
# Transmotor Battery Chargers

Types: **TBC 110-400**

# MANUAL

# 1 Introduction.

## 1.1 Transmotor.

Transmotor products are primarily produced for the marine industry for use all over the world, and Transmotor is the unchallenged market leader when it comes to DC power supply systems.

In recent years developments in power supply systems and equipment on large ships have led to a change in some countries from DC to AC voltages. But no matter what the voltage required, Transmotor can deliver economical, high-quality products either from our existing range of generators, motors, fans, battery chargers, transformers etc, or from new ranges which are in the pipeline.

Thanks to the high quality and durability of our products, a great number of AC/DC generators and power supply systems have been delivered over the years to armies, air-forces and navies all over the world.

We also supply AC and DC generators and other equipment for use in mining machinery, trucks for mine transport, road construction machinery, trains, buses, small-scale wind turbines and similar applications.

Our production process is never complete until final testing has been performed on each product before it leaves the factory. Every single product bearing the Transmotor name has been tested at full load until it has reached a stable operation temperature.

## 1.2 Transmotor battery Chargers TBC 110-400.

Transmotor products has a reputation of been tough products which can work well year after year without further service after being installed. The TBC charger series is no exception, based on well-proven technology, in a robust design with few high quality power parts. Power semiconductors and transformers are mounted so good cooling and mechanical stability is provided. The chargers can be used in very high temperature surroundings, up to 65°C.
The chargers are especially developed for use in the marine sector, where quality and reliability is of vital importance, and are suited to situations where reliability has first priority.

## 1.3 The TBC 110-400 Series.

This manual describes the installation and function of the following Chargers:

| | | | |
|---|---|---|---|
| TBC 110 | -- | 10A | battery charger. |
| TBC 130 | -- | 30A | battery charger. |
| TBC 160 | -- | 60A | battery charger. |
| TBC 400 | -- | 100A | battery charger. |

# 2 Description.

## 2.1 Charging Principe.

The chargers working principle are best described as consisting of 4 stages.

**Stage 1** is transforming the AC supply voltage to a lower AC voltage using a 50 Hz transformer.
**Stage 2** is a full wave rectification stage made up by 4 power diodes.
**Stage 3** is the voltage regulating element, a SCR regulated by the control PCB, to maintain constant output voltage.
**Stage 4** is a filter consisting of a choke. Together with the battery it filters out the ripple from the rectifier stage.

### 2.1.1 1-phase chargers.

Diagram 1 shows the Principe in TBC 110-160 chargers. Besides the above mentioned elements, there are some extra elements: Control transformer, fuses, shunt, voltmeter and ampere meter.

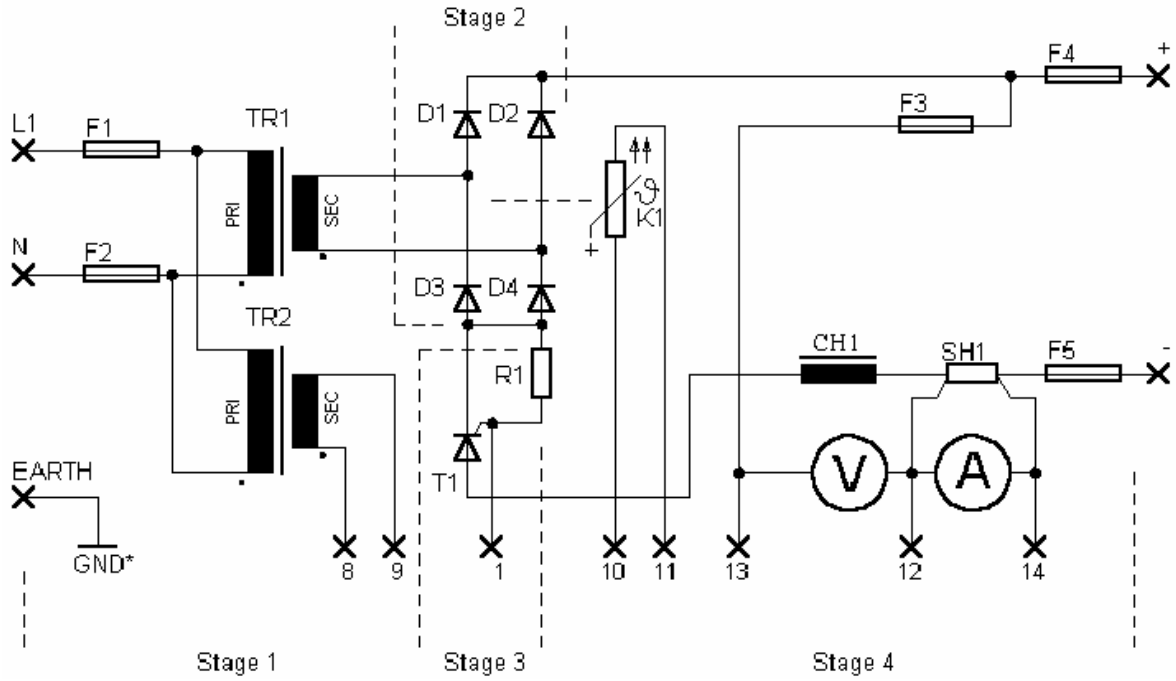


**Diagram 1:** TBC 1-phase charger diagram. Terminal numbers refers to control PCB terminals.

### 2.1.2 3-phase chargers.

Diagram 2 shows the principle in the TBC 400 three-phase charger.
In the 3-phase charger 3 SCR's are used for regulation, so the current in the three phases can be regulated individually, to ensure equal load on the three phases. Stage 2 and 3 are

combined in one unit, using 3 diodes and the 3 SCR's to form a three-phase rectifier bridge.

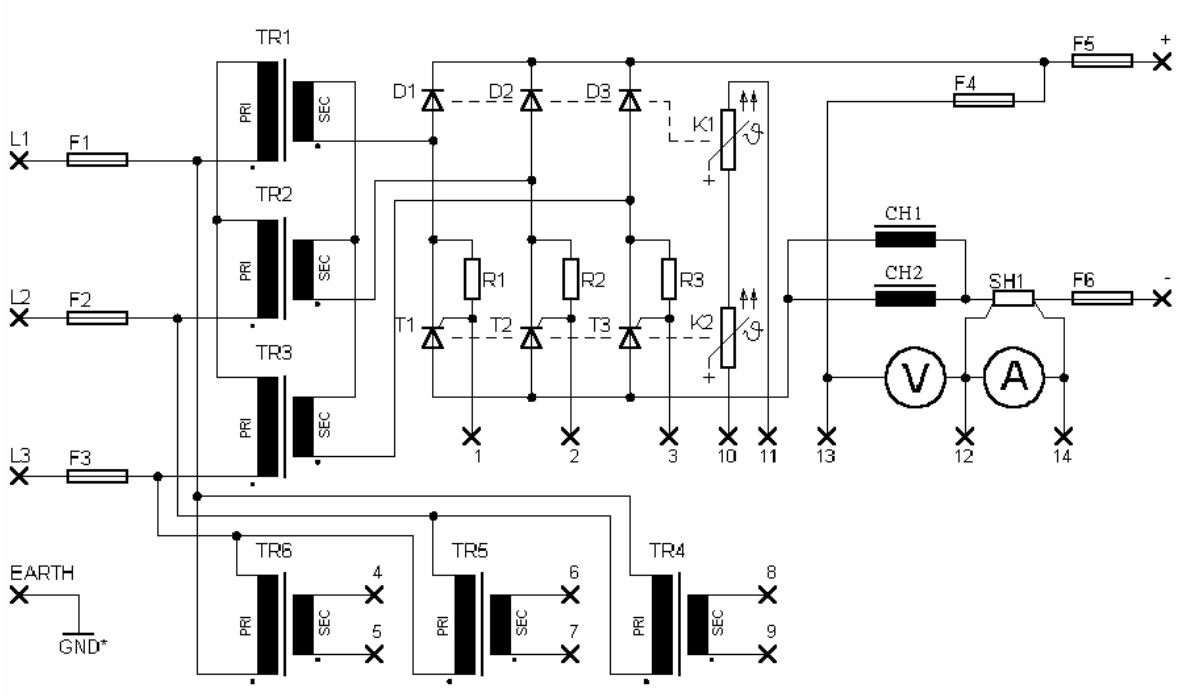


**Diagram 2:** TBC 3-phase charger diagram. Terminal numbers refers to control PCB terminals.

### 2.1.3 Regulation Principe.

The control PCB regulates the thyristors, so a constant charging voltage is ensured. The regulating method is split phase regulation. The thyristor is turned on in each period of the full wave rectified sine wave, at the phase point that ensures the wanted output voltage. The thyristor automatic turns of every time the rectified wave reaches zero.
From factory the constant charging voltage is set at 27.6 VDC, this is the recommended constant charging voltage for most lead-acid batteries.

## 2.2 Protection.

All input and output leads are protected with a fuse.
The use of bipolar fusing on input and output leads makes the charger suitable for all marine applications.

The control PCB also provides electronic protection of the charger, and alarms for malfunctions.

### 2.2.1 Current limiting.

The control PCB limits the charging current to the chargers rated charging current. When the consumption reaches the rated current the charger lowers the charging voltage, thereby protecting the charger from overload. The limiter is soft starting, so when a sudden

rise in current consumption arises, the charger releases the battery, before the protection sets in.

### 2.2.2 Overheat protection.

A thermal switch mounted on the heat sink cooling the rectifier diodes, protects the diodes. If the heat sink temperature gets to high the switch breaks the supply to the control PCB, and the charging stops.

### 2.2.3 Alarm functions.

The charger has a relay mounted with contacts that can be connected to an alarm panel. If a malfunction occurs or the power to the charger is turned off, the relay will turn off, signalling an alarm.

The control PCB measures the output voltage and gives an alarm for over voltage and under voltage conditions. In the TBC 400 three-phase charger it also gives alarm when one of the phases is absent (phase fault). These three fault conditions are indicated by LED´s on the front panel.

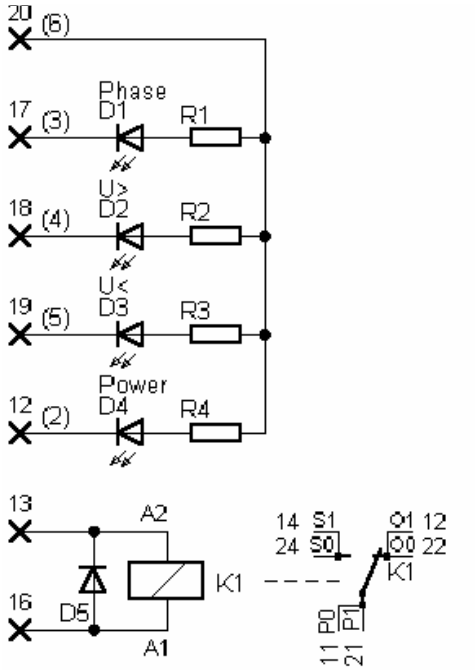


**Diagram 3:** TBC chargers alarm relay, and LED connections. Terminal numbers refers to control PCB terminals. Numbers in braches refers to LED PCB terminals.

# 3 Installation.

## 3.1 Mounting.

Find a dry and well-ventilated area for mounting of the charger, in a place close to the batteries. The charger should be wall mounted to ensure good cooling.

Cables are entered through the charger's bottom, at the rear end.

## 3.2 Connecting the batteries.

A good thick cable must be used between the charger and the batteries. The table below shows minimum cable thickness for the different charger sizes. Connections at both cable ends must be tight and secure to ensure a good connection.

| | |
|---|---|
| TBC 110 | Cable 2 x 2.5 mm² |
| TBC 130 | Cable 2 x 10 mm² |
| TBC 160 | Cable 2 x 16 mm² |
| TBC 400 | 2 Cables 1 x 25 mm² |

These dimensions meet the "Lloyds" standards.

Before starting any working on the battery connections, make sure that the input supply to the charger is switches off, or disconnected.
Open the charger cover.
Remove the two output fuses, from the fuse holders marked + and -.
Connect the positive battery cable to the fuse holder marked + and the negative battery cable to the fuse holder marked -.
Check the connections, to ensure that there are good connections.
Insert the two output fuses.
The voltmeter on the front will now show the battery voltage.

## 3.3 Connecting the supply input.

Check that the battery is already connected to the charger.
Make sure that the power to the supply cable is turned off.
Connect the phase and neutral to the fuse holders marked AC (On TBC 400 connect the 3 phases).
Make your earth connection to the yellow/green terminal next to the AC fuse holders, according to applicable safety standards.

1 mm². cable should be used.

## 3.4 Connecting an alarm unit.

The alarm-signalling relay is located next to the input terminals. The relay has a single change over contact set. With the aid of a multimeter find the appropriate terminals on the relay socket, for your alarm unit. When the supply to the charger is off the unit should give alarm. When the power is on and the charger is charging normally, there should be no alarm.

# 4 Operation.

## 4.1 Normal operation.

When the supply power is turned on, the following happens:

The green LED will light showing that there is power on the control PCB.
The voltage on the voltmeter on the charger front will rise to the charging voltage.
The ampere meter on the front will show that a charging current is flowing to the batteries.

## 4.2 Indication LED's.

Besides the green power LED, there are 3 red LED's for indication of different types of alarm. The LED's are of great help in locating the problem causing an alarm, whenever the charger gives an alarm.

The LED layout on the front cover, with a short explanation:

- Error — Shows missing phase on TBC 400 has no function in other charger models.
- Voltage high — Lights when a over voltage condition occurs.
- Voltage low — Lights when a under voltage condition occurs.
- Power on — Lights when power is present at the control print.

Fault tracing are covered in chapter 7.

# 5 Adjustments.

The charger has three adjustments. The adjustments are made on potentiometers at the top of the control PCB.

## 5.1 Adjusting the charging voltage.

The charging voltage is adjusted on potentiometer P3. The voltage is factory set to 27.6 VDC, this is the recommended constant charging voltage from most lead-acid battery producers. If other types of batteries have to be charged, the charger is easily adjusted to other charging voltages. Turning P3 clockwise rises the voltage, turning anti-clockwise lowers the voltage.
The charging voltage has to be set when the batteries are well charged. If the batteries are discharged the charger may be lowering the charging voltage in order not to exceed its maximum charge current. Its recommended to check the setting on fully charged batteries.

## 5.2 Adjusting the maximum charging current.

The current limit is adjusted on P2. It is factory set at the chargers maximum allowed charging current and should normally not be adjusted. If adjusted the **warranty is void**. This setting protects the charger from over load. By turning P2 anti clockwise the charging

current can be further lowered, if the batteries or installation can not carry the chargers maximum current. However to see the current limiting circuit in function a high load situation must be present, which mean: Qualified service personnel only.

## 5.3 Adjusting over and under voltage alarm.

The charger monitors the output voltage and gives alarm when the battery voltage gets very low or very high. The factory setting is to give an over voltage alarm at 30.0 VDC, and under voltage alarm at 21.5 VDC. The alarm voltages can be adjusted on P1. Turning P1 clockwise will rise both voltages and turning anti clockwise will lower them. The over voltage alarm set point is always 1.4 times the under voltage alarm set point.

Examples:

| Under | Over |
|---|---|
| 21.5V | 30.0V |
| 22.0V | 30.8V |
| 23.0V | 32.2V |
| 24.0V | 33.6V |

**The voltage alarm settings can be tested and readjusted by use of a variable power supply:**

1) Turn the power to the charger off.
2) Open the charger front.
3) Remove the output fuse, to the batteries + terminal
4) Remove the fuse for the instruments and control PCB.
5) Connect the negative terminal from the power supply to the battery - output terminal.
6) Connect the positive terminal from the power supply to the fuse holder for the instruments, at the end that is connected to the instruments.
7) Turn the power supply on, and rise the voltage to the desired under voltage alarm setting. The Voltmeter on the charger front will show the voltage.
8) Turn the power to the charger on. WARNING!! When the power is turned on, there are live wires inside that must not be touched.
9) Adjust on P1, so the LED for under voltage alarm lights. Test the setting by slowly adjusting the power supply output voltage, up and down. If necessary readjust, and test again.
10) Slowly raise the output voltage from the power supply, until the LED for over voltage alarm lights. This will show the over voltage alarm setting.
11) Turn the power to the charger off.
12) Remove the wires from the variable power supply, and reinsert the removed fuses
13) Close the charger front

# 6 Maintenance.

The TBC chargers do not require any specific maintenance. An annual check of the battery connections is recommended. Keep the charger dry, and clean from dust. Any fault that might arise can be traced following the fault tracing procedure.

# 7 Fault Tracing.

The TBC chargers are very robust, and therefore most likely a fault should be sought in bad or broken connections to or from the chargers. A fuse may also get old and break. Whenever a fault occurs the alarm relay will change to alarm position, causing an alarm when connected to your alarm unit. By means of the LED' s on the front panel both simple and more complicated faults can be traced.

## 7.1 The LED for low voltage lights up.

Check on the ampere meter, that the charger is still charging, it may be that the batteries just are totally discharged. If the charger is not charging check that the chargers output fuses are intact, if they are, the control print is most likely defect.

If the LED for Phase fault is lighting as well your problem is a missing phase, follow the procedure below.

## 7.2 The error LED lights up.

The charger is missing a phase, and closes down to protect it self. Check all fuses, there is most likely a broken fuse somewhere. If the fuses are intact, check that the correct voltage can be measured between the three phases at the input. If the input voltages are correct, check that the control transformers supplies approx. 30 VAC between the control PCB's terminal 4 and 5, and between terminal 6 and 7. If not, a control transformer is most likely defect.

## 7.3 The green power LED is not lighting.

The charger is missing its power supply, or the temperature inside the charger is so high that the termal switch is protecting the charger.
Check all input fuses. If the fuses are intact, and correct input voltage can be measured at the input, check that there is approx. 30 VAC between the control PCB's terminal 8 and 9. If it is not present, the control transformer is most likely defect. If the voltage is present, check that its also present between terminal 8 and 11. If present a new control PCB should be inserted. If not present the thermal switch is protecting the charger. Wait for the charger to cool down, if the problem persist, replace the thermal switch.

## 7.4 The LED for high voltage lights up.

There is a fault in the charger or in another charging units charging the same batteries. Quickly turn off the charger to protect your batteries. Most likely there is a fault on the control PCB or a short-circuited SCR.

# 8 Technical specifications.

## 8.1 Electrical.

| Type | Input Voltage<br>50 Hz Mains | Maximum Input Current<br>At: 230/400 VAC in<br>27.6 VDC out. | Output<br>Voltage | Output<br>Current*) |
|---|---|---|---|---|
| TBC 110 | 1 x 210-250 VAC | 2.0 Ampere | 24-30 VDC | 10 A |
| TBC 130 | 1 x 210-250 VAC | 5.9 Ampere | 24-30 VDC | 30 A |
| TBC 160 | 1 x 210-250 VAC | 11.3 Ampere | 24-30 VDC | 60 A |
| TBC 400 | 3 x 370-430 VAC | 3 x 4.9 Ampere | 24-30 VDC | 100A |

*) 10% higher release current before current limiter sets in.

Working temperature range:
0 - 65 Degree Celsius.

Charging method:
100% constant charging voltage. Factory set to 27.6 Volt.

Protection:
Bipolar fusing on input- and output terminals.
Built-in over voltage- and under voltage alarm. Factory set to 30.0 Volt and 21.5 Volt.
TBC 400 protected from operating when missing a phase.

Alarm relay ratings:
250 VAC, 16 Ampere.

EMC:
Filtered according to 82 / 499 / EOF and Nahr 1.

## 8.2 Mechanical.

| Type | Height<br>Without mounting console | Height | Width | Depth | Weight |
|---|---|---|---|---|---|
| TBC 110 | 335 mm. | 395 mm. | 210 mm. | 200 mm. | 14 Kg. |
| TBC 130 | 435 mm. | 495 mm. | 255 mm. | 225 mm. | 26 Kg. |
| TBC 160 | 485 mm. | 545 mm. | 305 mm. | 280 mm. | 38 Kg. |
| TBC 400 | 510 mm. | 560 mm. | 370 mm. | 320 mm. | 57 Kg. |