DCT1

direct connection energy transducer

USER MANUAL

22/06/2023

Contents

This manual

Information property

Safety messages

The following section describes the warnings related to user and device safety included in this document:

***NOTICE**: indicates obligations that if not observed may lead to damage to the device.*

CAUTION! Indicates a risky situation which, if not avoided, may cause data loss.

IMPORTANT: provides essential information on completing the task that should not be neglected.

General warnings

This manual is an integral part of the product and accompanies it for its entire working life. It should be consulted for all situations tied to configuration, use and maintenance. For this reason, it should always be accessible to operators.

***NOTICE**: no one is authorized to open the analyzer. This operation is reserved exclusively for CARLO GAVAZZI technical service personnel.*
Protection may be impaired if the instrument is used in a manner not specified by the manufacturer.

Service and warranty

In the event of malfunction, fault, requests for information or to purchase accessory modules, contact the CARLO GAVAZZI branch or distributor in your country. Installation and use of analyzers other than those indicated in the provided instructions void the warranty.

DCT1

Introduction

DCT1 is a direct connection energy transducer for DC systems up to 1000 V dc and current up to 600 A dc. Dedicated versions can implement three different communication protocols:

- Modbus RTU, or
- Modbus RTU with either 256-bit or 384-bit signature, or
- SML with 385-bit signature

Furthermore, thanks to the evaluation certificate, certified DCT1 versions are suitable for installation on electric vehicle chargers that requires Eichrecht approval.

Description

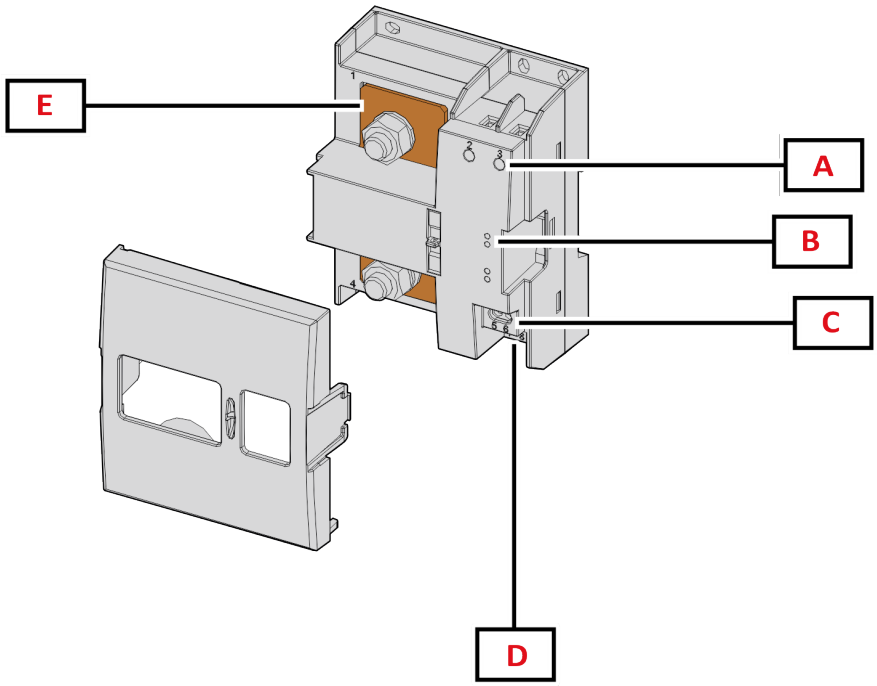

Figure 1 *DCT1 front*

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

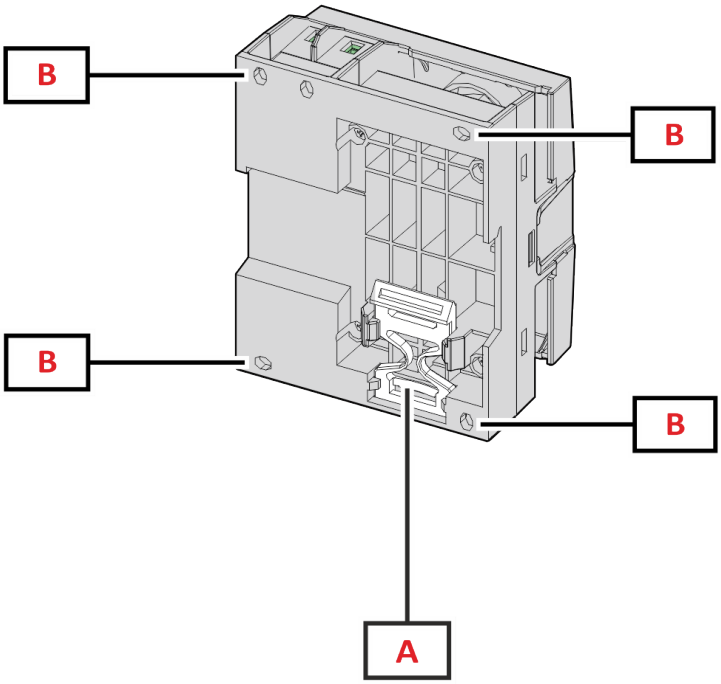

Figure 2 *DCT1 back*

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

Available versions

Part number	Voltage	Current	Output	Signature	Evaluation certificate
DCT1A60V10LS1X	150…1000 V	6-120 (600) A	Modbus RTU	-	-
DCT1A60V10LS2EC	150…1000 V	6-120 (600) A	Modbus RTU	256 bit	x
DCT1A60V10LS3EC	150…1000 V	6-120 (600) A	Modbus RTU	384 bit	x
DCT1A60V10LK1EC	150…1000 V	6-120 (600) A	SML	384 bit	x
DCT1A30V10LS1X	150…1000 V	2.5-50 (300) A	Modbus RTU	-	-
DCT1A30V10LS2EC	150…1000 V	2.5-50 (300) A	Modbus RTU	256 bit	x
DCT1A30V10LS3EC	150…1000 V	2.5-50 (300) A	Modbus RTU	384 bit	x
DCT1A30V10LK1EC	150…1000 V	2.5-50 (300) A	SML	384 bit	x

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

Configuration software

Configuration software

UCS is the DCT1 configuration software available in desktop version. It may connect to DCT1 via RS485 (Modbus RTU protocol). UCS allows to:

- set up the unit (online or offline);
- display the system state for diagnostic and setup verification purposes

Overview of the UCS functions:

- Setting up the system with DCT1 connected (online setup)
- Enter maintenance mode and set cable loss parameters (cable resistance)
- Defining the setup with DCT1 non connected, then applying it later (offline setup)
- Displaying the main measurements
- Check temperature on the shunt
- Displaying overrange and overtemperature warnings
- Recording the measurements of selected variables

Use

Maintenance mode and cable loss compensation

Maintenance mode is a special status of the meter where the cable loss parameter can be changed. To change cable loss parameters using UCS software, follow the wizard available in the section Maintenance. To change cable loss parameters using Modbus commands follow this procedure, referring to the Modbus protocol:

Step	Action
1	Power on DCT1
2	Send **Maintenance command** by 5 seconds from power on.
3	Send **Time sync command** by 10 seconds from previous command
4	Set new **Resistance value** by 10 seconds from previous command

Note: in certified models (part numbers ending with “EC”), this parameter can only be changed 50 times.

Settings

The following parameters can be set using UCS or Modbus commands:

- RS485 parameters
  - Address
  - Baudrate
  - Parity
  - Stop bit
- Easy connection enabling (only non-certified models)
- Start up current for run hour meters
- Device tag

Reset

The following reset commands are available only through modbus command

- Total meters (only non-certified models)
- Partial meters
- Factory settings

Commissioning

Modbus RTU

Modbus RTU communication port is used to transmit data to a Modbus master.

For further information about Modbus RTU communication refer to the communication protocol.

SML

For further information about SML communication refer to the communication protocol.

Essential information

Cable loss

DCT1 implements the cable loss correction factor, considering the resistance of the cable in the measurement of voltage and power (and therefore also energy). They are calculated as follows:

- $V = V_{meas} - R \cdot I_{meas}$
- $P = V_{meas} * I_{meas} - RI_{meas}^2$

Thus, the cable loss correction factor allows a more accurate measurement of the actual energy that flows from the charger to the car. Cable loss can only be set up in maintenance mode, through the dedicated procedure described above.

Easy connection

Easy connection function allows ignoring current and power direction, increasing only the positive energy meter, and not affecting the negative one when bidirectionality is not needed. The function is:

- available only for the non-certified version of the device
- disabled by default and can be enabled using UCS or Modbus command.

Temperature monitoring

DCT1 monitors the temperature of the shunt constantly; through the Modbus RTU the user can control two parameters:

- the temperature of the upper part of the shunt and
- the temperature of the lower part of the shunt.

The shunt should never exceed 120 degrees to avoid damage to the electronic components. The temperature is measured at two different points because the shunt can connect to conductors with different resistance.

Signature

Introduction

The signature, available in certificate versions, is a 256-bit or 384-bit data field that guarantees data authenticity. The process of the digital signature includes three stages:

1. Generation stage: an algorithm generates a couple of correlated keys,
   - the private key, which is known only by the DCT1 itself, and
   - the public key, lasered on the front of the meter (QR code) and available through Modbus RTU
2. Authentication stage: the set of data collected by the DCT1 is signed using the private key, which asserts the authenticity of the data,
3. Integrity stage: the data can be verified by the user only through the public key that matches the private one. Otherwise, the system leads to an error. It guarantees the integrity of the data reported by the device.

DCT1 implements this procedure to ensure the information it reports is not corrupted by an external system because no one apart from the DCT1 knows the private key, which is necessary to verify the authenticity of the data.

Modbus RTU versions

In EC versions with Modbus RTU port, in addition to the standard Modbus map, DCT1 provides an additional set of data, including a 256-bit (S2 version) or a 384-bit (S3 version) signature.

Step	Signature	Description
S2	256-bit	256 bit ECDSA SHA 256, using curve brainpoolP256r1
S3	384-bit	384 bit ECDSA SHA 384, using curve brainpoolP384r1

SML version

The SML version is available only with 384-bit signature.

Run-hour meters

DCT1 provides 3 run-hour meters:

Run-hour meter	Increases...
Run hour meter (kWh+)	when the power is positive and the current above I_tr
Run hour meter (kWh-)	when the power is positive and the current below -I_tr
Run hour meter (ON time)	always when DCT1 is ON.

Maintenance and disposal

Troubleshooting

Note: *in case of other malfunctions or of any failure, please contact the CARLO GAVAZZI branch or the distributor for your country*

Problem	Cause	Possible solution
The values are not the expected ones	Electrical connections are incorrect	Verify the connections
Exported energy meters (kWh-) don't increase	Measurement mode is set to A (default setting)	Set Measurement mode from A to B in UCS

Communication problems

Problem	Cause	Possible solution
No communication can be established with the analyser	Communication settings are incorrect	Check the set parameters
	Communication connections are incorrect	Verify the connections
	The settings of the communication device (third-party PLC or software) are incorrect	Check the communication with the UCS software

Cleaning

Disconnect the power supply and loads before cleaning. To keep the device clean, use a slightly wet cloth. Never use abrasives or solvents.

Responsibility for disposal

Dispose of the unit by separately collecting its materials and bringing them to the facilities specified by government authorities or by local public bodies. Proper disposal and recycling will help preventing potentially harmful consequences for the environment and for people.

Download

This manual	https://gavazziautomation.com/images/PIM/MANUALS/ENG/DCT1_IM_USE.pdf
DCT1 datasheet	https://gavazziautomation.com/images/PIM/DATASHEET/ENG/DCT1_DS_ENG.pdf
DCT1 installation manual	https://gavazziautomation.com/images/PIM/MANUALS/ENG/DCT1_IM_INST.pdf
UCS Software	https://www.gavazziautomation.com/images/PIM/OTHERSTUFF/ucs.zip

Symbols

Symbol	Description
	Danger
	Provides essential information on completing the task that should not be neglected
	Manual symbol
	Safety sign notice
	The product is not to be discarded with normal household waste
	Double insulation
	Single phase
	The indicated measurement is strongly recommended for the correct functioning of the device

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