



-power in control



## DBC-1 DEIF Battery Charger



### DATA SHEET

- 12/24 V-5/10 A-230 V
- High MTBF > 60,000 h at 40°C
- Temperature range -25°C to +70°C
- Overvoltage protected
- Boost/equalisation functionality
- Failure alarm functionality

<b>1. General information</b>	
1.1. Application and advantages.....	3
1.1.1. Application.....	3
1.1.2. Advantages.....	4
<b>2. Technical information</b>	
2.1. Description of functions.....	5
2.1.1. Protections.....	5
2.1.2. Power derating.....	5
2.1.3. Charge characteristic.....	5
2.1.4. Charger Failure Alarm.....	6
2.1.5. LED indication and alarm relay status.....	6
2.1.6. Equalisation/boost-charging.....	7
2.2. Technical specifications.....	8
2.2.1. General data.....	8
2.2.2. Input specifications.....	8
2.2.3. Output specifications.....	9
2.2.4. Other specifications.....	11
2.2.5. Connection specifications .....	12
<b>3. Mechanical specifications</b>	
3.1. Dimensions.....	13
3.1.1. 1205-1210 and 2405 versions.....	13
3.1.2. 2410 version.....	14
<b>4. Ordering information</b>	
4.1. How to order DBC-1.....	15
4.1.1. Order specifications.....	15
4.1.2. Disclaimer.....	15

# 1. General information

## 1.1 Application and advantages

### 1.1.1 Application

#### DC supply

The DBC-1 can be used as DC supply due to the low ripple of maximum 1.3 %. Automatic recovery and protection against overload, short circuit and reverse polarity are standard functionalities of the DBC-1.

#### Battery charger

DBC-1 is ideal for the use as battery charger. The general recommendation for charging lead (Pb) batteries is a voltage ripple of maximum 2-5 %, where the maximum voltage ripple for DBC-1 is 1.3 %. It is designed to charge both lead-acid and gel batteries. The recommended charge voltage for each cell in a lead battery is 2.3 V. With 6 cells, the charge voltage will be 13.8 V, and with 12 cells it will be 27.6 V. These levels are the default settings of the DBC-1 for 12 V and 24 V applications. The value of 2.3 V is also called the float charge of the battery. The float charge is the recommended charge voltage to maintain the capacity of the battery.

#### Boost/equalisation

A boost/equalisation function can be used to exploit the full capacity of the battery and to extend the lifetime. This is achieved by increasing the charge voltage per cell by 0.1 to 0.15 V. The DBC-1 will increase the total charge voltage by 0.8 V on 12 V types and 1.6 V at 24 V types, see "**Equalisation/boost-charging**" in the "**Description of functions**" chapter.

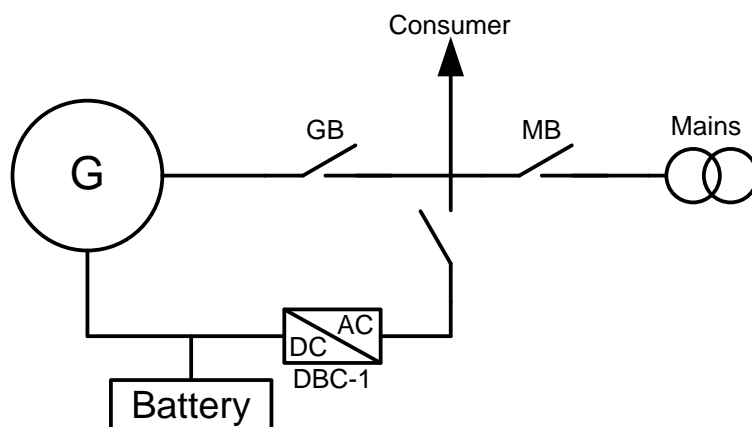
The lifetime is increased by this function, because the battery develops a difference in internal resistance, which will imply that some cells are not fully charged with normal charge voltage without boost/equalisation. These cells will be charged if the voltage per cell is increased.

#### Parallel operation

The DBC-1 can be used in parallel operation with other chargers of the same type, and with the same voltage rating. DBC-1 can also operate in parallel with a charge alternator.

#### Application example

The figure below shows the battery charger connected to a battery and generator alternator in a genset application.



**Voltage drop**

The charger can be adjusted to compensate the voltage drop in the wiring between the battery and the charger. Please notice that the current is only 50 % of the nominal current if the boost/equalisation function is used. Examples of voltage drop can be found in the table below.

Wire size, mm <sup>2</sup>	Length, m	Charge current, A	Voltage drop dV*, V
0.75	5	10	2.5
1.00	5	10	1.8
1.50	5	10	1.2
2.50	5	10	0.7
0.75	5	5	1.25
1.00	5	5	0.9
1.50	5	5	0.6
2.50	5	5	0.35

\* Based on threaded copper wire at 20°C.

The voltage drop formula is:  $dV = \text{length} \times \text{current} \times \text{cable resistance} \times 2$ , thus the double current or double length will also double the voltage drop.

Example: 1.5 mm<sup>2</sup>, 5 m, 10 A => dV = 1.2 V  
Setting for Pb battery charging: 27.6 + 1.2 = 28.8 V

**1.1.2 Advantages**

- DIN-rail and base-mounting (with 4 fixing holes)
- High level of overvoltage protection
- Led indicators for power OK, boost-charging and for alarm indication
- Alarm relay output contacts
- Equalisation (boost) charging
- Convection cooling. No moving parts
- Output short-circuit-protected
- High temperature-protected (power derating over-temperature)
- Reverse polarity-protected (automatically with mosfet)
- Low output ripple and noise level
- Lower volume and weight compared to similar alternatives
- Galvanically isolated input and output, typically 4 kV
- Low cost
- High efficiency
- High reliability (MTBF>60.000 hours. @ 40°C/Full load)
- Low failure rates, long life
- SMD technology.

## 2. Technical information

### 2.1 Description of functions

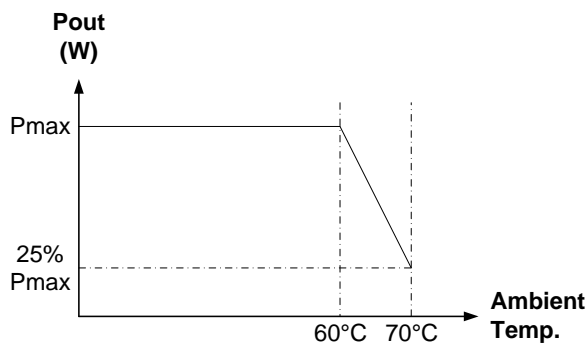
#### 2.1.1 Protections

- Protected against continuous short-circuit and no-load operation
- Protected against reverse battery polarity connection, and automatically restarts operation after the fault is removed
- Protected against over-temperature
- Protected against undervoltage on line input
- Protected against overvoltage on output. The unit shuts itself down when an overvoltage on output terminals arises.

An alarm condition occurs in any of the above cases.

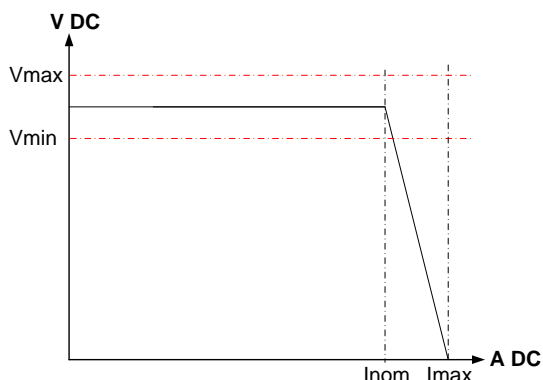
#### 2.1.2 Power derating

The DBC-1 series has a high temperature protection designed to allow safe operation at all times. The power output derates above 60°C of ambient temperature on a linear curve, see the figure below. This function will ensure that the high temperature will have a limited influence on the lifetime of the DBC-1.



#### 2.1.3 Charge characteristic

The output voltage is held constant as long as the load does not exceed the nominal current. A load exceeding the nominal current will automatically reduce the output voltage according to the IU characteristic line of DIN41772/DIN41773 power-limited as shown in the figure below.



### 2.1.4 Charger Failure Alarm

These units have a dry contact alarm output which is closed (energised) under normal operating conditions (no failure).

The alarm contact is steady open when:

- Failure on the line input or input fuse
- No output voltage.

The alarm contact will work intermittent when:

- Failure caused by battery reverse polarity connection
- Overvoltage condition on output terminals.

(Note: when overvoltage is detected while battery is connected, the alarm relay is open and locked in this position until the battery is disconnected)

### 2.1.5 LED indication and alarm relay status

Functionality	LED	Alarm relay
Normal operation	Green	Closed/energised
No load operation	Green	Closed/energised
Short circuit on output	Off	Open/deenergised
Reverse polarity connection	Green-Red *)	Switching open/closed *)
High temperature/power derating	Green	Closed/energised
No input voltage with battery connected	Red	Open/deenergised
No input voltage without battery	Off	Open/deenergised
Undervoltage on input	Red	Open/deenergised
Overvoltage on output with battery connected	Red	Open/deenergised
Overvoltage on output with no battery connected	Green-Red *)	Switching open/closed *)
Boost/equalisation mode	Blue	Closed/energised

\*) Approx. 0.5 sec. closed/green and 2.0 sec. open/red.

**Alarm functions**

The LED will be steady red when:

- Failure on the line input or input fuse
- No output voltage.

The LED will flash between red and green when:

- Failure caused by battery reverse polarity connection
- Overvoltage condition on output terminals.

**Boost-charge indicator**

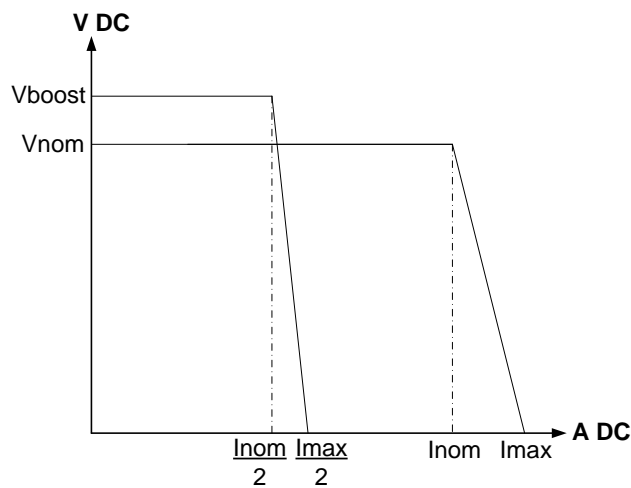
The LED indicator will turn blue when the boost-charge mode is activated.

**Input power OK**

The LED indicator will be steady green when there is healthy voltage on the output terminals.

**2.1.6 Equalisation/boost-charging**

Equalisation is activated by making a short circuit between the terminals "minus" and "boost". When the equalisation is activated, the output voltage is increased by 0.8 V DC at 12 V versions and 1.6 V DC at 24 V versions. The current will be reduced by approx. 50 %.



**Equalisation is only for lead-acid batteries and not acceptable for gel type batteries. Please check the battery manufacturer specifications for equalisation charge.**

## 2.2 Technical specifications

### 2.2.1 General data

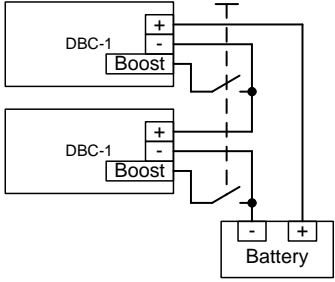
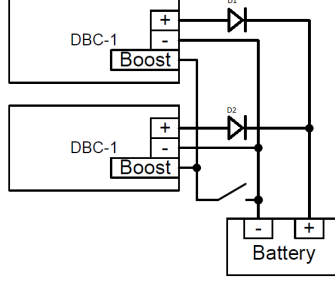
<b>Duty ratio</b>	Continuous duty is allowed
<b>Cooling</b>	Convection
<b>Maintenance</b>	None
<b>Short-circuit</b>	Protected against continuous short-circuit
<b>No-load operation</b>	Protected against continuous no-load operation
<b>Mounting</b>	DIN-rail, EN 50022-35 or 4 pcs. Ø4.5 mm holes for screw mounting. To obtain optimum cooling, it is imperative to comply with the specified installation position, where the terminals are at the bottom. If the mounting differs from this, a reduction in output must be expected, depending on the ambient temperature. If placed in conditions with vibrations, it might be necessary to use base-mounting instead of din-rail mounting.
<b>Distance for convection</b>	100 mm above and below the DBC-1 30 mm to each side

### 2.2.2 Input specifications

<b>Input voltage</b>	230 V AC models: 230 V AC +/- 15 %
<b>Maximum input current</b>	1205 230 V AC: 0.60 A 1210 230 V AC: 1.20 A 2405 230 V AC: 1.20 A 2410 230 V AC: 2.20 A
<b>Peak inrush current</b>	Cold conditions: max. 20 A Warm conditions: max. 100 A
<b>Frequency range</b>	47 to 63 Hz (supply)
<b>Power factor (Cos φ)</b>	1205 230 V AC: 0.43 capacitive 1210 230 V AC: 0.43 capacitive 2405 230 V AC: 0.55 capacitive 2410 230 V AC: 0.54 capacitive
<b>Fuse</b>	Input fuse: internal safety fuse (not exchangeable). If blown, it will cause the charger to stop working. Can only be exchanged by DEIF.



### 2.2.3 Output specifications

<p><b>Output voltage</b></p>	<p>For 1205 and 1210 versions:                  Factory setting 13.8 V DC +/- 1 %                  Adjustable 12.6 to 15.1 V DC</p> <p>For 2405 and 2410 versions:                  Factory setting 27.6 V DC +/- 1 %                  Adjustable 25.2 to 30.2 V DC</p> <p>(Can be adjusted with a trimmer potentiometer at the front)</p>
<p><b>Series operation</b></p>	<p>12 V + 12 V = 24 V DC: Possible                  12 V + 24 V = 36 V DC: Not possible                  24 V + 24 V = 48 V DC: Possible</p> 
<p><b>Parallel operation</b></p>	<p>5 A + 5 A = 10 A DC Possible                  5 A + 10 A = 15 A DC Possible                  10 A + 10 A = 20 A DC Possible</p> <p>It is recommended to mount two diodes as indicated on the drawing. This is to prevent errors on the output signal</p> 
<p><b>Output current</b></p>	<p>For 1205 and 2405 versions:                  Nominal current: 5.0 A                  Maximum current (short cct.): 6.0 A</p> <p>For 1210 and 2410 versions:                  Nominal current: 10.0 A                  Maximum current (short cct.): 12.0 A</p>
<p><b>Reflux current</b></p>	<p>In case the battery is connected without the input voltage connected, a current will go backwards from the battery to the charger. This current is max 8 mA for 12 V models and max 5 mA for 24 V models.</p>

<b>Output ripple</b>	<1.3 % of nominal output voltage @ 10 Hz-100 kHz.
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## 2.2.4 Other specifications

<b>Noise</b>	0.8 Vp-p type @ 10 Hz-100 MHz.
<b>Efficiency</b>	1205 230 V AC 0.83 % 1210 230 V AC 0.83 % 2405 230 V AC 0.85 % 2410 230 V AC 0.86 %
<b>Regulation</b>	Line regulation: All products have output regulation of maximum 1% in the range of line input of 230 V AC models: 230 V AC $\pm 15$ %  Load regulation: All products have output load regulation of maximum 1 % in the range of no load to full load.
<b>Dynamics</b>	<2 ms at a load distribution of 10 to 90% from rated current, peaks <2 %
<b>EMC</b>	IEC/EN 61000-6-4 vers. 115 V and 230 V IEC/EN 61000-6-1 vers. 115 V and 230 V IEC/EN 61000-6-2 vers. 115 V and 230 V  RFI suppression: According to EN55011 class B Static discharge ESD: 4 kV contact discharge IEC/EN 61000-4-2: 8 kV free air discharge Electromagnetic fields: 10 V/m according to IEC/EN 61000-4-3 Burst IEC/EN 61000-4-4: 2 kV AC/DC ports Surge IEC/EN 61000-4-5: Differential mode (DM) 1 kV, common mode (CM) 2 kV
<b>CE-marking</b>	All variants of the DBC-1 are CE-marked to the EMC Directive and the Low Voltage Directive. However, the following comments concerning EN 61000-3-2 (limits for harmonic current emissions) apply and must be observed upon installation of the DBC-1:  If the DBC-1 with 230 V AC supply is used as part of an apparatus which has a rated AC power of 1 kW or more, there is no requirement for compliance with EN 61000-3-2.  If the DBC-1 with 230 V AC supply is used as part of an apparatus which has a rated AC power less than 1 kW, compliance with EN 61000-3-2 must be ensured by the maker of the apparatus. In this case, the maker of the apparatus containing the DBC-1 with 230 V AC supply must carry out CE marking to the EN 61000-3-2 himself. All other parts of the CE marking provided by DEIF A/S are still valid.  Alternatively, permission to connect the DBC-1 with 230 V AC supply must be given by the local power supply authority of the place of installation of the DBC-1, as stipulated by EN 61000-3-2, clause 4. In this case, the entire CE marking provided by DEIF A/S, including to EN 61000-3-2, is valid.
<b>Safety</b>	IEC EN 60950/IEC EN 61010-1 Protection: Class I Degree of protection: IP20 Leakage current: <0.75 mA (50 to 60 Hz $\pm 5$ %)

<b>Temperature</b>	-25 to 70°C (operating, free convection) Note: derating starts at 60°C -40 to 85°C (storage)
<b>Humidity</b>	0-95 % R.H. (operating, non-condensed)



**Caution!** If high ambient temperature and high load, heat sink can get hot.

**Galvanic separation**

Electrical isolation values according to groups are listed in the following table:

	<b>DC output</b>	<b>Boost input</b>	<b>Alarm output</b>
<b>Mains input</b>	4 kV	4 kV	4 kV
<b>Alarm output</b>	2.5 kV	2.5 kV	X
<b>Earth</b>	500 V AC	500 V AC	2.5 kV
<b>DC output</b>	X	X	2.5 kV

**2.2.5 Connection specifications**

See the cover of the unit (imprint).

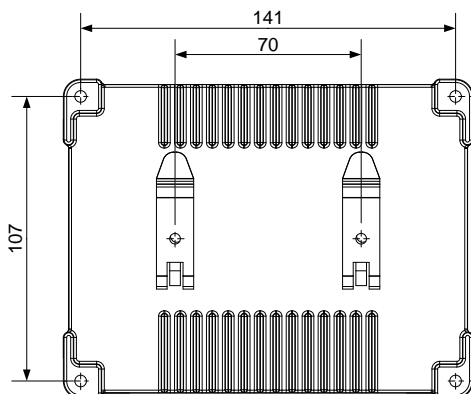
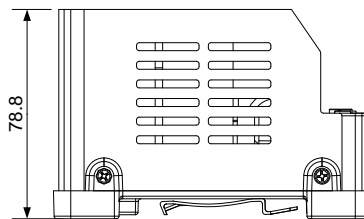
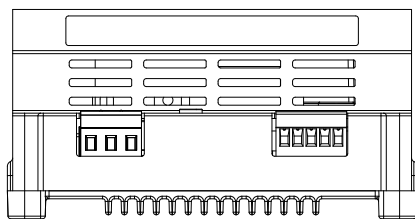
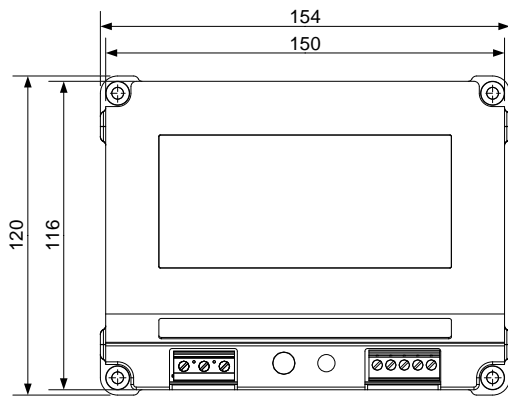
<b>Terminals</b>	Primary max.: 2.5 mm <sup>2</sup> Secondary max.: 2.5 mm <sup>2</sup>						
<b>Primary terminals</b>	<table border="1" style="margin-left: 20px;"> <tr> <td style="text-align: center;">L</td> <td>- Mains Line input.</td> </tr> <tr> <td style="text-align: center;">N</td> <td>- Mains Neutral input.</td> </tr> <tr> <td style="text-align: center;">PE</td> <td>- Protective Earth input. ⊕</td> </tr> </table> <p>PE on the DBC-1 <b>must</b> be connected to the protective earth of the switchboard.</p>	L	- Mains Line input.	N	- Mains Neutral input.	PE	- Protective Earth input. ⊕
L	- Mains Line input.						
N	- Mains Neutral input.						
PE	- Protective Earth input. ⊕						
<b>Secondary terminals</b>	<p>(-): Negative output to the battery (+): Positive output to the battery Alarm: Alarm contact outputs Alarm contact rating: 3 A 250V AC.</p>						

### 3. Mechanical specifications

#### 3.1 Dimensions

##### 3.1.1 1205-1210 and 2405 versions

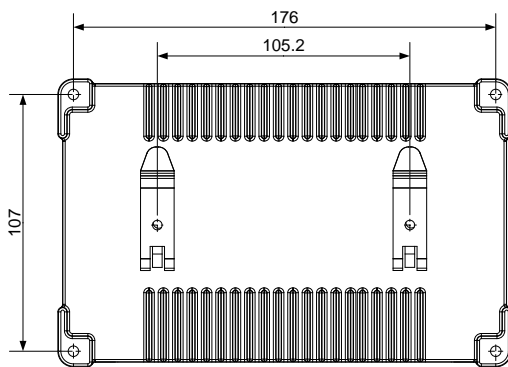
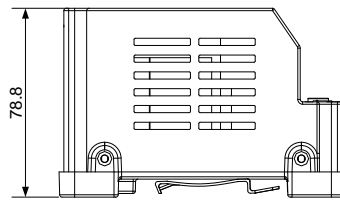
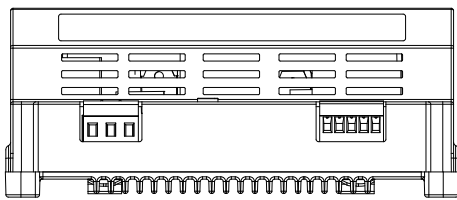
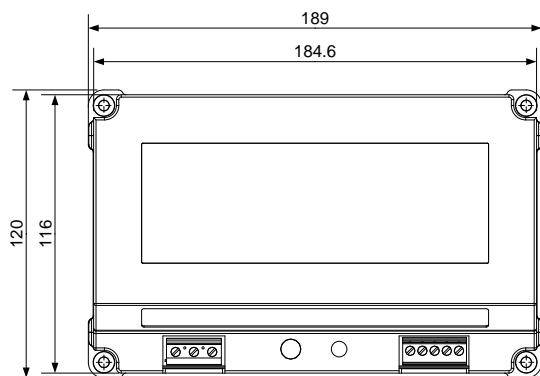
<b>Case</b>	Top cover is plastic consisting of polycarbonate and bottom part is aluminum alloy.
<b>Weight</b>	1205: 0.68 kg (1.5 lbs) 1210 and 2405: 0.74 kg (1.6 lbs)
<b>Dimensions (WxHxD)</b>	154 mm (6.06") x 120 mm (4.72") x 79 mm (3.10")



All dimensions are in mm.

### 3.1.2 2410 version

<b>Case</b>	Top cover is plastic consisting of polycarbonate and bottom part is aluminum alloy.
<b>Weight</b>	2410: 0.85 kg (1.87 lbs)
<b>Dimensions (WxHxD)</b>	189 mm (7.44") x 120 mm (4.72") x 79 mm (3.10")



All dimensions are in mm.

## 4. Ordering information

### 4.1 How to order DBC-1

#### 4.1.1 Order specifications

**Type - output voltage - output current - supply**

Example: DBC-1 - 24 V DC - 5 A - 230 V AC

#### 4.1.2 Disclaimer

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