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Control Solutions

# 240 W Universal, Isolated DC/DC

**User manual**

Type CUDC-240-55
Part-No. 723300

Version 01

LÜTZE SYSTEMATIC TECHNOLOGY

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# Content

# 1 Introduction

This manual is part of the product *240 W Universal, Isolated DC/DC* (*Part.-No. 723300, Type CUDC-240-55*). It contains important information about the handling and safety of the product.

- To avoid hazardous situations, read the manual before installing the product and using it. This applies to every person who is getting in touch with the product. Trained employees and experts, especially qualified persons who have worked with similar products before, have to read and understand the manual as well.
- Always keep the document at hand. This applies until the device is disposed of. Pass on the operating instructions if the device is sold, distributed or loaned.

# 2 General Information

## 2.1 Symbol Description

### 2.1.1 Safety Messages

This document contains several safety messages. Each safety message contains a defined signal word and a color. The color and the word are referring to an alert level. There are 4 levels. The safety messages point out hazardous situations and give information on how to avoid these.

| | |
|---|---|
| DANGER | **Indicates a hazardous situation, which if not avoided will result in death or serious injury.** |
| WARNING | **Indicates a hazardous situation, which if not avoided can result in death or serious injury.** |
| CAUTION | **Indicates a hazardous situation, which if not avoided can result in minor or moderate injury.** |
| NOTICE | **Indicates a situation which could damage the product or the environment. This notice does not apply to personal injury.** |

### 2.1.2 Handling Notes

Additionally, the following symbols can be found. These refer to important technical information and instructions:

| | |
|---|---|
|  | **Refers to important technical information. This indicates to the user a specific action that must be performed to operate the device safely.** |
|  | **Refers to the use of different tools.** |

## 2.2 Copyright

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## 2.3 Disclaim of Liability

The document was written under consideration of the applied standards, regulations and the current state of technology.

The content is verified of accuracy. Discrepancies are not excluded. For those discrepancies we disclaim liability. Applicable changes and additional information will be in the next version of the document.

The Friedrich Lütze GmbH does not assume liability for any damages and accidents of following reasons:

- Nonobservance of the document
- Untrained and unqualified personnel
- Non-conventional use
- Non approved reconstructions and functional modifications of the product
- Using non-original or non-admitted parts or equipment

## 2.4 Standards and Norms

The product is state of the technology and complies with the applicable safety regulations and the corresponding harmonized European standards (EN).

**NOTICE** **The current versions of the standards and further information on the product can be found in the corresponding data sheets which are valid with this document.**

### 2.4.1 Observe other applicable documents

When operating the device, please also observe all operating instructions enclosed with other components of your system.

**NOTICE** **This manual contains important information on safety, commissioning, operation, maintenance and disposal of the device.**

Always keep these operating instructions and the other applicable documents (e.g. data sheets, package inserts, declarations of conformity, etc.) at hand so that they are available when required. This applies until the device is disposed of. Hand over all documents in case of sale, distribution or rental of the device.

For reasons of clarity, we would like to point out that these operating instructions cannot describe all conceivable problems in connection with the use of this device.

Should you require further information or encounter special problems that are not dealt with insufficient detail in the operating instructions, you can request the necessary information about service from Friedrich Lütze GmbH.
(See also *chapter 10: Service*)

## 2.5 Type plate

**NOTICE** **Mind the original adhesive labels.** Keep them readable.

On the product following label with following data can be found:

- Part Number
- Hardware Revision
- Module description
- Manufacturing date
- Software version
- Serial number
- Data matrix code, contains: serial number, part number and date
- QR code

### 2.5.1 QR Code – product information (optional)

The code refers to further product information in the online catalog on the Lütze website. To access the site, please proceed as follows:

1. Scan the QR Code with a Smartphone or any other device that can read and interpret QR Codes.
2. Open the standard browser with the corresponding page.
3. Choose the appropriate language.
4. The device is displayed in the online catalog. Under *Downloads* you can download further technical documentation.

# 3 Safety

## 3.1 Safety instructions

### 3.1.1 Content of the instruction manual

**NOTICE** **These instructions must be read and understood before installing, operating or maintaining the device**.

The instruction manual has to be read and observed before any work is done on or with the device. This applies to all persons who get in contact with the device. Trained personnel and skilled workers, especially electricians who have already worked with similar devices, should also have read and understood the instructions.

### 3.1.2 Recipients

The operating manual addresses planners, project manager and programmers. It also addresses the operating employees which are responsible for the initial operation, the operation and for the maintenance of the products and systems. Regarding the employees three qualification levels are differentiated.

### 3.1.3 Operating Employees

**⚠ WARNING** **Risk of injury by deploying insufficient qualified operating employees!**

Inappropriate appoint of not qualified or insufficient personnel can cause property damages and personal injuries.

Tasks which apply special procedures should be done by trained and qualified employees or experts, especially electricians.

### 3.1.4 Responsibility of the Operator

**NOTICE** The customer is subject to an obligatory feedback if safety-related errors are discovered.

Since the device is operated in the commercial environment, the operator of the device is responsible for compliance with the instructions for occupational safety:

- The operator is responsible to train the employees and to inform himself about the industrial safety regulations.
- The operator is responsible that safety, environment protection regulations and rules for accident prevention are observed.
- The operator has to run a risk assessment at the working environment/place of installation to expose hazards and to alert those.
- The manual has to be stored near the product.
- The manual has to be obeyed.
- The product can just be run in a faultless technical condition.

# 4 Product description

## 4.1 Features and benefits

- Up to 240 W output power (voltage dependent)
- Converts any voltage between 10.5V and 55V to any voltage between 5V and 55V
- High efficiency and compact size
- Constant current or hiccup mode limitation, user settable
- Digital Power regulation
- Isolated topology (4.2kVdc)
- Modbus over USB interface for control and monitoring
- Multiple protections integrated
- Parallelable for power or redundancy (integrated ORing circuitry)
- Suitable for *POWERMASTER* software (available for Windows and Android OS)

## 4.2 Functional description

The device is a high performance digitally controlled isolated DC/DC converter. Its unique power stage architecture allows the device to operate over a very wide input and output voltage range, keeping high energy conversion efficiency, high reliability and tough regulation characteristics.
To achieve these performances, the device power stage is digitally controlled with an optimized switching algorithm. The system microprocessor allows the user to access the various measurements and system status in real time.
The device offers an integrated low loss ORing circuit to simplify the set-up of redundant power systems.

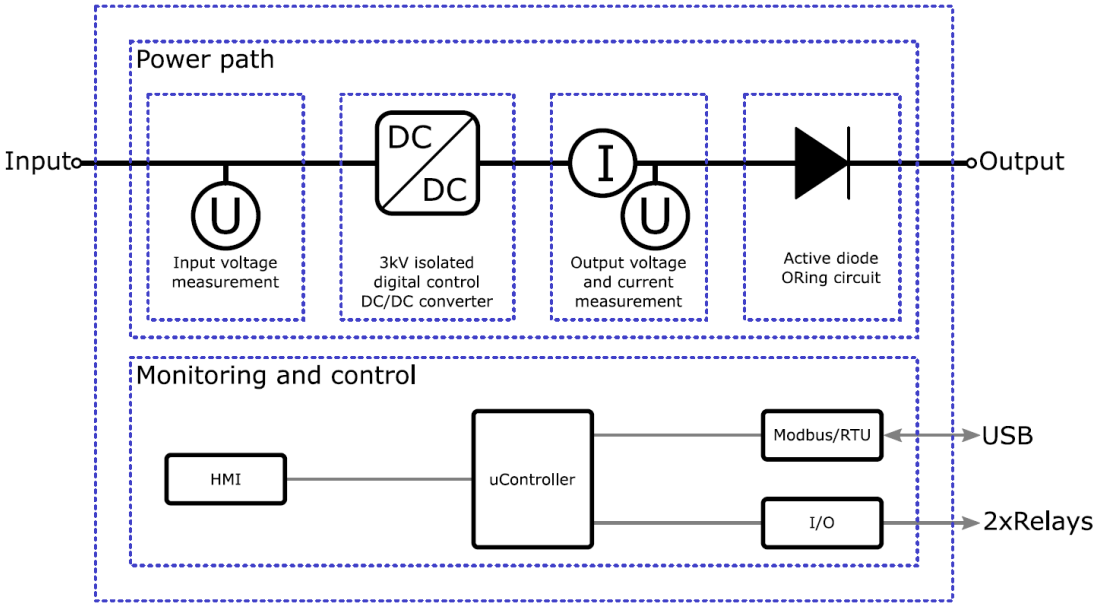



*Figure 1: simplified block diagram of the device*

# 5 Transport and storage

CAUTION

**Risk of material damage. Risk of damage due to improper handling during transport and storage.**

The device must be protected against moisture, unsafe packaging (mechanical damage), dust and electrostatic discharge.

# 6 Product construction

**Use latest device documentation, software and firmware to ensure reliable operation of the system (downloadable from www.luetze.com)**

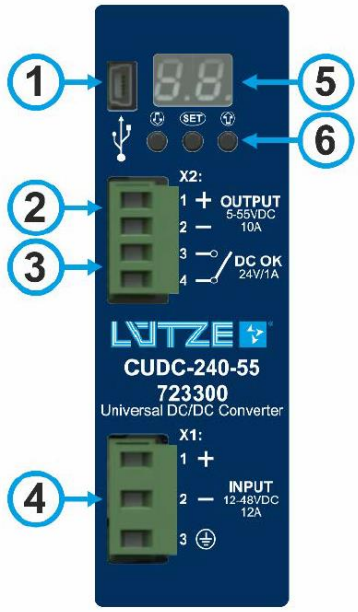



*Figure 2: Front panel view*

| | | |
|---|---|---|
| **1** | **Modbus over USB** | Used to connect a device running *POWERMASTER* or custom application. Firmware update is also possible |
| **2** | **DC Output** | Connected to the load. The output voltage is adjustable between 5 to 55 Vdc. |
| **3** | **DC-OK dry contact** | A normally open relay contact is available; the relay closes when the output voltage is >90% of the programmed output voltage value. |
| **4** | **DC Input** | Input voltage supply, range is from 12 to 48 Vdc. |
| **5** | **Display** | 2-digits LED display, used to program the device and read its status. |
| **6** | **Control keys** | 3 push buttons are provided to navigate through menus and to select various functions. |

# 7 Operation

## 7.1 Operating mode

### 7.1.1 Single

When the device is used as a single device powering the load, the operating mode must be set to “Single (SI)”, see *chapter 8: User interface*. Any voltage between 11VDC and 55VDC can be converted in any voltage between 5VDC and 55VDC with a maximum output power of 240W (see *product datasheet* for details).

### 7.1.2 Parallel

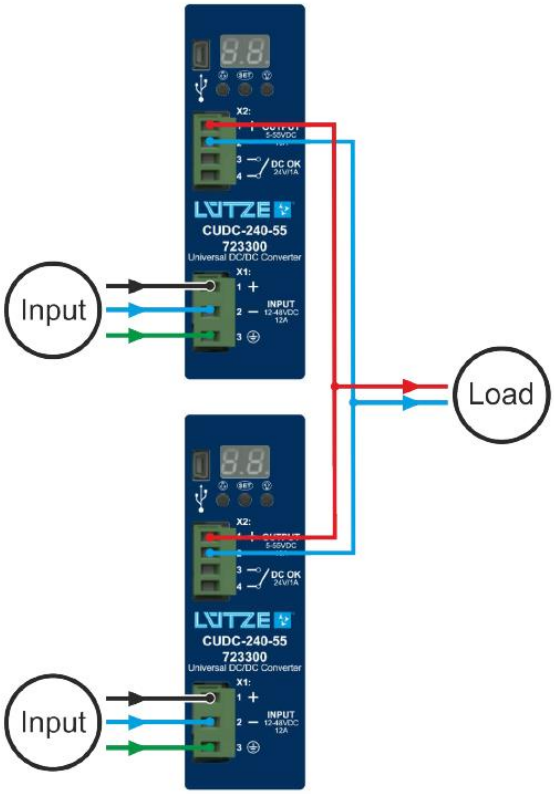



*Figure 3: parallel connection of devices*

Multiple devices can be connected in parallel to increase the output power capabilities and/or for redundancy purposes.
When operating in this mode, the operating mode must be set to “Parallel (PA)”, see *chapter 8: User interface.*
For proper operation between the units the cable length connecting the various devices to the load must have the same length and cross-section.
For optimal current sharing it may be necessary to slightly adjust some of the devices output voltage until the same current is delivered by all the units.
For precise set-up of a parallel system a good precision current meter is suggested.
It is recommended to limit the load power to 80% of the sum of the individual output power of the paralleled units.

| | |
|---|---|
| **NOTICE** | When “Parallel (PA)” mode is selected, the current limitation method is automatically fixed to the “Constant Current (CC)” model. |

## 7.2 Output voltage programming

The device's output voltage can be programmed over a range from 4.5V to 55V thanks to the "Output Voltage" menu item, see *chapter 8: User interface*. The resolution is 10mV.
While setting the output voltage, the screen cycles between integer part (with dot point on) and cents of volts every 3sec. For example, if the value 24.56 is set the screen cycles between the following two screens:

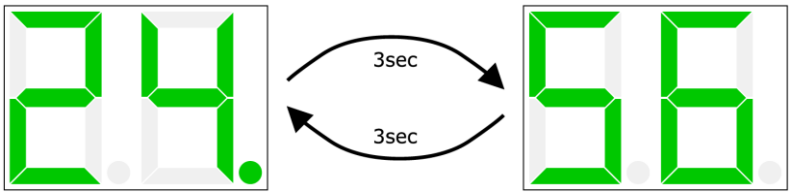



*Figure 4: Example of 24.56V setting value shown on display*

## 7.3 Current limitation

The device can be set-up with 2 different current limitation algorithms, depending on application. The maximum current delivered by the device can be limited thanks to the "Output Current (IO)" menu. The maximum output current (Imax) can be limited from 1A to 11A (default 10A) via this menu, see *chapter 8: User interface.* Once the load asks for more current than the programmed Imax, the device goes into current limitation mode; two limitation algorithms are selectable by the user, see *chapter 7.3.1: Hiccup* and *chapter 7.3.2 Constant current* for details.

**NOTICE** **To self-protect, the device never delivers higher current than the one specified on the datasheet "Output power limitation curve" and "Output current limitation curve" charts. This regardless of the Imax setting value.**

### 7.3.1 Hiccup

When the device is set up in "Hiccup mode (HU)", the output current is limited at **1.5xImax**. When the programmed Imax value is exceeded, a timer is started. If the load current demand is not reduced below Imax within 5 seconds, the output is switched off for 10 seconds.
An overload (OL) error message is shown on the display, see *chapter 7.6: Alarms* for details.
This cycle is then repeated until the load current demand is not decreased below Imax.
This operating mode is recommended when powering loads requiring high inrush current demands.
In case of a direct short circuit on the output, the output is switched off in about 0.2 seconds and kept off for 10 seconds. A short circuit (SC) error message is shown on the display, see *chapter 7.6: Alarms* for details. This cycle is then repeated until the short circuit is removed.

**NOTICE** When the "Parallel (PA)" mode is selected, the current limitation method is automatically fixed to the "Constant Current (CC)" model and it is not possible to select "Hiccup mode" when "Parallel mode" is selected.

### 7.3.2 Constant current

When the device is set up in "Constant Current (CC)", the output current is limited at Imax. If the load asks for more current than Imax, the output voltage is progressively decreased to keep the output current regulated at Imax. When the output voltage decreases below 90% of the programmed output voltage, the "DC-OK" relay dry contact opens, see *chapter 7.5: DC-OK Relay*, informing the user that the output voltage is no more regulated.
This operating mode is recommended when powering highly capacitive loads. In case of a direct short circuit on the output, the output is switched off in about 0.2 seconds and kept off for 10 seconds. A short circuit (SC) error message is shown on the display, see *chapter 7.6: Alarms* for details. This cycle is then repeated until the short circuit is removed.

## 7.4 Output enable

The device is provided with a software control allowing to switch the output of the device ON and OF. This flag is available at Modbus address 0x1014, see *chapter 7.7: Modbus* for details.

## 7.5 DC-OK Relay

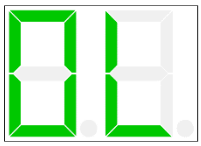
A normally open relay is used to indicate that the output voltage is available and regulated if the output voltage drops below 90% of the programmed output voltage value.

## 7.6 Alarms

### 7.6.1 Output short circuit

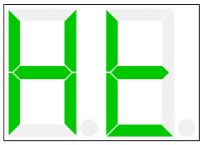
The “Short Circuit (SC)” error message appears when a short circuit is detected at the output.
In this case the output is switched off and then restarted after 10 seconds. This cycle is repeated until the short circuit is removed.

### 7.6.2 Output overload



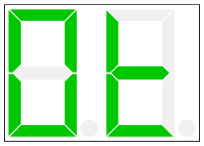
The “Overload (OL)” error message appears when the output current exceeds Imax; it is only applicable when “hiccup mode” current limitation is selected.
In this case the output is switched off after 5 seconds of continuous overload and then restarted after 10 seconds. This cycle is repeated until the output current is reduced below Imax.

### 7.6.3 Over temperature warning



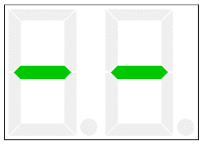
The “Over Temperature warning (Ht)” appears when the internal temperature is reaching unusually high levels. If no modification of the ambient operating temperature and/or load conditions is performed by the user, it is highly possible that an “Over Temperature (Ot)” occurs, causing the output to switch off.

### 7.6.4 Over temperature error



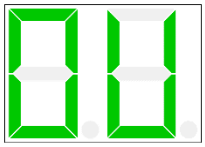
The “Over Temperature (Ot)” error message appears when the internal temperature exceeds the safe limits. In this case the output is switched off. The output is switched back on when the temperature decreased to safe limits. In case of repeated Over Temperature errors check the device ventilation and/or reduce ambient temperature.

### 7.6.5 USB power



When the device is only connected to a USB device with no input voltage applied, this information is shown on the display. The output is switched off but the user can however configure the device parameters and/or update the firmware.

### 7.6.6 Output over voltage




In case of an internal DC/DC converter defect, if the measured voltage exceeds the set voltage of 15%, the output is shut down and the alarm signaled.

## 7.7 Modbus

The device communicates through Modbus/RTU as specified on "MODBUS over Serial Line" and "MODBUS APPLICATION PROTOCOL SPECIFICATION"; documents available on http://www.modbus.org/.

*Table 1* contains the field types and *Table 2* the mapping fields:

| Type | Modbus function codes | | Description |
|---|---|---|---|
| | Read | Write | |
| BIT | 1,2 | 5,15 | Single bit with value 0 or 1 |
| SINT16 | 3,4 | 6,16 | Signed 16 bit value (2's complement) |
| UINT16 | 3,4 | 6,16 | Unsigned 16 bit value |

*Table 1: Modbus types*

| Address | Type | R/W | Unit | Min. | Max. | Description |
|---|---|---|---|---|---|---|
| *Settings* | | | | | | |
| 0x1000 | UINT16 | R/W | 1 | 1 | 99 | Modbus address. |
| 0x1010 | UINT16 | R/W | 0.01 | 4.5 | 57 | Nominal output voltage [V]. |
| 0x1011 | UINT16 | R/W | 0.1 | 1 | 11 | Maximal output current [A]. |
| 0x1012 | UINT16 | R/W | 1 | 1 | 2 | Operating mode (see *chapter 7.1: Operating mode*):<br>1. Single<br>2. Parallel |
| 0x1013 | UINT16 | R/W | 1 | 1 | 2 | Current limitation (see *chapter 7.2.: Output voltage programming*):<br>1. Hiccup<br>2. Constant current |
| 0x1014 | UINT16 | R/W | 1 | 0 | 1 | Output enable:<br>0: Disabled<br>1: Enabled |
| 0x1015 | UINT16 | R/W | 1 | 0 | 1 | Lock settings.<br>0: Disabled<br>1: Enabled |
| *Metering* | | | | | | |
| 0x2000 | SINT16 | R | 0.1V | 0 | 60 | Output voltage [V]. |
| 0x2001 | SINT16 | R | 0.1V | 0 | 15 | Output current [A]. |
| 0x2002 | SINT16 | R | 0.1V | 0 | 360 | Output power [W]. |
| 0x2003 | SINT16 | R | 0.1V | 0 | 60 | Input voltage [V]. |

| *State* | | | | | | |
|---|---|---|---|---|---|---|
| 0x4000 | BIT | R | 1 | 0 | 1 | DC OK |
| 0x4001 | BIT | R | 1 | 0 | 1 | Output disabled. |
| 0x4002 | BIT | R | 1 | 0 | 1 | Output short circuit. |
| 0x4003 | BIT | R | 1 | 0 | 1 | Output overload. |
| 0x4004 | BIT | R | 1 | 0 | 1 | USB powered. |
| 0x4005 | BIT | R | 1 | 0 | 1 | Over temperature warning |
| 0x4006 | BIT | R | 1 | 0 | 1 | Over temperature error. |
| 0x4007 | BIT | R | 1 | 0 | 1 | Output over voltage error. |

*Table 2: Modbus fields*

# 8 User interface

The device is provided with a 2-digits 7-segments LED display used to indicate the status and to navigate through the configuration menus. During normal operation, the measures are reported. Alarms are also reported on the display.

The layout of the menu is shown below. The various options are selected with the 3 keys.

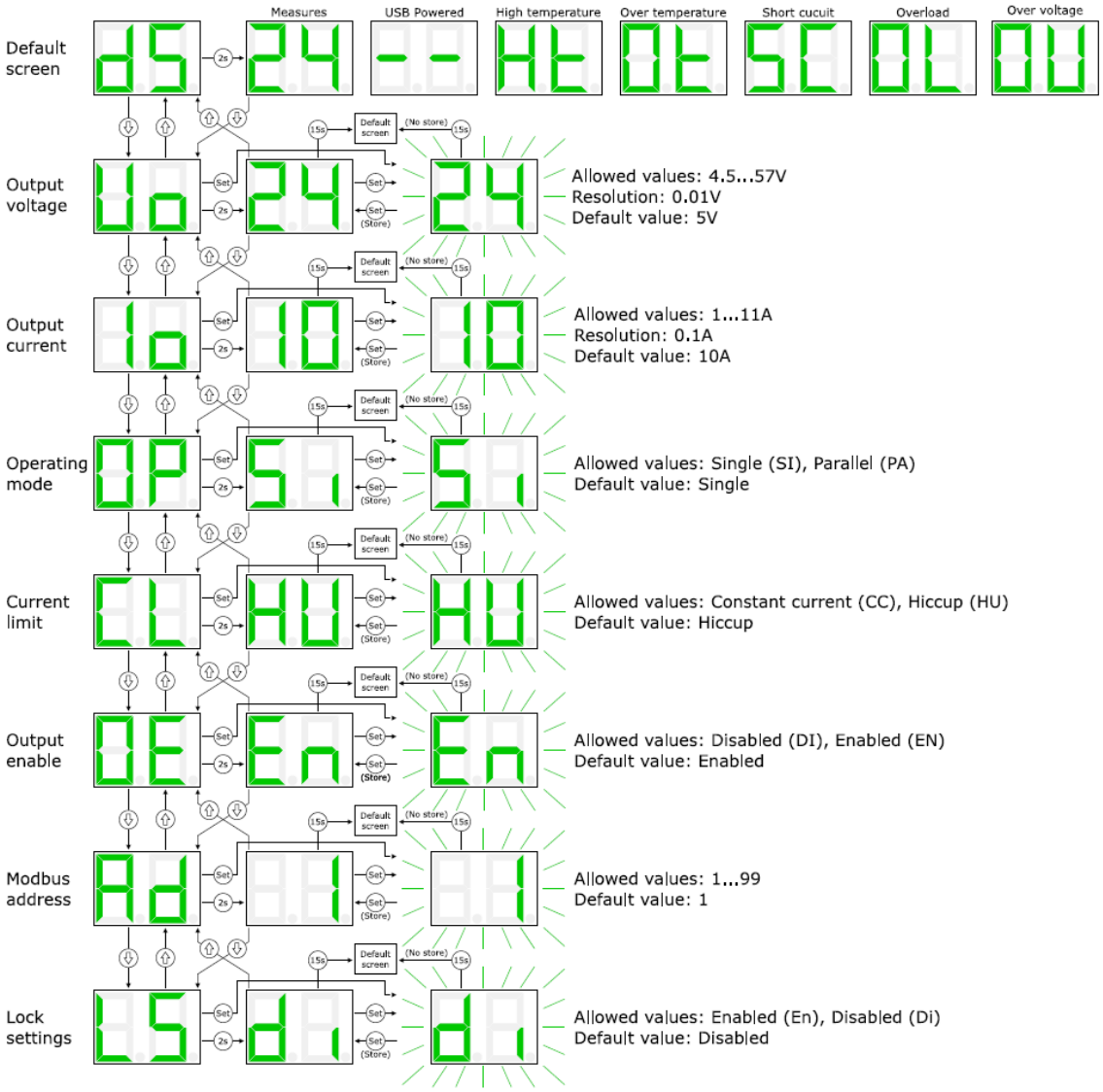



*Figure 5: HMI*

User can select the measure to show on the display, pressing the set button as shown beside.

The 3 available measures are:

- Output voltage
- Output current
- Input voltage

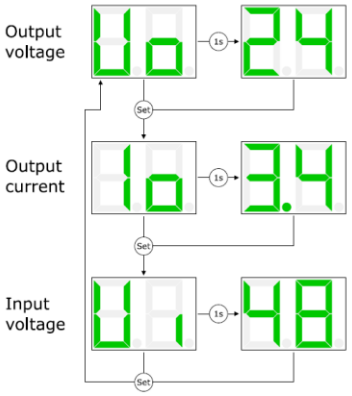



*Figure 6: HMI measures*

The locking/unlocking of the settings editing can be done using the field “Lock settings (LS)” in the “User Interface” menu (see *chapter 8: User interface*) or via the Modbus “Lock settings” field.

The locking/unlocking of the settings editing can also be done keeping pressed the ⇧(Up) and ⇩(Down) buttons for at least 3 seconds simultaneously. There are no notifications using this procedure.

When the lock is active, trying to edit a parameter using the device’s buttons shows a “SL” (Settings Locked) message for a couple of seconds. It is always possible to edit the setting through Modbus regardless the status of the lock.

## 8.1 Logs

The device stores important log information on flash memory. Logs are readable using the free *POWERMASTER* application.

### 8.1.1 DC-OK

*Modbus address*
***0x4000***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the measured output voltage exceeds the 90% of the nominal output voltage.

### 8.1.2 Output disabled

*Modbus address*
***0x4001***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the output is disabled through the Modbus settings.

### 8.1.3 Output short circuit

*Modbus address*
***0x4002***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the output is short circuited.

### 8.1.4 Output overload

*Modbus address*
***0x4003***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the output is overloaded.

### 8.1.5 USB powered

*Modbus address*
***0x4004***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the unit is powered by USB only.

### 8.1.6 Overtemperature warning

*Modbus address*
***0x4005***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the internal temperature is high. If the temperature increases more, the device may switch OFF.

### 8.1.7 Overtemperature error

*Modbus address*
***0x4006***

| *Value1* | *Value2* |
|---|---|
| ***Inactive (0), Active (1)*** | ***Not used*** |

Active when the internal temperature is too high. To prevent damage, the device switches OFF.

### 8.1.8 Power ON event

*Modbus address*
***0xE000***

| *Value1* | *Value2* |
|---|---|
| ***Power ON count.*** | ***Not used*** |

Generated at every time the device is turned ON.

# 9 Technical Specifications

See datasheet available on www.luetze.com

# 10 Service

For general questions about the product or repair requests, please contact us:

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Phone: +44 1827 313330
E-Mail: sales.gb(at)lutze.co.uk

# 11 Final Shutdown and Disposal

Mind the valid environmental standard of your country for the final shutdown and disposal.

For the final shutdown, the device must be disassembled. Electric parts must be disposed regarding the national electronic scrap regulation. You take the responsibility for the shipped article. You have to dispose the article regarding the terms of use and legal liability on your own costs and exempt Friedrich Lütze GmbH from the responsibilities of §19 passage 2 ElektroG (Take-back obligation of the manufacturer) and any third party in this content.

If you have handled the device to a commercial third party without any contractual acceptance of the disposal, you must take back the device after the final shutdown on your own cost and the legal liability.

The entitlement of indemnity from Friedrich Lütze GmbH by the customer does not prescribe before two years after the final shut down of the device. The two-year deadline of the suspension of statue for limitations can start with a written message about the terms from you to Friedrich Lütze GmbH.

# 12 Revision history

| Version | Revision | Editor | Date |
|---|---|---|---|
| 00 | Release | Briem | 05/12/2019 |
| 01 | New CI | Hardes/Briem | 11/06/2021 |
| | | | |

Subject to technical changes. This user manual must be kept for further use!

SYSTEMATIC TECHNOLOGY