CONTROLLED RECTIFIER CHARGER

SCR-30-B
24V, 30A

Instruction book

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1. TECHNICAL DATA

Rectifier type  SCR-30-R
Supply network  3x220V/5A, 50 or 60 Hz
             3x380V/3A, 50 or 60 Hz
             3x440V/2.5A, 50 or 60 Hz
Battery  12 Pb cells or 18-20 NiCd cells
Recommended fuse value in supply line  10A (3x220 V),
             6 A (3x380 or 440V)

IU CHARACTERISTIC

Output voltage on battery  27 V for Pb battery (factory adjusted)
                          28V for NiCd battery (factory adjusted)
Output voltage constancy  +/- 1.5%
Max. Ripple of output voltage  2%
Rectifier rated current limit  30 A
Electronic current limit  35 A

IUI CHARACTERISTIC

Output voltage on battery  33 V factory adjusted
Overcharging output current  factory adjusted, depending upon
                           battery capacity approx. 10% to 15% In
Ambient temperature  -10 °C to max 50 °C
Mechanical protection  IP 21
Dimension of the box for mounting onto the wall  height 600, width 450, depth 260mm
Weight  62 kg
2. INTRODUCTION

Thyristor rectifier – charger type SCR is intended for charging storage and at the same time it can be used as a supply source for consumers which are connected in parallel to storage battery.
Rectifier output voltage is maintained constant regardless of change of the input voltage and load current. In case of rectifier current overloading, the electronic current limiter will limit the current so that it with decrease output voltage.

3. DESCRIPTION OF EL. WIRING DIAGRAM

The rectifier is supplied from the three-phase network 3x220 V, 380 or 440 V which is achieved by a simple over connection of terminals on the rectifier transformer primary. Input circuit is ensured by fuses, and then phase leads are led through RSO filters. Voltage is connected to the rectifying transformer by means of a can circuit breaker located on the front panel. The TRANSFORMER is provided with three secondary windings. A three-phase semi-controlled rectifying bridge is supplied from the main three-phase winding (U2, V2, W2). The aux. winding (U3, V3, W4) is used for synchronization of the impulse unit, and the single phase winding (U4, 0, X4) is used for supply of the electronic unit and for supply of the voltage stabilizer +/-15 V.

The retifying module is designed as a three-phase semicontrolled thyristor-diode bridge. The rectifying module includes a printed card SU-23 which has the following functions:

a) stabilizes the rectifier voltage +/-15 V for supply of electronic assemblies,
b) regulates the rectifier voltage with accuracy +/- 15% 
c) limits the rectifier current

d) generates, synchronises and amplifies the impulse for triggering the thyristors,
e) by external command (change-over switch S2) switches the rectifier from IU to IUI characteristic or vice versa

The rectifier is protected by electronic current limit against current overloading on battery terminals or consumers terminals. Additional protection against exceeded current is realized by means of output fuses F4 and F5.

SCR 60-R contains also the SU-24 card.
This card detects if under voltage occurs on output terminals and in that case (after certain time delay-aprox. 10 sec) activates outer alarm or indicator lamp, as an indication that battery is being discharged. Alarm also occurs in the case of supply failure, malfunction of rectifier, and in case that electronic current limiter causes drop of output voltage.
4. ELECTRICAL DIAGRAM SCR 30-R
5. ADAPTATION OF THE RECTIFIER TO DIFFERENT SUPPLY VOLTAGE:

The rectifying transformer is made with terminals which give the possibility of operation with 3x220V, 3x380V or 3x440V supply network. This is not shown on the wiring diagram, because the transformer is factory connected in accordance with customer’s request. It is, however, possible to re-connected the transformer, for operation on other supply voltages.

On the transformer, two 12-pole terminals are found. One of them connects the transformer with the rest of the rectifier, while the other holds only jumpers, which should be connected as shown, for different voltages:

Terminals L1-L4=10mm²
Terminals L5-L11=4mm²
6. DESCRIPTION OF OPERATION (BATTERY CHARGING AND CONSUMERS SUPPLY)

In normal condition the rectifier and the battery are always connected in parallel with the consumers so that the rectifier will supply total current. In case the supply network is present for a longer time, the rectifier will supply consumers with constant voltage (±1.5%) and maintain battery in charged condition. In this case the rectifier supplies only the current to the battery, which is equal to the, current of battery self-discharging. The remaining, bigger part of the current supplied by the rectifier will flow through consumers.

If due to any reason an interruption occurs in rectifier supply with AC voltage, the battery will without interruption continue to supply consumers with DC voltage, voltage on consumers will drop rapidly for the value of the voltage drop in battery, and afterwards will get stabilized and will drop slowly due to battery discharging. When the network voltage has been restored the following situation might appear:

a) During absence of network voltage the battery is only discharged. In that case after return of network voltage the rectifier will maintain constant voltage 27 V on output terminals. Current that will flow from the rectifier (measured with ammeter Al) is divided to current, which flows into battery and recharges it.

b) During absence of network voltage the battery is heavily discharged. In such event, after return of network voltage, the rectifier will have decreased voltage and supply the current (measured with ammeter Al) that is limited by electronic current limiter (approx. 35A). By gradual battery charging, the voltage will raise towards 27 V with rectifier constant current. After a certain time (depending upon a degree of battery discharging and size of connected consumers) the voltage will reach 27 V, and the current will drop gradually, and at last a situation equal to the one described in Item a) will be achieved. It can be established that situations described on a) and b) correspond to the rectifier with IU characteristic i.e. to the rectifier when the rectifier changeover switch S2 (change-over switch IU, IUI) is in position IU.

**IUI characteristic** is achieved by setting the CHANGE-OVER SWITCH S2 in position IUI.

**IMPORTANT NOTE!**

Prior to overstitching the changeover switch S2 into position IUI it is necessary to disconnect all consumers (except the battery). This is especially important because the voltage on output terminals will reach approx. 32V. Battery charging i.e. OVERCHARGING with the rectifier that operates with IUI characteristic is essential in the following cases:

1. First battery charging
2. If the battery was inactive for a longer time (not charged nor discharged)
3. If the battery is heavily discharged. The rectifier with IUI characteristic will operate identically as the rectifier with IU characteristic until the battery charging current drops to approx. 10% to 15% of rated current in. Only in that case the voltage will start to raise above voltage 27V with charging current limit to approx. 10% to 15% In. (see IUI characteristic diagram)

![UI characteristic](image1)

Two hours after achieving final voltage (approx. 32V) it is possible to interrupt the overcharging process so that the changeover switch S2 is switched back to IU position. Consumers should then be connected to the rectifier.

7. FIRST PUTTING INTO OPERATION

The rectifier is mounted onto the wall (bulkhead) in a dry room. Inlet cable on I5, L6 and I7 and a cable that goes towards the battery L1, L2 should be connected, and afterwards the cable should be connected to the battery.

IMPORTANT NOTE!

Prior to final connection check once again polarity of the rectifier terminals and battery («+” to “+”, “-” to “-”).

Check whether the rectifier MAIN CIRCUIT BREAKER S1 is in zero-switched off position. Supply network voltage. Put on the rectifier by means of the MAIN CIRCUIT BREAKER S1 and connect over the CHANGE-OVER SWITCH S2 into position IUI.
The rectifier is charging the battery to IUI characteristic. Two hours after the final voltage has been achieved switch over the CHANGE-OVER SWITCH into position IU. Connect the cable for consumers connection to L3 and L4 (during connection pay attention to terminals that are under voltage).

8. SWITCHING OFF/ON

There are several degrees of switching off:

a) Switching off the MAIN CIRCUIT BREAKER S1 causes interruption of the rectifier operation. It is important to note that in this operation rating the battery will continue to supply consumers, and attention should be paid that battery is not discharged too much. Switching off is performed for ex. in case of control and repair in the rectifier feed line. By re-switching the MAIN CIRCUIT BREAKER S1 the rectifier is brought into normal working operation.

b) Switching off the MAIN CIRCUIT BREAKER and disconnection of at least one lead which is connected to the battery (« +" and/or" – “lead) causes interruption of the rectifier operation and interruption of consumers supply. Due to safety reason it is essential to switch off the consumers before this action. Switching off is performed for ex. in case of control or repair of the rectifier or the battery. The rectifier will be put into operation by connecting the battery lead and by switching on the MAIN CIRCUIT BREAKER S1 and consumers switching on.

9. MAINTENANCE INSTRUCTIONS

The rectifier does not require any maintenance or replacement of parts. If necessary clean the dust with a brush or a vacuum cleaner. Cleaning should be carried out when the rectifier is switched off as already described in Item 6b. In case of interruption of the rectifier operation it is necessary to check as follows:

a) Whether the fuses F1 to F5 are in proper order. If not replace them.
b) Whether there is the network supply on I5, I6, and I7.
c) Whether the battery cable and load cable on battery are in order
d) Whether diodes D2, D4, D6 and thyristor Th1, Th3 and Th5 are in order.

Eventual defected elements should be replaced. In the event that the performed action does not give successful results then the electronic card SU-23 should be replaced.
10. MECANICAL CONSTRUCTION SCR-30-R