DCT1

Energy transducer for DC systems

Description

DCT1 is a direct connection energy transducer for DC systems up to 1000 V dc and current up to 600 A dc, equipped with Modbus RTU or SML communication port. Dedicated versions of the DCT1, provided with evaluation certificate, implementing 256- bit or 384- bit signature on Modbus RTU or 384- bit signature on SML, are suitable for installation on electric vehicle chargers that requires Eichrecht certification.

Benefits

- **Easy and robust mounting.**DIN rail mounting permits easy positioning before fixing DCT1 on the back panel using standard screws.
- **Tamper proof.** The protection cover can be sealed to avoid access to both current/voltage connections and to communication terminals.
- **Secure and signed data transmission.** Transmitted data can't be corrupted thanks to the embedded signature algorithm that ensures data source authenticity. The public key can be read easily via Modbus RTU or by the QR code printed on the front.
- **Quick configuration.** Easy configuration via Modbus RTU using the UCS configuration software, available for download free of charge.
- **Accurate measuring.**DCT1 complies with the precision International standard IEC 62053-41 guaranteeing the highest accuracy from 1% to 100 % of the measuring range.
- **Temperature calibrated.** Able to work in an extremely wide temperature range thanks to the temperature drift compensation exploiting a calibration method based on two temperature sensors.
- **Clear and effective diagnostics.** Correct operation is immediately visible through the warning and status LEDs, and real- time diagnostics via Modbus. They control over range and overtemperature.

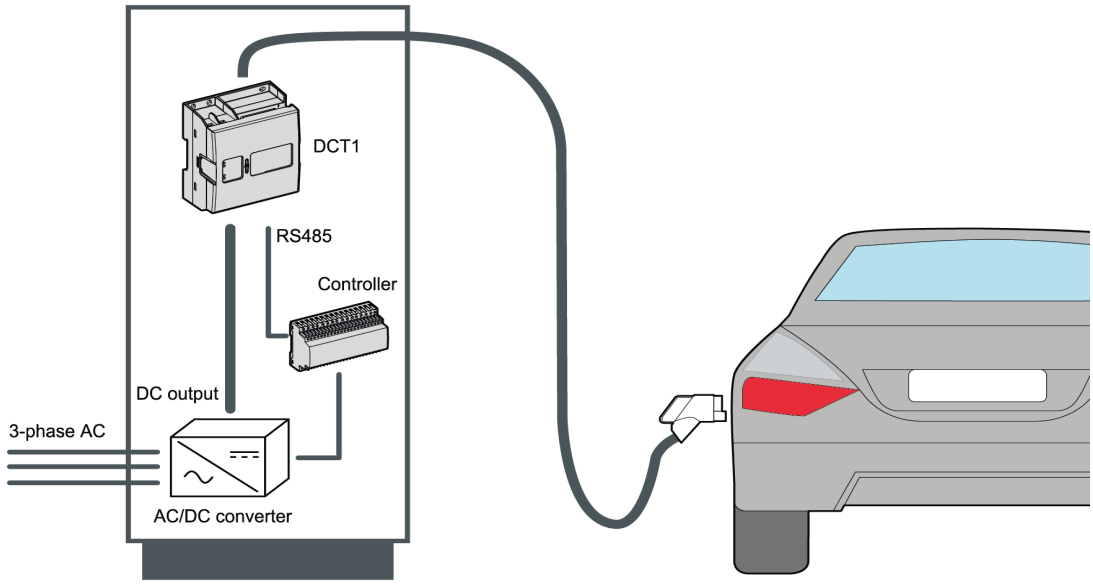
Applications

DCT1 can be installed in any DC switchboard with a rated current up to 600 A to monitor energy consumption or production and the main electrical variables. The main application is within a DC fast charger for electric vehicles, thanks to the 70 °C maximum ambient temperature and allowed maximum current and voltage.

With the evaluation certificate according to IEC 62052-11, IEC 62052-31, IEC 62053-41, VDE-AR-E 2418-3-100 Annex A, WELMEC 7.2 and the signed data transmission able to guarantee data source authenticity, application for Eichrecht certification, required for EV charger by the German law, is easily possible.

Cable loss compensation is able to calculate the losses due to the cable resistance from DCT1 to the connection point to measure only the energy actually provided to the car.

Architecture



Main functions

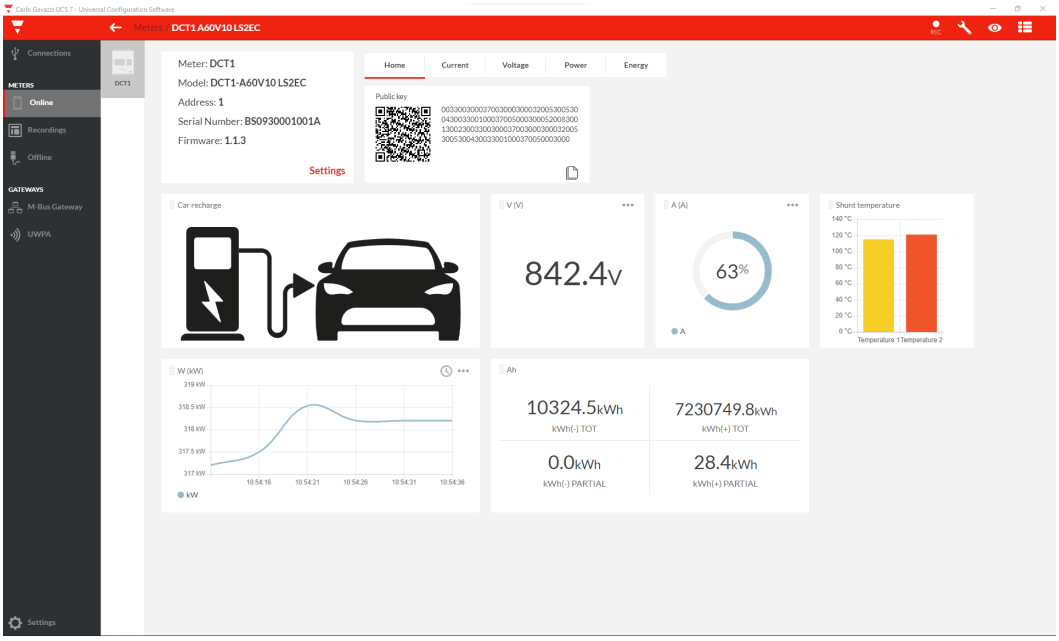
- Measure energy and ampere-hour
- Measure power, voltage and current
- Measure the load run hours and the total on-time
- Transmit data to controller or other systems through Modbus RTU or SML
- Signed data transmission (certified versions)
- Monitor internal temperature to help controller avoiding over-heating of the DCT1 and the power cables
- Cable loss compensation

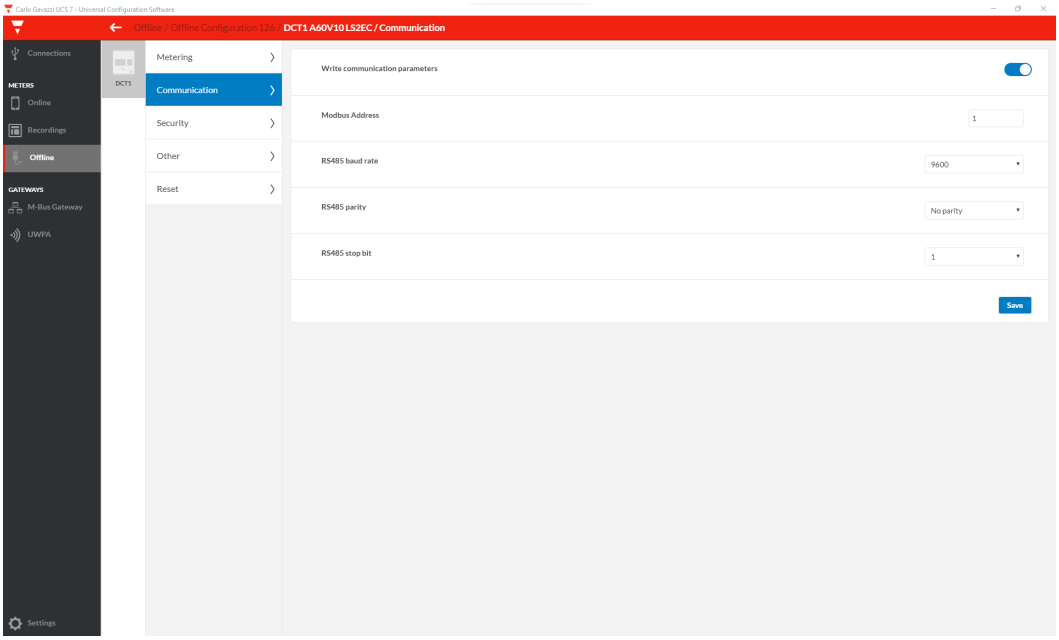
Main features

- Variables (V, A, W)
- Energy resolution 0.0001 kWh
- Data refresh time: 200 ms (Modbus RTU), automatic data push every 200 ms in SML version
- Continuous sampling of voltage and current
- Evaluation certificate for Eichrecht approval
- Class 1 accuracy according to IEC 62053-41 proven by the evaluation certificate
- cULus approved

UCS software

- Free download from Carlo Gavazzi website
- Configuration through RS485 from PC or trough UWP3.0 via LAN or the web (UWP Secure Bridge function)
- Setups can be saved offline for serial programming with a single command
- Real time data view for testing and diagnostics





Installation flexibility

DCT1 is designed to achieve maximum installation flexibility. Here you can see 3 examples:

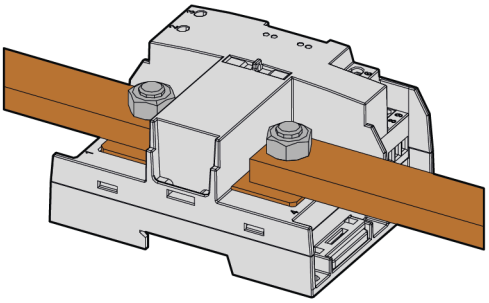


Fig. 1 *Bar-bar mounting*

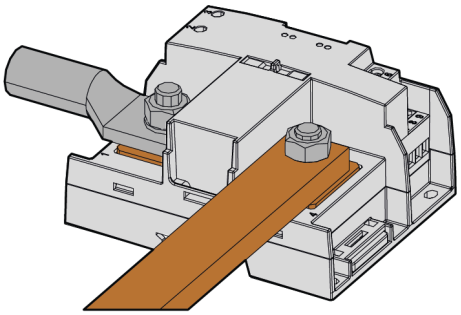


Fig. 2 *Horizontal screw-bar mounting*

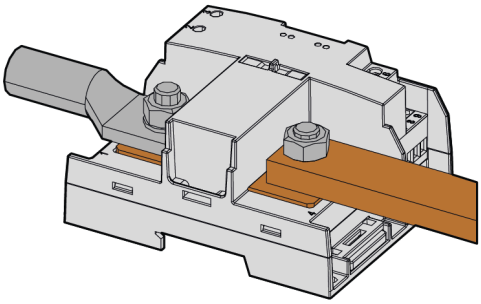


Fig. 3 *Vertical screw-bar mounting*

Structure

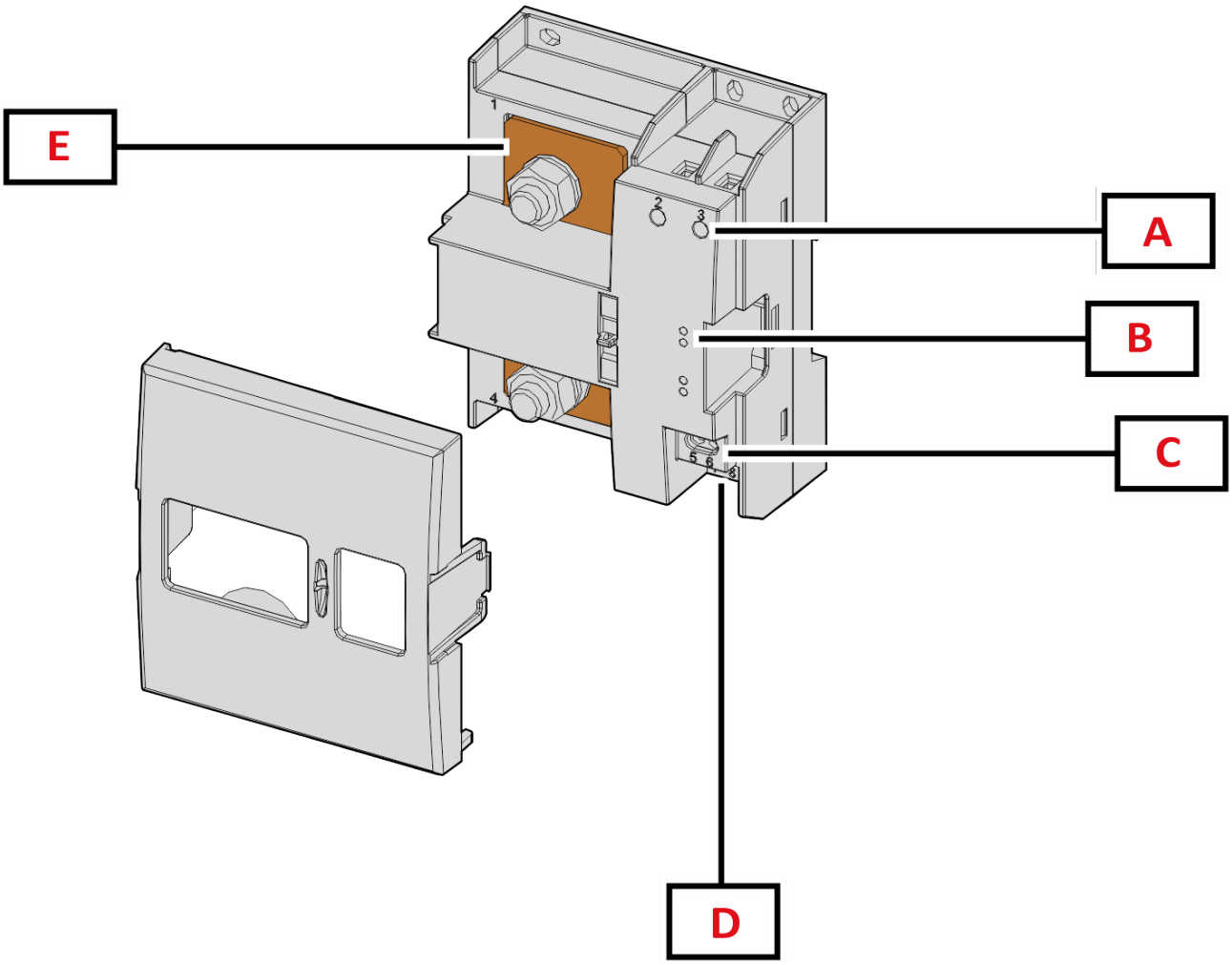


Fig. 4 *Front*

Area	Description
A	Voltage inputs
B	LEDs
C	Power supply
D	RS485 port
E	Current inputs

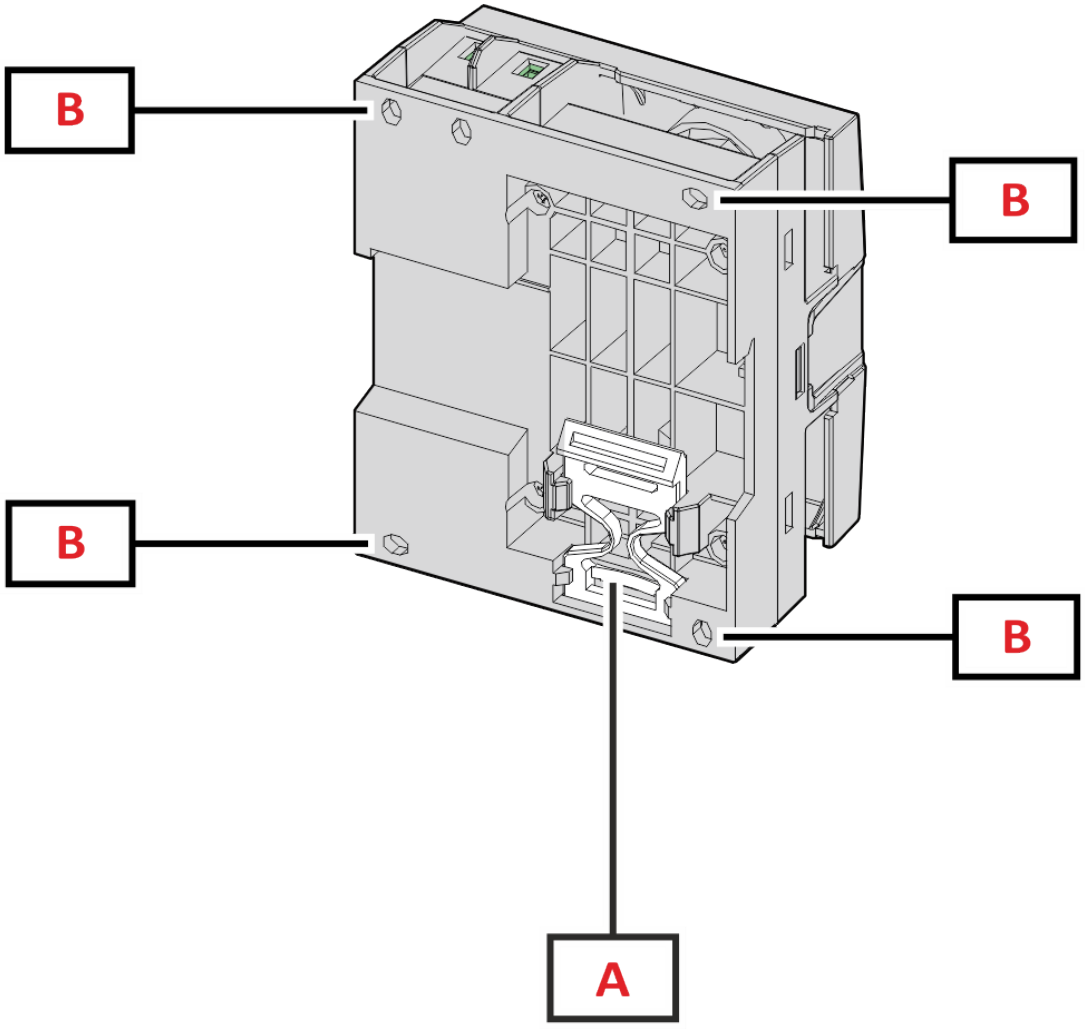


Fig. 5 *Back*

Area	Description
A	Bracket for DIN rail mounting (optional)
B	Holes for back panel mounting by screw terminals (mandatory)

Features

General

Material	Housing: PBT
Protection degree*	IP10
Protective class	II
Terminals	Current inputs: cable or lug. Max: 50x10 mm; M10 hole; recommended torque: 20 Nm/177 lb-in Voltage, power supply and RS485 port: min: 0.5 mm^2/20 AWG, max: 2.5mm^2/13 AWG 0.5 Nm /4.4 lb-in max
Overvoltage category	Cat. II
Rated impulse voltage	6kV
Pollution degree	2
Mounting	DIN rail and back panel by screw terminals
Weight	565 g/ 1.25 lb (package included)

(*)**Note**: the product can only be installed inside a cabinet with IP54 degree of protection for outdoor installation and IP51 for indoor installation.

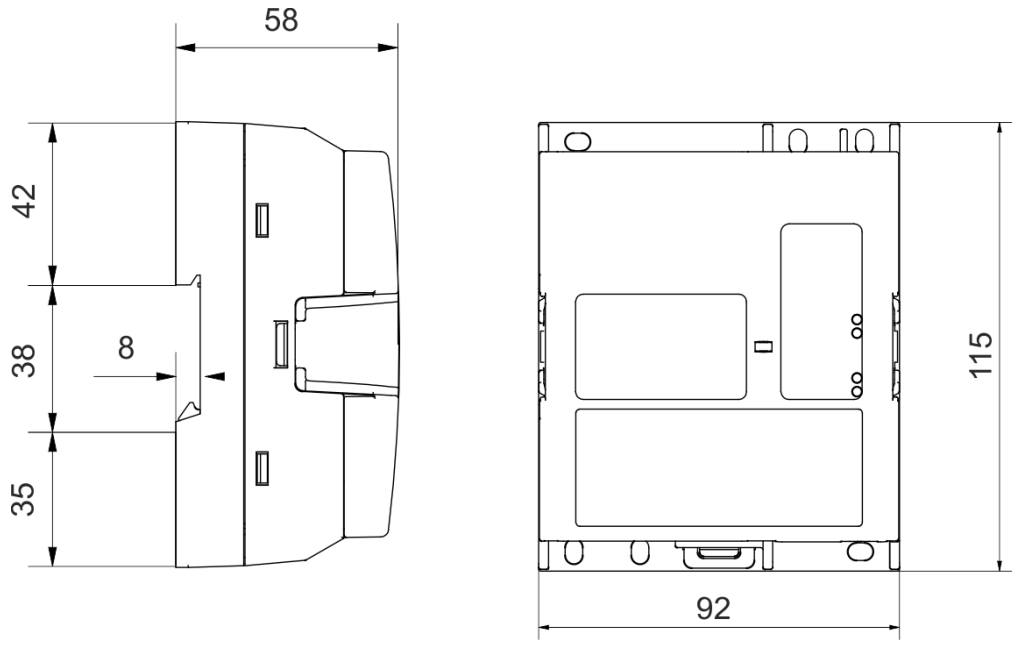


Fig. 6

Environmental specifications

Operating temperature	From -25 to +70 °C/from -13 to +158 °F
Storage temperature	From -40 to +85 °C/from -40 to +185 °F
Max temperature on shunt	120 °C / 248 °F
Mechanical environmental condition	M2

***Note**: R.H. < 90 % non-condensing @ 40 °C / 104 °F.*

Input and output insulation

Type	Measurement inputs	RS485 serial port	Power supply
Measurement inputs	-	Double/Reinforced	Double/Reinforced
RS485 serial port	Double/Reinforced	-	Functional
Power supply	Double/Reinforced	Functional	-

According to: EN 61010-2-030. Overvoltage category III with 600 V mains, category II with 1000 V mains. Pollution degree 2.

Compatibility and conformity

European directives	2014/35/EU (LVT - Low Voltage) 2014/30/EU (EMC - Electro Magnetic Compatibility) 2011/65/EU, 2015/863/EU(Electric-electronic equipment hazardous substances)
Standards	Electromagnetic compatibility (EMC) - emissions and immunity: EN 61000-6-2, EN 61000-6-3, IEC 62052-11 Electrical safety: EN 61010-1, IEC 62052-31, UL 61010-1, UL 61010-2-030, CAN/CSA-C22.2 No. 61010-1-12, CSA C22.2 No. 61010-2-030 Metrology: IEC 62053-41*, VDE Anwendungsregel VDE-AR-E 2418-3-100 Annex A (Accuracy class A) Security: WELMEC 7.2 (SW)
Approvals	CE c UL us UK CA

(*) Except for durability test

Evaluation certificate

The evaluation certificate is provided by an independent notify body, which performs tests and verifications to fulfill the following standards:

Standard	Description
IEC 62052-11	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC62052-31	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 31: Product safety requirements and tests
IEC62053-41 *	Electricity metering equipment - Particular requirements - Part 41: Static meters for DC energy (classes 0,5 and 1)
VDE-AR-E 2418-3-100 Annex A	Electric mobility - Measuring systems for charging stations
WELMEC 7.2	Software Guide (Measuring Instruments Directive 2014/32/EU)

(*) Except for durability test

Electrical specifications

Electrical system	
Managed electrical system	DC

Voltage inputs	
Voltage connection	Direct
Rated voltage (Un)	150 to 1000 V
Voltage tolerance	From 0.8 to 1.15 Un
Input impedance	3.2 MΩ

Current inputs	300 A	600 A
Current connection	Direct	Direct
Base current (Ib)	50 A	120 A
Minimum current (Imin)	2.5 A	6 A
Threshold current (Itr)	5 A	12 A
Maximum current (Imax)	300 A	600 A
Start-up current (Ist)	0.2 A	0.48 A
Input impedance	0,05 mΩ	0,025 mΩ

Power supply

Type	Auxiliary power supply
Consumption	< 0.9 W
Voltage	12 to 24 V dc

Measurements

Method	TRMS measurements of distorted waveforms
Energy update rate	10 ms

Available measurements

Active energy	**Unit**
Imported (+) Total	kWh+
Imported (+) partial	kWh+
Exported (-) Total	kWh-
Exported (-) partial	kWh-

Ampere-hour	**Unit**
Imported (+) Total	Ah+
Imported (+) partial	Ah+
Exported (-) Total	Ah-
Exported (-) partial	Ah-

Run hour meter	**Unit**
Total (kWh+)	hh:mm
Partial (kWh+)	hh:mm
Total (kWh-)	hh:mm -
Partial (kWh-)	hh:mm -
Total ON time	hh:mm
Partial ON time	hh:mm

Electrical variable	**Unit**
Voltage L-L	V
Current	A
Power	W

Shunt temperature	**Unit**
Upstream	°C
Downstream	°C

Energy metering

Energy metering depends on the measurement type you chose (selectable in non-certified models, according to the model in certified models).

Easy connection

Easy connection function: irrespective of the current direction, the power always has a plus sign that increases the positive energy meter. The negative energy meter is not available.

Bidirectional

Bidirectional: voltage, current, and power are measured using the proper sign. The positive or the negative energy increases according to the power sign.

Measurement accuracy

Current	IEC 62053-41*	VDE-AR-E 2418-3-100 Annex A
From Itr to Imax	± 0.5% rdg	± 1%
From Imin to Itr A	± 1% rdg	± 1.5%

Voltage	IEC 62053-41*	VDE-AR-E 2418-3-100 Annex A
From Un min -20% to Un max +15%	± 0.5% rdg	± 0.5%

Power	IEC 62053-41*	VDE-AR-E 2418-3-100 Annex A
From Itr to Imax	± 1% rdg	± 2%
From Imin to Itr A	± 1.5% rdg	± 2.5%

Energy	IEC 62053-41*	VDE-AR-E 2418-3-100 Annex A
Class	class 1	class A

(*) Except for durability test

Measurement resolution

Variable	Resolution by serial communication
Energy	0.0001 kWh
Ampere-hour	0.001 Ah
Power	0.001 kW
Current	0.001 A
Voltage	0.1 V
Run-hour meter	1 s
Shunt temperature	0.1 °C

LED

Front	Green. Status: power on and communication Amber. Warning: overrange (temperature, current or voltage) or fatal error Red kWh+. Pulse weight: proportional to energy consumption: 0.001 kWh per pulse Red kWh-. Pulse weight: proportional to exported energy: 0.001 kWh per pulse

Communication ports

Modbus RTU (S1, S2, S3 versions)

Protocol	Modbus RTU
Devices on the same bus	Max 247 (1/8 unit load)
Communication type	Multidrop, bidirectional
Connection type	2 wires
Configuration parameters	Modbus address (from 1 to 247) Baud rate (9.6 / 19.2 / 38.4 / 115.2 kbps) Parity (None/ Even)
Refresh time	≤ 200 ms
Configuration mode	Via keypad or UCS software

SML (K1 version)

Protocol	SML
Devices on the same bus	Max 247 (1/8 unit load)
Communication type	Multidrop, bidirectional
Connection type	2 wires
Configuration parameters	Modbus address (from 1 to 247) Baud rate (9.6 / 19.2 / 38.4 / 115.2 kbps) Parity (None/ Even)
Refresh time	200 ms
Configuration mode	Modbus commands entering maintenance mode

Connection Diagrams

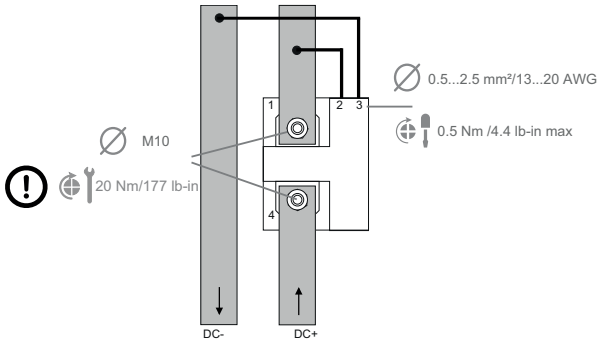


Fig. 7 *Current (option A) and voltage inputs*

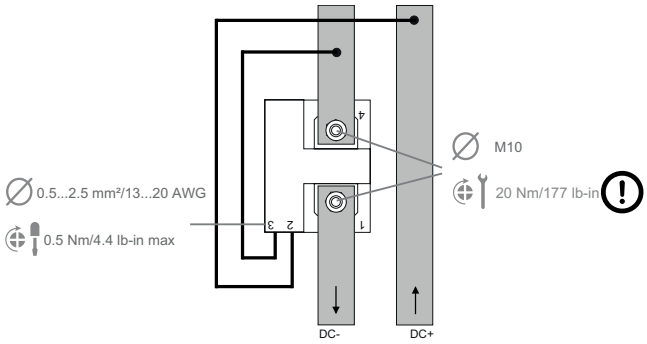


Fig. 8 *Current (option B) and voltage inputs*

Communication and power supply

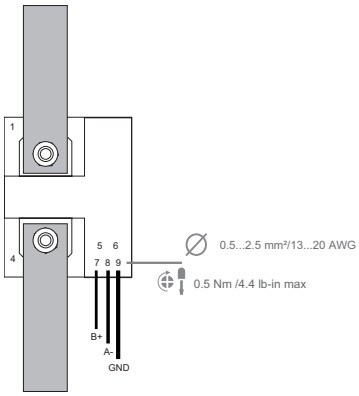


Fig. 9 *RS485 Modbus or SML port*

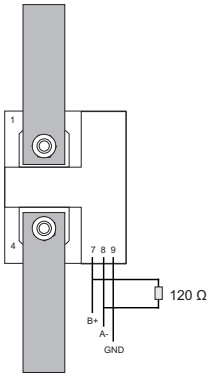


Fig. 10 *RS485 terminalization. Last device on RS485*

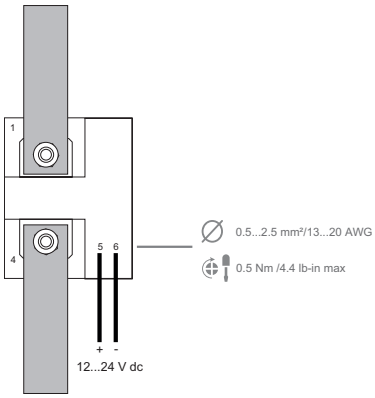


Fig. 11 *Power supply*

References

Order code

DCT1 ☐ V10 L S1 X

Code	Options	Description
DCT1	-	Model
☐	A30	Max current: 300 A
	A60	Max current: 600 A
V10	-	Max voltage: 1000 V
L	-	Power supply: 12...24 V dc
S1	-	RS485 Modbus RTU
X	-	Standard model

DCT1 ☐ V10 L ☐ EC

Enter the code option instead of ☐

Code	Options	Description
DCT1	-	Model
☐	A30	Max current: 300 A
	A60	Max current: 600 A
V10	-	Max voltage: 1000 V
L	-	Power supply: 12...24 V dc
☐	S2	RS485 Modbus RTU (256-bit signature)
	S3	RS485 Modbus RTU (384-bit signature)
	K1	SML
EC	-	Evaluation certificate according to IEC 62052-11, IEC 62052-31, IEC 62053-41*, VDE-AR-E 2418-3-100 Annex A and WELMEC 7.2

(*) Except for durability test