

*Equipment Documentation*

*Receiver/Auxiliary Unit*

*Type Series*

*EZ 100*

*Eu*



**VEB FUNKWERK KÖPENICK**

BETRIEB DES VEB KOMBINAT NACHRICHTENELEKTRONIK

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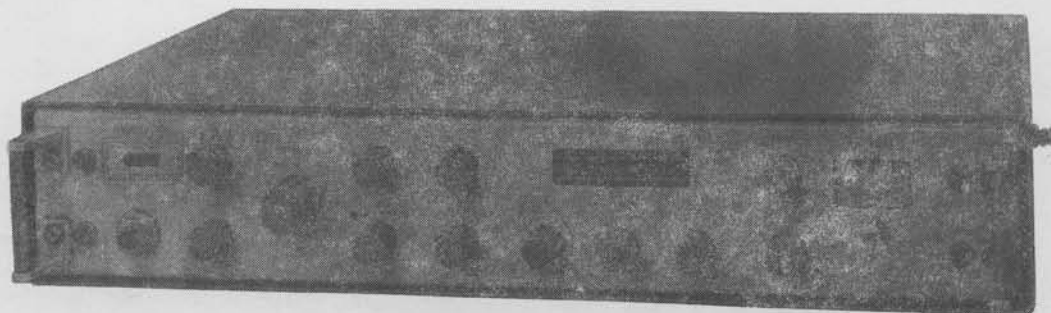
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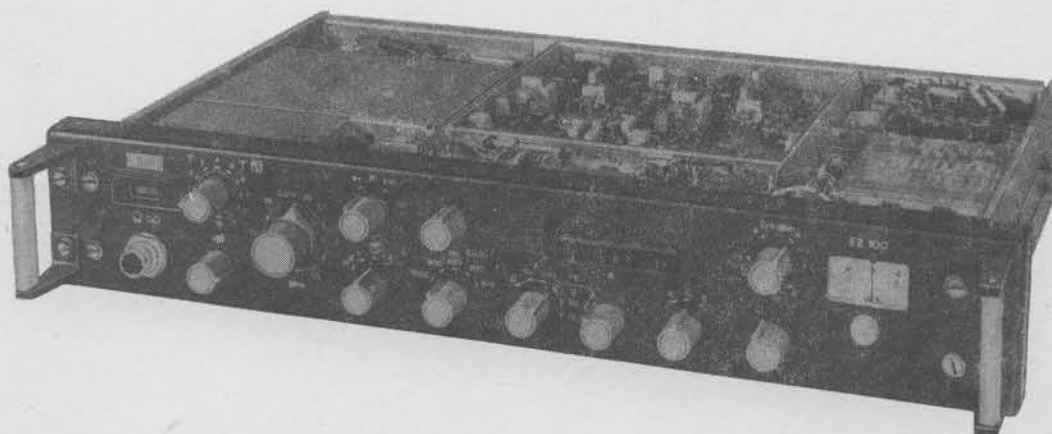
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I. SPECIFICATION

Photograph of the equipment



Receiver/auxiliary unit EZ 111



Receiver/auxiliary unit EZ 101

## 1. Application

The receiver/auxiliary unit (EZ) allows the following functions:

- Aerial selection
- Preselection for the frequency range 1.5 to 30 MHz
- Receiver-diversity operation
- Demodulation of the classes of emission F1 and F6
- Tuning indication

This auxiliary unit is a supplementary device for the receivers of type series EKD 100 and EKD 300. Operation with other types of receivers is possible when the connection values of the inputs of the auxiliary unit (EZ) are guaranteed.

The constructional design of the unit meets the mechanical/climatic application conditions for fixed and mobile land and sea radio services.

It fulfils the conditions of the CCIR Recommendations as well as the DSRK Regulations concerning compulsory equipment for sea-going ships, Section IV (OTAK), Edition 1975.

## 2. Technical data

The data mentioned in the following are average values. The guaranteed values for equipment acceptance are to be taken from the Technical Terms of Delivery 1399.036-00001 TLB.

### 2.1 General technical data

Operating temperature range	-25 to +55 °C
Temperature range for limited tolerances	-10 to +50 °C
Temperature range for transport	-40 to +70 °C
Admissible relative air humidity	≅ 95 % at +40 °C

Degree of protection	IP 43 per TGL 15165/01
Protection class	I per TGL 21366, 1/1976
Operating time	24 hours/d
Readiness for operation	2 s after switching on
Power supply	
Mains operation	
Voltage	127 V/220 V ac $\pm 10\%$ (+20 % for -25 to +35 °C)
Frequency	45 to 65 Hz
Power input	approx. 25 VA
Battery operation	
Voltage	12 V/24 V dc +10 %, -15 % floating (+20 % for -25 to +35 °C)
Overvoltage	16 V/32 V dc for $\leq 5$ minutes
Power input	approx. 25 W
Radio interference factor	24 dB below F 1 per TGL 20885

## 2.2 Aerial selection and preselection

Number of aerial inputs	4
Switching over	by hand
Number of aerial outputs	1
Maximum emf across the input	$\leq 5$ V, operable without input protection lamp. > 5 to 30 V, operable with input protection lamp. > 30 to 100 V, destruction of the input protection lamp.
Input resistances	75 ohm; s $\leq 3$
Output resistance	asymmetric



## Frequency ranges

Wideband operation	0.014 to 30 MHz
Preselector operation	1.5 to 30 MHz; 5 subranges
Switching and tuning	by hand

## Data for interaction with receivers of type series EDK 100 and EKD 300

Blocking (for preselector operation)

Impairment of the effective level at the receiver output  $\approx 3$  dB

for

Effective emf at input  $\approx 100 \mu\text{V}$

Interference emf at input  $\approx 30$  V

Spacing between effective and spurious frequency  $\approx 10$  %

Signal-noise ratios (sensitivity)

Impairment of the values given for the receivers  $\approx 3$  dB

Intermodulation attenuations

Impairment of the values given for the receivers  $\approx 3$  dB

Aerial selection through control of the aerial selector type AVV 01 S

Connection of the aerial selector output 4th aerial input

Coding of the control output BCD (8-4-2-1)

Switching by hand

Maximum selectable number of aerials 11

thereof via AVV 01 S 8

via aerial inputs 3

### 2.3 Receiver-diversity operation

<b>Inputs</b>	2 (AF outputs of two receivers)
Centre frequencies	1.905 kHz
Input voltages	0.4 to 1.2 V
Input resistances	> 1 kohm
<b>Output</b>	routed to F1/F6 demodulator
<b>Switching voltages</b>	
Difference of the two input voltages	> 0.1 to 0.3 V; through con- nection of the higher voltage to the F1/F6 demodulator

### 2.4 F1/F6 demodulation

<b>RF inputs</b>	2 (cf. Section 2.3: Inputs)
Preferably for demodula- tion and tuning indication of the classes of emis- sion F1 and F6	
Switching	by hand or by automatic switching (diversity)
<b>IF input</b>	
Preferably for tuning in- dication of the classes of emission A1, A3, A3A, A3Ba	
Centre frequency	200 kHz
Input voltage	50 to 100 mV
Input resistance	≥ 600 ohm
<b>Demodulatable classes of emission</b>	F1;F6
<b>Character position</b>	optional by using the AF inputs, character reversal by means of transmission mode switch on receiver EKD 100, EKD 300

F6 coding

	f <sub>1</sub>	f <sub>2</sub>	f <sub>3</sub>	f <sub>4</sub>
Channel A	T	T	Z	Z
Channel B	T	Z	T	Z

Evaluatable assigned frequency spacings

Class of emission F1 100 to 1500 Hz  
 Class of emission F6 100 to 500 Hz

Telegraph speed  $\leq$  200 Bd

Character distortion  $\leq$  10 %

Outputs

Classes of emission F1 and F6 (A channel) via channel A  
 Class of emission F6 (B channel) via channel B

Single-current output

Switchable channel A or B  
 Current 0/40 mA  
 Load resistance 0 to 600 ohm  
 Reference to earth potential output line C earthed

Double-current outputs

Channels A and B  
 Current  $\pm$  20 mA  
 Load resistance 0 to 1200 ohm  
 Reference to earth potential output lines floating  
 Current direction in the position of rest switchable in unit

Sound-keying outputs

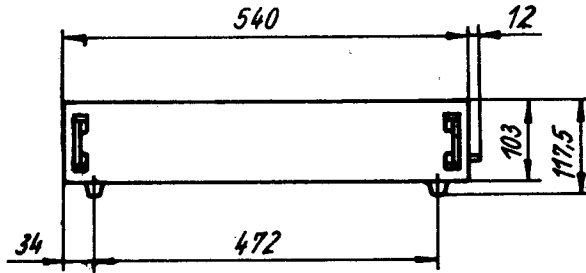
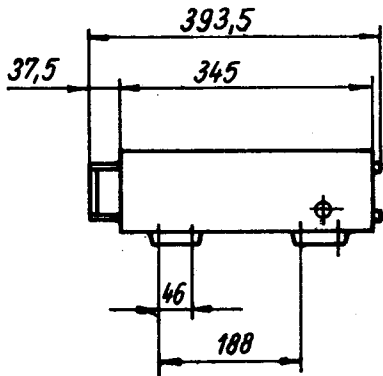
Channels A and B  
 Frequency 1000 Hz  
 Level -16 to +6 dBm, adjustable in the unit  
 Load resistance 600 ohm

Reference to earth potential	output lines floating
Operating sound/inoperative sound operation	switchable in the unit
<b>Headphone output</b>	
Switchable channel A or B	
Voltage	200 mV across 400 ohm
<b>Tape recorders/outputs</b>	
Channels A and B	
Voltage	300 mV across 10 kohm
<b>Output/indication - oscilloscope</b>	
Sweep voltage, horizontal	+ 750 mV across 10 kohm
Sweep voltage, vertical	branch off before an input (AF or IF)

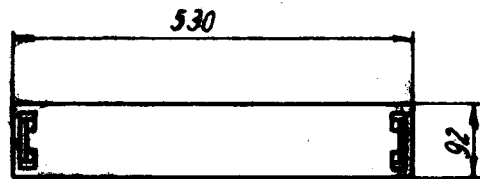
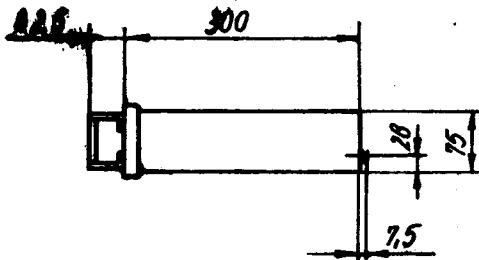
## 2.5 Tuning indication

Classes of emission	F1, F6, A1, A3, A3A, A3Ba
Indicating range	50 to 1600 Hz

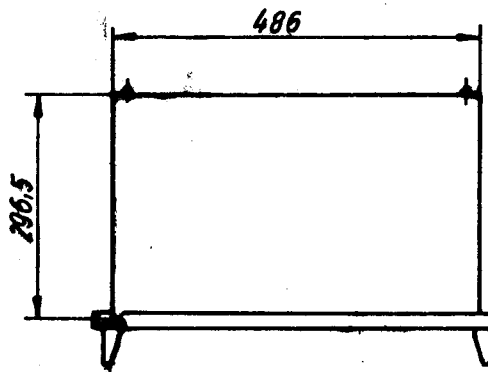
2.6 Weights and measures



EZ 111  
(desk-top unit)  
Weight approx. 14 kg



EZ 101  
(plug-in)  
Weight approx. 9.5 kg



### 3. Construction

The receiver/auxiliary unit has been designed and constructed in accordance with the receivers of the type series EKD 100 and EKD 300. The design as desk-top unit EZ 111 type 1399.36 A1 is accommodated in a lacquered light-metal casing and provided with plastic sliding supports. For operation with a receiver of the aforementioned type series, it is preferably mounted in a fixed manner on the receiver. For rack incorporation (19"), the variant EZ 101 type 1399.35 A1 without casing is provided. All the important controls and monitoring devices as well as the terminals for headphone and tape recorders are arranged on the front panel. All other outputs as well as aerial terminals and the power supply terminals for mains and battery are provided at the rear side of the casing or the unit.

After loosening the fastening screws of the plug-in (marked with a red ring), the plug-in is secured against falling out by means of laterally-arranged pawls. All electrical assemblies in the plug-in are of plug-type design.

The preselector and power supply section assemblies can be plugged in from the top side at the left and right side of the plug-in. Between these two assemblies, frames are arranged in three rows one above the other which take up five printed circuits 170 mm x 95 mm (receiver-diversity and F1/F6 demodulation). The upper and lower frame are of swivel-type construction so that access is given from both sides to all circuits.

After having taken out the plug-in, the slackening of four screws and the removal of the controls of the pre-selector, the front panel can be tilted up. Consequently, access is given to the wiring of the assemblies and to the controls behind the front panel.

The indicating section (tuning indication) assembly is arranged directly behind the front panel.

#### 4. Mode of operation

cf. general circuit diagram on page 22.

##### 4.1 Preselector 1399.035-01201

From one of the four aerial inputs, the input signal reaches a twin-circuit band-pass filter via the aerial selector and the input protection lamp. Via the follow-up amplifier of low-noise and low-distortion design, it is routed to the aerial output and placed at the disposal of the subsequently following amplifier.

The band-pass filter can be switched in five sub-ranges:

Range I	1.5 to 3 MHz
Range II	3 to 5 MHz
Range III	5 to 10 MHz
Range IV	10 to 20 MHz
Range V	20 to 30 MHz

Fine tuning is performed by a variable capacitor.

The following mean selection values are obtained:

Bandwidth	$0.05 \times f_E$
Stop-band attenuation	33 dB for $\Delta f \geq 0.1 \times f_E$ .

The total gain amounts to approximately 2 dB.

In a broad-band manner the signal in range 6 - 0.014 to 30 MHz - can be directly through-connected from the input protection lamp to the aerial output by bypassing the band-pass filter and the amplifier.

In the positions 4 to 11 the aerial selector delivers control commands which allow via the aerial selector AVV C1 S, type 1399.34, that a further eight aeri-als can be optionally connected to the 4th aerial input.

#### 4.2 Input section 1399.035-01351

A maximum of three output signals - two AFs and one IF - are applied from series-connected receivers to the input section. In the input section they are weighted (AF), converted (IF) and then passed on to the demodulator.

The AF signals AF 1 and AF 2 (centre frequency 1.905 kHz) generated by two different receivers are modulated by the frequency-shift keyed telegraphy signal, class of emission F1 or F6. For receiver-diversity operation they are weighted as regards the voltage magnitude and the respectively higher signal is through-connected to the output of the input section. The criterion for switching is a difference of the input voltages of roughly 0.2 V for a time period greater than 2 ms. The actual switching time is lower than 0.1 ms so that the switching operation does not cause errors.

In each case the through-connected input is indicated on the front panel by means of luminescent diodes. If receiver-diversity operation is not required, one of the two AF inputs can be switched through in each case by hand to the demodulator.

The IF signal (centre frequency 200.00 kHz) is converted to 1.905 kHz with crystal accuracy and also through-connected by hand to the demodulator. It should only be used for tuning indication for classes of emission with carrier.

#### 4.3 Demodulator 1399.035-01352

In the demodulator the signal ( $f = 1.905 \text{ kHz} \pm \Delta f$ ) delivered from the input section is demodulated by means of a phase control circuit (phase-locked loop; PLL).

At first it passes through a band-pass filter and then a switchable suppressor amplifier. The slope and bandwidth of the following PLL demodulator can be switched by hand for matching to the assigned frequency spacing of the signal (100 to 1600 Hz) to be demodulated; gradation 1:2.



The output signal of the demodulator is regenerated in a follow-up low-pass filter and is then available for further processing with a centre frequency of 0 V (at  $f = 1.905$  kHz).

#### 4.4 Processing section 1399.035-01353

At first, the signal delivered by the demodulator for fine matching to the assigned frequency spacing is amplified in an infinitely variable manner (1:2). For the class of emission F1 it is subsequently filtered in low-pass filters in accordance with the switched on telegraphy speed of 50 Bd or 200 Bd and then applied to keying section A.

Parallel with the aforementioned, it is routed to the indicating section for tuning indication and to the output "display/oscilloscope".

For the class of emission F6, the precisely-adapted signal in the assigned frequency spacing reaches the F6 decoder which separates the two channels A and B. Following filtering in low-pass filters, which are also dimensioned in accordance with the switched on telegraphy speed of 50 Bd or 200 Bd, the signals of both channels are regenerated by triggers and routed to the keying sections A and B.

#### 4.5 Keying section A 1399.035-01354

The keying section A consists of the functional groups:

- Tracking threshold
- Single-current keying section
- Double-current keying section and
- Sound-keying section.

For the class of emission F1 the signal arriving from the processing section is weighted by a tracking threshold. Consequently, with inexact receiver tuning or selective fading the number of character errors is markedly reduced despite the slightly higher character distortion.

The single-current keying section is supplied for the class of emission F1 from the tracking threshold, and for the class of emission F6 from the processing section optionally with the A or B channel.

With the aid of a keyed constant-current source, it generates current pulses 0/40 mA for the control of a telewriter. Continuous line current can be switched on. The output load resistance may amount to 0 to 600 ohm.

The double-current keying section is supplied by the F1 signal or from the F6 signal (A channel) via an opto-electronic coupling device, and generates with the aid of a keyed constant-current source floating current pulses -20 mA/+20 mA for output load resistances of 0 to 1200 ohm. The continuous line current can be switched on and is switchable in its polarity inside the unit.

The control of the sound-keying section is carried out parallel with the double-current keying section. The keyed frequency amounts to 1000 Hz. The adjustment of the output level of -16 to +6 dBm can be carried out inside the unit just like the switching over of the operating sound/inoperative sound. The output is floating. The designed load resistance amounts to 600 ohm.

The sound-keying section also delivers voltages for listening in via an headphone as well as for storage purposes by means of a tape recorder.

#### 4.6 Keying section B 1399.035-01355

The keying section B consists of the functional groups:

Double-current keying section and  
Sound-keying section.

Both functional groups operate in the same way as those of the keying section A. For class of emission F6 they are supplied by the B channel.

#### 4.7 Indicating section 1399.035-01401

The indicating section serves for the tuning indication and for the generation of a part of the control voltages for the control instrument. For the tuning indication the voltage taken from the processing section is converted into control signals for an horizontally-arranged row of luminescent diodes with 29 diodes whose dot-shaped light sources can be optically expanded to form vertical lines. If a discrete frequency is applied to the input section, only one line is lit in each case, e.g., the centre one for 1.905 kHz or 200.00 kHz. At the edge of the row of diodes markings are provided which allow checking of the exact centre tuning of the receiver as well as the correct adjustment of the assigned frequency spacing for F1 and F6 operation.

The indicating section also includes a rectifier for the generation and adjustment of the control voltages of the sound-keying outputs.

#### 4.8 Power supply section 1399.035-01801

The power supply section delivers the supply voltages for all assemblies. It is designed for both mains and battery operation.

Inputs:       Mains    127 V or 220 V ac  
              Battery    12 V or 24 V dc

Outputs:       +15 V regulated  
              -15 V regulated  
              +36 V for single-current keying section  
              2x36 V for double-current keying sections

Switching over from mains to battery operation is effected automatically when the mains voltage is missing or decreased. When the battery voltage is applied transverter operation starts in interaction with the mains transformer. For both modes of operation a galvanic separation of the inputs and outputs is given.

The battery input is protected against too high voltages. Protection against incorrect polarity is given in conjunction with the fuse arranged in the battery cable.

The intermediate dc voltages for the +15-V and -15-V paths which are stabilized by analogue controllers are gained from the secondary side of the mains transformer. The 36-V paths are not regulated; even in case of undervoltage they guarantee the voltages of roughly 30 V which are required for the operation of the keying sections.

## 5. Standard scope of delivery

### 5.1 1 receiver/auxiliary unit EZ 101 type 1399.35 A1 (plug-in)

1 Accessories according to	1399.035-10001 Z1 02
1 Equipment documentation	1399.036-90001 Eu 02
1 Works acceptance certificate	
1 Certificate of guarantee	

### 5.2 1 receiver/auxiliary unit EZ 111 type 1399.36 A1 (desk unit)

1 Accessories according to	1399.036-10001 Z1 02
1 Equipment documentation	1399.036-90001 Eu 02
1 Works acceptance certificate	
1 Certificate of guarantee	

### 5.3 Accessories

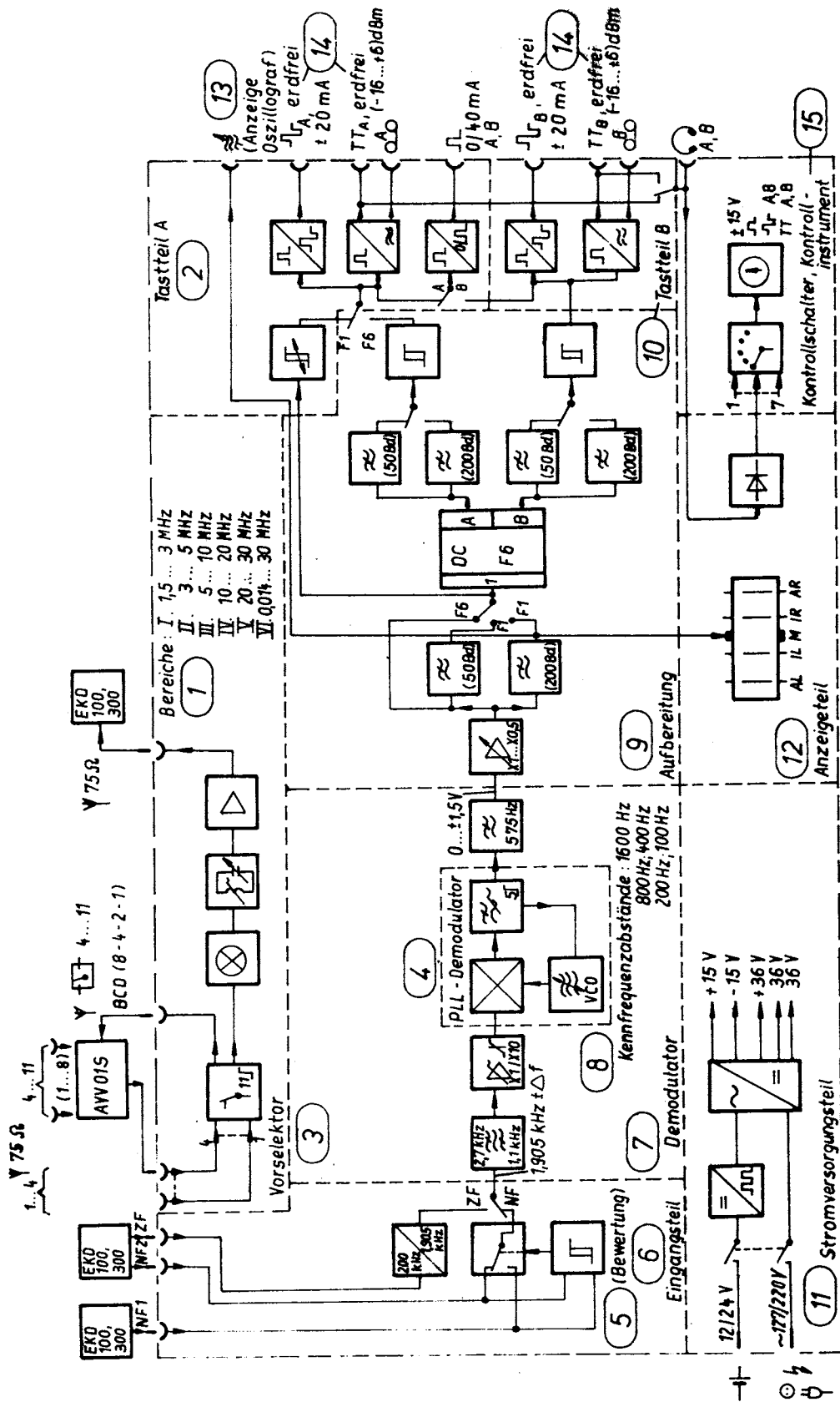
Packing of the accessories is effected in the respective equipment packing. The customer is recommended to place the accessories in the appropriate compartment as specified in the list of accessories in the accessories box of the receiver EKD 100 or EKD 300 after having taken the equipment into operation.

6. Scope of delivery of additional items

The following items are available against special order:

- Spare parts according to 1399.035-10001 E1 12 (EZ 101)
- Spare parts according to 1399.036-10001 E1 12 (EZ 111)
- Spare parts according to 1399.035-10001 E1 72 (EZ 101/111)
- Spare parts according to 1399.036-10001 E1 92 (EZ 101/111)
- Additional copies of the  
equipment documentation 1399.036-90001 Eu 02

# 7. General circuit diagram



## II. OPERATING INSTRUCTIONS

The following instructions are related to a receiver/auxiliary unit with casing - desk-top unit EZ 111 - called in the following the auxiliary unit which is operated together with a receiver of the type series EKD 100 or EKD 300, designated in the following as the basic unit.

The instructions are to be taken analogously for units without a casing, viz., the plug-in EZ 101.

Consult Section 3 for the assembly and connection of these units in the frame. The symbols used are explained in Section 2.4. The numbers in brackets refer to the positioning of the controls and connection devices - cf. Section 2.5.

### 1. Assembly, checking of the power supply voltages, and connections

#### 1.1 Assembly

Attention: cf. Section III/2.1 for the assembly and disassembly of the plug-in.

It is recommended to mount the auxiliary unit onto the basic unit in accordance with Figure 1 by means of four fillister-head screws BM 5x35 per TGL O-84-4.8 which form part of the accessories.

For this purpose the externally-arranged screws of the supports of the auxiliary unit are to be removed. The upper casing side of the basic unit is to be provided with four bores 5.5 mm diam.; the same arrangement of the bores is also to be executed on the upper rail in the casing. It is recommended to mark these bores by means of a punch which is guided from the inside through the four outer bushings of the upper left and right rail.

1.1.1 Assembly of the receivers of type series EKD 100 or EKD 300

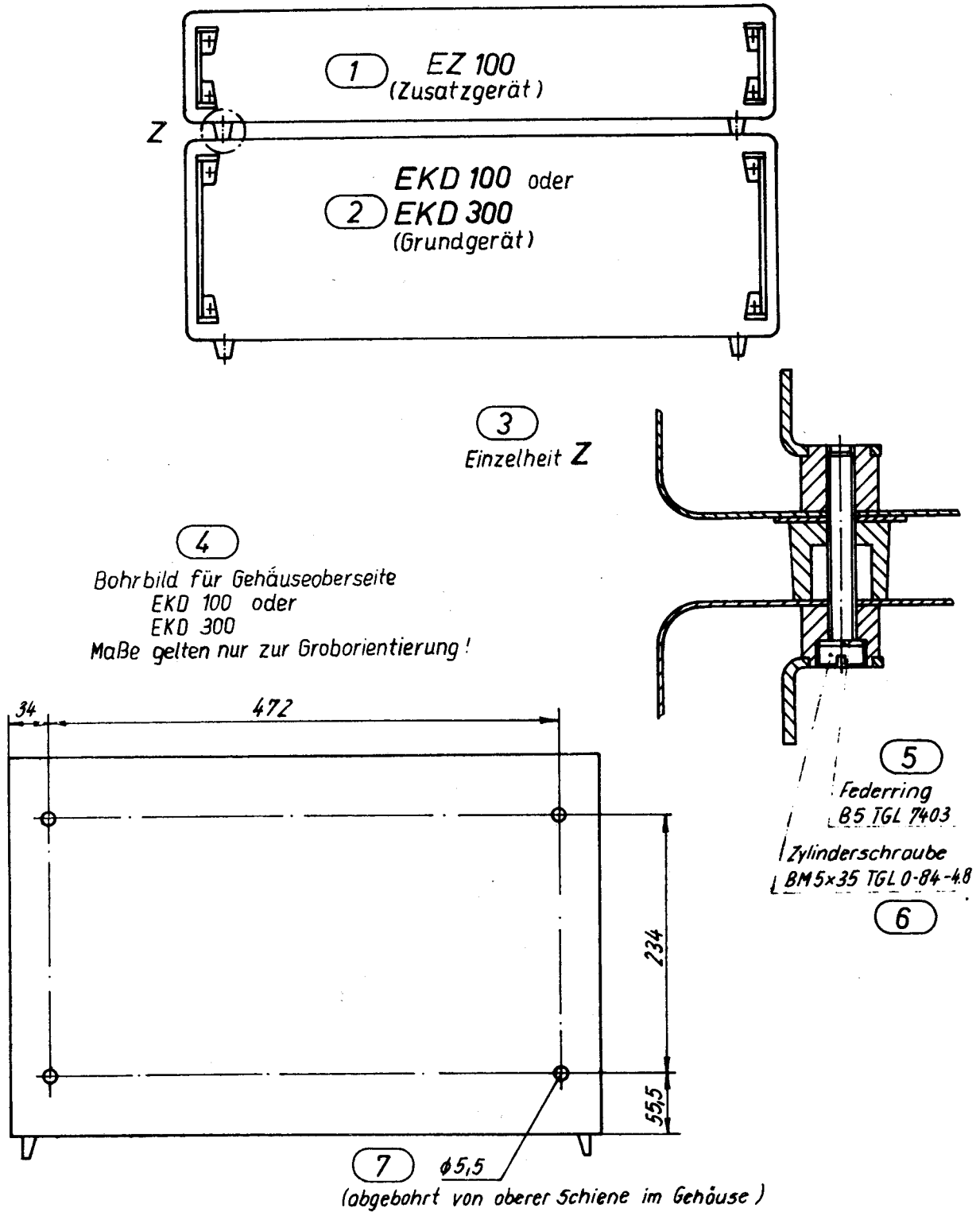


Figure 1



### 1.1.2 Checking of the power supply voltages

The mains and battery voltage can be selected independent of each other on the terminal board in the plug-in at the top right side.

Basic setting by the manufacturer: 220 V ac; 24 V dc

Examples:

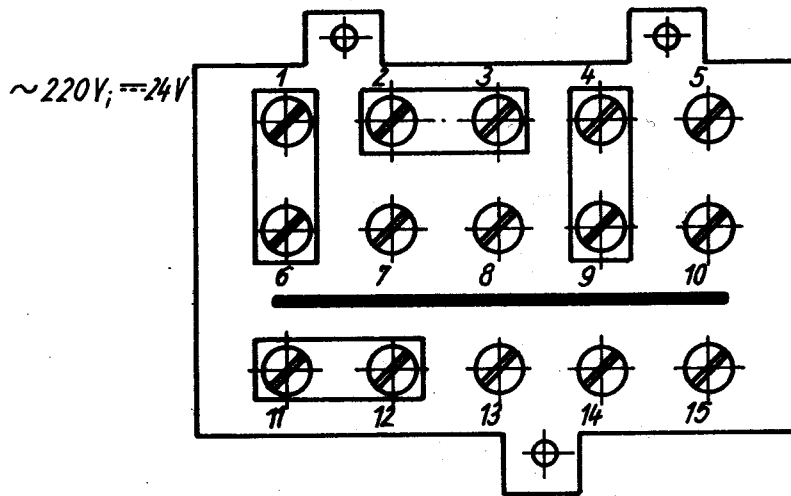


Figure 2

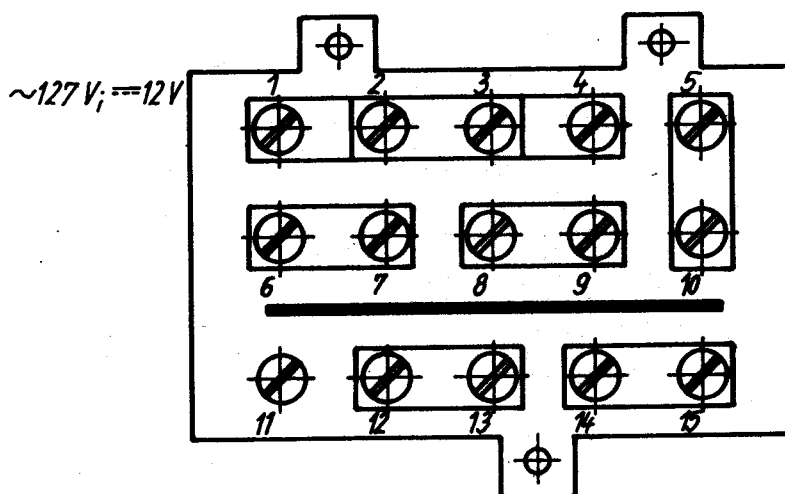


Figure 3

Attention: For mains operation, the fuse links F1001 and F1002 provided for the selected voltage are to be inserted in the plug-in at the top right side behind the front panel.

Power-current fuse link T 200 per TGL O-41571 for 220 V ac; and power-current fuse link T 400 per TGL O-41571 for 127 V ac.

For 12 or 24-V battery operation the fuse link A8 per TGL 11135 installed in the battery cable remains unchanged.

## 1.2 Connections

### 1.2.1 Earth

The earth bolt  $\perp$  (49) at the right side of the casing is to be connected via the RF low-impedance earth line 1399.036-02030 (cf. accessories) to the earth bolt of the basic unit (cf. Figure 4). From this position the earth connection is to be routed in accordance with the equipment documentation of the basic unit 1340.38-90001 Eu 02.

### 1.2.2 Mains

The connection is established via the mains connection cable  $\oplus \downarrow$  (48) (length approx. 1.8 m) to an earthed socket-outlet, for example, surface socket-outlet AD-TGL 200-3835 or to a terminal junction box for fixed installation.

Attention: With connection to ac voltage networks with a zero conductor as the protective conductor, transient currents can flow when the casing is earthed which influence reception as a result of humming.

In this case the zero conductor is to be disconnected from the earthed socket-outlet or the terminal junction box for the basic and auxil-

iliary unit and a common earth line is to be connected (cf. Figure 4) instead of the zero conductor.

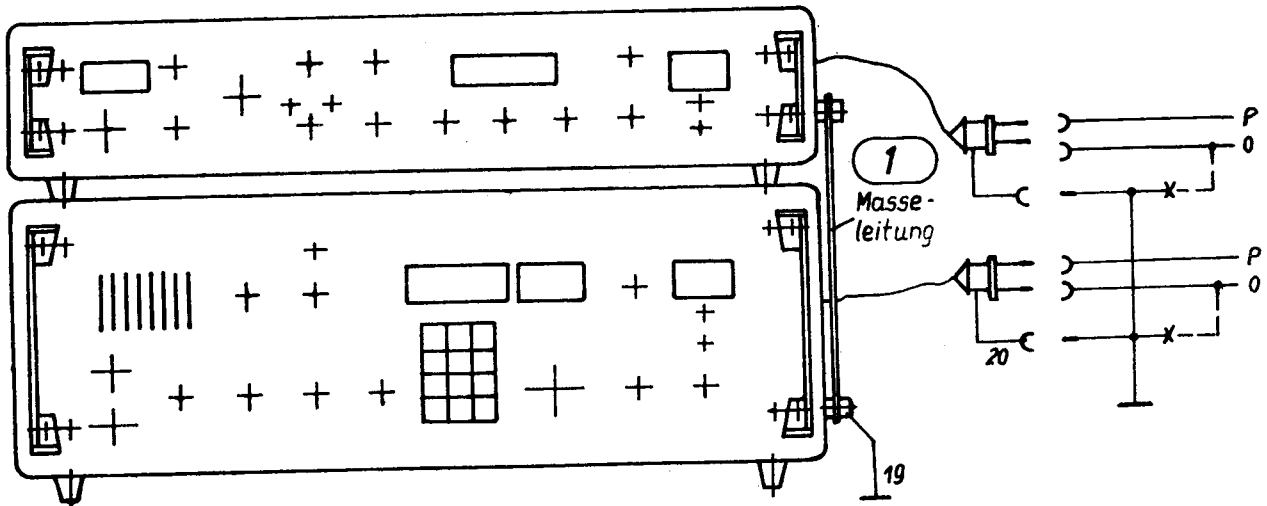


Figure 4

### 1.2.3 Battery

The connection is established with the battery connection cable 1414.006-01001 (cf. Figure 5) contained in the accessories to the battery connection plug — (26). If a longer feeder line is required, the cable is to be replaced after the fuse link (cross-section  $\cong 2.5 \text{ mm}^2 \text{ Cu}$ ). Access to the fuse link is to be guaranteed. The battery can be earthed at one side. When the positive pole is earthed, the fuse link is to be switched over to the negative line by reconnecting the cable. In case of incorrect polarity the fuse link is destroyed. During battery operation overvoltages up to 16 V or 32 V are permitted for a short time ( $t \cong 5 \text{ min.}$ ). Floating operation is possible up to these limits. When higher voltages are present, a protective circuit places the unit out of operation.

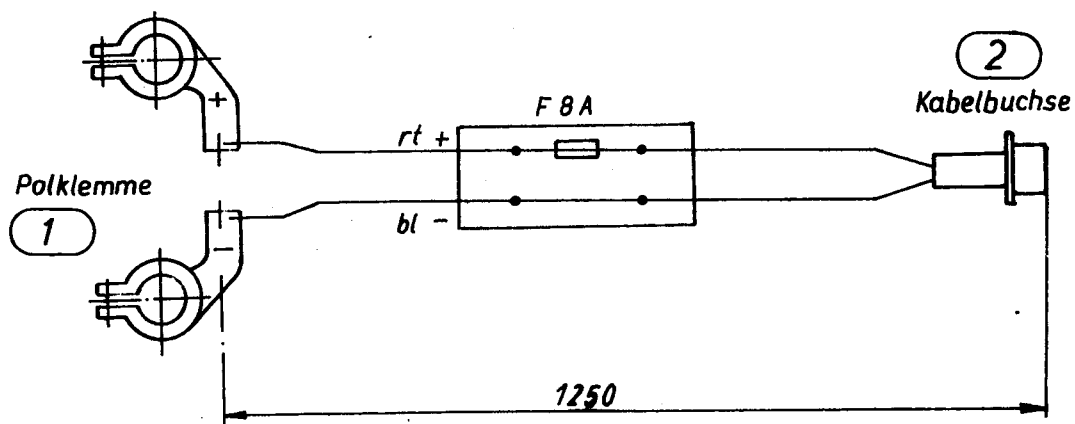


Figure 5

#### 1.2.4 Aerials

The aerials are connected via the four aerial inputs  
 → Y 75 ohm 1 to 4 (42,41.39,38) to the rear panel by means of RF plugs 11-2 per TGL 200-3800.

Those types of aerials should be used which are suitable for the operating frequency range and adapted to 75 ohm.

- Examples:
- 6-m rod aerial EAL 01 or EAS 01 made by VEB Funkwerk Köpenick, type 1371.29 or 1371.32
  - Polarisation aerial PAS 1 to PAS 5 made by VEB Funkwerk Köpenick, type 1371.18 A1 to A5


- Attention:
- Observe the following points for the aerial installation:
    - Observance of the legal directives
    - Installation of lightning protection devices
    - Exclusion of the interference range of electrical equipment
    - Decoupling in relation to the transmitting aerials; an emf of  $\cong 5$  V is to be attained
    - Employment of 75-ohm RF cable

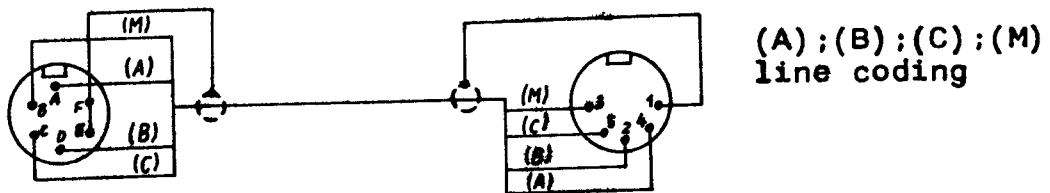
The unit is protected against an interference emf of up to 100 V by the input protection lamp (5) to which access is given through the withdrawable slide-in (5) at the top left side of the front panel. It is destroyed with an interference emf  $> 30$  V and must be replaced. If the occurring interference emf is known as being  $< 5$  V, the input protection lamp should be replaced by a connection bolt contained in the accessories.

The aerial output ( $\rightarrow$   $\Upsilon$  75 ohm (40) is connected with the aerial output (29 G) of the basic unit by the RF cable 1399.036-01030 (cf. accessories).

#### 1.2.5 Aerial selector AVV 01 S, type 1399.34

The aerial output of the aerial selector is to be connected to the 4th aerial input ( $\rightarrow$ )  $\Upsilon$  75 ohm 4. The conditions mentioned in Section 1.2.4 are applicable.

The connection of the control lines is effected via the socket "control lines AVV 01 S"  $\Upsilon$   4 to 11 (37) to the rear panel by means of the plugs 11-1-0-0 per TGL 24685. A 4-core screened cable, for example, telecom plastic-sheathed cable HYF (C)  $\Upsilon$  4 x 1 x 0.14 mm<sup>2</sup> per TGL 21807 is recommended for this purpose. The connection to the AVV 01 S is effected by means of plugs DKAS-05 per TGL 10472 (diode plug) - cf. Figure 6. Consult also the aerial distribution system AVV 01, equipment documentation 1399.032-90001 Eu 02. The maximum cable length amounts to 50 metres.



Plug 11-1-0-0  
TGL 24685  
(soldering side)

Plug DKAS-05  
TGL 10472  
(soldering side)

Figure 6

### 1.2.6 AF inputs

The connection of the inputs → AF 1 (36) and → AF 2 (43) is made at the rear panel by means of RF plugs 11-2 per TGL 200-3800 (cf. accessories). One of the two inputs can be connected with the AF output (0.8 V) of the basic unit by means of the RF cable 1399.036-01030 (cf. accessories).

Equipment for connection: receivers, tape recorders

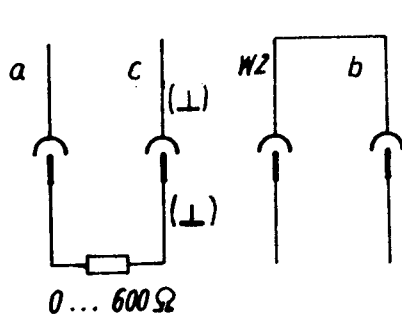
### 1.2.7 IF input

The IF input → IF (44) is connected at the rear panel with the IF output (200 kHz) of the basic unit by the RF cable 1399.036-01030.

Equipment for connection: receivers

### 1.2.8 Single-current output

The connection of the single-current output  $\square$  (23) is effected by means of equipment telephone pegs An-do-Step 160/M62 to the rear panel (cf. Figure 7).



Equipment telephone outlet  
M53-03 Z Nr An-do G 123

Equipment telephone peg  
An-do-Stp 160/M62

Figure 7

Equipment for connection: telewriter, punched-tape perforator

- Attention:**
- Do not apply external voltages from the connecting unit.
  - The earth connection of contact c is only permitted for the auxiliary unit, but not for the basic unit.
  - The maximum output voltage amounts to 48 V.

### 1.2.9 Double-current outputs

The connection of the double-current outputs  $\left(\rightarrow \sqcap \right)_A$  (27,28) and  $\left(\rightarrow \sqcap \right)_B$  (31,32) is carried out at the rear panel by one pair of sockets each, for example, by means of plug AA-sw per TGL 12762 (banana plug) or by means of cable shoes. Screened, flexible, two-core telecom cable ( $2 \times 0.75 \text{ mm}^2$ ) is to be employed as the connection line.

The screenings are to be earthed at the rear panel of the basic unit on its earth terminal  $\perp$  (25 G).

The floating outputs are poled in the following manner:

- Operation: Potential at (27) or (31); positive against (28) or (32) for the respective higher input frequency. Polarity changing can be accomplished by

exchanging the lines on the pair of sockets.

- Not in operation: The polarity can be changed in the unit by varying the position of the variable film resistor R 3479 or R 3579 from the right to the left stop (cf. Section 1.2.14) on the printed circuit in keying section A or B.

Basic setting by the manufacturer:

Variable film resistor	at right stop
Polarity	potential at (27) or (31) negative against (28) or (32)

Equipment for connection: punched-tape perforator, vf carrier telegraphy equipment, remote-control line

- Attention:
- Do not apply external voltages from the connecting unit.
  - The maximum output voltage amounts to 48 V.

#### 1.2.10 Sound-keying outputs

The connection of the sound-keying outputs ( $\rightarrow$   $\Pi_A$  (29, 30) and ( $\rightarrow$   $\Pi_B$  (33,34) is established at the rear panel by one pair of sockets each by means of plug AA-sw per TGL 12762 (banana plug) or cable shoes. Screened, two-core, telecom cable ( $2 \times 0.75 \text{ mm}^2$ ) is to be used as the connection line. The screenings are to be earthed at the rear panel of the basic unit at its earth terminal  $\perp$  (25 G).

The outputs are floating. The level adjustment is carried out in the unit on the printed circuits/keying section A or B with the variable film resistors R 3456 or R 3556 (cf. Section 1.2.14). In case of output levels of  $> 0 \text{ dBm}$ , the indication of the control instrument (18) is to be set afterwards to the blue mark by means of the variable film resistor R 4125 in the display section (cf. Section 1.2.14).



The changeover from operating sound to inoperative sound is possible on the printed circuit/keying section A or B by means of the variable film resistors R 3463 or R 3563 by setting to the right or left stop (cf. Section 1.2.14).

Basic setting by the manufacturer:

Variable film resistor: at right stop  
Output level +6 dBm for the respective higher input frequency


The position of rest is selected together with the position of rest of the double-current outputs.

Basic setting by the manufacturer:

Position of rest: no output level


Equipment for connection: peripherals, remote-control line

#### 1.2.11 Display/oscilloscope

The connection of the output display/oscilloscope (→  (35) is effected at the rear panel via an RF plug 11-2 per TGL 200-3800 (cf. accessories).

Equipment for connection: Oscilloscope, supply of the horizontal input. The vertical input is to be connected in parallel with the AF1, AF2 of IF input by means of the RF intermediate piece 33 per TGL 200-3800 (cf. accessories for basic unit).

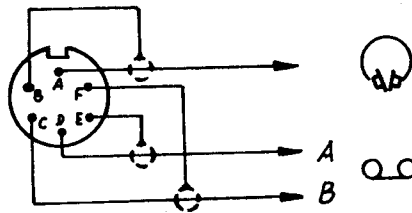
#### 1.2.12 Headphone output

The connection of the headphone  (1) is established on the front panel via a plug 11-1-0-0 per TGL 24685 (cf. Figure 8). The headphone is contained in the accessories of the basic unit.

### 1.2.13 Outputs for tape recorders

The connection of a tape recorder  $\text{O.D. (1)}$  is carried out via the same plug 11-1-0-0 per TGL 24685 as for headphone connection.

The channels A and B can be connected (cf. Figure 8) independent of each other. A single-core, screened, flexible line is to be used.



Plug 11-1-0-0  
per TGL 24685  
(soldering side)

Figure 8

### 1.2.14 Position of the adjustment devices and fuse links in the plug-in

Attention: Dismounting and mounting of the plug-in is carried out in accordance with Section III/2.1. If necessary, the plug-in is to be operated for adjustment work via a 30-pole test cable 1340.137-01146 (contained in the accessories of the basic unit).

Figure 9 shows the position of the fuse links, the variable film resistors to be set and the terminal board.

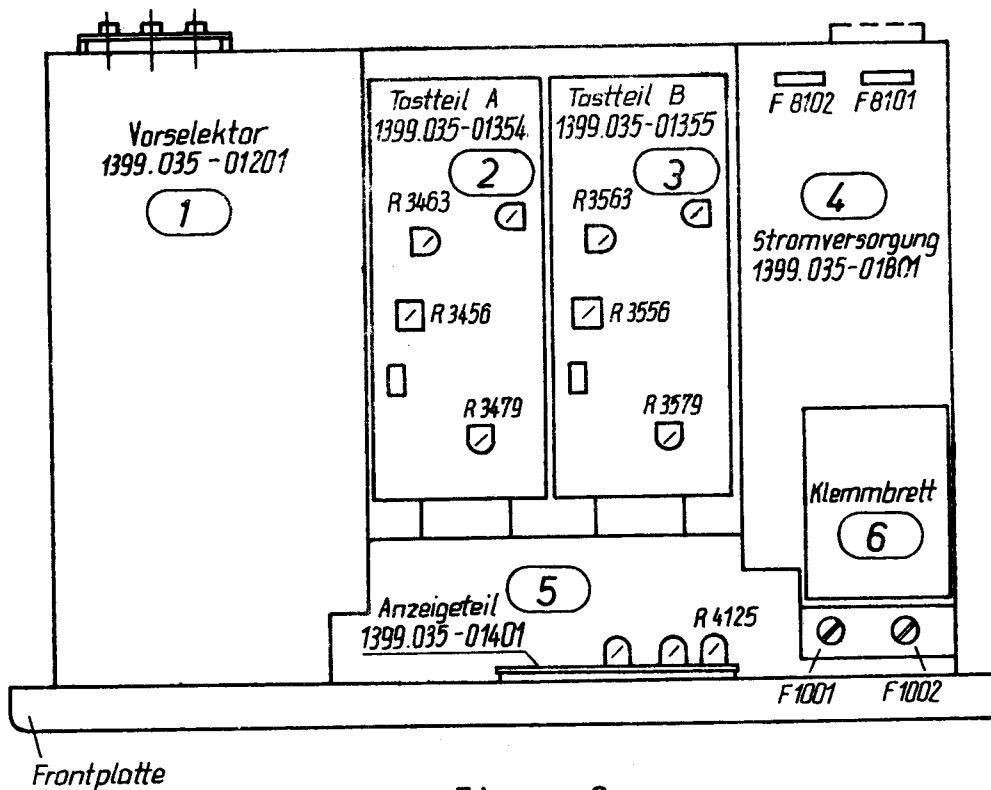


Figure 9

Variable film resistors

- Sound-keying outputs

Level adjustment/channel A	R 3456
channel B	R 3556
Adjustment/indication/control instrument	
channel A and channel B	R 4125
Changeover/operating sound - inoperative sound	
channel A	R 3463
channel B	R 3563

- Double-current outputs and sound-keying outputs

Changeover of the position of rest/channel A	R 3479
channel B	R 3579

Attention: All the other variable film resistors shall **only** be adjusted during repair work in accordance **with** the repair instructions 1399.036-00001 Ra.

## Fuse links


Mains operation 127 V F 1001, F 1002 T 400 per TGL O-41571  
Mains operation 220 V F 1001, F 1002 T 200 per TGL O-41571  
+15 V path F 8101 F 1 per TGL O-41571  
-15 V path F 8102 F 1 per TGL O-41571

## 2. Operation

### 2.1 Switching on

- Switching on with switch "unit on/off" 0 → | (21)
- Service indication (20) is lit

### 2.2 Aerial selection and preselection

- Operation of the basic unit in accordance with the required class of emission; cf. equipment documentation for basic unit.
- Selection of the aerial with the aerial selector (6).
- Selection of the frequency range with the range switch (7).
- Actuation of the fine tuning  (4); approximately three turns from the beginning of the range to the end of the range.

Criteria: Maximum of the IF rated level or of the AF line level on the control instrument (14) of the basic unit, which is caused by the effective transmitter.

- When searching for transmitters with a not exactly known frequency, set the range switch (7) to the position 0.014 to 30 MHz.
- A brightly lit input protection lamp indicates a high interference emf at the aerial input. Uncouple the aerial and the source of interference. Otherwise, an interruption in reception would be the result due to a destroyed input protection lamp.

## 2.3 F1/F6 demodulation and tuning indication

### 2.3.1 Operation of the basic unit

Consult also the equipment documentation of the basic unit, Section II/2.10.3.

- Set the class of emission switch (8 G) to position F  $\sqcap$  or F  $\sqcup$  in accordance with the character position of the transmitter.
- Select the optimum bandwidth with the bandwidth switch (6 G) in accordance with the maximum assigned-frequency spacing and telegraph speed.
- Set control switch (7 G) to position  $\mathcal{T} \sqcap$ .
- Adjust the rated frequency of the transmitter; for a correction of the adjustment, cf. tuning indication on the additional unit, Section 2.3.5.

### 2.3.2 Selection of the inputs: AF, IF, diversity operation

The selection of the input is carried out by the input switch (9).

- Input AF1 or AF2: Demodulation of the classes of emission F1 and F6.
- Input  $\longleftrightarrow$  : Receiver-diversity operation for the classes of emission F1 and F6.  
Utilisation with fading input signals as long as two receivers are available which are supplied from sufficiently spatially-separated aerials (aerial diversity) or with different frequencies with uniform modulation (frequency diversity).
- Input IF: Tuning indication for the classes of emission A1, A3, A3A, A3Ba with carrier.

By means of the gain switch (10), matching of the input to lower aerial emf and certain interferences is possible:

- Position x 1: Aerial-emf  $\cong 10 \mu\text{V}$ , constant or subjected to selective fading.

- Position x 10: - Aerial-emf < 10  $\mu$ V, constant or subjected to selective or attenuation fading.
- Aerial-emf > 10  $\mu$ V, heavy bursts (thunderstorms and similar).

### 2.3.3 Selection of the class of emission

The classes of emission are selected by the class of emission switches A (14) and B (16).

Class of emission switch A (14):

- F1 Demodulation of the class of emission F1 via a tracking threshold, viz., automatic correction in case of inexact tuning of the basic unit and reduction of the character error rate for heavy selective fading,  
Character distortion < 15 %
- F1/0 Telegraphy speed  $\cong$  200 Bd.  
Single-current output operable.  
Double-current and sound-keying output/channel A in the inoperative state.
- F1/50 Telegraphy speed  $\cong$  50 Bd.  
All outputs of channel A are operable.
- F1/200 Telegraphy speed  $\cong$  200 Bd.  
All outputs of channel A are operable.
- F6 Demodulation of the class of emission F6 (A channel) and the class of emission F1.  
Character distortion < 10 %.
- F6/0 cf. F1/0
- F6/50 cf. F1/50
- F6/200 cf. F1/200

Class of emission switch B (16):

Attention: For reception of channel B, set the class of emission switch A (14) also to position F6.

- F6 Demodulation of the class of emission F6 (B channel)  
Character distortion < 10 %.

- F6/0 Telegraphy speed  $\cong$  200 Bd.  
Single-current output operable.  
Double-current and sound-keying output/channel B  
in the inoperative state.
- F6/50 Telegraphy speed  $\cong$  50 Bd.  
All outputs of channel B are operable.
- F6/200 Telegraphy speed  $\cong$  200 Bd.  
All outputs of channel B are operable.

#### 2.3.4 Adjustment of the assigned frequency spacing

The adjustment of the assigned frequency spacing is effected

- coarsely with the assigned frequency switch (13) in the steps 1600 Hz - 800 Hz - 400 Hz - 200 Hz - 100 Hz and
- finely with the assigned frequency control (12) in the ratio 1 : 0.5 (cf. also Section 2:3.5).

#### 2.3.5 Tuning indication

By means of the tuning indication (15) the frequency adjustment of the basic unit and the adjustment of the assigned frequency spacing are checked.

- Class of emission F1:

With the frequency adjustment on the basic unit (10 G) the symmetric position of the luminous lines are adjusted in relation to the centre mark M. By varying the assigned frequency adjustment (12, 13) the luminous lines are brought to coincide with the external marks AL and AR (cf. Figure 10).

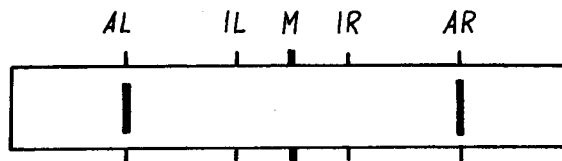


Figure 10

- Class of emission F6:

With the frequency adjustment on the basic unit (10 G) and variation of the assigned frequency adjustment (12, 13), the luminous lines are brought to coincide exactly with the external marks AL, AR and the internal marks IL and IR (cf. Figure 11).

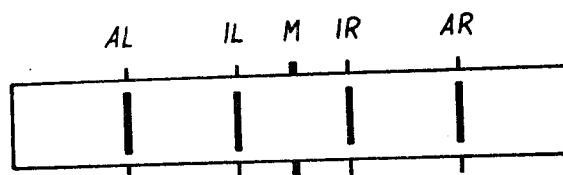


Figure 11

- Class of emission A1, A3, A3A, A3Ba (input IF):

With the frequency adjustment on the basic unit (10 G) the luminous line is brought to coincide with the centre mark M.

### 2.3.6 Selection of outputs

The outputs for the classes of emission F1 and F6 (A channel) are identical.

The single-current output can be switched on channel A or channel B by the single-current switch (22). In position 0 a constant line current of 40 mA is generated. The positions of rest of the double-current and sound-keying outputs (class of emission switch in the positions F1/0, F6/0 (cf. Section 2.3.3)) can be selected in the unit, cf. Sections 1.2.9, 1.2.10 and 1.2.14. Consult Section 1.2.10 and 1.2.14 for the level adjustment of the sound-keying outputs and for the switching of the operating sound - inoperative sound.

The outputs for tape recorders and sound keying display the same features.



The headphone output can be switched by means of the control switch (17) in positions +15 V, -15 V, 0/6 dBm A,  $\square$ ,  $\square$  A,  $\square$  B on channel A, but only in position 0/6 dBm



B on channel B. The operation of the output indication/oscilloscope is explained in Section 1.2.11.






### 2.3.7 Control switch and control instrument

















The following checks during operation are possible with the aid of the control switch (17) and the control instrument (18):

- Checking of the operating voltages
  - +15 V, pointer in the right black section
  - 15 V, pointer in the left black section
  
- Level checking of the sound-keying outputs
  - 0/6 dBm A, channel A
  - 0/6 dBm B, channel B
  - Pointer in the blue section (adjustment of the indication, cf. Section 1.2.10 and 1.2.14)
  
- Current checking of the single-current output
  - +40 mA: pointer in the right black section
  - 0: pointer in the middle position
  
- Current checking of the double-current outputs
  -  A, channel A
  -  B, channel B
  - Pointer in the right or left black section in accordance with current direction.
  
- cf. Section 2.3.6 for switching the headphone output.

## 2.4 Explanation of symbols

### Front panel

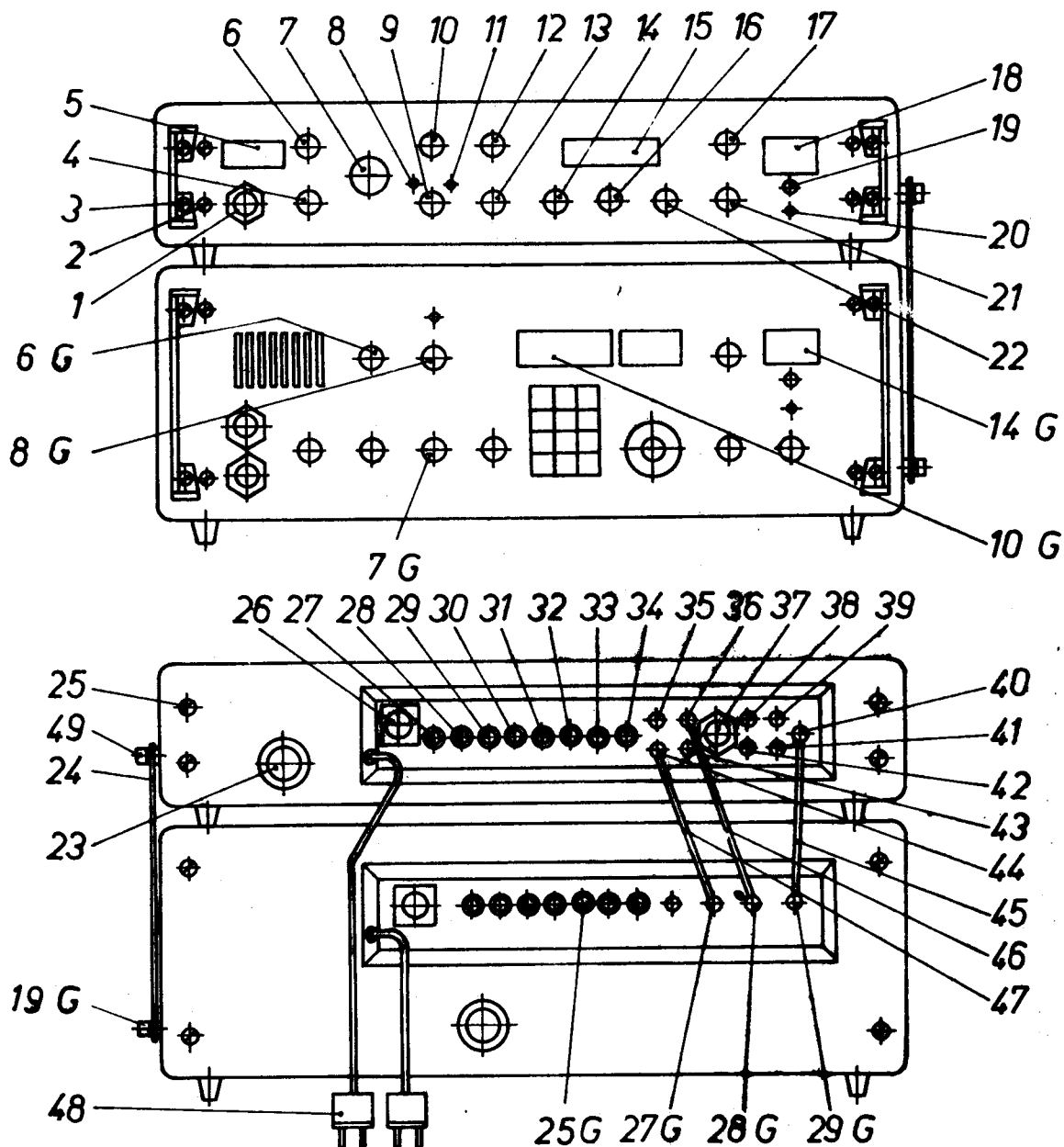
Item	Symbol	Designation
1		Connection for headphone Connection for tape recorders
6		Aerial selection Aerial selection via AVV 01 S
4		Preselector tuning
10	x1  x10	Gain, switchable x1 and x10
9	IF AF1 AF2 ↔	IF input AF1 input AF2 input Receiver-diversity operation
14	A	Channel A
16	B	Channel B
14,16	F1/0 (F6/0)	Class of emission F1 (F6), telegraphy speed 200 Bd, inoperative for double-current and sound-keying output
14	F1/50 (200)	Class of emission F1, telegraphy speed 50 (200) Bd
14,16	F6/50 (200)	Class of emission F6, telegraphy speed 50 (200) Bd
22	 A,0,B	Single-current output 40 mA, channel A (F1, F6), channel B (F6)
17	15 V + -  A 0/6 dBm  B	Operating voltage check +15 V Operating voltage check -15 V Level check of sound-keying output Channel A  Level check of sound-keying output Channel B

Item	Symbol	Designation
17		Current checking of the single-current output
	A	Current checking of the double-current output Channel A
		Current checking of the double-current output
	B	Channel B
21	0 I	Equipment "OFF" Equipment "ON"
<u>Rear panel</u>		
23		Single-current output
48		Mains connection
26		Battery connection
27,28	 A	Double-current output, channel A
29,30	 TTA	Sound-keying output, channel A
31,32	 B	Double-current output, channel B
33,34	 TTB	Sound-keying output, channel B
35		Output indication/oscilloscope
44	 IF	Input IF
36	 AF1	Input AF1
43	 AF2	Input AF2
37	 4-11	Output/control lines for AVV 01 S
42,41 39,38	 75 $\Omega$ 1,2,3,4	Aerial inputs 1,2,3,4
40	 75 $\Omega$	Aerial output

Right side panel

49  Earthing bolt

## 2.5 Control and connection devices



### Explanation of the items

#### Receiver/auxiliary unit

- 1 Socket: Outputs for headphone and tape recorders
- 2 Front panel fastening screws
- 3 Plug-in fastening screws
- 4 Knob: Tuning/preselector
- 5 Slide-in with input protection lamp
- 6 Aerial selector
- 7 Range switch
- 8 Input indication AF1
- 9 Input switch

- 10 Gain switch
- 11 Input indication AF2
- 12 Assigned frequency adjustment
- 13 Assigned frequency switch
- 14 Class of emission switch/channel A
- 15 Tuning indication
- 16 Class of emission switch/channel B
- 17 Control switch
- 18 Control instrument
- 19 0-point correction for control instrument
- 20 Operating indication
- 21 Switch: Equipment "ON/OFF"
- 22 Single-current switch
- 23 Connection outlet: Single-current output
- 24 Earth line
- 25 Rear panel fastening screws
- 26 Plug: Battery connection
- 27 } Pair of sockets:
- 28 } Double-current output/channel A
- 29 } Pair of sockets:
- 30 } Sound-keying output/channel A
- 31 } Pair of sockets:
- 32 } Double-current output/channel B
- 33 } Pair of sockets:
- 34 } Sound-keying output/channel B
- 35 Socket: Display/oscilloscope
- 36 Socket: Input AF1
- 37 Socket: Control lines AVV 01 S
- 38 Socket: Aerial input 4
- 39 Socket: Aerial input 3
- 40 Socket: Aerial output
- 41 Socket: Aerial input 2
- 42 Socket: Aerial input 1
- 43 Socket: Input AF2
- 44 Socket: Input IF
- 45 RF connection cable
- 46 RF connection cable
- 47 RF connection cable
- 48 Plug: Mains connection
- 49 Earthing bolt

Basic unit (type series EKD 300)

- 6 G Bandwidth switch
- 7 G Control switch
- 8 G Class of emission switch
- 10 G Frequency adjustment
- 14 G Control instrument
- 19 G Earthing bolt
- 25 G Socket: Earth connection
- 27 G Socket: IF output 200 kHz, approx. 100 mV
- 28 G Socket: AF output approx. 0.8 V
- 29 G Socket: Aerial input 75 ohm

### 3. Assembly and connection of the auxiliary unit EZ 101

#### 3.1 Occupation of the female multipoint connector

For the connection of the plug-in, a female multipoint connector 2-30 per TGL 10395 is to be installed in the rack.

The occupation of the connector is shown looking at the soldering terminals, cf. Figure 13.

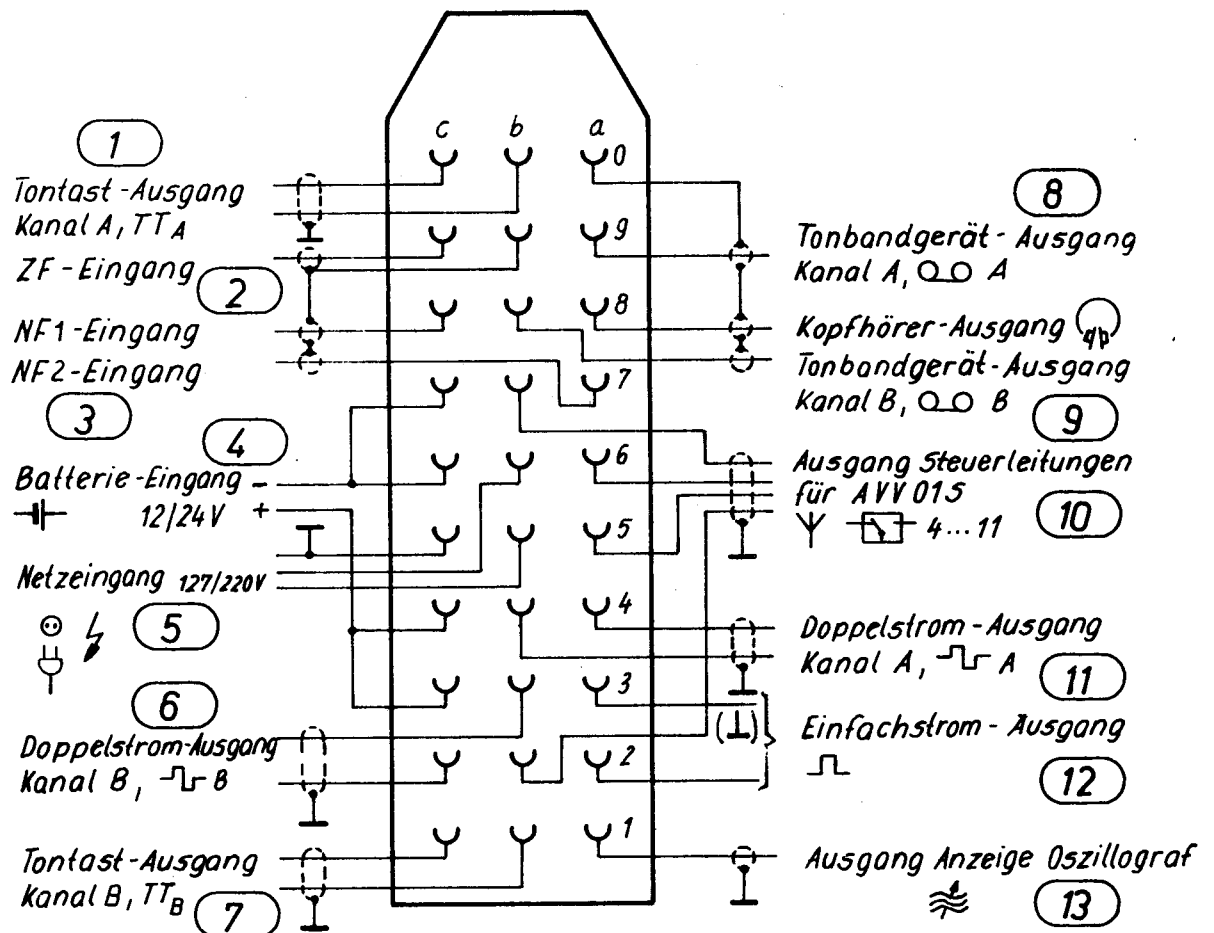
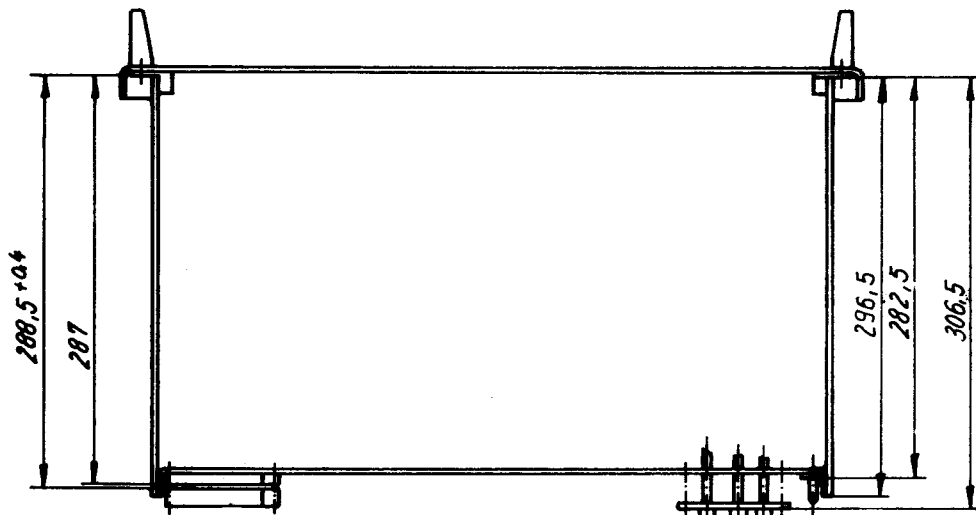
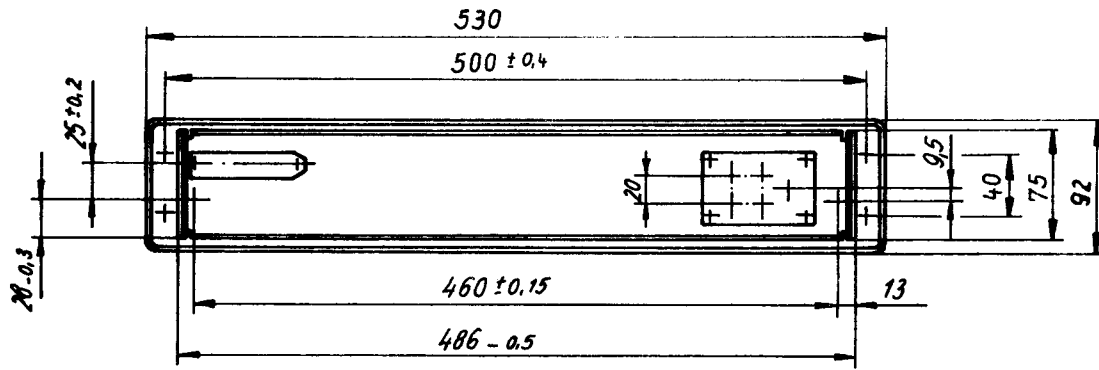


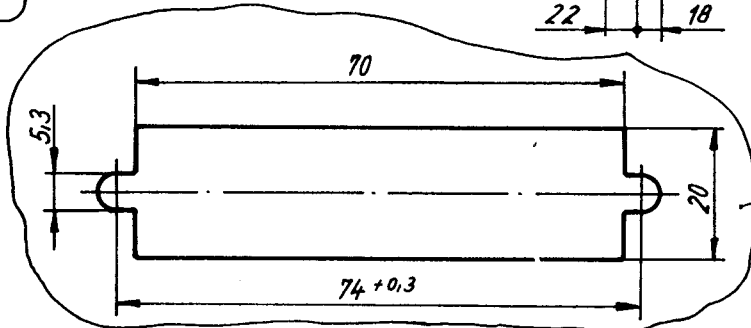
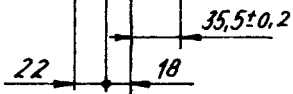
Figure 13

### 3.2 Assembly dimensions for EZ 101



Buchsenleiste 2-30 TGL 10395

1



Montageplatte für Buchsenleiste

2

3 Führungsbuchse FWB-N 610.004-6

Buchsenleiste 2-30 TGL 10395

1

4 Abstandbuchse 4x3 FWB-N 303.141

4

5 Scheibe FWB-N 610.004-9

5

6 schwimmend Größtspiel 0,1

6

7 Sechskantmutter M 4 TGL 0-934-6

7

15,5

### III. MAINTENANCE INSTRUCTIONS

#### 1. General instructions

The equipment requires little maintenance. The operational safety of the unit is guaranteed by regular maintenance work. The maintenance work listed in the following can be carried out by the operator of the unit himself.

Further assembly, testing and balancing work may only be executed by skilled service personnel.

The following maintenance work is to be executed.

#### At intervals of 8 to 14 days

1. Cleaning, cf. Section 2.2.
2. Checking of the external terminals, cf. Section 2.3.

#### Every 6 months

1. Cleaning, cf. Section 2.2.
2. Checking of the internal and external terminals, cf. Section 2.3.
3. In case of mobile employment, check the most important screw connections, cf. Section 2.4.
4. Checking of the drive for preselector tuning, cf. Section 2.5.
5. Functional checking, cf. Section 2.6.

#### 2. Maintenance work

Attention: Before starting maintenance work, withdraw the mains plug. Maintenance work on the plug-in is to be carried out always in the dead state.

##### 2.1 Disassembly and assembly of the plug-in

Before starting disassembly work, remove the protective caps or the RF plugs from the aerial inputs and the aerial output (38 to 42). Slacken the four red-marked fastening screws. Subsequently, pull out the plug-in up to the stop,



unlock the laterally-arranged locking latches, and then fully withdraw the plug-in from the casing. Assembly is executed in the reverse sequence.

## 2.2 Cleaning

Auxiliary aids required:

- 1 soft flat brush with metal insert
- 1 duster, 1 drying cloth
- 1 wiping cloth
- x1 alkali-free cleansing agent, e.g. Fit

For the maintenance work at 8 to 14-day intervals, the front panel inclusive the controls are to be freed from dust by using the flat brush. Wipe the casing with the duster.

For maintenance work in the 6-months cycle - at shorter intervals in case of heavier contamination - the plug-in and the casing are cleaned with the flat brush after having opened the equipment. This is followed by carefully wiping the front panel of the plug-in and the outer surfaces of the casing with a wet cloth and the cleansing agent. The cleaned areas are then to be wiped with the drying cloth.

Attention: Pay careful attention when cleaning the lettered parts and the tuning indication (15).

Do not use corroding and grinding cleansing agents.

## 2.3 Checking of the connections

During the 8 to 14-day maintenance cycle, check all external terminals and connectors of the incoming and outgoing lines of the unit. Retighten loose terminal connections; line breakages and badly contact-making connectors are to be eliminated.

Furthermore, the following parts of the system are to be subjected to a visual inspection:

1. Earth connection (21) from the auxiliary unit to the basic unit and further to the earth connection lead.
2. Aerials, inclusive lightning protection and supply wires.
3. Battery connection terminals.

Breakages and corrosion damages are to be eliminated.

#### 2.4 Checking of the most important screw connections

Carry out the following checks on the plug-in:

- Fastening screws for the frames of the printed circuits (accessible from the rear, six pieces);
- Fastening screws for the preselector (accessible from the top, four pieces);
- Fastening screws for the power supply section (accessible from the right side, five pieces) marked by a red dot.

Carry out the following checks on the casing:

- Fastening screws which serve for fastening to the basic unit (cf. Section II/1.1.1; four pieces);
- Fastening of the earth line (24).

Loose screw connections are to be tightened.

#### 2.5 Checking of the drive for preselector tuning

The drive shall run easily. The bearings of the drive elements have been greased during assembly. Under normal operating conditions, maintenance is not necessary. Work on the preselector shall only be carried out in accordance with the repair instructions 1399.036-00001 Ra 02 by the service department.

#### 2.6 Functional checking of the unit

Checking of the most important functions of the additional unit should be made together with a basic unit (cf. appropriate equipment documentation). Measuring instruments are not required.

The following connections and terminals are to be established:

- Connection to the basic unit; cf. Section II/2.5 (24,45, 46,47)
- Aerial at aerial input 1 (42)
- Telewriter at single-current output (23)
- Headphone at headphone output (1)
- Short-circuit at double-current output/channel A (27,28)
- Short-circuit at double-current output/channel B (31,32)
- Mains (48) and/or battery input (26)

### 2.6.1 Mains and battery operation

Control sequence	Function
1. Switch (21) Equipment "ON"   .	Operating indication (20) lights up.
2. Control switch (17) +15 V (-15 V).	Control instrument (18). Pointer to right (left) mark.
3. Battery operation, switch off mains voltage; repeat control sequences 1 and 2.	as 1 and 2.

### 2.6.2 Aerial selection and preselection

Control sequence	Function
1. Set (10 G) basic unit to known radio transmitter in the frequency range 1.5 to 30 MHz. Actuate preselector, cf. Section II/2.2	Maximum tuning of the indication on the control instrument (14 G) of the basic unit. Radio reception.
2. Select range 0.014 to 30 MHz (7).	The indication on the control instrument (14 G) remains constant.

Control sequence	Function
3. Connect aerial successively to aerial inputs 2,3,4 (41, 39,38) and select appropriately (6).	The indication on the control instrument (14 G) remains constant.

### 2.6.3 F1/F6 demodulation, tuning indication

Control sequence	Function
1. Adjust teletyping reception of a known F1 or F6 transmitter, class of emission F1 or F6; cf. Section II/2.3.	Unobjectionable adjustment of the assigned frequency (13,12) and frequency (10 G) is possible; observe by means of the tuning indication (15). Telewriter types text clearly, channel A or A and B. Sound-keying can be heard with headphone. Control instrument (18) indicates keying in the corresponding positions of the control switch (17).
2. If an F6 transmitter is not received, teletyping reception of an F1 transmitter is possible instead by setting the class of emission F6, cf. Section II/2.3. For this purpose, set the tuning indication (15) - cf. Section II/2.3.5 - with the aid of the assigned frequency adjustment (13,12) and the frequency adjustment (10 G) to	Functions as 1, but limited to:

Control sequence	Function
<p>- marks IL and AR or AL and IR</p> <p>and</p> <p>- marks IR and AR or AL and IL.</p>	<p>- Class of emission F6 (A channel)</p> <p>- Class of emission F6 (B channel)</p>
<p>3. If neither F1 or F6 transmitter can be received, reception of its own 70.2-MHz decade frequency is possible instead.</p> <p><u>Basic unit:</u></p> <p>- Class of emission switch (8 G) F <math>\sqcap</math> and F <math>\sqcup</math></p> <p>- Frequency adjustment (10 G) 00.000.00 MHz + <math>\Delta f</math></p> <p><u>Additional unit:</u></p> <p>- Class of emission (14,16) to F6 (cf. Section II/2.3)</p> <p>With variation of <math>\Delta f</math> within the selected assigned frequency adjustment (13,12) and class of emission changeover (8 G) F <math>\sqcap</math> or F <math>\sqcup</math>, search for the marks AL, IL, IR, AR, of the tuning indication (15) (cf. Section II/2.3.5).</p>	<p>The frequency-shift sequence in F6 code (cf. Section I/2.4) can be followed for channel A and B by means of the headphone and control instrument (18) in the appropriate positions of the control switch (17).</p>
<p>4. as 3, but <math>\Delta f = 0</math>.</p> <p>Continuously vary the assigned frequency adjustment (13,12) between 1600 Hz and 200 Hz.</p>	<p>The tuning indication (15) remains on the centre mark M. <u><math>\pm 1</math></u> luminous line.</p>
<p>5, as 1, but input switch (9) set to position <math>\longleftrightarrow</math></p>	<p>Input indication AF1 (8) lights up. Functions as 1.</p>

Control sequence	Function
6. as 1, but RF connection cable (46) from input AF1 (36) to input AF2 (43) and input switch (9) set to position ←→ .	Input indication AF2 (11) lights up. Functions as 1.
7. as 1, but input switch (9) set to position IF.	An unobjectionable setting of the assigned frequency adjustment (13,12) and the frequency adjustment (10 G) is possible; observe with tuning indication (15).

### 3. Behaviour when disturbances occur

In case of disturbance, a coarse fault localization is necessary for correct repair work. External error sources are to be excluded by carrying out checks on terminals and incoming and outgoing lines. This is followed by executing a functional check (cf. Section 2.6). In case of a total breakdown, check the fuse links. If the fault cannot be eliminated, contact the service department and state the kind of fault.

#### 3.1 Replacement of fuse links and the input protection lamp

The fuse link (8 A per TGL 11135) for battery operation is arranged in the battery connection lead. All other fuse links are arranged in an accessible manner from the top in the plug-in (cf. Section II/1.2.14).

The input protection lamp (MZL 12/0.1 As 8.5 per TGL 9816) or the connection bolt is accommodated in the slide-in (5) and can be exchanged easily.

#### 3.2 Replacement of assemblies

The replacement of assemblies inclusive printed circuits is possible. In order to re-establish the technical guarantee values, rebalancing in accordance with the repair instructions 1399.036-00001 Ra 02 is necessary by the service department.