

# 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 EN 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  $^{\circ}$ C / 158  $^{\circ}$ F maximum ambient temperature and allowed maximum current and voltage.

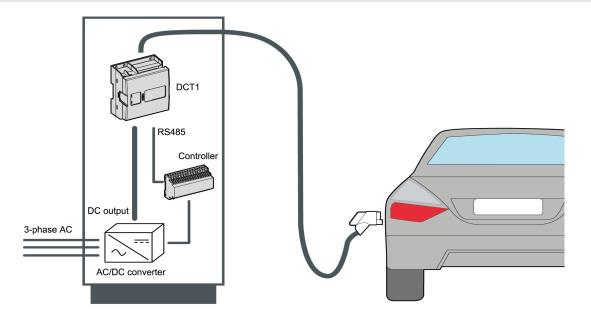
With the evaluation certificate according to EN IEC 62052-11, EN IEC 62052-31, EN IEC 62053-41, VDE-AR-E 2418-3-100 Annex A, WELMEC 7.2 and the signed data transmission able to guarantee data source authenticity, application for Eichrecht certification, required for EV charger by the German law, is easily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



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### 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

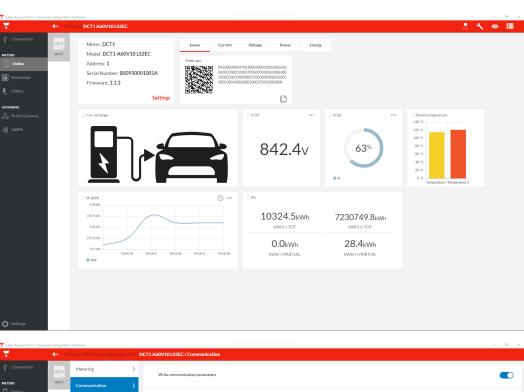
## Main features

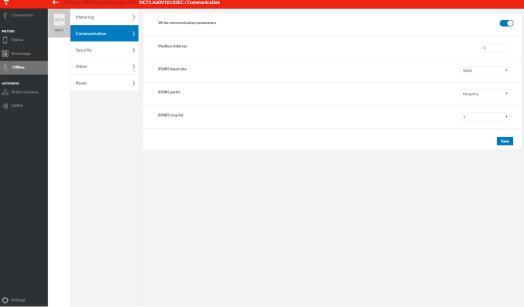
- Variables (V, A, W)
- Energy resolution 0.0001 kWh
- Data refresh time: 200 ms (Modbus RTU), automatic data push every 200 ms in SML version
- · Continuous sampling of voltage and current
- Evaluation certificate for Eichrecht approval
- Class 1 accuracy according to EN IEC 62053-41 proven by the evaluation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



### **UCS** software

- Free download from Carlo Gavazzi website
- Configuration through RS485 from PC or through UWP3.0 / UWP4.0 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:

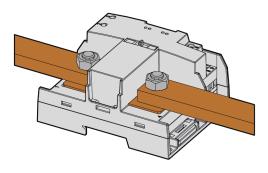


Fig. 1 Bar-bar mounting

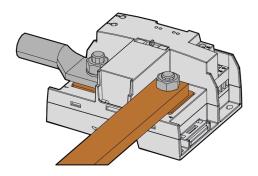


Fig. 2 Horizontal screw-bar mounting

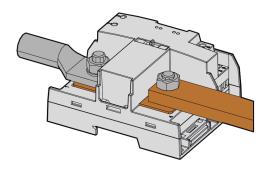


Fig. 3 Vertical screw-bar mounting



# **Structure**

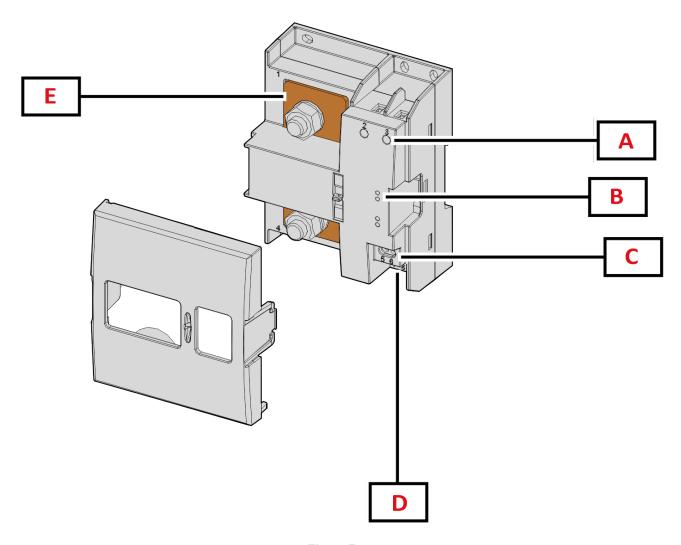


Fig. 4 Front

Area	Description
Α	Voltage inputs
В	LEDs
С	Power supply
D	RS485 port
E	Current inputs



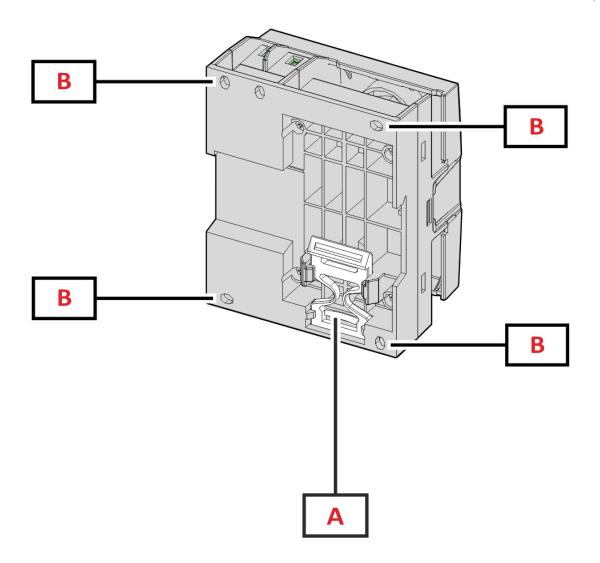


Fig. 5 Back

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

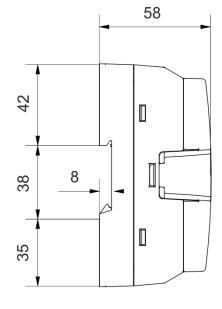


# **Features**

# 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 lbin  Voltage, power supply and RS485 port: from 0.5 mm² to 2.5 mm² / from 20 AWG to 13 AWG, 0.5 Nm / 4.4 lbin 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.



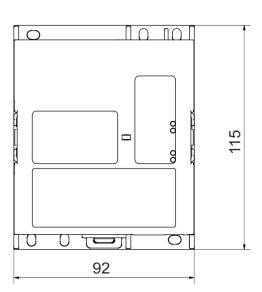


Fig. 6



### **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 envir- onmental condition	M2

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

\*Note: All the tests required by CE and cURus compliance have been performed in the above stated operating temperature range. In addition, communication functionality and measurement accuracy have been tested without anomalies at temperature down to -40°C/-40°F.

### Input and output insulation

Туре	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 IEC 61000-6-2, EN IEC 61000-6-3, EN IEC 62052-11
	<b>Electrical safety</b> : EN IEC 61010-1, EN 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
	<b>Metrology</b> : EN IEC 62053-41*, VDE Anwendungsregel VDE-AR-E 2418-3-100 Annex A (Accuracy class AB)
	Security: WELMEC 7.2 (SW)
Approvals	CE
	c <b>FL</b> ° us

<sup>\*</sup> Except for durability test



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## **Evaluation certificate**

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

Standard	Description
EN IEC 62052-11	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 11: Metering equipment
EN IEC 62052-31	Electricity metering equipment (AC) - General requirements, tests and test conditions - Part 31: Product safety requirements and tests
EN IEC 62053-41*	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)

<sup>\*</sup> Except for durability test

## **Electrical specifications**

Electrical system	
Managed electrical sys-	DC
tem	

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 ΜΩ

Current inputs	300 A	600 A
Current connection	Direct	Direct
Base current (lb)	50 A	120 A
Minimum current (Imin)	2.5 A	6 A
Threshold current (ltr)	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

Туре	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

<sup>\*</sup> Except for durability test



Current	Accuracy
From Itr to Imax	± 0.5% rdg
From Imin to Itr A	± 1% rdg

Voltage	Accuracy
From Un min -20% to Un max +15%	± 0.5% rdg

Power	Accuracy
From Itr to Imax	± 1% rdg
From Imin to Itr A	± 1.5% rdg

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

# Measurement resolution

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

# **LED**

	Green. Status: power on and communication	
Front	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 para- meters	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	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	
	Modbus address (from 1 to 247)	
Parameters	Baud rate (115.2 kbps)	
	Parity (None)	
Refresh time	200 ms	
Configuration mode	Modbus commands entering maintenance mode	



# **Connection Diagrams**

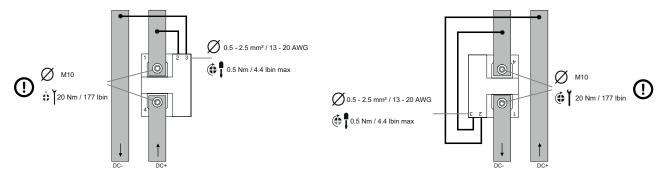


Fig. 7 Current (option A) and voltage inputs

Fig. 8 Current (option B) and voltage inputs

### **Communication and power supply**

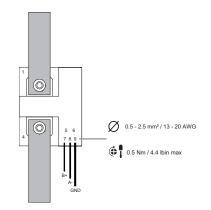


Fig. 9 RS485 Modbus or SML port

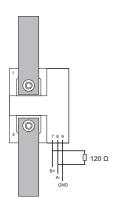


Fig. 10 RS485 terminalization. Last device on RS485

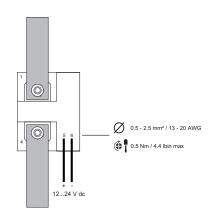


Fig. 11 Power supply



# References

Order code 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 S1 RS485 Modbus RTU X Standard model

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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)	
	<b>S</b> 3	RS485 Modbus RTU ( 384-bit signature)	
	K1	SML	
EC	-	Evaluation certificate according to EN IEC 62052-11, EN IEC 62052-31, EN IEC 62053-41*, VDE-AR-E 2418-3-100 Annex A and WELMEC 7.2	

<sup>\*</sup> Except for durability test



# **CARLO GAVAZZI compatible components**

Purpose	Component name/code key	Notes
Configure analyzer via desktop application	UCS software	Available for free download at: www.gavazziautomation.com
Aggregate, store and transmit data to other systems	UWP 3.0, UWP 4.0	See relevant datasheet at: www.gavazziautomation.com



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