SIEMENS

LEVEL METER Type D 349

-60 to +30 dB (-6 to +3 Np)
30 to 30,000 Hz

SIEMENS AKTIENGESELLSCHAFT

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-60 to +30 dB (-6 to +3 Np)
30 to 30,000 Hz

Full Information
Order No.. S45034-D349-B-01-7670

Herausgegeben vom

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I. APPLICATION

The level meter Type D 349 is a small and handy device which is independent from external current sources for up to 50 operating hours. This device lends itself particularly well for level, attenuation (overall attenuation) and gain measurements on transmission systems and their units of equipment. Its frequency range comprises the VF telephone channels (300 to 3400 Hz), program channels (30 to 15,000 Hz), the spectra of electro-acoustics (30 to 20,000 Hz), stereo transmission (30 to 53,000 Hz), and the basebands of various carrier systems.

Fig. 1 Level meter Type D 349 with plug-in storage battery Type D 466

Further advantages are the approximately rms response to the measuring voltage (i.e., sufficient measuring accuracy with non-sinusoidal voltage waves, a measuring accuracy that is widely independent of external influences (e.g., temperature fluctuations) and applicability as measuring or detector amplifier.

The plug-in storage battery Type D 466 used as current source contains a permanently mounted charging unit; it is to charge the battery from ac mains with nominal voltages between 110 and 240 V.

A leather case Type B 17 (Fig.2) can be obtained for protection and transportation.

Together with the level oscillator Type W 330, a handy audio measuring setup is obtained with which even impedance magnitudes between 30 Ω and 10,000 Ω can be measured. Both devices can be accommodated in the portable case Type B 16 together with the accessories (Fig.3).

Fig.2
Level meter Type 9 D 349
in leather bag

Fig.3
Level meter Type 9 D 349 and
level oscillator Type 9 W 330
in portable case 9 B 16

II. ELECTRICAL DATA

Frequency range . . . . . 30 to 30,000 (100,000) Hz

Level measurement

	Calibration, referred to: 0 dB ≙ 0.775 V / 0 dBm ≙ 1 mW (across Z)	0 Np ≙ 0.775 V
Measuring range, as referred to the 0-dB (0-Np) mark of the instrument, can be switched in steps of 10 dB (1 Np),		
for voltage level (E_o = 0.775 V)	-50 to +30 dB	-5 to +3 Np
for power level (P_o = 1 mW)	-50 to +30 dBm	-5 to +3 Npm
as referred to Z = ...	600; 900 Ω	600 Ω
Minimum measurable (readable) level	-60 (-70) dB	-6 (-7) Np
Voltage range, can be set in 9 steps (as referred to full-scale deflection)	3; 10 mV to 30 V	-
Minimum measurable (readable) voltage . . .	1 (0.5) mV	-

Measuring error at +20°C, 800 (1000) Hz, for measuring range and instrument deflection 0 dB (0 Np)	±0.1 dB	±0.01 Np
additionally in the case of temperature deviations between 0 and 45°C as referred to +20°C		±0.5%/10°C
Additional divider error	±0.15 dB	±0.015 Np
Additionally, when measuring ringing voltage 500/20 Hz	±0.3 dB	±0.03 Np
Frequency response of the indication, as referred to 800 (1000) Hz at +20°C		
in the range of 300 to 4000 Hz	±0.05 dB	±0.005 Np
in the range of 30 to 30,000 Hz	±0.2 dB	±0.02 Np
in the range of 30 to 100,000 Hz	±0.5 dB	±0.05 Np
Input impedance (balanced)		250 kΩ//150 pF
can be switched to	600; 900 Ω	600 Ω

Balance-to-unbalance ratio (common-mode suppression)

up to 4000 Hz	> 50 dB	> 6 Np
up to 15,000 Hz	> 40 dB	> 4.6 Np

Impedance Measurement (in connection with level meter Type W 330)

Measuring frequencies . . . . . 200 to 4000 Hz

Impedance range, can be set in 5 steps
(as referred to full-scale deflection) . . . . . 100; 300 to 10,000 Ω
Minimum measurable value . . . . . 30 Ω

Measuring error, as referred to full-scale deflection
up to 5000 Ω . . . . . ±5%
above 5000 Ω . . . . . ±10%

Use as Amplifier

Maximum gain with termination into 600 Ω . . . . . approx. 30 dB (3 Np)
Maximum permissible output voltage . . . . . 100 mV
Internal impedance . . . . . approx. 600 Ω

Noise voltage at the output (input terminated into 600 Ω) . . . . . ≦ 0.5 mV

Input current with a battery voltage of 11 V . . . . . approx. 4 mA

With the Plug-in Storage Battery Type D 466:

Operating hours without recharging . . . . . approx. 50 hours
Charging time on a 220-V mains after 20 hours of continuous operation . approx. 8 hours
Power supply for charging . . . . . 110 to 240 V; 47 to 63 Hz; approx. 5 VA

III. FUNCTIONING AND LAYOUT

Refer to Figs. 4 and 5 in the text, and circuit diagrams Rel str... in the annex

The level meter is composed of the following groups:

Input with impedance switch, first divider, preamplifier, second divider, detector amplifier, output, calibrating oscillator, plug-in storage battery.

The transformerless input "⊸" of the device is floating and balanced. The device has two electrically isolated shields, an inner one which is connected to the b-wire of the input jack, and an outer one connected to the c-wire.

With the impedance switch S2 the high input-impedance can be changed to 600 Ω, on the model calibrated in decibels also to 900 Ω.

In the 1st and 2nd dividers the sensitivity of the level meter is in accordance with the setting of measuring range switch S1.

From the 1st divider the voltage under test is applied to the preamplifier which is designed as impedance converter. Two transistor stages (Ts1 and Ts2) operated in a grounded-collec-

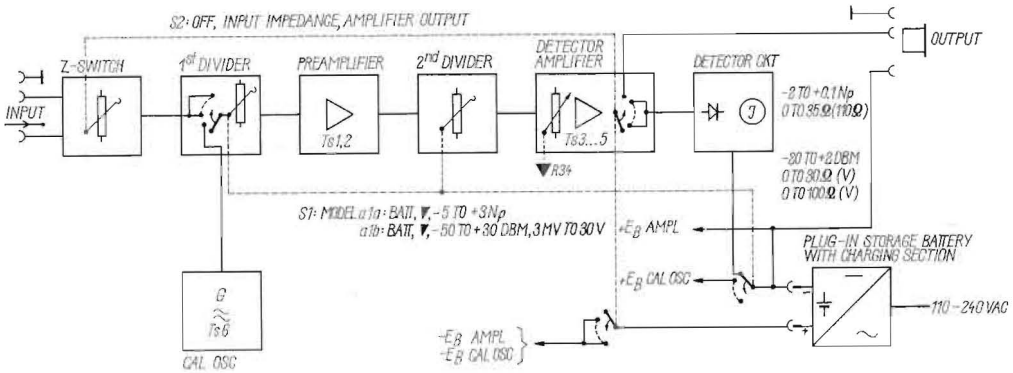


Fig. 4 Basic circuit diagram

tor configuration are connected in series. They make possible the high input impedance of the preamplifier. Limiter diodes Gr1a, b and Gr2a, b protect the transistors against overvoltages.

The detector amplifier raises the voltage under test to the value required for the detector circuit and the earphone output. It consists of a two-stage intermediate amplifier (transistor Ts3, Ts4) and a final amplifier (transistor Ts5).

The dc-coupled transistor Ts3 and Ts4 of the intermediate amplifier operate in a grounded emitter configuration. Feedback from the fourth (Ts4) to the third stage (Ts3) ensures that the gain remains constant and is flat in the desired range. The gain can be varied by means of potentiometer R34 (▼) in the feedback path.

The final amplifier consists of a transistor stage operating in a grounded-emitter configuration (Ts5) which is connected in current feedback via resistor R46 at the emitter. In the case of the decibel model the gain is varied by means of the function switch S2 for measuring power levels across Z = 900 Ω.

The detector circuit is designed for approximate rms response to the amplified measuring voltage; in addition the amplifier has a wide overloading margin. In this way the indication errors remain low even when the measured waveform is far form sinusoidal.

In position " ⊓ " of S2 the instrument is short-circuited and the amplified voltage applied to the output jacks. With an internal impedance of approx. 600 Ω the gain is approximately 30 dB (3 Np) with termination into 600 Ω.

The calibrating oscillator produces the constant ac voltage required for calibration. It consists of a single-stage oscillator circuit (Ts6) which oscillates at about 2,5 kHz. With the Zener diode Gr5 connected across the tuned circuit the calibrating voltage is kept constant.

As current source, a plug-in storage battery is used. It contains nine nickel-cadmium alkaline cells whose nominal voltages amount to 11 V, and is inserted into the level meter for operation.

For charging, the plug-in storage battery can be connected to any Schuko three-wire safety plug (110 V to 240 V ac) via a built-in charging circuit.

When S1 is set to the position BATT, the voltage of the plug-in storage battery is applied via a series resistor to the panel meter for indication.

The switches, calibration controls, connecting jacks, indicating instrument and battery holder are mounted on a plastic baseplate (mounting board). The amplifier subassembly with the calibrating oscillator is designed as circuit board joined to the mounting board by means of spacer studs.

The casing of the device consists of the mounting board as front panel, a metal frame and a baseplate. The whole structure is screwed together at the bottom by means of four slotted nuts.

To facilitate reading, the device can be tilted by 25° from the horizontal position by means of a metal handle to be swung out of the baseplate.

IV. INSTRUCTIONS FOR USE AND NOTES ON MAINTENANCE

Figs. 1 and 5

1. Preparations

The plug-in storage battery must so be inserted that the pull strap snaps into the corresponding holding spring on the device. Energize the device. For this purpose, switch S2 must be turned clockwise from " ○ "; the black field below the switching knob becomes red.

To check the plug-in storage battery, switch S1 must be set to position BATT; on the neper model, switch S2 may be set to " ∞ " or "Z" (600 Ω), " ∞ ", "Z" (900 Ω). When the indication on the instrument is below the black bar BATT or if it visibly drops when switch S1 is set to " ▼ ", the battery is nearly empty.

For charging, the plug-in storage battery must be pulled out of the level meter and plugged into a Schuko three-wire power outlet (110 to 240 V ac). For charging on an ac mains with other connector types, a Schuko coupling block is supplied to which any other type of plug can be connected by way of an intermediate line. The time required to fully charge the

nickel-cadmium cells of a plug-in storage battery Type D 466 depends on the mains voltage available.

Charging times

Mains voltage in V	Charging time to fully charge a nearly empty battery, approx. hours	Charging time after approx. 40 hours of discharging, approx. hours	Max. permissible exceeding of the charging time approx. hours
110	42	16	30
130	36	14	25
220	21	8	15
240	19	7	14

Exceeding of the specified charging time may lead to damage of the nickel-cadmium cells. If the condition of the battery is not known, the charging time can nevertheless be

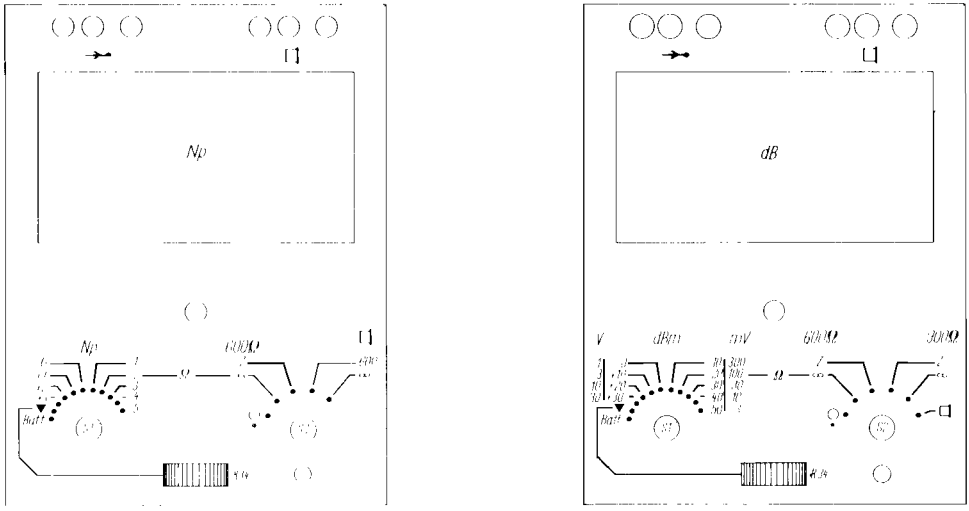


Fig. 5 Front view, at the left: neper model
at the right: decibel model

chosen according to the above table (column "charging time after approx. 40 hours of discharge), provided that at least 12 hours have elapsed after completion of the last charging process.

When the plug-in storage battery is fully charged, the level meter can be continuously operated for 50 hours.

For the measurement it is recommended to use shielded, balanced cords (depending on connecting possibilities) with either three-pole, shielded connectors at both ends (e.g., Type Rel ltg 546) or with individual banana plugs at one end (e.g., Rel ltg 703).

2. Calibration

Set switch S1 to position " ▼ ".
Switch S2 may be set to any operating position except " ⊔ ". By means of control R34 set the pointer of the instrument to the calibration mark " ▼ ".

3. Measuring

a. Level and Voltage Measurements

Choose the input resistance by means of switch S2 depending on the type and termination of the specimen to be measured.

In the position Z = 900 Ω (only with the decibel model) all level values refer to the power level of 0 dBm = 1 mW across 900 Ω. In the normal case Z = 600 Ω, the power and voltage levels are equal.

If the magnitude of the level under test is unknown, set switch S1 first to the most insensitive range of +30 dBm or +3 Npm. Then apply the signal to the input jacks "→•", and turn switch S1 towards greater sensitivity until a well-readable value is indicated on the instrument. The measured value is obtained by adding up the values shown on the scale and set on switch S1. In adding take into account the algebraic sign.

To measure voltage on the decibel model, proceed as with the level measurement.

The position of switch S1 indicates (in V or mV) the measured value for full-scale meter deflection. Read parts thereof on the 0 to 100 or 0 to 30 scale.

b. Application as Detector or Audio Amplifier

Apply the ac voltage to be amplified to input jack "→•". Set switch S2 to " ∞ " or "Z" (600 Ω).

Increase the gain by means of switch S1 and control R34 only to such an extent that the pointer of the instrument is still within the scale range. The amplifier is then not overloaded and the output voltage not distorted.

Now, switch S2 must be set to " ⊓ " and another earphone or measuring instrument (e.g., an oscilloscope) connected to the jacks " ⊓ ". With termination into 600 Ω the maximum gain amounts to approx. 30 dB (3 Np).

Since the instrument is short-circuited when switch S2 is set to position " ⊓ ", the level meter, when used as an audio amplifier, can be overloaded without damaging the instrument.

c. Impedance Measurements

Together with the level oscillator Type W 330 even impedance measurements can be carried out with the level meter D349.

Calibrate the level meter as described in section 2.

Now, set switch S1 on the level meter Type D349 to "-2 Np" (-20 dBm/100 mV), and switch S2 to "∞ -Ω".

On the level oscillator Type W 330 set the level range switch S3 to the CW stop "10,000 Ω".

Connect the specimen to jack " Ω " of the level oscillator. Connect the oscillator output and the level meter input by means of a balanced, shielded line (see chapter VII).

Turn switch S3 of the level oscillator back towards "100 Ω" until the panel meter indicates as well readable deflection. The Ω-values set on S3 indicate the respective full-scale values. Further details are contained in the description of the level oscillator.

Note: In order not to discharge the plug-in storage battery more than necessary, the level meter must be turned off immediately after completion of the measurement. To do this, switch S2 must be turned to " ◯ "; the red field then becomes black.

4. Notes on Maintenance

The nickel-cadmium cells in the plug-in storage battery are gas-tight and need no maintenance. They withstand approximately 300 charging cycles which, when properly done (see Instructions for Use) amount to approximately 10,000 operating hours. When the storing capacity goes noticeably down, the battery needs early renewal. The simplest way is to use a spare storage battery and to return the old slide-in chassis to the factory for repair. However, it is not difficult either to exchange the cadmium cells of the plug-in storage battery. The relevant instructions are contained in chapter V (Fault Location and Fault Elimination), section 7. Instructions, how to examine the charging circuit of the battery unit, are contained in section 5a of the same chapter.

Plug-in storage batteries which are not discharged in the device should be recharged every 12 months; this safeguards the usability of the cells.

The switches contained in the level meter are self-cleaning, requiring no special maintenance. They must not be treated with any fatty or fat-dissolving agents (including all commercially available protective and cleaning agents for contacts).

V. FAULT LOCATION AND FAULT ELIMINATION

Figs. 1,4, 5, parts list, circuit diagrams and wiring diagrams

Note: The level meter Type D 349 is double-shielded. The "inner" shield, which is connected to the b-wire of input jacks "→•", is made up of the inner shielding plate, the metal casing for the plug-in storage battery and an insulated metal foil applied to the rear panel.

The "outer" shield, which is connected to the c-wire of input jacks "→•" consists of the front panel, the metal sheet covering and the rear panel of the casing.

These two shields must not be interconnected.

1. Visual Inspection

Often, trouble spots can be detected by a mere visual inspection.

For this purpose the device must be opened:

The slotted nuts countersunk in the rubber feet at the bottom of the level meter must be screwed out. Remove the cover and the molded plastic frame. Now the circuit board can be swung out and the circuit is well accessible for locating and eliminating faults.

All joints must be checked as to their stability by means of tweezers. Carefully check the connecting cable of the circuit board.

2. Contact Fault Location by Means of an Earphone

Connect an earphone (= 2000 Ω) to the jacks " ⊓ " of the energized device (switch S2 must be set to " ⊓ "), and track down contact faults by tapping the circuitry. If the fault appears only very vaguely, an amplifier (e.g., an efficient D 349 device or another level meter with amplifier output) may be put into circuit between the faulty level meter and earphone.

In the various positions of level range switch S1 only certain parts of the circuit are active.

The fault can be tracked down by suitable selection of the switch positions.

a. Switch S1 must be set to " ▼ ", switch S2 to " ⊔ ". The earphone must be plugged into the jacks " ⊔ ". The following units will then be active: calibrating oscillator, 1st divider, preamplifier, 2nd divider and detector amplifier with all transistors Ts1 to 6.

b. Apply the measuring voltage (frequency in the range of audibility) to the input jacks " →← ", set S2 to " ∞ ", and establish about full-scale deflection by means of S1; then plug the earphone into the jacks " ⊔ " and set S2 to " ⊔ ". Now the input circuit and all sections of the circuit stated under a., except for the calibrating oscillator, are in operation.

Of great help in contact-fault location is use of the contact fault locator, Type K 53. It even allows accurate detection of sudden level changes as small as 0.01 dB (0.001 Np).

3. Fault Location by Means of Measuring Instruments

Faults can best be tracked down by means of measurements. Therefore, important measuring points have been entered in the circuit diagrams and the associated measuring data in a table. With these circuit diagrams and the subsequent testing and repair instructions, locating and tracking down of faults is facilitated.

Measuring instruments required:

High-impedance multi-range measuring instrument for dc ($\geq$ 50 kΩ/V),
e.g., Siemens µA-Multizet meter . . . . . Ms List No. 231252
Level oscillator of high level accuracy,
(±0.1 dB or ±0.01 Np), e.g. . . . . Type W 25
or level oscillator . . . . . Type W 217
together with calibrating level meter, e.g. . . . . Type D 322
Level meter
with input impedance $\leq$ 100 kΩ, e.g., ... Types D 342, D 349
or high-impedance voltmeter, e.g., ... Type U 133

4. Fault Location

Note: To protect the transistors, disconnect the soldering iron from the mains while actually soldering.

a. In position BATT of switch S1: no indication, or indication too low.
In position " ▼ " of switch S1 the indication slowly decreases:

Charge the plug-in storage battery as described in the Instructions for Use. If the indication still is faulty, check the plug-in storage battery slide-in chassis according to the testing instructions of section 5a.

b. The indication cannot be adjusted to 0 dBm (0 Npm) when switch S1 is in position " ▼ ":

Apply standard level 0 dB $\hat{=}$ 0,775 V to jack " ⟶ ". Switch S1 must be set to 0 dB (0 Np), switch S2 to ∞ (Z = 600 Ω).

If, now, the indication can be set to 0 dB (0 Np), check the calibrating oscillator according to section 5b.

If the indication cannot be set to 0 dB (0 Np), check whether approximately -23 dB (-2,3 Np) can be measured at the amplifier output " ⊏| " by means of the level meter. Switch S2 must be set to " ⊏| " for this purpose.

If the value measured is correct, check the detector circuit according to section 5d.

If the value measured heavily deviates from the nominal value, check the amplifier according to section 5c.

5. Testing Instructions

a. Plug-in Storage Battery

Remove the screw at the top (pull strap) and pull off the cap. Then disconnect the battery at one side (Fig. 6) and solder a 600-Ω resistor (= 1/4 W) to the dc output (small jacks).

Note: First check the resistor with an ohmmeter; soldering must be done carefully. Were the battery disconnected and the dc output open, the full mains voltage would appear across rectifier Gr2. Connect the slide-in chassis to a 220-V mains and measure the voltage across this 600-Ω resistor by means of a high-resistance multirange measuring instrument.

Caution: Measuring point may carry full mains voltage with respect to ground!

Approximately 10 V must be measured. If a different indication is obtained, proceed as follows:

Disconnect the plug-in storage battery from the mains. Check the individual rectifiers roughly by means of an ohmmeter. With the Siemens µA-Multizet meter a resistance of approx. 50 kΩ should be measured in the forward direction of an undamaged rectifier in the position "Ω x 1000"; in the backward direction the pointer must not be deflected at all. If a rectifier proves to be damaged, check the capacitor C1, as a safety measure, for a short circuit and replace it, if necessary.

If the charging unit proves to be in order, replace the battery according to section 7.

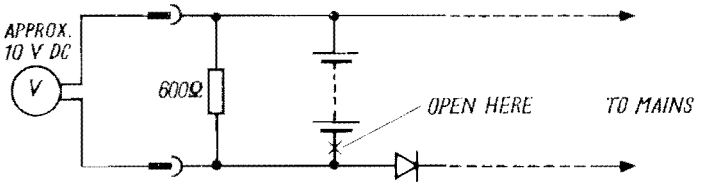


Fig. 6 Checking the charging unit

b. Calibrating Oscillator

Set the level range switch S1 to " ▼ ". Measure the dc supply voltage at measuring point (15) and the emitter dc voltage at measuring point (17). AC measurements at the measuring points (16) and (18) are to be carried out by means of a high-impedance level meter (e.g. Type D 349) or wideband voltmeter (e.g. Type U 133). Low voltages, for example, may be due to a defective transistor. Usually a faulty transistor can be detected by means of the above-mentioned dc measurements. Incorrect ac values may also be obtained when the limiting diode Gr5 does not operate properly.

The oscillator shall operate between approximately 2.0 and 2.7 kHz. Connect a frequency counter or frequency meter to measuring point (18). Concentrate the fault search on frequency-determining parts (such as transformer Ü1, capacitor C26) and their connections. Determine interturn shorts and interruptions on Ü1 by means of dc resistance measurements according to the instructions given in the parts list.

In the connection plan also to section 9 in order to correctly set the calibrating voltage.

c. Preamplifier and Detector Amplifier

For dc measurements the level range switch S1 must be set to "0", the function switch S2 to "Z = 600 Ω". Measure the dc voltage with respect to the b-wire by means of a high-resistance multi-range measuring instrument (e.g., the Siemens µA-Multizet meter) at the terminals designated (2) to (13) in the circuit diagrams. If the measurement obtained deviates from the values specified, check the components surrounding the measuring point and exchange the transistor, if necessary.

For ac measurements apply a level of -50 dB (-5 Np) to the input jacks and set switch S1 accordingly. Set switch S2 to " ∞ ", (Z = 600 Ω). Measure, with a high-impedance level meter (e.g. Type D 349) or voltmeter (e.g. Type U 133) the ac voltages with respect to the b-wire at the terminals (1) to (14) (in the case of (14) switch S2 must be set to " ⊓| "). In this way the signal can be tracked all the way to the output. When the values measured are wrong, check the surroundings of the measuring point.

If the measured values comply with those specified, set switch S1 to the input level "0 dB" (0 Np) and apply this level to the input jacks.

If, now, no correct indication "0 dB (0 Np)" is obtained on the instrument, check the 1st divider (R4, C5, R5) and the 2nd divider (R21 to R26).

d. Detector Circuit

Set the level range switch S1 to " ▼ ". Switch S2 may be set to any position except " ⊓| ". Now connect a high-impedance level meter or voltmeter to measuring point (13) . If the indication is correct on this instrument but not on the panel meter, look for the fault at the rectifiers (Gr3, 4), capacitors C23, 24, or resistor R44. The rectifiers can be checked by means of the µA-Multizet meter in position "Ω x 1000". In this measurement an inverse resistance of ≧ 500 kΩ and a forward resistance of some kΩ should be obtained. By way of trial replace the capacitors (see the parts list).

6. Aligning Instructions

a. Setting the Calibrating Voltage

Apply the standard level 0 dB ≙ 0 Np ≙ 0,775 V to the input jacks " → ● ".
Set the function switch S2 to " ∞ " (Z = 600 Ω).
Set the level range switch S1 to "0" dB (Np).

With the calibrating potentiometer R34 (front panel, see Fig. 5) adjust the pointer deflection on the instrument to exactly "0 dB (0 Np)". Now turn switch S1 to " ▼ " and set the pointer of the instrument by means of the trimmer potentiometer R47 (on circuit board of the amplifier subassembly Type 35-D 465c or d in the output divider of the calibrating oscillator) again to exactly "0 dB (0 Np)". For this alignment it may be necessary to resolder the links from a to b and c to d to a-c and b-d.

The alignment can be checked by setting S1 back to "0 dB (Np)".

b. Aligning and Checking the Amplitude/Frequency Response

At low frequencies:

Set the level oscillator (e.g. Type W 217) to 30 Hz, 0 dB (Np), Zi = 0 Ω, and connect it to the level meter input jacks " →● ".

Set the level range switch S1 of the level meter to be tested to "0 dB (Np)", and the function switch S2 to " →● " (Z = 600 Ω).

Adjust the pointer of the measuring instrument to the 0-dB (Np) mark by means of potentiometer R34 (on the front panel).

Switch the frequency on the level oscillator to 1 kHz. The pointer deflection should now be between 0 and 0.1 dB (+0.01 Np). If necessary, effect subsequent adjustment by means of potentiometer R39 (on circuit board of the amplifier subassembly Type 35-D 465).

Note: The alignment by means of R39 affects the alignment previously effected at 30 Hz by means of R34. Therefore the alignment by means of R39 and R34 must be carried out alternatively several times until the specified values are obtained.

At high frequencies check the deviations:

Connect the level oscillator to the level meter as described under the heading "low frequencies", and set a frequency of 1 kHz.

Set the switch on the level meter as described above.

Set the pointer of the instrument to the "0"-dB (Np) mark by means of potentiometer R34 (on the front panel).

Now vary the frequency on the level oscillator to values up to 30,000 Hz.

Permissible deviations: from 300 Hz up to 4 kHz: ±0.05 dB (±0.005 Np)
up to 30 kHz: ±0.2 dB (±0.02 Np)

Measurements at other level values

The aligning steps and checking measurements must also be carried out at levels between +30 dB (+3 Np) and -50 dB (-5 Np). The same tolerances apply as in the range of 0 dB (0 Np).

7. Replacing the Nickel-cadmium Battery

Remove the screw at the top (pull strap) and pull off the cap. Unsolder the upper battery lead. Then loosen the strap with which the battery and capacitor C1 are fastened to the holding clamp. Tilt the battery slightly away from the holding clamp and pull it out of the socket. Now the lower battery lead can be unsoldered. The new battery (manufacturer DEAC, order No. C44153-Z2-C1) must be inserted in the reverse order.

VI. TYPES, DIMENSIONS AND WEIGHTS

Description	Type	Dimensions in mm	Approx. Weight in kg
Level Meter (30 to 30,000 Hz)			
-60 to +30 dB (dBm)	S45034-D349-B302 Rel 3 D 349b1b+	127x163x87	1.3
-6 to +3 Np	S45034-D349-B402 Rel 3 D 349b1a+	127x163x87	1.3
Accessories			
1 Schuko three-wire coupling block	C42334-Z3-C31	54x60	0.1

Description	Type	Dimensions	Approx. Weight in kg
Required for operation			
1 plug-in storage battery . .	S45035-D466-A703 Rel 35 D 466+	106x39x28	0.2
Depending on requirements			
1 leather case	S45034-B17-A703 Rel 3 B 17+	185x150x100	0.4
1 connecting cord	Rel ltg 546a-d	500 to 2000	0.2
or	Rel ltg 703d-h	1000 to 3000	0.2
1 reserve plug-in storage battery	S45035-D466-A703 Rel 35 D 466+	106x39x28	0.2

Description	Type	Dimensions	Approx. Weight in kg
1 portable case for level meter and level oscillator .	S45034-B16-A701 Rel 3 B 16+	326x280x119	1.6
1 level oscillator (200 to 4000 Hz) -4.7 to 0.7 Np	S45034-W330-B402 Rel 3 W 330a2a+	127x163x87	1.3
or			
1 level oscillator (200 to 4000 Hz) -46 to +6 dB(m)	S45034-W330-B302 Rel 3 W 330a2b+	127x163x87	1.3

+ former order No.

EXPLANATION

Under the heading Symbol the abbreviations used in the circuit diagrams have been stated in alphabetical and, as far as possible, numerical order. Quantity denotes the number of equal component parts contained in a device or subassembly. The description column states the name of the component part as well as its principle characteristic dara.

There denote, for example,

in connection with a resistor: 300 kΩ ±5% 0.5 W

300 kΩ	nominal value of the resistance
±5%	tolerance of the nominal resistance
0.5 W	load rating as referred to an ambient temperature of 20°C

with a capacitor: 1000 pF ±20% 125 V

1000 pF	nominal value of capacitance (1 pF = 1 µµF = 10^{-12} F)
±20%	tolerance of the nominal capacitance
125 V	permissible operating dc voltage

with a semiconductor: I_D > 4 mA, U_{Sp} > 50 V;

I_D	forward current at +1 V
U_{Sp}	inverse voltage rating

with a transformer: Wicklg. I (1a, 2a)
725 Wdg 0.3 CuL 25 Ω

Wicklg. II (4b, 5b, 6b)
165 Wdg 0.5 Cu2L 2.7 Ω
Abgriff (5b): 138 Wdg

Wicklung I, 725 Wdg

(1a, 2a)	725 turns, beginning at soldering lug 1a, ending at 2a
0.3 CuL	of copper wire (Cu); diam. 0,3 mm; enameled (L)
25 Ω	dc resistance of winding I

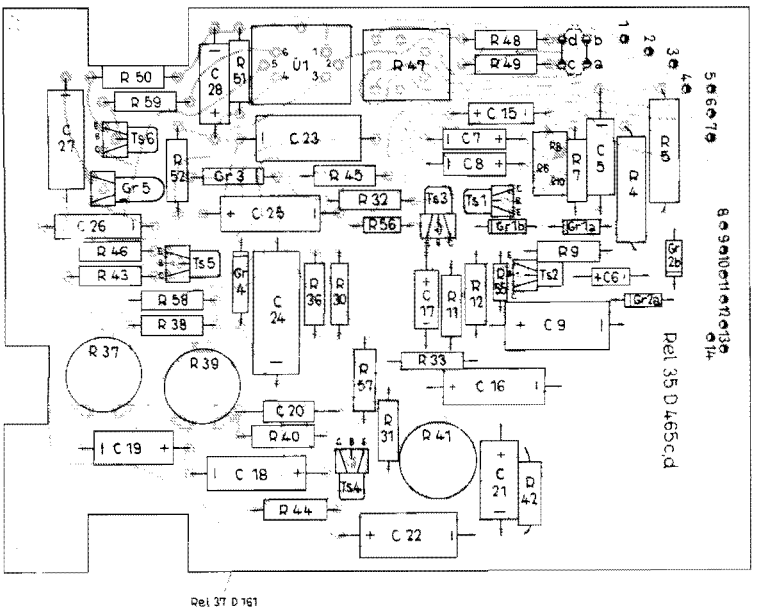
Wicklung II, 165 Wdg

(4b, 5b, 6b)	165 turns, beginning at soldering lug 4b, ending at 6b
0.5 Cu2L	of copper wire (Cu); diam. 0,5 mm; double-enameled (2L)
2.7 Ω	dc resistance of winding II
Abgriff (5b): 138 Wdg	tap at soldering lug 5b at turn No. 138

Symbol	Qty.	Description	Order Designation	Page
	1	Amplifier subassembly		
	for model Rel 3 D 349b1a		Rel 35 D 465c	
	for model Rel 3 D 349b1b		Rel 35 D 465d	
	1	Divider subassembly		
	for model Rel 3 D 349b1a		Rel 35 D 492a	
	for model Rel 3 D 349b1b		Rel 35 D 492b	
	1	Plug-in storage battery	Rel 35 D 466	
	for model Rel 3 D 349b1a, 1b			
C3	1	MKL capacitor 1 µF 250 V	B32110-D2105-M	
J	1	Moving-coil pointer instrument, round form	V70349-A576-A6	
		Layer-type resistor		
R1	1	600 Ω ±0.5%, 1.5 W	B54416-A9601-D000	
R3	1	390kΩ ±5%, 0.25W	B51263-A2394-j	
R35	1	145Ω ±2%, 0.25W	B51263-A2141-G5	
R53	1	350kΩ ±2%, 0.33W	B51264-A2354-G	
R34	1	Layer-type resistor 150Ω +20/-30%, 0.1W	W40951-C8151-M001	
S1	1	Midget rotary switch	C44315-A12-A40	
S2	1	Rotary switch	C40315-M302-B2	
	for model Rel 3 D 349b1b			
		Layer-type resistor		
R2	1	900 Ω ±0.5%, 1W	B54415-A9901-D000	
R54	1	2.152kΩ ±1%, 0.1W	B51263-A9212-F52	
	Always required for operation:			
	1	Plug-in storage battery	Rel Sk 35 D 466	
	1	Schuko three-wire coupling block	C42334-Z3-C31	

for model 35 D 465c, d

		Electrolytic capacitor	
C 6	1	2,2µF/20V	B55170-A3225-M
C 7	1	10µF/10V	B45170-A1106-M
C 8	1	22µF/15V	B45170-A2226-M
C 9	1	50µF/15V	B41931-A4506-S
C 18	1	10µF/15V	B41951-A4106-S
C 19	1	5µF/15V	B41951-A4505-S
C 21	1	5µF/15V	B41951-A4505-S
C 22	1	50µF/6V	B41951-A2506-S
C 25	1	10µF/15V	B41951-A4106-S
C 28	1	5µF/15V	B41951-A4505-S
C 26	1	MKH-capacitor	B32220-K3103-M
		0,01µF 250V	
		MKL capacitor	
C 23	1	2,2µF ±20%, 63V	B32110-E9225-M
C 24	1	3,3µF ±20%, 63V	B32110-E9335-M
C 27	1	1µF ±20%, 63V	B32110-E9105-M



Amplifier subassembly, Rel ms 35 D 465c, d (Issue 1)

C 20	1	Styroflex capacitor	B51861-B1206-F
C 17 C	1	Tantalum electrolytic capacitor 15µF/15V	B45170-J2156-M
Gr 1a, b Gr 2a, b	4	Diode I_D = 115mA; E_{Sp} = 25V	BAY 60
Gr 3, 4	2	Germanium diode I_D = 6mA; E_{Sp} = 15V	OA 160 (Telefunken)
Gr 5	1	Zener diode I_Z = 20mA; r_Z = 1.2Ω; E_Z = 7V	Q62604-K7-B
		Metal film resistor	
R 4	1	250kΩ ±2%; 0.5W	MEAD 0.5 W 0.5 DIN 0.2%
R 46	1	612.5Ω ±0.5%; 0.15W	250 K TK50 W40135-B9611-D251
		Layer-type resistor	
R 6	1	75kΩ ±5%; 0.25W	B51263-A2753-J
R 7	1	20kΩ ±5%; 0.25W	B51263-A2203-J
R 8	1	270kΩ ±5%; 0.25W	B51263-A2274-J
R 9	1	560Ω ±5%; 0.25W	B51263-A2561-J
R 10	1	2.4kΩ ±5%; 0.25W	B51263-A2242-J
R 11	1	25kΩ ±5%; 0.25W	B51263-A2253-J
R 12	1	6kΩ ±5%; 0.25W	B51263-A2602-J
R 30	1	10kΩ ±5%; 0.25W	B51263-A2103-J
R 31	1	5.1kΩ ±5%; 0.25W	B51263-A2512-J
R 32	1	18kΩ ±5%; 0.25W	B51263-A2183-J
R 33	1	2.2kΩ ±5%; 0.25W	B51263-A2222-J
R 36	1	10kΩ ±5%; 0.25W	B51263-A2103-J
R 38	1	56kΩ ±5%; 0.25W	B51263-A2563-J
R 40	1	9kΩ ±2%; 0.25W	B51263-A2902-G
R 42	1	3.9kΩ ±5%; 0.25W	B51263-A2392-J
R 43	1	6kΩ ±5%; 0.25W	B51263-A2602-J
R 44	1	41kΩ ±2%; 0.25W	B51263-A2413-G
R 45	1	570Ω ±1%; 0.1W	B51263-A9571-F
R 48	1	80Ω ±1%; 0.1W	B51263-J9800-F
R 49	1	220Ω ±1%; 0.1W	B51263-A9221-F
R 50	1	680Ω ±5%; 0.25W	B51263-A2681-J
R 51	1	3.9kΩ ±5%; 0.25W	B51263-A2392-J
R 52	1	15kΩ ±5%; 0.25W	B51263-A2153-J
R 57, 58, 59	3	100Ω ±5%; 0.25W	B51263-A2101-J
R 55, 56	2	560Ω ±5%; 0.15W	B51263-A2561-J

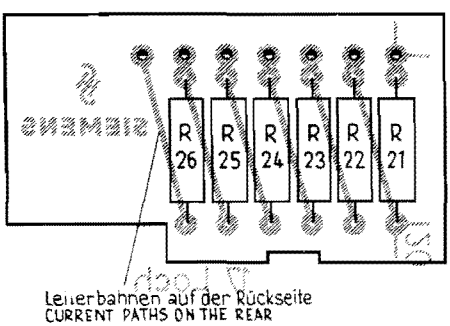
		Layer-type variable resistor	
R37	1	50kΩ +20/-30%; 0.1W	W40100-B8503-M001
R39	1	1kΩ +20/-30%; 0.1W	W40100-B8102-M001
R41	1	2kΩ +20/-30%; 0.1W	W40100-B8202-M001
R47	1	Wire-wound variable resistor 100Ω ±5%;	W40203-A8101-J008
Ts 1 to 6	6	Transistor	Q60203-Y58-J
Ü 1	1	Oscillator transformer Wicklg. I (5,3) 800 1/2 Wdg. 0.07 CuL 110Ω 290-350mH Wicklg. II (4,6) 65 Wdg. 0.10 CuL 5.5Ω Ü II/III = 1.97 ±2% Wicklg. III (2,1) 33 Wdg. 0.10 CuL 3.0Ω 0.48-0.61 mH	Rel Bv 622 W 3018
	for model Rel 35 D 465c		
R5	1	Metal film resistor 2.55kΩ ±0.2%; 0.5W	MEAD 0.5 W 0.5 DIN 0.2% 2.55k TK50
C5	1	Styroflex capacitor 150pF 160V	B31861-B1151-K
	for model Rel 35 D 465d		
R5	1	Metal film resistor 2.55kΩ ±0.2%; 0.5W	MEAS 0.5 W 0.5 DIN 0.2% 2.55k TK50
C5	1	Styroflex capacitor 100pF 160V	B31861-B1101-K

for model Rel 35 D 492a

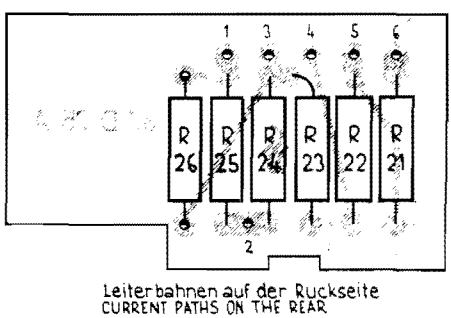
		Metal film resistor	
R21	1	343Ω ±0.5%; 0.15W	W40135-B9341-D301
R22	1	415Ω ±0.5%; 0.15W	W40135-B9411-D501
R23	1	153Ω ±0.5%; 0.15W	W40135-B9151-D301
R24	1	56.1Ω ±0.5%; 0.15W	W40135-B9560-D101
R25	1	20.67Ω ±0.5%; 0.15W	W40135-B9200-D671
R26	1	12.03Ω ±0.5%; 0.15W	W40135-B9120-D031

for model Rel 35 D 492b

		Metal film resistor	
R21	1	684Ω ±0.5%; 0.15W	W40135-B9681-D401
R22	1	216Ω ±0.5%; 0.15W	W40135-B9211-D601
R23, 24	1	68.4Ω ±0.5%; 0.15W	W40135-B9689-D401
R25	1	31.6Ω ±0.5%; 0.15W	W40135-B9310-D601
R26	1	46.24Ω ±0.5%; 0.15W	W40235-B9460-D241

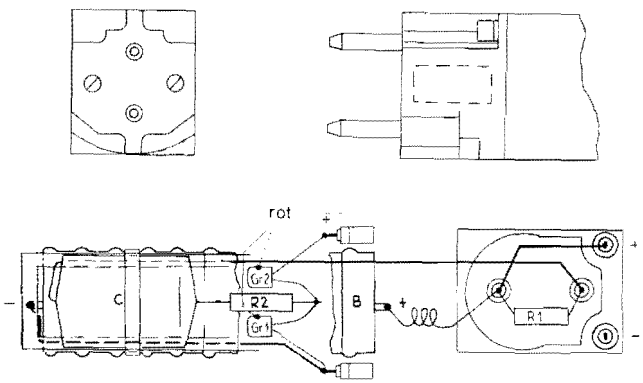


Divider subassembly
Rel ms 35 D 492a (Issue I)



Divider subassembly
Rel ms 35 D 492b (Issue II)

B	1	Battery 9/225 DIX (DEAC) with shrinking tubing and soldering lug	C44153-Z2-C1
C1	1	MKH capacitor 0.56 µF ±400 V	B32231-A6564-M
Gr 1, 2	2	Selenium point-type rectifier 37.5V dc/20mA	V23201-F1217
		Layer-type resistor	
R1	1	1MΩ ±5%; 0.33W	B51264-A2105-J
R2	1	150Ω ±5%; 0.33W	B51264-A2151-J



Plug-in storage battery
Rel ms 35 D 466 (Issue 7)

Gleichspannungs-Meßpunkte:

Schalter S1 auf "▼", Schalter S2 auf "600 Ω"

Messen mit "µA-Mittlast": Meßpunkt ○ gegen b-Ader

Betriebsspannung am Steck-Akkumulator: 10 V-

Wechselspannungs-Meßpunkte in Np, dB oder mV_{eff}:

Pegelsender (z.B. Rel 3 W 25) mit Eingang "-o-o-" des Prüflings verbinden

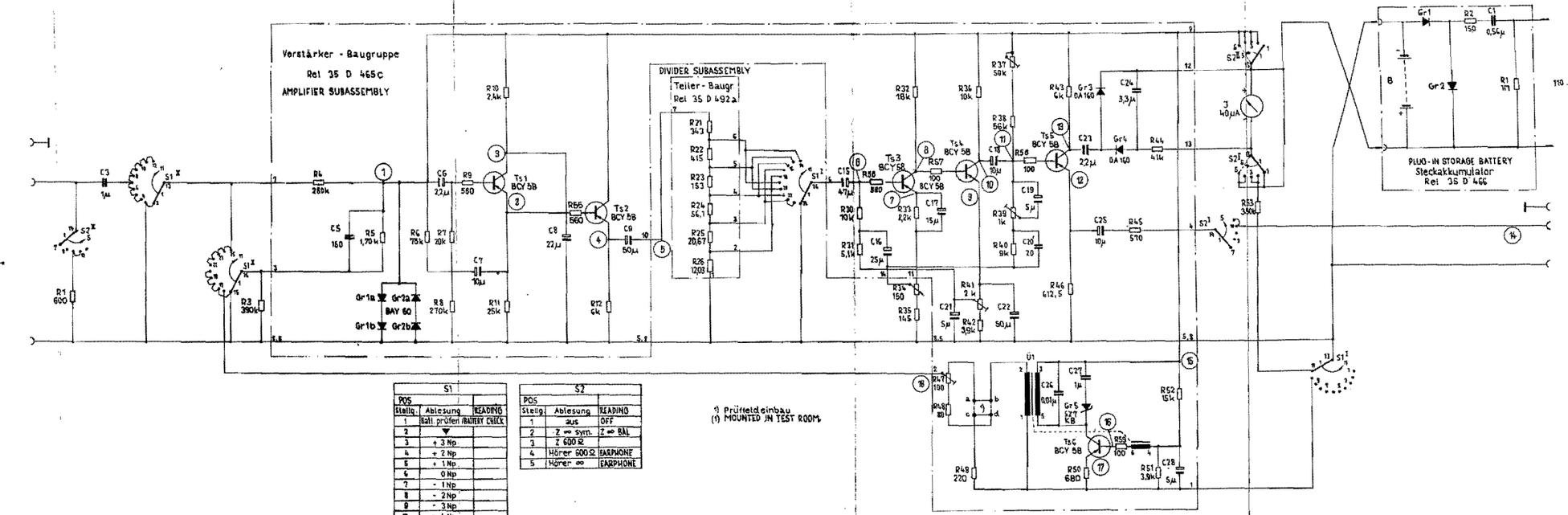
Sender in Stellg. -5 Np (-50 dB), Rl = 0, f = 1 kHz

Prüflings Schalter S1 auf "-5 Np (-50 dBm)", Schalter S2 auf "Z = ∞ (600-Ω)"
mit R34 Anzeige am Instrument auf Marke "0 Np (0 dBm)"

Messen mit selektivem Pegelmesser D 349 oder Röhrenvoltmeter D 133 (beide haben gleichstromfreien Eingang) : Meßpunkt ○ gegen b-Ader

Meßpunkte für Gleichsp.	Wechselsp.	Meßwerte (Richtwerte) Np-Gerät bla	dBa-Gerät blb	Bemerkungen
+	①	-5,02 Np ≙ 5,1 mV	-50,17 dB ≙ 2,4 mV	
(2)	-	6 bis 7,5 V		
(3)	-	9 bis 9,5 V		
(4)	-	6 bis 7,5 V		
-	⑤	-5,05 Np ≙ 5 mV	-50,5 dB ≙ 2,3 mV	
-	⑥	-5,46 Np ≙ 3,23 mV	-50,5 dB ≙ 2,3 mV	
(7)	-	0,9 bis 1,1 V		
(8)	-	2,0 bis 3,9 V		siehe Bemerkg. zu Meßpunkt ⑩
(9)	-	2,3 bis 3,0 V		
(10)	-	6 V, mit Regler R61 einstellbar		Abgleich beeinflußt Spannungen an den Meßpunkten ⑦, ⑧, ⑨ !
-	⑪	-1,61 Np ≙ 155 mV	-16,9 dB ≙ 111 mV	
(12)	-	0,6 bis 0,65 V		siehe Bemerkg. zu Meßpunkt ⑬
(13)	-	4 V, mit Regler R37 einstellbar		Abgleich beeinflußt Spannung an Meßpunkt ⑫ !
+	⑬	+0,05 Np ≙ 812 mV	-0,1 dB ≙ 760 mV	
-	⑭	-2,3 Np ≙ 77,5 mV	-23 dB ≙ 55,2 mV	Schalter S2 auf "□", Abschluß 600 Ω
(15)	-	10 V		wie Betriebsp.an Steck-Akkumulator
-	⑯	-1,17 Np ≙ 239 mV	-10,7 dB ≙ 226 mV	Schalter S1 auf "▼"
(17)	-	1,0 bis 2,0 V		"
	⑱	+2,0 Np ≙ 10h mV	+20 dB ≙ 77,5 mV	Schalter S1 auf "▼"

Das Auffinden der Meßpunkte erleichtern die Hinweise in den nebenstehenden Stromlaufen Rel str 3 D 349bla und blb sowie das Montageschaltbild Rel str 35 D 465c,d der Leiterplatte der Verstärker-Baugruppe in der Stückliste sowie in Englisch aus Rel str 3 D 349blb



S1		
POS		
Stellg.	Ablesung	READING
1	Batt. prüfen	BATTERY CHECK
2	▼	
3	+ 3 Np	
4	+ 2 Np	
5	+ 1 Np	
6	0 Np	
7	- 1 Np	
8	- 2 Np	
9	- 3 Np	
10	- 4 Np	
11	- 5 Np	

S2		
POS		
Stellg.	Ablesung	READING
1	aus	OFF
2	Z ∞ sym.	Z ∞ BAL
3	Z 600 Ω	
4	Hörer 600 Ω	EARPHONE
5	Hörer ∞	EARPHONE

*) Prüfteldeinbau
(1) MOUNTED IN TEST ROOM

Pegelmesser Np
LEVEL METER Np

Rel str 3 D 349b1a Dt, En

Ausg.1 3.2.67 Fa

Voltage Measuring Points:

ttch S1 to "▼", switch S2 to "600 Ω"

easurement with "pk Multizet meter": Measuring point ○ against b-wire

erating voltage at the plug-in storage battery : 10 V DC

Voltage Measuring Points in db, W, or V_{RMS}

nect the level oscillator (e.g., Type Rel 3 W 25) to the input "•—•" of the spectrum

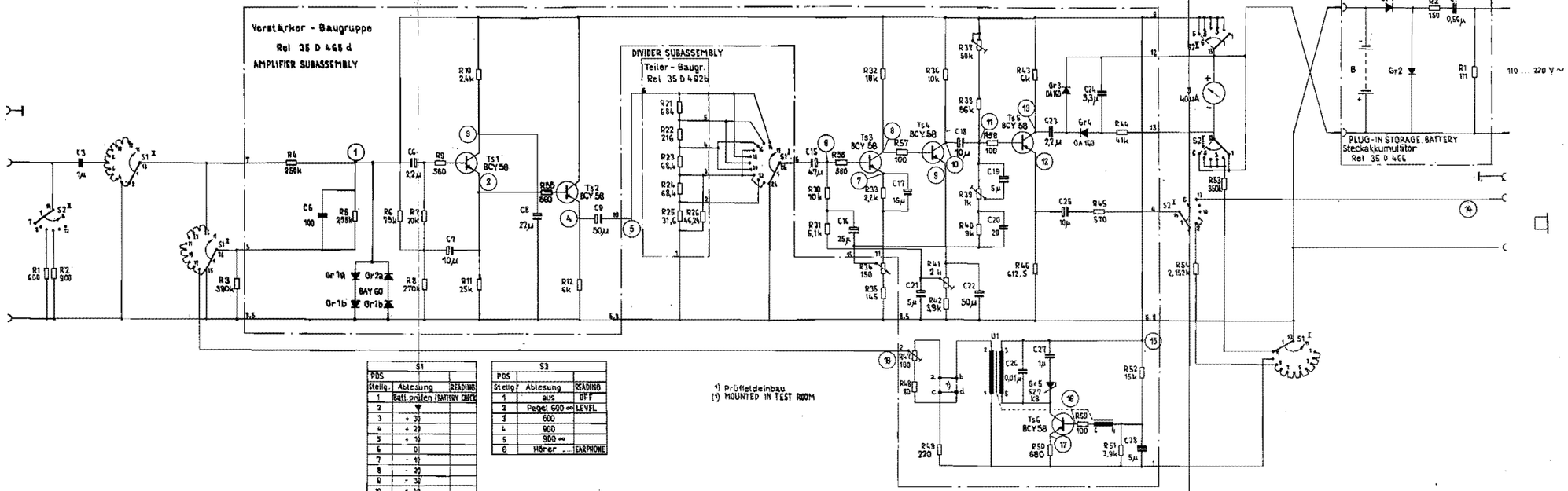
scillator in position -50 db (-5 N), Z_i = 0, f = 1 kc/s

surement: Switch S1 to "-50 db (-5 N)", switch S2 to "2 = ∞ (600 Ω)",
with 83k meter indication to mark "0 db (0 N)"

surement with satisfactory level oscillator Type U 345 or tube voltmeter Type U 133 (both with
free inputs): Measuring point ○ against b-wire

suring Points for vltg.	AC vltg.	Measured Values (Guiding Values) db-model bTb	W model bTa	Remarks
	①	-10,17 db ≙ 2,4 mv	-5,02 N ≙ 5,1 mv	
	-	6 to 7,5 v		
	-	9 to 9,5 v		
	-	5 to 7,5 v		
	⑤	+50,5 db ≙ 2,3 mv	-5,05 N ≙ 5 mv	
	⑥	+50,5 db ≙ 2,3 mv	-5,48 N ≙ 3,23 mv	
	-	0,9 to 1,1 v		
	-	2,0 to 3,0 v		see remark to meas. point ⑩
	-	2,3 to 3,0 v		
	-	6 v, adjustable with control R41		alignment influences voltages at the meas. points ⑦ ⑧ . ⑨
	⑪	+16,9 db ≙ 111 mv	-1,51 N ≙ 155 mv	
	-	0,6 to 0,65 v ~		see remark to meas. point ⑬
	-	4 V, adjustable with R37		Alignment influences voltage at meas. point ⑫
	⑬	+0,1 db ≙ 750 mv	+0,15 N ≙ 812 mv	
	⑭	+23 db ≙ 55,2 mv	+ 2,3 N ≙ 77,5 mv	switch S2 to "□", 600-Ω termin
	-	10 V		same as the operating voltage at the plug-in storage battery
	⑮	+10,7 db ≙ 226 mv	-1,17 N ≙ 239 mv	switch S1 to "▼"
	-	1,0 to 2,0 v		"
	⑯	+20 db ≙ 77,5 mv	+2,0 N ≙ 104 mv	switch S1 to "▼"

ding of the measuring points is facilitated by the remarks in the circuit diagrams Rel str 3 D 349b1a and b1b and
pining diagram Rel ae 35 D 465c,d given in the parts list for the conductor board of the amplifier subassembly.
alle in Deutsch siehe Rel str 3 D 349b1a



S1		
POS		
Stellg.	Ablesung	READING
1	Batt. prüfen	BATTERY CHECK
2	▼	
3	+ 30	
4	+ 20	
5	+ 10	
6	0	
7	- 10	
8	- 20	
9	- 30	
10	- 40	
11	- 50	

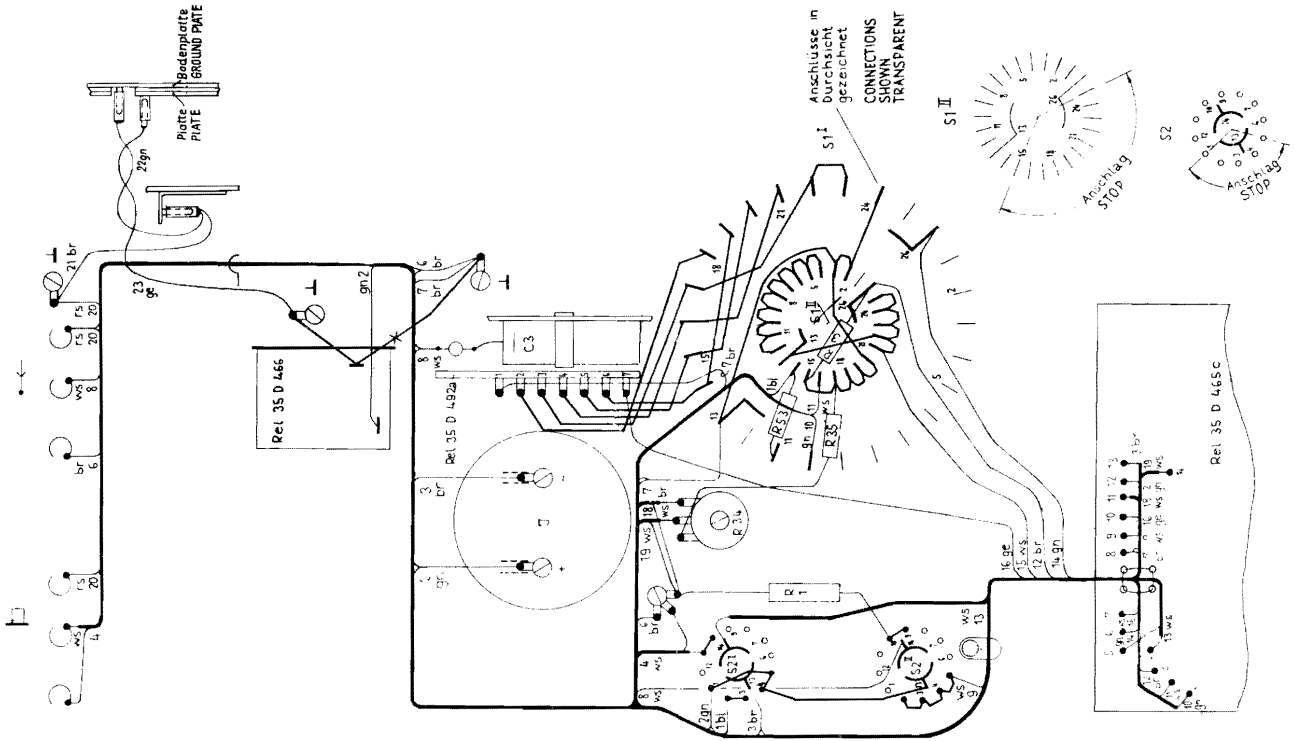
S2		
POS		
Stellg.	Ablesung	READING
1	aus	OFF
2	Pegel 600 ∞	LEVEL
3	600	
4	900	
5	900 ∞	
6	Hörer ...	EARPHONE

*) Prüffeldeinbau
(*) MOUNTED IN TEST ROOM

Pegelmesser dB, dBm
LEVEL METER DB, DBM

Rel str 3 D 349b1b Dt, En

Ausg. 1 3.2.67 Fa



Pegelmesser Np
LEVEL METER Np

Rel ms 3 D 349b1a

Ausg. 1 3.2.67 Fa