

INSTALLATION INSTRUCTION

LDD960-UU

960 W COMBO DC UPS / DC-DC Converter



SYSTEM DESCRIPTION

LDD960-UU is a microprocessor-controlled unit that can perform 2 functions:

- UPS rated 960 W / 20 A usable in any system rated 12 – 48 VDC
- DC-DC converter (non-isolated) rated 960 W / 20 A usable in any combination of IN/OUT voltages 12 – 48 VDC

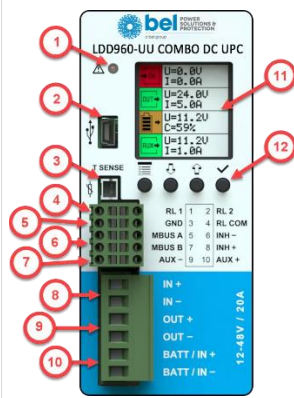
For the UPS function you may use 1 battery of 12 V, independently of the operating load voltage. For any supply voltages (12 – 48 VDC) it may use also multiple battery configuration (10 – 58 VDC). LDD960-UU monitors the voltage coming from a DC power supply and in case of power failure a backup battery is supplying the energy to the load. In normal condition the battery is kept charged by an integrated battery charger supporting various battery chemistries.

As a DC-DC converter (no battery present) the input must be connected to the battery connector.

The input voltage is converted to any output voltage as per the set-up.

READ THIS CAREFULLY BEFORE INSTALLATION!	VOR DER INSTALLATION BITTE FOLGENDE SICHERHEITSHINWEISE BEACHTEN!	LEGGERE ATTENTAMENTE PRIMA DELL'INSTALLAZIONE!	A LIRE ATTENTIVEMENT AVANT L'INSTALLATION!
<p>Before operating, read this document thoroughly and retain it for future reference. Non-respect of these instructions may reduce performances and safety of the devices and cause danger for people and property. The products must be installed, operated, serviced and maintained by qualified personnel in compliance with applicable standards and regulations. Do not open the device, it does not contain replaceable components, the tripping of the internal fuse (if included) is caused by an internal failure. Do not repair or modify the device, if malfunction or failure should occur during operation, send unit to the factory for inspection. No responsibility is assumed by Bel for any consequences deriving from the use of this material.</p>	<p>Lesen Sie dieses Dokument vor der Inbetriebnahme sorgfältig durch und bewahren Sie es zum späteren Nachschlagen auf. Die Nichtbeachtung dieser Anweisungen kann die Funktion und Sicherheit der Geräte beeinträchtigen und birgt Gefahren für Personen und Eigentum. Die Geräte müssen von qualifiziertem Personal unter Einhaltung der geltenden Normen und Vorschriften installiert, betrieben, gewartet und instand gehalten werden. Öffnen Sie das Gerät nicht, es enthält keine austauschbaren Komponenten, das Auslösen der internen Sicherung (falls vorhanden) ist stets auf tiefergehende Fehler im Schaltkreis zurück zu führen. Reparieren oder modifizieren Sie das Gerät nicht. Sollte während des Betriebs eine Fehlfunktion oder ein Defekt auftreten, schicken Sie das Gerät zur Überprüfung ins Werk. Bel übernimmt keine Haftung für die Folgen, die sich aus dem Einsatz dieses Gerätes ergeben.</p>	<p>Prima dell'installazione, leggere attentamente questo documento istruzioni e conservarle per future consultazioni. L'inosservanza delle presenti istruzioni può compromettere le caratteristiche e la sicurezza dell'apparecchio e causare pericolo per le persone e le cose. Il prodotto deve essere installato, utilizzato e riparato da personale qualificato e nel rispetto delle normative vigenti. Non aprire il prodotto, esso non contiene componenti sostituibili, il guasto del fusibile interno (se previsto) è causato da un guasto interno. Non tentare di riparare o modificare il prodotto, se durante il funzionamento si verificano guasti o anomalie, inviarlo al produttore per il controllo. Bel non si assume nessuna responsabilità per qualunque conseguenza derivante dall'uso di questo materiale.</p>	<p>Lire ces instructions avant l'installation, conserver ce manuel pour référence future. Défaut de se conformer à ces instructions peut affecter les caractéristiques et la sécurité du dispositif, et causer du danger aux personnes ou aux biens. Les produits doivent être installés, exploités et entretenus par du personnel qualifié et en conformité avec les règlements. N'ouvrez pas le produit, il ne contient aucune pièce réparable, le déclenchement du fusible interne (le cas échéant) est causé par un défaut interne. Ne pas essayer de réparer ou modifier le produit ; si des défaillances se produisent pendant le fonctionnement, retourner le produit au fabricant pour inspection. Bel n'assume aucune responsabilité des conséquences éventuelles découlant de l'utilisation des produits.</p>
CAUTION	ACHTUNG	ATTENZIONE	AVVERTISSEMENT
<p>RISK OF BURNS, EXPLOSION, FIRE, ELECTRICAL SHOCK, PERSONAL INJURY. Never carry out work on live parts! Danger of fatal injury! The product's enclosure may be hot, allow time for cooling product before touching it. Do not allow liquids or foreign objects to enter into the products. To avoid sparks, do not connect or disconnect the device before having previously turned-off input power and wait for internal capacitors discharge (minimum 1 minute).</p>	<p>GEFAHR VON VERBRENNUNGEN, EXPLOSIONEN, FEUER, STROMSCHLAG, PERSONENSCHÄDEN. Führen Sie niemals Arbeiten an spannungsführenden Teilen durch! Gefahr von tödlichen Verletzungen! Das Gehäuse des Gerätes kann heiß sein, lassen Sie Zeit zum Abkühlen des Gerätes, bevor Sie es berühren. Lassen Sie keine Flüssigkeiten oder Fremdkörper in die Geräte eindringen. Um Überschlüge zu vermeiden, schließen Sie das Gerät nicht an oder trennen Sie es nicht ohne vorher die Eingangsspannung abgeschaltet zu haben, und warten Sie die Entladung der internen Kondensatoren ab (mindestens 1 Minute).</p>	<p>RISCHIO USTIONI, ESPLOSIONE, INCENDIO, SCOSSA, LESIONI GRAVI. Non effettuare mai operazioni sulle parti sotto tensione! Pericolo di lesioni letali! Il contenitore può scottare, lasciar quindi raffreddare il dispositivo prima di toccarlo. Non far entrare liquidi o oggetti estranei nel dispositivo. Per evitare scintille, non collegare o scollegare l'apparecchiatura prima di avere tolto tensione di ingresso e prima che sia avvenuta la scarica dei condensatori interni (min. 1 minuto).</p>	<p>RISQUE DE BRULURES, EXPLOSION, INCENDIE, ELECTROCUTION, DOMMAGE AUX PERSONNES. Ne jamais effectuer des opérations sur les parties sous tension! Danger de mort! Le boîtier peut produire des brûlures, le laisser refroidir avant de toucher l'appareil. Ne faire pas pénétrer des liquides ou des corps étrangers dans l'appareil. Pour éviter des étincelles, ne pas connecter ou déconnecter l'équipement jusqu'à ce que la tension d'entrée a été supprimée et avant qu'il n'ait eut lieu la décharge des condensateurs internes (minimum 1 minute).</p>
INTENDED USE	BESTIMMUNGSGEMÄßER BETRIEB	USO PREVISTO	UTILISATION
<p>These are isolated devices suitable for SELV and PELV circuitry and are designed to be mounted on DIN rail and installed inside a protective enclosure. They are intended for general use such as in industrial control, communication, and instrumentation equipment. Do not use these devices in applications where malfunction may cause injury or death.</p>	<p>Es handelt sich um galvanisch getrennte Geräte, die für SELV- und PELV-Anwendungen geeignet sind und für die Montage auf DIN-Schienen und die Installation in einem Schutzgehäuse konzipiert sind. Sie sind für den allgemeinen Gebrauch wie z.B. in industriellen Steuer-, Kommunikations- und Automatisierung-Anwendungen vorgesehen. Verwenden Sie diese Geräte nicht in Anwendungen, bei denen eine Fehlfunktion zu Verletzungen oder zum Tod führen kann.</p>	<p>I dispositivi sono isolati, adatti per applicazioni SELV e PELV, sono dotati di aggancio per il montaggio su guida DIN all'interno di quadri elettrici o contenitori di protezione, per l'utilizzo con controllori industriali, unità di comunicazione o apparecchi di misura. Non utilizzare in applicazioni in cui un eventuale guasto può comportare rischio di lesioni o di morte.</p>	<p>Les produits sont isolés, appropriés pour les circuits TBTS et TBTP et sont équipés d'un crochet pour montage sur rail DIN dans des armoires ou conteneurs de protection, pour utilisation avec les contrôleurs industriels, des modules de communication ou des unités de mesure. Ne pas utiliser ces dispositifs dans une application où un dysfonctionnement pourrait entraîner le risque des blessures ou de mort.</p>
ENVIRONMENTAL CHARACTERISTICS	UMGEBUNGSBEDINGUNGEN	CARATTERISTICHE AMBIENTALI	CARACTÉRISTIQUES ENVIRONNEMENTALES
<p>Installation in a Pollution Degree 2 environment. Do not use in wet area or subject to moisture. Carefully recycle the product and related batteries according to local regulations.</p>	<p>Installation in einer Umgebung mit Verschmutzungsgrad 2. Nicht in nassen Bereichen oder unter Feuchtigkeit verwenden. Das Gerät und die zugehörigen Batterien sind entsprechend den lokalen Vorschriften zu recyceln bzw. zu entsorgen.</p>	<p>Usare in ambienti con Grado di Inquinamento 2. Non far funzionare l'apparecchio in un ambiente umido o soggetto a formazione di condensa. Riciclare il prodotto e le batterie collegate, nel rispetto delle normative locali vigenti.</p>	<p>Utiliser les produits dans des environnements avec degré de pollution 2. Ne pas employer l'appareil dans un environnement humide ou soumis à la condensation. Recycler les produits et les batteries, conformément à la réglementation locale.</p>

CONNECTIONS AND USER INTERFACE



1. **Alarm LED indicator:** ON when the unit is in backup. Blinks at 1 Hz rate in case of error.
2. **Modbus RTU over USB:** Used to connect a PC running POWERMASTER or custom application for remote monitoring and controlling. Firmware update is also possible through USB connection.
3. **Temperature sensor:** Optional temperature sensor to measure the battery temperature for protection and temperature compensated charge method.
4. **Relays dry contacts:** 2 relays are present for remote monitoring.
5. **Modbus RTU over RS485:** Used to connect a PC running for remote monitoring and controlling. Firmware update is also possible through RS485 connection.
6. **Inhibit input:** A voltage between 5 VDC and 30 VDC applied to this input activates the inhibit function.
7. **Auxiliary output supply:** Maximum 5A supply from the battery (unregulated).
8. **Input connection:** 2 poles are provided for input connection. This must be connected to a power supply rated 12 – 48 VDC.
9. **Output connection:** 2 poles are provided for output connection. It must be connected to the load to be backed up.
10. **Battery connection:** 2 poles are provided for battery connection. This must be connected to the battery. Please respect the correct polarity.
11. **Display area:** provides information regarding the device status.
12. **Control keys:** 4 push buttons are provided to navigate through the menus and to select the various functions.

USER INTERFACE

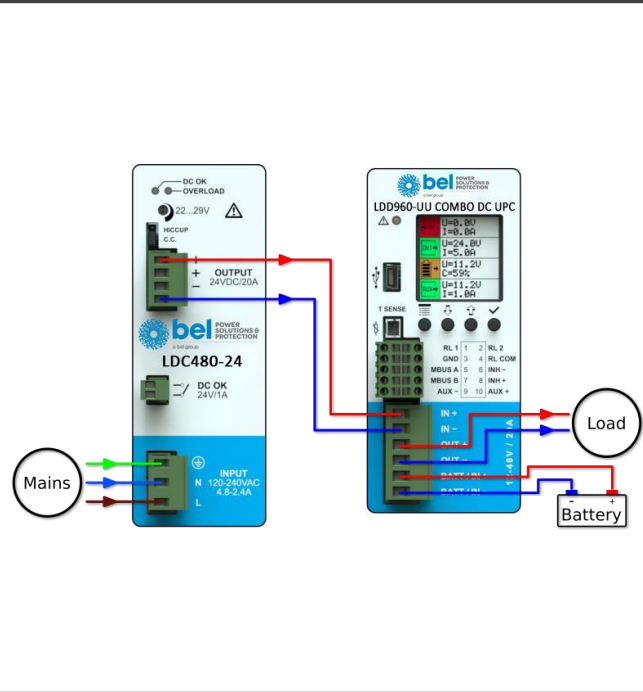
SYMBOL	NAME	FUNCTION
	MENU KEY	Scrolls between menus.
	DOWN KEY	Scrolls down menus and values.
	UP KEY	Scrolls up menus and values.
	OK KEY	Confirms selection.
	INPUT	The measured input voltage and current is shown in this section.
	OUTPUT	The measured output voltage and current is shown in this section.
	BATTERY	The battery voltage, current, temperature, resistance and charge are shown in this section. During charging and discharging the symbol background color changes to orange and the number of bars drawn inside reflects the charge status. During discharging and charging an arrow drawn beside the symbol reflects the direction of the current flowing through the battery, pointing towards the battery during charging. Battery section is not present in DC-DC mode.
	AUXILIARY	The measured auxiliary output voltage and current is shown in this section.

MODE DISPLAYED

UPS STATUS SCREEN	DC/DC STATUS SCREEN	ALARM SCREEN
<pre> →IN U=0.0U I=0.0A OUT→ U=24.0U I=7.7A U=10.2U C=94% AUX→ U=10.2U I=0.0A </pre>	<pre> DC/DC mode →IN U=10.3U I=19.1A OUT→ U=24.0U I=7.7A AUX→ U=10.2U I=0.0A </pre>	<pre> 1/1 [Warning Icon] Battery disconnected. Check battery and connection. Bat U=0.0V </pre>

OPERATING MODE

UPS MODE



UPS Mode:

In UPS mode the LDD960-UU protects a load from unwanted power interruption in case of mains failure. An example of UPS connection is given on to the side. When the input is present LDD960-UU acts as a bypass, connecting the input to the output via the input switch. Meanwhile, if required, the battery is charged. During bypass there is no voltage conversion, therefore the output supply voltage is equal to the input voltage.

In case of power outage, the LDD960-UU takes energy from the battery to keep the output regulated at “Nominal output voltage”.

Backup:

The system is in backup mode if the supply for the output is sourced from the battery (input supply missing). During backup the battery is monitored continuously to prevent over discharge.

A programmable backup timer is also implemented in order to fix a maximum backup time during power outages. This allows preserving the battery life and shortening the recharge time, avoiding discharging the battery when not needed. During backup the internal Coulomb counter is used to give an estimate of the residual charge of the battery.

Backup starts when the output voltage is lower than 90% of the “Nominal output voltage”.

Battery charger:

The battery charger supports various chemistries such Lead-Acid, Nickel, Lithium and Super-capacitors. Other charging algorithms can be implemented by request (contact factory).

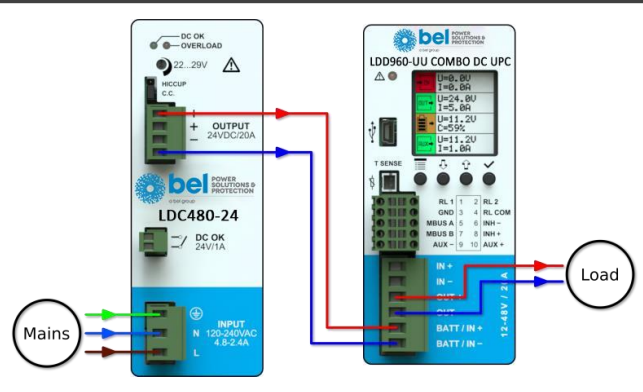
The battery charger automatically reduces the current to avoid exceeding the maximum input current in case of high current load.

Warnings:



- In order to avoid potentially hazardous situations including fire hazard, safety recommendations must be followed. Only authorized staff can install the unit.
- For Lithium cells the balancing and protection circuit must be included in the battery pack.
- For Nickel batteries the use of the external temperature sensor is mandatory. The sensor must be placed in contact with the battery.

DC-DC MODE



DC-DC Mode:

LDD960-UU can be used as a high performance DC/DC converter. An example of DC-DC connection is given on to the side.

Any voltage between 10 V to 55 V can be converted to any voltage between 10 V to 55 V (step-up and step-down operation) with up to 20 A input or output current.

Input and output are protected against over current with user settable limits. When used as a DC-DC converter the input supply must be connected to the battery connector as shown on to the side.



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ADDITIONAL FUNCTIONS



Battery health monitor

- **Internal resistance measurement:** The resistance is periodically measured. The internal resistance is a good indicator of the battery health status; a sudden increase of the internal resistance indicates a potential problem on the battery or on the battery wiring.
- **Temperature measurement:** The battery temperature is monitored through an optional temperature sensor (P/N: WNTC-2MT). The battery charger takes into account the battery temperature and provides a temperature compensated charging voltage. In case of over or under temperature the system disconnects the battery to prevent damage.
- **Coulomb counter:** Estimates the remaining battery capacity and consequently the available backup time.
- **Deep discharge protection:** It protects against the deep discharge of the battery which can lead to its irreversible damage.

Cold Start:

The cold start is a procedure that allows turning ON the UPS without the input power. This procedure is used to turn ON the UPS to operate during a power interruption. This practice is also a method to see if the battery connected to the LDD960-UU is functional. In cold start the LDD960-UU will remain ON for at least 60 seconds independently from the battery voltage being under the deep discharge threshold, the inhibit input and the backup timer. After the first 60 seconds the device stays ON until the battery is not deep discharged, the backup timer is not expired or the inhibit input is not active. If the input supply returns during cold start the device reverts to normal operation.

To cold start the LDD960-UU:

- Press and hold simultaneously the  and  buttons until you see the welcome message on the screen. On the status screen the "Cold start" text is written beside the input icon.
- Release the buttons.

PC shutdown and automatic restart:

- **PC shutdown:** In case the LDD960-UU is used to supply a PC it is possible to automatically shut down the PC after an adjustable time of backup. For this the PC must run the POWERMASTER application (provided free) and must be connected through Modbus. Optionally POWERMASTER can call a task on the PC before shutting down, for example to backup some sensitive data.
- **Automatic restart:** LDD960-UU is able to automatically restart a PC which was powered OFF by mistake, for example in case of the Operating System (OS) crash. The user may adjust an output current threshold and a timer used for detecting the PC OFF status. In order to restart the PC the LDD960-UU toggles the output OFF and then ON again. User must enable in the PC BIOS the automatic start in case of supply ON.

Power ON screen:

This screen is shown at power ON. It shows the device name, serial number and firmware version.

Status:

This is the default view where the user can find the most relevant information about the device status. The system always falls back to this view after 60s of inactivity (no key pressed).

Settings:

All the device settings are configurable from this menu. Use the UP/DOWN KEY to navigate through the parameters. Press the OK KEY to enter/exit the editing mode. In editing mode use the UP/DOWN KEY to change the highlighted value.

Info:

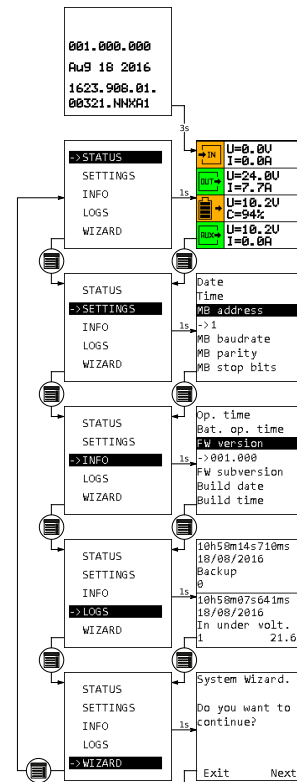
Device information such as firmware version, serial number and device name is visible from this menu.

Logs:

All the alarms and event are logged in a circular buffer and visible from this screen. Use the UP/DOWN KEY to navigate through the logs.

Wizard:

The wizard helps the user to configure the system through a series of screens.



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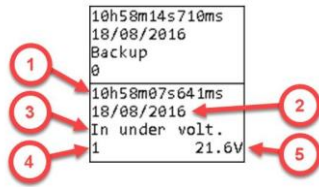
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LOGS



Time: time at which the log occurred
Date: date at which the log occurred
Name: unique log name
Primary value: optional
Secondary value: optional

Every event is logged in the device FLASH memory. From the log menu the user can view their history. Use the UP/DOWN KEYS to navigate between logs, 2 logs are visible simultaneously on the LCD. Logs are of 3 different kinds: **info**, **alarms** and **events**. All **info** and **alarms** have an associated Modbus field with the current status (0 if inactive or 1 if active). For **info** and **alarms** a log is generated at each status transaction. In case of active alarm the front LED and the buzzer turn ON.

ALARMS

TYPE	LCD NAME	DESCRIPTION
Battery disconnected	Bat. discon.	Active when no battery is detected by LDD960-UU.
Battery Ri too high	Bat Ri too high	Active when measured battery internal resistance exceed the alarm threshold
Battery under temperature	Bat under temp.	Active when the battery measured temperature (using the optional external sensor) is under the threshold specified in " <i>Battery min. temperature</i> " field. If active the battery charged is disabled.
Battery over temperature	Bat over temp.	Active when the battery measured temperature (using the optional external sensor) exceed the threshold specified in " <i>Battery max. temperature</i> " field. If active the battery charged is disabled.
Battery lifetime elapsed	Bat lifetime	Active when the actual calculated battery lifetime exceeds the threshold specified in " <i>Battery lifetime</i> " field.
Battery charge failure	Bat charge fail	Active when LDD960-UU could not charge the battery correctly. When active, the battery charger is disabled. Disconnect the battery to reset the alarm.
Battery SoC < 25%	Bat SoC 25%	Active when the battery State of Charge is under 25% of the nominal full charge capacity.
Battery over discharge current	Bat over dis. I	Active when the measured battery discharge current reaches the threshold specified in " <i>Battery max. discharge current</i> " field.
Battery low	Bat low	Active when the measured battery voltage is under the threshold specified in " <i>Battery low voltage</i> " field.
Battery deep discharged	Bat deep disch.	Active when the battery measured voltage is under the threshold specified in " <i>Battery deep discharge voltage</i> " field.
Backup	Backup	Active when the system is in backup.
Input under voltage	In under volt.	Active when the measured input voltage is under 90% of the " <i>Nominal output voltage</i> " field.
Input over voltage	In over volt.	Active when the measured input voltage exceeds 120% of the " <i>Nominal output voltage</i> " field.
Output under voltage	Out under volt.	Active when the measured output voltage is under 90% of the " <i>Nominal output voltage</i> " field.
Output over voltage	Out over volt.	Active when the measured output voltage exceeds 120% of the " <i>Nominal output voltage</i> " field.
Output overload	Out overload	Active when the measured output current reaches the threshold specified in " <i>Max. output current</i> " field.
Input over current	In over cur.	Active when the measured input current reaches the threshold specified in " <i>Max. input current</i> " field.
Auxiliary output overload	Aux overload	Active when an excessive load is detected on the auxiliary output.
External temperature sensor error	Ext. T error	Active when the external temperature sensor is not connected while it's use is mandatory like in NiMh battery charging.
Backup time left < 25%	Bkp left 25%	Active when the system is in backup and the maximal backup time is less than the " <i>Max. backup time</i> " field.
Warning over temperature	Warn. over T	Active when the internal temperature is high. If the temperature increases more the device may switch OFF.
Error over temperature	Error over T	Active when the internal temperature is too high. To prevent damage the device switches OFF.



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BCM.00546_AF

EVENTS		
TYPE	LCD NAME	DESCRIPTION
Power ON event	Power on	Generated at every time the LDD960-UU is turned ON.
Shutdown event	Shutdown	Shutdown reason: 1 - Deep discharge 2 - Max. backup time elapsed 3 - Shutdown command 4 - Reset command 5 - Inhibit signal
Battery cycle triggered by	Bat. cycle triggered by	0 - Schedule 1 - User
Battery cycle ended by	Bat. cycle ended by	Battery cycle end reason: 1 - State of charge 2 - Time limit 3 - Input under voltage 4 - Battery in charge 5 - User

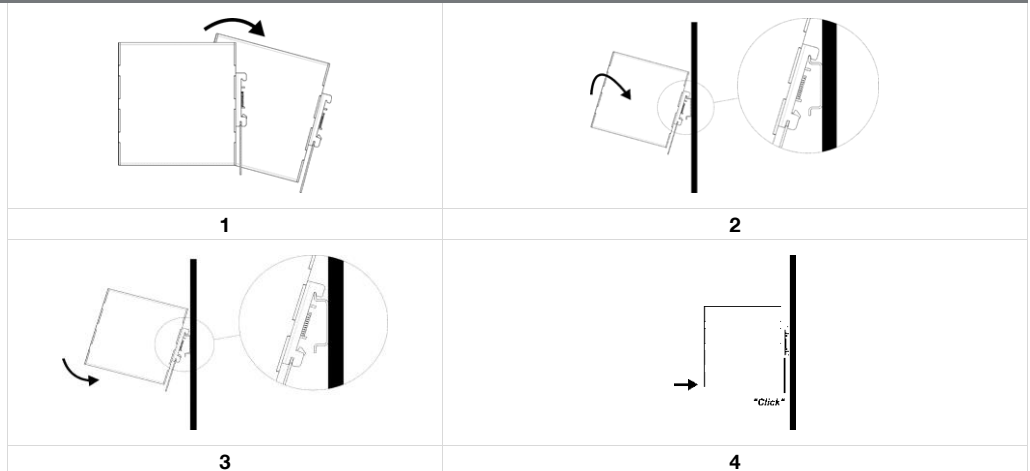
MOUNTING / DISMOUNTING INSTRUCTIONS

For DIN rail fastening according to IEC 60715 TH35-7.5(-15)

Mounting as shown in figure, with input terminals on lower side, with suitable cooling and maintaining a proper distance between adjacent devices as specified in the Installation Instruction of each family.

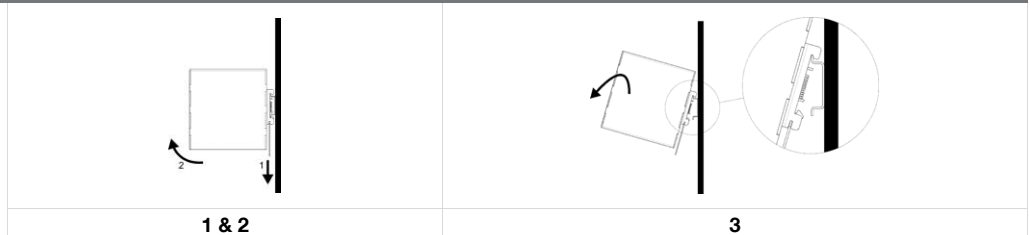
MOUNTING:

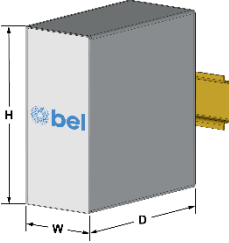
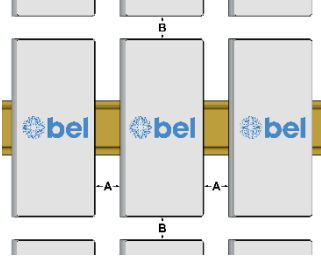
1. Tilt the unit slightly backwards.
2. Fit the unit over the top edge of the rail.
3. Slide it downward until it hits the stop.
4. Press against the bottom for locking.

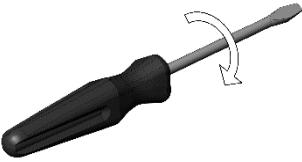
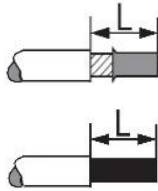


DISMOUNTING:

1. Pull down the slide clamp lever
2. Tilt the unit upward
3. Unhook the unit from the rail



DIMENSIONS:		DISTANCES:	
			
Dimension	mm (inc)	Distance	mm (in)
W	54.0 (2.16)	A	20 (0.8)
H	115.0 (4.52)	B	50 (2.0)
D	110.0 (4.33)		

RECOMMENDED CONNECTING CABLE			
	Recommended Tightening torque		IN / OUT / BATT IN connections
	IN / OUT / BATT IN connections		Solid: 2.5 mm ² / 12 AWG Stranded: 2.5 mm ² / 12 AWG L: 7.0 - 8.0 mm / 0.27 - 0.315 in
	Auxiliary connections		Solid: 0.75 mm ² / 18 AWG Stranded: 0.75 mm ² / 18 AWG L: 7.0 - 8.0 mm / 0.27 - 0.315 in
	Insertion force per pole Max 3N or 0.674 lbf		Auxiliary connections
	Withdrawal force per pole Min 1.5N or 0.337 lbf		

NOTES:

- Data may change without prior notice in order to improve the product.
- Please refer to the latest version of [LDD960-UU Datasheet](#) or [LDD960-UU User Manual](#) on our website belfuse.com/power-solutions



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