ENKO Electronic Control Systems

EBC Series Battery Chargers

(Technical Specifications and User Manual)

5/13/2012
ENKO Ltd.
Marketing division/V02

Table of Contents

1- GENERAL DESCRIPTION:

EBC series battery chargers are intended to be used for charging VRLA (wet or jell types) type starter batteries for Diesel Engines. All chargers comply with European standards for EMC and LVD and intended to be used in industrial environments.

There are six models in the EBC family and these chargers cover a wide range of applications in the gen-set industry. This document covers all the technical specifications of the family and describes in detail, how they should be used for reliable operation.

2- MODELS:

EBC series battery charger family consists of 6 models, which cover a full range of applications in the Gen-Set market;

	Model No:	Output Voltage	Output Current
1-	**EBC1205**	**12VDC** (factory adjusted between 11Vdc and 15.5Vdc, default is 13.8Vdc)	**5.0ADC** (minimum current >5.5ADC into short circuit)
2-	**EBC1210**	**12VDC** (factory adjusted between 11Vdc and 15.5Vdc, default is 13.8Vdc)	**10.0ADC** (minimum current >11.0ADC into short circuit)
3-	**EBC2405**	**24VDC** (factory adjusted between 22Vdc and 29.0Vdc, default is 27.6Vdc)	**5.0ADC** (minimum current >5.5ADC into short circuit)
4-	**EBC2410**	**24VDC** (factory adjusted between 22Vdc and 29.0Vdc, default is 27.6Vdc)	**10.0ADC** (minimum current >11.0ADC into short circuit)
5-	**EBC2420**	**24VDC** (User adjustable between 22Vdc and 30.0Vdc, default is 27.6Vdc)	**20.0ADC** (minimum current >22.0ADC into short circuit)
6-	**EBC2440**	**24VDC** (user adjustable between 22Vdc and 30.0Vdc, default is 27.6Vdc)	**40.0ADC** (minimum current >44.0ADC into short circuit)

3- FEATURES:

There are common features for EBC series chargers, which are standard in all the models of the family. Some features vary, depending on the model of the charger and these features are explained in the following document;

3.1 Common features:

- **Current Limiting:**
  - All units have full current limiting and all models can work into short circuit continuously over their rated working temperature range.
  - All models guarantee to deliver more than 110% of their rated output current continuously during short circuit, over their specified temperature range,

- **Boost Charge function:**
  - All units have “Boost Charge” capability and this is an external controlled function. During Boost Charging, battery manufacturer’s boost charge specifications are observed for longest battery life time. The units’ terminal voltage increases but the rated current is reduced to 50% of its rated output current value,

- **Wide input voltage range:**
  - All models have wide input voltage range, varying from 150Vac to 300Vac, phase to neutral.
  - EBC 2440 has 3 phase input voltage capability and this unit differs from the rest of the family members. This unit has a working range from 320Vac to 460Vac phase-to-phase.

- **Alarm Output:**
  - All models have alarm output to indicate alarm condition. Alarm output hardware specifications vary, depending on the models. All 5A and 10A units have solid state alarm output stages but 20A and 40A units are fitted with a potential free contact relay with N/O terminal.
  - During alarm condition; the LED indicators on the front panel indicate the status of the charger unit and user has to check this according to the table given in this document,
  - Make sure to observe the alarm output terminal polarity, when connecting the external load to this terminal.

3.2 Special features:

- **Alarm output type:**

  - EBC 1205, EBC 2405, EBC 1210 and EBC 2410 models have solid state transistor type output for driving an external alarm relay,
  - The Alarm Output is a normally open (N/O) type output and it is energized if there is no alarm condition. Therefore, alarm output is active under normal operating conditions,
  - EBC 2420 and EBC 2440 charger units have built-in alarm relay, which is energized, if there is no alarm condition. This is N/O type output.

- **Output Voltage adjustment:**
  - EBC 1205, EBC 2405, EBC 1210 and EBC 2410 chargers have fixed output terminal voltages and cannot be adjusted. The output voltage is factory adjusted and can be set to customer requirement, if indicated during order period.
  - EBC 2420 and EBC 2440 units have on-board voltage adjustment trimmers, where customer can adjust according to the user manual.

- **Output power derating:**
  - EBC 1205, 1210, 2405 and 2410 models do not have power derating and will work at full power up to 60ºC,
  - EBC 2420 and EBC 2440 has power derating, cutting in at 60ºC and linearly de-rated down to zero output power at 70ºC.

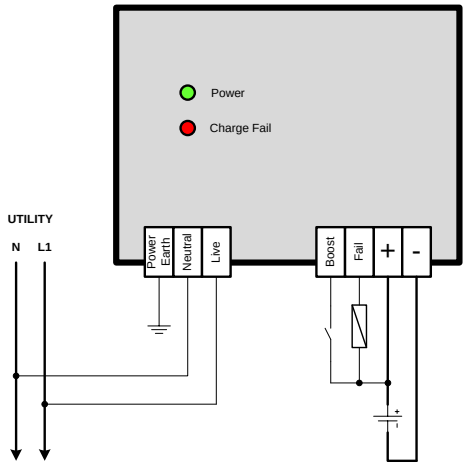
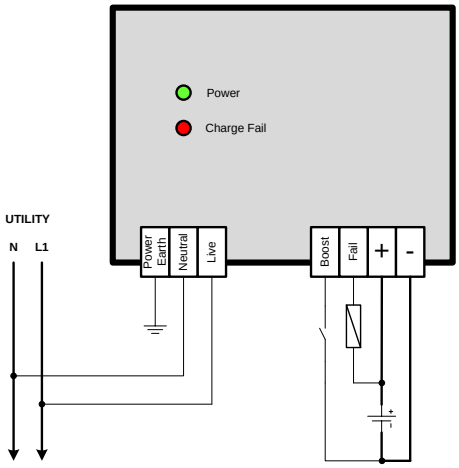
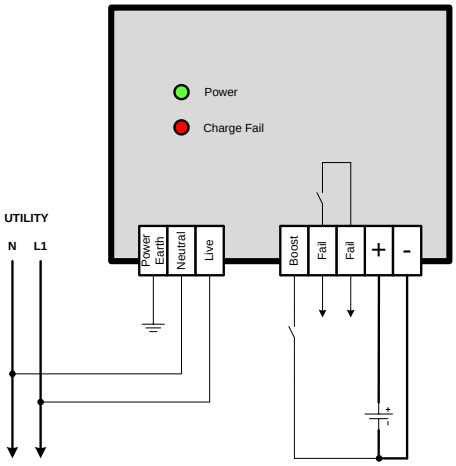
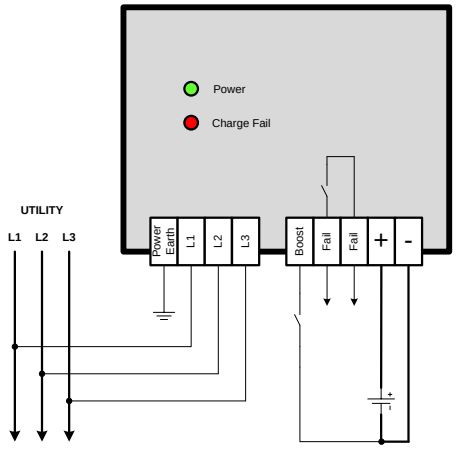
- **Over-Voltage protection:**
  - EBC 2420 and EBC 2440 charger units have over-voltage protection functions built into the unit. These charger units will cut-off after they detect over-voltage on the output terminals. This will also generate an alarm signal.
  - Other models do not have built-in over-voltage protection function.

- **Reverse Polarity protection:**
  - All models are fitted with a built-in reverse polarity protection diode. EBC1205, EBC1210, EBC2405, and EBC2410 have also built-in trip fuses fitted in series with the output terminal. This is required in order to protect the device against reverse polarity connection. (if reverse connection is made, make sure to change the output fuse for proper operation of the charger unit)
  - EBC2420 and EBC2440 chargers are fitted with semiconductor type reverse polarity protection and no internal or external fuses are required on the output for protection. It is done automatically.

- **Rail mounting option:**
  - All models are panel fitted with screws but can also be arranged for rail mounting. This has to be indicated at the time of order.
  - EBC2420 is rail mounting type only,
  - EBC 2440 is panel mounting only with four fixing screws,

4- TERMINAL CONFIGURATION AND CONNECTION DIAGRAMS:

The connection diagrams for all the models are shown schematically in the following table. These diagrams are intended to give quick reference for the user and for specific applications; user has to refer to the installation manuals of EBC series battery chargers.

EBC1205, EBC1210, EBC2405	EBC2410
	
EBC 2420	**EBC 2440**
	

5- FUNCTIONAL DESCRIPTION:

5.1 Mains connection terminals:

Mains connections must be made carefully. For specified isolation and protection, utility live and neutral lines must be connected to their respective terminals. Power earth connection must be provided for proper noise suppression and safety. Use minimum 1.5 mm² wire size for all mains connections except EBC2440. For this model, minimum 2.0 mm² wire size must be used.

5.2 Battery connection terminals:

Battery connections terminals are arranged according to the current rating of each model. Care should be taken to use appropriate wire size when connecting to the battery. These wires will carry full charge current and should be kept at minimum length. Wire sizes should be selected according to the table below. Failing to tighten the terminal screws may cause burning of the terminals.

Charger current rating	Wire size up to 5m cable length	Wire size up to 10m cable length
5A	1.5 mm²	2.0 mm²
10A	2.0 mm²	2.5 mm²
20A	2.5 mm²	4.0 mm²
40A	6.0 mm²	----

It is strongly recommended that; the wires from charger unit to the batteries do not exceed 10m cable length. Failing to do so will affect overall efficiency and reduce the performance of your charger unit. If it is a must, then use wires with double the sizes given in the above table for output terminal connections.

5.3 Alarm output functions:

All models have built in alarm functions with an alarm output terminal. Alarm output connections differ according to charger model. For solid state alarm output, user can use this function as an input to their controller or connect an external relay.

Alarm output is energized, if there is no alarm. If the unit fails to operate and generate an alarm signal, alarm output will de-energize (high impedance) and front panel RED alarm LED will indicate. Use alarm output function according to the table below:

EBC1205, EBC1210, EBC2405, EBC2410 (alarm output is solid state type)				
Alarm function	**Alarm output type**	**LED**		**Operation**
		Green	**Red**	
Normal operation	continuous	ON	OFF	Energized
No utility power / no DC output with battery connected	continuous	OFF	ON	De-energized
Reverse connection or output fuse blown (internal o/p fuse blown)	continuous	ON	ON	De-energized
EBC2420, EBC2440 (alarm output is relay type)				
Alarm function	**Alarm output type**	**LED (RGB) multicolor**		**Operation**
Normal operation	continuous	ON	GREEN	Energized
Over voltage on the output (battery connected)	continuous	ON	Red	De-energized
Reverse connection (in protection mode)	Intermittent	ON	GREEN RED	On-off operation
No input voltage / input under voltage	continuous	ON	RED	De-energized
Short circuit on the output	continuous	OFF	----	De-energized
Boost charging condition	continuous	ON	BLUE	Energized

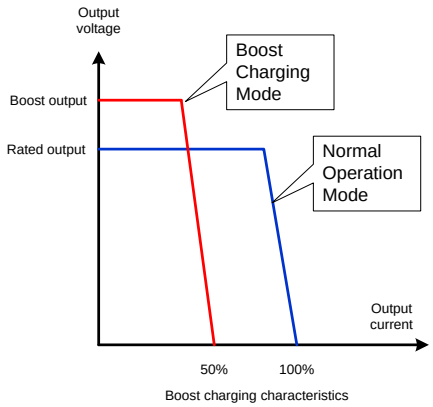
5.4 Boost function (Cell Equalization):

Boost function is activated externally and can be used periodically in order to replenish the battery condition and charge hold capacity. Boost charging has to be used according to battery manufacturers' instructions.

Boost charging will be activated according to the table below. During boost charging period, the charger terminal voltage will increase but the charge current will decrease to 50% of its rated output capacity, in order to protect the batteries from getting damaged. During boost charge period, boost charge control input must stay active.

MODEL	**Boost input activation**
EBC 1205 EBC 1210 EBC 2405 EBC 2410	Connect boost charge input terminal direct to battery **positive terminal**
EBC 2420 EBC 2440	Connect boost charge input terminal direct to battery **negative terminal**

Boost charge characteristic is shown in the below diagram. Boost charging acts according to battery manufacturers' specifications:



Boost charging characteristics

5.5 Over-voltage protection:

Over-voltage protection is only applicable for EBC2420 and 2440 chargers. When charger output increases to a level, where it can damage the batteries, it trips an output over-voltage protection alarm and switches the output off.

Once the over-voltage condition is removed from the output, the charger will automatically reset itself back into normal operating condition. During over-voltage period, alarm output is de-energized, indicating an alarm condition.

5.6 Reverse Polarity protection:

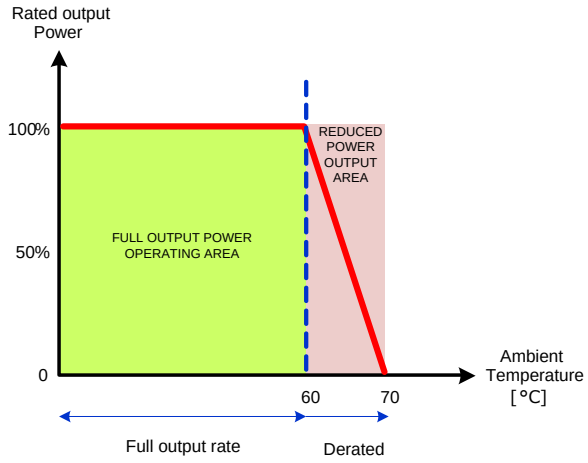
If the battery terminals are connected in reverse polarity, chargers will trip its output fuse for protection. The 5A and 10A models have internally fitted fuses for protection but 20A and 40A models have internal semiconductor controlled reverse polarity protection and this requires no service. The units will recover from protection mode, after the reverse polarity connection is removed.

For EBC 2420 and EBC 2440 models, the units will automatically reset itself back to normal operation mode, after reverse polarity connection is removed and connected correctly. No fuses are required on the output.

MODEL	Fuse rating and type	Where to fit
EBC 1205 EBC 2405	10A, slow blow fuse	Internally fitted
EBC 1210 EBC 2410	15A, slow blow fuse	Internally fitted
EBC 2420 EBC 2440	No fuse required	Semiconductor fuse, nothing to replace or control

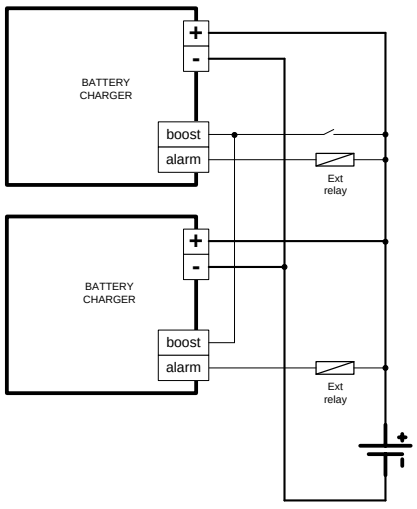
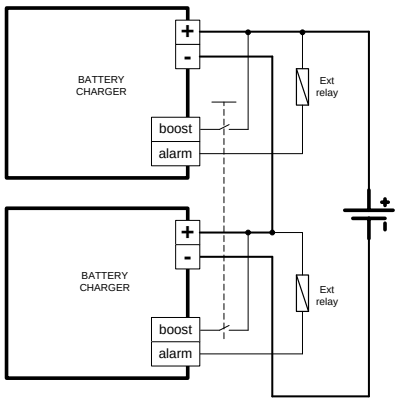
5.7 Power Derating:

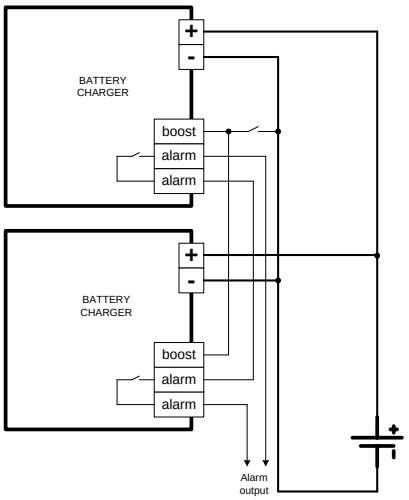
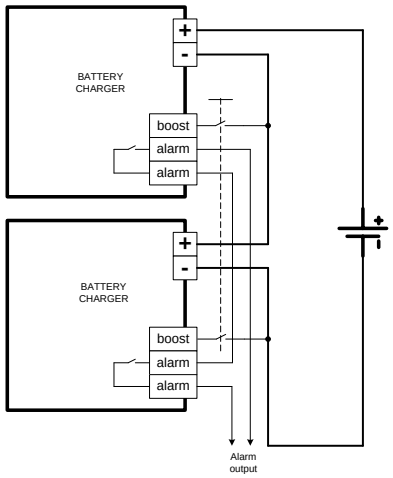
EBC 2420 and EBC 2440 chargers are protected with power derating, starting at 60ºC ambient temperature and reducing down to zero power at 70ºC. Power derating curve is shown in the below diagram:



5.8 Series and Parallel operation:

EBC series battery chargers can be connected in series or in parallel in order to increase the output voltage or current capacity. Different models cannot be connected in series or in parallel, only same model chargers can be connected in series or in parallel to increase the available output capacity. While connecting the chargers in series or in parallel, make sure to connect the alarm and boost terminals according to the table given below;

MODEL	PARALLEL CONNECITON	SERIES CONNECTION
EBC 1205 EBC 1210 EBC 2405 EBC 2410		

EBC 2420 EBC 2440		
Output voltage	Only same model chargers can be connected in parallel and when chargers are connected in parallel, the output voltage of the parallel combination does not change.	Only same chargers can be connected in series and when chargers are connected in series, the output voltage is multiplied by the number of the units connected in series.
Output current	when chargers are connected in parallel, the output current is multiplied by the number of chargers connected in parallel	When chargers are connected in series, the output current of the combination does not change
No-load and Full-load operation	All units can operate into no-load and full-load, whether they are connected individually or in parallel	All units can operate into no-load and full-load, whether they are connected individually or in series

5.9 Applicable Standards:

All units are designed and manufactured according to the following standards:

SAFETY **LVD directive 2006/95/EC**	EN61010-1 (2010), EN60529 (2002)
EMC **EMC directive 2004/108/EC**	EN61000-6-1 (2007), EN61000-6-2 (2005), EN61000-6-3 (2007) EN61000-6-4 (2007)

6- TECHNICAL SPECIFICATIONS:

The technical specifications for all EBC family of chargers are shown in the table below;

Specification	Description	
Input Specifications:		
AC Input Voltage range:	150Vac to 300Vac for single phase units (phase-neutral) 300Vac to 440Vac for 3 phase units (phase-phase)	
Operating frequency range:	45Hz to 450Hz. (All models can operate at full capacity with DC input voltage feed, within their specified input voltage ranges)	
DC Input voltage range:	250Vdc to 400Vdc for 5A, 10A and 20A models, 380Vdc to 620Vdc for EBC 2440 model	
Continuous Input current at full load condition:	EBC1205 < 0.80 A at 230Vac input voltage EBC1210 < 1.50 A at 230Vac input voltage EBC2405 < 1.50 A at 230Vac input voltage EBC2410 < 3.00 A at 230Vac input voltage EBC2420 < 5.50 A at 230Vac input voltage EBC2440 < 2.00 A at 400Vac phase to phase input voltage	
Efficiency:	EBC1205 > 80% EBC1210 > 80% EBC2405 > 80% EBC2410 > 82% EBC2420 > 86% EBC2440 > 88%	
Input Power Factor:	Capacitive (no PFC compensation)	
Input fuse protection:	EBC 1205 EBC 1210 EBC 2405 EBC 2410	6.3A / slow blow Type: 5x20mm, glass type
	EBC 2420 EBC 2440	6.3A / slow blow Type: T-LAG TR5 series
Inrush current at 230Vac cold start:	EBC 1205 EBC 1210 EBC 2405 EBC 2410	<100A
	EBC 2420	<160A
	EBC 2440	<100A / 400Vac input
Input terminal type:	All models	2.5mm² cross section with screw fastening
Output Specifications:		
Output voltage range:	12V models	Factory setting: 13.8Vdc Adjustable: 12.6 … 15.0 VDC (optional factory set at time of order)
	24V models	Factory setting: 27.6Vdc

		Adjustable: 25.5 … 30.0 VDC (only for 20A and 40A units, it is user settable)	
Output current and terminal types:	EBC 1205 EBC 2405	5.0A	2.5mm²
	EBC 1210 EBC 2410	10.0A	2.5mm²
	EBC 2420	20.0A	2.5mm²
	EBC 2440	40.0A	16.0mm²
Short-circuit current:	>110% nominal current under short circuit conditions (can withstand short circuit continuously over the operating temperature range)		
Output ripple voltage:	<1.0% of nominal output voltage over 10Hz to 100KHz		
Output noise level:	<1V pk-pk		
Line regulation:	<1% over specified input voltage range at constant output load (not exceeding rated load)		
Load regulation:	<1.5% at constant input voltage, from no load to full load on the output, measured at the output terminals		
Remote sensing:	Not available on EBC series		
Reverse polarity protection:	EBC 1205 EBC 1210 EBC 2405 EBC 2410	Parallel diode fitted internally with internal fitted wire type fuse protection (fuse replaceable)	
	EBC 2420 EBC 2440	Parallel diode fitted internally. Output fuse has to be fitted EXTERNALLY	
Front panel indicators:	Green LED for operation status indication Red LED for alarm output status indication		
Environmental conditions:			
Operating temperature range:	-25ºC to +60ºC at full load and maximum input voltage. For EBC2420 and EBC2440, output power is linearly de-rated starting at 60ºC to 70ºC down to zero and output is off for T_{amb} > 70ºC		
Storage temperature and humidity:	-30ºC to +80ºC, (10%rh to 90%rh, non-condensing)		
Cooling type:	Convection cooled (vertical mounted and no physical obstacles are allowed within 40mm from each side and 100mm above and below. See installation diagram before use)		
Humidity:	10%Rh to 95%Rh, non-condensing and operating		
Altitude:	1200mt at full rated load. Derate linearly from full power to 50% power from 1200mt to 4000mt over the specified working temperature range.		
Galvanic isolation:	Input – output (with voltage input terminals shorted)	4KV	
	Output – Earth (with output	500Vac	

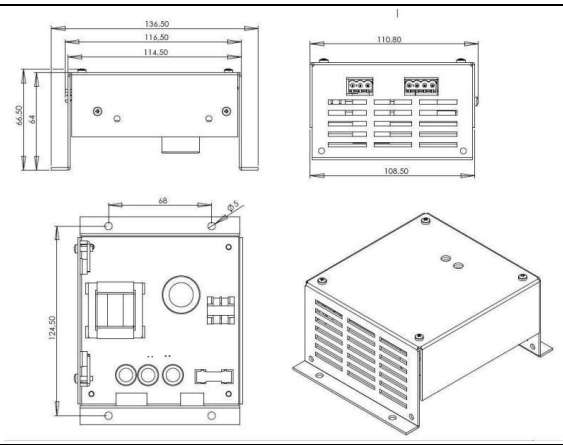
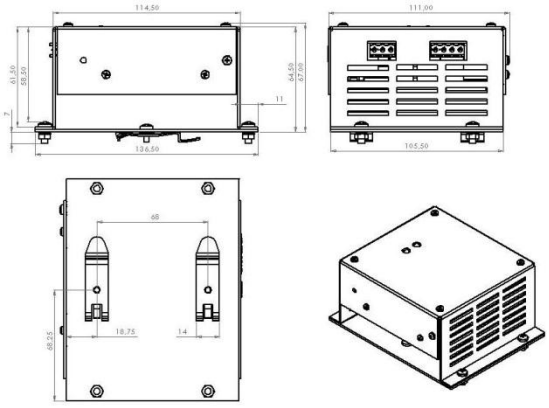
	terminals shorted)	
ESD protection:	8kV free air discharge on the metal case	
EMC noise immunity:	EMC comply with IEC/EN 61000-6-3	
Conducted and radiated EMI:	EN55011 / EN55022-B	
Vibration (non-operating):	10 to 55Hz, 19.6m/s² constant sweep, for 1 hour X, Y, Z axis, each.	
Protection class:	IP20 all sides IP00 panel mounting side	
Output protection fuse:	EBC 1205 EBC 2405	10A / 140A²s, fast Size: 6.3 x 32mm
	EBC 1210 EBC 2410	15A / 350A²s fast Size: 6.3 x 32mm
	EBC 2420	25A / 900A²s, fast blow (external)
	EBC 2440	45A / 2200A²s, fast blow (external)
Additional functions:		
Alarm function:	All models are fitted with alarm function; alarm output is energized when operating at normal conditions. Alarm output specifications vary, depending on the model	
	EBC 1205 EBC 2405 EBC 1210 EBC 2410	Solid state alarm output, current sink to ground (50mA max, load to be connected between alarm output terminal and battery positive terminal)
	EBC 2420 EBC 2440	Potential-free relay output, 1.0A / 250Vac contact rating, normally energized
Boost Charge:	All models are fitted with boost charge function; operation vary depending on the model	
	EBC 1205 EBC 2405 EBC 1210 EBC 2410	Boost charge input terminal has to be connected to battery positive for activation
	EBC 2420 EBC 2440	Boost charge input terminal has to be connected to battery negative for activation.
Over-voltage protection:	EBC 2420	Active when Vo > 32Vdc
	EBC 2440	
Power derating:	EBC 2420 EBC 2440	Output power de-rating starts at 60ºC and linearly de-rated down to zero at 70ºC

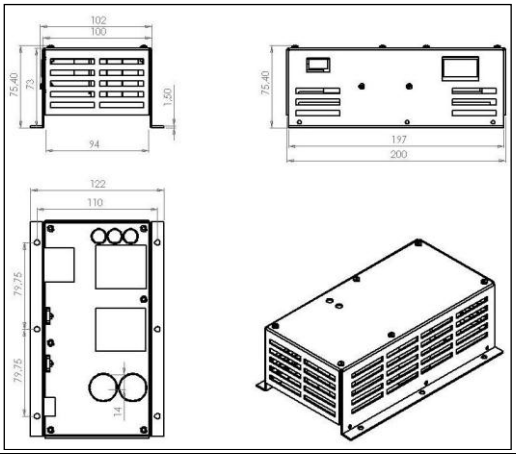
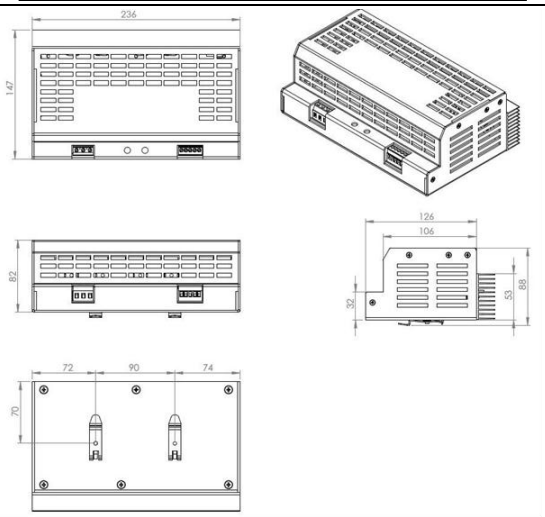
7- MECHANICAL DATA AND INSTALLATION:

Mechanical data is given in the drawings below. Installation regulation must be observed for reliable operation. Mechanical clearances must also be provided for proper ventilation to operate over the specified temperature range.

When mounting chargers in series or parallel, make sure that; the combination is connected side by side as mounting one above the other will increase the working temperature of the one on top.

When mounting, make sure that the units are fixed tightly on the mounting panel. Failing to do so will cause damage in vibrating conditions. Make sure that; the wires are tightened and secured and they are not loose in their sockets.

MODEL	MECHANICAL DATA
EBC 1205 EBC 2405 EBC 1210 (Panel mounting case)	
EBC 1205 EBC 2405 EBC 1210 (Rail mounting case)	

EBC 2410	
EBC 2420	
EBC 2440