EFFEKTA®
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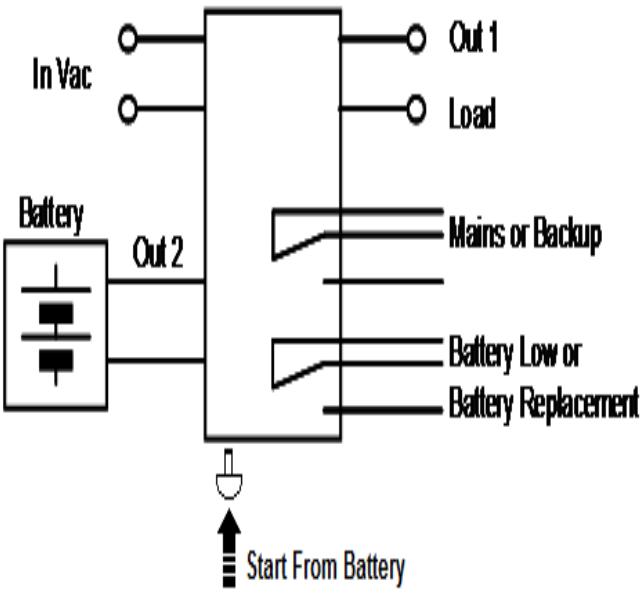
DCH Uninterruptible Power Supply Output Vdc

Thank you for selecting EFFEKTA's Direct Current (dc) UPS products as DIN Rail Version. This product will give the utmost satisfaction and reliably support your process.

General Description

Our DCH DC-UPS units optimize power management. AC Mains power is automatically supplied to the load and the battery. Should the AC mains supply be unreliable then the battery will support the load.
The integrated "Battery Care" concept is based on algorithms that implement rapid and automatic charging over time, the recovery of flat batteries and real time diagnostics during both installation and operation. The Real Time auto-diagnostic system registers battery faults such as sulfating, short circuits, reversed polarity connection, and battery disconnection. In this way problems can be detected and displayed as LED Blink Codes during installation and operation. The continuous monitoring of battery efficiency reduces the risk of battery damage and allows for safe operation when permanently connected. Each device is suited for all battery types. It is possible to set predefined charging curves by means of jumpers for Open Lead Acid, Sealed Lead Acid, Gel, Ni-Cd Ni-Mh (option) and Lithium (option) batteries. Charge and boost functions can be programmed and also changed to a single charging mode by the user. The rugged housing is suitable for DIN rail mounting and provides IP20 protection.
DCH dc UPS Power Supplies are extremely compact and cost-effective.



Main Characteristics

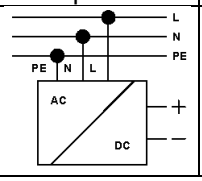
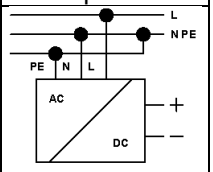
- Input: Single-phase 115–230-277 Vac
- Output Load: power supply: 24 Vdc; 3, 5, 10, 20 A; 12 Vdc 3, 6, 10, 35 A 48 Vdc; 5 – 10 A
- Output Battery: charging: 24 Vdc; 3 – 5 – 10 – 20 A; 12 Vdc; 3 – 6 – 10 – 35 A; 48 Vdc; 5 – 10 A
- Suited for the following battery types: Open Lead Acid, Sealed Lead Acid, lead Gel, Ni-Cd, Ni-Mh and Lithium
- Automatic diagnostic of battery status. Charging curve IUoUO, constant voltage and constant current Battery Life Test function (Battery Care)
- Switching technology
- Four charging levels: Boost, Absorption, Trickle and Recovery
- Short circuit protection: Overload and reversed polarity
- Signal output (contact free) for discharged or damaged battery
- Signal output (contact free) for mains or Backup
- Protection degree IP20 with DIN rail space saving

Safety and warning notes

WARNING – Explosion Hazard. Do not disconnect Equipment unless the power has been switched off or the situation is known to be non-hazardous.
WARNING – Explosion Hazard. Substitution of components may impair suitability for class I, Division 2.
WARNING – Switch off the circuit breakers before connecting the UPS device. Never work on the device when it is electrically connected. The device must be installed in accordance with UL508. The device must have suitable external isolators through which the dc UPS can be disconnected. Danger of fatal Injury!

Connection (terminal and wiring):

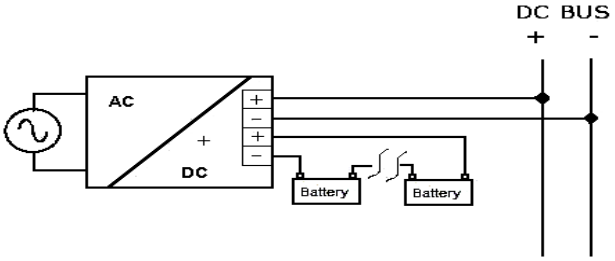
Cable Connection: The following cable cross-sections may be used:

	Solid (mm^2)	Stranded (mm^2)	AWG	Torque (Nm)	Stripping Length	DCH (Size)	1 Phase L N PE Input AC	1 Phase L N PE Input AC
In:	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm	Size 1 and 2		
	4.0	6.0	30 – 10	0.8 – 1.0 Nm	7 mm	Size 3		
Out:	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm	Size 1 and 2		
	4.0	6.0	30 – 10	0.8 – 1.0 Nm	7 mm	Size 3		
Signal:	0.2 – 2.5	0.2 – 2.5	24 – 14	0.5 – 0.6 Nm	7 mm	All types		

The connection is made by screw type 2.5 mm^2 or 4.0 mm^2 (DCH 24V 20A – DCH 12V 35A) terminal blocks. Use only copper cables that are designed for operating temperatures of > 75 °C. Wiring terminal shall be marked to indicate the proper connection to the power supply.

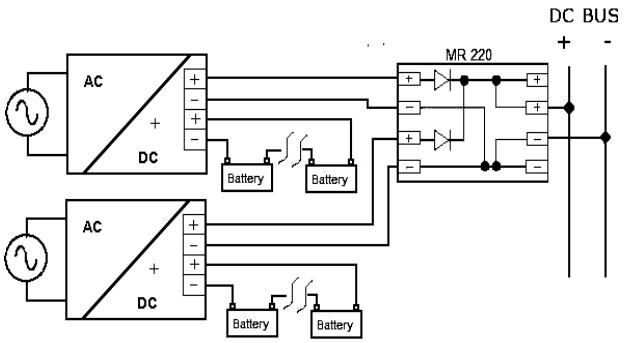
Output Power connections:

Normal connection



Typical application for DCH device: One output for Load "DC Bus", one Input/Output for connection to the battery.
N°1 battery (12 Vdc) for DCH 12V;
N°2 battery (12 Vdc) connected in Series for DCH 24V;
N°4 battery (12 Vdc) connected in Series for DCH 48V;

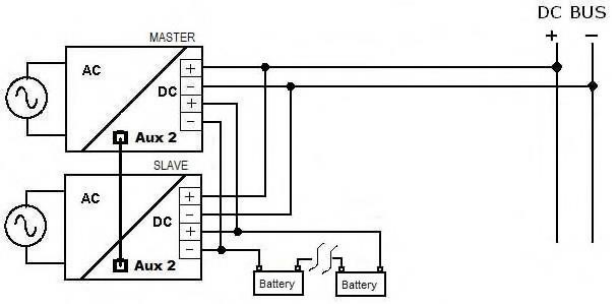
Parallel connection "Redundancy"



DC power supplies can be connected in parallel for 1+1 redundancy to obtain higher system reliability. A redundant system has increased power availability. This is the simplest way is to put two DCH in parallel. In case one power supply unit fails then the other is automatically able to support the load without interruption. A redundant system has two major advantages:
- A faulty power supply can be recognized.
- Diagnosis LEDs gives information about the status of the Load and the Battery (see Display Signals for more data) but do not cover failures such as an internal short circuit in the secondary side of the power supply. In such a rare case, the defective unit becomes a load for the other power supplies and the output voltage cannot be maintained. This can only be avoided by utilizing decoupling diodes which are included in the Redundancy Module MR220.

Recommendations for building redundant power systems:
a) Use separate input fuses for each DCH.
b) Monitor the individual DCH unit's three LEDs. Each unit has two relays, the Mains or Backup and the Low Battery or Battery Replacement relay (in a faulty situation). This feature reports a faulty unit; see Relay Contact Rating for technical detail.
c) If possible, connect each power supply to different phases or circuits.

Parallel connection "Double Power":

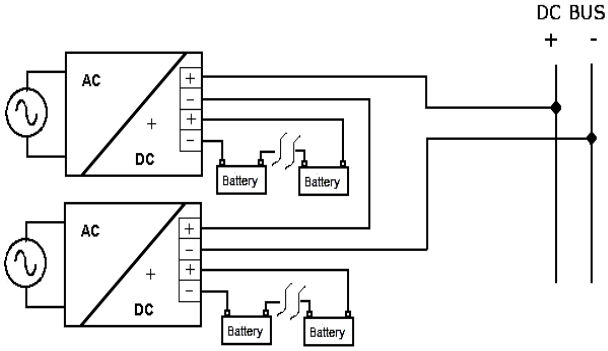


Power supplies can be paralleled for 1+1=2 to obtain double power in a single unit. A parallel connection is only possible in SIZE 3 devices in the specific "P" version (i.e. DCH 24V 20A P), thereby reaching the sum of the current at the same output voltage. It is necessary to use a standard UTP cable RJ45 to connect Aux2 of each device. The communication protocol is based on CAN2.0A standard. Accordingly the system has only one output for the Load and One output for the battery.
a) Use separate input fuses for each DCH.
b) Configure one unit as master and the other as slave (see "master/slave network configuration").

User interface elements (such as jumpers, charging level trimmer, start button, time-buffering rotary switch, thermal sensor, relays) may only be used on the master, not on the slave. Set charging level trimmers at the same level on both master and slave. In this configuration mode, only the Master device give display status LED indications and signal port output mains/backup and low battery. You may not use the Slave device for signal status; use only the LED Diagnosis on the Power device (it is always ON).

Master/slave network configuration

1. Switch off the units and connect RJ45 cable in Aux 2.
2. Set rotary switches "Time Buffering" in, master: 0; slave: 1.



3. Switch on the units together; hereafter the rotary switch on Master device is available for setting Time Buffering.

The network remains so configured as long as RJ45 cable remains connected.
If you want to reconfigure the network:

4. Switch off the units and disconnect RJ45 cable;
5. Switch on the units together.
6. Go back to point 1.

To start battery without mains voltage, push start button only on Master (the Slave will power up sequentially).
In such double power connection, all battery tests are under master control and synchronization

Series connection:

a) It is possible to connect as many units in series as needed, providing the sum of the output voltage does not exceed 150Vdc.
b) Voltages above 60Vdc can be dangerous and are not SELV. Such devices must be installed with protection against hazard through contacting and also be grounded.
c) For serial operation use power supplies of the same type.
d) Grounding of the output is necessary when the sum of the output voltage is above 60Vdc.
e) Keep an installation clearance of 10 mm (left/right) between two power supplies and avoid installing the power supplies on top of each other.
Note: Avoid return voltage (e.g. from a decelerating motor or the battery) at the output terminals.

Output Load (Mains input ON)

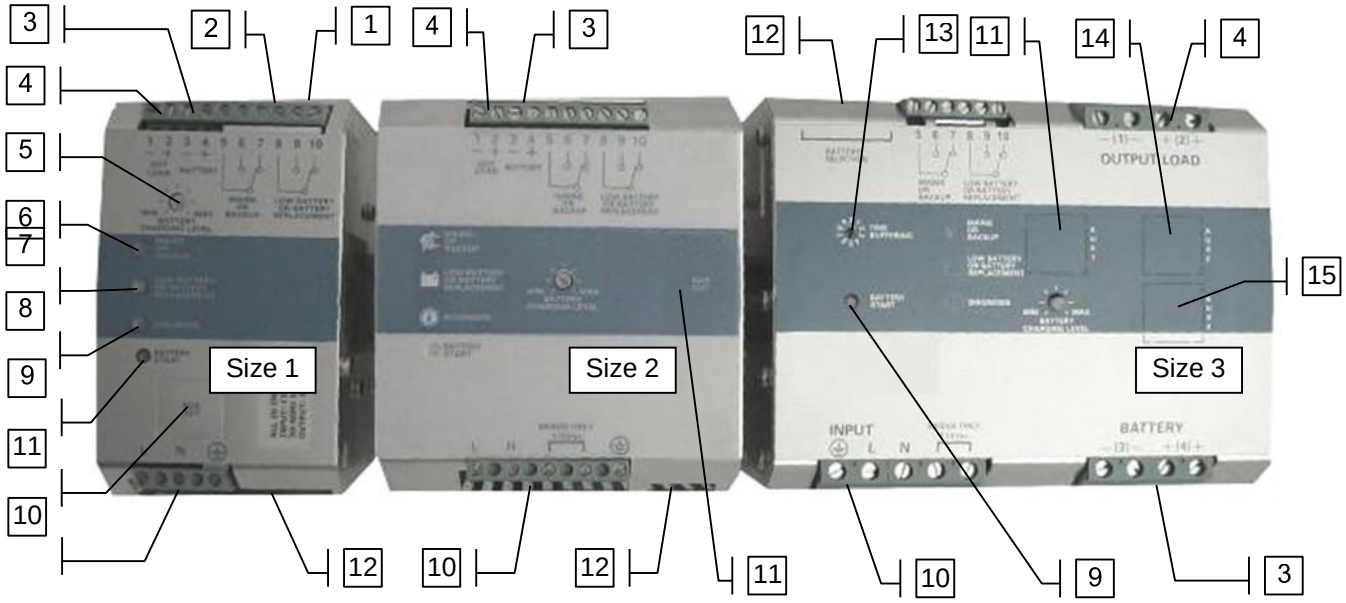
The output Load in normal mode and the Mains Input Vac voltage follow the charging battery dc output voltage. The minimum and maximum ranges are stabilized as following:
DCH 12V:11 – 14.4 Vdc; (without battery connected. Voltage fixed at 12Vdc)
DCH 24V:22 – 28.8 Vdc; (without battery connected. Voltage fixed at 24Vdc)
DCH 48V:44 – 57.6 Vdc; (without battery connected. Voltage fixed at 48Vdc)
The available power is automatically allocated between load and battery: Supplying power to the load is the first priority. Power will be given to the battery or to the load as required.
- In “Power Boost Mode” the maximum current to the load output is 2 times the rated current 2 x In (Iload = In+ Ibatt) in continuous operation and 3 times the rated current 3 x In (load = 2In+ Ibatt) for 4 seconds; above this value, the devices is electrically protected against overload and short circuit.
- In “Power Boost Mode”, if the battery generates current to the load for more than 4 minutes, the device gives a report (8 Blink) which means that the battery it is discharging.
- If the Mains Input Voltage falls below a Threshold level (50% of the Vac input) the battery is immediately connected to the Output Load, without any interruption.
- Voltage dips: In this situation the voltage in the output load is the same as the battery.
To Avoid deep battery discharge, the battery will supply the load until battery voltage reaches 1.5 V/cell. Below this level the device automatically switches off to prevent deep discharge and battery damage.

Output Load In Buffer Mode (Mains Input OFF)

Some example of buffering time depending on LOAD Output in function to the Ah of the battery.

Buffering Time	BATT1.2 Ah	BATT 3 Ah	BATT7.2 Ah	BATT12 Ah	BATT100 Ah
Load 1.5 A	20 min	60 min	200 min	400 min	/
Load 3 A	8 min	30 min	120 min	240 min	/
Load 5 A	3 min	15 min	55 min	100 min	/
Load 7.5 A	2 min	10 min	30 min	60 min	/
Load 10 A	No	7 min	20 min	45 min	20 h
Load 12 A	No	3 min	12 min	30 min	600 min
Load 15 A	No	No	9 min	20 min	400 min
Load 20 A	No	No	7 min	13 min	240 min

Operating and Display Element:



No. 1, 2 Signal Ports (Output Isolated):

Connections for,
No. 1: Low Battery, Fault connections systems, Battery replacement. Contact: 8,9,10.
No. 2: Mains/Back Up: Input Mains On/Off. Contact: 5,6,7.

Relay Contact Rating:

Max.DC1: 30 Vdc 1 A; AC1: 60 Vac 1mA: Resistive load (EN 60947-4-1), min.1mA at 5 Vdc: min. permitted load.

Signal Output port true table:		Port N°2 - Led N°6 Mains Back-Up		Port N°1 - Led N°7 Fault Battery	
		5-6 Closed	5-7 Closed	8-9 Closed (OK)	8-10 Closed
Mains Input Vac	ON	. - led off		. - led off	
	OFF		. - led On (1)	. - led off	
The battery in BackUP it is less than 30% cap?	YES		. - led On		. - led On
	NO		. - led On	. - led off	
Battery or system Fault?	YES	. - led off			. - led On (2)
	NO	. - led off		. - led off	

Note: (1) For better efficiency of the system, filter relay Mains/Back up with a delay of at least 5 seconds before giving alarm Mains Lost, example: connection to PLC. (2) See Diagnosis Led

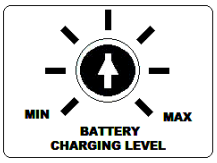
No. 3: Battery Connection Port:

Connect the battery between pin. 3 (–) and 4 (+).
One battery (12 Vdc) for DCH 12V.
Two battery (12 Vdc) connected in Series for DCH 24V.
Four battery (12 Vdc) connected in Series for DCH 48V.

No. 4: Output Load:

Connect this Output to the load 1 (–). 2 (+).

No. 5: Charging Level Current:



It is possible to set the max recharging current for the batteries using the trimmer (Charging Level). The current adjustment goes from 20% - 100% of Input. Set the maximum charging current between 10% and 20% of the battery capacity.

No. 6, 7 and 8 Display Signals

No.6: LED Mains/Back Up: Input Mains On/Off
No.7: LED Low Battery(capacity less than 30%), Fault connections systems, Battery replacement.
No.8: LED Battery charge mode, LED Diagnosis. Diagnosis of the system through “blinking code” signal

Monitoring Control chart:	State	LED Diagnosis (No.8)	LED Battery Fault (No.7)
Charging Type	Trickle	1 Blink/sec	OFF
	Boost	2 Blink/sec	OFF
	Recovery	5 Blink/sec	OFF
System Auto Diagnosis	Reverse polarity or high battery Voltage (over 32.5Vdc for DCH 24V)	1 Blink/pause	ON
	Battery No connected	2 Blink/pause	ON
	Element in Short Circuit	3 Blink/pause	ON
	Over Load or short circuit on the load	4 Blink/pause	ON
	Bad battery; Internal impedance bad or bad battery wire connection	5 Blink/pause	ON
	Life test not possible	6 Blink/pause	ON
	Bad thermal sensor	7 Blink/pause	ON
	Boost condition; battery discharge after 4 min. of overload.	8 Blink/pause	ON
	Internal fault	9 Blink/pause	ON
	Low battery (under 18.5Vdc for DCH 24V) Only if started from battery, no Mains input. Form Jumper N°5 or Push Button	10 Blink/pause	ON
	CAN bus error	11 Blink/pause	
	Life test not possible; parallel mode on Slave Device	12 Blink/pause	
	Bad battery wire connection; Parallel mode on Slave Device	13 Blink/pause	
	Boost condition; battery discharge after 4 min. of overload; Parallel mode on Slave Device	15 Blink/pause	

No. 9: Start from Battery, No Mains Vac

No. 9: Push-button, for 3 sec., on the front panel to switch ON the system without the “Mains input Vac” but only the battery connected. (Not present in DCH 24V 10A and DCH 48V 5A).
See also No.12: (Jumper n.5) The same function is available for remote start from the battery, via RTCONN cable connected in the Push-button mounted on front Panel of the external system. Standard function for all products, Size 2 only with code DCH 24V 10A (S) and DCH 48V 5A (S).

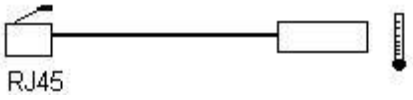
No. 10: Input AC Port pin. L – N:

1 Phase Switching Power Supplies L, N, PE ⏚Size 2 and Size 3 BRIDGE ONLY for input 115 Vac, and connect L, N, and PE.

No. 11: Auxiliary Output

RJ 45 behind the label in SIZE 1 and SIZE 3. Remove the window label to find the connector. SIZE 2: DCH 24V 10A and DCH 48V 5A requires ARJ code for RJ45 connector.
It is possible to connect:

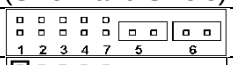
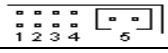
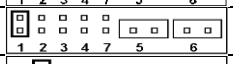
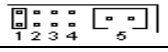
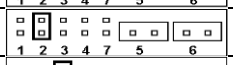
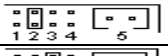
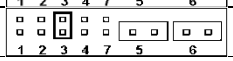
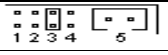
- Temperature sensor, for ambient temperature charging compensation.



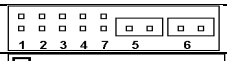
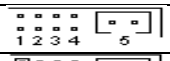
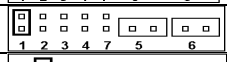
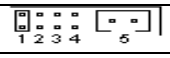
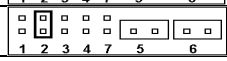
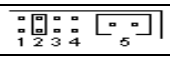
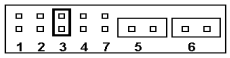
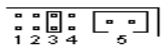
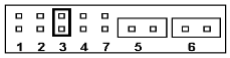
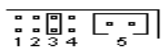
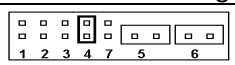
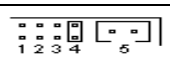
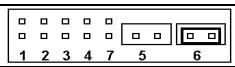
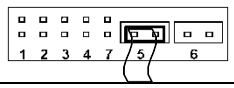
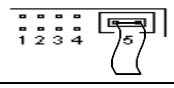
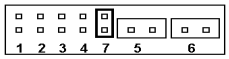
No. 12: Battery Management Configurations

Preliminary Operations: One device for all battery types.
Completely automatic: The DCH units are suitable to charge most batteries types thank to User Selectable charging curves. They can charge open lead acid, sealed lead acid, Gel, Ni-Cd Ni-MH and Lithium batteries. It is possible to change or add other charging curves by connecting the device to a portable PC.
Please see the tables below correlating to the DCH part number, battery types and corresponding jumper settings.

DCH 1203 A, DCH 1206 A, DCH 1210 A, DCH 2403 A, DCH 2405 A, DCH 2410 A, DCH 2410 AS, DCH 4805 AS

Battery Type Selection	Jumper Position (Size 1 and Size 3)	Jumper Position (Size 2)	Trickle/Float charge (Volt/Cell)	Fast/Bulk charge (Volt/Cell)
Open Lead			2.23	2.40
VRLA (AGM) Low			2.25	2.40
VRLA (AGM) High			2.27	2.40
Gel Battery			2.30	2.40

DCH 1235 AP, DCH2420 AP, DCH 4810 AP

Battery Type Selection (NiCd)	Jumper Position (Size 1 and Size 3)	Jumper Position (Size 2)	Trickle/Float charge (Volt/Cell)	Fast/Bulk charge (Volt/Cell)
Open Lead			2.23	2.40
VRLA (AGM) Low			2.25	2.40
Gel Battery			2.30	2.40
(1) NiCd – NiMh			10% Imax Trimmer	1.70 – (12V) 10 cells 1.50 – (24V) 20 cells
(2) Lithium			Battery disconnected	3,65 V – (12V) 4 cells 3,65 V – (24V) 8 cells
Functional Setting			Function	
Battery Life test ON			Jumper present: Life test enabled.	
Fast Charge Enable			Jumper present: fast charge enabled.	
“Battery Start” (without Input Mains) (3)			RTCONN cable for connection to external Push-button mounted on front Panel of the external system.	
Fast Recovery Charge (4)		Not available	Jumper present: Fast Recovery Charge, enabled only for Size 3. Possibility to recharge the battery also when the voltage is close to Zero with the maximum power of the device. For safety, the Load Output voltage follows the voltage of the battery.	

Notes:

1) In NiCd-NiMh (option to be defined when ordering), the VRLA (AGM) High charging curve is deleted. End-of-charge is determined by negative 6V detection of battery voltage (-5mV/cell). If no negative 6V but only a "flat" profile is detected fast charge is terminated after 10 min. General end-of-charge timeout is set to 16 hours. Trickle charge current is regulated at 10% of max current corresponding to trimmer position. In order to detect end-of-charge negative 6V, charging current must be set at least at 30% of nominal battery capacity (0.3 C), at lower values of charging current, negative 6V detection is not guaranteed.
2) In Lithium (option to be defined when ordering), the VRLA (AGM) High charging curve is deleted. In Float charge, with battery disconnected, the voltage on OUT LOAD is always 14,6V (12V) or 29,2V (24V).
3) Don't leave the jumper in position 5; default discharge in Back up mode when the battery close to Zero. For Size 2: models are DCH 24V 10A (S) or DCH 48V 5A (S) (S means start with battery functions, otherwise only start with Input Mains).
4) Jumper selection n.7 is available only on Size 3.

No. 13: Buffering Time Setting

On models Size 3 it is possible to set a buffering time. It can be selected by setting the desired value on rotary switch 13. Buffering time is initiated when the mains is switched OFF. The LOAD output will be ON for the selected time.

Switch position	0	1	2	3	4	5	6	7	8	9
Buffering Time (min.)	œ	0.5	2	5	10	15	20	30	45	60

If the switch is in position 0, the LOAD output will be in ON state until the battery is completed discharged. To prevent damage risks, the unit disconnects the batteries when a minimum voltage level is reached.
Units Size 1-2 do not allow user setting of a buffering time. The LOAD output will be in ON state until the battery it is completed discharged. It is however possible to request factory customized versions with specific buffering time setting.

No. 14: Auxiliary Output "Aux 2"

Present only in DCH 24V 20A and DCH 12V 35A. Provided CAN2.0A connection.
Connection for external Intelligent display.

No. 15: Auxiliary Output "Aux 3"

Present only in DCH 24V 20A and DCH 12V 35A. Not used.

Battery Care

The Battery Care philosophy is based on algorithms that implement rapid and automatic charging e.g. battery charge optimization over time, flat batteries, recovery and real time diagnostic during installation and operation. The Real Time auto-diagnostic system monitors battery faults such as elements in short circuit, accidental reverse polarity connection and disconnection of the battery. Faults can be easily detected and removed by help of the LED diagnosis Blink Code during the installation and after sell. Each device is suited for all battery types. It is possible to set predefined curves for Open Lead Acid, Sealed Lead Acid, Gel, Ni-Cd (option), and Lithium (option) via the jumpers. These guarantee battery reliability by continuously testing the internal impedance status and thereby avoid any possible risk of damage. This also assures a permanent, reliable and safe connection of the battery to the power supply. The system uses a battery stimulation circuit with algorithms to evaluate and detect parameters and is able to recognize sulphated batteries or batteries with a short-circuited cell.
Battery Test: Automatic. Every 60 sec. check battery connection. Every 220 minute in trickle charge tests the battery efficiency. The fault is signalized with relay commutation and diagnosis led blinking.

Diagnostic Checks:

Check for accidental disconnection of the battery cables:
DCH detects accidental disconnection and immediately switches off the output power.

Battery not connected:
If the battery is not connected no output power.

Test of quality wire connections:
During trickle charge the quality (resistance) on the battery connection is checked every 20 sec. This to detect if the cable connection has been properly made.

Battery in Open Circuit or Sulphated:
Every 220 minutes, the DCH tests internal impedance in trickle charging mode.

Reverse Polarity check:
If the battery it is connected with inversed polarity, the DCH is automatically protected.

Test of battery voltage connections:
A voltage check is carried out to prevent connection of wrong battery types and measures the nominal voltage.

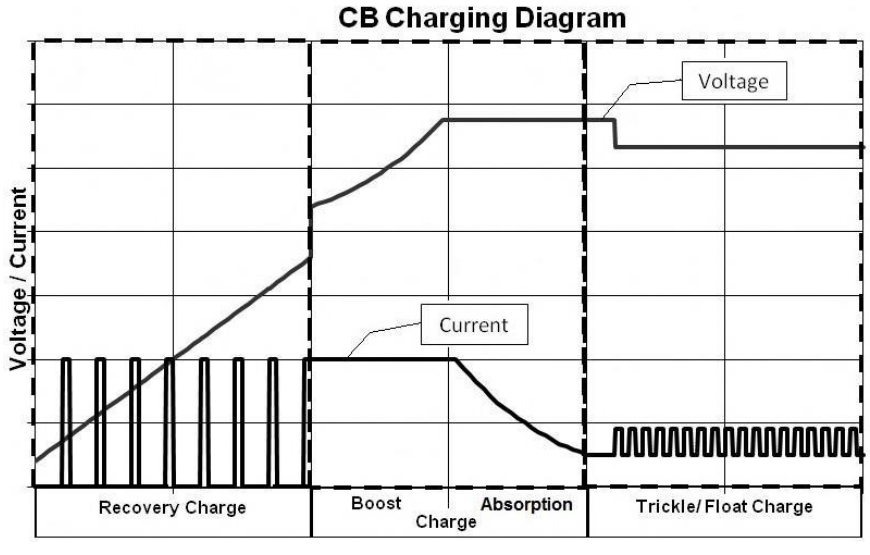
End of Charge check
When the battery is completely charged, the device switches automatically to trickle charging mode.

Check for Battery Cells in short circuit
Thanks to specific evaluation algorithms, the CBs recognize batteries cells with internal short circuits. In trickle charge, a test of element for short circuits occurs every 2 hours.

Diagnosis of battery and device
All DCH devices support the user during installation and operation. A Blink code of Diagnosis LED allows discrimination between various possible faults.
Error conditions, “LED Battery Fault” ON and “LED Diagnosis” blinking in sequence; see Display Signal section.

Charging Curve
Automatic multi-stage operation and real time diagnostic allows fast recharge and recovery of deep discharged batteries, adding value and reliability to the system hosting the DCH device. The type of charging is voltage stabilized and current stabilized IUoUo.
Three charging modes are identified by a flashing code on a diagnosis LED.
To maintain the output Load in lower voltage state, don’t put a jumper in position 5. In this case no boost charge is foreseen, only float charge.

	State	Diagnosis LED	Battery Fault LED
Charging Type	Trickle	1 Blink/sec	OFF
	Boost	2 Blink/sec	OFF
	Recovery	5 Blink/sec	OFF



Compensation Recharges according to temperature

(For SIZE 2: DCH 24V 10A and DCH 48V 5A require /ARJ code)

Connecting to RJ45 Auxiliary Output the cable RJTEMP (supplied separately), the DCH will vary the voltage of battery charging depending on the temperature:

Fast Charge	Trickle charge
+/-5mV/°C x n. of Cells from -8°C to +60°C +140mV/Cell ÷ -200mV/Cell compared to the value at 20°C	+/-3mV/°C x n. of Cells from -20°C to +60°C +120mV/Cell ÷ -120mV/Cell compared to the value at 20°C

If the temperature is less than -20°C or greater than +60°C then an alarm is signaled with code blink 7. The sensor place on cable RJTEMP must be applied on the battery.

If the sensor is not connected or if the sensor is defective, the led Low Batt is on and the led Diagnosis continues to show the status of the battery as trickle charge, fast charge or recovery charge.

Protection Features

On the primary side: the device is equipped with an internal fuse. If the internal fuse is activated, it is most probable that there is a fault in the device. If the fuse is broken, the device must be checked in the factory.

On the secondary side Battery and load: The device is electrically protected against short circuits and overload.
Inverse polarity: the device it is automatically protected against inverse battery polarity and inverse connection of load.
Over current and output short circuit: The unit limits the output current (see the technical data).

Deep discharge: The unit disconnects the battery when a minimum voltage level is reached.

Thermal behaviour: When the ambient temperature of over 50°C, the output current must be reduced by 2.5% per °C. At a maximum temperature of 70°C the output current will be 50% of In. The devices are protected from over temperature conditions in “the worst case”. In this situations the device shuts down, the output and automatically restarts when the inside temperature falls.

Standards and Certification

Electrical Safety:
Assembling device: IEC/EN 60950 (VDE 0805) and EN 50178 (VDE 0160).
Installation according: IEC/EN 60950.
Input / Output separation: SELV EN 60950-1 and PELV EN 60204-1. Double or reinforced insulation.
EMC Standards Immunity:
EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5.
EMC Standards Emission:
EN 61000-6-4, EN 61000-6-3, EN 61000-3-2 (see data sheet for each device)
Standards Conformity:
Safety of Electrical Equipment Machines: EN 60204-1.
CE The CE mark in According to EMC 2004/108/EC and Low voltage directive 2006/95/EEC

Norms and Certifications

In Conformity to: IEC/EN 60335-2-29 Battery chargers; 89/336/EEC EMC Directive; 2006/95/EC (Low Voltage); DIN41773 (Charging cycle); Emission: IEC 61000-6-4; Immunity: IEC 61000-6-2. CE.

Rail Mounting:

All modules must have a minimum vertical and horizontal distance apart of 10 cm in order to assure sufficient auto convection. Depending on the ambient temperature and load of the device, the temperature of the housing can become very high!