DESCRIPTION

Uninterruptible DC Power Supply
Type GL110 / LG110S

for ships of the navy

GL110 / LG110S

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2. Fundamentals for the standby power supply on board of ships

2.1 General possibilities

2.1.1 Standby parallel mode of operation (Fig. 2.1).

With this classical mode of operation the battery and the consumer are continuously coupled with each other; a power supply ensures the charging of the battery as well as the supply of the consumers when mains are available.

In any case, inherent to the system the battery voltage is always identical with the voltage of the “secured bar”. The power supply must be so designed on the output side that, for one thing, the batteries are reasonably charged and, for the other thing, the consumer voltage remains within the required tolerance range. As far as the current load is concerned, respective reserves will have to be considered, since the consumer current available is determined by a battery which has to be recharged. If the current available is rated too low, there will be continual charging/discharging cycles between the power supply and the battery, or the battery and the consumer resp.

2.1.2 Standby parallel operation with BCU (battery control unit) (Fig. 2.2):

The standby parallel operation is enlarged by a facility which can cut off charging subject to the battery condition. As compared with the classical standby parallel operation, the continual minor charging/ discharging cycles are prevented. The battery is decoupled via diodes in forward direction to the “secured bar”, so that in the event of load impacts or a mains failure the battery takes over the supply of the consumers without interruption, and a relay contact bridges the diode. Special charging methods such as constant current supply or impressing of a trickle charging current, are neither possible with this system. The maximum charging voltage results from the set voltage from the “secured bar”.

2.1.3 Uninterruptible changeover operation (Fig.2.3.):

This system provides for a charge of the battery and a supply of the “secured bar” independet of each other. The battery and the “bar” are decoupled by diodes. A reset switch bridges the diode path in case of a mains failure of in case of loads which exceed the output current of the rectifier set. With this method the optimum charging methods may be chosen for any type of battery you like.

2.2 Charging technique requirements for nickel-cadmium batteries

2.2.1 Charging flat to full, 10 h.

2.2.2 Trickle charge at a minimum loss of liquid.

2.2.3 Taking into account the differing ambient temperatures.

Acc. to the present state of knowledge this results in the following charging method:

- Charging at I = const. ≥ 30 A to 1.6. V / element = 32.0 V

- Trickle charging at I = const. = 400 mA

- Switching off the charge until U ≤ 1.3 V / element = 26.0 V, then switching on the charge

- Immediate switching on of the charge after the battery has been under load

2.3 Power supply requirements for the “secured bar”

2.3.1 Uninterruptible operation

2.3.2 Selectable consumer voltage

2.3.2 Constant consumer voltage

2.4 Comparison of systems

2.4.1 With standby parallel operation the charging condition of the battery determines the voltage on the “secured bar”. (Fig. 2.4).

2.4.2 With standby parallel operation a charge of the battery which requires little maintenance an is preserving the battery, is not possible.

2.4.3 With standby parallel operation the battery determines the maximum available consumer current during the charge (Fig. 2.5).

2.4.4 With changeover operation the charge of the battery and the standby power supply of the consumers are independent of each other.

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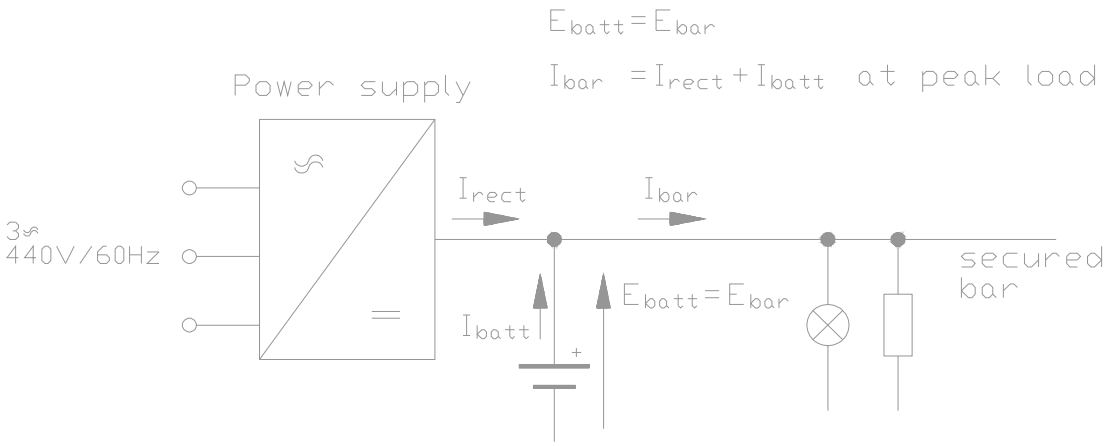

Fig. 2.1 Standby parallel mode of operation

Assets

- one power unit
- minimum of equipment required
- absolutely uninterruptible

Drawbacks

- Equipment voltage = battery voltage, i. e. voltage on the “secured bar” 19..31 V
- only suitable for certain battery types
- no charging current limitation, i. e. breakdown of the “bar” voltage in case of peak loads
- the tolerance of the output voltage must conform to the requirements of the battery

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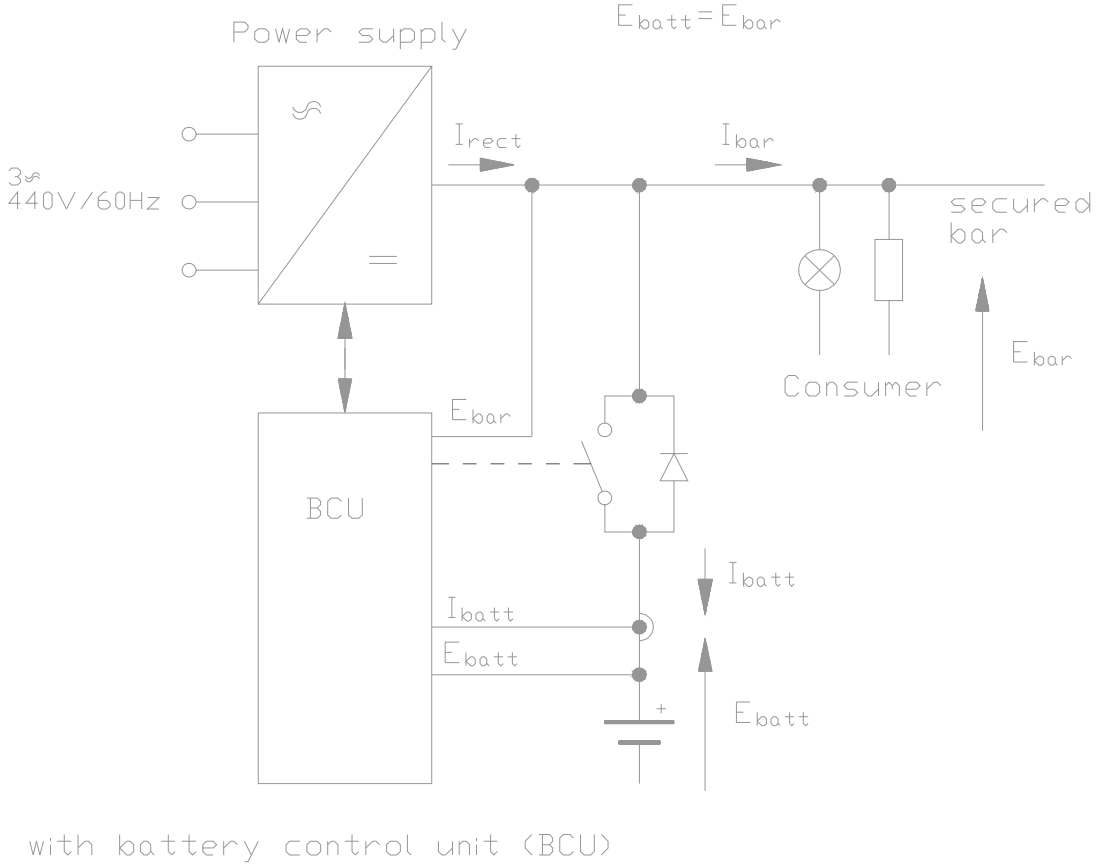

Fig. 2.2 Standby parallel mode of operation

Assets

- One power unit
- Freely selectable "bar" voltage with charged battery *
- No continual minor charging/discharging cycles

* only with pilot line of BCU power supply

Drawbacks

- More equipment required
- Equipment voltage = battery voltage during charge
- Max. equipment voltage determines max. charging voltage
- Short voltage drop in case of a mains failure

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E_{bar} = 26 ... 29 V freely selectable
E_{batt} = 19 ... 31 V depending on charging condition
$I_{bar} = I_{rect} + I_{chg} + I_{bat}$

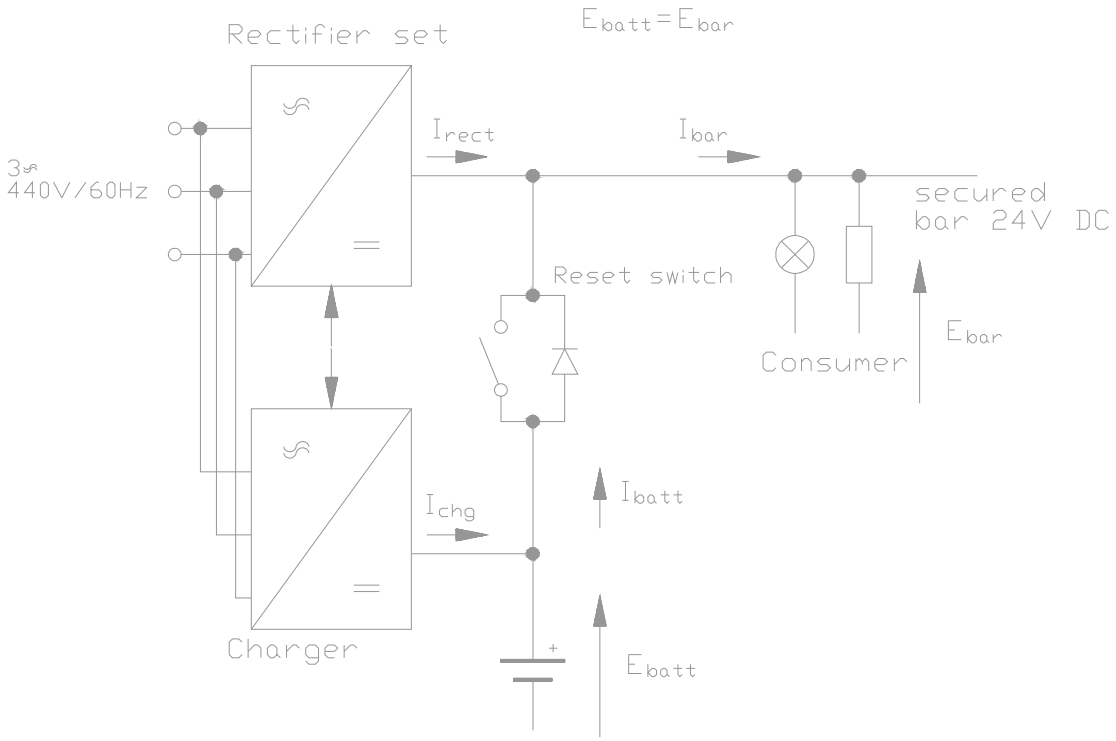

Fig. 2.3 Uninterruptible changeover operation

Assets

- Optimum charge of the battery
- Consumer voltage independent of the battery voltage
- No continual minor charging/discharging cycles
- Load reserve $I_{bar} = I_{rect} + I_{chg} + I_{batt}$
- Operation when rectifier fails

Drawbacks

- More equipment required
- Short voltage drop in case of a mains failure

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Fig. 2.4 Battery voltage versus voltage of secured bar

Battery voltage	Voltage on the "secured bars" E_{bar}			
	Standby parallel mode	Standby parallel mode with BCU		Uninterruptible changeover mode
		Charging	Charging off	GL110/LG110
0,0 V	0,0 V	0,0 V	Echarge max.	)
19,0 V	19,0 V	19,0 V	Echarge max.	) freely selectable
26,7 V	26,7 V	26,7 V	Echarge max.	) 26 ... 29 V
28,8 V	28,8 V	28,8 V	Echarge max.	)
31,0 V	31,0 V	31,0 V		If $E_{Batt} = U_{GL}110 + 4.2\,V \rightarrow\rightarrow$ $U_{GL}110 = U_{GL}110 + 1.8\,V$

Fig. 2.5 Comparison of charging and load conditions

	Standby parallel mode	standby parallel mode with BCU	Uninterruptible changeover mode
			GL110 / LG 100 S
Charging current	$I_{batt} = I_{rect} - I_{bar}$	$I_{bat} = I_{rect} - I_{bar}$	$I_{batt} = I_{chg}$
Trickle charging current	$I_{batt} = f(E_{bar}; J_{batt})$	$I_{batt} = Ø$ bzw. $= f(E_{bar}; J_{batt})$	$I_{batt} = I_{trick.}$
Load current during charge	$I_{bar} = I_{rect} - I_{batt}$	$I_{bar} = I_{rect} - I_{batt}$	$I_{bar} = I_{rect}$
Load current with charged battery	$I_{bar} = I_{rect}$	$I_{bar} = I_{rect}$	$I_{bar} = I_{chg} + I_{rect}$

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3. Description of the system

The uninterruptible DC power supply system GL110/GL110 S is composed of 3 functional units (Fig. 3.1),

- the GL110 rectifier
- the LG110S charging section
- and the reset switch.

The three functional units are accomodated in 2 19" cabinets having 9 units of height each (Fig. 3.2). With mains beeing available, the GL110 rectifier with its controlled output characteristic supplies the “secured bar”. The max. rectifier current amounts to 80 A, while the output voltage is freely selectable within the range of 26 ... 29 V.

By means of the LG110S charger the battery is being charged when mains are available. The max. charging current is 30 A. The charging characteristic is optimum adjusted to the LS 230 nickel-cadmium batteries and described in detail in section 5.

In case of a mains failure the “secured DC supply bar” including its consumers is directly coupled with the battery by means of diodes so that an uninterruptible reset switch effects the short-circuiting of the diodes after a short period of time. A detailed description is given in section 6.

All operating and display elements are arranged on the front of the instruments, the same as the connections for mains voltage, control lines and the connections to the battery as well as to the “secured bar”. All inputs on the mains side and all ouputs on the DC side are protected via selective circuit breakers.

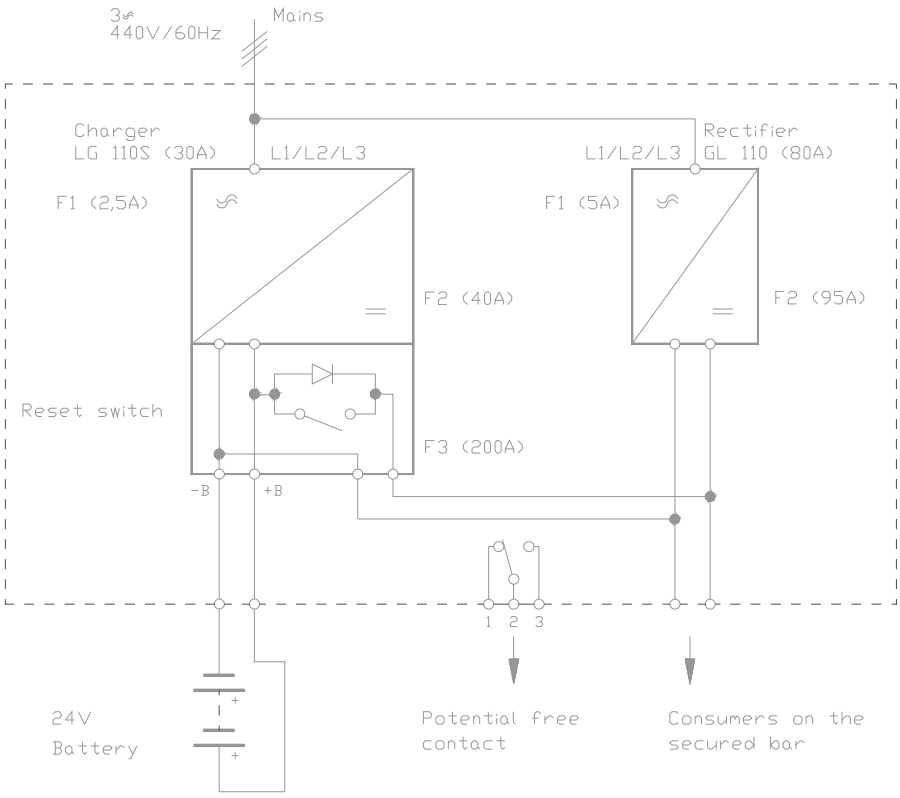

Fig. 3.1 Block diagram, uninterruptible DC power supply GL110 / LG110S

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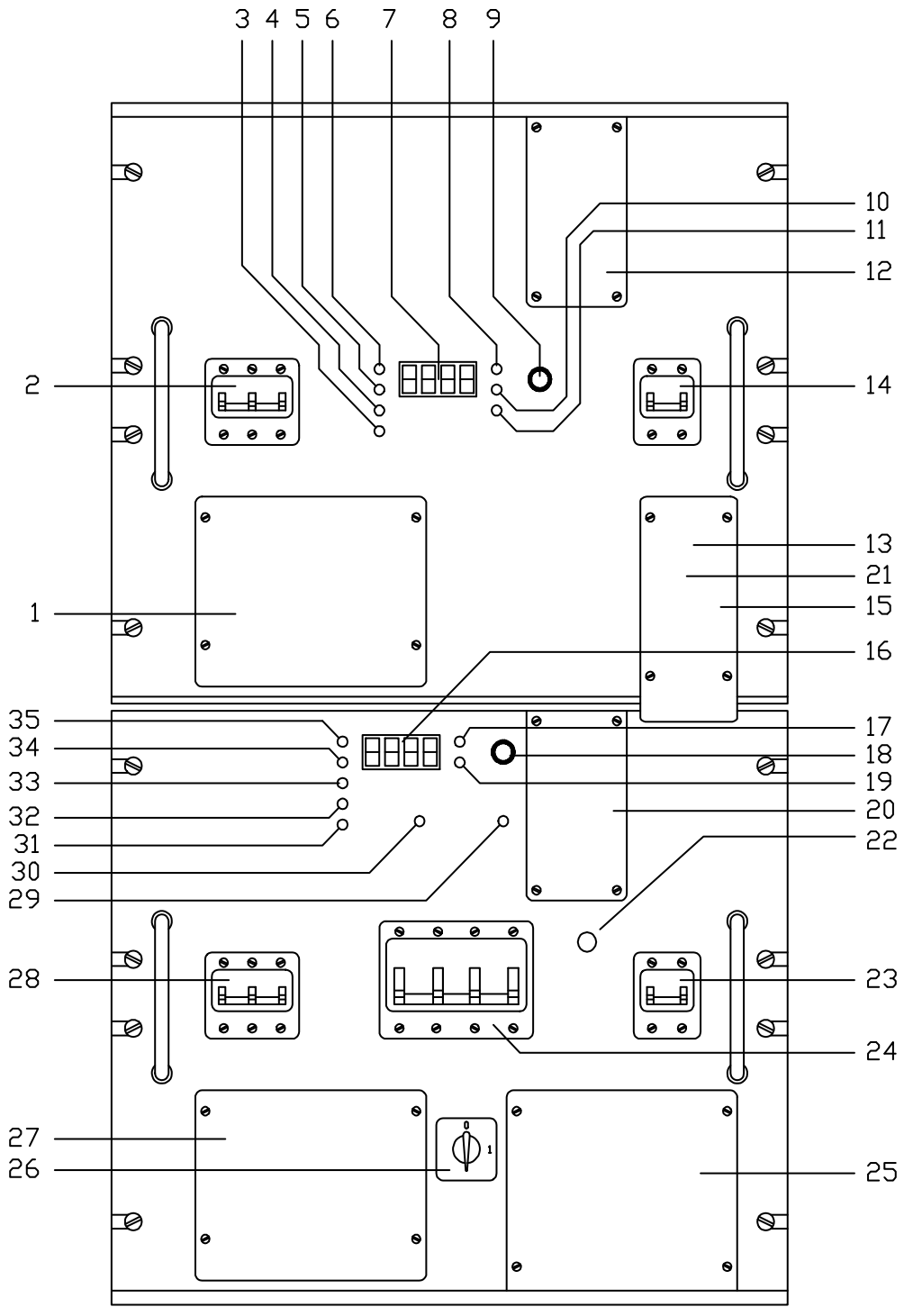

Fig. 3.2 Front panel

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Front panel description

Rectifier GL110

1 Covered AC Connection Terminals MAINS INPUT and MONITORING OUTPUT

2 ACB F1 MAINS INPUT

3 LED - red, Eout < 22 V

4 LED - red, Eout > 32 V

5 LED - green, OPERATION O. K.

5 LED - yellow, MAINS EXISTING

7 7 digit LED Display for Output Voltage and Current

8 LED - yellow, Eout/ V

9 Pushbutton S 1 SELECT SWITCH

10 LED - yellow, Iout / A

11 LED - red, OVERLOAD

12 Cover with Potentiometer for Setting OUTPUT VOLTAGE with R33

13 Socket J 1 (Connection for Data Transfer)

14 ACB F2 DC OUTPUT

15 Covered DC Connection Bolts DC OUTPUT

Battery Charger LG110S

16 7 digit LED Display for Output Voltage and Current

17 LED - yellow, Eout / V

18 Pushbutton S 1 SELECT SWITCH

19 LED - yellow, Iout / A

20 Cover with Potentiometer for Setting OUTPUT VOLTAGE with R33

21 Flexible cable for Data Transfer

22 Socket J 1 (Connection for Data Transfer)

23 ACB F2 DC OUTPUT

24 ACB F3 RESET SWITCH

25 Covered DC Connection Bolts Battery and SECURED BAR

26 Key Switch ON / OFF for MANUAL CHARGE

27 Covered AC Connection Terminals MAINS INPUT and MONITORING OUTPUT

28 ACB F1 MAINS INPUT

29 LED - red, BATTERY OPERATION

30 LED - green, MAINS OPERATION

31 LED - yellow, MANUAL CHARGE ENDED

32 LED - red, Eout < 18 V

33 LED - red, Eout > 33 V

34 LED - green, OPERATING O. K.

35 LED - yellow, MAINS EXISTING

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4. Description of the GL110 rectifier

The rectifier set is designed for the supply of the “secured bar” on board of ships when the mains supply is available. The output voltage is adjustable from 26...29 V. The max. rectifier current is 80 A.

4.1 Connections (Fig. 4.2)

- Connectable and accessible from the front
- Terminals on the mains side (with caps) suitable for through-wiring
- Terminals for potential-free contact in the connection box on the mains side
- Direct voltage output through covered threadet bolt in the front side

Attention:
The threadet bolt nuts of the direct voltage output may only be tightened with a starting torque of a max. of 20 Nm.

4.2 Operating and display elements (Fig. 4.1)

- Four-digit LED display for indication of the output voltage and current.
  Changeover by means of press-button

- Mains available
- Display “Operating o.k.” (no failure) Luminescent diodes
- Display “Overload”
- Display “U>32 V”
- Display “U<22 V”
- Circuit breaker input (mains)
- Circuit breaker output (DC)
- Setting of the output voltage with a potentiometer after removal of the control p.c.b. cover

4.3 Monitoring

A potential-free contact is available for monitoring the operation. The contact relay is tightened during trouble-free operation. The following failures are signalled:

- Mains failure
- Overload I > 80 A
- Output voltage > 32 V)
- Output voltage < 22 V)

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4.4 Perfomance description

4.4.1 GL110

The 3 x 440 V AC mains supply is converted into direct voltage of 26...29 V/80 A max. by the assemblies which are referred to hereafter and described in detail (Fig. 4.3 and 4.4). After being rectified and screened, the supply voltage (3 x 440 V AC) is passed via the AC filter to the power unit.

Triggered by the regulator and control p.c.b., the DC voltage (660 V) is pulse-width modulated and passed to the transformers T4 and T5.

Via T6 as an intermediate storage, and C1 the potentialy isolated low voltage (26...29 V) is available on the output terminals after DC filtering.

The power supply feeds the display, the control p.c.b. and the power unit with its supply voltage. The display unit signals failures, operating status and the values of the output voltage or of the output current. The output characteristic with the alarm levels is illustrated in Fig. 4.5.

4.4.2 AC filter GL110

Mains connection L1, L2, L3, PE, 3 x 440 VAC
Via F1 the three-phase AC voltage reaches a combination of capacitors and chokes. These have the following functions:

- to protect the unit against transient mains interferences, power factor improvements (cos φ)

- to suppress the radio interferences conducted to the mains

Thereafter the three-phase AC voltage is rectified by means of a three-phase bridge rectifier and connected to the mains screening J3 via J3.1. On the secondary side of the two auxiliarys transformers there are six potentially isolated AC voltages available which are fed via J10.1 and J11.1 into the power supply. The auxiliary transformers are fused with the fuses F4 and F5. Via bushing type capacitors the connections of the potential-free contact (1/2 = normally opened, 2/3 = normally closed) are fed into the power supply.

4.4.3 GL110 mains screening

A capacitor bank is available on this unit for screening the three-phase supply voltage after the rectifier.

4.4.4 GL110 power supply

On this unit potentially isolated 15 V DC supplies are generated.

Four alternating voltages are fed via J10 into the power supply which generate the stabilized 15 V constant voltages for the driver connections of the switch settings. Via J13 these are fed into the power unit. To generate th 15 V DC supply for the display and the regulator and control p.c.h., an alternating voltage is fed into J11. The regulated 15 V DC voltage applies to J14. Via the KB 1 flat ribbon lead it will be passed into the display and the regulator and control unit. The potential-free contact is connected to the terminal strip on the front panel of the set by means of the wire harness KB 9.

4.4.5 GL110 power unit

The GL110 power unit is designed as a double flow converter. The two converter transformers (T3, T4) alternately transfer the energy via V1...V6 to the joint output choke T6 at a clock frequency of 40 kHz. Via the electrolytic capacitor C1 the output voltage is led into the DC filter.

The R-C combinations (R-C-1) protect the rectifier and free-running diodes from voltage oscillations. The C-Bg.1 and C-Gb.2 sub-assemlies are components of the radio-interference screening system.

The potentially-isolated pulse-width modulated signals pass through terminal J12 to reach the driver stages which, in turn, drive the power transistors.

4.4.6 GL110 regulator and control unit

The output data (voltage, current) are passed to precision measuring amplifiers and controls via KB5 and J12/J20 on the regulator and control p.c.b. These data are then transformed into pulse width modulated signals and transfered potentially-isolated to the power stage. This sub-assembly is designed as plug-in board, the voltage supply and various analogous signals being passed via KB1 to J21.

After loosening the four fastening screws, the cover on the front panel can be removed. Then the output voltage of the set can be adjusted with R33.

4.4.7 GL110 display

On the display board there are four 7-segment components which effect a 4-digit display of the current and voltage, as well as 7 LEDs which indicate a number of measuring and control operations.

An A/D converter drives the digital display via the toped integrated driver. The analogous measuring values of voltage and current are supplied to the display unit via the terminal strip J17 and adapted to certain voltage levels by means of resistor combinations. By means of the “select switch” the display of either the current or the voltage can be chosen. According to the change-over either the LED E/V or I/A lights up.

Change-over is effected by means of a relay which is also accomodated on the board.

The yellow “Mains existing” LED lights up when mains are available. In additon, the green LED “Operation o.k.” indicates orderly operation.

The red LEDs E > 32 V or E < 22 V resp. light up when the permitted voltage range is exceeded.

In case of overload operation the “Overload” LED lights up. The LEDs for the respective disturbance indications and the LED “Operating o.k.” are driven via comparators with transistors switched in sequence.

4.4.8 GL110 DC filter

The transient interferences of the converter output are dampened by L-C combinations in the DC filter to VG 95 373, section 24, limiting value, class 3. Via a circuit breaker the DC voltage is fed to the output terminals of the set. The pilot line signals are transmitted via J1 and the bushing type capacitors via KB2 through the filter to the display.
In the filter also the output data of voltage and current are picked off and transmitted by means of bushing type capacitors and KB5 to the regulator p.c.b. and by means of KB10 to the display.

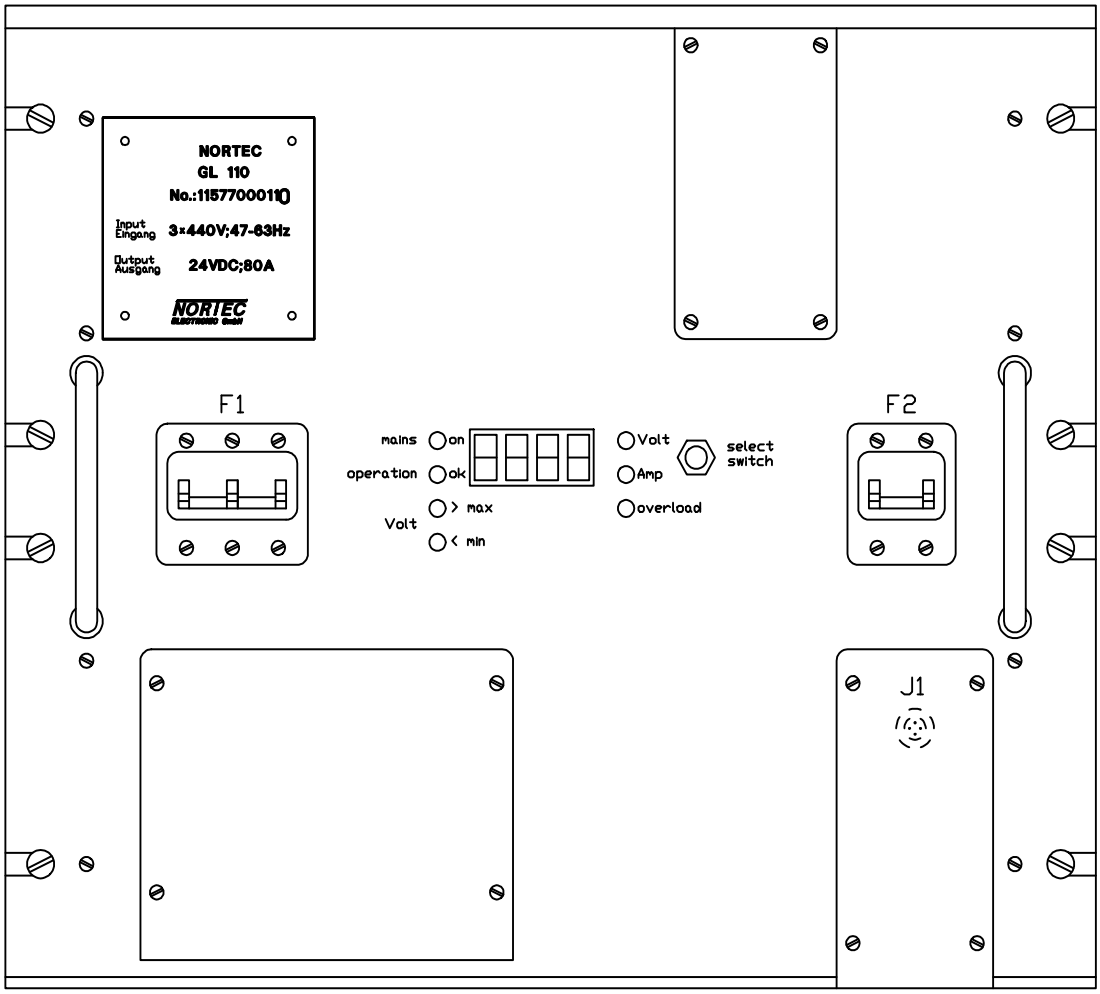

Fig. 4.1 Front panel GL110

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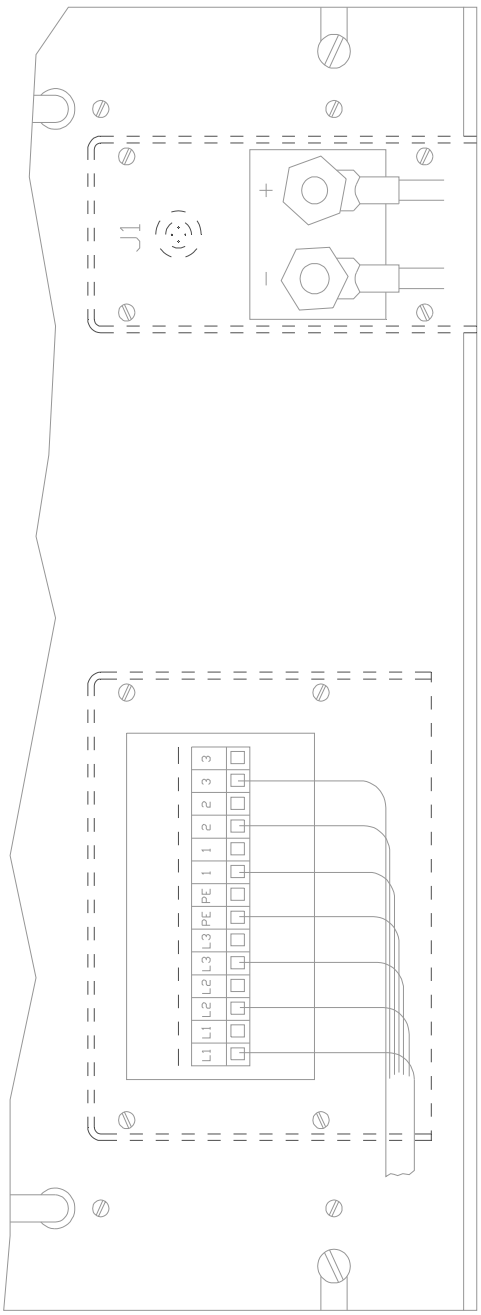

Fig. 4.2 GL110 AC- and DC-connection

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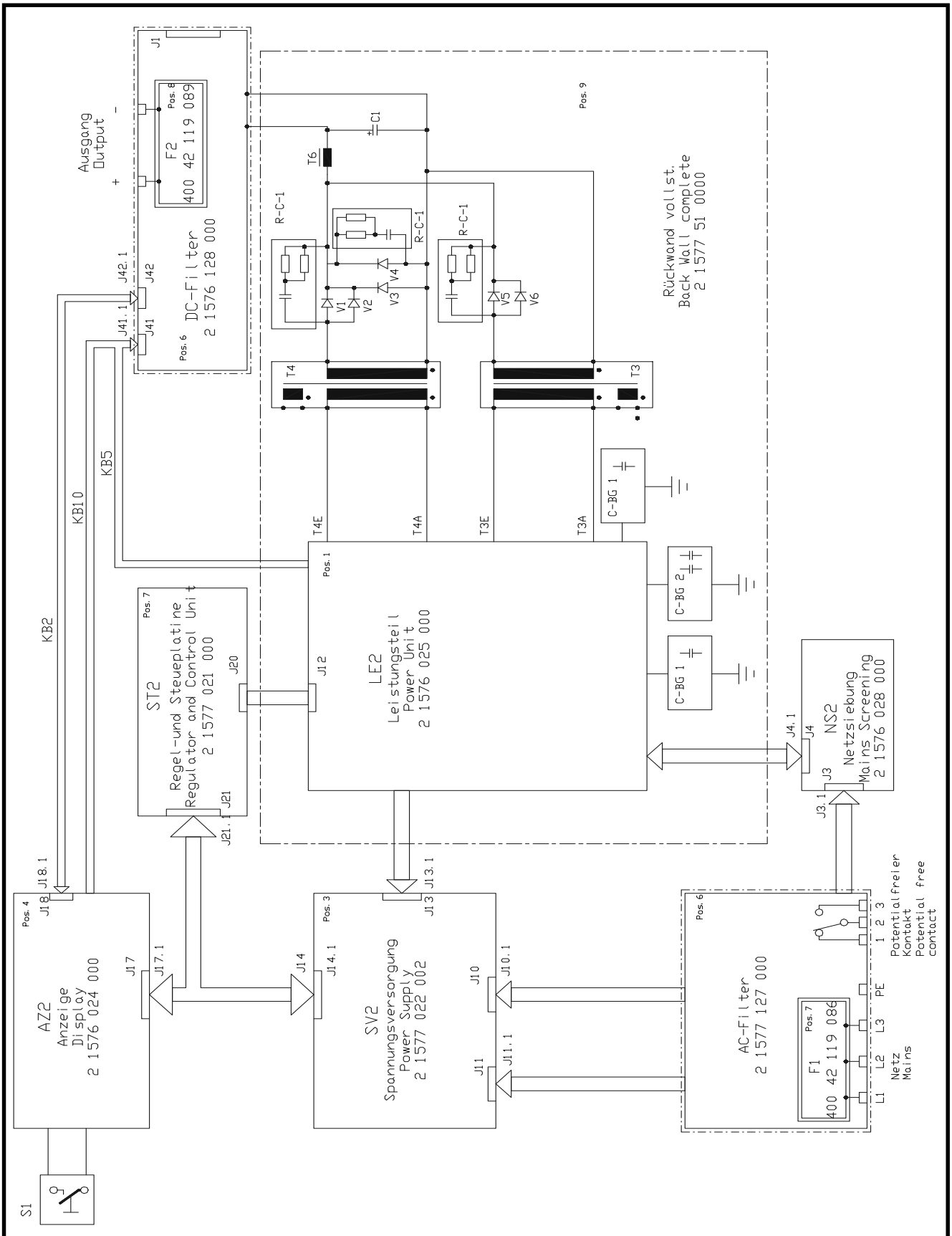

Fig. 4.3 Complete circuit diagram GL110

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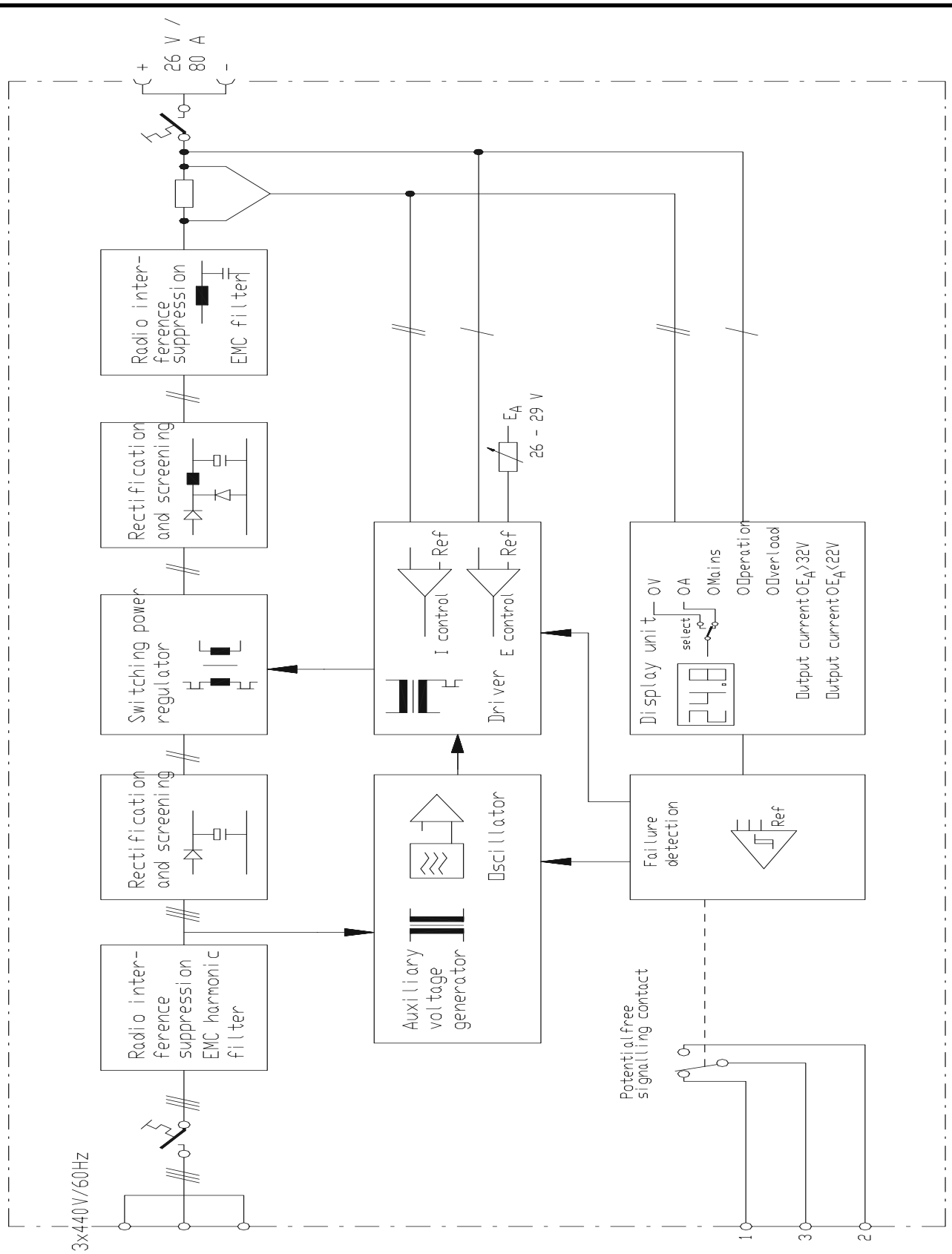

Fig. 4.4 Rectifier set GL110
Function diagram GL110

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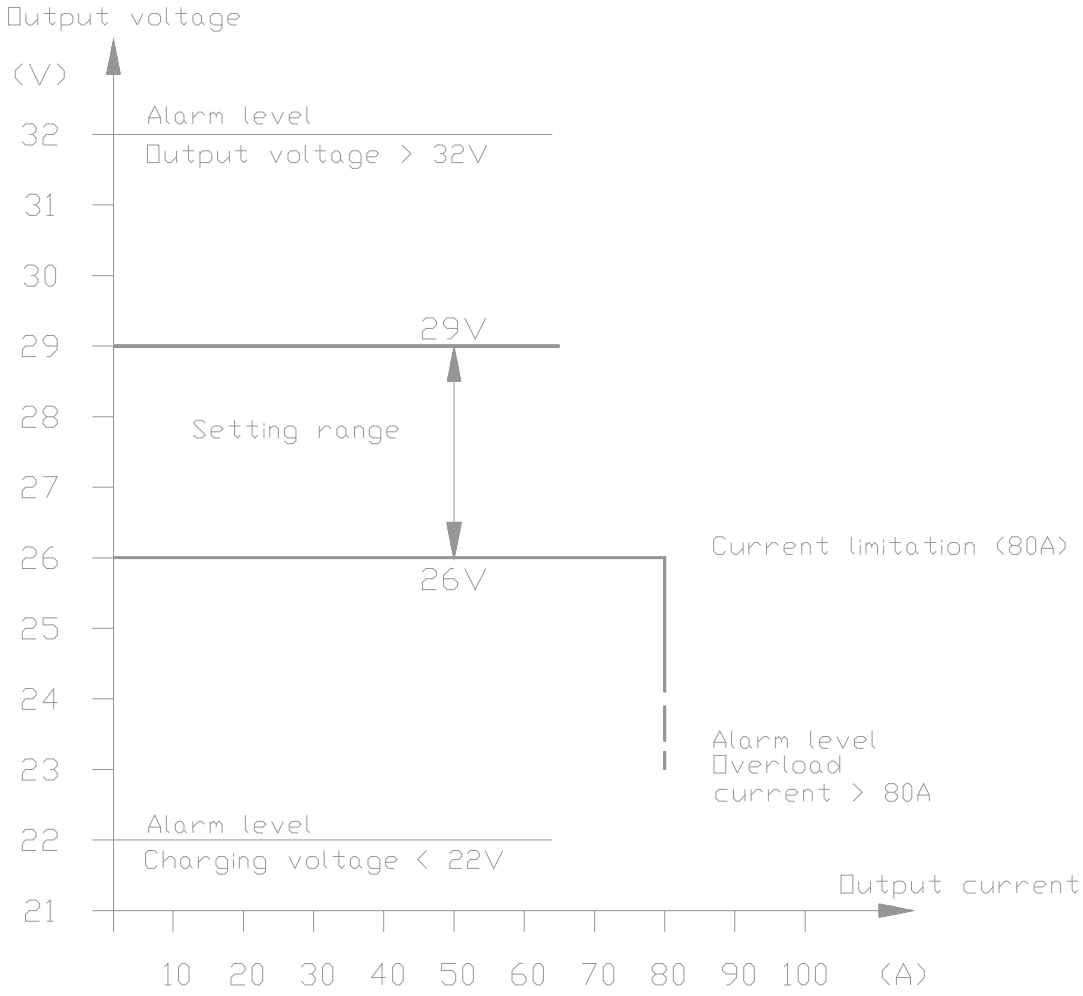

Fig. 4.5 Rectifier GL110

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5. Description of the LG110S charger

The charger is designed for the automatic charge and trickle charge of nickel-cadmium batteries. Charging is effected acc. to an IE-characteristic. The charging current is limited to 30 A, the max. output voltage is adjustable.

When the set voltage has been reached, change-over to trickle charge operation at a constant current of 400 mA is effected.

When the battery voltage rises to 31.0 V, the charging current is switched off, until the battery has reached 26.0 V in its no-load condition. At this point the charging current will be switched on again.

After loading the battery due to a mains failure or due to a current consumption which is bigger than the system current (rectifier 80 A + charger 30 A = 110 A), charging will automatically be cut in, i.e. charging at a constant current of 30 A till the upper switching-off setting is reached.

The upper switching-off setting during charge can be adjusted between 29...32 V, normal setting is 31.5V. The output characteristic of the charger is illustrated in Fig. 5.1, and the typical charging curve in Fig. 5.2.

5.1 Connections (Fig. 5.4)

- Connectible and accessible from the front
- Terminals on the mains side (with cover) suitable for through-wiring
- Terminals for the potential-free contact in the connection box on the mains side
- Charging voltage output via threaded bolt with cover in the front panel
- Connection of the “secured bar” via threaded bolts with cover in the front panel

Attention:

The threaded bolt nuts for the connection to the secured bar may only be tightened with a starting torque of a max. of 20 Nm.

5.2 Operating and display elements (Fig. 5.3)

- Four-digit LED indication of output voltage and current. Changeover by means of press button.
- Mains available
- Indication “Operating o.k.” (no disturbance)
- Charging voltage < 18 V
- Charging voltage > 33 V
- “Fast charge period on” with key switch
- Optical and acoustical signal when fast charge period has ended
- Circuit breaker at the charging output (DC)
- Circuit breaker reset switch (DC)
- Adjustment of the switch settings with potentiometers after removal of cover

5.3 Monitoring

A potential-free contact is available for monitoring the operation. The relay of this contact is attracted during undisturbed operation. The following disturbances are signalled:

- Mains failure or missing output voltage GL110
- Charging voltage < 18 V
- Charging voltage > 33 V

5.4 LG110S performance description (Fig. 5.5, 5.6)

The 3 x 440 V, 50/60 Hz supply voltage is fed via the AC filter, the rectifier and the mains screening to the power unit. Here the DC voltage is chopped and potentially isolated transmitted to the low voltage side by means of the transformer T4. This AC voltage is then rectified and flows via a low-pass (T5, C6) to the DC filter. From the DC filter the DC voltage passes via the circuit breaker F2 to th battery terminals. The voltage supply feeds the power unit, the display and the regulator and control board with the corresponding supply voltages. Additionally, the battery is fed with trickle charging current by the SNT of the regulator and control unit.

The charging current and the charging voltage are picked up in the DC filter and passed via shielded wires to the regulator display. The display p.c.b. indicates the output voltage or the output current as well as certain operating conditions and/or disturbances. If necessary, the battery which is fused by means of F3, can be switched onto the “secured bar” with the aid of the reset switch.

5.4.1 LG110S AC filter

(Functions and design the same as described for the GL110, para. 4.4.2).

5.4.2 LG 110 mains screening

(Function and design the same as described for the GL110, para. 4.4.3).

5.4.3 LG110S voltage supply

This unit generates the potentially isolated 15 V DC supplies and a 43 V DC supply for the trickle charger in the regulator and control unit. AC voltages are fed into J10 from which the stabilized 15 V DC voltages for the driver circuits of the switch setting are drived. These are led via J13 to the power unit. For generating the 15 V DC supply for the display, the regulator and control p.c.b. J11 will be supplied with two potentially isolated AC voltages. Via the flat ribbon cable KB1 these are led to the display and to the regulator and control unit. From the display the trickle charge passes through the DC filter and arrives at the battery terminals. The drive of the potential-free contact is effected by means of J14, pin 12. By means of the wire harness KB9 the potential-free contact is connected to the terminal strip on the front panel of the set.

5.4.4 LG110S power unit

The LG110S power unit is designed as a single-ended flow converter. The power transistors are driven at a clock frequency of 40 kHz. This energy is transmitted to the secondary side of the converter T4. The secondary voltage is rectified and supplies the electrolytic capacitor C6 via the output choke T5.
Via the DC Filter the output voltage arrives at the output terminals of the set. The sub-assemblies C-Bg.1 and C-Bg.2 are components of the interference screening system.

5.4.5 LG 110 regulator and control unit

On the regulator and control unit the output data (voltage, current) are led via J20 to the respective measuring amplifiers. The current and voltage regulator changes the pulse-width of the control signals for the power unit, potentially isolated, with the aid of the pulsewidth modulator and the topped driver stage. In addition, the time and control elements for manual fast charge are accomodated on this board. Afer loosening 4 fastening screws, the cover of the front panel can be removed. Then the output voltage of the set can be adjusted by means of R33. For setting the output voltage the safety switch F2 must be cut off. The key switch (pos. 26, fig. 3.2) shall not be in position 1 (manueal charging). Where necessary, the pluggable board can also be removed and possibly replaced.

5.4.6 LG110S display

On the display board there are four 7-segment components by means of which a 3-digit display is achieved, as well as 9 LEDs which indicate certain states of operation. With the select switch the user can select either the current or the voltage display. Change-over is effected by means of a relay which is also mounted on the board. The LEDs E/V or I/A resp. will light up accordingly. The analogous current and voltage data available at multiplug J16 are brought to a certain voltage level by means of resistors and passed to an A/D converter. The A/D converter drives the 7-segment components via the topped integrated driver. If the set is connected to the mains supply, this will be indicated by the yellow LED “Mains existing”. Orderly operation is indicated by the green LED “Operating o.k.”.

When the output voltage reaches values 33 V or 18 V, the LED “E > 33 V” or the LED “E < 18 V” lights up. The LEDs “Mains operation” and “Battery operation” indicate whether the reset switch is switched on or off. The “Manual charge ended” LED indicates the end of the manual fast charge. This state of operation is also acoustically signalled by a hooter.

5.4.7 LG110S DC filter

A combination of inductive resistors and capacitors shall shield the output terminals from interferences signalling from the set. The DC filter contains a precision resistor which measures the output current. The measuring point is connected to the display and to the regulator and control board by means of the wire harnesses KB5 and KB10. The measuring values for voltage measurement and regulation are also passed through these wire harnesses.

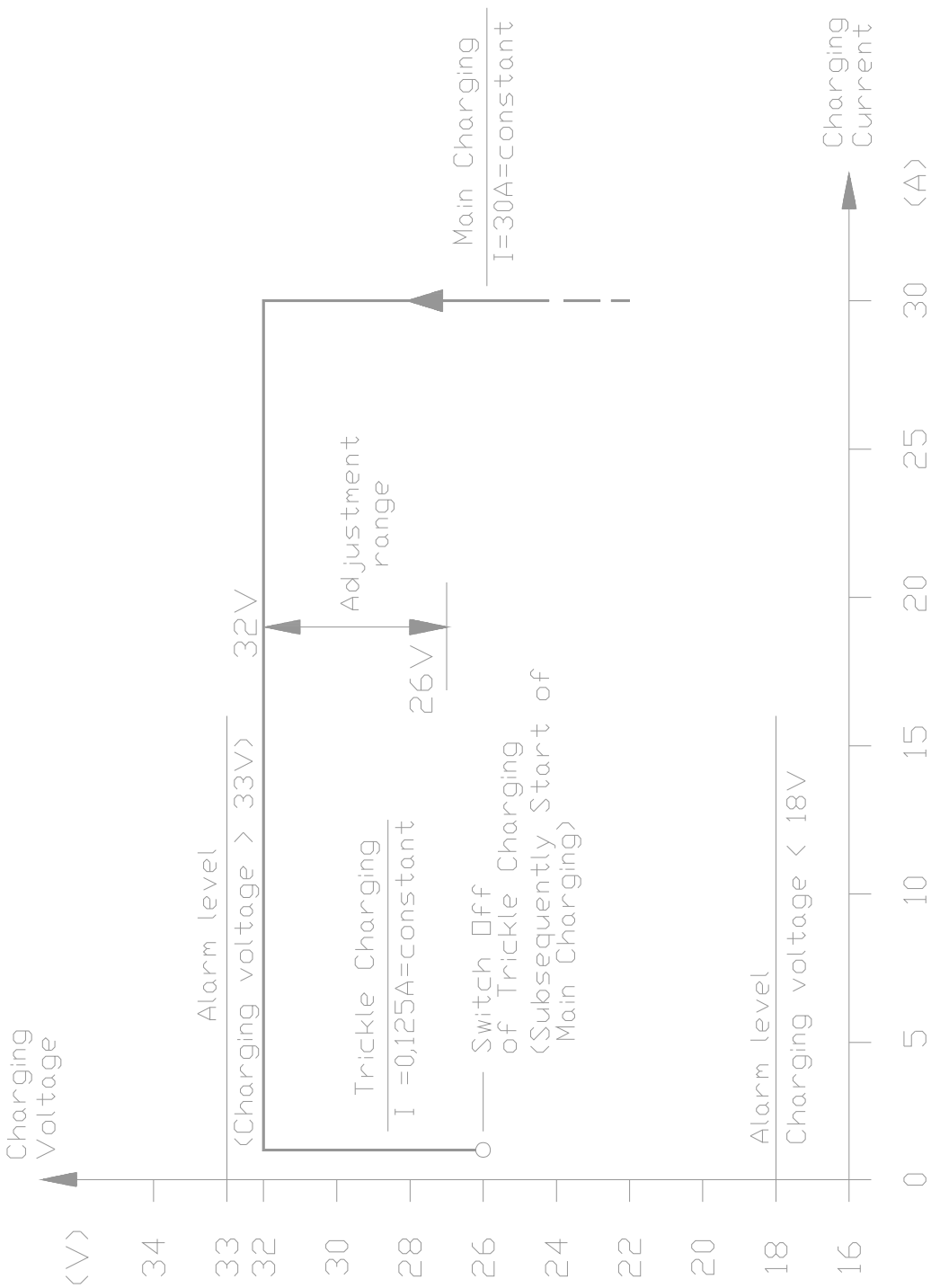

Fig. 5.1 Battery Charger LG110S

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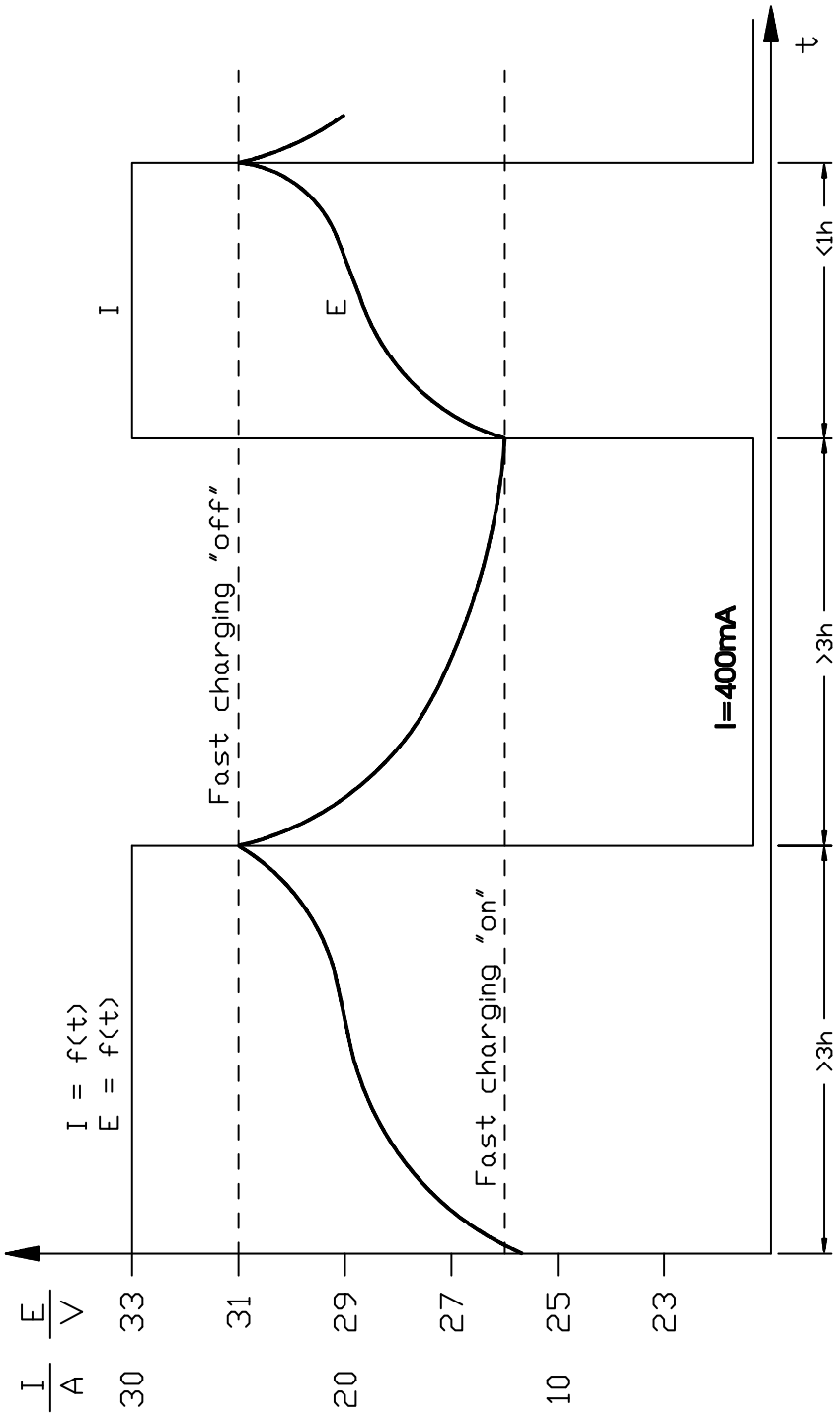

Fig. 5.2 Charging diagram LG110S

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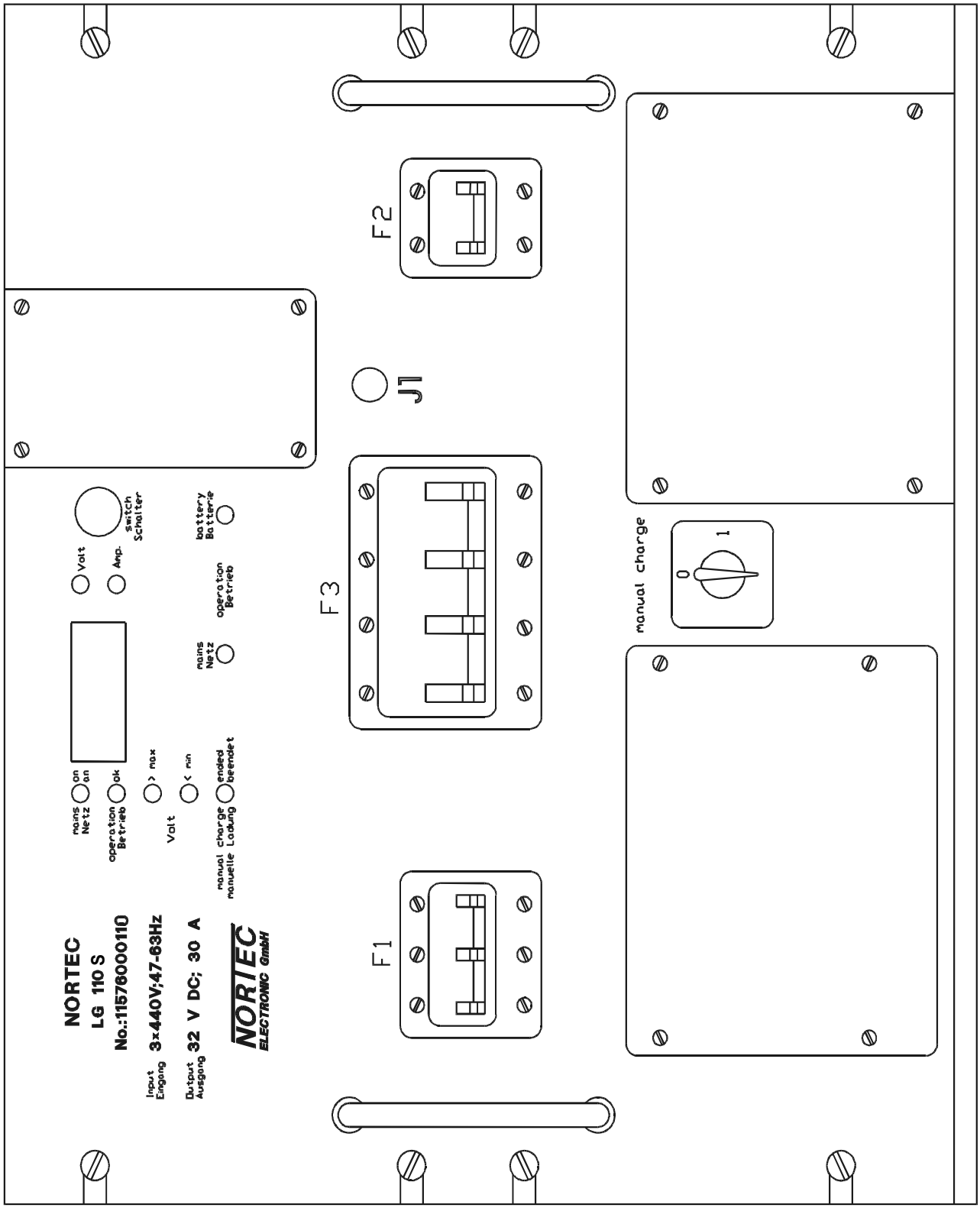

Fig. 5.3 Front panel LG110S

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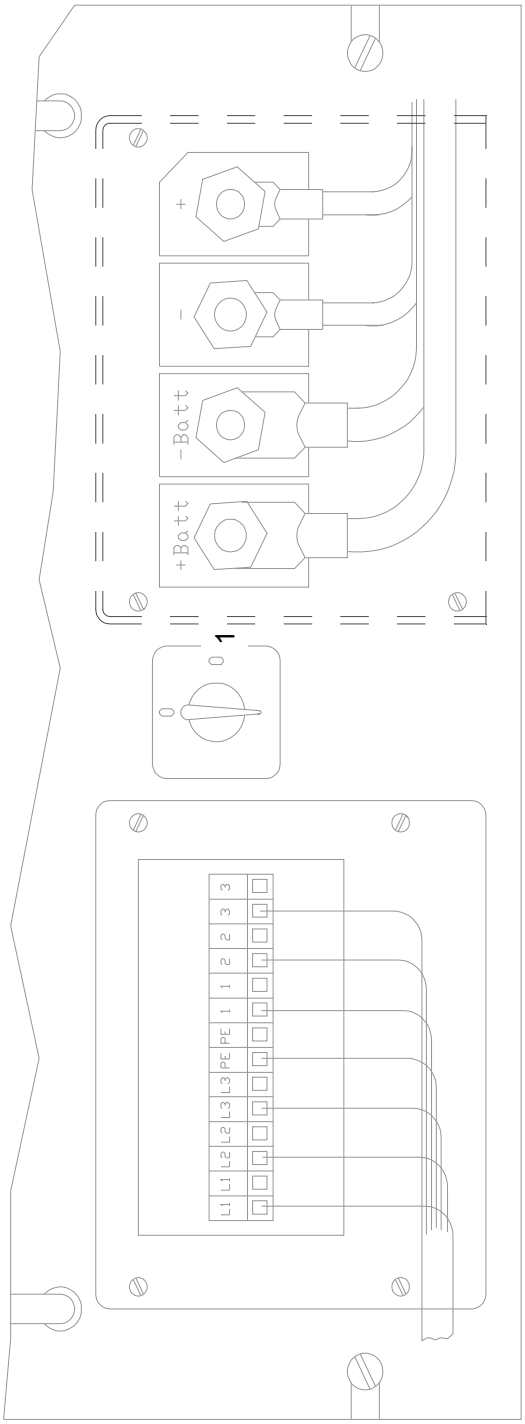

Fig. 5.4 LG 110S AC und DC-Anschluß AC- and DC-connection

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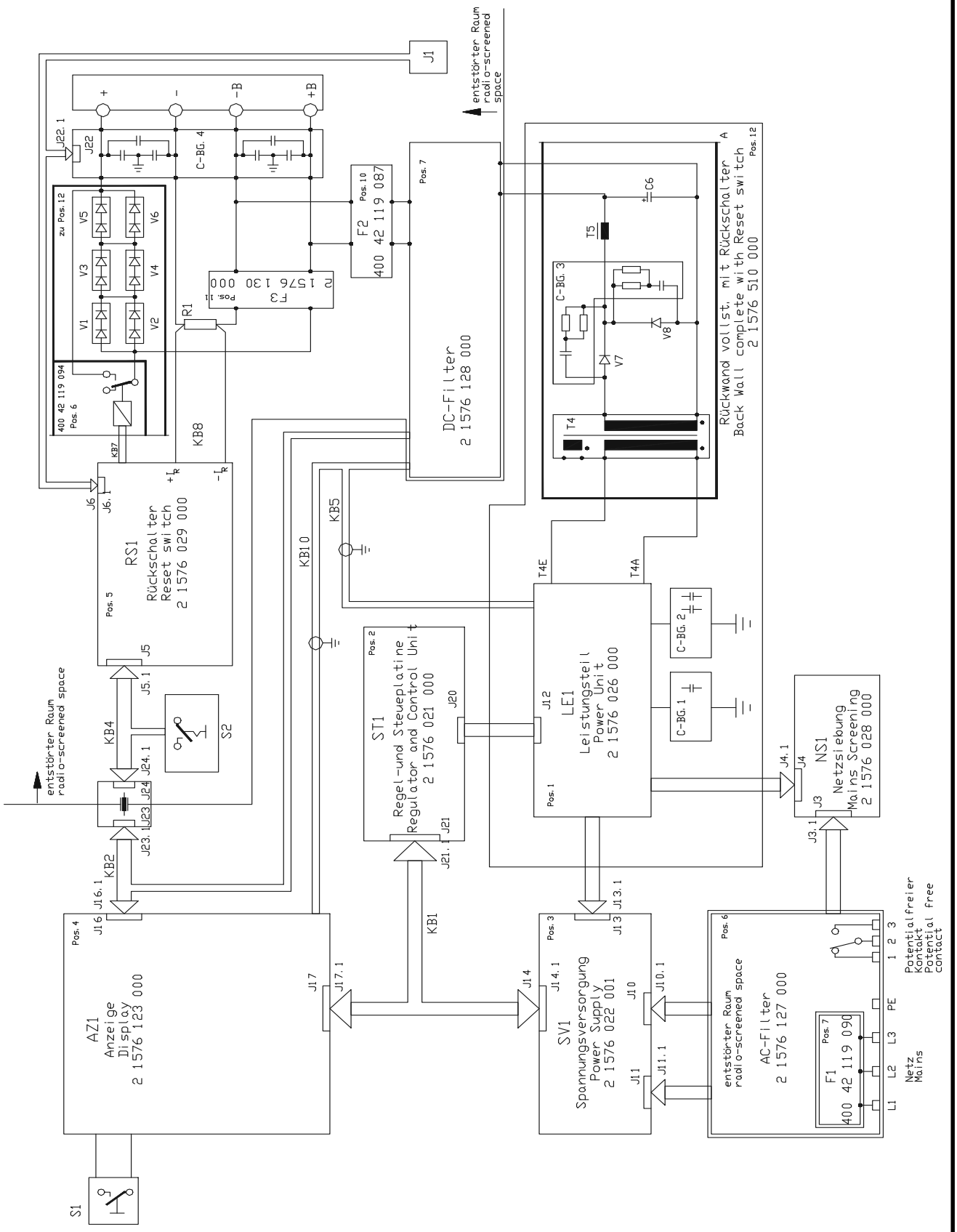

Fig. 5.5 Complete circuit diagram LG110S

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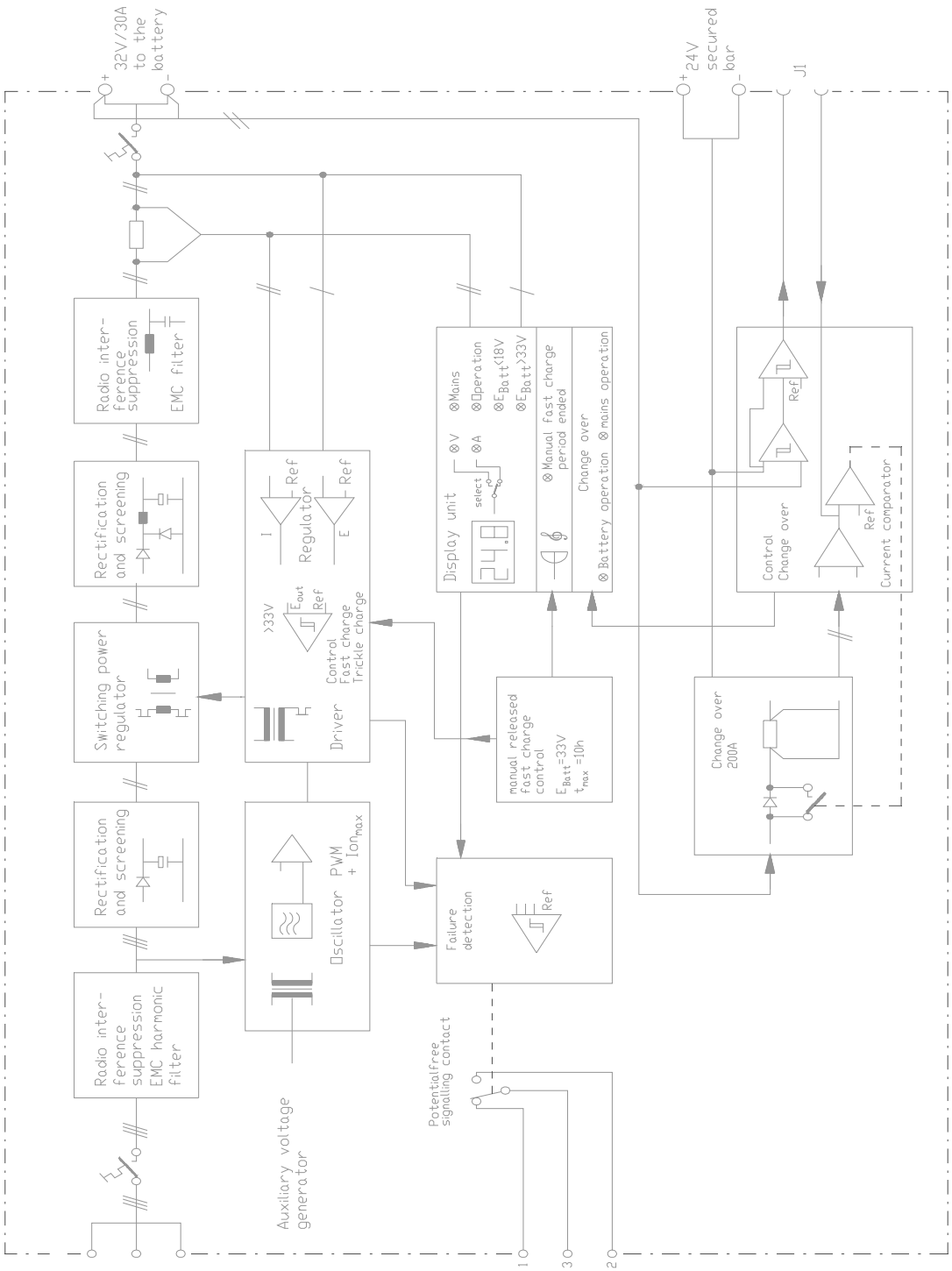

Fig. 5.6 LG110S charger with changeover unit

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6. LG110S reset switch

The reset switch is accomodated in the LG110S. The functional principle is shown in the Fig. 6.1 and 6.2. The battery is connected via rectifier diodes to the “secured bar” so that the uninterruptible take-ofer of load is ensured (Fig. 6.3). Afer taking over the load, and dependent on the current, the reset switch closes the relay K1 thereby bridging the diode path. The criteria for switching on and off are shown in Fig. 6.1. Functional characteristics of the reset switch p.c.b.:

This component measures the reset switch current IR, the voltage of the “bar” Ebar and the battery voltage Ebatt.

Measuring points:

- I_R is measured at the resistor R1 and fed via KB8 to the measuring amplifiers (+ I_R, - I_R).
- E_{bar} and E_{batt} are measured directly on the output terminals of the LG110S charger.

The following data are transmitted by means of a connecting cable from the GL110 rectifier (J1) to the LG110S charger (J1):

- the rectifier current Irect
- transfer of signals from the LG110S to the GL110 in order to raise the output voltage.

In the “reset switch p.c.b.” assembly a summation current is built up (Ibar = IR + Irect) by means of which K1 is controlled acc. to the following criteria:

- Current load of the bar Ibar > 80 A and current in the reset switch IR ³ 50 A effects an instantaneous cutting of the relay K1.

- Current load of the bar Ibar > 80 A and reset switch current IR within the range 10 A < IR < 50 A effect cutting in of the relay after 2 minutes.

During a mains failure the reset switch K1 immediately bridges the diode length.

In case of a mains failure or a missing connection of the pilot line J1 the potential-free contact in the LG110S will be activated, and the LED “Operating o.k.” will go out. As sonn as the relay K1 is attracted, the display will be switched over to “battery operation”. The relay K1 remains switched on for at least 10 seconds. Opening the relay K1 is principally only possible with mains voltage applying to the rectfier GL110 and a summation current of Ibar < 80 A.

The dealy and the graded cutting-in of the relay K1 prevents an unnecessary switching to and for during momentary load fluctuations. At a “bar” voltage of low setting and a high charging voltage, a current flow between battery and bar can be produced during the charge from which an uncontrolled charge would result. To prevent this, the output voltage of the rectifier = bar voltage will be increased by approx. 1.8 V at a battery voltage which exceeds the “bar” voltage by 4.2 V. After decrease of the charging voltage the increased voltage at the rectifier output will also be reduced. Provision has been made for the bar voltage to be kept within STANAG tolerances (Fig. 6.4).

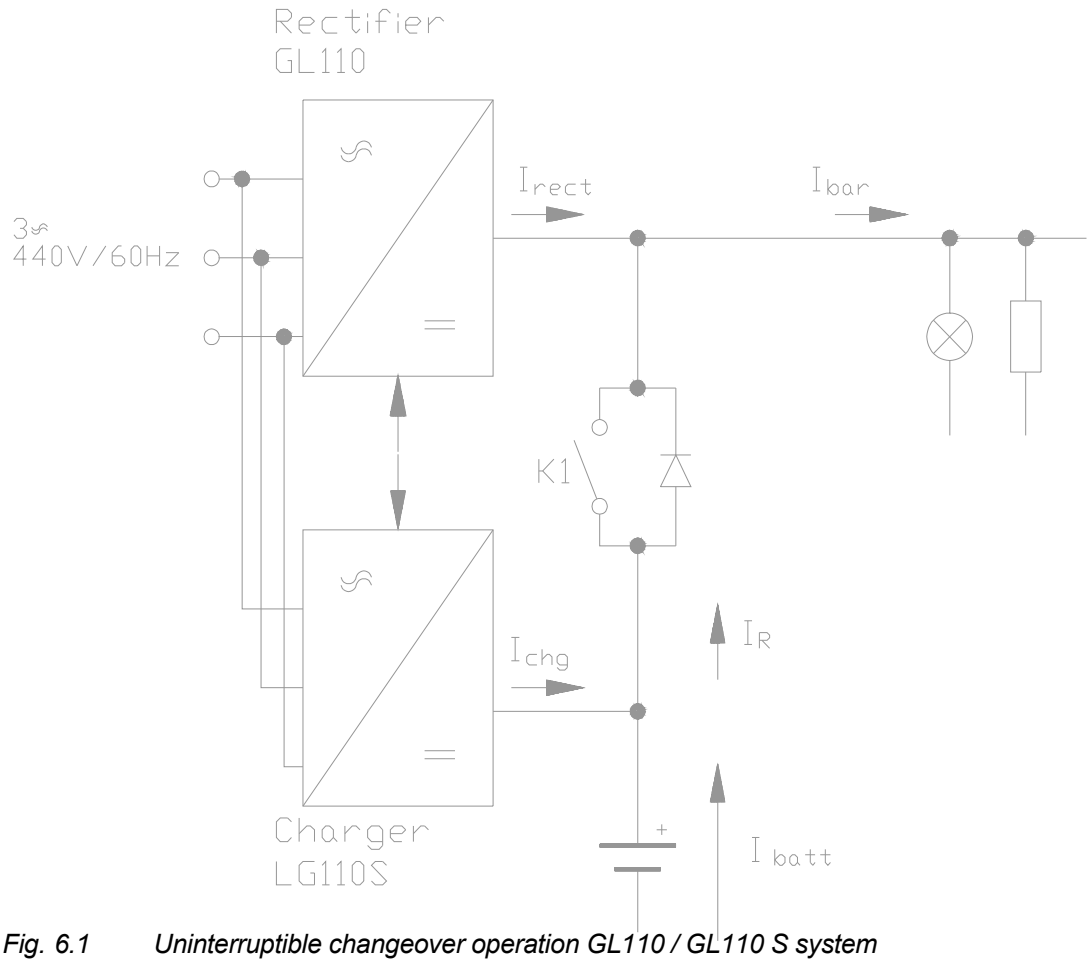

Fig. 6.1 Uninterruptible changeover operation GL110 / GL110 S system

Criteria for switching on relay K 1

Mains operation
$I_R = I_{Chg} + I_{batt}$

Emergency operation
$I_R = I_{batt}$

Reset switch current IR		
< 10 A	10...50A	> 50 A
remains OFF	2 min. ON	ON immediately

Criteria for switching off relay K 1

$I_{bar} = I_{rect} + I_R < 80$ A
To $t_{del} = 10$ s
The relay K 1 switches Off only in case of mains operation

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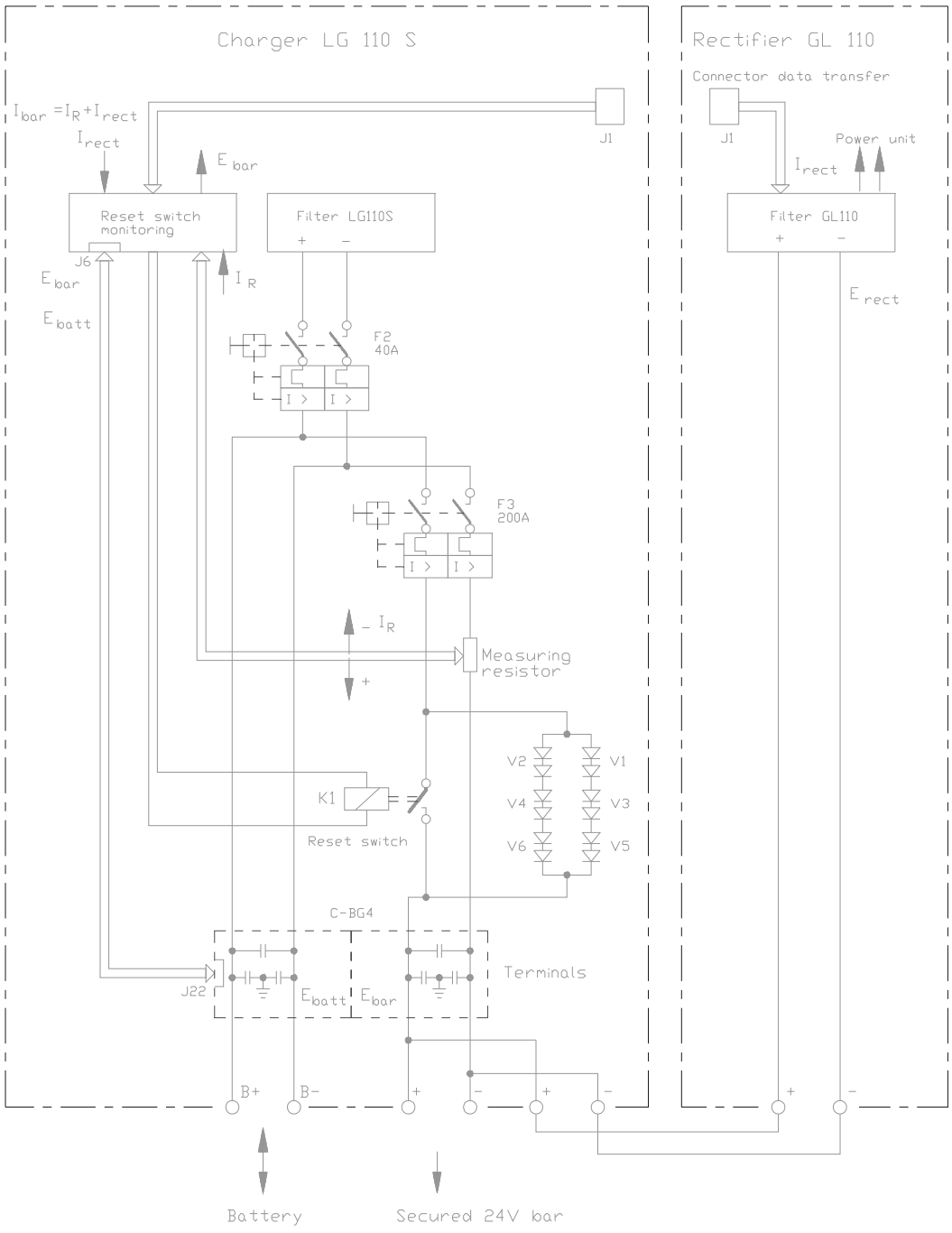

Fig. 6.2 Function principle of reset switch

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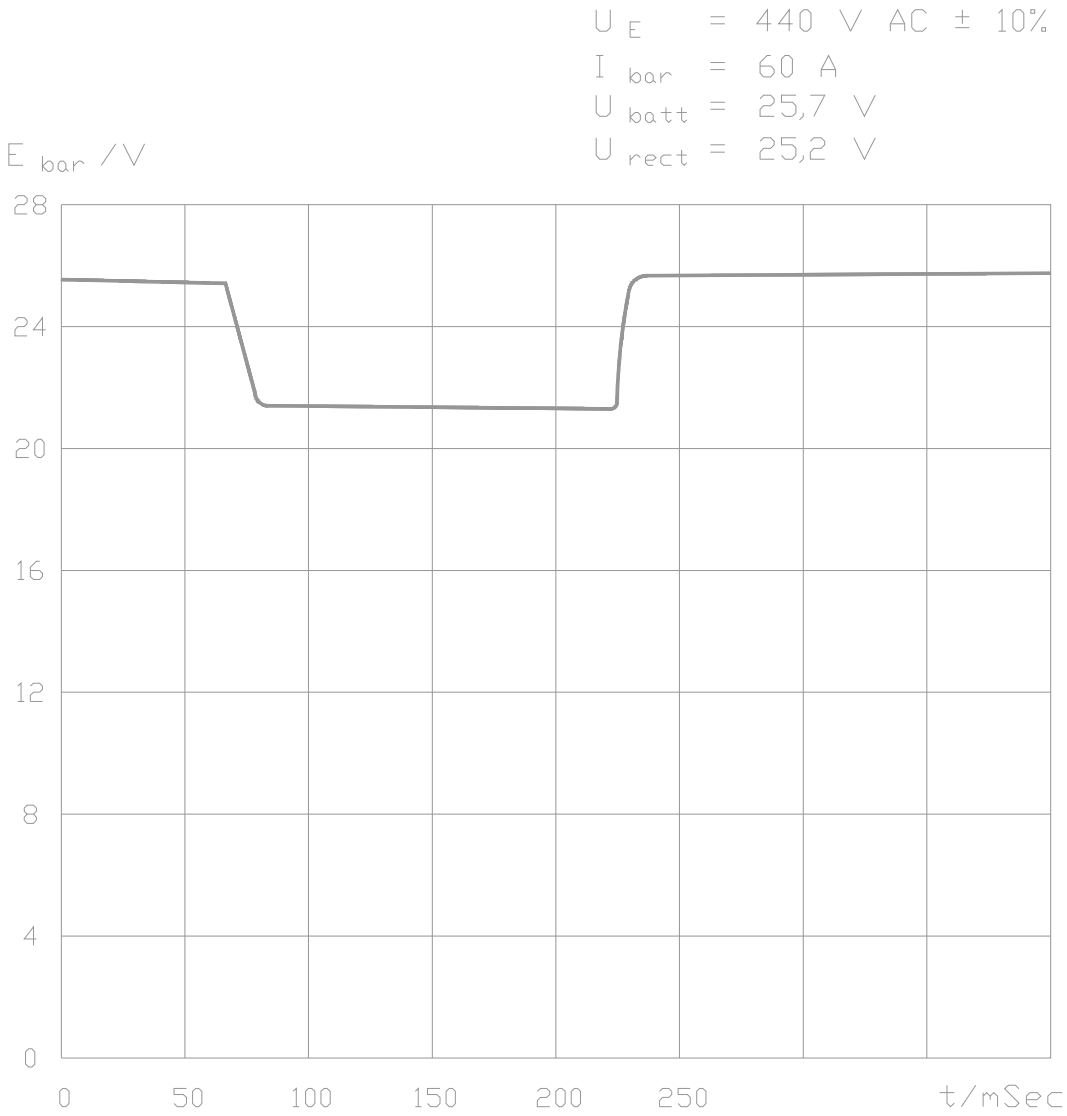

Fig. 6.3 Changeover from mains to battery operation GL110 / LG110S

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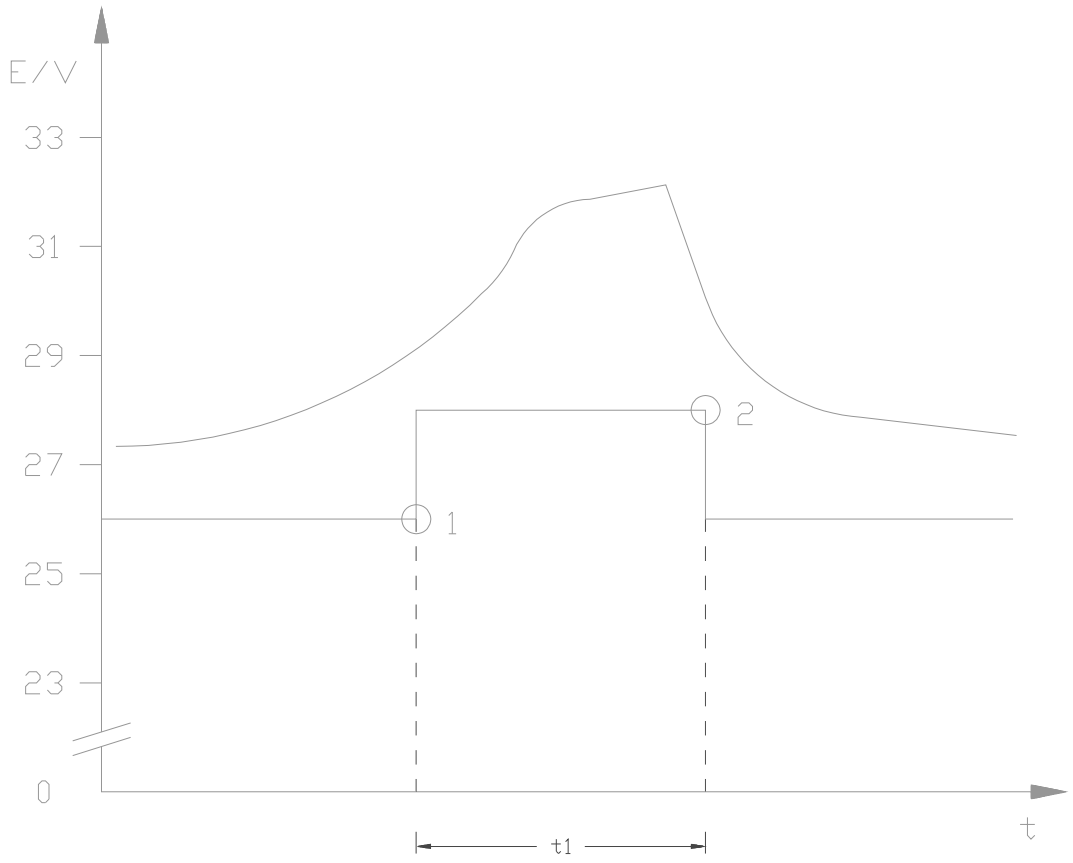

Fig. 6.4 Stepping-up of voltage GL110

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7. Technical data

7.1 GL110 rectifier

Heigth	: 9 units of height (U)
Depth	: 270 mm as of front panel
Width	: 19 “
Weight (kg)	: approx. 37,5 kg
Protection category	: IP 20 to DIN 40050
Insulation class	: I
Input voltage	: 3 x 440 V ~ ± 10 %, 47...63Hz without neutral conductor
Rated current	: approx. 4.8 A/phase at 3 x 440 V
Active power absorbed	: 2900 W
Power factor	: cos.φ > 0.8
Output voltage	: 26...29 V/± 5 %
Output current	: 80 A max.
Rated power output	: 2320 W
Electrical efficiency	: ≥ 0.8
Output characteristic	: I/E (constant voltage with current limitation)
Circuit breaker at the mains input	: 5 A
Circuit breakter at the mains output	: 95 A

Fault indication by means of a potential-free signalling contact to the respective terminals

Contact load	: 5 A / 250 V
EMC protection	: to VG 94.373, limiting value class 3
Ambient temperature	: 0...45°C

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7.2 LG110S charger

Height	: 9 units of height (U)
Depth	: 270 mm as of front panel
Width	: 19 “
Weight (kg)	: approx. 38,5 kg
Protection category	: IP 20 to DIN 40050
Insulation class	: I
Input voltage	: 3 x 440 V~ ± 10 %, 47...63 Hz without neutral conductor
Rated current	: approx. 2.0 A/phase at 3 x 440 V
Power factor	: cos.φ > 0.8
Active power absorbed	: 1200 W
Charging voltage	: max. 32 V, setting from 27..32 V
Output current	: 30 A max.
Rated power output	: 960 W
Electrical efficiendy	: ≥ 0.8
Output characteristic of NiCd batteries	: Ia I - charging characteristic
Output characteristic of Pb batteries	: I_oE I_a - charging characteristic
Circuit breaker at the mains input	: 2.5 A
Circuit breaker at the output battery	: 40 A
Circuit breaker at the output “bar”	: 200 A

Failure indication via potential-free signalling contact to the outside

Contact load	: 5 A / 250 V
EMC protection	: to VG 95373, limiting value class 3
Saltwater-proof	
Ambient temperature	: 0...45°C

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7.3 Reset switch

The reset switch assemblies are accomodated in the LG110S charging section.

Max. current loadbattery - bar	200 A
Circuit breaker	200 A

Uninterruptible coupling of battery - bar via rectifier diodes.

Bridging of the rectifier diodes depending on current load

Changeover time:	200 ms at I > 50 A and in case of a mains failure
Changeover time: No changeover	2 min. at I = 10...50 A at I < 10 A

Opening of the relay contacts only with mains voltage applying to the GL110 rectifier and after a delay of 10 seconds.

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8. Taking into operation, operating and display elements

8.1 Taking into operation

- Insert the LG110S and the GL110 in the mounting rack (LG110S at the bottom, GL110 on top).
- Switch off all switches (GL110 : F1, F2 / LG110S : F1, F2, F3) (Fig. 8.1, 8.2).
- Plug on the 4-pole connecting lead from GL110 - J1 to LG110S, J1 and screw it down.
- Connect output connector of GL110 (+/-) to output connector of LG110S (+/-). (Min. 16 mm², max. 25 mm²) (Fig. 8.4).
- connect the output connectors (+/-) of the LG110S (Fig. 8.4) to the “secured bar”. Mind the polarity!

First connect the cable to the LG110S and then to to battery.

- Connect the mains supply (L1, L2, L3, PE, 440 V mains supply). Where necessary, also the potential-free contact can be connected.

1-2 breaker, 2-3 closer.

- Switch on F2 on the LG110. LG110S indicates the battery voltage.

- Set key switch to “0”.

- Switch on F1 on the LG110S and on the GL110; by means of the select switch the indication can be switched over so that either the output voltage or the output current will be indicated.

- By means of F2 on the GL110 the voltage can now be switched over to the “secured bar”. Then the reset switch can be activated by means of F3 on the LG110S.

8.2 Operating and display elements (Fig. 3.29

8.2.1 GL110 rectifier

- Mains existing
  The yellow LED lights up when the circuit breaker F1 is closed.

- Operating o.k.
  The green LED lights up when the two red LEDs (E_{out} >32 V and E_{out} < 18V do not light up and when the connecting cable between the LG110S and the GL110 (J1) is properly connetec. The potential-free contact is coupled with the LED display.

- Select switch
  By means of this switch the indication can be switched over so that either the output voltage or the output current will be indicated.
  Accordingly, either the LED E_{out}/V or I_{out}/A lights up

8.2.2 LG110S charger

- Mains existing
  The yellow LED lights up when the circuit breaker F1 is closed

- Operating o.k.
  The green LED lights upwhen the two red LED´s (E_{out} > 33 V and E_{out} < 18 V) do not light up and when the connecting cable between the LG 110 and the GL110 (J1) is properly connected.
  The potential free contact is coupled with the LED display.

- Select switch
  By means of this switch the indication can be switched over so that either the output voltage or the output current will be indicated.

- Mains operation / Battery operation
  The LEDs display the switching state of the reset switch.

  Mains operation:
  The “bar” is being supplied by the GL110 rectifier set, the relay K1 is open.

  Battery operation:
  The “bar” is being supplied by the battery, the relay K1 is closed.

9. Malfunction analysis

9.1 GL110 malfunction analysis

Fault	Possible cause	Measuring point	Remedy
I. E_{out} too high	1. Setting of wrong rated values	- MP Usoll= 2.6 - 2.9 V	- Reduce rated value by means of R 33 on the control p. c. b.
	2. Defective control p. c. b. Defective sense line	-	- Replace control p. c. b. Replace sense line
II. E_{out} too low (I_{out} < 80 A)	1. Wrong rated value setting	- MP Usoll=2.6 - 2,9 V	- Increase rated value on control p. c. b. by means of R 33
	2. Defective control p. c. b.	- Signals at T3/T4 **ATTENTION:High Voltage**	- Replace control - Replace control
III. No output voltage	1. F 1 or F 2 switched off	- J4 —> 620 V available (Fig. 9.1)	- Switch on circuit breaker
	2. F 4 of F 5 defective	- J 10 —> 4 x 20 V ~ E1 - E4 J 11 20 V ~/35 V ~ E5 ; E6 (Fig. 9.2)	- Replace fuses F4, F5 (5 x 30, 63 mA)
	3. Defective voltage supply p. c. b.	- J 13 —> 4 x 15 V - (Fig. 9.3) J 14 —> 15 V -	- Replace p.c.b.
	4. Control p. c. b. missing	- J 20 —> Measure output pulses (Fig. 9.4)	- Replace p. c. b.
	5. Power p. c. b. or Power transistors defective	- Measure signals at T3/ T4	- Replace p. c. b. and Power transistors
IV. Faulty display	1. Display defective	- displayed values should not deviate from values measured on the outside by more than 7 %.	- Replace p. c. b.

Employed measuring instruments:

- Oscilloscope for 40 kHz
- Multimeter with internal resistance of apx. 1 M Ohm

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9.2 LG110S malfunction analyses (NC)

Fault	Possible cause	Measuring point	Remedy
I. Eout too high	1. Setting of wrong rated value	- MP1 = 3,2 V	- Reduce rated value by means of R 33 on the control p. c. b.
	2. Defective control p. c. b	-	- Replace control p. c. b.
	3. Defective sense line	-	- Replace sense line
II. Eout to low (Iout < 30 A)	1. Wrong rated value setting	- MP6 = 0,3 V	- Increase rated value on control p. c. b. by means of R 33
	2. Defective control p. c. b.	-	- Replace control p. c. b
III. Not output voltage	1. F 1 or F 2 switched off	- J 4 —> 620 V available (Fig. 9.5)	- Switch on circuit breaker
	2. F 4 or F 5	- J 10 —> 2 x 20 V ~ (E1 : E4) J 11 20V ~/ 35 V ~ (E5 : E6) (Fig. 9.7)	- Replace fuses F4 (5 x 30, 63 mA) or F5 (5 x 30, 160 mA)
	4. Control p. c. b. missing	- J 20 —> Measure output pulses (Fig. 9.8)	- Replace p. c. b.
	5. Power p. c. b. or Power transistor defective	- Measure signals at T4	- Replace p. c. b. and Power transistors
IV. No trickle charge	1. Defective fuse on display p. c. b.	- (Fig. 9.9)	- Replace fuse (5 x 20, 0,2 AT) - replace regulator p.c.b.
V. Faulty display	1. Display defective	- displayed values should not deviate from values measured on the outside by more than 7 %.	- Replace p. c. b.
VI. Reset switch fails to switch	1. F 3 switched off	-	- Switch on circuit breaker
	2. F 6 on reset switch board defective	- Earth —> Pin 5 J 6 —> + Ebar (Fig. 9.10)	- Replace fuse - (5 x 15, 2 AT)
	3. Reset switch relay K 1 defective	- Measure voltage on Earth —> Pin 5 J 6 —>< + Ebar (Fig. 9.10)	- Replace reset switch
	4. Reset switch defective		

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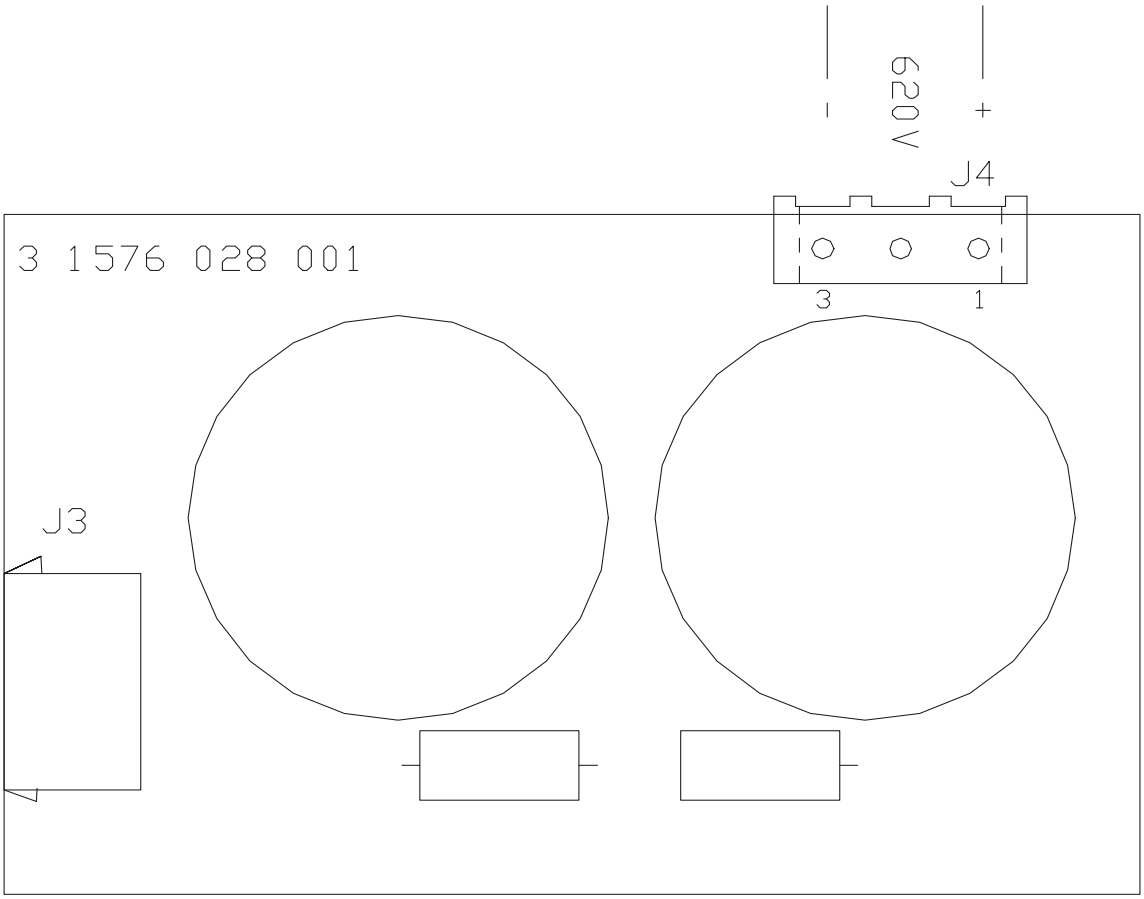

Fig. 9.1 Mains screening GL110

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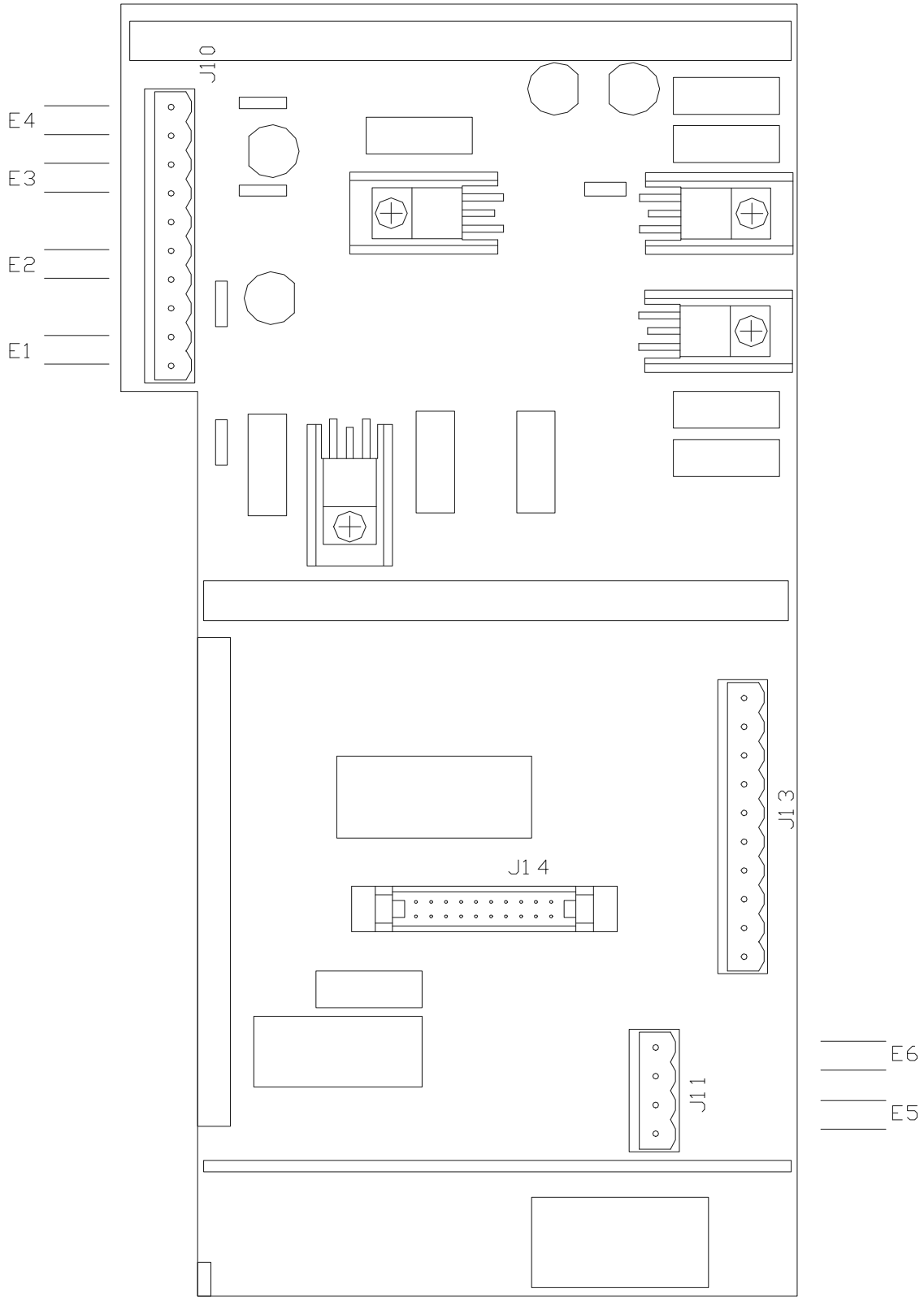

Fig. 9.2 AC Measuring GL110

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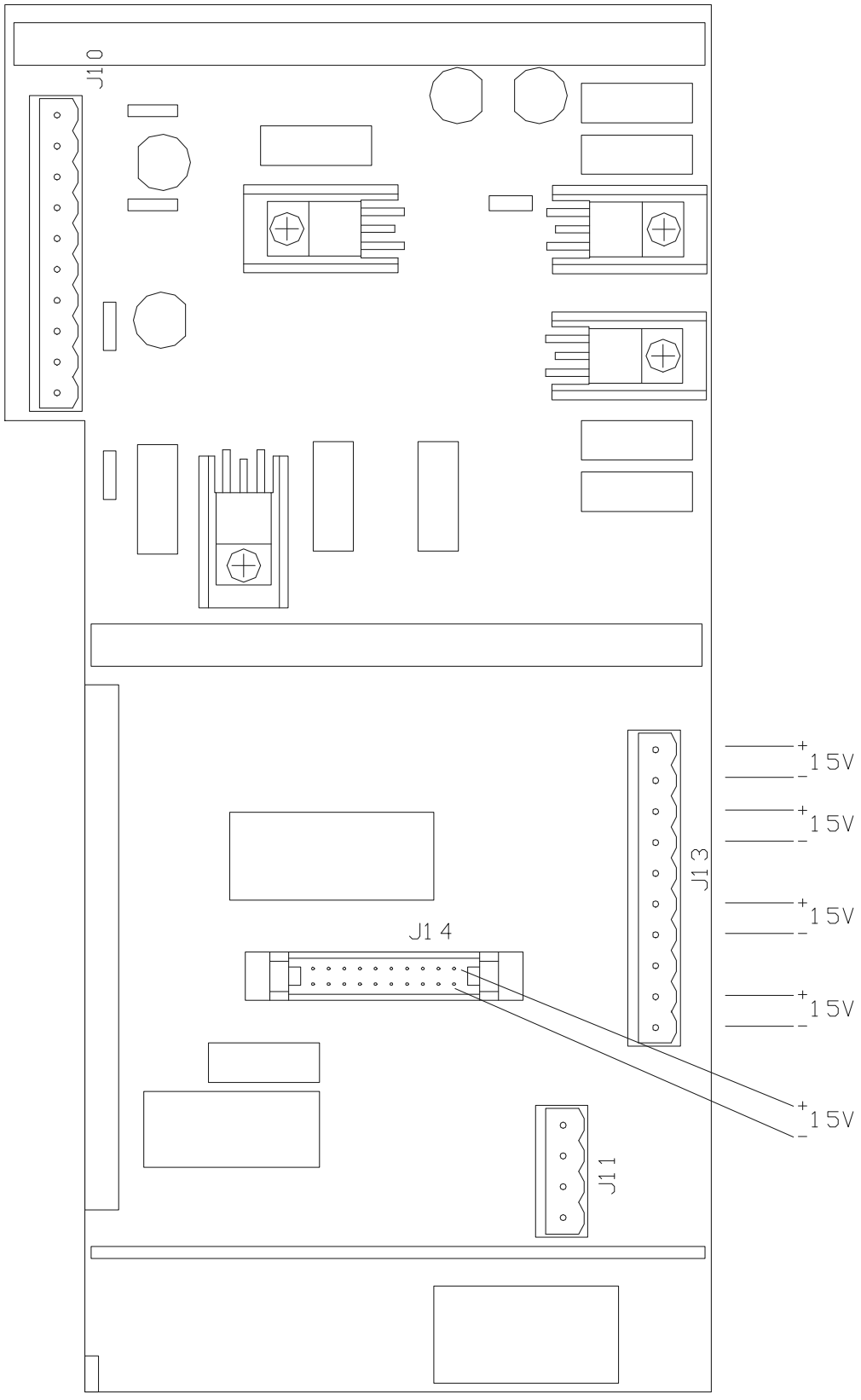

Fig. 9.3 DC Measuring GL110

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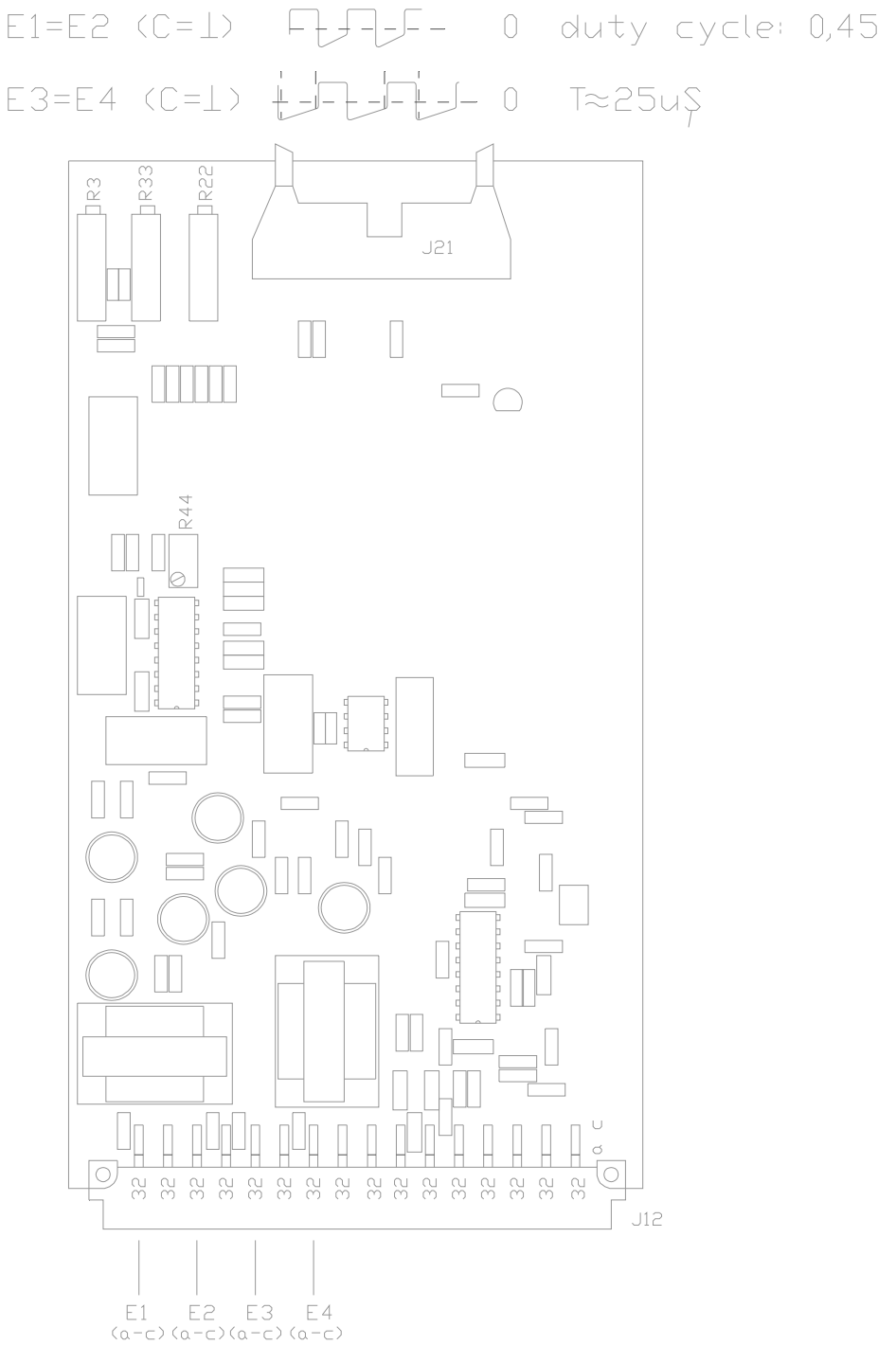

Fig. 9.4 Pulse Measuring GL110

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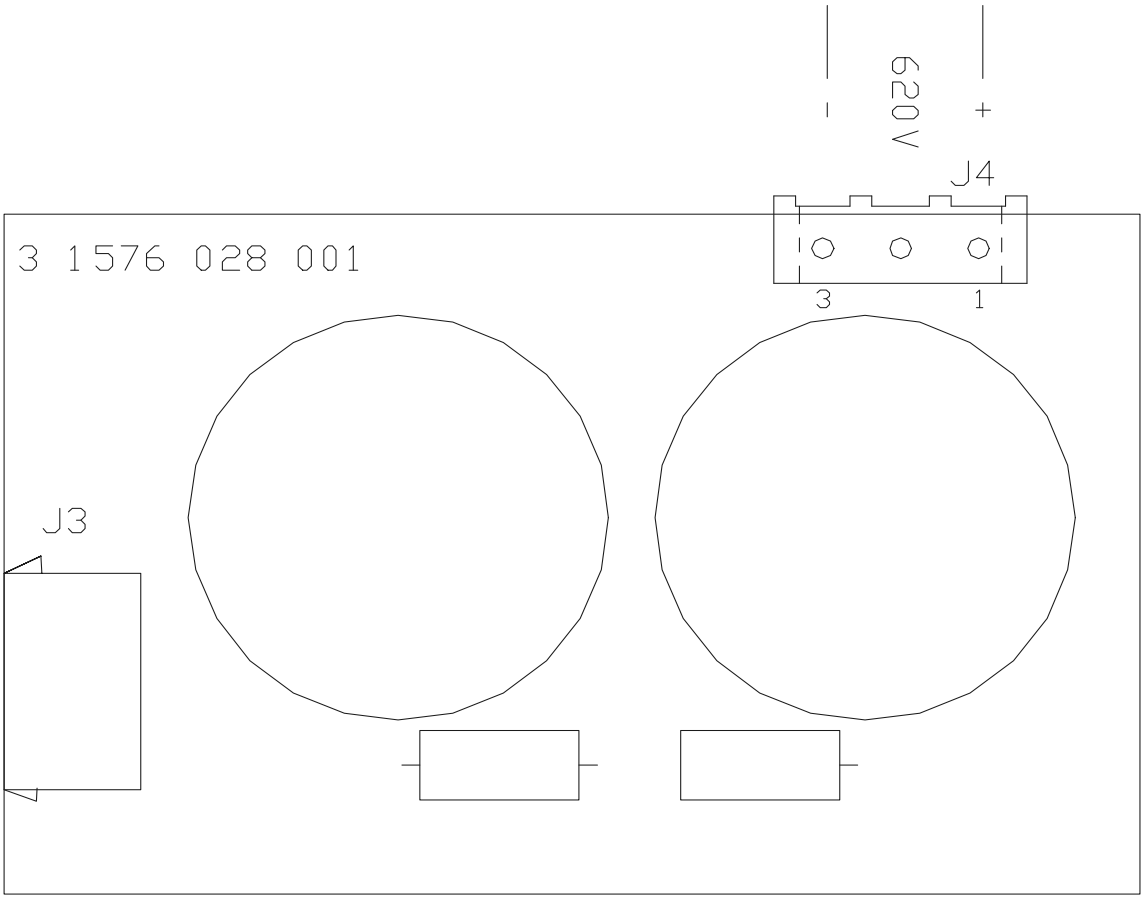

Fig. 9.5 Mains screening LG110S

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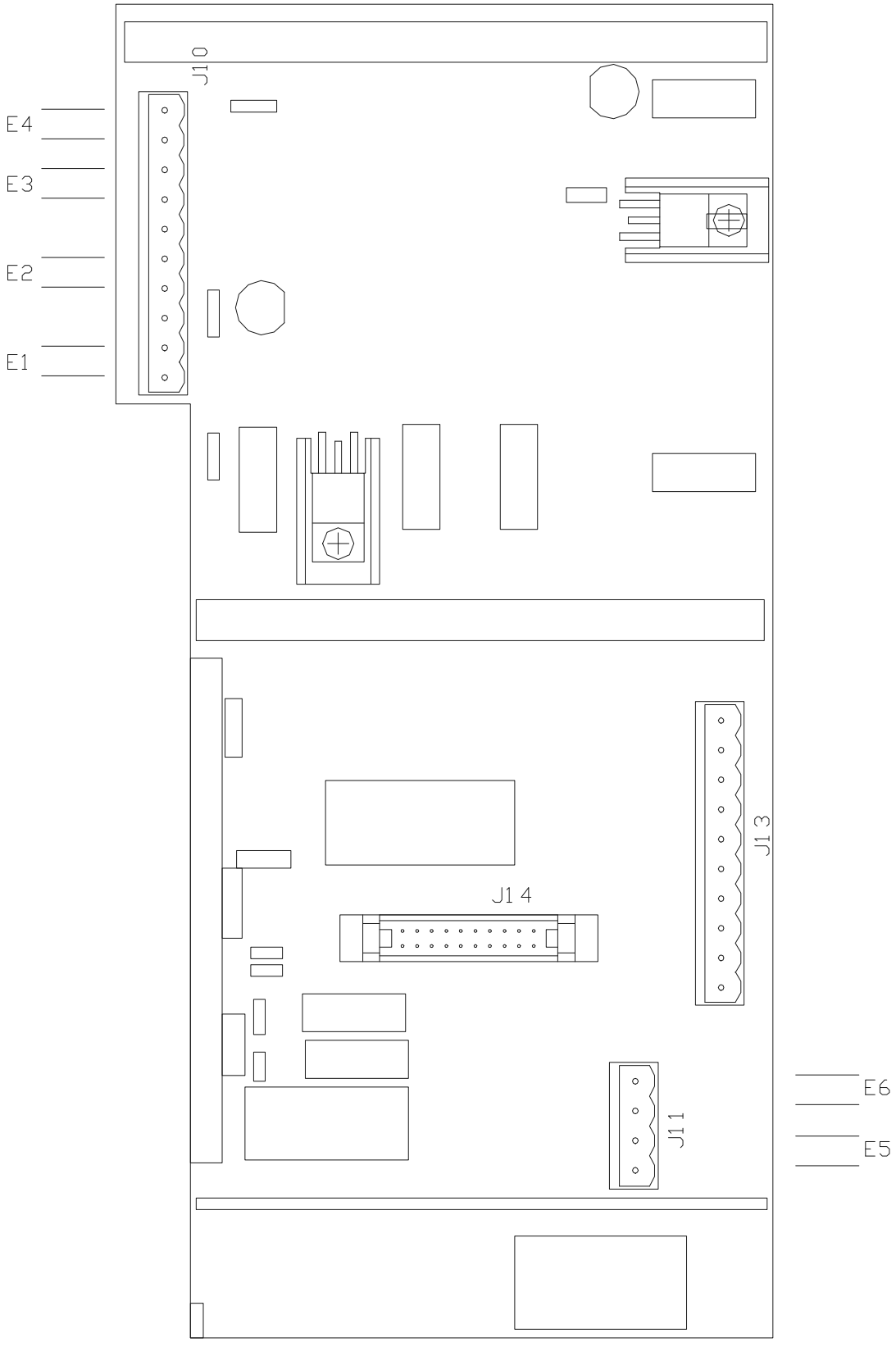

Fig. 9.6 AC Measuring LG110S

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Tel.: +49 / 4102 / 42002 - Fax.: +49 / 4102 / 42840
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Web: www.nortec-electronics.de

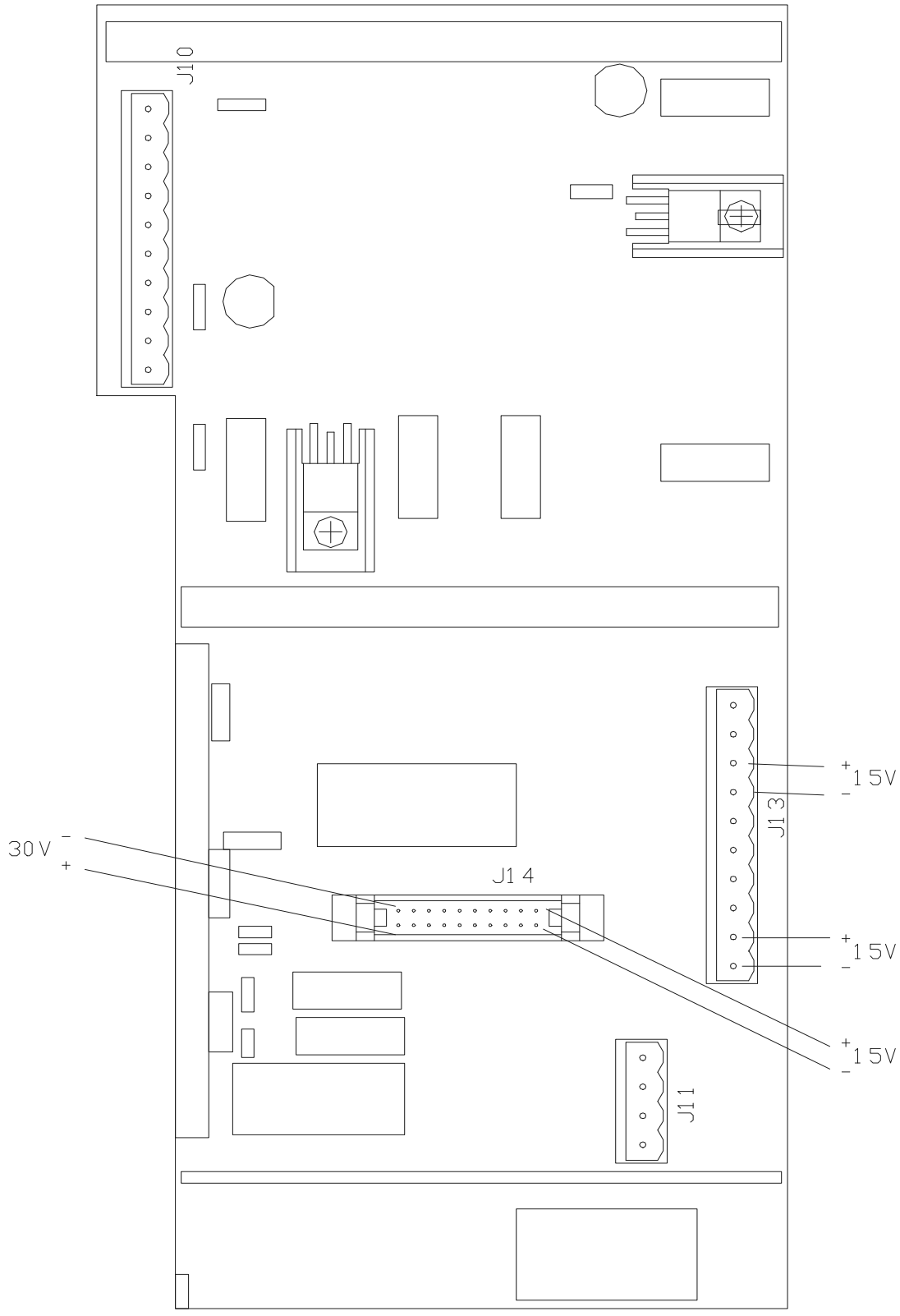

Fig. 9.7 DC Measuring LG110S

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Tel.: +49 / 4102 / 42002 - Fax.: +49 / 4102 / 42840
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Web: www.nortec-electronics.de

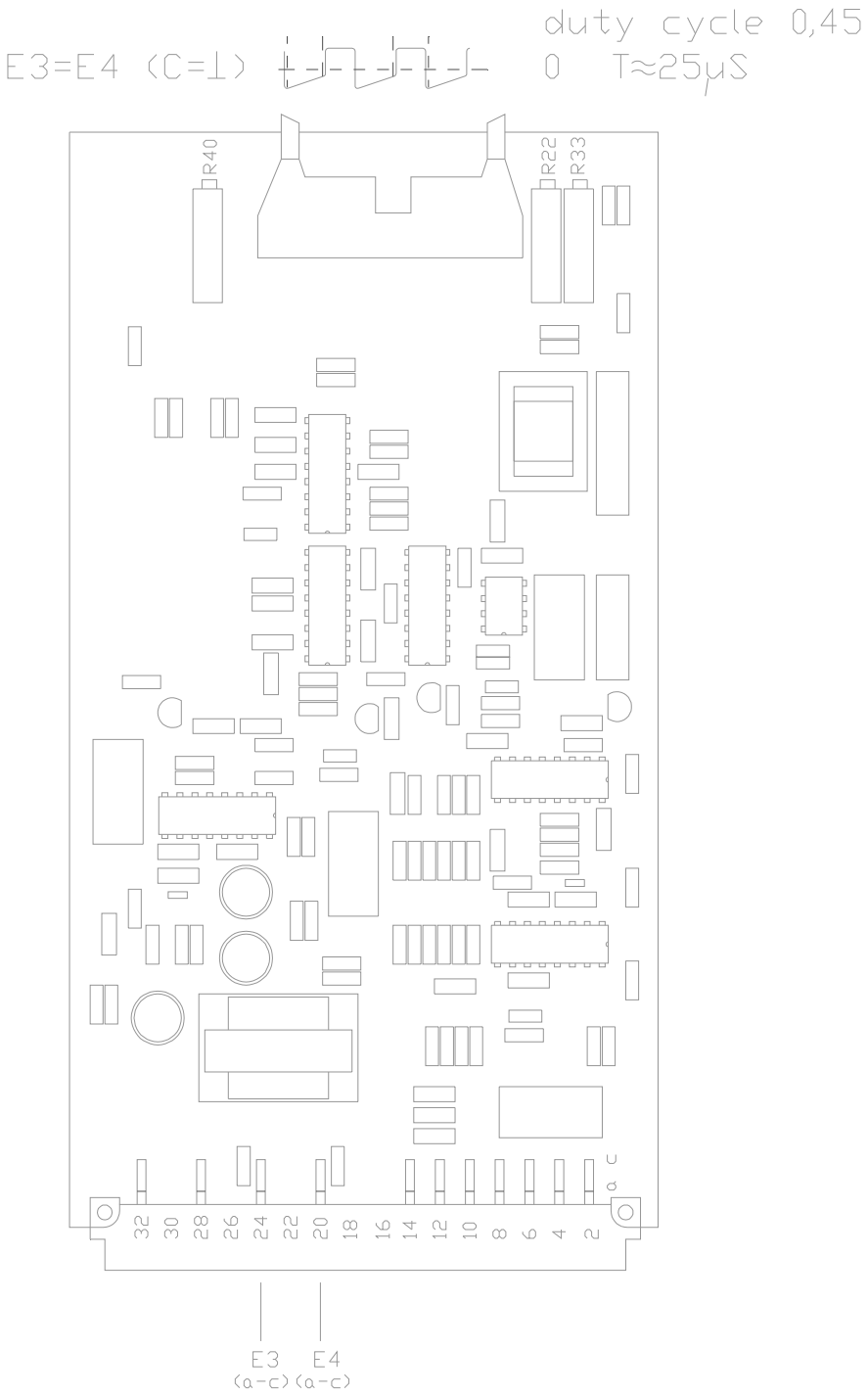

Fig. 9.8 Pulse Measuring LG110S

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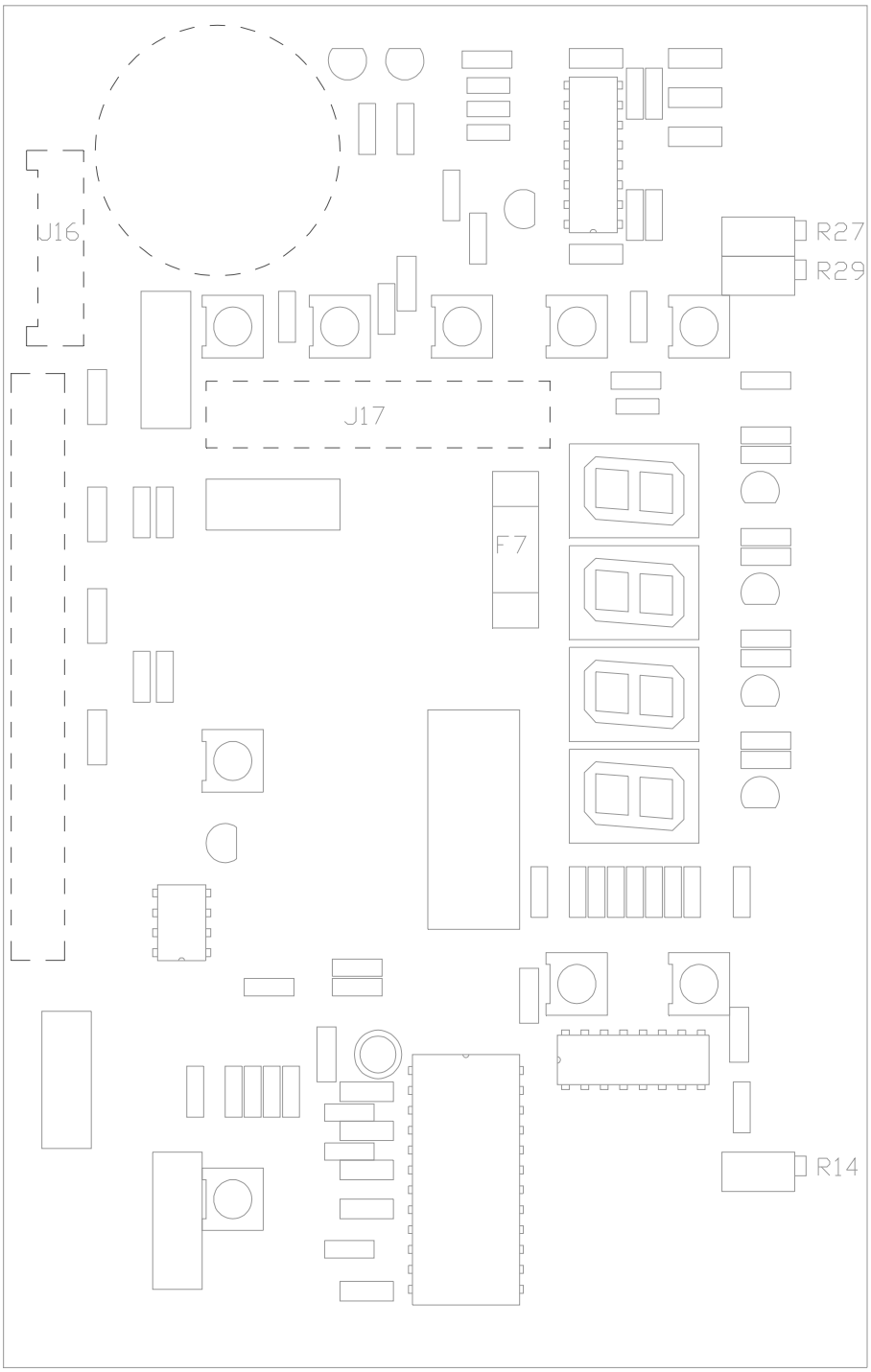

Fig. 9.9 Display p.c.b.

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Tel.: +49 / 4102 / 42002 - Fax.: +49 / 4102 / 42840
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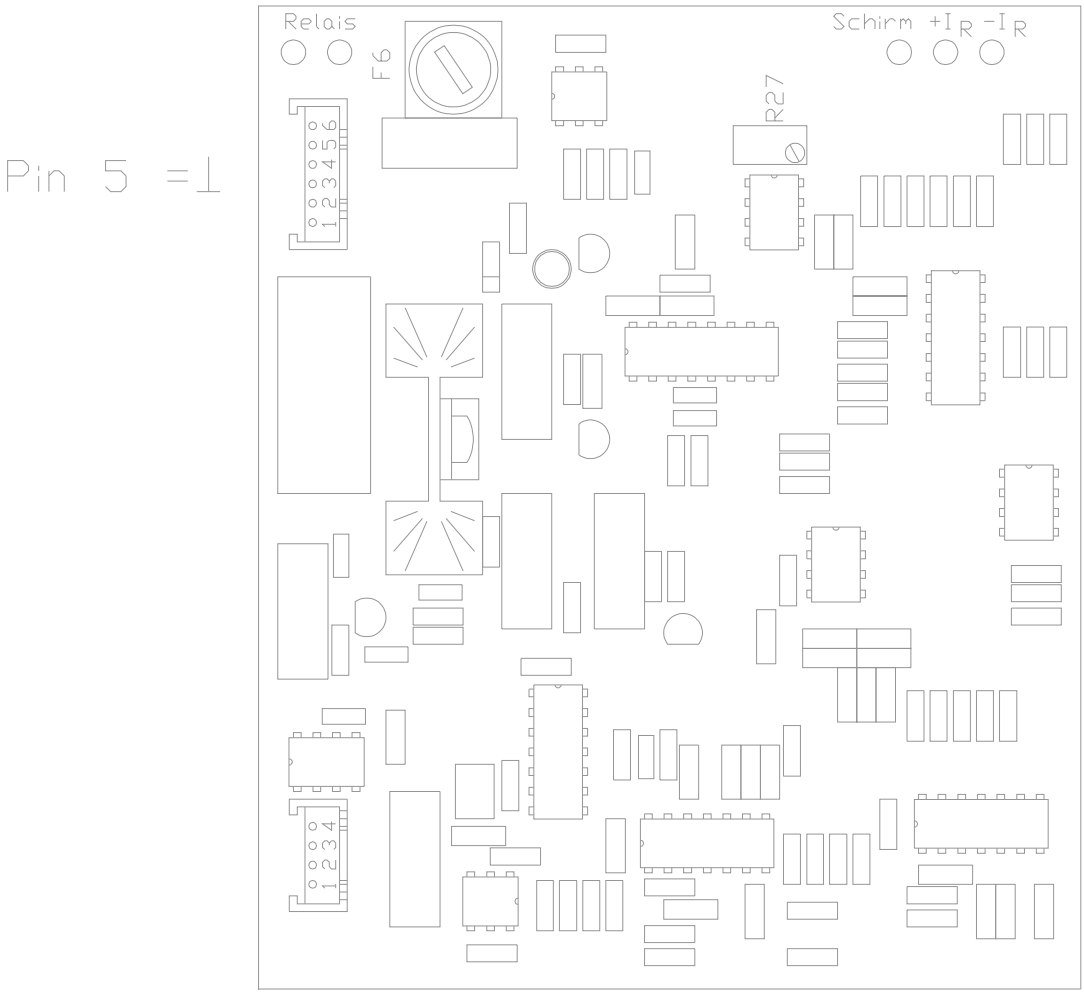

Fig. 9.10 Reset switch p.c.b.

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Annex

Schematic Diagrams LG 110

Schematic Diagrams GL110

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