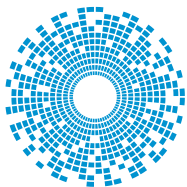


USER MANUAL

LDD240-WU

240 W Universal DC-DC Converter



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1 PRODUCT DESCRIPTION

Use latest device Documentation, Software and Firmware to ensure reliable operation of the system (belfuse.com/power-solutions).

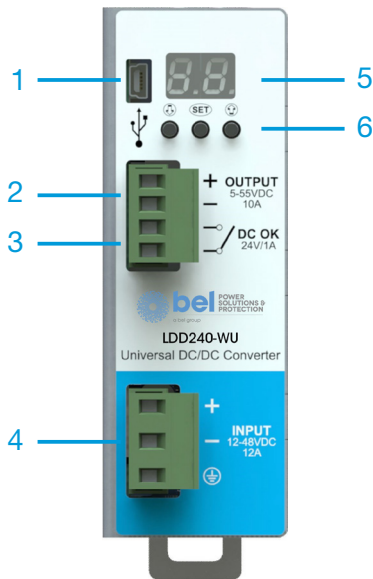


Figure 1. Front panel view

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.

2 FEATURES AND BENEFITS

- Up to 240 W output power (voltage dependent)
- Converts any voltage between 10.5 V and 55 V to any voltage between 5 V and 55 V
- High efficiency and compact size
- Constant current or hiccup mode limitation, user settable
- Digital Power regulation
- Isolated topology (4.2 kVDC)
- 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)

3 FUNCTIONAL DESCRIPTION

LDD240-WU 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 LDD240-WU power stage is digitally controlled with an optimized switching algorithm. The system microprocessor allows the user to access to the various measurements and system status in real time.

LDD240-WU offers an integrated low loss ORing circuit to simplify the set-up of redundant power systems.

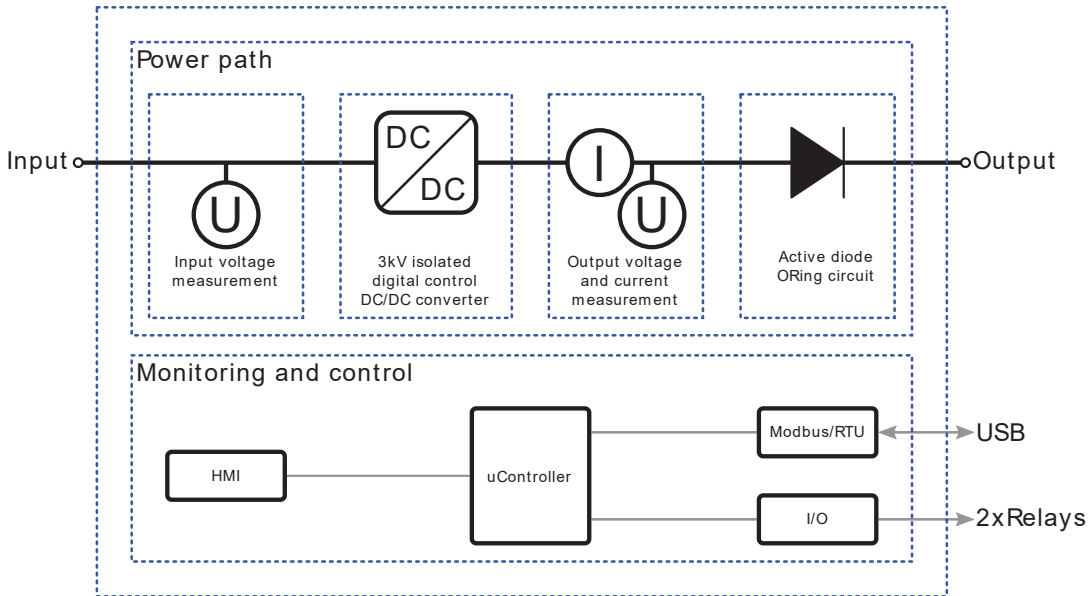


Figure 2. LDD240-WU simplified block diagram

3.1 OPERATING MODE

3.1.1 SINGLE

When the LDD240-WU is used as a single device powering the load the operating mode must be set to “Single (SI)”, see §4. Any voltage between 11 VDC and 55 VDC can be converted in any voltage between 5 VDC and 55 VDC with a max. output power of 240 W (see datasheet for details).

3.1.2 PARALLEL

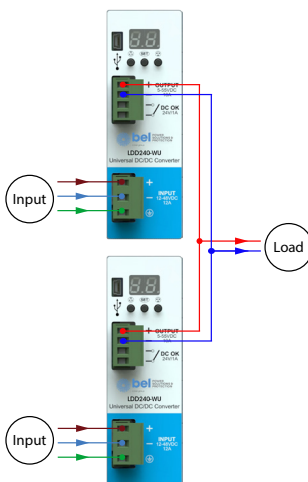


Figure 3. LDD240-WU parallel connection

Multiple LDD240-WU can be connected in parallel to increase the output power capabilities and/or for redundancy purposes.

When operating in this mode operating mode must be set to “Parallel (PA)”, see §4.

For proper operation between the units the cable length connecting the various LDD240-WU 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.

Note: when “Parallel (PA)” mode is selected the current limitation method is automatically fixed to “Constant Current (CC)” model.

3.2 OUTPUT VOLTAGE PROGRAMMING

LDD240-WU output voltage can be programmed over a range from 4.5 V to 55 V thanks to the “Output Voltage” menu item, see §4. The resolution is 10 mV.

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 V is set the screen cycles between the following two screens:

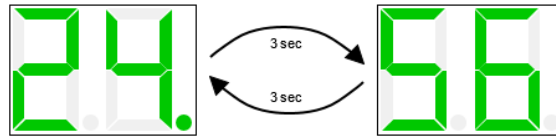


Figure 4. Example of 24.56 V setting value shown on display

3.3 CURRENT LIMITATION

LDD240-WU 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 (I_{max}) can be limited from 1 A to 11 A (default 10 A) through this menu, see §4. Once the load asks for more current than the programmed I_{max} the device goes into current limitation mode; two limitation algorithms are selectable by the user, see §3.3.1 and §3.3.2 for details.

WARNING: 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 I_{max} setting value.

3.3.1 HICCUP

When LDD240-WU is set up in “Hiccup mode (HU)” the output current is limited at $1.5 \times I_{max}$. When the programmed I_{max} value is exceeded a timer is started. If the load current demand is not reduced below I_{max} within 5 seconds the output is switched off for 10 seconds. Overload (OL) error message is shown on the display, see §3.6 details. This cycle is then repeated until the load current demand is not decreased below I_{max} .

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. Short Circuit (SC) error message is shown on the display, see §3.6 details. This cycle is then repeated until the short circuit is removed.

NOTE: When “Parallel (PA)” mode is selected the current limitation method is automatically fixed to “Constant Current (CC)” model and it is not possible to select “Hiccup mode” when “Parallel mode” is selected.

3.3.2 CONSTANT CURRENT

When LDD240-WU is set up in “Constant Current (CC)” the output current is limited at I_{max} . If the load asks for more current than I_{max} the output voltage is progressively decreased to keep the output current regulated at I_{max} . When the output voltage decreases below 90% of the programmed output voltage the “DC-OK” relay dry contact opens see §3.5, 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. Short Circuit (SC) error message is shown on the display, see §3.6 details. This cycle is then repeated until the short circuit is removed.

3.4 OUTPUT ENABLE

The LDD240-WU is provided with a software control allowing to switching ON and OFF the output of the device. This flag is available at Modbus address 0x1014, see §3.7 for details.

3.5 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.

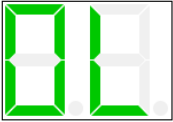
3.6 ALARMS

3.6.1 OUTPUT SHORT CIRCUIT



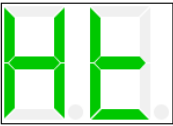
The “Short Circuit (SC)” error message appears when a short circuit is detected at the output. In this case the output is switched off and then restarted after 10 seconds. This cycle is repeated until the short circuit is removed.

3.6.2 OUTPUT OVERLOAD



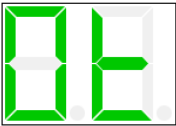
The “Overload (OL)” error message appears when the output current exceeds I_{max} ; it is only applicable when “hiccup mode” current limitation is selected. In this case the output is switched off after 5 seconds of continuous overload and then restarted after 10 seconds. This cycle is repeated until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

3.6.3 OVER TEMPERATURE WARNING



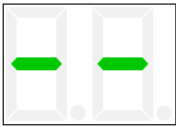
The “Over Temperature warning (Ht)” appears when the internal temperature is reaching unusually high levels. If no modification of the ambient operating temperature and / or load conditions is performed by the user, it is highly possible that an “Over Temperature (Ot)” error occurs, leading to the output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

3.6.4 OVER TEMPERATURE ERROR



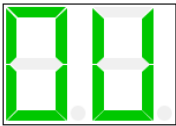
The “Over Temperature (Ot)” error message appears when the internal temperature exceeds the safe limits. In this case the output is switched off. The output is switched back on when the temperature decreased to safe limits. In case of repeated Over Temperature errors check the device ventilation and/or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

3.6.5 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.

3.6.6 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.

3.7 MODBUS

LDD240-WU 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 mapped 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	Signed 16 bit value (2's complement)

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 (§3.1): 1. Single 2. Parallel
0x1013	UINT16	R/W	1	1	2	Current limitation (§3.2): 1. Hiccup Constant current
0x1014	UINT16	R/W	1	0	1	Output enable. 0: Disabled 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

4 USER INTERFACE

The LDD240-WU 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.

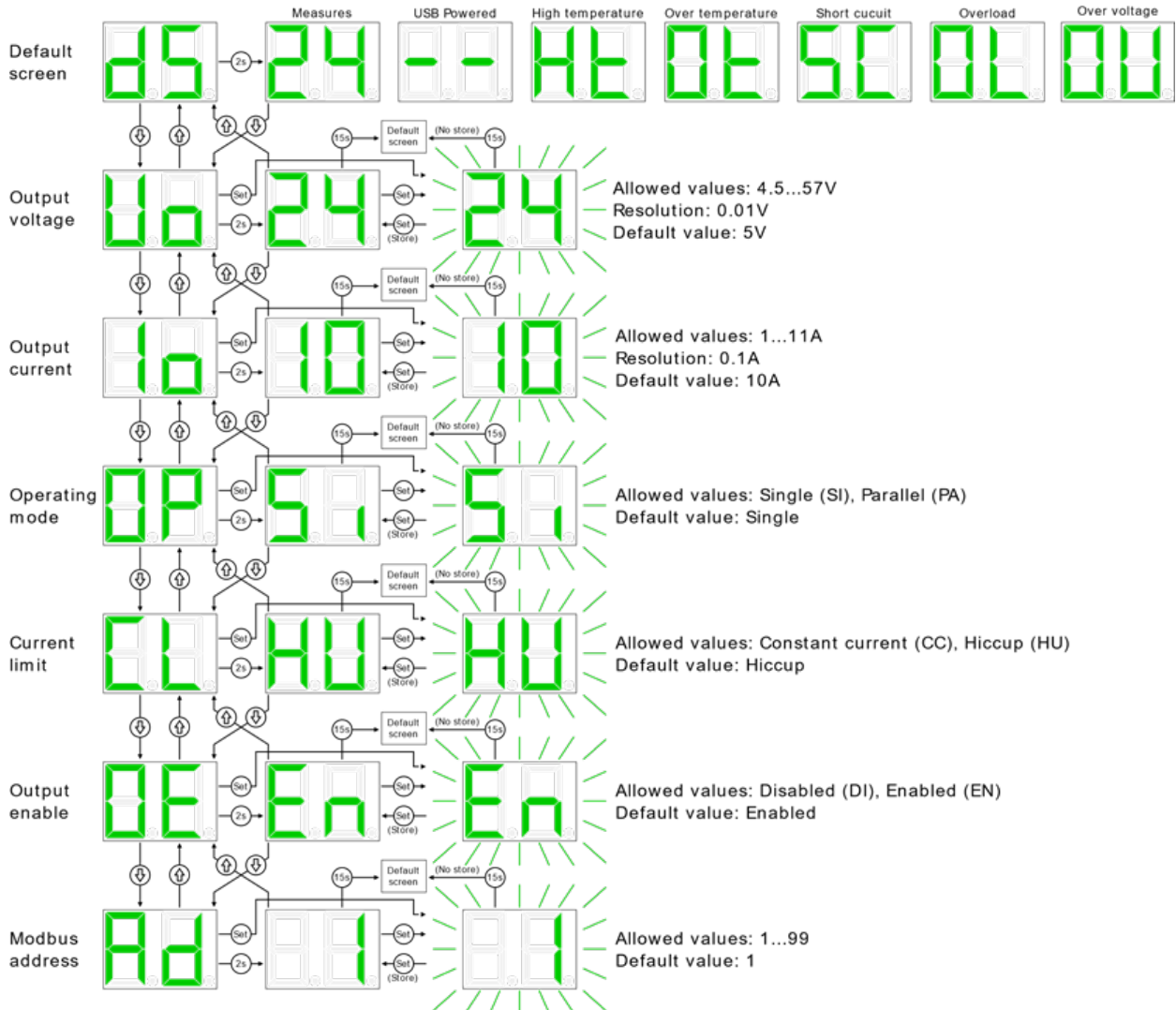


Figure 5. HMI

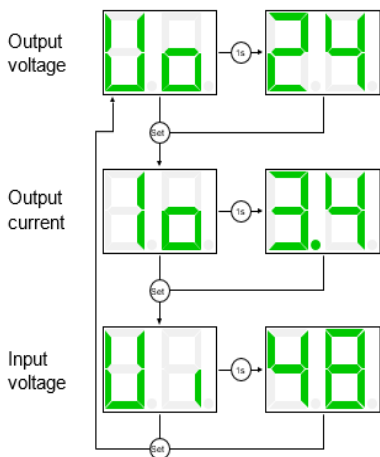


Figure 6. HMI measures

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

4.1 LOGS

LDD240-WU stores important log information on flash memory. Logs are readable using the free POWERMASTER application.

4.1.1 DC-OK

Modbus address	Value1	Value2
0x4000	Inactive (0), Active (1)	Not used

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

4.1.2 OUTPUT DISABLED

Modbus address	Value1	Value2
0x4001	Inactive (0), Active (1)	Not used

Active when the output is disabled through the Modbus settings.

4.1.3 OUTPUT SHORT CIRCUIT

Modbus address	Value1	Value2
0x4002	Inactive (0), Active (1)	Not used

Active when the output is short circuited.

4.1.4 OUTPUT OVERLOAD

Modbus address	Value1	Value2
0x4003	Inactive (0), Active (1)	Not used

Active when the output is overloaded.

4.1.5 USB POWERED

Modbus address	Value1	Value2
0x4004	Inactive (0), Active (1)	Not used

Active when the unit is powered by USB only.

4.1.6 OVER TEMPERATURE WARNING

Modbus address	Value1	Value2
0x4005	Inactive (0), Active (1)	Not used

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

4.1.7 OVER TEMPERATURE ERROR

Modbus address	Value1	Value2
0x4006	Inactive (0), Active (1)	Not used

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

4.1.8 POWER ON EVENT

Modbus address	Value1	Value2
0xE000	Power on count	Not used

Generated at every time the LDD240-WU is turned ON.

5 TECHNICAL SPECIFICATIONS

See LDD240-WU datasheet available on belfuse.com/power-solution.