-SUB-dLV-5V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-xV modules are not isolated.

TRION-POWER-SUB-dLV-1V

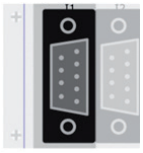
TRION-POWER-SUB-dLV-1V				
Range	1 V_{RMS} (±2 V_{PEAK}) **NOT ISOLATED** ⚠			
Sampling rate / resolution	100 S/s to 2 MS/s		24-bit	
1 year accuracy (23 °C ±5 °C)	DC	±0.015 % of reading ±200 µV		
	0.5 Hz to 10 kHz	±0.03 % of reading		
	10 kHz to 500 kHz	±(0.006 % * f) of reading		f: frequency in kHz
	500 kHz to 3000 kHz	±(0.006 % * f) of reading		f: frequency in kHz
Gain drift	10 ppm / °C			
Offset drift	10 µV / °C			
Typical THD	-100 dB			
Typical CMRR	>70 dB @ 50 Hz; >65 dB @ 10 kHz; >45 dB @ 100 kHz			
Bandwidth (-3 dB)	5 MHz			
Isolation voltage	None. Use with isolated current transducer.			
Common mode voltage	±10 V_{DC}			
Overvoltage protection	±300 V_{DC}			
Connector	D-SUB-9			
Input impedance	5 MΩ, 15 pF			
Sensor supply (±9 V)	Max. 40 mA			

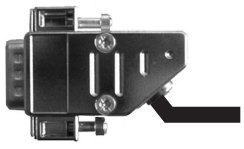
	SNR	SFDR[1)]	ENOB[2)]	$Noise_{PP}$
Sample rate	[dB]	[dB]	[Bit]	[µV]
0.1 kS/s	120	133	19.6	4.8
1 kS/s	117	130	19.2	6.3
10 kS/s	111	129	18.2	16.0
100 kS/s	104	129	17.1	49.0
1000 kS/s	95	129	15.5	162.0
2000 kS/s	92	129	15.0	243.0

Tab. 11: TRION-POWER-SUB-dLV-1V

1) SFDR excluding harmonics

2) ENOB calculated from SNR





Pin 1:	TEDS	Pin 6:	n.c.
Pin 2:	IN+	Pin 7:	IN-
Pin 3:	n.c.	Pin 8:	n.c.
Pin 4:	GND (not isolated)	Pin 9:	-9 V (40 mA max.)
Pin 5:	+9 V (40 mA max.)		

WARNING

Risk of injury due to electric shock

TRION-POWER-SUB-dLV-xV modules are not isolated.

Connection expample

Module	LITE[PA] with TRION-SUB-dLV-1V[1)]
Clamp supply required	No
Sensor	Current probe with voltage output signal

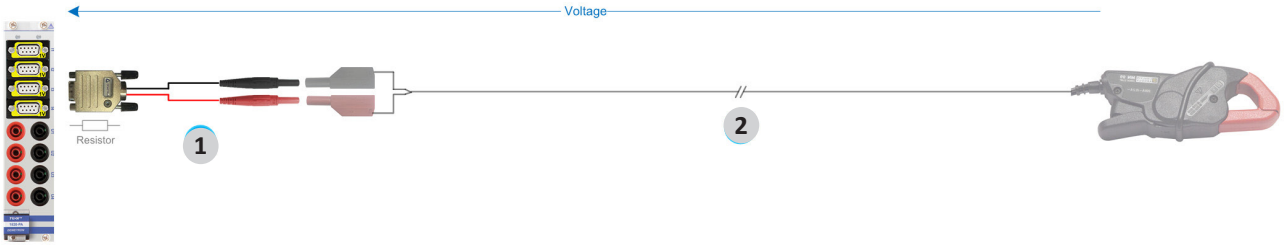


Fig. 12: Connection example

No.	Article	Description
1.	Adapter DB9 to banana sockets	On request; an internal resistor could be required depending on sensor)
2.	SE-CUR-CLAMP-x-B e.g.	Current probe or clamp with voltage output

Tab. 12: Articles for solution

[1)] The connection scheme shown above also works with TRION-SUB-dLV-5V sub modules.

Installing the 19” mounting brackets

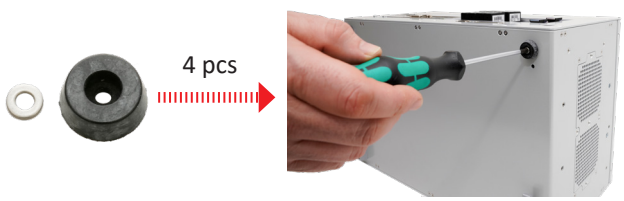
To install the LITE[PA] in a 19“ control cabinet, the feet and carrying handles must be removed. Afterwards the mounting brackets need to be attached. To do this, carry out the following steps:

1. Remove the carrying handles on both sides of the insturment.

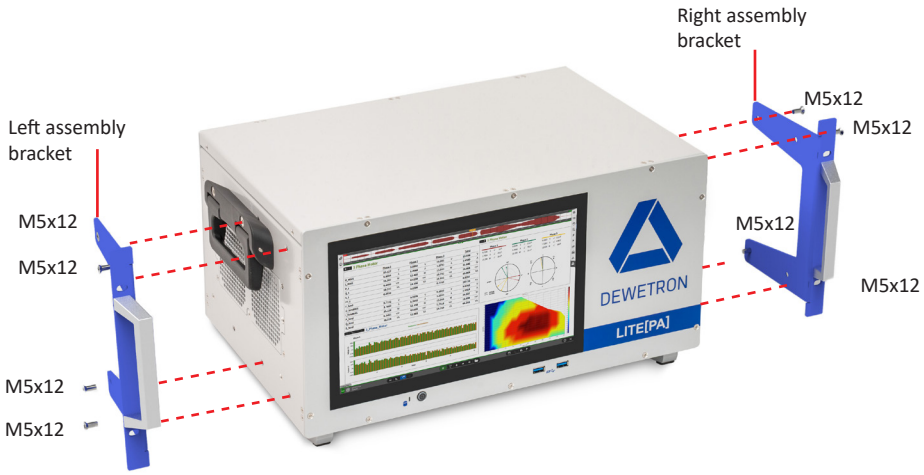
2. Remove the feet on the bottom of the instrument by unscrewing them.

3. ***INFORMATION*** If you leave them attached, the device will take up one more height unit in the control cabinet.

4. Install rubber caps instead of the feet.



5. Fasten the mounting brackets on the left and right side of the device with 4 M5x12 screws on each side.



The mounting kit installation is now finished and the device is ready to be installed in a 19“ control cabinet.

NOTICE

When installing the 19" mounting brackets, the maximum length for screws is 12 mm. If a screw gets lost, replace it with M5x12 countersunk head screw only. Otherwise the display or the power supply could get damaged!

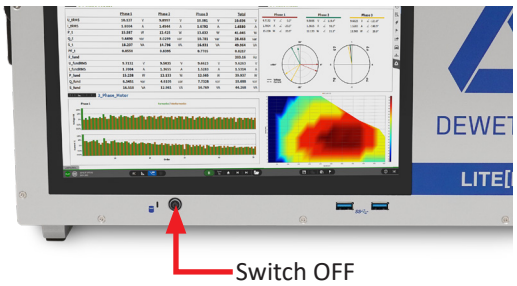
Exchanging TRION sub-modules

NOTICE

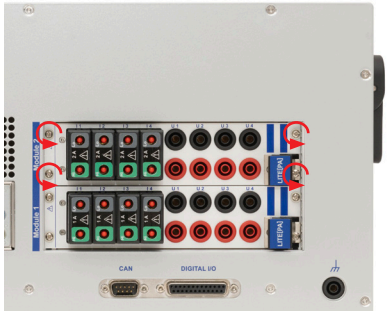
Proper ESD precautions must be taken to avoid any damage to the unit.

Proceed as follows to exchange a TRION sub-module:

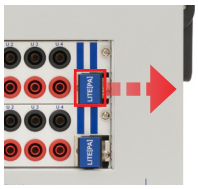
1. Switch off the instrument and unplug all connected cables.



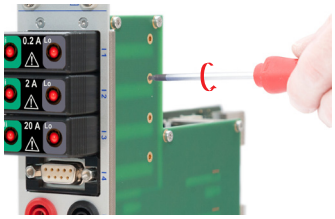
2. Loosen the screws at the top and bottom of the LITE[PA] measurment board on the back side of the instrument.



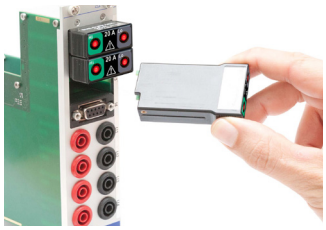
3. Pull down the injector/ejector handle and remove the LITE[PA] measurement board from the housing.



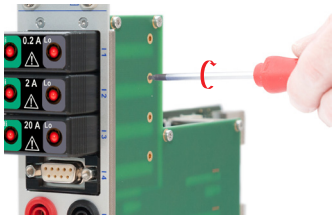
4. Loosen the torx screw (M2x4, TX6) which secures the sub-module of the channel you want to replace.



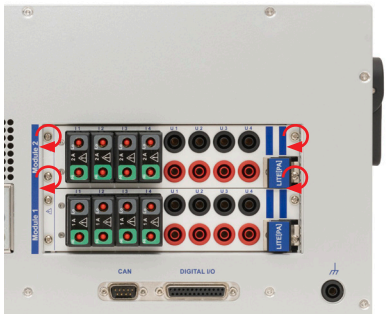
5. Insert the new sub-module.



6. Secure the replaced sub-module with the torx screw (M2x4, TX6). Max. torque: 0.2 Nm.



7. Insert the measurement board into the housing until a resistance appears.
8. Pull up the injector/ejector handle to latch the board. Tighten the screws at the top and bottom of the LITE[PA] measurement board (4x) to secure the board.



The sub-module is now exchanged and the system is ready to use.

Cooling considerations

The intake vent of the LITE[PA] is located at the left side of the chassis, and the cooling exhaust vent for the LITE[PA] on the rear of the chassis.

NOTICE

Adequate clearance between the chassis and surrounding equipment or blockages must be maintained to ensure proper cooling of the chassis power supply as well as the modules plugged into the chassis.

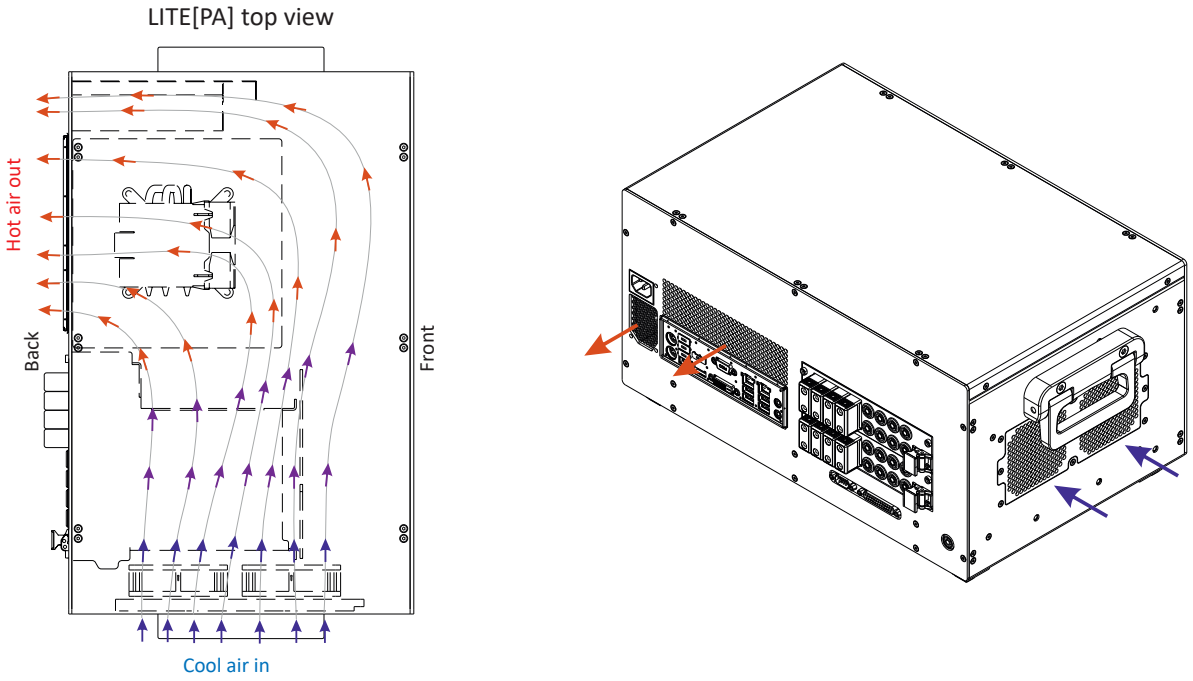


Fig. 13: Cooling stream

System recovery

For more information regarding a total recovery refer to the corresponding total recovery technical reference manual shipped with your DEWE3 system.

Software

Further information on how to operate with OXYGEN find in the corresponding user manual available at: https://ccc.dewetron.com/pl/oxygen

For a more detailed explanation of the OXYGEN software refer to the OXYGEN Technical Reference Manual, which is available at *https://ccc.dewetron.com/pl/oxygen*.

Starting OXYGEN

When starting OXYGEN, the measurement screen is displayed. OXYGEN will instantly start to acquire data but will not store it yet. *Fig. 14* shows an overview of the measurement screen and some important buttons and menu tabs.

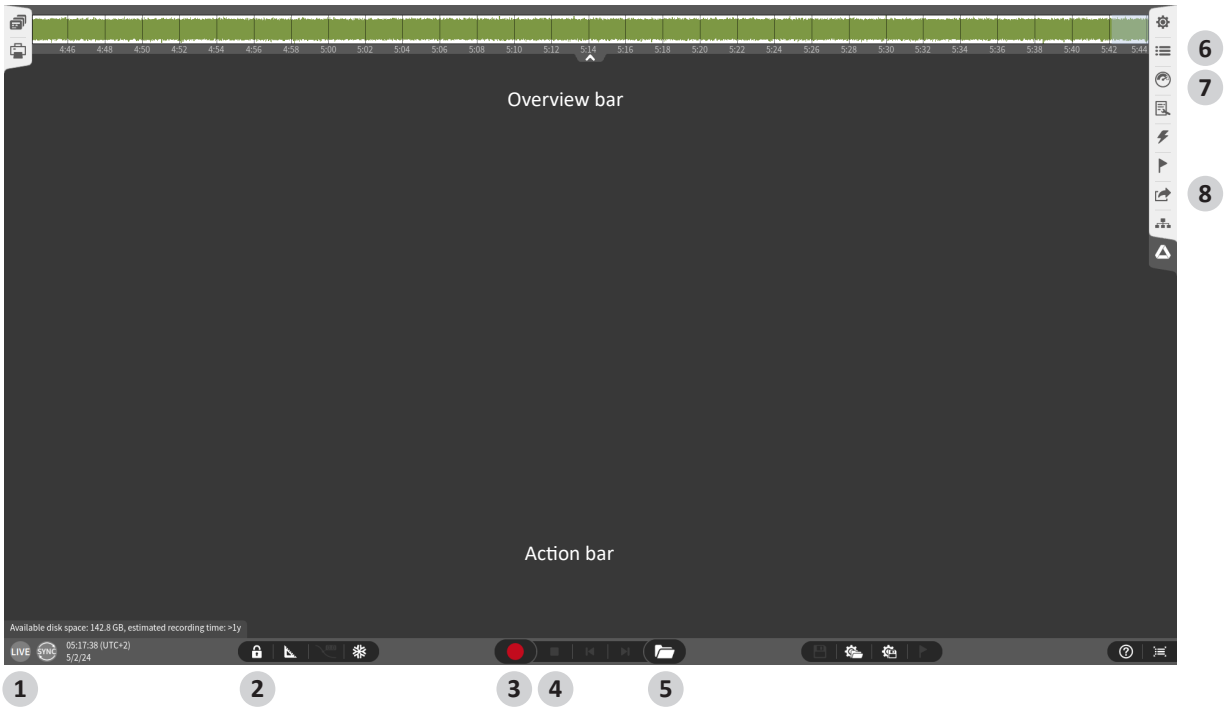


Fig. 14: Measurement screen

1. Software mode indicator
2. Design mode
3. Record
4. Stop
5. Open data file
6. Data channel list menu
7. Instruments menu
8. Export menu

Connect and set up signals and sensors

It is possible to directly measure ±10 V or to use MSIs to expand the input signal possibilities:

Open the Data Channel List by double clicking/tapping on the menu tab on the right side or by swiping it over the whole measurement screen, seen in *Fig. 15*.

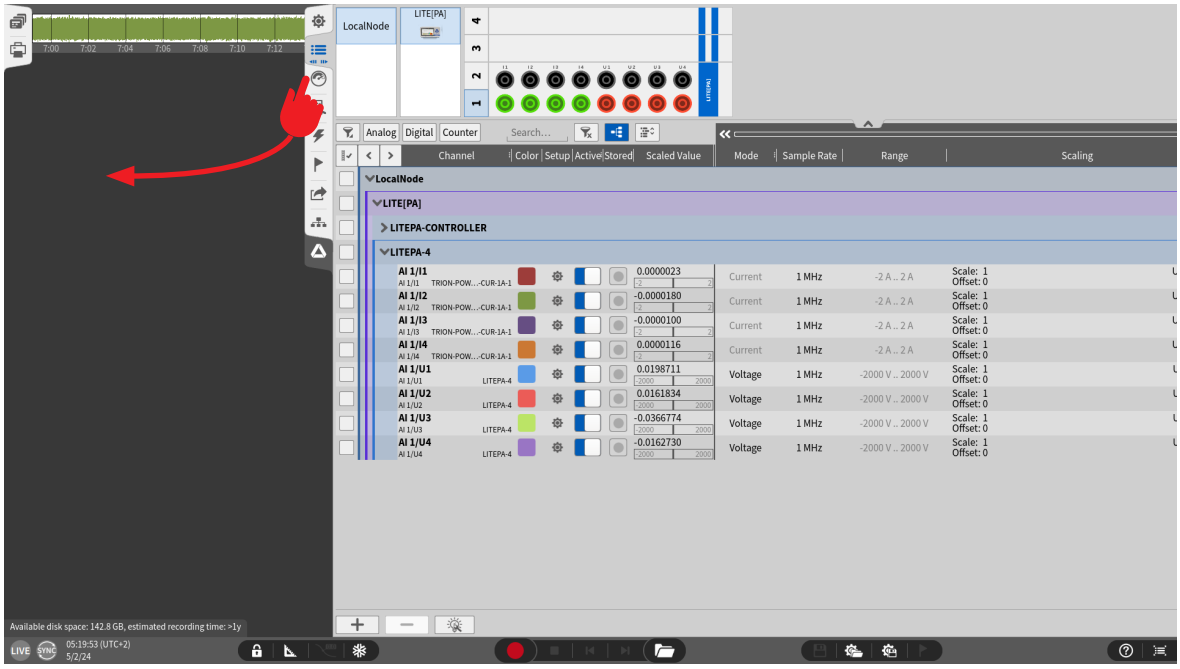


Fig. 15: Expanding data channel list

Changing channel settings

The next step is to change the channel settings:

1. Click on the channel name in the list to enter a new name.
2. Alternatively, the channel settings will also open by clicking on the gear button (see *Fig. 16*).

There different settings are available

- Sensor scaling (unit and scaling or sensitivity factor)
- Table scaling for a non-linear scaling

All settings are automatically saved when entered and do not have to be saved separately.

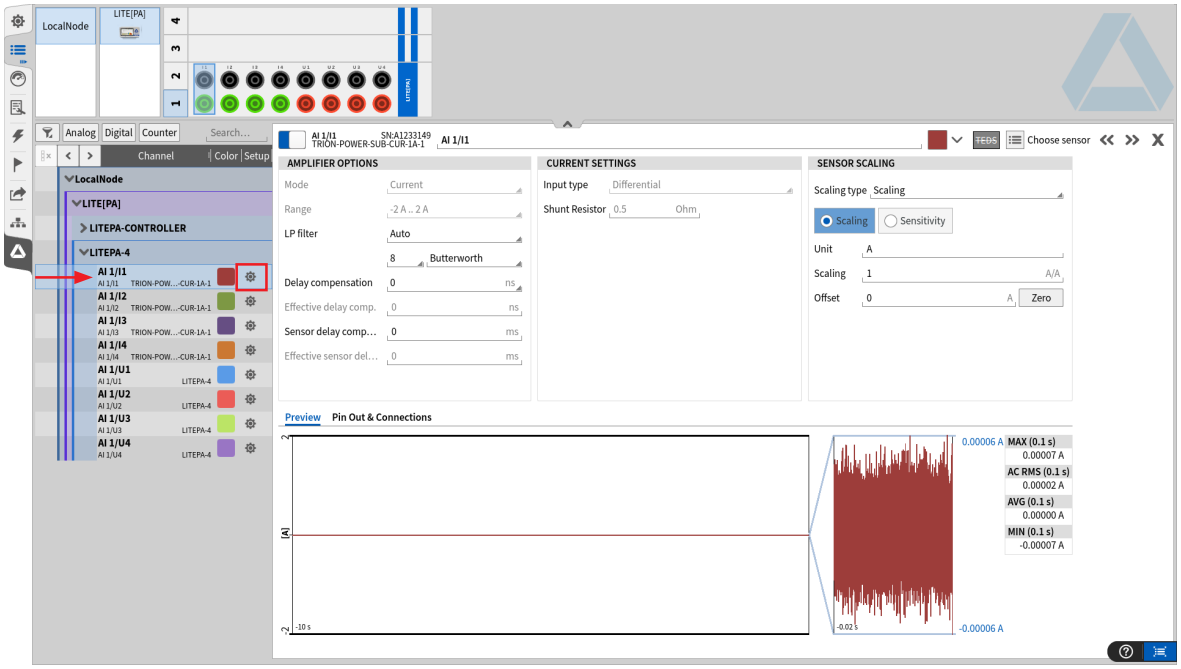


Fig. 16: Changing channel settings

Create a Power Group

To create a Power Group there are 2 methods, one without pre-selecting the channels and one with channel pre-selection. Both methods require a switch to the channel list.

Method 1 – without channel pre-selection

To create a Power Group without channel pre-selection proceed as follows:

1. Click on the “+” button on the bottom left on the, see ① in *Fig. 17*.
2. Choose the Power Group tab in the optional calculations and click “add”, see ② *Fig. 17*.

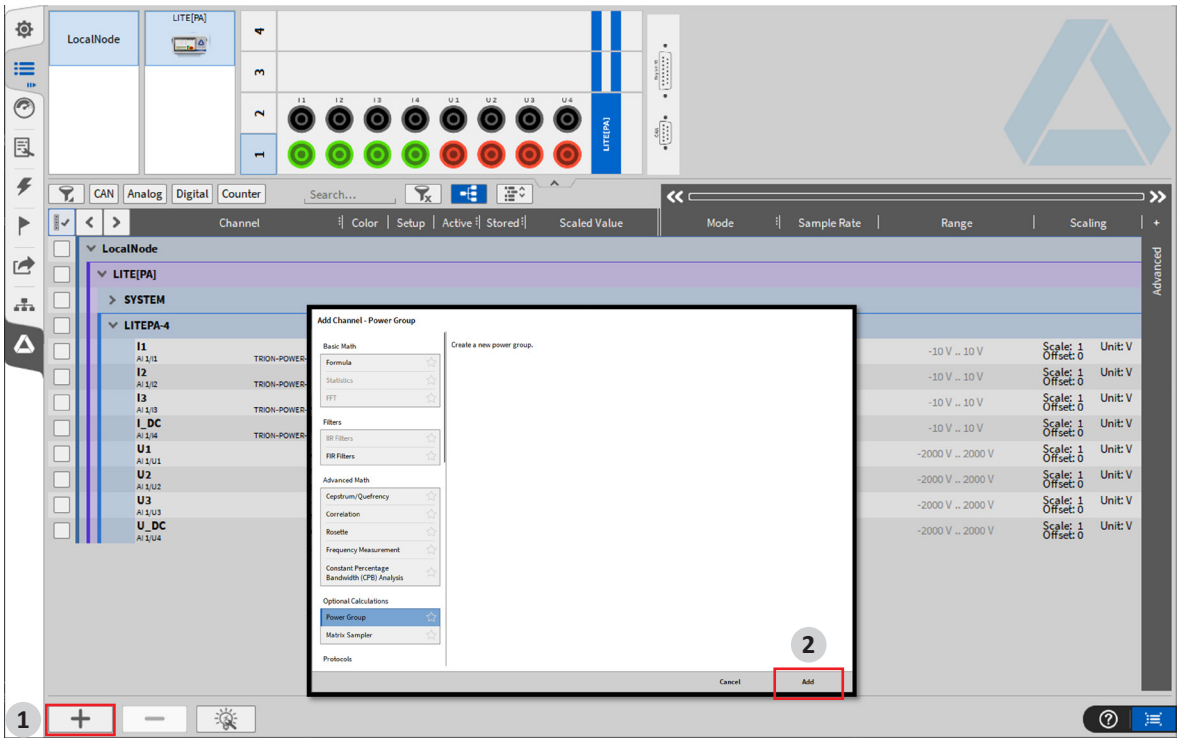


Fig. 17: Create a Power Group without channel pre-selection (1)

3. Choose the wiring type fitting your application, e.g. three phase, three wire, in line-line configuration, see ③ *Fig. 18*.

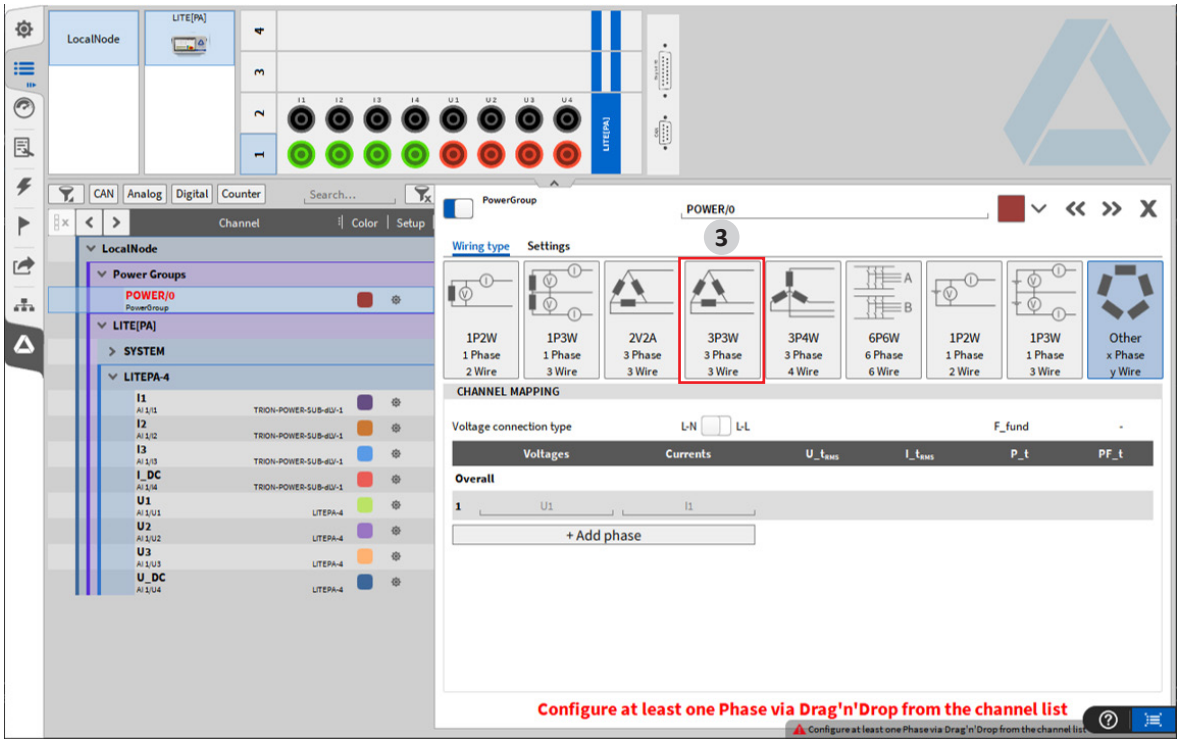


Fig. 18: Create a Power Group without channel pre-selection (2)

4. Drag‘n‘drop voltages and currents to the wiring schematic. If necessary, check the unit of the channel. The first voltage is used as synchronization basis, indicated in green.

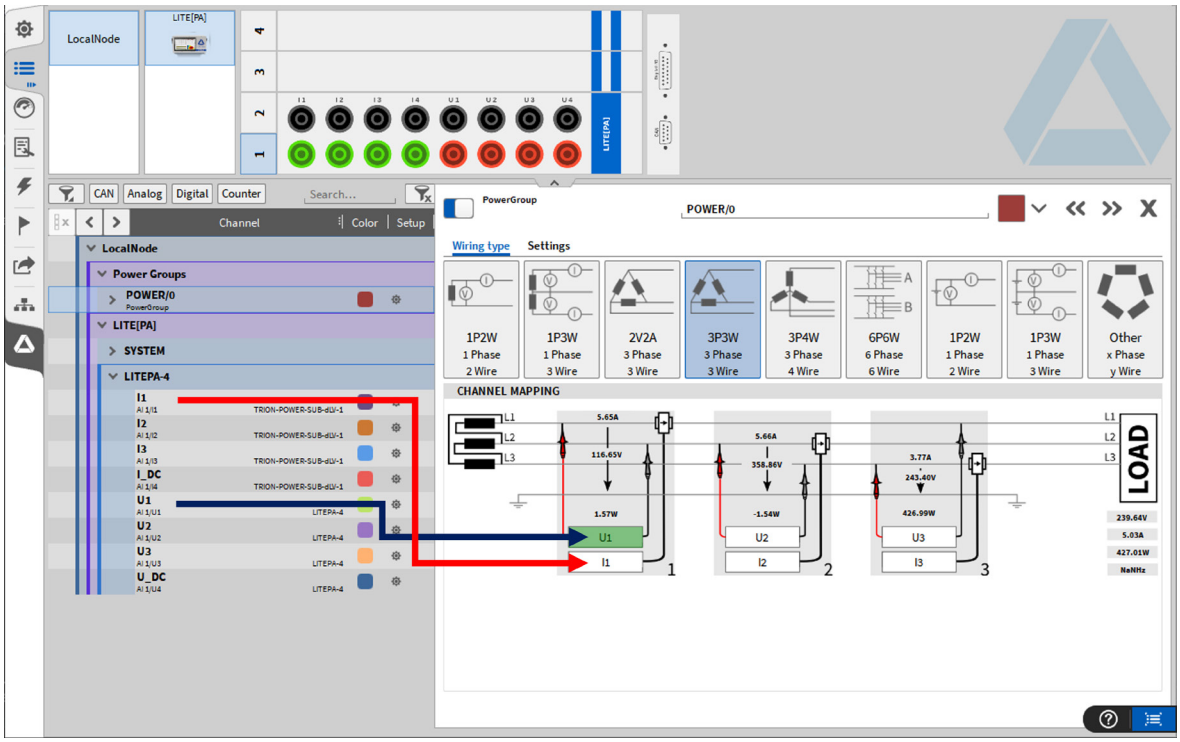


Fig. 19: Create a Power Group without channel pre-selection (3)

The Power Group is now ready for further use.

Method 2 – with channel pre-selection

To create a Power Group with channel pre-selection proceed as follows:

5. Select the channels for voltage and current, starting with the first voltage, see ① to ⑥ in *Fig. 20*, and click on the light bulb symbol at the bottom left, see ⑦ in *Fig. 20*.

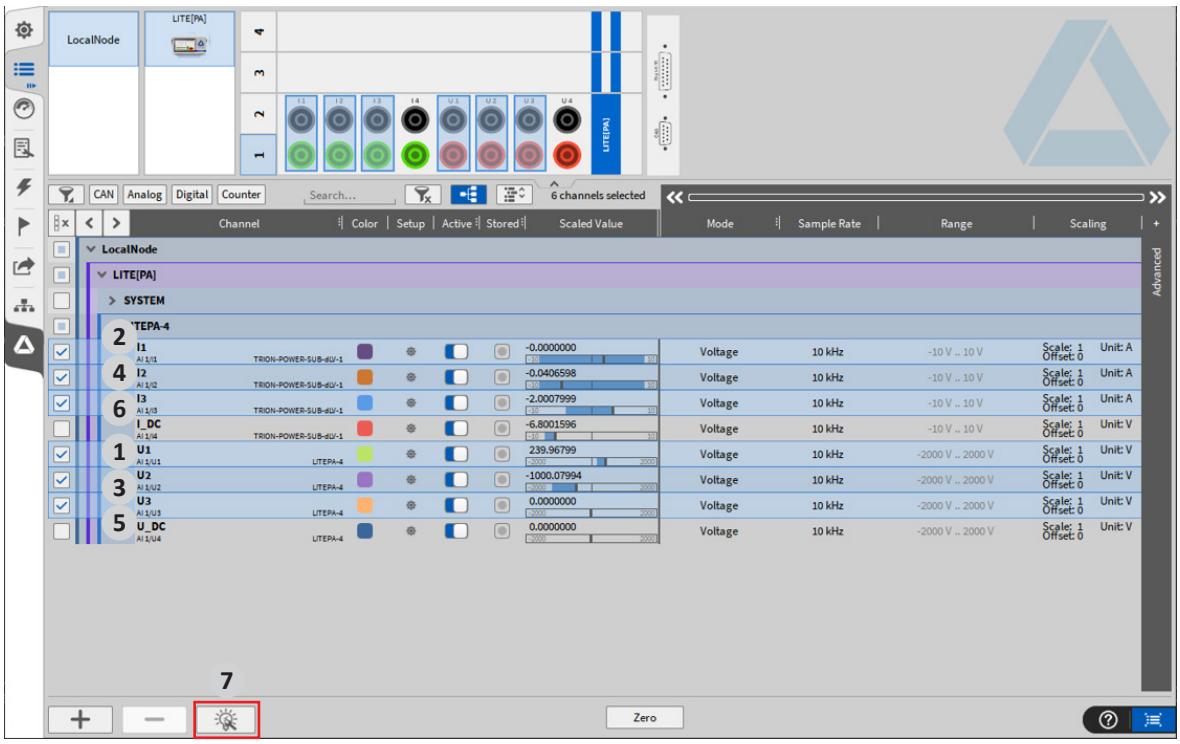


Fig. 20: Create a Power Group with channel pre-selection (1)

6. With this method, the wiring type is selected as three-phase, three-wire, star connection by default. This can be changed by simply clicking on a different wiring type.

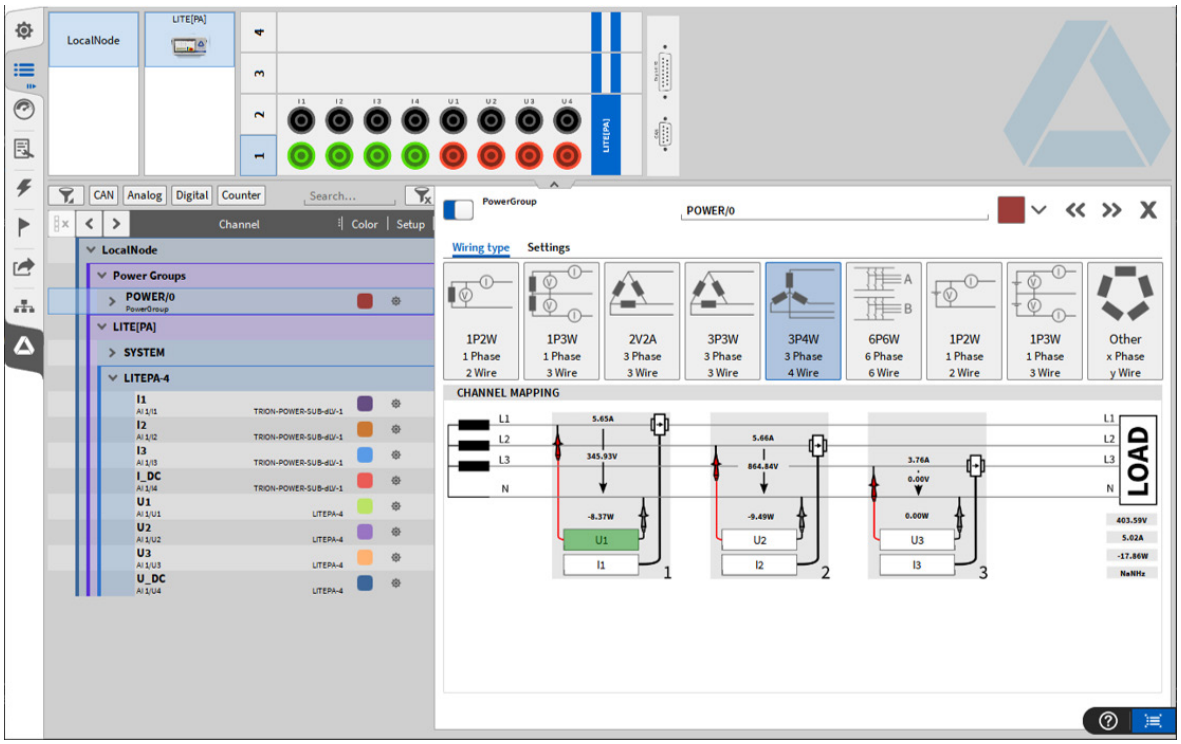


Fig. 21: Create a Power Group with channel pre-selection (2)

The Power Group is now ready for further use.

Place the Power instrument on the measurement screen

There are 2 methods to place the Power instrument on the measurement sceen: without and with a pre-designed Power instrument template.

Method 1 – without Power instrument template

To place the Power instruement on the measurement screen without a pre-designed template, proceed as follows.

1. Drag‘n‘drop the power group from the small channel list to the measurement screen.

   Alternatively drag the power instrument from the instrument tab and assign the power group.

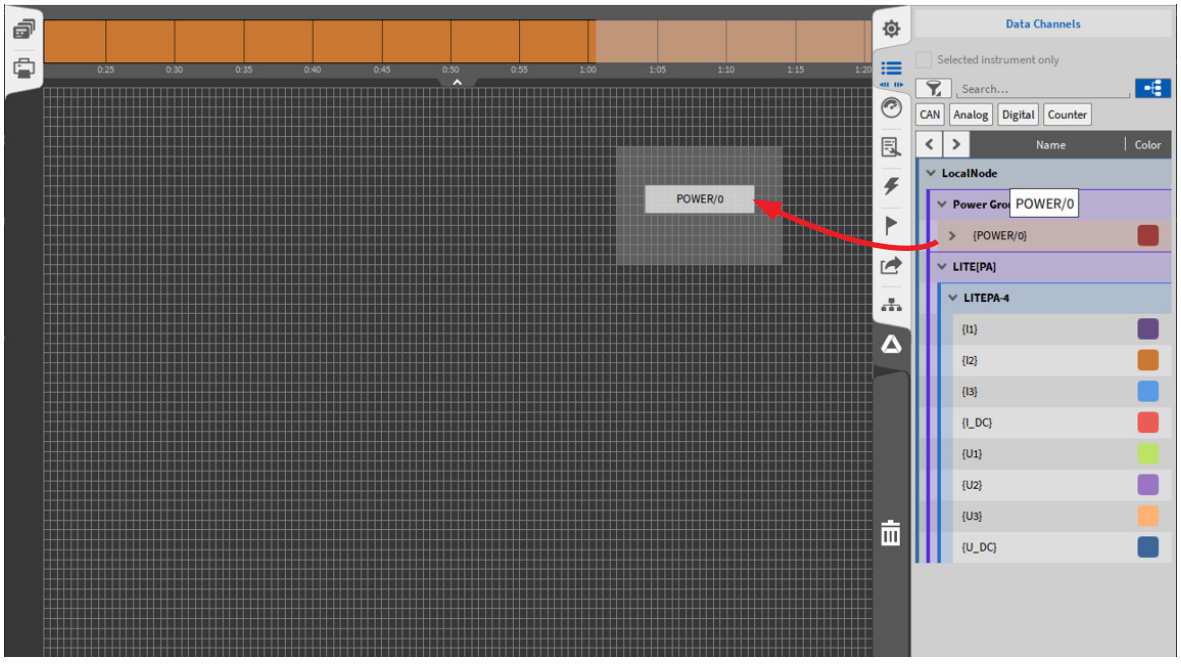


Fig. 22: Place the Power instrument without a template (1)

2. Resize the instrument and disable the design mode at the bottom left, see ① in *Fig. 23*.

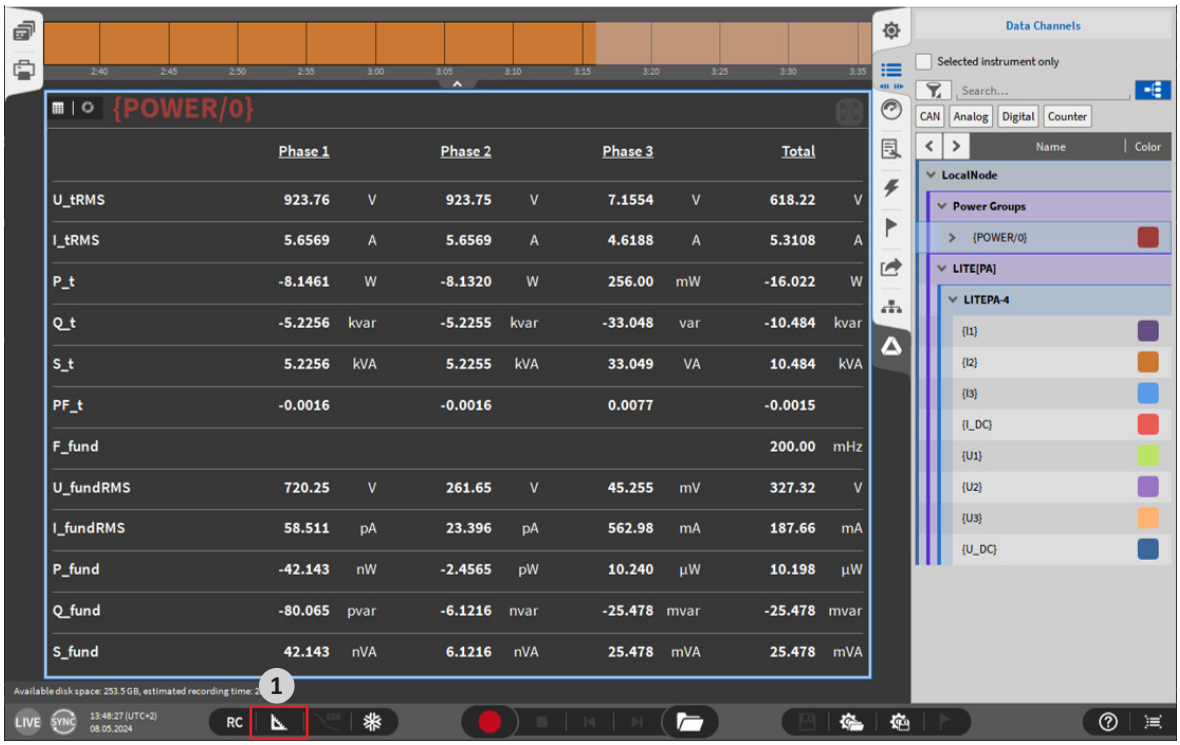


Fig. 23: Place the Power instrument without a template (2)

3. To access the scalar view of the power instrument, click in the circle on the top left of the instrument, see ② in *Fig. 24*.

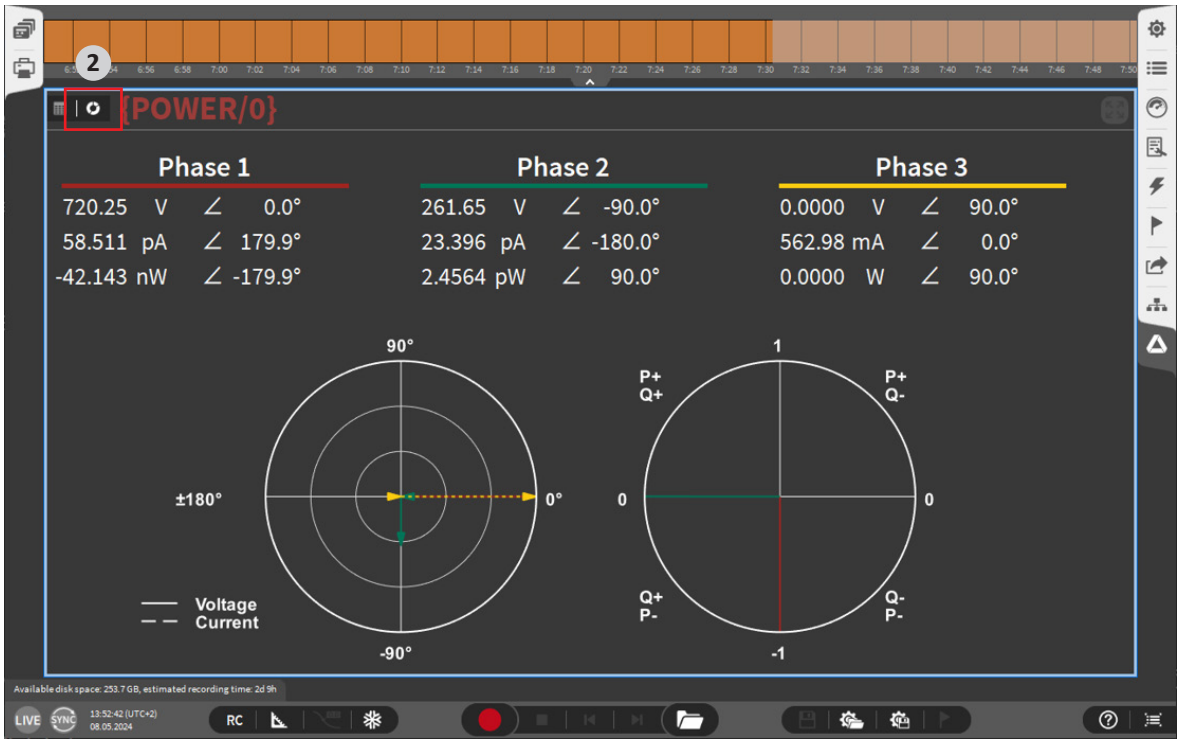


Fig. 24: Place the Power instrument without a template (3)

The Power instrument is now ready for further use.

Method 2 – with Power instrument template

To place the Power instruement on the measurement screen with a pre-designed template, proceed as follows.

1. Open the screens overview and click on the magic wand symbol, see ① in *Fig. 25*.

2. Choose the desired Power Group and press “add”, see ② in *Fig. 25*.

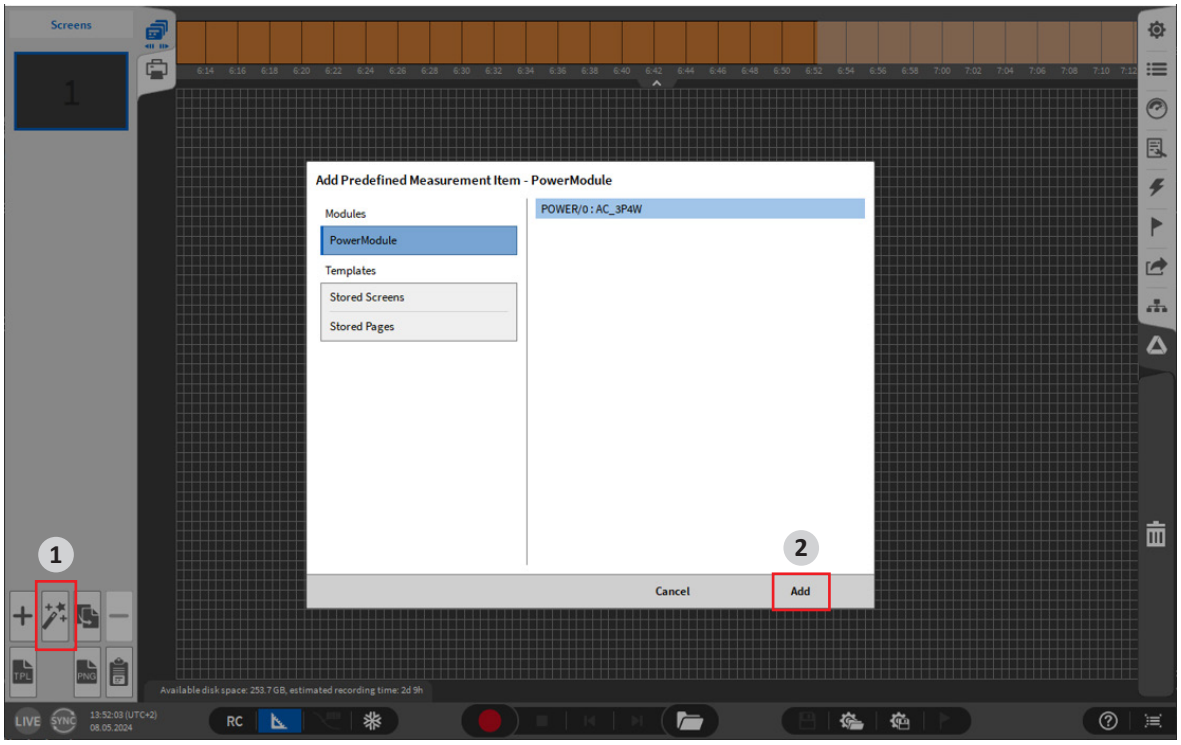


Fig. 25: Place the Power instrument with a template (1)

3. The power group template automatically creates two power group instruments, one in table mode and one in scalar mode in addition to a chart recorder for voltages and one for currents.

Fig. 26: Place the Power instrument with a template (2)

The Power instrument is now ready for further use.

Design the measurement screen

After the channel settings are done, design the measurement screen to your needs:

1. Double-click/tap on the menu tab or swipe the menu to the right.

2. Click or tap on the *Instrument* menu tab and drag and drop a recorder on the measurement screen.

   More instruments can be added and adjusted like this, when being in *Design Mode* (see 2 in *Fig. 14*).

3. Click on the *Data Channel* menu tab and add the signal by selecting the instrument and the signal to be shown or by drag and dropping the signal into the instrument.

4. Disable the *Design Mode*.

The design of the measurement screen is now finished.

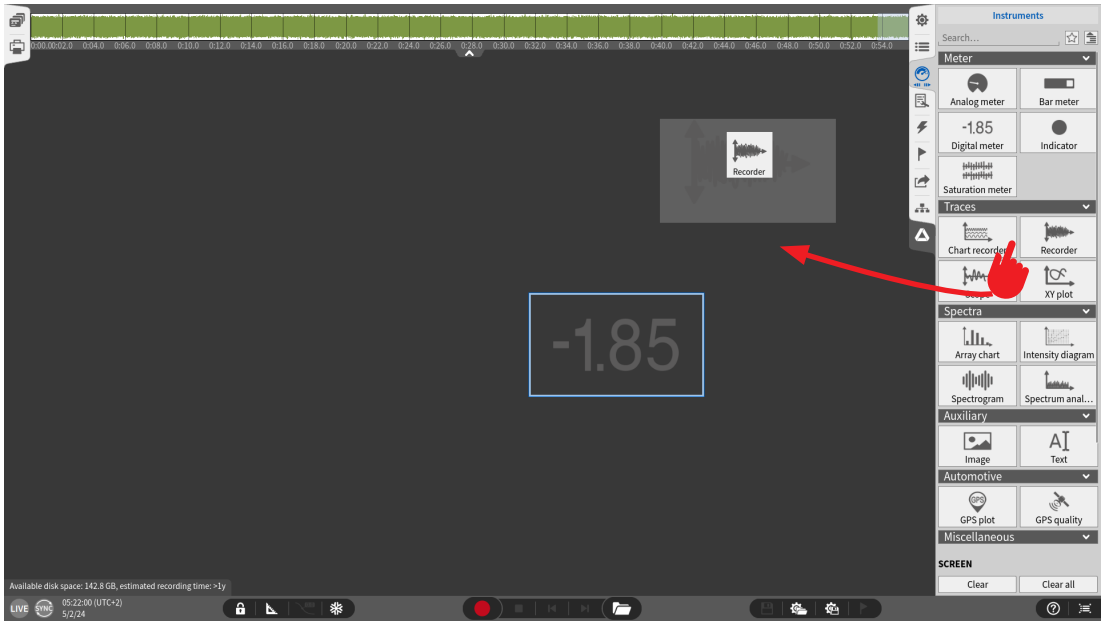


Fig. 27: Designing the measurement screen

Fig. 28: Selecting instrument and signal

Record

To start the recording proceed as follows.

1. Click on the record button.

   The red border and the REC indicator seen in *Fig. 29* in the lower left corner displays that the recording is going on.

2. Click on the Stop button to stop the recording.

The recording process is now finished.

NOTICE

Note that only channels with a sampling rate ≤ 1 kHz can be recorded.

Fig. 29: Recording

Open datafile and export

To open a datafile, proceed as follows:

1. Click on the file button, and select the corresponding file (see *Fig. 30*). The green border and PLAY indicator in the lower left corner indicate that a file is loaded for post-processing (see *Fig. 31*).
2. To export the data, click or tap on the *Export Settings* menu tab.
3. Select the desired format and the channels to be exported.
4. Click on the export button seen in *Fig. 31*.

The exporting process is now finished.

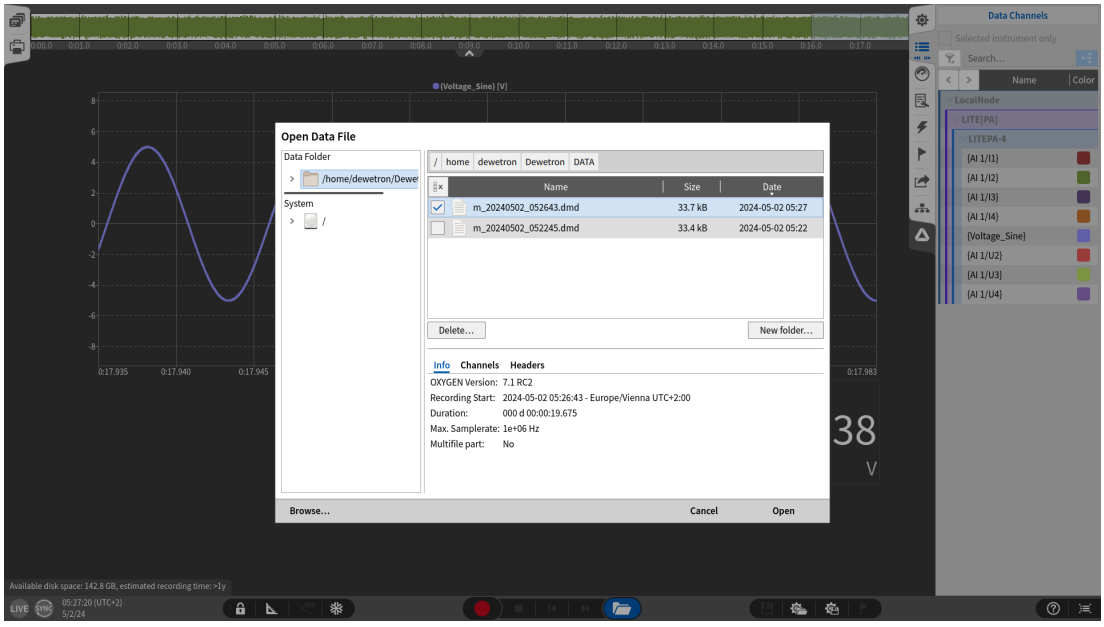


Fig. 30: Opening data file

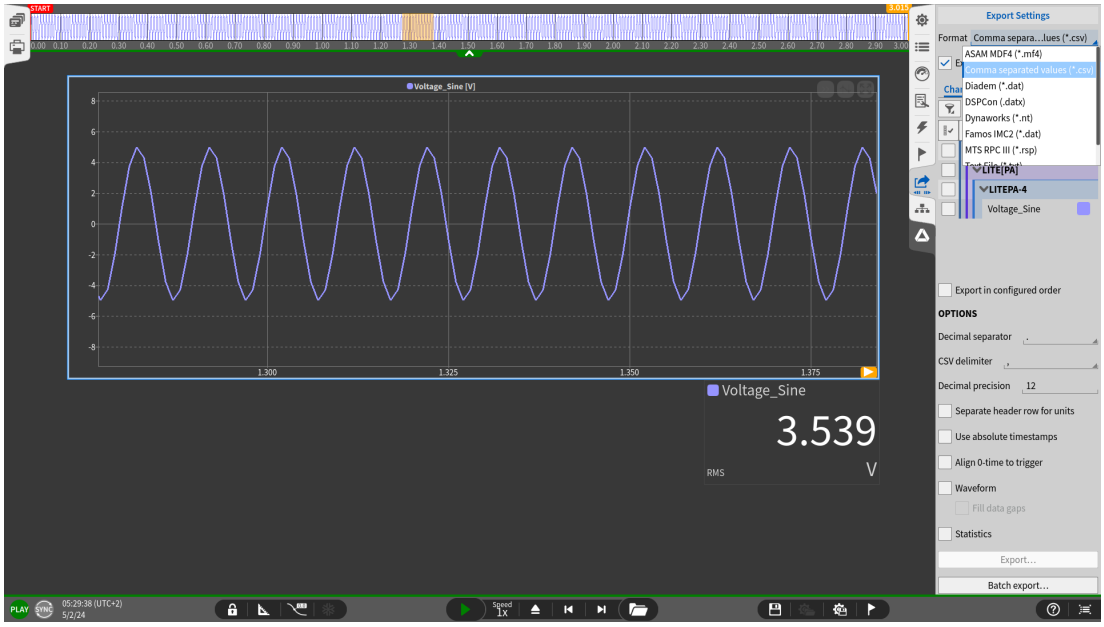


Fig. 31: Exporting data file for post-processing

Maintenance and service

The information in this section is designed for use by qualified service personal.

Service intervals

Actions	On demand	At least once a year	Every 5 years
Clean dust from chassis exterior/interior	Depending on environmental conditions	x	-
Clean filters	Depending on environmental conditions	x	-
Calibrate measurement boards	-	x	-
Change CPU fan	-	-	x
Change chassis fan	-	-	x
Change CMOS battery	-	-	x
Change SSD	Depending on SSD health status	-	x

Tab. 13: Service intervals

Surface cleaning

- Clean surface of the chassis with dry lint-free cloth.
- Use a dry velocity stream of air to clean the chassis interior.

  Do not use harsh chemical cleaning agents.

NOTICE

Many components within the chassis are sensitive to static discharge damage. Always wear a ground wrist strap and service the unit only in static-free environment.

WARNING

Risk of injury

Disconnect all cables before servicing the unit.

Filter pad cleaning

NOTICE

The LITE[PA] must not be opened or disassembled except for cleaning the filter pad. The filter pad has to be checked regularly depending on environmental condition.

Requirements

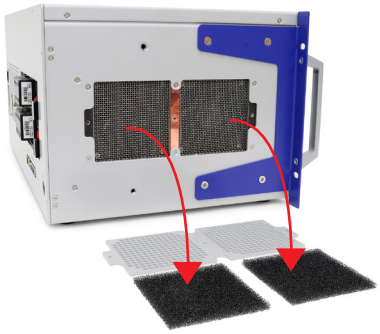
- TORX T10 screw driver
- Compressed air

Procedure

In order to perform the filter pad cleaning procedure, proceed as follows:

1. Switch-off the instrument and disconnect any high-voltage sensors/connectors.
2. Open the filter pad cover plate by loosening the 3 screws marked in the picture below.

3. Remove the filter pad cover plate and take out the filter pads.



4. To clean the filter pad use a dry compressed stream of air.
5. After cleaning put the filter pads back in their place, close the filter pad front panel and retighten its screws (3x).

The filter pad cleaning procedure is now finished.

Updates

Operating system and antivirus/security software

Before installing software updates consult with DEWETRON for compatibility guidance. Also keep in mind that the use of any antivirus or other security software may slow down your system and may cause data loss.

Software updates

NOTICE

The system BIOS is protected by password. Any change in the BIOS may cause a system crash. When the system is booting, do not press ESC-button on keyboard. This may clear the BIOS settings and cause system faults.

Any change in the file structure as deleting or adding files or directories might cause a system crash.

Before installing software updates contact DEWETRON or your local distributor. Use only software packages which are released by DEWETRON. Further information is also available in the Internet (http://www.dewetron.com).

After power off the system wait at least 10 seconds before switching the system on again. Otherwise the system may not boot correct. This prolongs also the life of all system components.

Support

DEWETRON has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support contact your local distributor first or DEWETRON directly.

For Asia and Europe contact:

DEWETRON GmbH
Parkring 4
8074 Grambach
AUSTRIA

Tel.: +43 316 3070
Fax: +43 316 3070-90
E-Mail: support@dewetron.com
Web: http://www.dewetron.com

The telephone hotline is available
Monday to Friday between
08:00 and 17:00 CET (GMT +1:00).

For the Americas contact:

DEWETRON Inc. (HQ USA)
2850 South County Trail, Unit 1
East Greenwich, RI 02818
USA

Tel.: +1 401 284 3750
Toll-free: +1 866 598 3393
Fax: +1 401 284 3750
Email: support@dewetron.com
Web: http://www.dewetron.com

The telephone hotline is available
Monday to Friday between
08:00 and 16:30 EST

Service and repairs

We are very sorry that your DEWETRON system is not operating properly. Our team is here to ensure that your DEWETRON product is returned to peak performance as quickly as possible.

Help us to provide you with the best support by following the RMA policy.

Some problems can be solved remotely by our support team. To facilitate a quicker resolution to the problem and save unnecessary shipping costs, we ask you to first have your problem investigated by our technical support before sending your product. Contact details for our support can be found on our website. Describe the error accurately and with as much detail as possible. This helps expedite the repair process.

If a repair is necessary, complete our online RMA form. You will then receive an RMA (Return Material Authorization) number and detailed instructions that identify where to ship the damaged product.

Products arriving at our repair department without RMA require follow-up calls and investigation, which lead to a longer turnaround. Only the team of DEWETRON is allowed to perform any kinds of repairs to your system to assure a safe and proper operation in future.

INFORMATION

Only the team of DEWETRON is allowed to perform any kinds of repairs to your system to assure a safe and proper operation in future. For information regarding service and repairs contact your local distributor first or DEWETRON directly.

INFORMATION

Any spare parts (screws, backplanes, cables etc.) must be obtained from DEWETRON only.

Training

DEWETRON offers training at various offices around the world several times each year. DEWETRON headquarters in Austria have a very large and professional conference and seminar center, where training classes are conducted on a regular basis starting with sensors and signal conditioning, A/D technology and software operation.

Dewetron Inc. in the USA also has a dedicated training facility connected to its headquarters, located in Rhode Island.

For more information about training services visit https://www.dewetron.com/academy.

Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your DEWETRON data acquisition system is delivered, it is calibrated at our DEWETRON headquarter. Each of this system is delivered with a certificate of compliance with our published specifications. Detailed calibration reports from our calibration system are available for purchase with each order. We retain them for at least one year, so calibration reports can be purchased for up to one year after your system was delivered.

Certificates

CE certificate of conformity

Manufacturer	DEWETRON GmbH
Address	Parkring 4 8074 Grambach, Austria Tel.: +43 316 3070-0 Fax: +43 316 3070-90 Email: sales@dewetron.com http://www.dewetron.com
Name of product	**LITE[PA]**
Kind of product	*Power analyzer*

The product meets the regulations of the following EC-directives:

2014/35/EU

Directive of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits

2014/30/EU

Directive of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (recast)

The accordance is proved by the observance of the following standards:

LVEMC	**Safety**	IEC 61010-1:2010/AMD1:2016 pol. deg. 2 and IEC 61010-2-030:2017	
	Emissions	EN 61000-6-4	EN 55011 Class A
	Immunity	EN 61000-6-2	Group standard

Graz, February 26, 2024

Place / Date of the CE-marking

Ing. Thomas Propst / Manager Total Quality

Conformity to IEC 61000-4-30

Manufacturer	DEWETRON GmbH
Address	Parkring 4 8074 Grambach, Austria Tel.: +43 316 3070-0 Fax: +43 316 3070-90 Email: sales@dewetron.com http://www.dewetron.com

This certificate has been issued as a result of an assessment of the performance of the models listed below as to their conformity with the requirements of IEC 61000-4-30:2008 Class A, Electromagnetic compatibility (EMC) Part 4-30: Testing and measurement techniques – Power quality measurement methods.

Instruments	**DEWE2 series (all devices)**	**TRIONet**
	DEWE3 series (all devices)	**TRIONet3**
	LITE[PA]	
	in combination with	
Amplifiers	**TRION(3)-1820-POWER-4**	**TRION(3)-1810-HV-8**
	TRION3-1810M-POWER-4	**TRION3-SUB-8 with SUB-600V**
	LITE[PA] module	
	and	
Software	**OXYGEN with OPT-POWER-BASIC and OPT-POWER-ADV since version 2.3**	

Standard	Parameter	IEC section	Referring to	Class	Comment
IEC 61000-4-30	Power frequency	5.1	-	A	a)
	Magnitude of supply voltage	5.2	-	A	a)
	Flicker	5.3	61000-4-15	A	b)
	Supply voltage unbalance	5.7	-	A	a)
	Voltage harmonics	5.8	61000-4-7	A	c), d)
	Voltage interharmonics	5.9	61000-4-7	A	d)

General notice: no synchronisation to UTC 10 minute tick

a) 10/12 period values only with setting “Max. update rate” = 190 ms

b) For U_din in range of 60 V to 690 V

c) Only with grouping setting = “Type 1”; no smoothing with LP filter

d) For nominal value of 5 A, use SUB-CUR-20A; for currents above use external current sensor

On the basis of the evidence presented, the above products conform to the requirements of IEC 61000-4-30:2008 (Edition 2) Class A, Electromagnetic compatibility (EMC) Part 4-30: Testing and measurement techniques – Power quality measurement methods:

Graz, August 10, 2023

Place / date of issue

Ing. Thomas Propst / Manager Total Quality