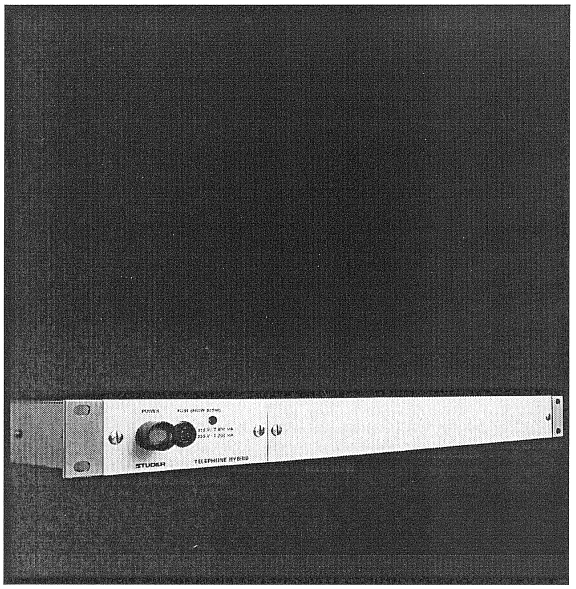
STUDER
professional audio equipment



Studer
Telephone Hybrid

Betriebs- und Serviceanleitung
Operating and Service Instructions
Mode d'emploi et Instructions de service

Prepared and edited by
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A Safety Information

CAUTION RISK OF ELECTRIC SHOCK DO NOT OPEN ATTENTION RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR ACHTUNG GEFAHR: ELEKTRISCHER SCHLAG NICHT ÖFFNEN	To reduce the risk of electric shock, do not remove covers (or back). No user-serviceable parts inside. Refer servicing to qualified service personnel.
	This symbol is intended to alert the user to presence of un-insulated *dangerous voltage* within the equipment that may be of sufficient magnitude to constitute a risk of electric shock to a person.
	This symbol is intended to alert the user to the presence of *important instructions* for operating and maintenance in the enclosed documentation.
CLASS I LED PRODUCT CLASS I LASER PRODUCT	Assemblies or sub-assemblies of this product can contain opto-electronic devices. As long as these devices comply with Class I of laser or LED products according to EN 60825-1:1994, they will not be expressly marked on the product. If a special design should be covered by a higher class of this standard, the device concerned will be marked directly on the assembly or sub-assembly in accordance with the above standard.

A1 First Aid

In Case of Electric Shock:

Separate the person as quickly as possible from the electric power source:
- By switching off the equipment,
- By unplugging or disconnecting the mains cable, or
- By pushing the person away from the power source, using dry insulating material (such as wood or plastic).
- After having sustained an electric shock, *always* consult a doctor.

Warning! ***Do not touch the person or his clothing before the power is turned off, otherwise you stand the risk of sustaining an electric shock as well!***

If the Person is Unconscious:

- Check the pulse,
- Reanimate the person if respiration is poor,
- Lay the body down, turn it to one side, call for a doctor immediately.

B General Installation Hints

Please consider besides these general hints also any product-specific hints in the "Installation" chapter of this manual.

B1 Unpacking

Check the equipment for any transport damage. A unit that is mechanically damaged or that has been penetrated by liquids or foreign objects must not be connected to the AC power outlet or must be immediately disconnected by unplugging the power cable. Repairs must only be performed by trained personnel in accordance with the applicable regulations.

B2 Installation Site

Install the unit in a place where the following conditions are met:

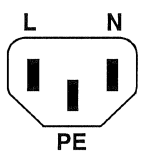
- The temperature and the relative humidity of the environment must be within the specified limits during operation of the unit. Relevant air values are the ones at the air inlets of the unit.
- Condensation must be avoided. If the unit is installed in a location with large variation of ambient temperature (e.g. in an OB-van), feasible measures must be taken before and after operation (for details on this subject, refer to Appendix 1).
- Unobstructed air flow is essential for proper operation. Air vents of the unit are a functional part of the design and must not be blocked in any way during operation (e.g. by objects placed upon them or placement of the unit on a soft support).
- The unit must not be heated up by external sources of heat radiation (sunlight, spot lights).

B3 Earthing and Power Supply

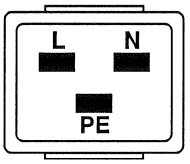
Earthing of units with mains supply (class I equipment) is performed via the protective earth (PE) conductor integrated in the mains cable. Units with battery operation (< 60 V, class III equipment) must be earthed separately.
Earthing the unit is one of the measures for protection against electrical shock hazard (dangerous body currents). Hazardous voltage may not only be caused by a defective power supply insulation, but may also be introduced by the connected audio or control cables.
If the unit is installed with one or several external connections, its earthing must be provided during operation as well as while the unit is inoperative. If the earthing could be interrupted via the power supply (e.g. by pulling the mains plug), an additional, permanent earthing must be installed using the provided earth terminal.
Avoid ground loops (hum loops) by keeping the loop surface as small as possible (by consequently guiding the earth conductors in a narrow, parallel way), and reduce the noise current flowing through the loop by inserting an additional impedance (common-mode choke).

Class I Equipment (Mains Operation)

Should the equipment be delivered without a matching mains cable, the latter has to be prepared by a trained person using the attached female plug (IEC320/C13 or IEC320/C19) with respect to the applicable regulations in your country.
Before connecting the equipment to the AC power outlet, check that the local line voltage matches the equipment rating (voltage, frequency) within the admissible tolerance. The equipment fuses must be rated in accordance with the specifications on the equipment.
Equipment supplied with a 3-pole appliance inlet (protection conforming to class I equipment) *must* be connected to a 3-pole AC power outlet so that the equipment cabinet is connected to the protective earth.
For information on mains cable strain relief please refer to Appendix 2.



IEC 320 / C13



IEC 320 / C19

Female plug (IEC320), front-side view:		*National American Standard:*
L (Live)	Brown	*Black*
N (Neutral)	Blue	*White*
PE (Protective Earth	Green/Yellow	*Green*

Class III Equipment (Battery Operation up to 60 V_{DC})

Equipment of this protection class must be earthed using the provided earth terminal, if one or more external signals are connected to the unit (see explanation at the beginning of this paragraph).

B4 Electromagnetic Compatibility (EMC)

The unit conforms to the protection requirements relevant to electromagnetic phenomena that are listed in the guidelines 89/336/EC and FCC, part 15.

- The electromagnetic interference generated by the unit is limited in such a way that other equipment and systems can be operated normally.
- The unit is adequately protected against electromagnetic interference so that it can operate properly.

The unit has been tested and conforms to the EMC standards of the specified electromagnetic environment, as listed in the following declaration. The limits of these standards ensure protection of the environment and corresponding noise immunity of the equipment with appropriate probability. However, a professional installation and integration within the system are imperative prerequisites for operation without EMC problems.
For this purpose, the following measures must be followed:

- Install the equipment in accordance with the operating instructions. Use the supplied accessories.
- In the system and in the vicinity where the equipment is installed, use only components (systems, equipment) that also fulfill the EMC standards for the given environment.
- Use a system grounding concept that satisfies the safety requirements (class I equipment must be connected with a protective ground conduc-

tor) and that also takes into consideration the EMC requirements. When deciding between radial, surface, or combined grounding, the advantages and disadvantages should be carefully evaluated in each case.

- Use shielded cables where shielding is specified. The connection of the shield to the corresponding connector terminal or housing should have a large surface and be corrosion-proof. Please note that a cable shield connected only single-ended can act as a transmitting or receiving antenna within the corresponding frequency range.
- Avoid ground loops or reduce their adverse effects by keeping the loop surface as small as possible, and reduce the noise current flowing through the loop by inserting an additional impedance (e.g. common-mode choke).
- Reduce electrostatic discharge (ESD) of persons by installing an appropriate floor covering (e.g. a carpet with permanent electrostatic filaments) and by keeping the relative humidity above 30%. Further measures (e.g. conducting floor) are usually unnecessary and only suitable if used together with corresponding personal equipment.
- When using equipment with touch-sensitive operator controls, please take care that the surrounding building structure allows for sufficient capacitive coupling of the operator. This coupling can be improved by an additional, conducting surface in the operator's area, connected to the equipment housing (e.g. metal foil underneath the floor covering, carpet with conductive backing).

C Maintenance

All air vents and openings for operating elements (faders, rotary knobs) must be checked on a regular basis, and cleaned in case of dust accumulation. For cleaning, a soft paint-brush or a vacuum cleaner is recommended.
Cleaning the surfaces of the unit is performed with a soft, dry cloth or a soft brush.
Persistent contamination can be treated with a cloth that is slightly humidified with a mild cleaning solution (soap-suds).
For cleaning display windows, commercially available computer/TV screen cleaners are suited. Use only a slightly damp (never wet) cloth.
Never use any solvents for cleaning the exterior of the unit! Liquids must never be sprayed or poured on directly!
For equipment-specific maintenance information please refer to the corresponding chapter in the Operating and Service Instructions manuals.

D Electrostatic Discharge during Maintenance and Repair

Caution:

Observe the precautions for handling devices sensitive to electrostatic discharge!
Many semiconductor components are sensitive to electrostatic discharge (ESD). The life-span of assemblies containing such components can be drastically reduced by improper handling during maintenance and repair work. Please observe the following rules when handling ESD sensitive components:

- ESD sensitive components should only be stored and transported in the packing material specifically provided for this purpose.
- *When performing a repair by replacing complete assemblies, the removed assembly must be sent back to the supplier in the same packing*

material in which the replacement assembly was shipped. If this should not be the case, any claim for a possible refund will be null and void.

- Unpacked ESD sensitive components should only be handled in ESD protected areas (EPA, e.g. area for field service, repair or service bench) and only be touched by persons who wear a wristlet that is connected to the ground potential of the repair or service bench by a series resistor. The equipment to be repaired or serviced as well as all tools and electrically semi-conducting work, storage, and floor mats should also be connected to this ground potential.
- The terminals of ESD sensitive components must not come in uncontrolled contact with electrostatically chargeable (voltage puncture) or metallic surfaces (discharge shock hazard).
- To prevent undefined transient stress of the components and possible damage due to inadmissible voltages or compensation currents, electrical connections should only be established or separated when the equipment is switched off and after any capacitor charges have decayed.

E Repair

Removal of housing parts, shields, etc. exposes energized parts. For this reason the following precautions must be observed:

- Maintenance may only be performed by trained personnel in accordance with the applicable regulations.
- The equipment must be switched off and disconnected from the AC power outlet before any housing parts are removed.
- Even if the equipment is disconnected from the power outlet, parts with hazardous charges (e.g. capacitors, picture tubes) must not be touched until they have been properly discharged. Do not touch hot components (power semiconductors, heat sinks, etc.) before they have cooled off.
- If maintenance is performed on a unit that is opened and switched on, no un-insulated circuit components and metallic semiconductor housings must be touched, neither with your bare hands nor with un-insulated tools.

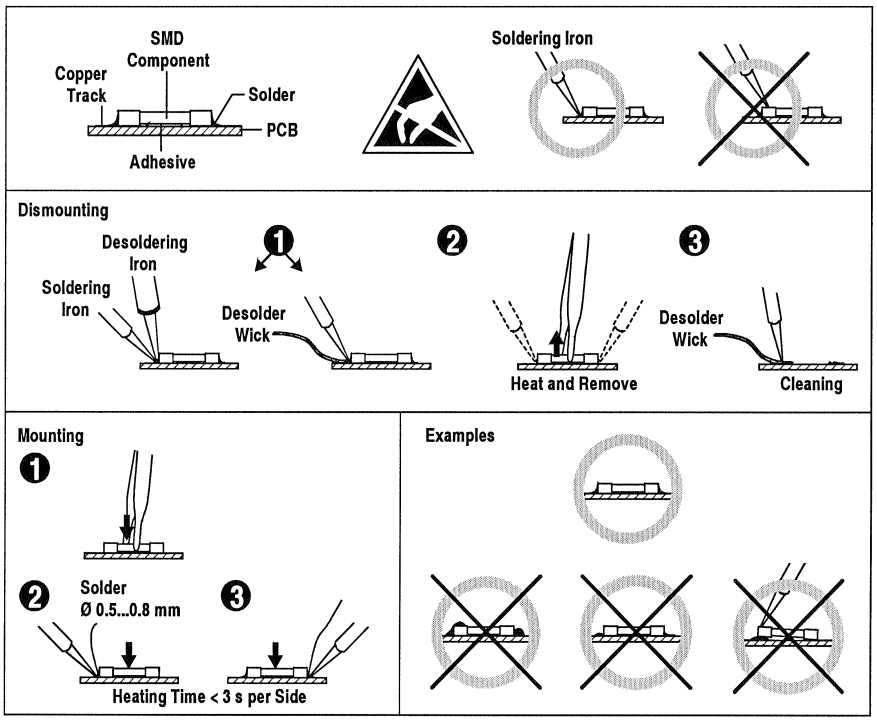
Certain components pose additional hazards:

- *Explosion hazard* from lithium batteries, electrolytic capacitors and power semiconductors (watch the component's polarity. Do not short battery terminals. Replace batteries only by the same type).
- *Implosion hazard* from evacuated display units.
- *Radiation hazard* from laser units (non-ionizing), picture tubes (ionizing).
- *Caustic effect* of display units (LCD) and components containing liquid electrolyte.

Such components should only be handled by trained personnel who are properly protected (e.g. safety goggles, gloves).

E1 SMD Components

Studer does not keep any commercially available SMD components in stock. For repair the corresponding devices should be purchased locally. The specifications of special components can be found in the service manual.
SMD components should only be replaced by skilled specialists using appropriate tools. No warranty claims will be accepted for circuit boards that have been damaged. Proper and improper SMD soldering joints are illustrated below.



F Disposal

Disposal of Packing Materials

The packing materials have been selected with environmental and disposal issues in mind. All packing material can be recycled. Recycling packing saves raw materials and reduces the volume of waste.
If you need to dispose of the transport packing materials, please try to use recyclable means.

Disposal of Used Equipment

Used equipment contains valuable raw materials as well as materials that must be disposed of professionally. Please return your used equipment via an authorized specialist dealer or via the public waste disposal system, ensuring any material that can be recycled is.
Please take care that your used equipment cannot be abused. To avoid abuse, delete sensitive data from any data storage media. After having disconnected your used equipment from the mains supply, make sure that the mains connector and the mains cable are made useless.

G Declarations of Conformity

G1 Class A Equipment - FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Caution: *Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. Also refer to relevant information in this manual.*

G2 CE Declaration of Conformity

We,
Studer Professional Audio GmbH,
CH-8105 Regensdorf,
declare under our sole responsibility that the product
Studer Telephone Hybrid
1.918.102.00 (serial no. 9303 and up)
1.918.105.00 (serial no. 8991 and up)
to which this declaration relates, according to following regulations of EU directives and amendments

- Low Voltage (LVD):
  73/23/EEC + 93/68/EEC
- Electromagnetic Compatibility (EMC):
  89/336/EEC + 92/31/EEC + 93/68/EEC

is in conformity with the following standards or other normative documents:

- Safety:
  Class I equipment, EN 60065:1993.
  EN41003:1991, provided that the unit is installed only by a qualified technician or by an electrotechnically trained person (service personnel according to EN 60950).
- EMC:
  EN 50081-1:1992, EN 50082-1:1992.

Regensdorf, January 29, 1996

B. Hochstrasser, Managing Director

P. Fiala, Manager QA

Appendix 1: Air Temperature and Humidity

General

Normal operation of the unit or system is warranted under the following ambient conditions defined by *EN 60721-3-3, set IE32, value 3K3.*
This standard consists of an extensive catalogue of parameters, the most important of which are: ambient temperature +5...+40 °C, relative humidity 5...85% (i.e., no formation of condensation or ice); absolute humidity 1...25 g/m³; rate of temperature change < 0.5 °C/min. These parameters are dealt with in the following paragraphs.
Under these conditions the unit or system starts and works without any problem. Beyond these specifications, possible problems are described in the following paragraphs.

Ambient Temperature

Units and systems by Studer are generally designed for an ambient temperature range (i.e. temperature of the incoming air) of +5...+40 °C. When rack mounting the units, the intended air flow and herewith adequate cooling must be provided. The following facts must be considered:

- The admissible ambient temperature range for operation of the semiconductor components is 0 °C to +70 °C (commercial temperature range for operation).
- The air flow through the installation must provide that the outgoing air is always cooler than 70 °C.
- Average heat increase of the cooling air shall be 20 K, allowing for an additional maximum 10 K increase at the hot components.
- In order to dissipate 1 kW with this admissible average heat increase, an air flow of 2.65 m³/min is required.

Example: A rack dissipating $P = 800\ W$ requires an air flow of $0.8 * 2.65\ m^3/min$ which corresponds to $2.12\ m^3/min$.

- If the cooling function of the installation must be monitored (e.g. for fan failure or illumination with spot lamps), the outgoing air temperature must be measured directly above the modules at several places within the rack. The trigger temperature of the sensors should be 65 to 70 °C.

Frost and Dew

The unsealed system parts (connector areas and semiconductor pins) allow for a minute formation of ice or frost. However, formation of dew visible with the naked eye will already lead to malfunctions. In practice, reliable operation can be expected in a temperature range above –15 °C, if the following general rule is considered for putting the cold system into operation:
If the air within the system is cooled down, the relative humidity rises. If it reaches 100%, condensation will arise, usually in the boundary layer between the air and a cooler surface, together with formation of ice or dew at sensitive areas of the system (contacts, IC pins, etc.). Once internal condensation occurs, trouble-free operation cannot be guaranteed, independent of temperature.

Before putting into operation, the system must be checked for internal formation of condensation or ice. Only with a minute formation of ice, direct evaporation (sublimation) may be expected; otherwise the system must be heated and dried while switched off.

A system without visible internal formation of ice or condensation should be heated up with its own heat dissipation, as homogeneously (and subsequently as slow) as possible; the ambient temperature should then always be lower than the one of the outgoing air.

If it is absolutely necessary to operate the cold system immediately within warm ambient air, this air must be dehydrated. In such a case, the absolute humidity must be so low that the relative humidity, related to the coldest system surface, always remains below 100%.

Ensure that the enclosed air is as dry as possible when powering off (i.e. before switching off in winter, aerate the room with cold, dry air, and remove humid objects as clothes from the room).

These relationships are visible from the following climatogram. For a controlled procedure, thermometer and hygrometer as well as a thermometer within the system will be required.

Example 1: An OB-van having an internal temperature of 20 °C and relative humidity of 40% is switched off in the evening. If temperature falls below +5 °C, dew or ice will be forming.

Example 2: An OB-van is heated up in the morning with air of 20 °C and a relative humidity of 40%. On all parts being cooler than +5 °C, dew or ice will be forming.

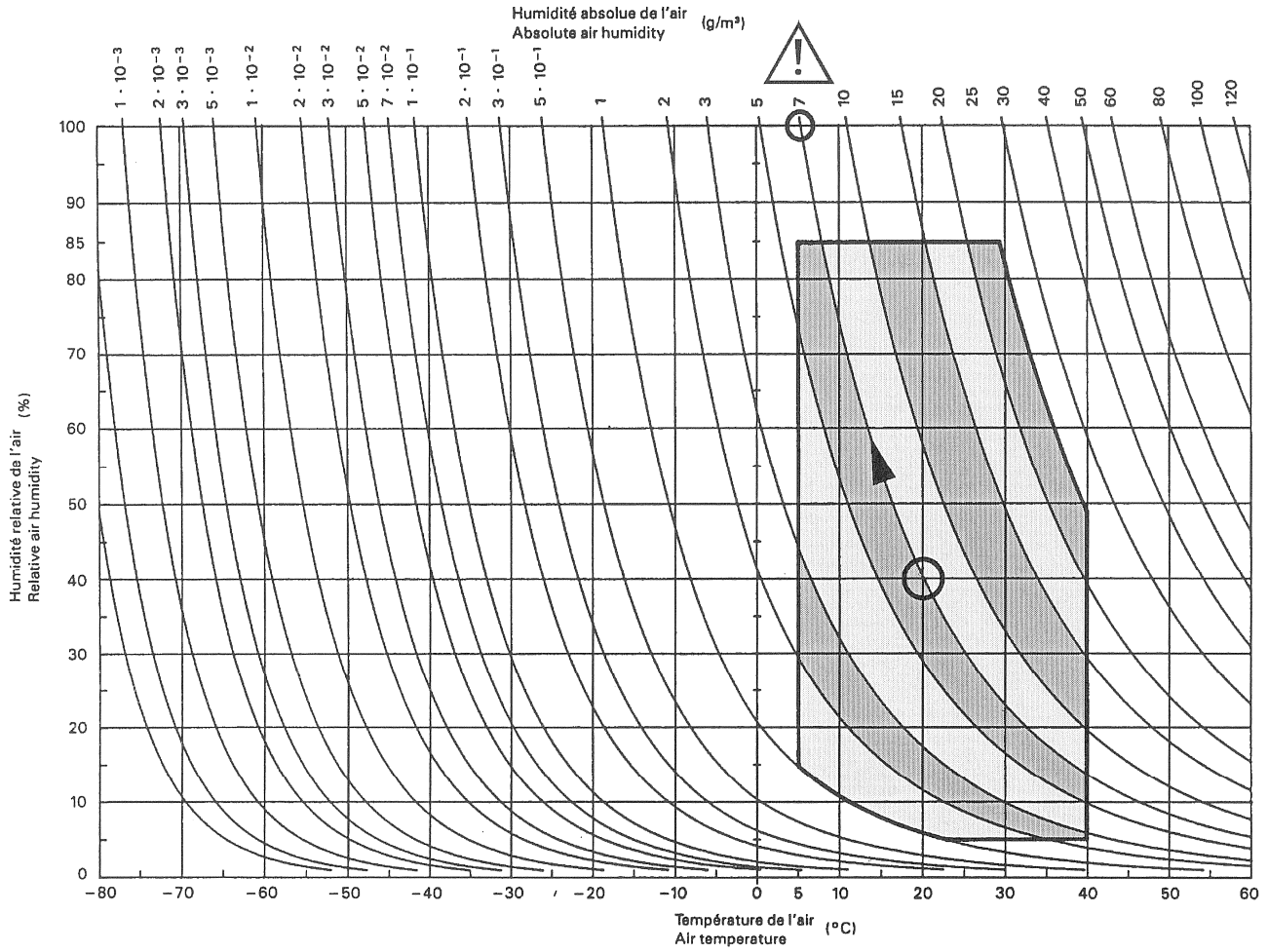
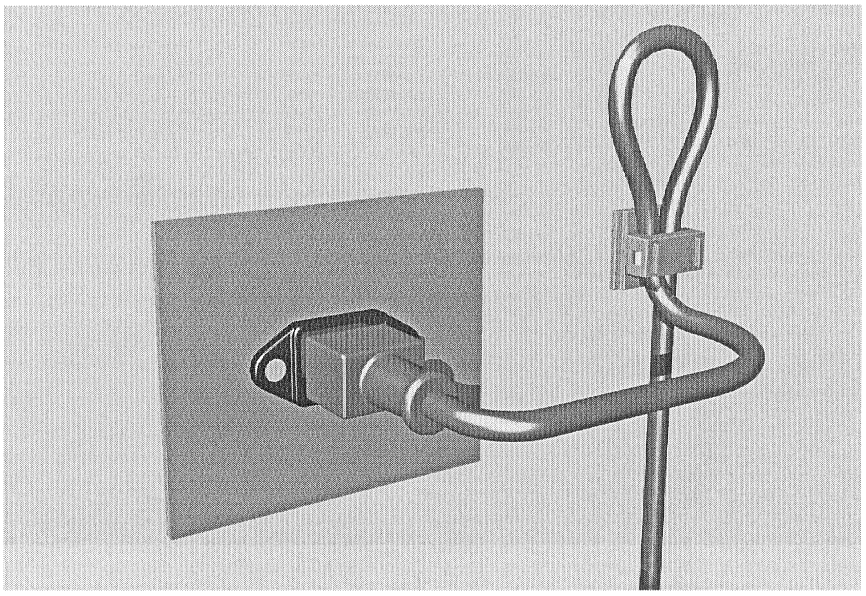


Figure B.3 – Climatogramme pour catégorie 3K3
Climatogram for class 3K3

Appendix 2: Mains Connector Strain Relief

For anchoring connectors without a mechanical lock (e.g. IEC mains connectors), we recommend the following arrangement:



Procedure: The cable clamp shipped with your unit is auto-adhesive. For mounting please follow the rules below:

- The surface to be adhered to must be clean, dry, and free from grease, oil, or other contaminants. Recommended application temperature range is 20...40 °C.
- Remove the plastic protective backing from the rear side of the clamp and apply it firmly to the surface at the desired position. Allow as much time as possible for curing. The bond continues to develop for as long as 24 hours.
- For improved stability, the clamp should be fixed with a screw. For this purpose, a self-tapping screw and an M4 bolt and nut are included.
- Place the cable into the clamp as shown in the illustration above and firmly press down the internal top cover until the cable is fixed.

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1. ALLGEMEINE HINWEISE

1.1
BESCHREIBUNG DES TELEFON-HYBRID

Um ein Telefongespräch zwischen dem Sprecher im Studio und einem ausserhalb des Studios befindlichen Gesprächspartner auf Band aufzuzeichnen oder übertragen zu können, muss die Telefonleitung an das Mischpult angeschlossen werden.

Da auf einer üblichen 2-Draht Telefonleitung die Gesprächssignale beider Teilnehmer vorhanden sind, wird neben dem Gesprächsteilnehmer auch der Studiosprecher in Telefonqualität (300 . . . 3400 Hz) übertragen. Wird im Mischpult das Mikrofonsignal des Sprechers dem Gespräch zugemischt, ergeben sich aus der Addition des "guten" Signals – Studioqualität – und des "schlechten" Signals – Telefonqualität – unerwünschte Verzerrungen und Signalverfälschungen.

Der Telefon-Hybrid erlaubt nun, durch gezielte Dämpfung des "schlechten" Sprechersignals (Rückhördämpfung) die Übertragungsqualität des Telefongesprächs wesentlich zu verbessern. Diese Rückhördämpfung wird im Prinzip durch die aus der Telefonie bekannte Gabelschaltung (Hybrid!) erreicht.

Der STUDER Telefon-Hybrid ermöglicht die Übertragung eines Telefongesprächs mit einem Sprecher im Studio in optimaler Qualität. Das Gerät braucht ausser dem Aufschalten auf die Telefonleitung keine weitere Bedienung.

Die optimale Rückhördämpfung des Studio-Sprechsignals wird dadurch erreicht, dass der Hybrid automatisch eine Ersatzlast zur Telefonleitung bildet. Der Abgleich erfolgt elektronisch: Real- und Imaginärteil der Telefonleitung werden möglichst genau nachgebildet (Widerstand und Kapazität). Der automatische Abgleich setzt ein, sobald ein Sprechsignal vorhanden ist.

1. GENERAL INFORMATION

1.1
DESCRIPTION OF THE STUDER TELEPHONE HYBRID

In order to record or to transmit a conversation between the announcer in the studio and a person outside the studio beeing interviewed by telephone, the telephone line has to be connected to the mixing console.

The full conversation is transmitted since both voice signals are carried on a normal 2-wire telephone line. However the voice of the announcer in the studio is thereby also transmitted in telephone quality (300. . .3400 Hz). By mixing the microphone signal of the announcer – studio quality – to the conversation, the addition of the "good" and "poor" signals results in a distorted and untrue signal.

The telephone hybrid allows to greatly improve the quality of a telephone transmission by selectively suppressing the unwanted "poor" signal (sidetone attenuation). This sidetone attenuation is done in principle by a hybrid circuit which is a familiar feature in telephony.

The STUDER telephone hybrid permits high-quality transmission of telephone conversations with the announcer in the studio. Apart from connecting it to the telephone line, the hybrid works automatically.

The reason for the maximum sidetone attenuation of the studio voice signal in the receiver line is that the hybrid automatically constitutes a dummy load for the telephone line. This adjustment is performed electronically, the real component and the imaginary component of the telephone line beeing matched as near as possible (resistance and capacitance). The matching process begins as soon as an announcer signal occurs.

1. GENERALITES

1.1
DESCRIPTION DE L'HYBRIDE TELEPHONIQUE

Pour transmettre une conversation entre un speaker dans un studio de radio-télévision et une personne contactée par téléphone au cours d'une interview, il est nécessaire de faire transiter l'appel par le pupitre de mélange.

Toute la conversation est alors transmise sur une ligne téléphonique standard (2 fils). Cependant la voix du speaker du studio est transmise dans la bande téléphonique (fréquences comprises entre 300 et 3400 Hz). Le résultat du mixage direct dans le studio est donc la combinaison des signaux de haute et basse qualité. La résultante est un signal inexact et distordu.

On peut grandement améliorer la qualité de la transmission en supprimant de façon sélective le signal de basse qualité (réduction de la réjection). Celà est réalisé par le circuit hybride d'usage courant en téléphonie.

L'hybride téléphonique STUDER permet une transmission de haute qualité de conversations téléphoniques entre un speaker dans un studio et des correspondants extérieurs. Après branchement à la ligne téléphonique, l'appareil fonctionne entièrement automatiquement.

L'hybride téléphonique STUDER assure le maximum d'atténuation du signal speaker dans la ligne téléphonique réceptrice. En effet, il constitue automatiquement une charge morte pour la ligne. Cet ajustage automatique est réalisé électroniquement, la ligne étant adaptée aussi bien que possible par capacité et résistance. Le processus d'adaptation s'effectue dès l'apparition d'un signal modulé.

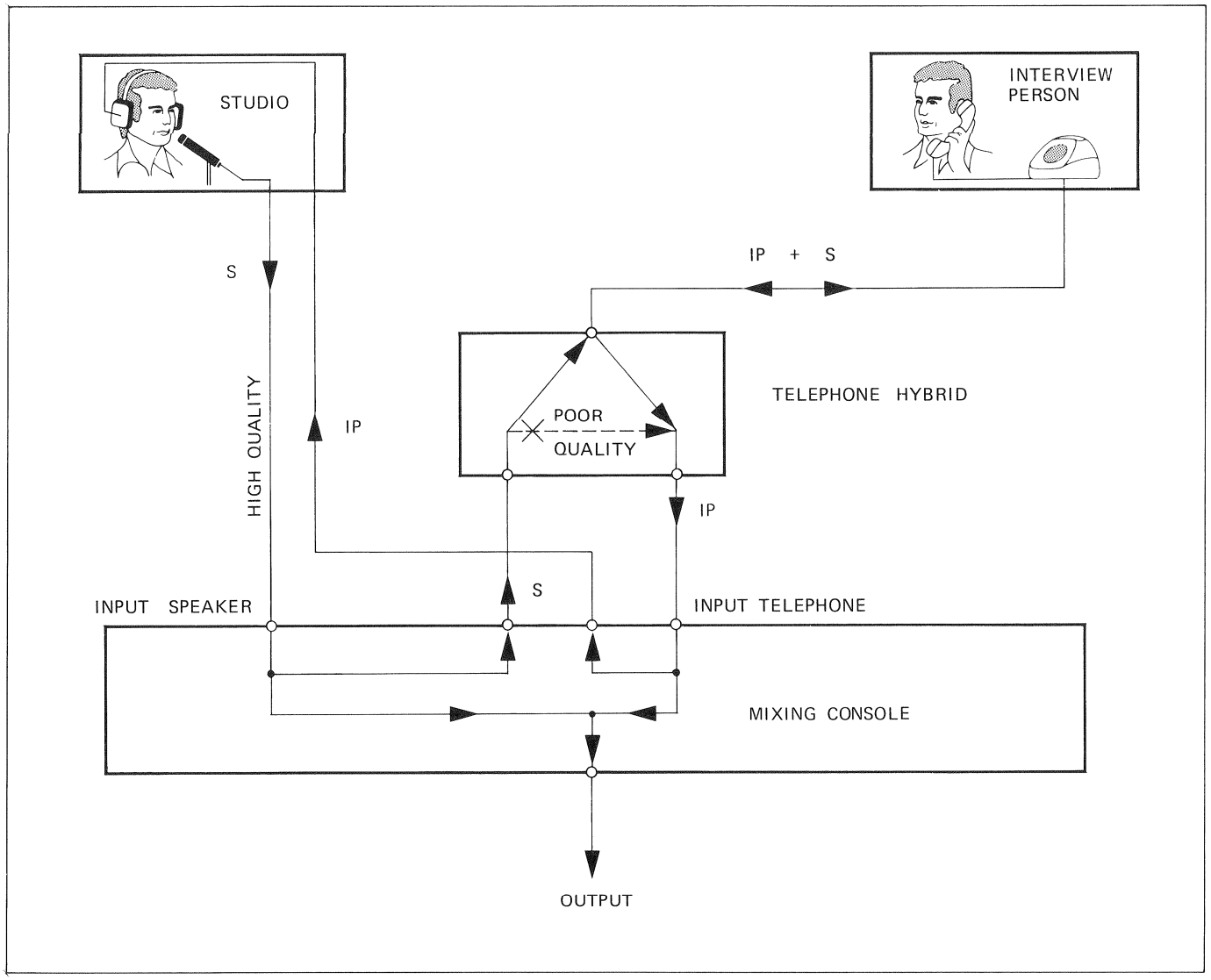


Fig. 1.1
Prinzip der Telefonübertragung über ein Mischpult

Principle of a telephone transmission via a mixing console

Principe de la transmission d'une conversation téléphonique par un pupitre de mélange

Relais-Einheit:
Wird der Telefon-Hybrid, ohne Umweg über eine Telefonstation, direkt auf die Amtsleitung geschaltet, genügt der Gleichstromwiderstand der Gabelschaltung (1,5 kOhm) nicht mehr, um das Amtsrelais zum Anziehen zu bringen. Daher muss der Gleichstromwiderstand mit Hilfe einer Drossel auf 200 Ohm verkleinert werden; die Leitungsimpedanz darf dadurch allerdings nicht beeinflusst werden.

Mit dem Umschaltrelais wird – durch einen externen Schalter angesteuert – die Telefonleitung vom Telefonapparat auf den Telefon-Hybrid umgeschaltet.

Relay unit:
If the telephone hybrid is connected directly to the telephone line, without a connection to a telephone set, the DC resistance of the hybrid (1.5 kohms) is no longer sufficient to activate the subscriber's relay in the telephone exchange. For this reason the DC resistance of the hybrid circuit is reduced by means of a choke to 200 ohms in such a way as not to influence the line impedance.

The switching relay is activated with an external switch and switches the telephone line from the telephone set to the hybrid.

Unité de relais:
Si l'hybride téléphonique est commuté, sans détour par un poste téléphonique, directement sur la ligne réseau, la résistance du termineur (1,5 k) ne suffit plus pour faire attirer le relais de réseau. C'est pourquoi la résistance doit être diminuée à 200 ohms à l'aide d'une bobine de self; il ne faut cependant pas que l'impédance de ligne en soit influencée.

A l'aide du relais de commutation – commandé par un commutateur externe – la ligne téléphonique est commutée de l'appareil téléphonique sur l'hybride téléphonique.

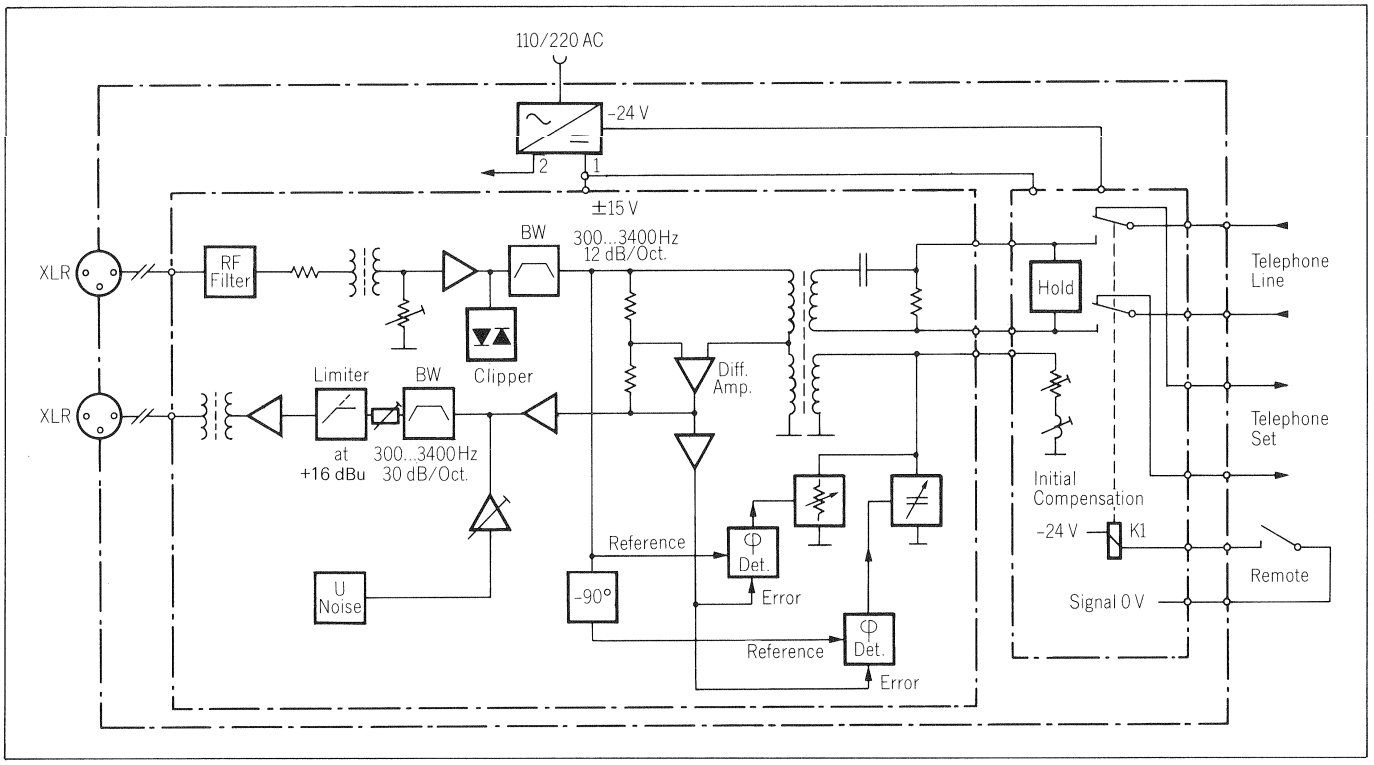


Fig. 1.2
Blockschaltbild des Telefon-Hybrid mit Relais-Einheit

Block diagram telephone hybrid and relay unit.

Schéma bloc de l'hybride téléphonique avec unité de relais.

1.2 VARIANTEN

Es sind zwei Betriebsarten möglich:

1.2.1 Betrieb mit Europakarte "TELEFON-HYBRID 1.915.760–81/764"

1.2 VERSIONS

Two modes of operation are possible:

1.2.1 Operation with a single board (standard European size) "TELEPHONE HYBRID 1.915.760-81/764"

1.2 VARIANTES

Deux modes d'applications sont possibles:

1.2.1 Application avec carte européenne "HYBRIDE-TELEPHONIQUE 1.915.760-81/764"

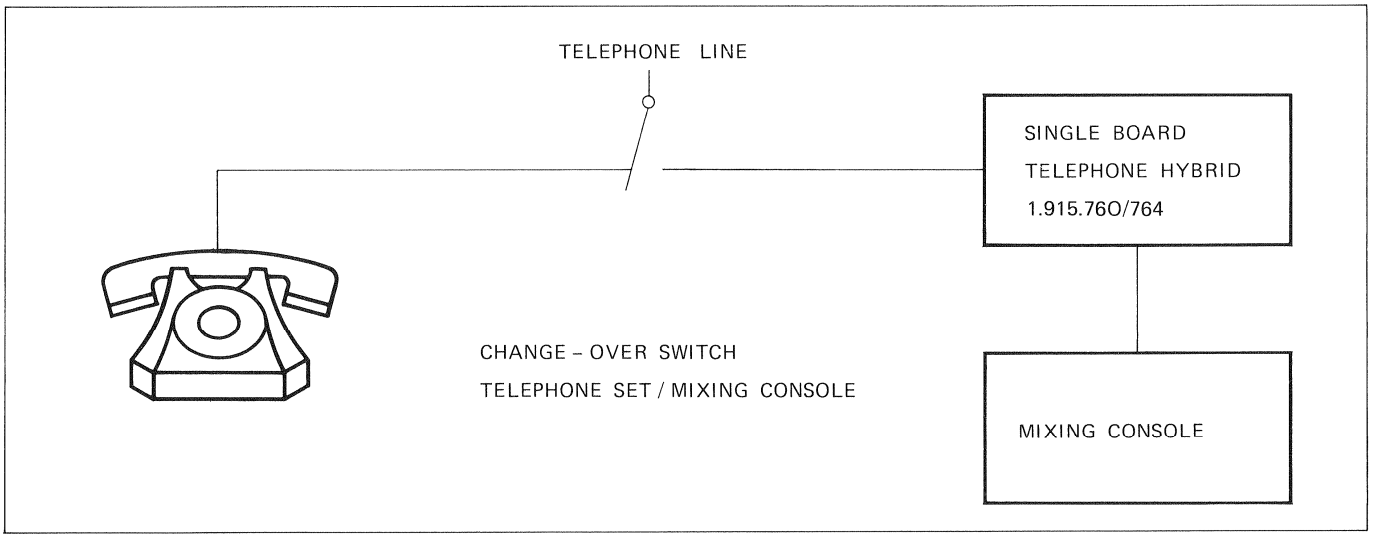


Fig. 1.3

Die Verbindung wird über den Telefonapparat aufgenommen. Nach dem Umschalten auf das Mischpult wird der Haltestrom für das Teilnehmerrelais durch einen Widerstand auf der Hybridkarte aufgebracht.

The telephone set is used to establish a telephone connection (call). After switching over to the mixing console, the holding current for the subscriber's relay is delivered by a resistor on the hybrid board.

La communication est prise en charge via l'appareil téléphonique. Après commutation sur le pupitre de mélange, le courant de maintien pour le relais d'abonné est fourni par une résistance sur la carte de l'hybride.

1.2.2 Betrieb mit den Europakarten "TELEFON-HYBRID 1.915.760-81/764 und "DUAL RELAY UNIT 1.915.762-81":

Falls ein Anruf – statt auf den Telefonapparat – direkt auf den Hybrid geschaltet werden soll, wird der Anzugstrom für das Amtsrelais durch die Drossel auf der Relais-Einheit aufgebracht. Mit Hilfe des Relais kann die Umschaltung der Amtsleitung vom Telefonapparat auf den Telefonhybrid ferngesteuert vorgenommen werden. Eine zusätzliche elektronische Schaltung erlaubt das Vorabgleichen der Telefonleitung.

1.2.2 Operation with two single board (standard European size) " TELEPHONE HYBRID 1.915.760-81/764" and "DUAL RELAY UNIT 1.915.762-81"

If a phone call is being picked up directly by the hybrid, the starting current for the subscriber's relay is delivered by a choke on the relay unit. The relay allows to switch-over the telephone line from the telephone set to the hybrid remotely.
An additional circuit allows to preadjust the hybrid to the telephone line.

1.2.2 Application avec les cartes européennes "HYBRIDE TELEPHONIQUE 1.915.760-81/764 et "UNITE DE RELAIS DOUBLE 1.915.762-81"

Si un appel – au lieu d'être commuté sur l'appareil téléphonique – doit directement être commuté sur l'hybride, le courant d'attraction pour le relais de réseau est fourni par la bobine sur l'unité de relais. A l'aide du relais, la commutation de la ligne réseau, de l'appareil téléphonique sur l'hybride téléphonique, peut s'effectuer de façon télécommandée.
Un circuit supplémentaire sert à la pré-ajustage de la ligne téléphonique.

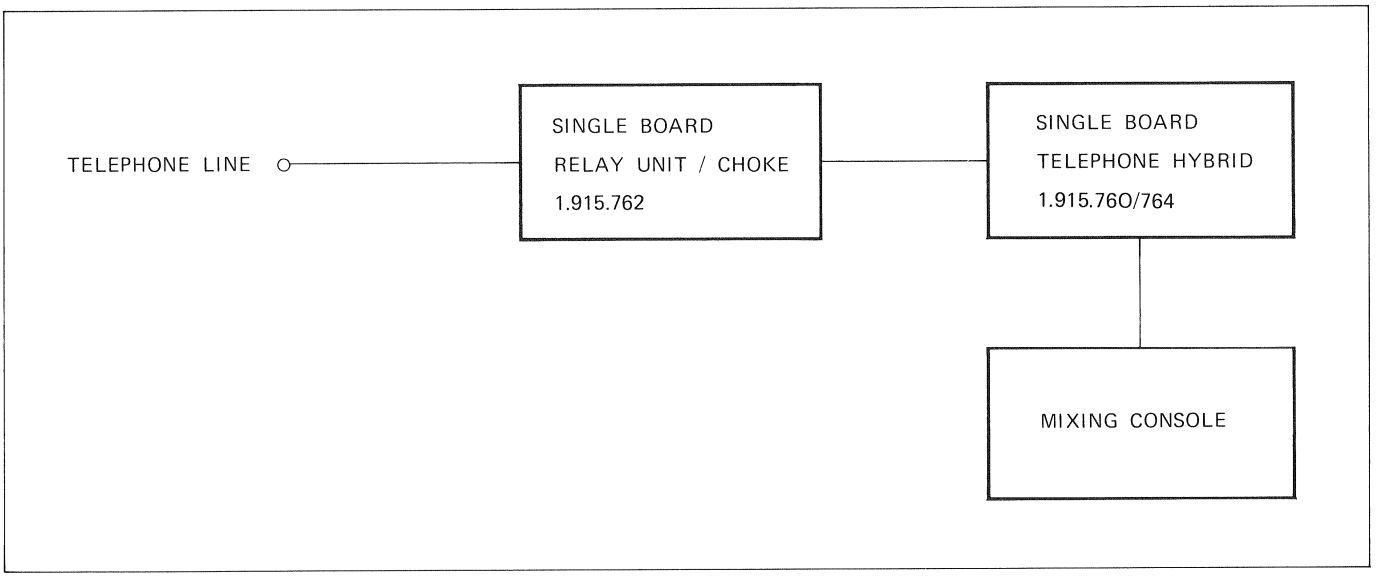


Fig. 1.4

1.3 BESTELL-INFORMATIONEN

1.3 ORDER INFORMATION

1.3 INFORMATIONS DE COMMANDE

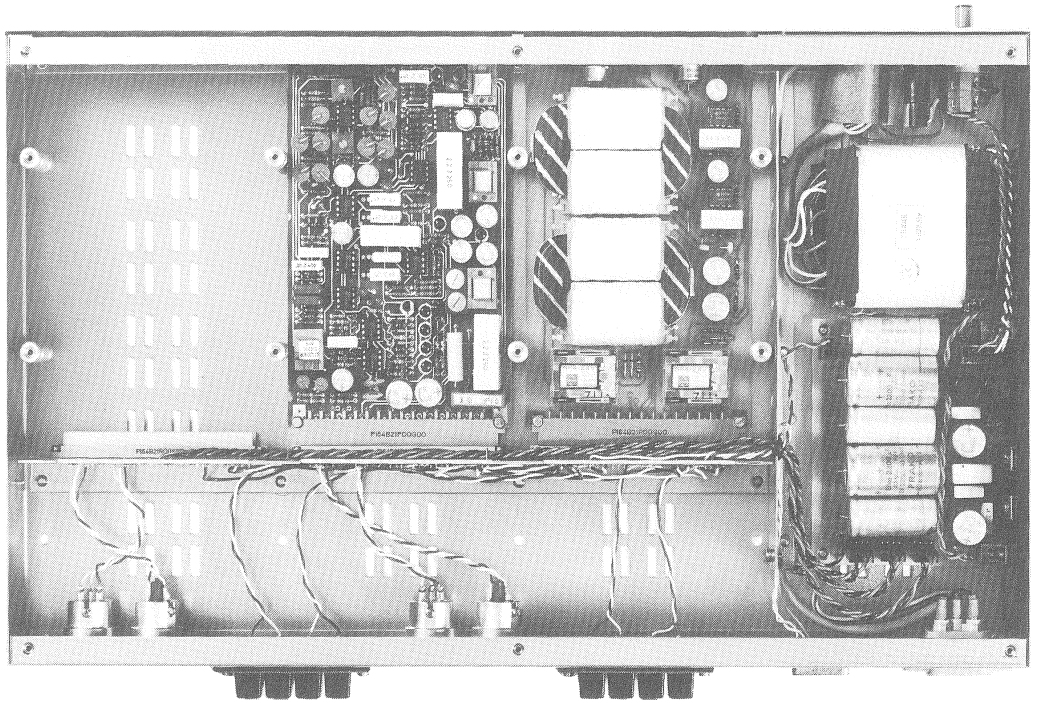


Fig. 1.5

Bestell Nr. 75.700.89118

Die Einheit Nr. 75.700.89118 umfasst:

1 Rackrahmen	1.918.102
1 Telefon-Hybrid	1.915.760-81
1 Dual-Relais-Einheit	1.915.762-81

Bestell Nr. 75.700.89114:

1 Rackrahmen	1.918.102
1 Telefon-Hybrid	1.915.764
1 Dual-Relais-Einheit	1.915.762-81

Order no. 75.700.89118

The unit no. 75.700.89118 consists of:

1 card frame	1.918.102
1 telephone hybrid	1.915.760-81
1 dual relay unit	1.915.762-81

Order no. 75.700.89114:

1 card frame	1.918.102
1 telephone hybrid	1.915.764
1 dual relay unit	1.915.762-81

No de commande 75.700.89118

L'unité no 75.700.89118 comprend:

1 baie	1.918.102
1 hybride téléphonique	1.915.760-81
1 unité de relais double	1.915.762-81

No de commande 75.700.89114:

1 baie	1.918.102
1 hybride téléphonique	1.915.764
1 unité de relais double	1.915.762-81

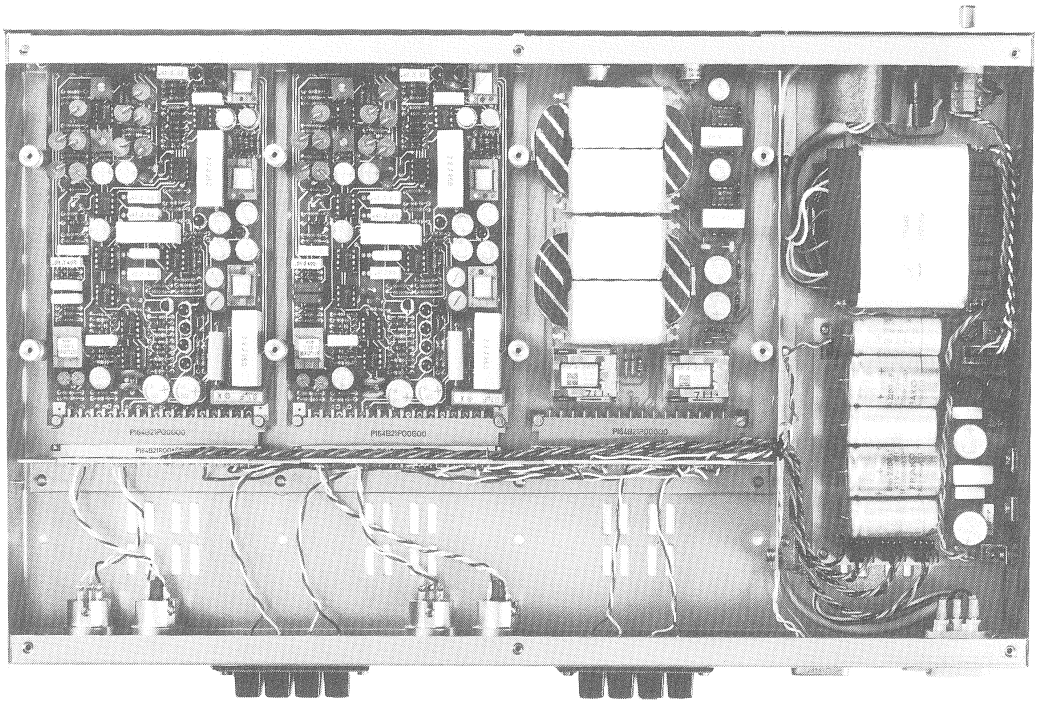


Fig. 1.6

Bestell Nr. 75.700.89228

Die Einheit Nr. 75.700.89228 umfasst:

1 Rackrahmen	1.918.102
2 Telefon-Hybride	1.915.760-81
1 Dual-Relais-Einheit	1.915.762-81

Bestell Nr. 75.700.89224:

1 Rackrahmen	1.918.102
2 Telefon-Hybride	1.915.764
1 Dual-Relais-Einheit	1.915.762-81

Der Telefonhybrid kann auch als einzelner Print bezogen werden. Europakarte 100 x 160 mm (Bauhöhe über Print 25 mm):
1.915.760-81 für Normalausführung
1.915.764 für Telefon-Hybrid mit Noise-Gate

1.915.764: Es handelt sich um eine von einem Kunden gewünschte Spezialversion.
Siehe Section 6/9

Die Dual-Relais-Einheit kann auch als einzelner Print bezogen werden. Europakarte 100 x 160 mm (Bauhöhe über Print 30 mm):
1.915.762-81

Order no. 75.700.89228

The unit no. 75.700.89228 consists of:

1 card frame	1.918.102
2 telephone hybrids	1.915.760-81
1 dual relay unit	1.915.762-81

Order no. 75.700.89224:

1 card frame	1.918.102
2 telephone hybrides	1.915.764
1 dual relay unit	1.915.762-81

The telephone hybrid is also obtainable as a single board of standard European size, 100 x 160 mm (height above p.c.b. 25 mm):
1.915.760-81 normal version
1.915.764 automatic telephone hybrid with noise gate

1.915.764: This is a special version as demanded by a customer.
See Section 6/9

The dual relay unit ist also obtainable as a single board of standard European size, 100 x 160 mm (height above p.c.b. 30 mm):
1.915.762-81

No de commande 75.700.89228

L'unité no 75.700.89228 comprend:

1 baie	1.918.102
2 hybrides téléphoniques	1.915.760-81
1 unité de relais double	1.915.762-81

No de commande 75.700.89224:

1 baie	1.918.102
2 hybrides téléphoniques	1.915.764
1 unité de relais double	1.915.762-81

L'hybride téléphonique est également livrable en tant que plaquette à circuit imprimé individuelle. Carte européenne 100 x 160 mm (hauteur de montage sur plaquette à circuit imprimé, 25 mm):
1.915.760-81 pour normale
1.915.764 pour hybride téléphonique avec Noise-Gate

1.915.764: C'est une version spéciale, demandée par un client.
Voir Section 6/9

L'unité de relais double est également livrable en tant que plaquette à circuit imprimé individuelle. Carte européenne 100 x 160 mm (hauteur de montage sur plaquette à circuit imprimé, 30 mm):
1.915.762-81

2. TECHNISCHE DATEN

2.1 HINWEISE

0 dBu ≙ 0,775 V_{eff}

0 VU ≙ 1 mW an 600 Ohm, gemessen mit Sprache nach ASA C 16.5.
Vorlauf (Lead) 8 dB
Speisung, stabilisiert:
± 15 V/33 mA

2.2 SENDETEIL

Eingangspegel, einstellbar:
+6 dBu . . . + 15 dBu
Eingangsimpedanz:
> 5 kOhm
Eingangssymmetrie:
> 60 dB
Eingang symmetrisch und erdfrei.
Bandpass im Sendeweg mit Nachbildung des Frequenzganges einer Telefonkapsel:
300 . . . 3400 Hz (– 3 dB), 12 dB/Oktave
Sendepegel:
– 13 VU bei 600 Ohm
Klirrfaktor:
< 1%

2.3 EMPFANGSTEIL

Eingangspegel normal:
– 13 VU bei 600 Ohm
Maximaler Eingangspegel:
+ 3 VU
Ausgangspegel, einstellbar:
+ 6 dBu . . . + 15 dBu
Ausgang symmetrisch und erdfrei.
Ausgangsimpedanz:
⩽ 50 Ohm
Last:
⩾ 200 Ohm
Frequenzgang Bandpass:
300 . . . 3400 Hz, (– 3 dB), 30 dB/Oktave
Eingebauter Rauschgenerator, Pegel einstellbar.
Klirrfaktor:
< 1%
Begrenzer am Ausgang:
Einsatzpunkt (fix) bei ca. + 16 dBu
Einschwingzeit ca. 0,5 ms
Erholzeit (IEC 268-8) ca. 0,5 s

2. SPECIFICATIONS

2.1 NOTES

0 dBu ≙ 0.775 V_{RMS}

0 VU ≙ 1 mW at 600 ohms measured with voice (ASA C 16.5.42).
Lead 8 dB
Supply voltage, stabilized:
± 15 V/33 mA

2.2 TRANSMIT CIRCUIT

Input sensitivity, adjustable:
+ 6 dBu . . . + 15 dBu
Input impedance:
> 5 kohms
Input symmetry:
> 60 dB
Input balanced and floating.
Bandpass in transmit circuit simulating the frequency response of a telephone capsule:
300 . . . 3400 Hz (– 3 dB) 12 dB/octave
Transmit level:
– 13 VU at 600 ohms
Total harmonic distortion:
< 1%

2.3 RECEIVE CIRCUIT

Input level, nominal:
– 13 VU at 600 ohms
Maximum input level:
+ 3 VU
Output level, adjustable:
+ 6 dBu . . . + 15 dBu
Output balanced and floating.
Output impedance:
⩽ 50 ohms
Load:
⩾ 200 ohms
Frequency response bandpass:
300 . . . 3400 Hz (– 3 dB), 30 dB/octave
Built-in noise generator, level adjustable.
Total harmonic distortion:
< 1%
Limiter on output:
Threshold fixed at approx. + 16 dBu
Attack time approx. 0.5 ms
Release time (IEC 268-8) approx. 0.5 s

2. CARACTERISTIQUES TECHNIQUES

2.1 REMARQUES

0 dBu ≙ 0,775 V_{eff}

0 VU ≙ 1 mW dans 600 ohms mesuré selon ASA C 16.5
Avance (lead) 8 dB
Tension d'alimentation stabilisée:
± 15 V/33 mA

2.2 CIRCUIT DE TRANSMISSION

Sensibilité d'entrée ajustable:
+ 6 dBu à + 15 dBu
Impédance d'entrée:
> 5 kohms
Symétrie d'entrée:
> 60 dB
Entrée symétrique et flottante.
Filtre passe-bande dans le circuit de transmission équivalent à la réponse en fréquence d'une capsule téléphonique:
300 à 3400 Hz (–3 dB) chute de 12 dB/octave
Niveau de transmission:
–13 VU sur 600 ohms
Distorsion harmonique totale:
< 1%

2.3 CIRCUIT RECEPTEUR

Niveau d'entrée nominal:
–13 VU sur 600 ohms
Niveau d'entrée max.:
+ 3 VU
Sensibilité de sortie ajustable:
+ 6 dBu à + 15 dBU
Sortie symétrique et flottante.
Impédance de sortie:
⩽ 50 ohms
Impédance de charge:
⩾ 200 ohms
Réponse en fréquence:
300 à 3400 Hz (– 3 dB), 30 dB/octave
Générateur de bruit à niveau ajustable.
Distorsion harmonique totale:
< 1%
Sortie sur limiteur:
Seuil fixé à environ + 16 dBu
Temps d'attaque 0,5 ms environ
Temps de recouvrement (IEC 268-8) 0,5 s env.

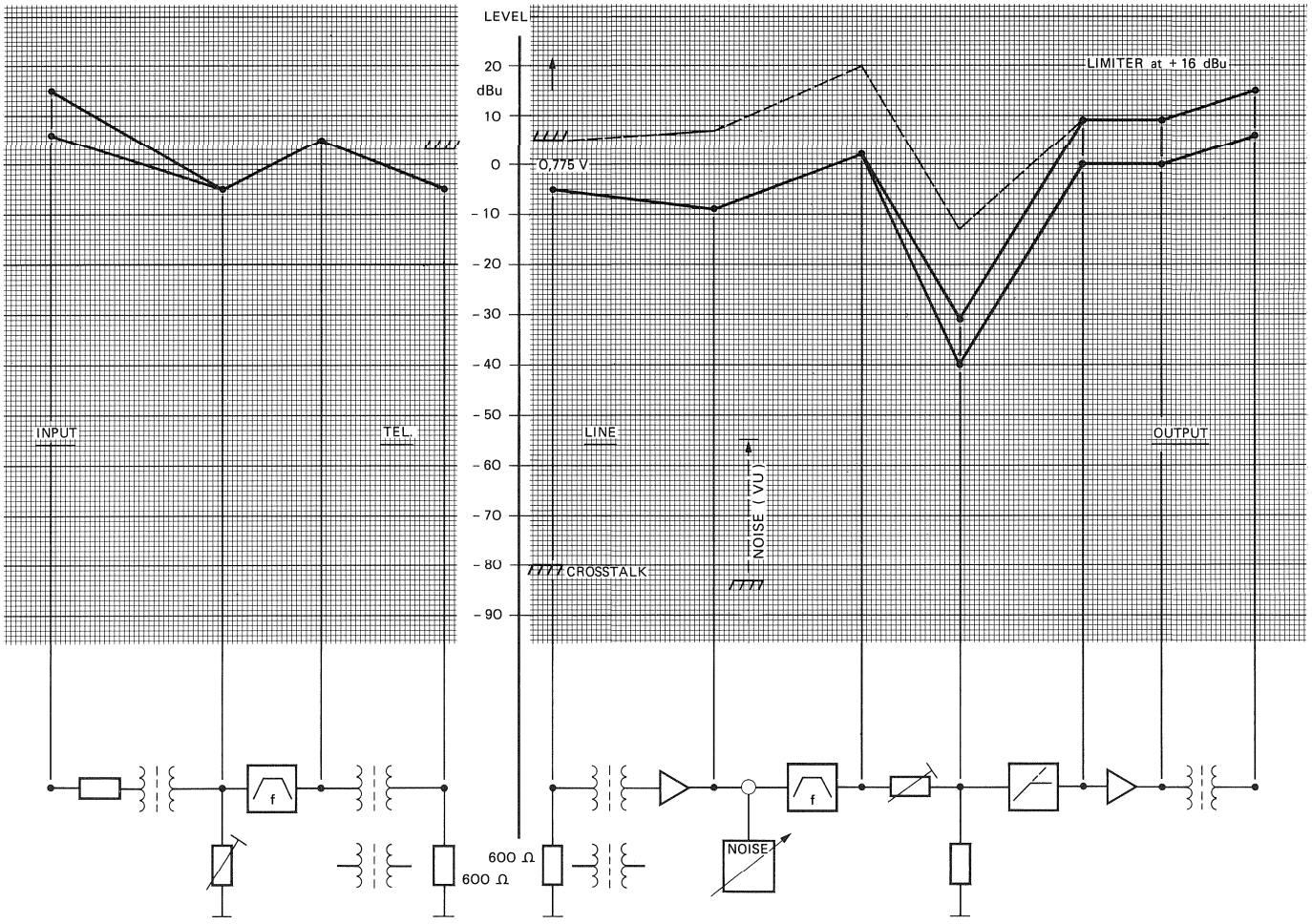


Fig. 2.1
Pegeldiagramm des Telefon-Hybrid

Level diagram

Diagramme des niveaux de l'hybride téléphonique

2.4 HYBRID-TEIL

Ein-/Ausgang symmetrisch und erdfrei.
Prüfspannung:
1 kV
DC-Eingangs-/Ausgangsimpedanz:
1500 Ohm
Abgleichbereich R:
200 Ohm . . . 2000 Ohm
Abgleichbereich C:
0 . . . 0,1 µF
Rückhördämpfung Sinus (Ersatzlast):
> 40 dB
Rückhördämpfung weisses Rauschen (Ersatzlast):
> 30 dB
Rückhördämpfung an einer Amtstelefonleitung, je nach Qualität der Leitung (gemessen mit Sprache):
ca. 20 dB
Symmetrie:
> 60 dB

2.4 HYBRID CIRCUIT

Input/output balanced and floating.
Test voltage:
1 kV
DC input/output impedance:
1500 ohms
Balancing range R:
200 ohms . . . 2000 ohms
Balancing range C:
0 . . . 0.1 µF
Sidetone attenuation, sine wave (dummy load):
> 40 dB
Sidetone attenuation, white noise (dummy load):
> 30 dB
Sidetone attenuation on a telephone exchange line, depending on quality of line (measured with speech):
approx. 20 dB
Symmetry:
> 60 dB

2.4 CIRCUIT D'INSERT

Entrée/sortie symétrique et flottante.
Tension d'épreuve:
1 kV
Impédance d'entré et de sortie DC:
1500 ohms
Plage de réglage en résistance pure:
200 à 2000 ohms
Plage de réglage en capacité:
0 à 0,1 µF
Atténuation de réjection
signal sinusoïdal (charge morte):
> 40 dB
bruit blanc:
> 30 dB
Atténuation de réjection sur une ligne quelconque (mesuré avec parole):
20 dB environ
Symétrie:
> 60 dB

Der Abgleich wird durch das Sprechersignal im Sendeteil gesteuert. Einsatzpunkt einstellbar. Bereich:
0 . . . – 25 dB

Nach neuesten Empfehlungen ist der Nominalpegel der Telefonleitung – 13 VU ± 3 VU an 600 Ohm.
Das Nebensprechen zwischen Telefonleitungen kann – 80 VU betragen. Zum Schutz der Privatgespräche soll das Nebensprechen vom Geräuschpegel überdeckt werden. Zu diesem Zweck ist ein Rauschgenerator eingebaut.

Matching is controlled by the speaker signal in the transmit circuit. Threshold adjustable. Range:
0 . . . – 25 dB

The most recent recommendations are that the nominal level should be – 13 VU ± 3 VU at 600 ohms.
Crosstalk between telephone lines can be – 80 VU. As a safeguard of privacy, the crosstalk must be masked by the noise level. A noise generator is provided to meet these requirements.

Adaptation contrôlée par le signal modulé dans le circuit de transmission. Seuil ajustable, plage de variation:
0 à – 25 dB

D'après les normes les plus récentes le niveau ligne nominal devrait être de – 13 ± 3 VU sur 600 ohms. Diaphonie entre des lignes téléphoniques: – 80 VU. Pour la garantie du secret des communications, le niveau de diaphonie doit se situer au dessous du niveau de bruit. Un générateur de bruit est fourni dans ce but.

2.5 RACK-EINSCHUB 19"

Der Rack-Einschub ist für folgende Maximalbestückung ausgelegt:

2 Telefon-Hybrid		1.915.760-81
	oder	1.915.764
1 Dual-Relais-Einheit		1.915.762-81

Im Rack-Einschub ist das Netzteil integriert:
Netzeingang:
100, 120, 140, 200, 220, 240 V ~. Einstellung der Netzspannung mit Spannungswähler.
Netzsicherung für 100 . . . 140 V:
400 mA (träge)
Netzsicherung für 200 . . . 240 V:
200 mA (träge)
Speisung:
Audio ± 15 V, 0,5 A
Signalisierung 24 V, 0,2 A

Die Audioausgänge sind auf XLR Stecker (CANNON) geführt:
Eingang: Buchse
Ausgang: Stecker
Die Telefon-Eingänge und Ausgänge sind auf Strips geführt.
Für die Fernsteuerung der Relais wird ein 15-poliger Cannon-Stecker des Typs D eingesetzt.

2.5 CARD FRAME (19" RACK MODULE)

The 19" rack module has space for the following circuit boards:

2 telephone hybrids		1.915.760-81
	or	1.915.764
1 dual relay unit		1.915.762-81

The power supply is integrated into the 19" frame:
Power input:
100, 120, 140, 200, 220, 240 VAC. The mains voltage can be set by means of a voltage selector.
Primary power fuse for 100 . . . 140 V:
400 mA (slow blow)
Primary power fuse for 200 . . . 240 V:
200 mA (slow blow)
Supply voltages:
Audio ± 15 V, 0.5 A
Signalling 24 V, 0.2 A

The audio outputs are taken to XLR (CANNON) connectors:
Input female
Output male
The telephone inputs and outputs are wired to terminal strips.
A D-type Cannon 15 pin connector is provided for the remote control of the relays.

2.5 CHASSIS EMBROCHABLE 19"

Le châssis embrochable est conçu pour l'équipement maximal suivant:

2 hybrides téléphoniques		1.915.760-81
	ou	1.915.764
1 unité à relais double		1.915.762-81

Le bloc d'alimentation est incorporé au châssis embrochable:
Entrée secteur:
100, 120, 140, 200, 220, 240 V alternatif. Choix de la tension de secteur par sélecteur de tension.
Fusible secteur pour 100 . . . 140 V:
400 mA (temporisé)
Fusible secteur pour 200 . . . 240 V:
200 mA (temporisé)
Alimentation:
audio ± 15 V, 0,5 A
Signalisation 24 V, 0,2 A

Les sorties audio sont conduites sur des connecteurs XLR (cannon):
Entrée: connecteur femelle
Sortie: connecteur mâle
Les entrées et sorties téléphoniques sont conduites sur des barrettes.
Pour la télécommande des relais, un connecteur à 15 pôles de type D est utilisé.

2.6 ABMESSUNGEN

2.6 DIMENSIONS

2.6 DIMENSIONS

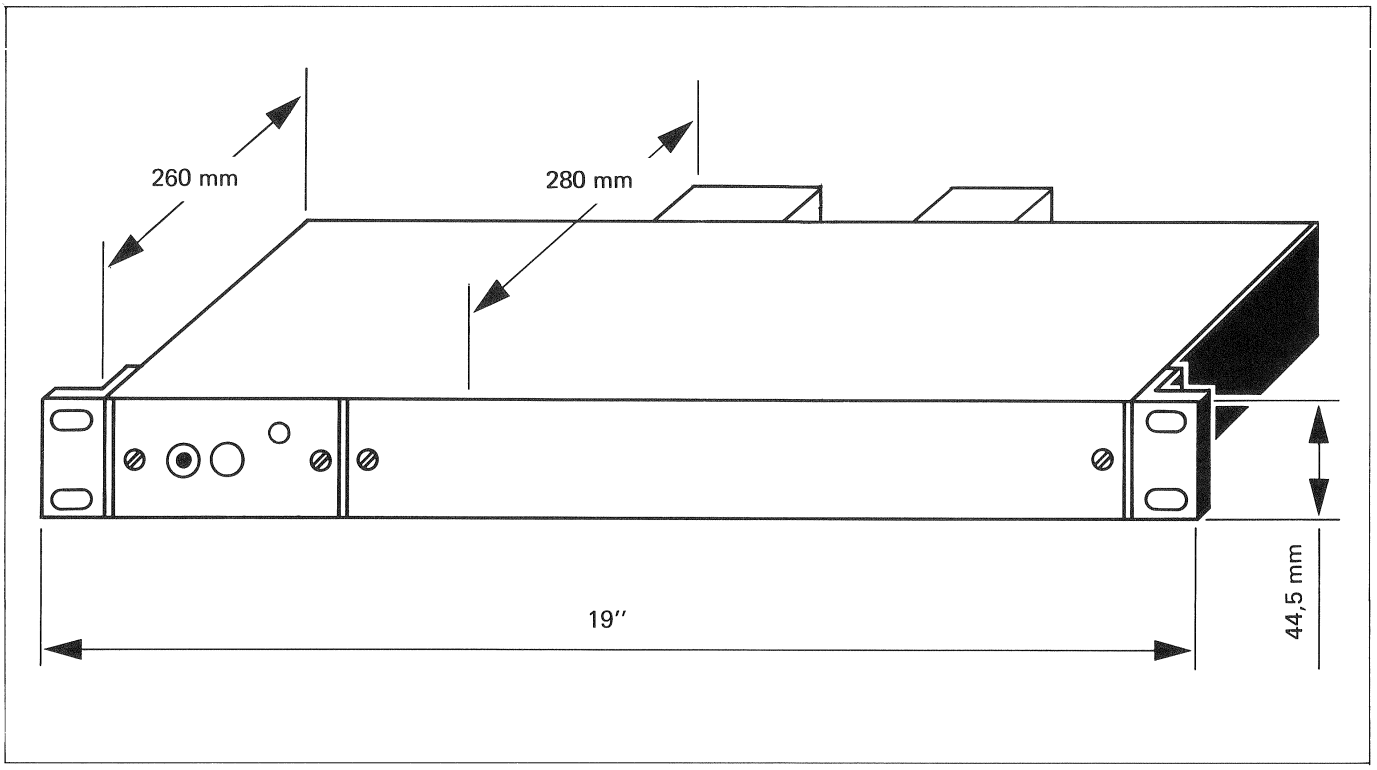


Fig. 2.2

Gewicht:
ca. 5,4 kg (Maximalbestückung)
ca. 4 kg (Rack-Einschub)

Weight:
approx. 5.4 kg (fully equipped)
approx. 4 kg (card frame)

Poids:
env. 5,4 kg (équipement maximal)
env. 4 kg (châssis embrochable)

3. INSTALLATION DES TELEFON-HYBRID

3. HOW TO INSTALL THE TELEPHONE HYBRID

3. INSTALLATION DE L'HYBRIDE TELEPHONIQUE

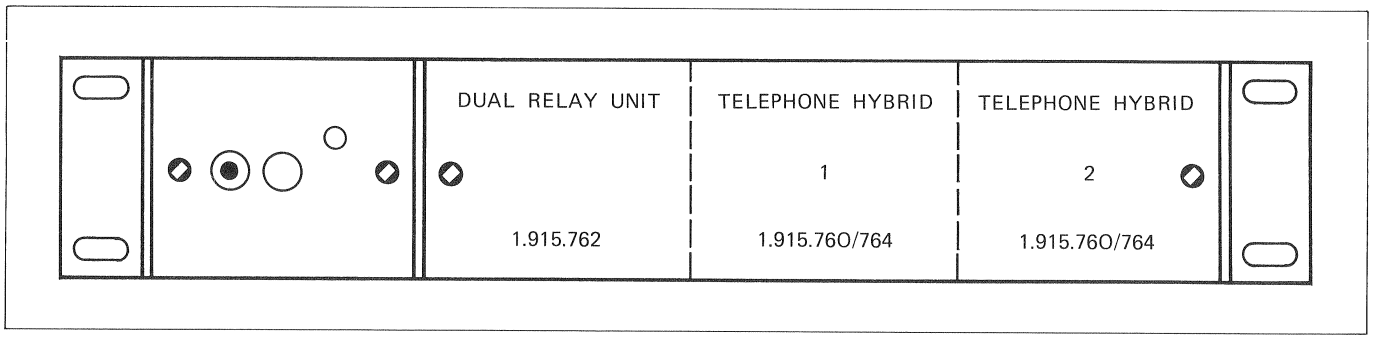


Fig. 3.1
Vorderansicht / Front view / Vue de face

Die Frontplatte ist zweiteilig:
- Abdeckung der Europa-Karten
- Abdeckung des Spannungswählers

The front cover is bipartite:
- cover for the p.c. boards
- cover for the voltage selector

Le panneau frontal est constitué de deux parties:
- cache des cartes européennes
- cache du sélecteur de tension

3.1 WAHL DER NETZ-SPANNUNG

- Front-Abdeckung lösen
- Gewünschte Netzspannung einstellen:
  100 . . . 240 V
- Netzsicherung kontrollieren:
  100 . . . 140 V: 400 mA träge
  200 . . . 240 V: 200 mA träge
- Front-Abdeckung wieder befestigen

3.1 ADAPTATION TO THE MAINS VOLTAGE

- remove front cover
- adjust voltage selector:
  100 . . . 240 V
- check primary power fuse:
  100 . . . 140 V : 400 mA (slow blow)
  200 . . . 240 V : 200 mA (slow blow)
- refix front cover

3.1 CHOIX DE LA TENSION D'ENTREE

- déposer le cache frontal
- choisir la tension de secteur souhaitée:
  100 . . . 240 V
- contrôler le fusible secteur:
  100 . . . 140 V: 400 mA (temporisé)
  200 . . . 240 V: 200 mA (temporisé)
- reposer le cache frontal

3.2 STECKER

3.2 CONNECTORS

3.2 CONNECTEURS

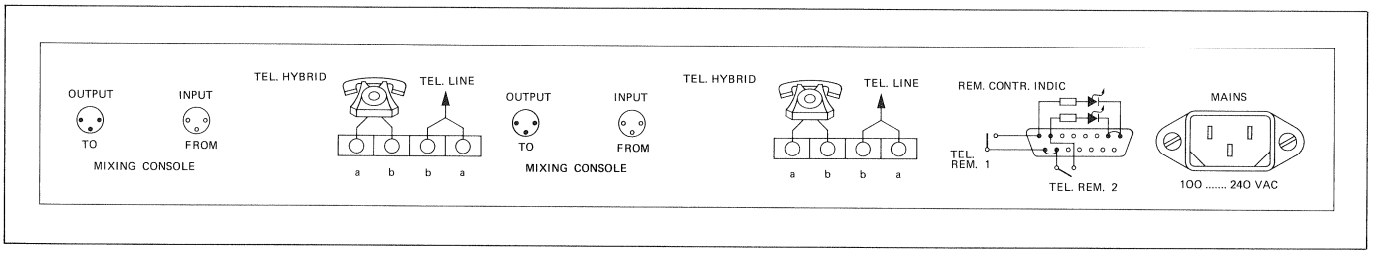


Fig. 3.2
Rückansicht / Back view / Vue antérieure

3.2.1
Netzstecker

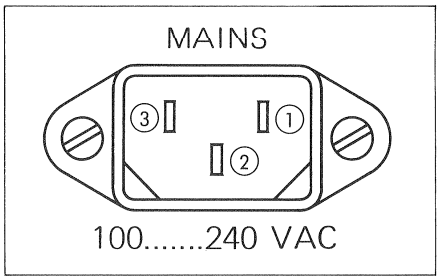


Fig. 3.3

Nr. 1 Phase
Nr. 2 Erde
Nr. 3 Null-Leiter

3.2.2
Audio-Stecker

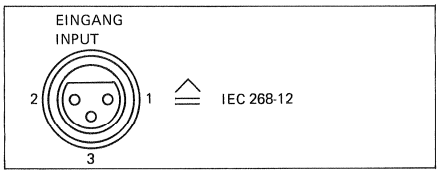


Fig. 3.4
Eingang (weiblich)
Input (female)
Entrée (femelle)

Nr. 1 Audio-Masse ⊥
Nr. 2 A-Leitung (heiss)
Nr. 3 B-Leitung (kalt)

3.2.3
Signalisierung/Fernsteuerung

3.2.1
Mains connector

Fig. 3.3

No. 1 live
No. 2 ground
No. 3 neutral

3.2.2
Audio connectors

3.2.3
Signalling/remote control

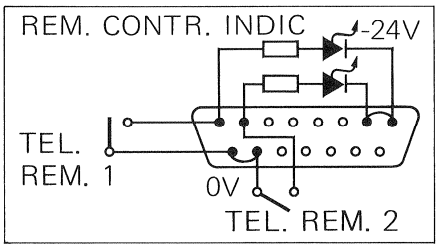


Fig. 3.6
15 poliger Stecker Typ D
15-pin connector type D
Connecteur 15 pôles type D

3.2.1
Connecteur secteur

No 1 phase
No 2 terre
No 3 ligne neutre

3.2.2
Connecteur audio

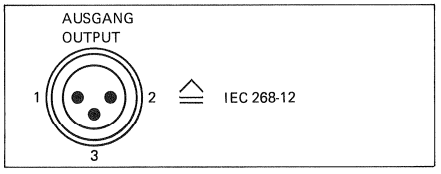


Fig. 3.5
Ausgang (männlich)
Output (male)
Sortie (mâle)

No 1 masse audio ⊥
No 2 ligne A (point chaud)
No 3 ligne B

3.2.3
Signalisation/télécommande

3.3 ANWENDUNGSBEISPIELE

3.3 APPLICATION EXAMPLES

3.3 EXEMPLES D'APPLICATION

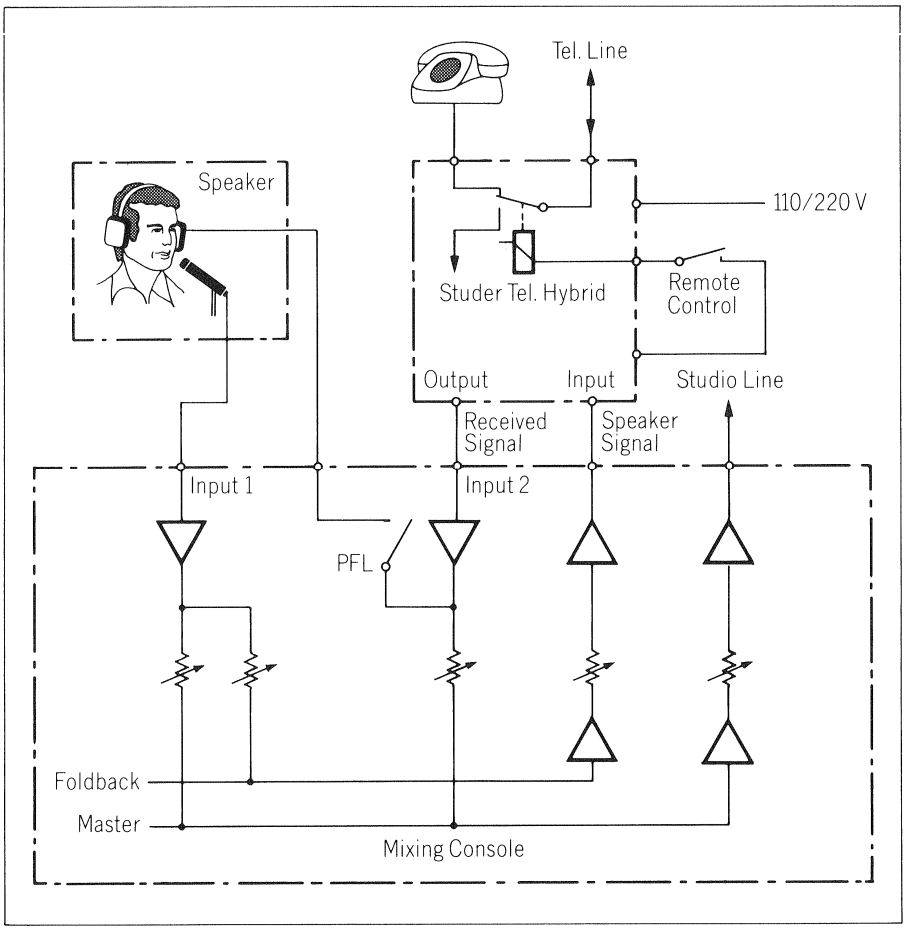


Fig. 3.7
Anwendungsbeispiel mit dem Hybrid

Example with one hybrid

Exemple d'application avec un hybride

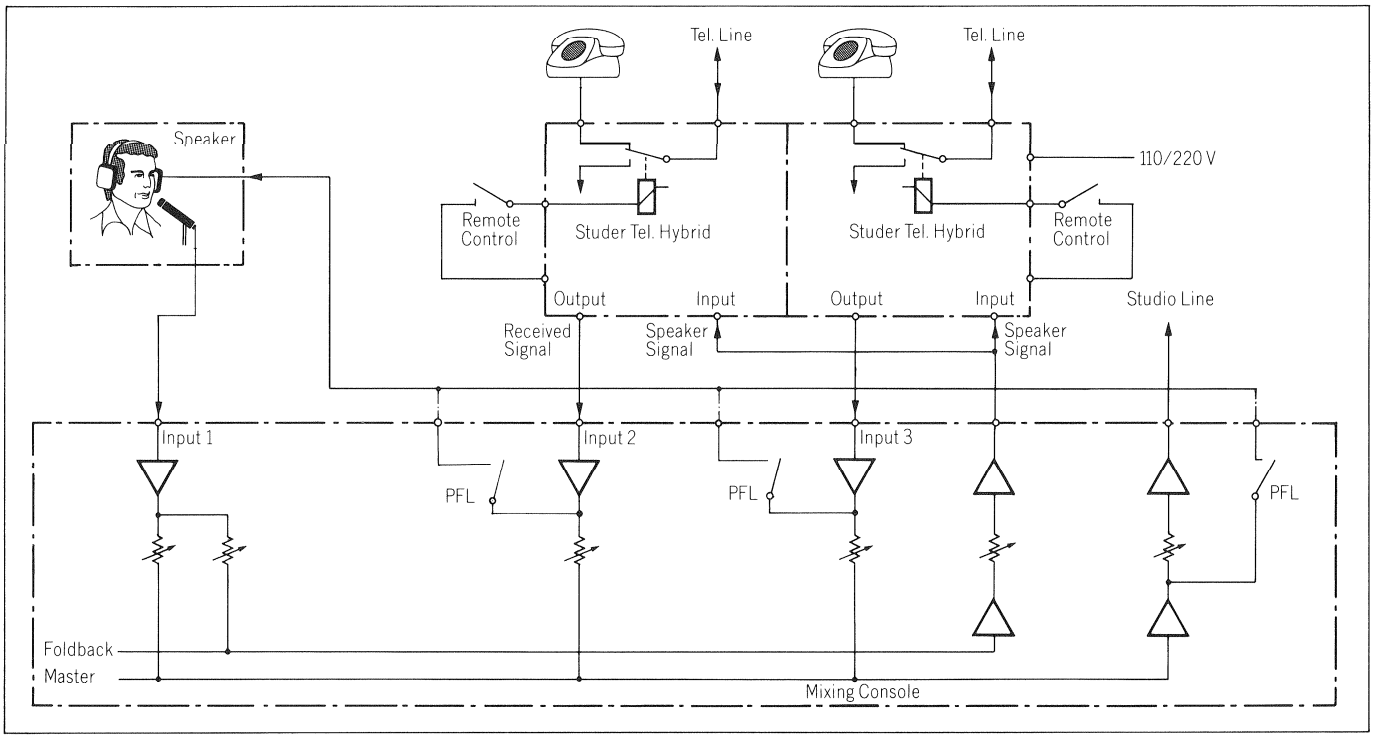


Fig. 3.8

Anwendungsbeispiel mit zwei Hybriden | Example with two hybrids | Exemple d'application avec deux hybrides

4. FUNKTIONSBESCHREIBUNG, EINMESSEN

4.1 BESCHREIBUNG DES BLOCKSCHALTBILDES

Das Grundprinzip des Telefon-Hybrids basiert auf der bekannten Brückenschaltung:

4. FUNCTION DESCRIPTION, LINE UP

4.1 DESCRIPTION OF THE BLOCK DIAGRAM

The working principle is based on the well known bridge circuit.

4. DESCRIPTION DE FONCTION, ETALONNAGE

4.1 DESCRIPTION DU SCHEMA-BLOC

L'hybride téléphonique repose sur le principe connu du circuit en pont:

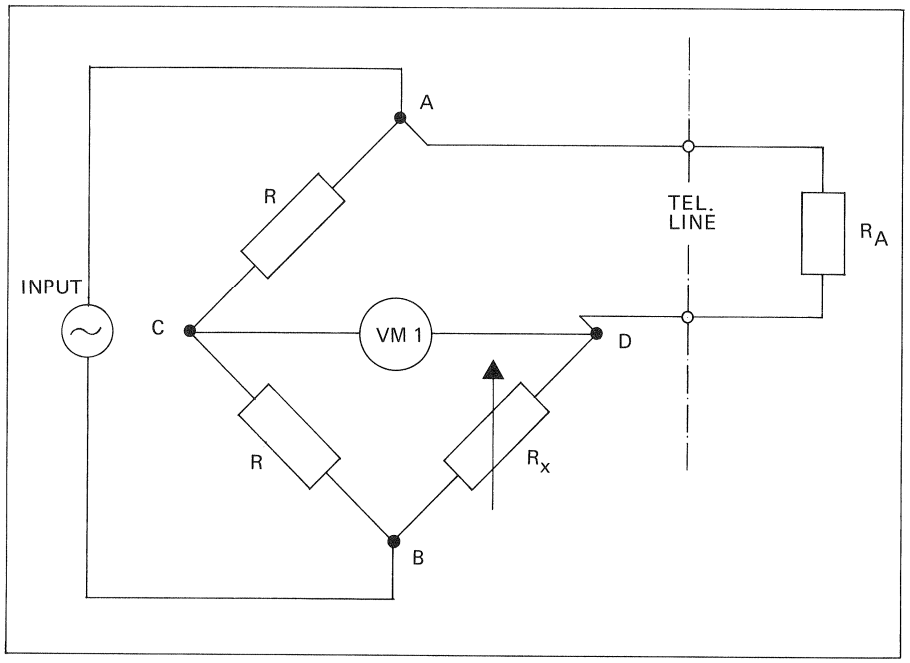


Fig. 4.1

Die Brückenschaltung wird abgeglichen bis die Bedingung

$$R_X = R_A$$

erfüllt ist. Wird nun an den Eingang der Brücke (A – B) eine Spannung angelegt, ist die Spannung zwischen den Punkten C – D = 0 Volt.
Die an R_A anliegende Spannung ist dann gegenüber der Eingangsspannung um 6 dB abgeschwächt.

Eine an die Telefonleitung (R_A) angelegte Spannung erscheint am Ausgang (C – D).
R_X wird im STUDER Telefon-Hybrid automatisch abgeglichen. An Stelle eines Voltmeters VM 1 wird der Eingang eines Operationsverstärkers angeschlossen (C – D).
Wird am Eingang (INPUT) eine Spannung angelegt, erscheint bei der noch nicht abgeglichenen Brücke am Punkt F (Fig. 4.2) ein Fehlersignal.

The resistor R_X is adjustable and has to be varied until the condition

$$R_X = R_A$$

is fulfilled. Under this balanced condition if any voltage is applied to the input of the bridge (A – B), there will be no voltage between C – D (C – D = 0 volts).
The voltage on R_A is then 6 dB lower than the voltage applied to the input.

However a voltage supplied from the telephone line (R_A) appears at the output (C – D).
In the STUDER telephone hybrid the adjustment of the resistor R_X is done automatically. The voltmeter VM 1 is replaced by the input of an op amp (C – D).
With the bridge not properly balanced a signal applied to the input produces an error signal at the output F of the op amp (fig. 4.2).

Le circuit en pont est équilibré jusqu'à ce que la condition

$$R_X = R_A$$

soit remplie. Dès lors qu'une tension est appliquée à l'entrée du pont (A – B), la tension entre les points C – D = 0 volt.
La tension présente en R_A est alors affaiblie de 6 dB par rapport à la tension d'entrée.

Une tension appliquée à la ligne téléphonique est présente à la sortie (C – D).
R_X est équilibré automatiquement dans l'hybride téléphonique STUDER. A lieu d'un voltmètre VM 1, l'entrée d'un amplificateur opérationnel est raccordé (C – D).
Si une tension est appliquée à l'entrée (INPUT), un signal d'erreur apparaît au point F (fig. 4.2) du pont pas encore équilibré.

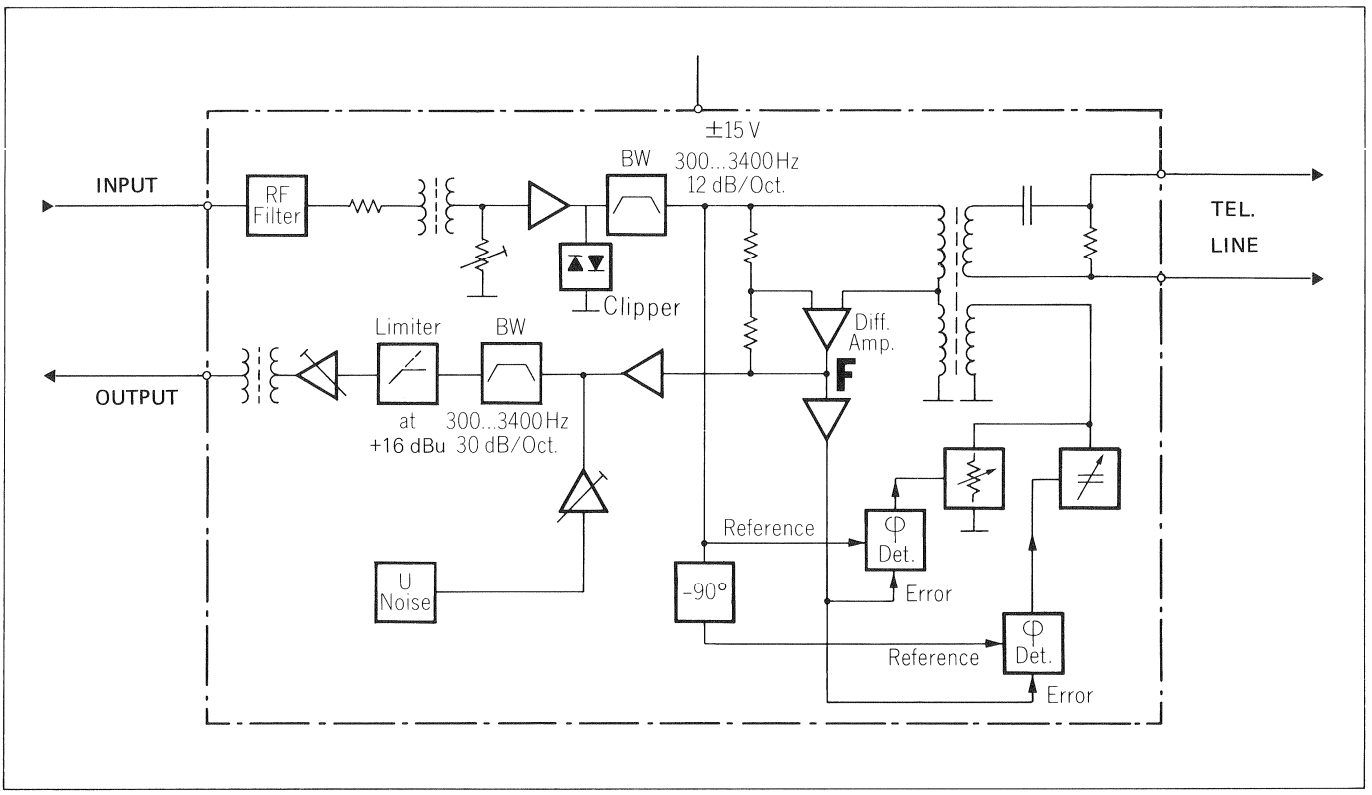


Fig. 4.2
Blockschaltbild des Telefon-Hybrid

Mit einer Phasenvergleichs-Schaltung wird aus dem Eingangssignal und dem Fehlersignal ein Signal gebildet, das einen "elektronischen Widerstand" so lange abgleicht, bis das Fehlersignal ein Minimum erreicht.

Aus dem um 90° verschobenen Eingangssignal und dem Fehlersignal wird in einer zweiten Phasenvergleichs-Schaltung ein weiteres Signal gebildet, das einen "elektronischen Kondensator" so lange abgleicht, bis das Fehlersignal ein Minimum erreicht.
Damit sind Real- und Imaginärteil der Brücke (R_X) denjenigen der Telefonleitung (R_A) angeglichen. Bei fehlendem Eingangssignal bleibt der letzte Abgleich gespeichert.

Das Sendesignal (INPUT-TELEPHONE LINE) wird in einem Eingangstransformator symmetriert. Ein Abschwächer (SEND) erlaubt die Anpassung an den gewählten Leitungspegel. Ein Bandpass (12 dB/Oktave) beschneidet den Frequenzgang auf die für Telefonübertragung benötigte Bandbreite und bewirkt damit die Nachbildung des Frequenzganges einer Telefonkapsel. Ein Diodenbegrenzer begrenzt das Ausgangssignal auf 3 V_{ss}. Das Ausgangssignal gelangt über den Leitungsübertrager auf die Telefonleitung.

Block diagram of the telephone hybrid

A phase comparator circuit processes both the input and the error signals and produces a signal changing an "electronic resistor" until the error signal reaches a minimum.

A second phase comparator circuit processes the – 90° phase shifted input signal and the error signal and produces a further signal changing an "electronic capacitor" until the error signal reaches a minimum.
In this way the real and imaginary components (R_X) of the bridge approximate to these of the telephone line (R_A).
If no input signal is applied the circuit memorizes the last measured values.

The signal (INPUT – TELEPHONE LINE) is fed through a balancing transformer to the first stage. An adjustable resistor (SEND) allows the adaptation to the selected line level. A bandpass filter (12 dB/octave) limits the frequency response to the bandwidth of a telephone transmission therefore providing the characteristic of a carbon microphone. A diode clipper limits the output signal to 3 V_{p-p}. The output signal is then fed to the telephone line via the line transformer.

Schéma-bloc de l'hybride téléphonique

A l'aide d'un circuit de comparaison de phase, le signal d'entrée et le signal d'erreur donnent un signal qui modifie une "resistance électronique" jusqu'à ce que le signal d'erreur atteint un niveau minimum.

Dans un deuxième circuit de comparaison de phase, le signal d'entrée, décalé de 90°, et le signal d'erreur, donnent un nouveau signal qui modifie un "condensateur électronique" jusqu'à ce que le signal d'erreur atteint un niveau minimum. Ainsi, les parties réelle et imaginaire du pont (R_X) sont assimilées à celles de la ligne téléphonique (R_A).
En cas d'absence d'un signal d'entrée, la dernière compensation reste mémorisée.

Le signal d'émission (INPUT – TELEPHONE LINE) est équilibré dans un transformateur d'entrée. Un atténuateur (SEND) permet l'adaptation au niveau de ligne choisi. Un filtre passe-bande (12 dB/octave) limite la réponse en fréquence à la largeur de bande nécessaire pour la transmission téléphonique et il en résulte la simulation de la réponse en fréquence d'une capsule téléphonique. Un limiteur à diodes borne le signal de sortie à 3 V_{pp}. Le signal de sortie est conduit sur la ligne téléphonique via le translateur de ligne.

Das Empfangssignal (TELEPHONE LINE-OUTPUT) durchläuft in entgegengesetzter Richtung zuerst den Leitungsübertrager und wird in einem steilflankigen (30 dB/Oktave) Bandpassfilter von unerwünschten Signalen – Zählimpulse, Steuerungsimpulse etc. – befreit.
Ein Begrenzer schützt die nachfolgenden Stufen vor Übersteuerung bei zu hohen Signalen. Mit dem Abschwächer (RETURN) wird der Studio-Leitungspegel eingestellt. Das Ausgangssignal wird in einem Leitungsverstärker verstärkt und über einen Transformator auf den Ausgangsstecker geführt.

The receiving signal (TELEPHONE LINE – OUTPUT) passes through the line transformer to a high order band-pass filter (30 dB/octave) where all unwanted signals – counting pulses, control pulses etc. – are attenuated.
To prevent overloading of the following stages a limiter is provided. An adjustable resistor (RETURN) allows to adjust the output signal to the studio line level. After the line amplifier the signal passes an output transformer and is fed to the output connector.

Le signal de réception (TELEPHONE LINE – OUTPUT) parcourt en sens opposé, d'abord le translateur de ligne et est ensuite dépouillé de signaux indésirables – impulsions de commande, etc. – dans un filtre passe-bande à pente raide (30 dB/octave).
Un limiteur protège les étages consécutifs de la surmodulation en cas de signaux de niveau trop élevé. L'atténuateur (RETURN) permet de régler le niveau de ligne studio.
Le signal de sortie est amplifié dans un amplificateur de ligne et conduit sur le connecteur de sortie via un transformateur.

4.2 EINMESSEN

Falls vom Kunden nicht anders spezifiziert, wird der Telefon-Hybrid vom Herstellerwerk auf den internationalen Telefon-Leitungspegel von – 13 VU und einen Studio-Leitungspegel von + 6 dBu eingestellt.

Eine Anleitung zum Umpegeln des Hybrids ist im Abschnitt 4.2.2 zu finden.

0 dBu ≙ 0,775 V_{eff}

0 VU ≙ 1 mW an 600 Ohm, Eichung mit Sinussignal. Gemäss PTT-Vorschriften wird der Sprechpegel mit einem VU-Meter nach ASA C 16.5 gemessen. Vorlauf (Lead) 8 dB gegenüber Sinussignal. – 13 VU entsprechen also – 5 dBu.

4.2.1 Initialabgleich der Telefonleitung

Der Telefon-Hybrid regelt den R- und C-Anteil der Telefonleitung aus. Dies ist der Hauptanteil der Leitungsnachbildung. Es können jedoch auch induktive Anteile, von Relais und Transformatoren herrührend, auftreten. Da der Hybrid normalerweise immer auf die gleiche Zentrale (Amt) aufgeschaltet ist, kann durch einen Vorabgleich enventuell eine bessere Nachbildung und damit eine grössere Rückhördämpfung erzielt werden.

Abgleichvorgang
Telefon-Hybrid gemäss Kapitel 3 anschliessen und eine gute Amtsverbindung herstellen (nicht Hauszentrale!). Den Telefonhörer der Partnerstation mit Tüchern schalldicht umwickeln oder das Telefon durch eine 600 Ohm-Ersatzlast nachbilden.

4.2 LINE UP

Unless otherwise requested by the customer, the telephone hybrid is normally factory-aligned to the international standard telephone level of – 13 VU and a studio line level of + 6 dBu.

An instruction for realignment to other levels is provided in section 4.2.2

0 dBu ≙ 0.775 V_{RMS}

0 VU ≙ 1 mW in 600 ohms (sine wave).
According to telephone network regulations the speech level is measured with a VU meter, built according to ASA standard C 16.5. Lead 8 dB compared to sine wave. – 13 VU correspond to – 5 dBu.

4.2.1 Preadjustment of the telephone line

The telephone hybrid compensates for the R- and C-components of the telephone line. These are the main components of the line. However there can be inductive components too, originating in relays and transformers. Since the hybrid is normally always connected to the same telephone exchange, preadjustment will provide a better sidetone attenuation due to a more accurate adjustment of the bridge.

Preadjustment procedure
Connect the hybrid as seen in section 3 and establish a good telephone connection via the main exchange (not the private exchange!). To prevent the pickup of sound by the other station, wrap its handset with clothes or replace the telephone by a 600 ohm load.

4.2 ETALONNAGE

Sauf spécification contraire du client, l'hybride téléphonique est réglé d'usine au niveau de ligne téléphonique de – 13 VU et à un niveau de ligne studio de + 6.

Des instructions pour le changement de niveau de l'hybride se trouvent au paragraphe 4.2.2

0 dBu ≙ 0,775 V_{eff}

0 VU ≙ 1 mW sur 600 ohms, étalonnage avec son sinusoïdal. Selon norme PTT, le niveau de parole est mesuré à l'aide d'un VU-mètre d'après ASA C 16.5. Avance (Lead) de 8 dB par rapport au son sinusoïdal. – 13 VU correspond donc à – 5 dBu.

4.2.1 Equilibrage initial de la ligne téléphonique

L'hybride téléphonique règle jusqu'à pleine puissance, les proportions R et C de la ligne téléphonique. Ceci constitue la majeure partie du montage équivalent. Des proportions inductives, en provenance de relais et de transformateurs, peuvent cependant aussi se présenter. Etant donné que normalement l'hybride est toujours branché sur le même central (public), un meilleur montage équivalent (simulation de ligne) et partant un plus grand affaiblissement du signal local, peuvent être obtenus par une pré-ajustage.

Procédé d'équilibrage
Connecter l'hybride téléphonique selon le chapitre 3 et établir une bonne communication de réseau (pas de central d'abonné). Insonoriser le combiné de la station opposée en l'enveloppant de chiffons ou en remplaçant la station par une charge équivalente de 600 ohms.

1. Methode:
Ein Sprachprogramm auf den Eingang (INPUT) des Hybrids geben.
Am Anzeige-Instrument des Mischpults den Hybrid-Ausgang (OUTPUT) beobachten und gleichzeitig das Programm über einen parallelgeschalteten Kopfhörer abhören.
Durch Verändern der beiden Trimmpotentiometer auf der Relais-Einheit die maximale Unterdrückung (Rückhördämpfung) einstellen.

1st method:
Apply a speech program to the hybrid INPUT and monitor the hybrid OUTPUT on the main monitor meter of the mixing console. Connect headphones in parallel and monitor as well.
Seek maximum sidetone attenuation by varying both adjustable resistors of the dual relay unit.

1re méthode:
Brancher un programme de parole sur l'entrée (INPUT) de l'hybride.
Observer la sortie de l'hybride (OUTPUT) sur l'indicateur du pupitre de mélange et écouter en même temps le programme via un casque d'écoute connecté en parallèle. En modifiant les deux potentiomètres réglables sur l'unité de relais, chercher l'affaiblissement maximal (atténuation de réjection).

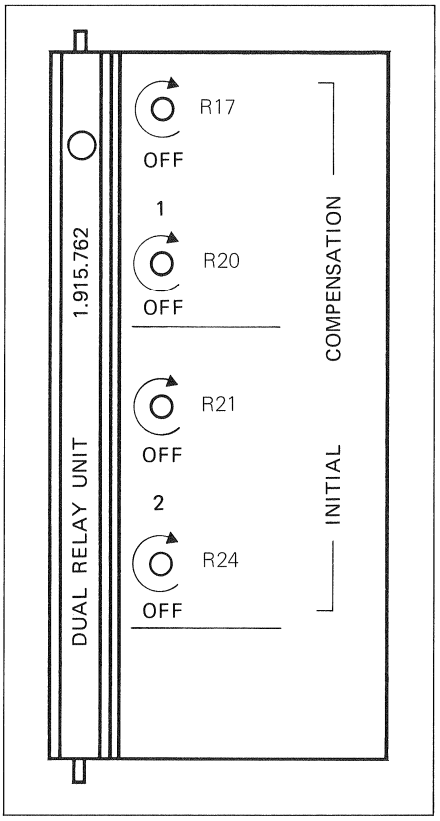


Fig. 4.3

2. Methode:
Kontrolle des Frequenzganges des unterdrückten Signals (langsamer Sweep verwenden).
Falls eine Überhöhung sichtbar ist, die beiden Trimmpotentiometer abgleichen bis der Frequenzgang möglichst flach ist. Überhöhungen sind meistens zwischen 400 und 600 Hz zu beobachten. Überprüfung der Rückhördämpfung nach Methode 1.

Falls durch diese Einstellungen keine Verbesserung erzielt werden kann, sind beide Trimmpotentiometer auf OFF zu drehen.

2nd method:
Check the frequency response of the attenuated return signal. Use a slow sweep generator.
Adjust for flat response by means of the two adjustable resistors of the dual relay unit. Mostly the response peak will be between 400 and 600 Hz. Check the resulting sidetone attenuation with the first method.

If no improvement can be reached, turn both adjustable resistors to OFF position.

2e méthode:
Contrôle de la réponse en fréquence du signal atténué (utiliser une vitesse de wobbulation lente).
Si une surélévation est observée, équilibrer les deux potentiomètres réglables jusqu'à ce que la réponse en fréquence soit aussi plate que possible. Les surélévations sont observées le plus souvent entre 400 et 600 Hz. Vérification de l'attenuation de réjection selon méthode 1.

Si aucune amélioration n'est obtenue par ces réglages, tourner les deux potentiomètres réglables sur OFF.

4.2.2
Umpegeln

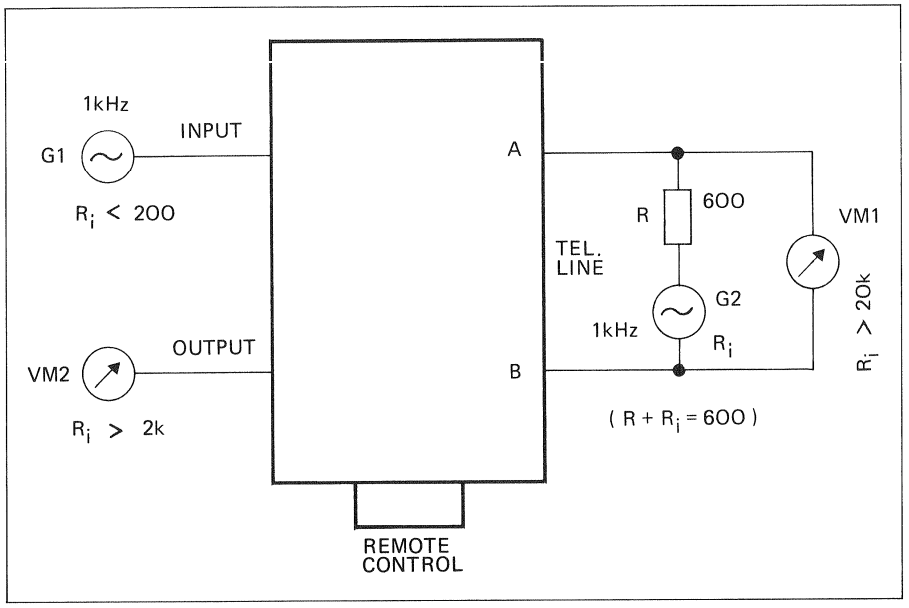


Fig. 4.4

1. Studio-Leitungspegel (Bereich + 6 . . . + 15 dBu) mit Generator G1 einstellen. Pegel des Generators G2 auf Null.
Trimmpotentiometer R3 (SEND) so einstellen, dass der Pegel auf der Telefonleitung (VM1) – 5 dBu erreicht.

2. Pegel des Generators G1 auf Null drehen. Mit Generator G2 – 5 dBu einstellen (an VM1). Mit Trimmpotentiometer R34 (RETURN) den Pegel am Ausgang (VM2) auf Studio-Leitungspegel einstellen.

4.2.2
Realignment

1. Adjust generator G1 to the studio line level between + 6 and + 15 dBu. Level of generator G2 set to zero. Adjust the telephone line level by means of the adjustable resistor R3 (SEND) to – 5 dBu (on VM1).

2. Turn level of generator G1 to zero. Adjust generator G2 to – 5 at the telephone line (VM1). Adjust the hybrid OUTPUT (VM2) to studio line level by means of adjustable resistor R34 (RETURN).

4.2.2
Changement de niveau

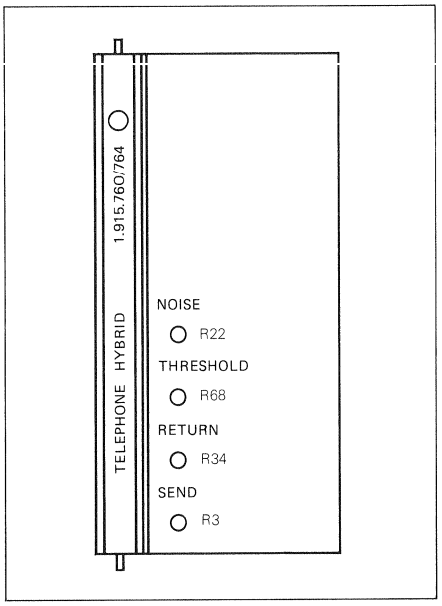


Fig. 4.5

1. Régler le niveau de ligne studio (domaine + 6 . . . + 15 dB) avec le générateur G1. Niveau du générateur 2 à zéro.
Régler le potentiomètre réglable R3 (SEND) de façon que le niveau sur la ligne téléphonique (VM1) atteigne – 5 dBu.

2. Amener le niveau du générateur G1 à zéro. Avec le générateur G2, régler – 5 dBu (sur (VM1). Avec le potentiomètre réglable R34 (RETURN), faire correspondre le niveau à la sortie (VM2) à celui de la ligne studio.

Bemerkung:
Die angegebene Reihenfolge muss unbedingt eingehalten werden, da der Hybrid mit der ersten Einstellung auf die 600 Ohm-Leitungsimpedanz abgeglichen wird. Der telefonseitige Stromkreis darf keinesfalls geöffnet oder kurzgeschlossen werden.

3. Der Einsatzpunkt für den automatischen Abgleich wird vom Herstellerwerk auf 15 dB unter dem Studiopegel eingestellt. Falls ein anderer Einsatzpunkt gewünscht wird, kann die Einstellung mit dem Trimmpotentiometer 3 (THRESHOLD) vorgenommen werden.

4. Gemäss Postbestimmungen darf ein Nebensprechen von – 80 VU auf der Telefonleitung nicht mehr verständlich sein. Um dies zu erreichen, überdeckt ein eingebauter Rauschgenerator das Nebensprechen. Vom Herstellerwerk wird ein Rauschabstand von 67 dB (80 VU – 13 VU) eingestellt. Sollte dies den jeweiligen Postbestimmungen nicht entsprechen, kann der Rauschabstand mit dem Trimmpotentiometer 4 (NOISE) eingestellt werden.

Note:
The sequence of the adjustment is very important because the first calibration matches the hybrid to the 600 ohms line impedance. Do not open or short circuit the telephone line during the adjustment.

3. The beginning of the automatic matching process is factory-aligned to 15 dB below studio line level. This working point can be varied by means of the adjustable resistor 3 (THRESHOLD).

4. Telephone network regulations demand that crosstalk of – 80 VU at the output of the telephone hybrid must not be understandable. To meet that requirement a built-in noise generator is factory-aligned to – 67 dB (80 VU – 13 VU). If other regulations require a different noise level, adjustable resistor 4 (NOISE) has to be varied.

Remarque:
L'ordre indiqué doit absolument être respecté, car l'hybride est équilibré avec le premier réglage par rapport à l'impédance de ligne de 600 ohms. Le circuit du côté téléphonique ne doit en aucun cas être interrompu ou court-circuité.

3. Le seuil de fonctionnement pour l'équilibrage automatique est réglé d'usine à 15 dB en-dessous du niveau de studio. Si un autre seuil de fonctionnement est souhaité, le réglage peut être effectué à l'aide du potentiomètre réglable 3 (THRESHOLD).

4. Selon spécifications PTT, une diaphonie de – 80 VU à la ligne téléphonique ne doit plus être intelligible. Pour y arriver, un générateur de bruit incorporé couvre la diaphonie. Un rapport signal/bruit de 67 dB (80 VU – 13 VU) est réglé d'usine. Si ce réglage ne correspondait pas aux spécifications PTT en vigueur, le rapport signal/bruit peut être réglé à l'aide du potentiomètre réglable 4 (NOISE).

5. SERVICE ANLEITUNG

5.1 STROMVERSORGUNG

Das Netzgerät 1.918.099-81 ist im Rack-Einschub 1.918.102 eingebaut.

5.1.1 Technische Daten:

Netzeingang:
100, 120, 140, 200, 220, 240 V, 50 . . . 60 Hz
Netzsicherung, 100 . . . 140 V:
400 mA träge
Netzsicherung, 200 . . . 240 V:
200 mA träge
Sekundärsicherungen:
2 x 1A träge
Speisespannungen:
Audio ± 15 V, 0,5 A
Signalisation + 24 V, 0,2 A

5. SERVICE INSTRUCTIONS

5.1 POWER SUPPLY

The mains power supply 1.918.099-81 is built-in into the 19" frame 1.918.102.

5.1.1 Specifications

Power input:
100, 120, 140, 200, 220, 240 V, 50 . . . 60 Hz

Primary power fuse, 100 . . . 140 V:
400 mA (slow blow)
Primary power fuse, 200 . . . 240 V:
200 mA (slow blow)
Secondary fuses:
2 x 1A (slow blow)
Supply voltages:
Audio ± 15 V, 0.5 A
Signalling + 24 V, 0.2 A

5. INSTRUCTIONS DE SERVICE

5.1 ALIMENTATION

Le bloc-secteur 1.918.99-81 est incorporé au châssis embrochable 1.918.102.

5.1.1 Caractéristiques techniques:

Entrée secteur:
100, 120, 140, 200, 220, 240 V, 50 . . . 60 Hz
Fusible secteur, 100 . . . 140 V:
400 mA (temporisé)
Fusible secteur, 200 . . . 240 V:
200 mA (temporisé)
Fusibles secondaires:
2 x 1A (temporisé)
Tensions d'alimentation:
audio ± 15 V, 0,5 A
Signalisation + 24 V, 0,2 A

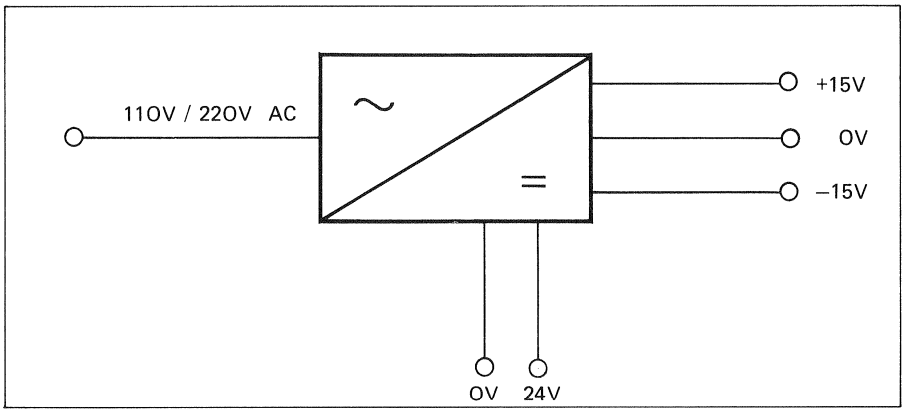


Fig. 5.1

5.1.2 Wahl der Eingangsspannung

– Frontabdeckung, linker Teil, lösen
– gewünschte Netzspannung einstellen
– Netzsicherung kontrollieren
– Frontabdeckung wieder befestigen

5.1.3 Sekundärsicherungen ersetzen

– Gehäusedeckel abschrauben (6 Schrauben)
– Sicherungen 1A träge einsetzen

5.1.2 Adaptation to the mains voltage

– remove front cover
– adjust voltage selector
– check primary power fuse
– refix front cover

5.1.3 Replacement of secondary fuses

– remove frame cover (undo 6 screws)
– change fuses 1A (slow blow)

5.1.2 Choix de la tension d'entrée

– déposer le cache frontal, partie gauche
– choisir la tension d'alimentation souhaitée
– contrôler le fusible secteur
– reposer le cache frontal

5.1.3 Remplacement des fusibles secondaires

– dévisser le couvercle du boîtier (6 vis)
– remplacer les fusibles 1A (temporisé)

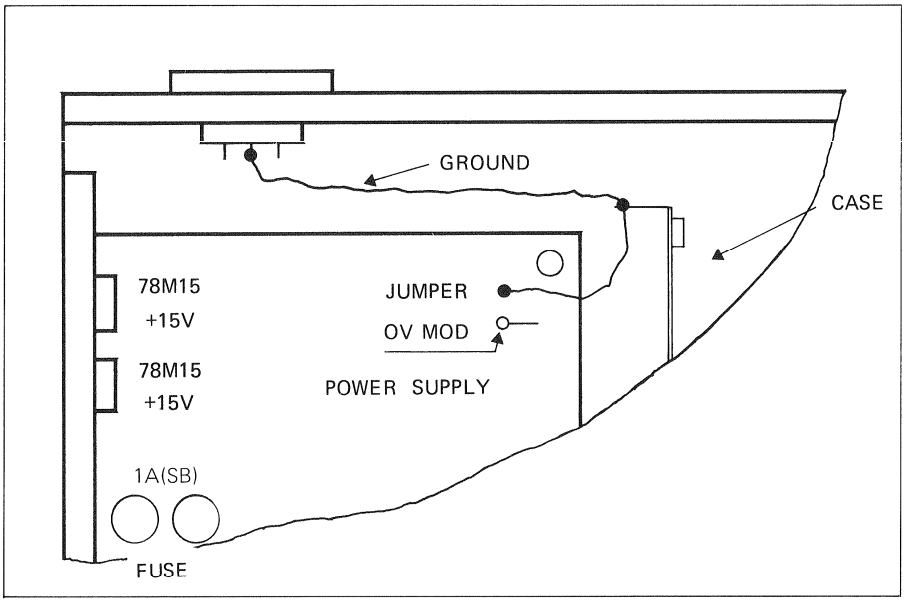


Fig. 5.2

5.1.4
Netzkontrollampe ersetzen

- Am Netzschalter die rote Kalotte abziehen
- Lampe auswechseln (36 V, EAO)

5.1.4
Replacement of power indication lamp

- remove red cap of the power switch
- change lamp (36 V, EAO)

5.1.4
Remplacement de la lampe-témoin d'alimentation

- retirer la calotte rouge de l'interrupteur principal
- remplacer la lampe (36 V, EAO)

5.1.5
Netzteil reparieren

- Gehäusedeckel abschrauben
- Netzteilprint inkl. Kühlprofil ausbauen

5.1.5
Repair of power supply

- remove frame cover (undo 6 screws)
- remove power supply p.c.b. including heat sink

5.1.5
Réparation du bloc-secteur

- dévisser le couvercle du boîtier
- déposer la plaquette á circuit imprimé du bloc d'alimentation, y compris le profilé de refroidissement

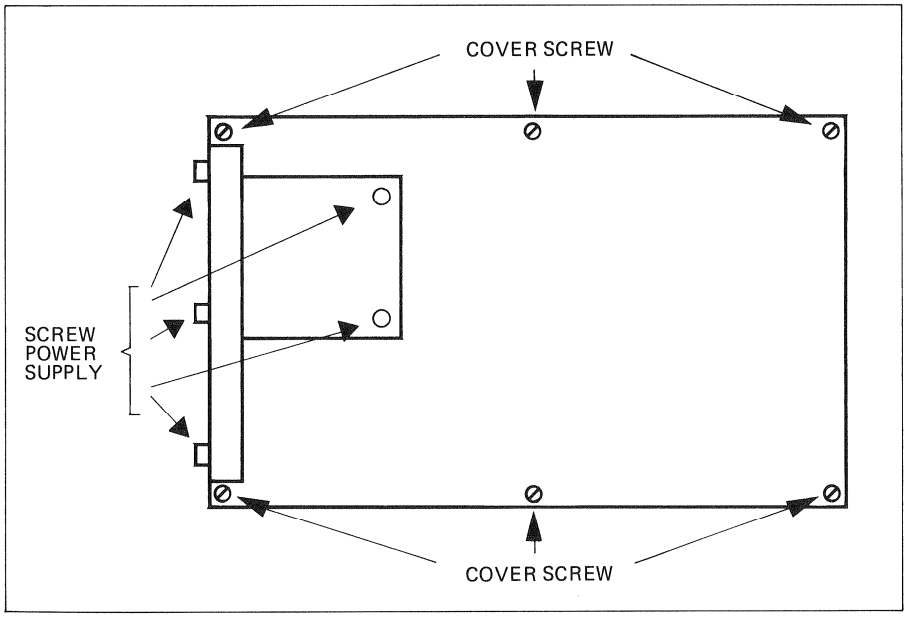


Fig. 5.3

5.2
HYBRID 1.915.760-81/764
EINGANGSKREIS (SEND)

5.2
HYBRID 1.915.760-81/764
INPUT CIRCUIT (SEND)

5.2
HYBRIDE 1.915.760-81/764
CIRCUIT D'ENTREE (SEND)

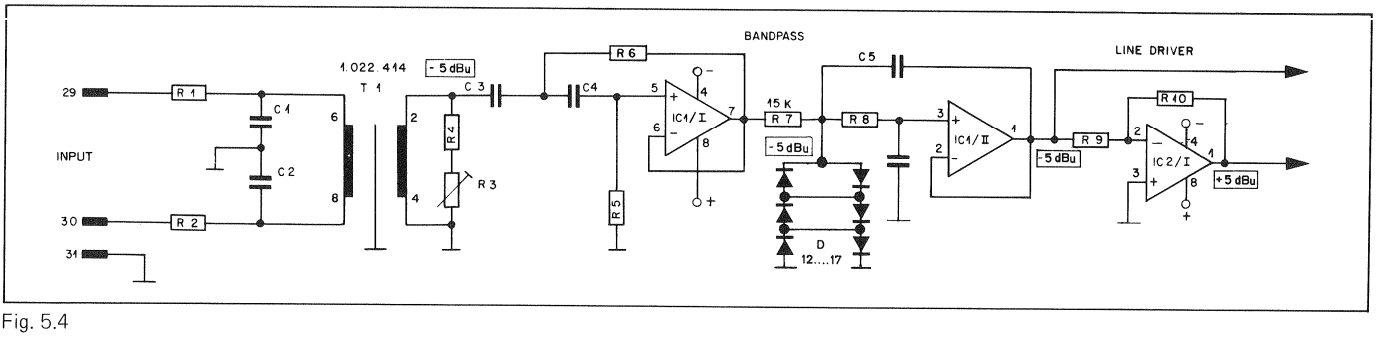


Fig. 5.4

R1, R2, C1, C2 bilden ein Hochfrequenzfilter, das Frequenzen oberhalb 15 kHz beschneidet.

Die Verstärkung des nachgeschalteten Bandpassfilters beträgt 1. Das Filter hat eine Steilheit von 12 dB/Oktave. Es bewirkt die Nachbildung des Frequenzganges einer Kohle-Mikrofonkapsel.

R1, R2, C1, C2 form a low-pass filter which cuts off frequencies above 15 kHz.

The following band-pass filter has unity gain and a slope of 12 dB/octave. It shapes the SEND signal and provides the frequency response of a normal carbon microphone capsule.

R1, R2, C1, C2 forment un filtre haute fréquence, qui limite les fréquences au-dessus de 15 kHz.

Le filtre passe-bande possède un gain de 1, une pente de 12 dB/octave et est réglé pour la bande passante suivante (schéma de la bande passante d'un micro téléphonique au carbon).

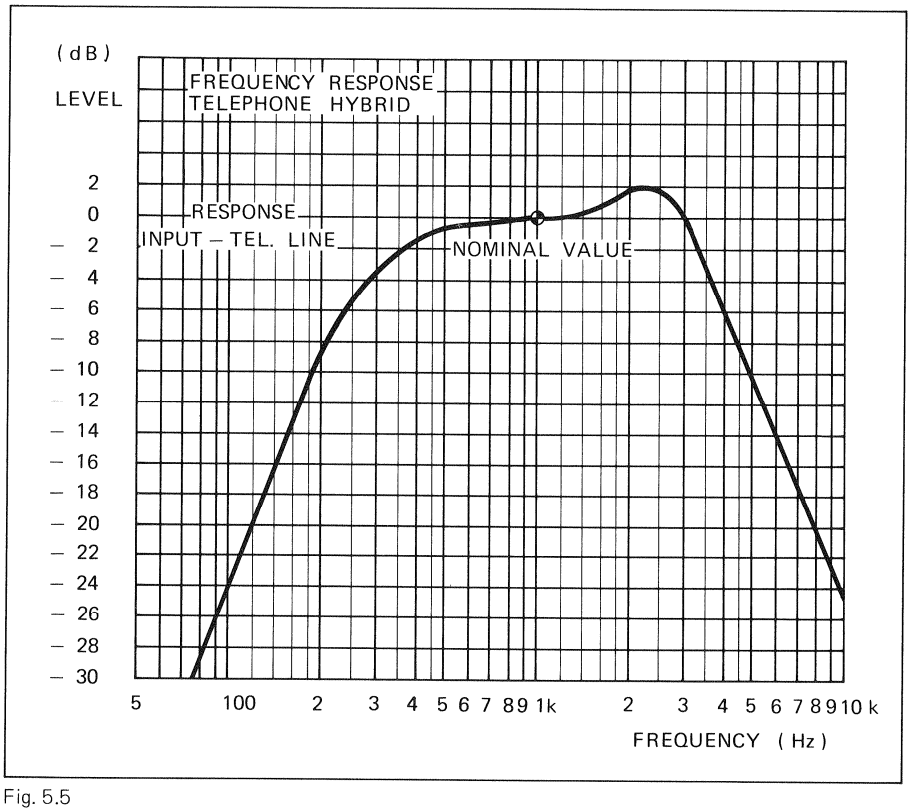


Fig. 5.5

Die postalischen Bestimmungen verlangen, dass der auf die Telefonleitung abgegebene Pegel 3 V_{ss} nicht überschreiten darf. Die Dioden D12 . . . D17 begrenzen höhere Signale.

Der Leitungsverstärker IC2/I ist auf eine Verstärkung von 10 dB eingestellt und treibt die Hybridschaltung.

Telephone network regulations demand an output level to the telephone line of not more than 3 V_{pp}. To meet this, diodes D12 . . . D17 clip any signal exceeding that limit.

The line amplifier IC2/I has a gain of 10 dB and drives the hybrid circuit.

Les spécifications des PTT exigent que le niveau appliqué à la ligne téléphonique ne dépasse pas 3 V_{pp}. Les diodes D12 . . . D17 limitent les signaux de niveau plus élevé.

L'amplificateur de ligne IC2/I est réglé sur un gain de 10 dB et attaque le circuit hybride.

5.3 HYBRID AUSGANGSKREIS (RETURN)

Die Schwellwert-Schaltung der Ausführung 1.915.764 ist in Kapitel 5.8 beschrieben.

5.3.1 Bandpassfilter

5.3 HYBRID OUTPUT CIRCUIT (RETURN)

The noise gate circuit 1.915.764 is described in section 5.8

5.3.1 Band-pass filter

5.3 CIRCUIT DE SORTIE HYBRIDE (RETURN)

Le circuit à seuil de l'exécution 1.915.764 est décrit au chapitre 5.8.

5.3.1 Filtre passe-bande

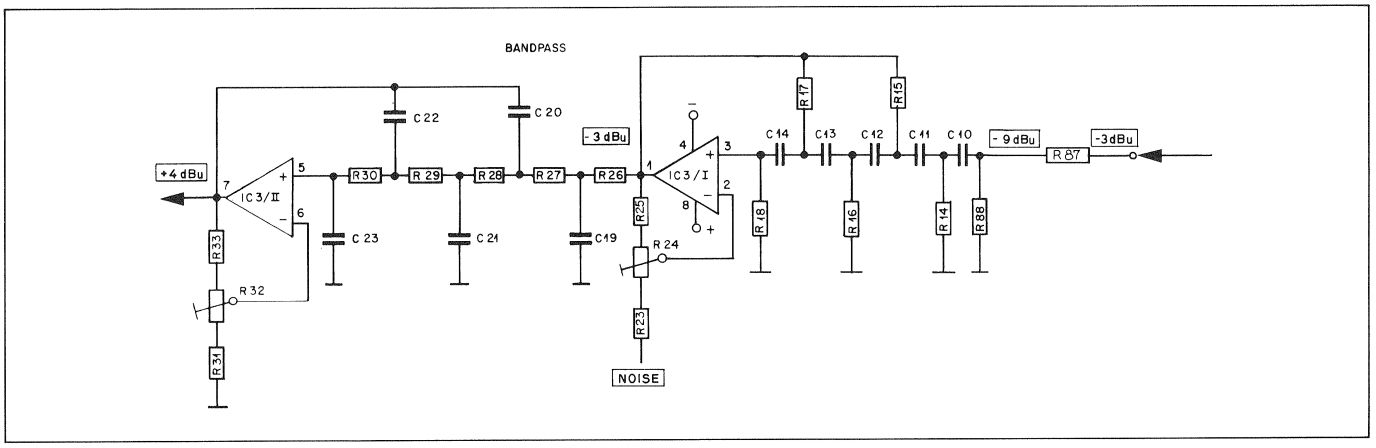


Fig. 5.6

Das Bandpassfilter ist fünfter Ordnung mit einer Steilheit von 30 dB/Oktave.
Mit den Trimmpotentiometern R24 und R32 kann die Charakteristik der Filter eingestellt werden.

The fifth-order band-pass filter has a slope of 30 dB/octave.
Its characteristic can be adjusted by means of adjustable resistors R 24 and R 32.

Le filtre passe-bande dans le circuit de retour est du 5ème ordre (30 dB/octave).
A l'aide des deux potentiomètres R 24 et R 32, on peut régler la caractéristique du filtre.

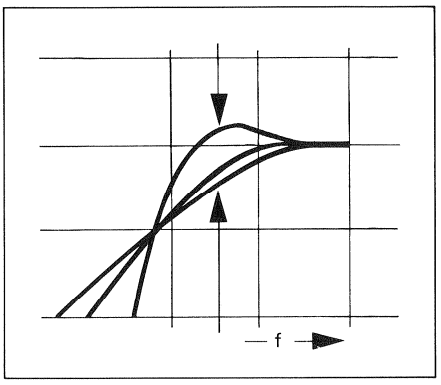


Fig. 5.7

Die Verstärkung jeder Filterstufe beträgt 6 dB.

The gain of each filter section is approximately 6 dB.

Le gain des seuls étages est d'environ 6 dB.

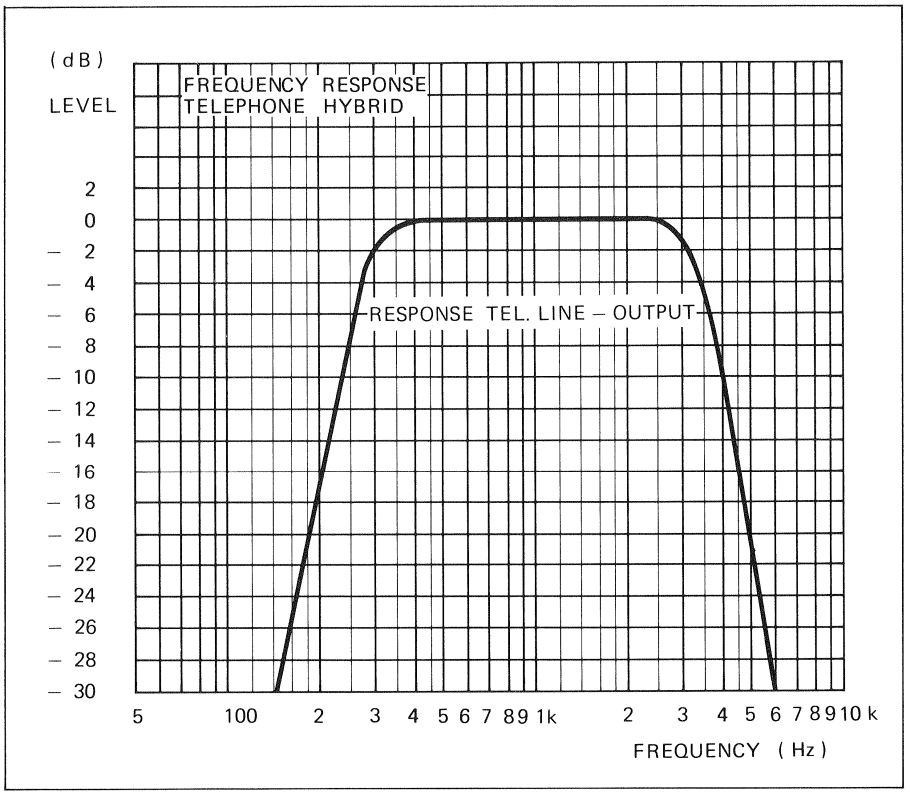


Fig. 5.8
Durchlasskurve des Gesamtfilters.

Frequency response of the band-pass filter

Courbe de gain du filtre total

5.3.2
Rauschgenerator

Ein Operationsverstärker mit grosser Verstärkung wird als Rauschquelle verwendet. Seine Verstärkung lässt sich mit R22 verändern.

5.3.2
Noise generator

A high gain op amp acts as a noise source. Its gain can be varied by means of adjustable resistor R 22.

5.3.2
Générateur de bruit

On utilise comme générateur de bruit un amplificateur opérationnel à grand gain (max. 45 dB) réglable par R 22.

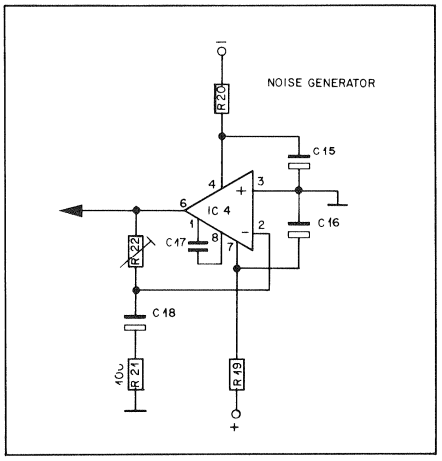


Fig. 5.9

Zur Verbesserung der Speisespannungs-Unterdrückung des Operationsverstärkers ist eine zusätzliche Siebung bestehend aus R19, R20, C15, C16 eingebaut.

To improve supply voltage rejection, additional filtering is provided (R19, R20, C15, C16).

Pour améliorer le découplage de la tension d'alimentation de l'ampli opérationnel, un filtre supplémentaire a été utilisé (R19, R20, C15, C16).

5.3.3 Begrenzer

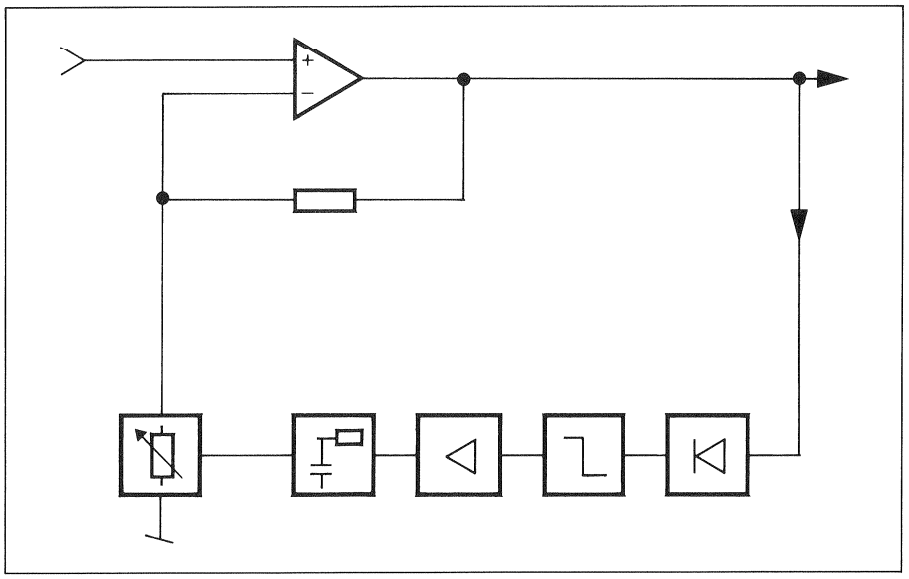


Fig. 5.10
Blockschaltbild

In ungeregeltem Zustand beträgt die Verstärkung ca. 45 dB. Nach dem Einsetzen der Regelung regelt Q5 die Verstärkung zurück.

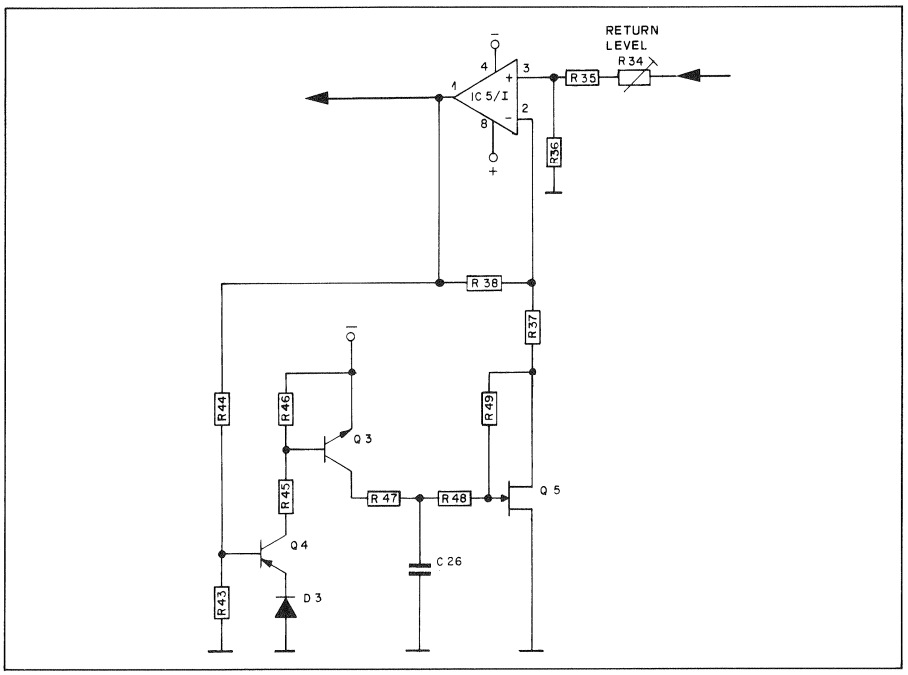


Fig. 5.11

Q4 arbeitet als Halbwellen-Gleichrichter und dient gleichzeitig als Schwelle. Q3 arbeitet als invertierender Verstärker. Die Ansprechzeit wird durch R47, C26 bestimmt, die Erholzeit durch R48, R49 und C26.
Der Feldeffekt-Transistor regelt als veränderlicher Widerstand die Verstärkung von IC5/I.

5.3.3 Limiter

Block diagram

In unlimited condition, the gain is approximately 45 dB. In the limiting range, Q5 acts as an adjustable gain control.

Q4 is a half wave rectifier and works as a threshold. Q3 works as an inverting amplifier. The attack time is determined by R47, C26, the recovery time is set by R48, R49 and C26.
The FET Q5 acts as a variable resistor and controls the gain of IC5/I.

5.3.3 Limiteur

Schéma bloc

Dans l'état non limité, le gain est d'environ 45 dB et est ensuite réglé par Q5.

Q4 forme un redresseur demi-onde et en même temps le suil. Q3 travaille en amplificateur-inverseur. R47, C26 forment le temps d'attaque, C26, R48, R49, le temps de recouvrement. Q5 constitue une résistance réglable. Le limiteur commence à travailler à + 16 dBu de la sortie.

5.3.4 Leitungsverstärker

5.3.4 Line amplifier

5.3.4 Amplificateur de ligne

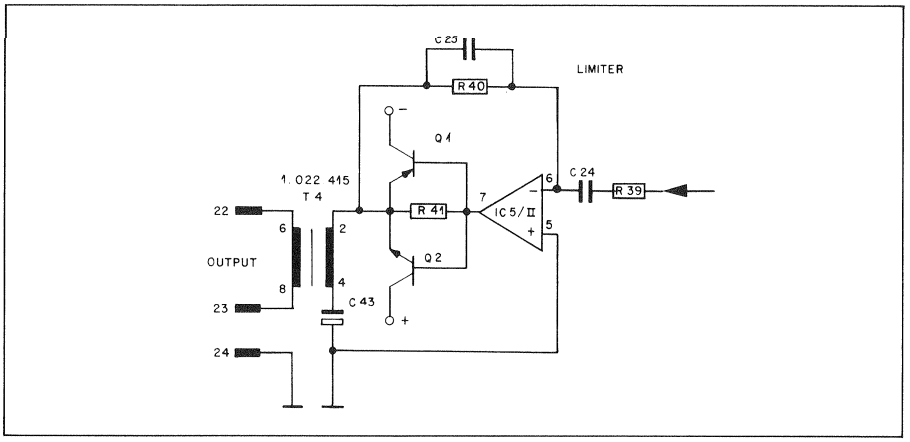


Fig. 5.12

Die Ausgangsstufe mit Transformator hat eine Verstärkung von 6 dB.
R39, C24 bilden ein Hochpassfilter.

The output stage including the transformer has a gain of 6 dB.
R39, C24 form a high-pass filter.

L'étage avec le transformateur amplifie de 6 dB. La bande passante est limitée vers le bas par R39, C24.

5.3.5 Speisung der Hybrid-Karte

Die Versorgungsspannungen werden gegen Kurzschluss auf der Printkarte durch die PTC-Widerstände R50 und R51 geschützt.

5.3.5 Power supply filter of the hybrid p.c. board

As a protection against short circuits on the p.c. board, the supply voltages pass through PTC resistors R50 and R51.

5.3.5 Alimentation

La tension d'alimentation est protégée contre les court-circuits sur le circuit imprimé par les résistances CTP R50 et R51.

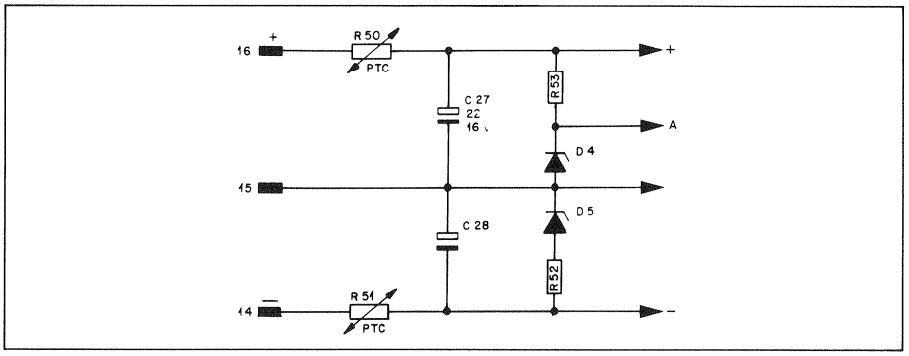


Fig. 5.13

Der Spannungsteiler D4, D5, R52, R53 erzeugt die Hilfsspannung "A" für die Regelglieder R-VAR und C-VAR des Hybrids.
Speisespannungen:
symmetrisch ± 12 V . . . ± 15 V

The voltage divider circuit D4, D5, R52, R53 produces the auxiliary voltage "A" which is used for the compensation circuits R-VAR and C-VAR of the hybrid.
Supply voltages:
symmetrical ± 12 V . . . ± 15 V

Un séparateur D4, D5, R52, R53, produit une tension de secours A.
Tension d'alimentation:
symétrique ± 12 V à ± 15 V

5.4 HYBRIDAUSGLEICH

Die Schaltung ist in zwei parallel arbeitende Kreise aufgeteilt. Das Sprechsignal steuert einerseits den R-Abgleich, andererseits, um — 90° phasenverschoben, den C-Abgleich.

5.4 HYBRID COMPENSATION

The circuit is divided into two parts working in parallel. The speech signal controls the R-compensation, the — 90° phase shifted speech signal controls the C-compensation.

5.4 COMPENSATION HYBRIDE

Le circuit est subdivisé en deux circuits travaillant en parallèle. Le signal de parole commande d'une part l'équilibrage R, et d'autre part, déphasé de — 90°, l'équilibrage C.

Phasenbeziehungen: Phase relations: Rapports de phases:

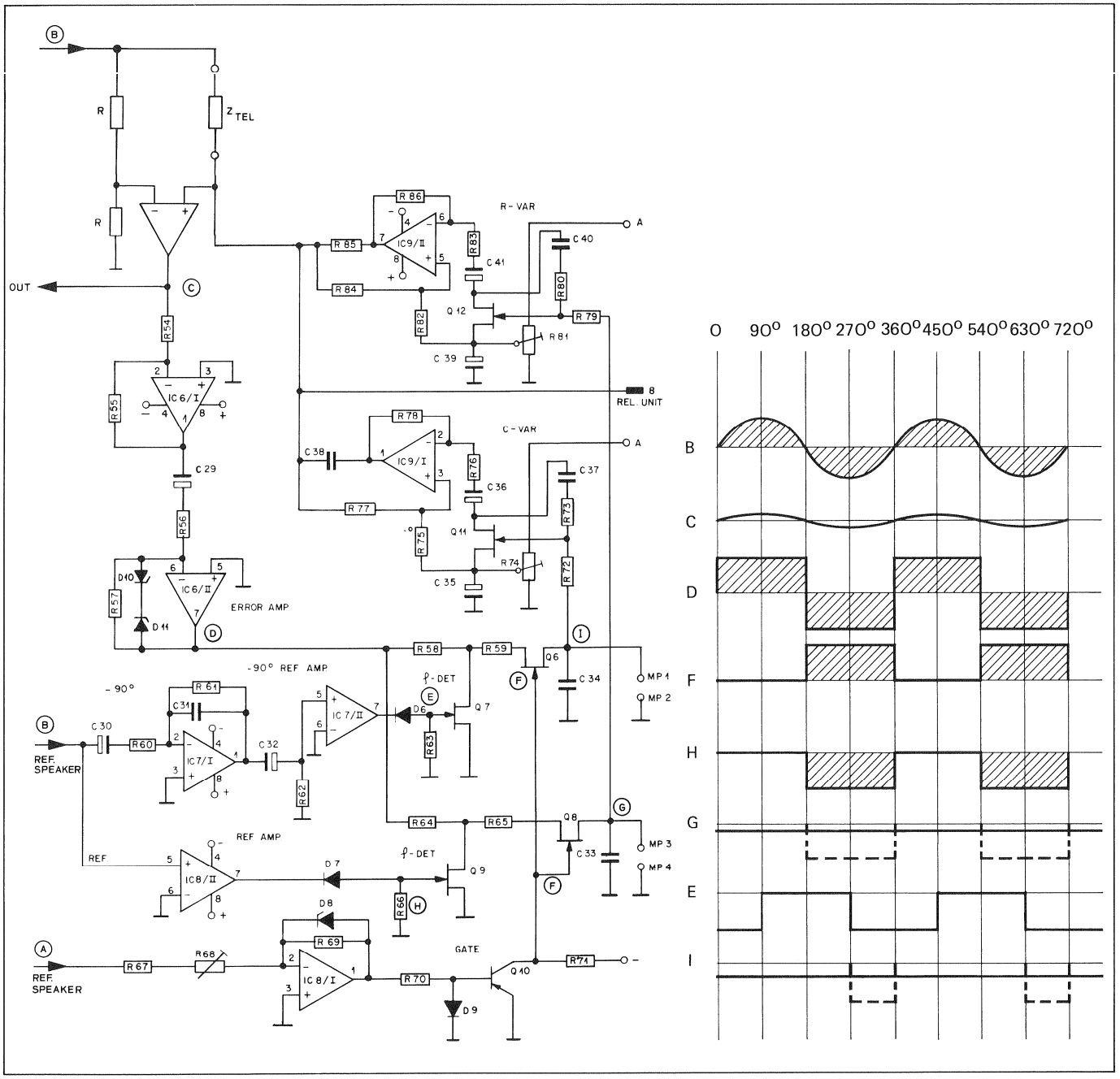


Fig. 5.14

Die Schaltung mit IC8/I wandelt das Sprechsignal "A" in das Signal "F" um, welches die FET-Schalter Q6 und Q8 auf den Abgleich vorbereitet.
Liegt kein Sprechsignal an, sperren Q6 und Q8. Die Abgleichspannung bleibt daher an C33 bzw. C34 gespeichert.

The circuit around IC8/I changes the speech signal into a signal "F" which prepares the FET switches Q6 and Q8 for the adjustment of the bridge.
If no speech signal is present, Q6 and Q8 are blocked. Therefore the compensation voltage is stored in C33 and C34 respectively.

Le circuit avec IC8/I convertit le signal de parole "A" en un signal "F", qui prépare les commutateurs FET Q6 et Q8 à l'équilibrage.
En l'absence de signal de parole, Q6 et Q8 bloquent. La tension d'équilibrage reste de ce fait mémoirisée sur C33 resp. C34.

Das Fehlersignal an Punkt "C" wird in IC6 verstärkt und bildet das Signal "D".
Die beiden Sprechsignale werden in den Referenzverstärkern IC8/II bzw. IC7 aufbereitet und steuern als Signale "H" und "E" die beiden Phasendetektoren.
Aus dem Signal "D" werden durch die Phasendetektoren Spannungsimpulse freigegeben, die dann an C33 zur Steuerspannung "G" und an C34 zur Steuerspannung "I" aufgebaut werden.
Die beiden Steuerspannungen bilden über die Regelglieder R-VAR und C-VAR die Leitungsimpedanz so nach, dass das Fehlersignal "C" ein Minimum erreicht.
Die Spannungen "G" und "I" an den Kondensatoren C33 und C34 können sowohl positiv als auch negativ sein.

The error signal "C" is being amplified in IC6 and forms the signal "D".
Both speech signals are processed through the reference amplifiers IC8/II and IC7 respectively and, as signals "H" and "E", control the phase detectors. These phase detectors release portions of the signal "D" which build-up to the control voltage "G" on C33 and the control voltage "I" an C34.

The control voltages influence the compensation circuits R-VAR and C-VAR which match the telephone line impedance in such a way that the error signal "C" reaches a minimum.
The voltages "I" and "G" at the capacitors C33 and C34 can be of positive or negative polarity.

Le signal d'erreur au point "C" est amplifié en IC6 et forme le signal "D".
Les deux signaux de parole sont traités dans les amplificateurs de référence IC8/II resp. IC7 et commandent les deux comparateurs de phase en tant que signaux "H" et "E".
A partir du signal "D", les comparateurs de phase libèrent des impulsions de tension qui donnent lieu respectivement aux tensions de commande "G" et "I" en C33 et en C34. Les deux tensions de commande, via les atténuateurs variables R-VAR et C-VAR, simulent l'impédance de ligne de telle façon que le signal d'erreur "C" atteigne un minimum.
Les tensions "G" et "I" aux condensateurs C33 et C34 peuvent être aussi bien positive que négative.

5.5 TELEFON-AUSGANGSKREIS

5.5 TELEPHONE OUTPUT CIRCUIT

5.5 CIRCUIT DE SORTIE DU TELEPHONE

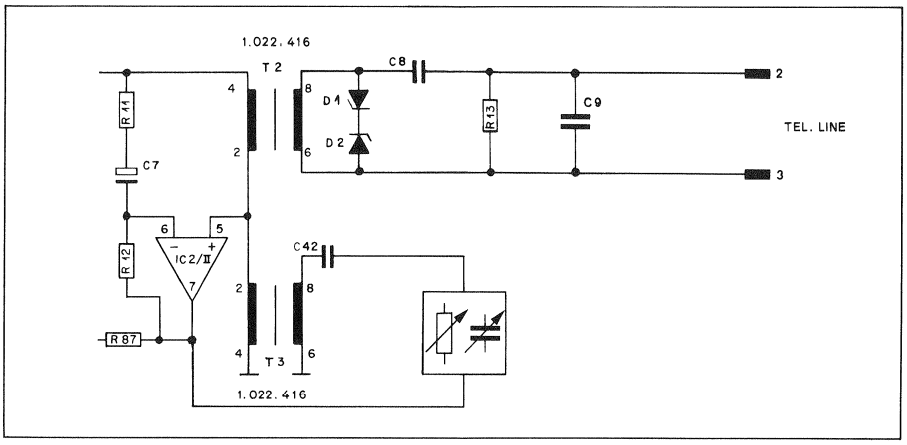


Fig. 5.15

Transformator T2 dient der galvanischen Trennung des Hybrids von der Telefonleitung, T3 gehört zur Leitungsnachbildung. Der Telefon-Eingang wird durch die Dioden D1 und D2 vor zu hohen Eingangsspannungen (Rufspannungen!) geschützt. R13 bildet eine Gleichstromlast für den Haltestrom des Teilnehmerrelais.

Transformer T2 separates the hybrid from DC voltages on the telephone line, T3 belongs to the matching circuit. The telephone input is protected against high voltages (call signals!) by diodes D1 and D2. R13 is a DC load and provides the holding current for the subscriber's relay in the telephone exchange.

Le transformateur T2 procure une séparation galvanique. T3 sert à la simulation de ligne. Les diodes D1 et D2 protègent l'entrée des hautes tensions (appel téléphonique). R13 constitue la charge en continu pour le courant de maintien du relais du correspondant.

5.6 ABGLEICH

5.6 ALIGNMENT

5.6 EQUILIBRAGE

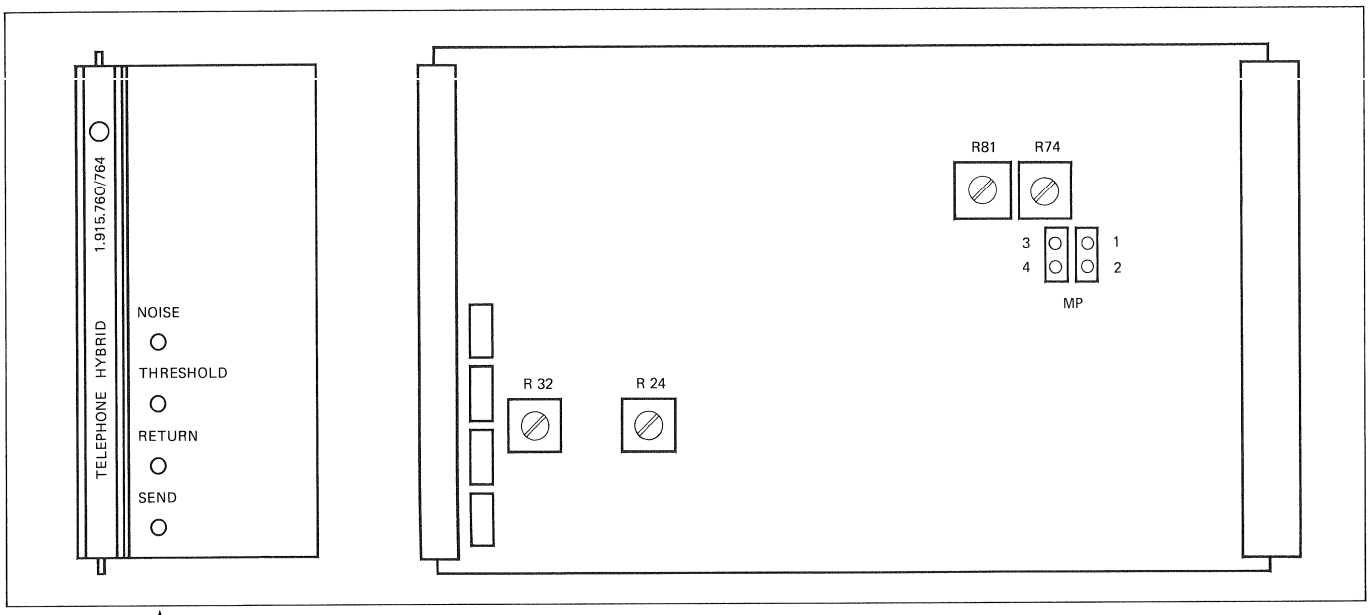


Fig. 5.17

Für den Abgleich von SEND, RETURN, THRESHOLD und NOISE siehe Kapitel 4.2.

Adjustment of SEND, RETURN, THRESHOLD and NOISE see section 4.2.

Pour l'équilibrage de SEND, RETURN, THRESHOLD et NOISE, voir chapitre 4.2.

5.6.1 Einstellen des Arbeitspunktes

Der Ausgang auf die Telefonleitung wird mit einem 600 Ohm Widerstand abgeschlossen.
Messpunkt 1 + 2 sowie 3 + 4 je miteinander verbinden.
Am Hybrid-Eingang (INPUT) ein Signal von 1 kHz mit Leitungspegel einspeisen.
Am Hybrid-Ausgang (OUTPUT) das unterdrückte Signal beobachten.
Mit den Trimmpotentiometern R74 und R81 wird das Restsignal auf ein Minimum abgeglichen.
Die Verbindungen MP1 + 2 und MP3 + 4 wieder entfernen.

5.6.1 Calibrating the working point

Load the telephone line output with a 600 ohms resistor.
Bridge the testpoints 1 + 2 and 3 + 4. Feed a 1 kHz signal with line level into the hybrid INPUT.
Measure the hybrid OUTPUT signal.
Adjust the output signal by means of R74 and R81 for minimum reading.
Disconnect MP1 + 2 and MP3 + 4.

5.6.1 Réglage du point de fonctionnement dynamique

La sortie sur la ligne téléphonique est terminée par une résistance de 600 ohms.
Relier respectivement entre-eux les points de mesure 1 + 2 ainsi que 3 + 4.
Appliquer un signal de 1 kHz avec niveau de ligne, à l'entrée de l'hybride (INPUT).
Observer le signal atténué à la sortie de l'hybride (OUTPUT).
Avec les potentiomètres réglables R74 et R81, le signal atténué est équilibré à un niveau minimum.
Enlever de nouveau les connexions MP1 + 2 et MP3 + 4.

5.6.2
Einstellen des steilflankigen Bandpassfilters

Von der Telefonleitung 1 kHz bei – 10 dB in den Hybrid einspeisen und das Signal am Hybrid-Ausgang (OUTPUT) beobachten.
Mit R24 den Frequenzgang bei 300 Hz auf – 3 dB gegenüber dem 1 kHz Pegel einstellen.
Mit R32 den Frequenzgang bei 3400 Hz auf – 3 dB gegenüber dem 1 kHz Pegel einstellen.

Kontrolle des Frequenzganges zwischen 300 und 5000 Hz. Es darf keine Überhöhung von mehr als 0,5 dB auftreten. Bei grösserer Überhöhung die Eckfrequenzen neu abgleichen und kontrollieren.

5.6.2
Adjustment of the 30 dB/octave band-pass filter

Feed 1 kHz at – 10 dB from telephone line into the hybrid and measure the hybrid OUTPUT signal.
Adjust the frequency response at 300 Hz to – 3 dB by means of R24.
Adjust the frequency response at 3400 Hz to – 3 dB by means of R32.

Check frequency response between 300 and 5000 Hz (+ 0.5, – 0 dB).
Adjust with R24 and R26 if necessary.

5.6.2
Réglage du filtre passe-bande à flanc raide

Depuis la ligne téléphonique, appliquer 1 kHz a – 10 dB à l'hybride et observer le signal à sa sortie (OUTPUT).
Avec R24, à 300 Hz, régler la réponse en fréquence sur – 3 dB par rapport au niveau de 1 kHz.
Avec R32, à 3400 Hz, régler la réponse en fréquence sur – 3 dB par rapport au niveau de 1 kHz.

Contrôle de la réponse en fréquence entre 300 et 5000 Hz. Il ne doit pas y avoir de surélévation supérieure à 0,5 dB. En cas de surélévation plus grande, rééquilibrer et contrôler les fréquences limites par rapport à la surélévation.

5.7
DUAL-RELAIS EINHEIT 1.915.762-81

Die Einheit hat drei Funktionen:
Umschaltung der Telefonleitung vom Telefonapparat auf den Hybrid. Dazu dienen die Relais K1 und K2 oder K3 und K4.

Haltedrossel: Falls ein Hybrid direkt auf die Amtsleitung aufgeschaltet ist, darf der Gleichstromwiderstand für das Ansprechen des Teilnehmerrelais nicht mehr als 200 Ohm betragen.
Ein ohmscher Widerstand würde jedoch die Telefonleitung zu stark belasten. Deshalb wird eine Drossel (L1 bzw. L2) mit tiefer Grenzfrequenz eingesetzt.
R_i < 200 Ohm
f_g < 10 Hz mit 600 Ohm Leitungsimpedanz
Induktivität 12 H
Gleichstrom 60 mA

Vorabgleich der Telefonleitung: Die Schaltung bildet eine elektronische Induktivität mit Seriewiderstand.

5.7
DUAL RELAY UNIT 1.915.762-81

The unit has three different functions:
To switch-over the telephone line from the telephone set to the hybrid by means of relays K1 and K2 or K3 and K4.

Holding choke: If a hybrid is connected directly to the main exchange, the DC resistor must not exceed 200 ohms.
Because an ohmic resistor connected in parallel to the hybrid would load the telephone line too much, a choke (L1 or L2) with a low cut-off frequency is provided.
R_i < 200 ohms
f_g < 10 Hz with a 600 ohms line impedance
Inductance 12 H
DC current 60 mA

Preadjustment of the telephone line: The circuit represents an electronically tuned inductance and a series resistor.

5.7
UNITE DE RELAIS DOUBLE 1.915.762-81

L'unité possède trois fonctions:
Commutation de la ligne téléphonique, de l'appareil téléphonique sur l'hybride. Les relais K1 et K2 ou K3 et K4 sont utilisés à cet effet.

Bobine de maintien: si un hybride est branché directement sur la ligne réseau, la résistance pour la réponse du relais d'abonné ne doit pas être supérieure à 200 ohms.
Une résistance chargerait cependant trop fortement la ligne téléphonique. C'est pourquoi une bobine (L1 resp. L2) à basse fréquence limite est utilisée.
R_i < 200 ohms
f_g < 10 Hz avec impédance de ligne 600 ohms
Inductance 12 H
Courant continu 60 mA

Tarage de la ligne téléphonique: Le circuit constitue une inductance électronique avec résistance en série.

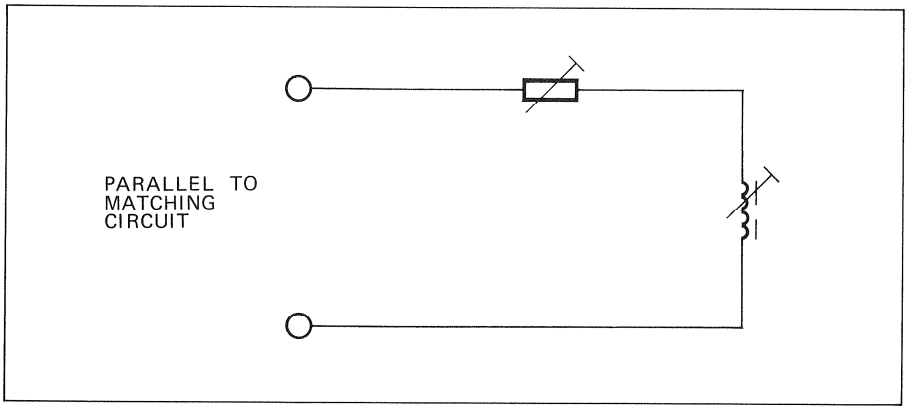


Fig. 5.18
Ersatzbild
Equivalent circuit diagram
Image équivalente

Mit R20 (R24) wird die Induktivität, mit R17 (R21) der Seriewiderstand abgeglichen. Siehe auch 4.2.1.
Abgleichbereich:
R (reell) 0 . . . 5 kOhm
L (induktiv) 0,1 . . . 12 H

By means of R20 (R24) the inductance can be tuned, by means of R17 (R21) the series resistor can be aligned to preadjust the telephone line (see section 4.2.1)
Balancing range:
R (real) 0 . . . 5 kohms
L (inductive) 0.1 . . . 12 H

20 (R24) sert à l'équilibrage de l'inductance, R17 à celui de la résistance en série. Voir également 4.2.1.
Domaine d'équilibrage:
R (réel) 0 . . . 5 kOhm
L (inductif) 0,1 . . . 12 H

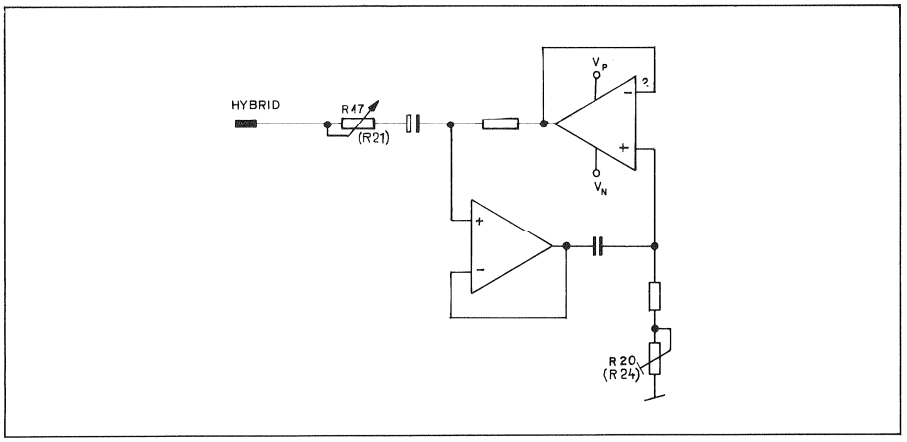


Fig. 5.19

5.8 ERSATZTEILE

Netztransformator	1.022.519
Netzgerät komplett	1.918.099-81
Spannungsregler + 15 V μA78M15	50.05.0253
Netzkontrollampe 36 V, EAO	51.02.0157
Primärsicherung 200 mAT	51.01.0110
Primärsicherung 400 mAT	51.01.0113
Sekundärsicherung 1AT	51.01.0117
Fernsteuerstecker Typ D, 15p	54.02.0183
Steckergehäuse (zu Typ D)	54.02.0460

5.8 SPARE PARTS

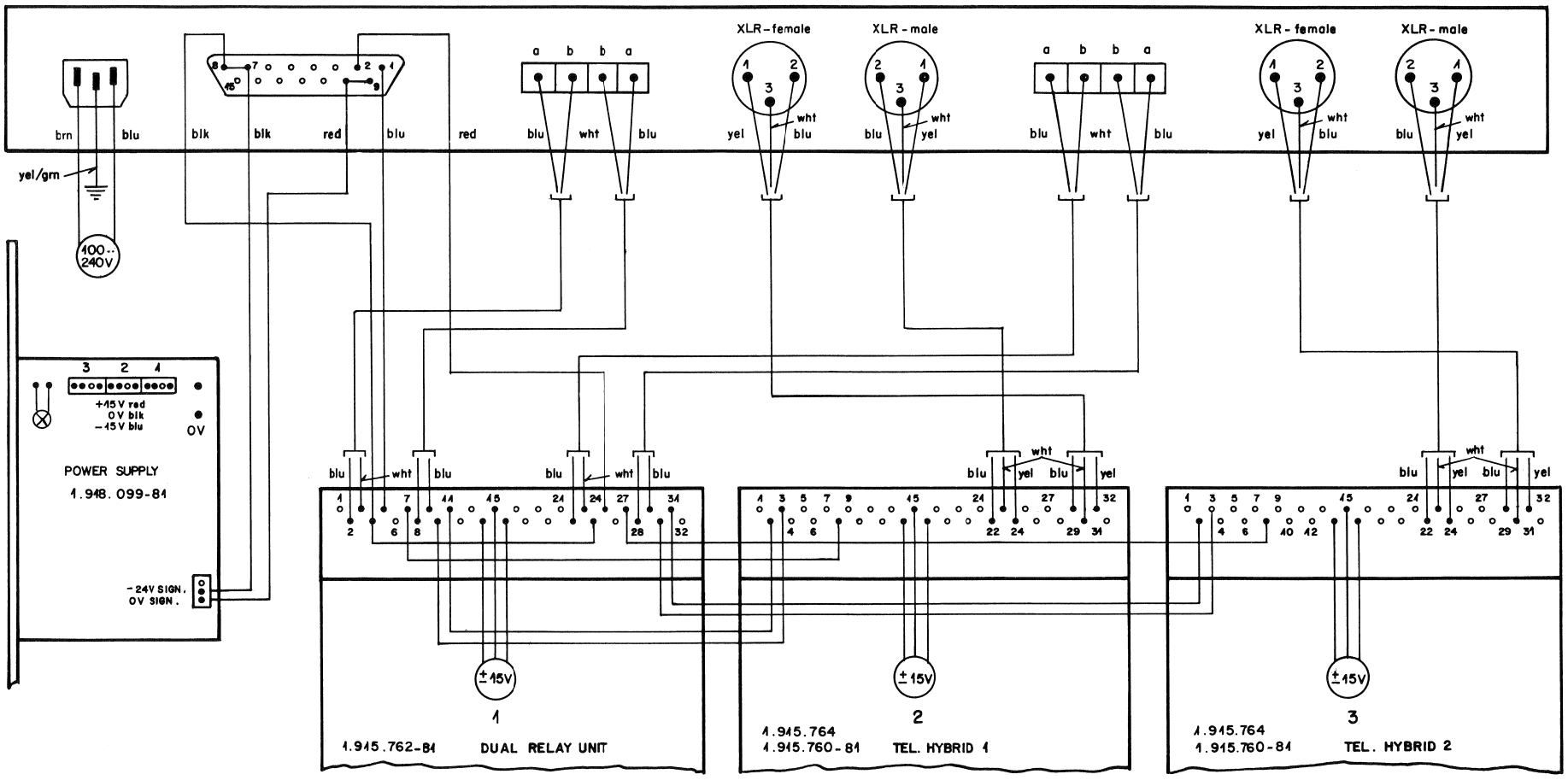
Mains transformer	1.022.519
Power supply cpl.	1.918.099-81
Voltage regulator + 15 V μA78M15	50.05.0253
Power indicator lamp 36 V, EAO	51.02.0157
Primary fuse 200 mA (slow blow)	51.01.0110
Primary fuse 400 mA (slow blow)	51.01.0113
Secondary fuse 1A (slow blow)	51.01.0117
Remote control plug type D, 15-pin	54.02.0183
Plug socket (type D)	54.02.0460

5.8 PIECES DE RECHANGE

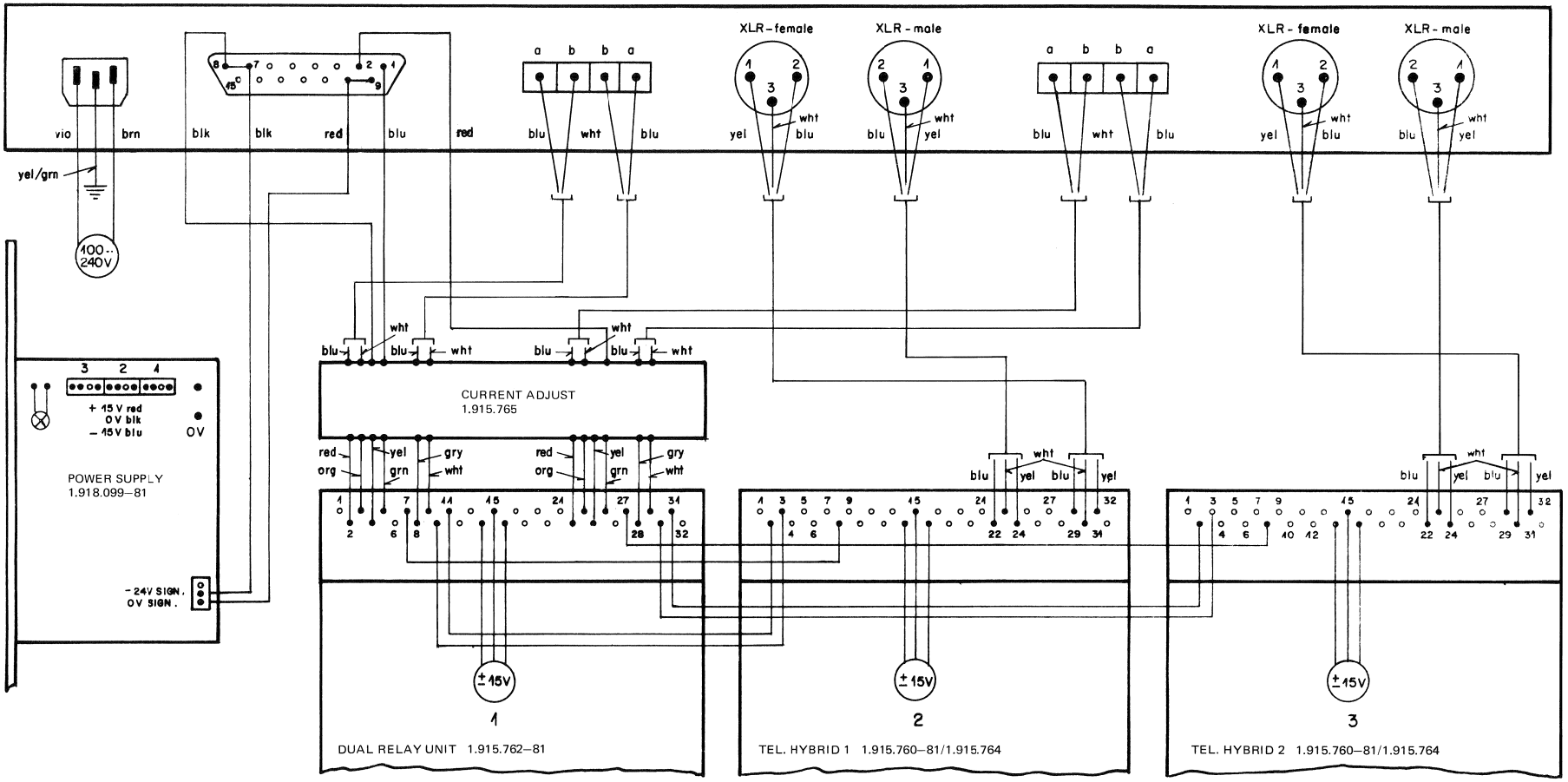
Transformateur secteur	1.022.519
Partie secteur complète	1.918.099-81
Régulateur de tension + 15 V μA78M15	50.05.0253
Lampe de contrôle secteur 36 V EAO	51.02.0157
Fusible primaire 200 mA	51.01.0110
Fusible primaire 400 mA	51.01.0113
Fusible secondaire 1A (temporisé)	51.01.0117
Prise télécommande 15 broches type D	54.02.0183
Boîtier de la prise	54.02.0460

CONTENTS

TELEPHONE HYBRID CARD FRAME WIRING LIST 1.918.102



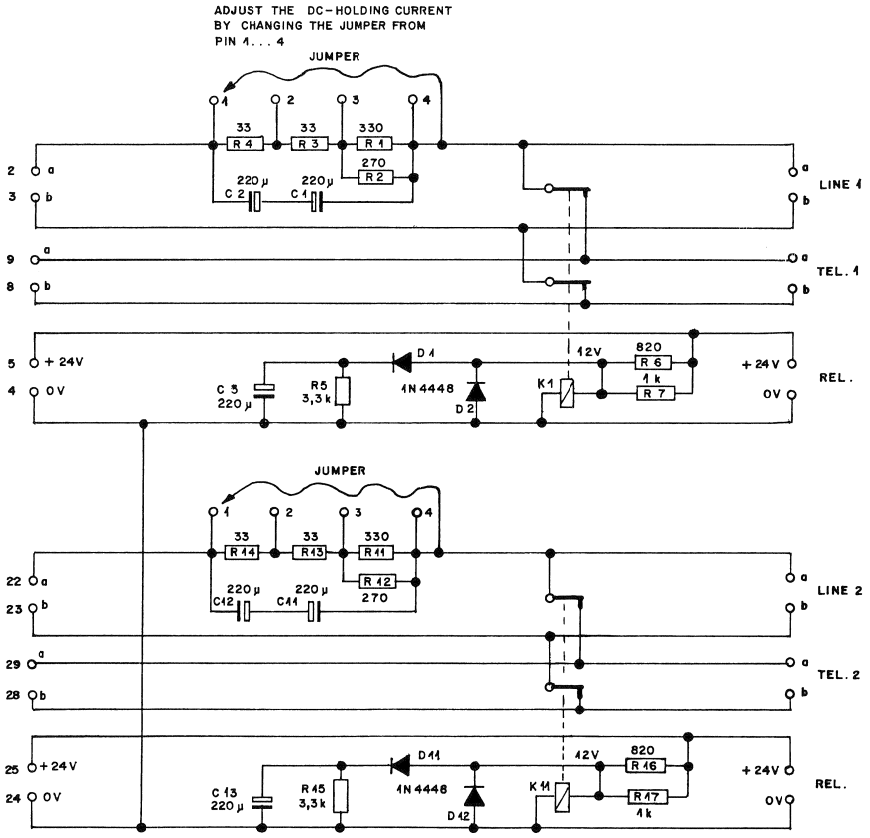
TELEPHONE HYBRID CARD FRAME WIRING LIST (WITH CURRENT ADJUST) 1.918.105

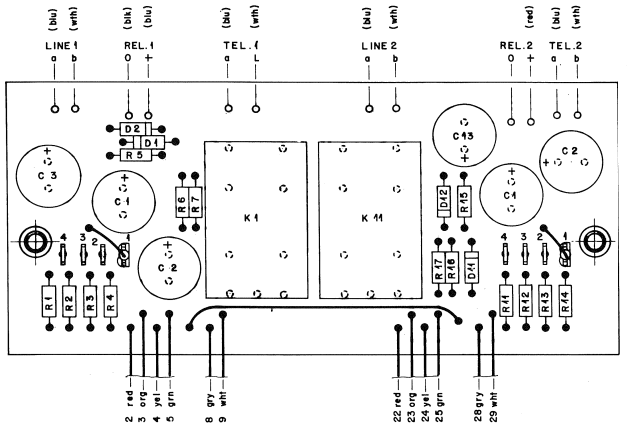


Ausgabe	5.11.79	Si	We		⓪
	Datum	Gez.	Gepr.	Ges.	Index

Ersatz für:	Ersetzt durch:	Kopie für:
STUDER REGENSDORF ZÜRICH	Benennung: TEL. HYBRID CARD FRAME WITH CURRENT ADJUST WIRING LIST	Nummer: 1. 918.105

CURRENT ADJUST PCB 1.915.765





IND	POS NO	PART NO	VALUE	SPECIFICATIONS/EQUIVALENT	MFR
	C1,11	59.22.4221	220µF	16V EL	
	C2,12	59.22.4221	220µF	16V EL	
	C3,13	59.22.4221	220µF	16V EL	
	D1,11	50.04.0125	1N4448	SI	ANY
	D2,12	50.04.0125	1N4448	SI	ANY
①	K1,11	56.04.0147	2u, AgPd	RELAY 12V	NA
	R1,11	57.11.4331	330 Ω	CF	
	R2,12	57.11.4271	270 Ω	CF	
	R3,13	57.11.4330	33 Ω	CF	
	R4,14	57.11.4330	33 Ω	CF	
	R5,15	57.11.4103	3,3 kΩ	CF	
	R6,16	57.11.4821	820 Ω	CF	
	R9,19	57.11.4102	1 kΩ	CF	

IND	DATE	NAME
④		
③		
②		
①	15.9.81	RH
○	16.10.19	Gri

EL = ELECTROLYTIC NA = NATIONAL
SI = SILICIUM
CF = CARBON FILM

STUDER CURRENT ADJUST 1.915.765.00 PAGE 1 OF 1

Ausgabe	11.8.80	Si			⓪
	Datum	Gez.	Gepr.	Ges.	Index

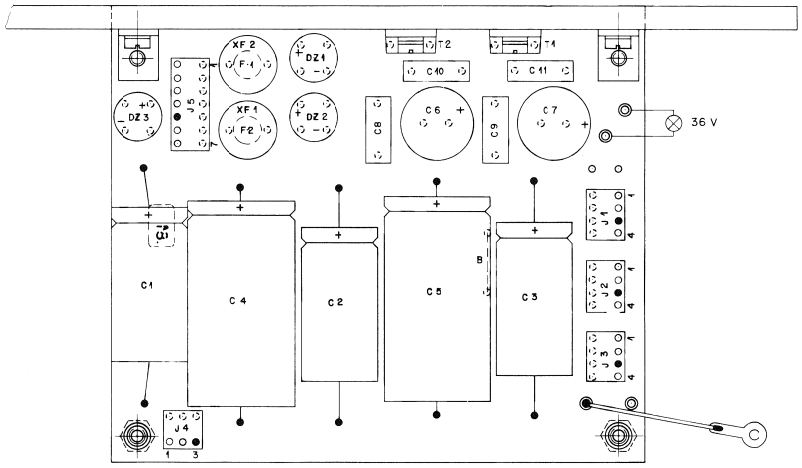
Ersatz für:	Ersetzt durch:	Kopie für:

STUDER REGENSDORF ZÜRICH

Benennung: CURRENT ADJUST TEL. HYBRID

Nummer: SC 1.915.765.00

POWER SUPPLY PCB 1.918.099–81



POS	PART NO	VALUE	SPECIFICATIONS	MFR	I
C 1	59.25.5102	1000 µF	40V 20% ELECTROLYT		
C 2	59.25.5102	1000 µF	40V 20% ELECTROLYT		
C 3	59.25.5102	1000 µF	40V 20% ELECTROLYT		
C 4	59.25.5222	2200 µF	40V 20% ELECTROLYT		
C 5	59.25.5222	2200 µF	40V 20% ELECTROLYT		
C 6	59.22.4102	1000 µF	16V ELECTROLYT		
C 7	59.22.4102	1000 µF	16V ELECTROLYT		
C 8	59.31.0334	0.33 µF	63V MPETP		
C 9	59.31.0334	0.33 µF	63V MPETP		
C10	59.31.1104	0.1 µF	100V 20% MPETP		
C11	59.31.1104	0.1 µF	100V 20% MPETP		
DZ1	70.01.0224		BZ50/C1500	SIE	
DZ2	70.01.0224		BZ50/C1500	SIE	
DZ3	70.01.0224		BZ50/C1500	SIE	
J 1	54.01.0241		CIS 4 PIN		
J 2	54.01.0241		CIS 4 PIN		
J 3	54.01.0241		CIS 4 PIN		
J 4	54.01.0287		CIS 3 PIN		
J 7	54.01.0218		CIS 7 PIN		
T 1	50.05.0253		UA 7815 VOLT.REG.		
T 2	50.05.0253		UA 7815 VOLT.REG.		
F 1	51.01.0117	1AT/250V	FUSE SLOW BLOW		
F 2	51.01.0117	1AT/250V	FUSE SLOW BLOW		
XF1	53.03.0116	5x20	FUSE HOLDER		
XF2	53.03.0116	5x20	FUSE HOLDER		

Codierung: Schaltdraht 64.01.0108 Ø0,8x8mm
(muss 4mm vorstehen)

In	Buchsenleiste	J1	in Kontakt	3
"	"	J2	" "	3
"	"	J3	" "	3
"	"	J4	" "	3
"	"	J5	" "	5

J1... J3
1 +15 V
2 −15 V
3 Key
4 0V

J4
1 +24 V
2 0V
3 Key

J7
1 20 V~
2 20 V~
3 20 V~
4
5 Key
6 20 V~
7

Fig. 5

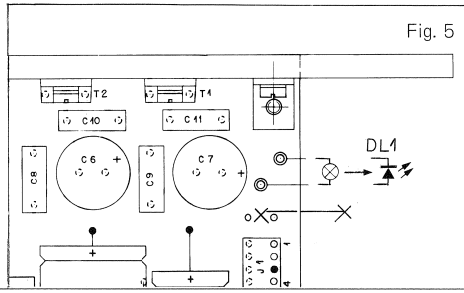
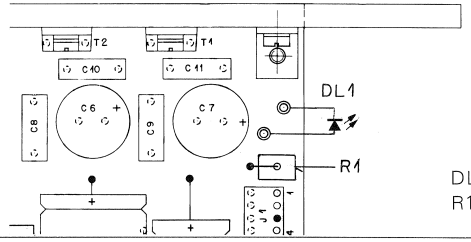
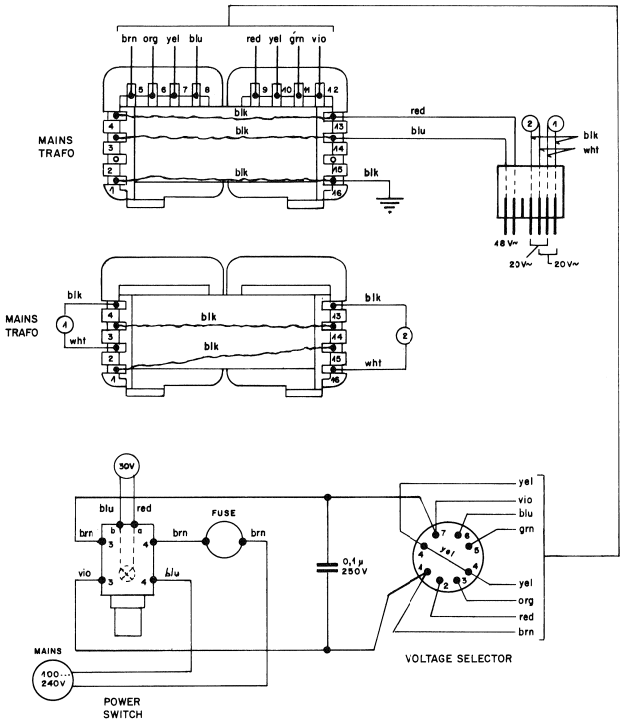


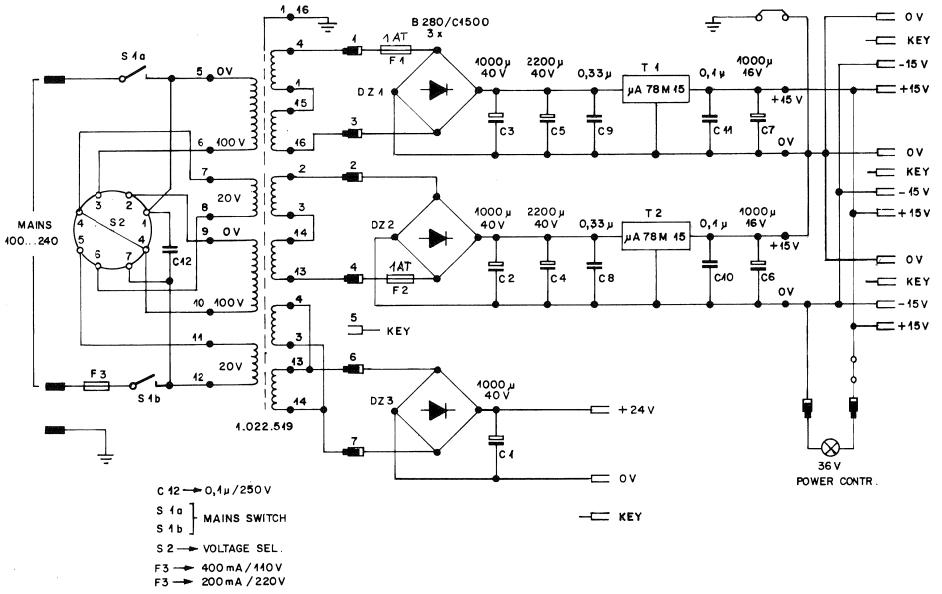
Fig. 4



DL1 = LED red, 3mm QCV11-7 (50.04.2129)
R1 = Resistor, 1.5kOhm/4W (57.56.5152)

TRANSFORMER AND POWER SUPPLY PCB 1.918.099–81





← Fig. 4

← Fig. 5

Fig. 3

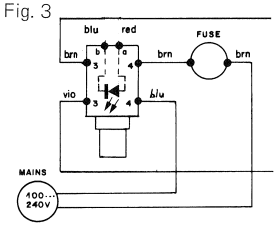
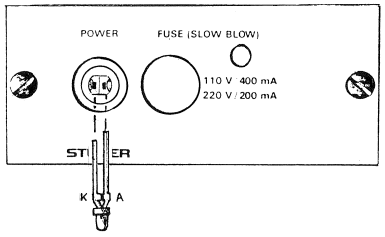


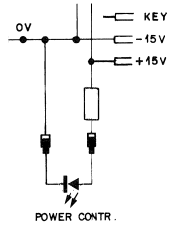
Fig. 2



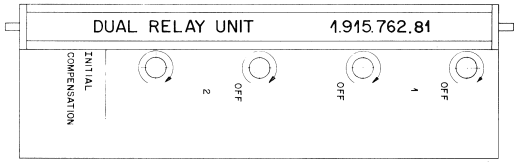
Modification of Power-On signal lamp:
LED instead bulb

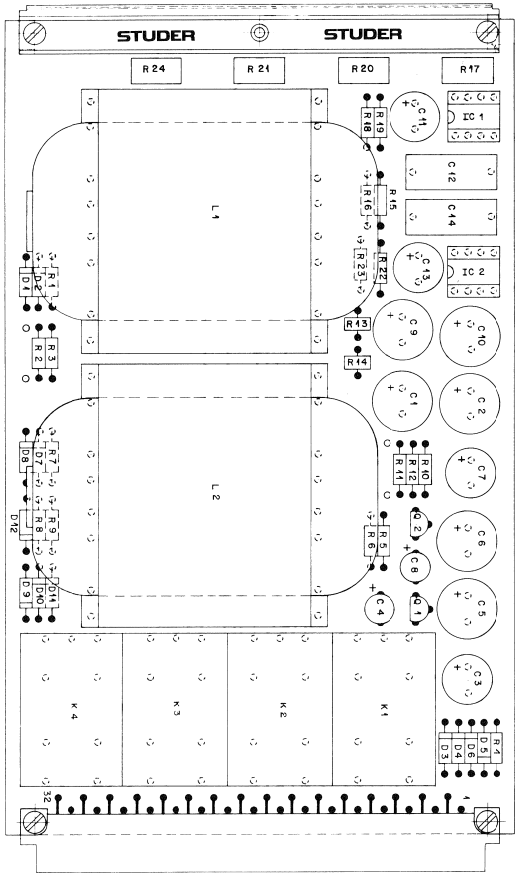
- Remove Power Supply PCB 1.918.099.81
- Cut printed conductor (X) Fig. 5
- Insert resistor R1 Fig. 4
- Exchange bulb with LED DL1 Fig. 2
  (Cathode = blue wire)

Fig. 1



DUAL RELAY UNIT 1.915.762–81





IND	POS NO	PART NO	VALUE	SPECIFICATIONS/EQUIVALENT	MFR
C	1	59.22.4224	220 µF	16 V EL	
C	2	59.22.4224	220 µF	16 V EL	
C	3	59.22.5104	100 µF	25V EL	
C	4	59.30.1224	220 µF	3V TA	
C	5	59.22.4224	220 µF	16 V EL	
C	6	59.22.4224	220 µF	16 V EL	
C	7	59.22.5104	100 µF	25V EL	
C	8	59.30.1224	220 µF	3V TA	
C	9	59.22.4224	220 µF	16 V EL	
C	10	59.22.4224	220 µF	16 V EL	
C	11	59.22.2224	220 µF	6V EL	
C	12	59.05.1155	1,5 µF	63V MPC	
C	13	59.22.2224	220 µF	6V EL	
C	14	59.05.1155	1,5 µF	63V MPC	
D	1...12 except	50.04.0125	1N4448	or equivalent	ANY
D	3, 9	50.04.1108	ZPD5V6	BZX83 5V6	ITT, S
① IC	1, 2	50.09.0107	RC4558NB	Dual Op. Amp.	TI, RA
(?) K	1...4	56.04.0143	2u, AgAu	Relay	NA
L	1, 2	1.022.525		Inductivity	ST
P		54.01.0358		Edge Connector	
Q	1, 2	50.03.0497	BC550C		T,P,ITT

8.Okt. 1982

IND	DATE	NAME	Konstruktion
④			ITT INTERMETALL ST STUDER
③			NA NATIONAL TI TEXAS INSTRUMENTS
②	15.2.82	SP	P PHILIPS EL ELECTROLYTIC
①	11.3.81	VA	RA RAYTHEON TA TANTALLUM
O	18.7.79	WY	S SIEMENS MPC POLYCARBONATE

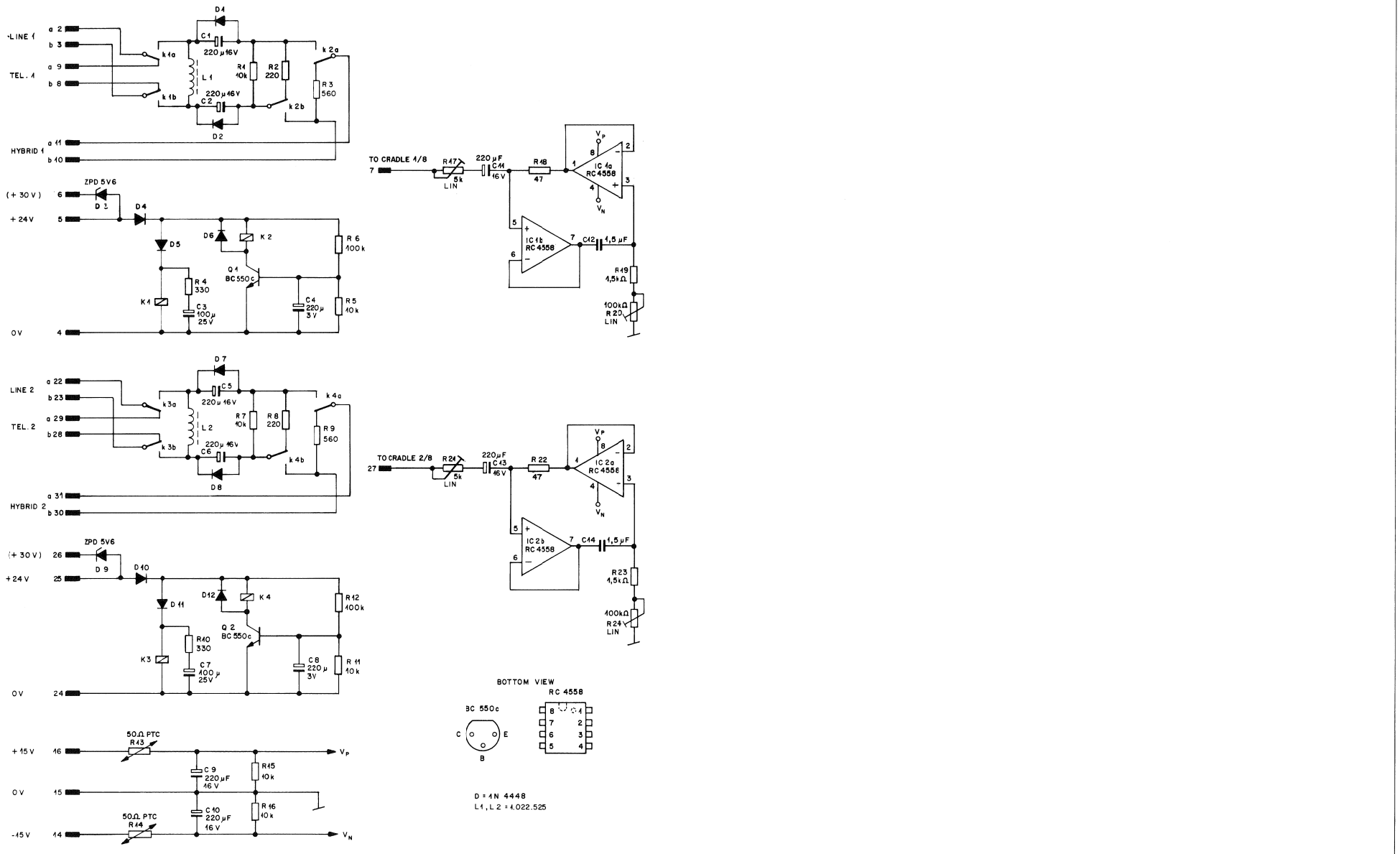
STUDER DUAL RELAY UNIT 1.915.762-81 PAGE 1 OF 2

IND	POS NO	PART NO	VALUE	SPECIFICATIONS/EQUIVALENT	MFR
R	1	57.11.4403	10 k		
R	2	57.11.4224	220		
R	3	57.11.4561	560		
R	4	57.11.4331	330		
R	5	57.11.4403	10 k		
R	6	57.11.4104	100k		
R	7	57.11.4403	10 k		
R	8	57.11.4224	220		
R	9	57.11.4561	560		
R	10	57.11.4331	330		
R	11	57.11.4403	10 k		
R	12	57.11.4104	100k		
R	13	57.99.0206	50	PTC	
R	14	57.99.0206	50	PTC	
R	15	57.11.4403	10 k		
R	16	57.11.4403	10 k		
R	17	58.01.7502	5 k	Potm.	
R	18	57.11.4470	47		
R	19	57.11.4152	1,5k		
R	20	58.01.7104	100k	Potm.	
R	21	58.01.7502	5 k	Potm.	
R	22	57.11.4470	47		
R	23	57.11.4152	1,5k		
R	24	58.01.7104	100k	Potm.	
XIC		53.03.0166		IC-Socket DIL 8 pins	

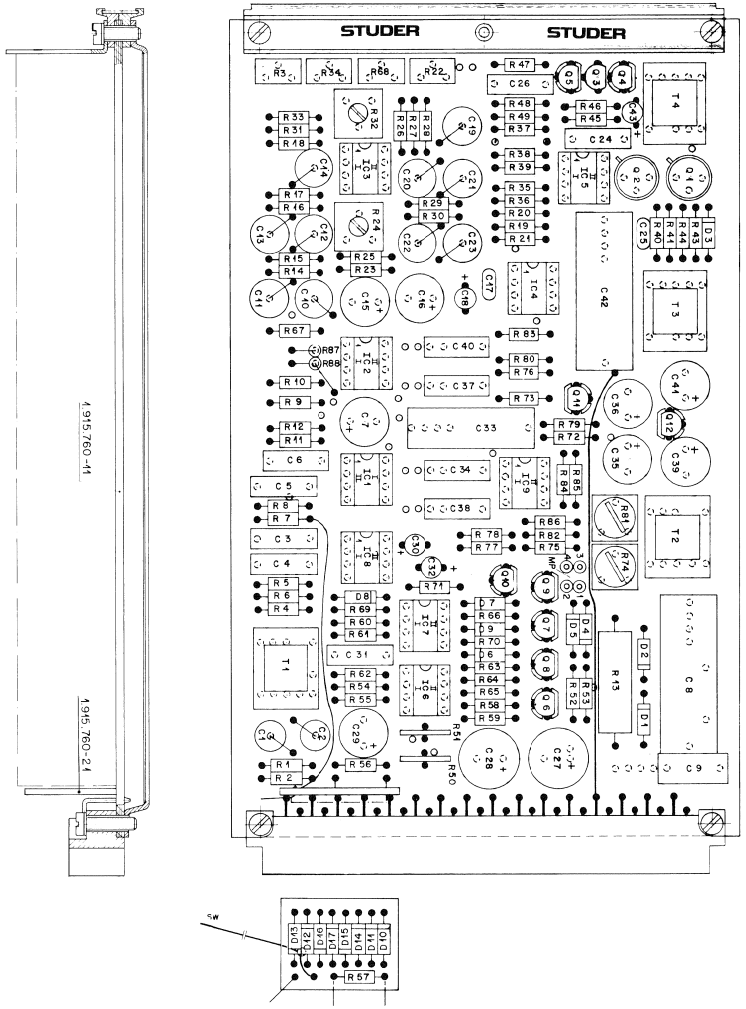
IND	DATE	NAME	8.Okt. 1982 Konstruktion
④			
③			
②	15.2.82	SP	
①	11.3.81	VA	
O	18.7.79	WY	

STUDER DUAL RELAY UNIT 1.915.762-81 PAGE 2 OF 2

DUAL RELAY UNIT 1.915.762–81



TELEPHONE HYBRID PCB 1.915.760–81 (PATENT PENDING)



POS NO	PART NO	VALUE	SPECIFICATIONS	EQUIVALENT MFR
C 1	59.12.3681	680 pF	1% 500V~	PS
C 2	59.12.3681	680 pF	1%	PS
C 3	53.34.6409	0,1 µF	10%	PE
C 4	53.34.6409	0,1 µF	10%	PE
C 5	59.12.4103	0,01 µF	5%	PE
C 6	53.11.6152	1500 pF	5%	PC
C 7	59.22.4601	100µF	3V	EL
C 8	1.915.760-03	2,2 µF	10% 250V~	PE ST
C 9	59.31.8473	0,047µF	400V~	PE
C 10	53.12.7403	0,01µF	1%	PS
C 11	53.12.7403	0,01µF	1%	PS
C 12	53.12.7403	0,01µF	1%	PS
C 13	53.12.7403	0,01µF	1%	PS
C 14	59.12.7103	0,01µF	1%	PS
C 15	53.32.4474	100µF	16V	EL
C 16	59.22.4101	100µF	16V	EL
C 17	59.34.2330	33pF		CER
C 18	53.36.0470	47µF	3V	TA
C 19	53.12.7103	0,01µF	1%	PS
C 20	59.12.7103	0,01µF	1%	PS
C 21	59.12.7103	0,01µF	1%	PS
C 22	59.12.7103	0,01µF	1%	PS
C 23	59.12.7103	0,01µF	1%	PS
C 24	57.12.4473	0,047µF		PE
C 25	59.32.2222	2200pF		CER
C 26	59.02.0474	0,47µF	5%	PC
C 27	53.22.4274	270µF	16V	EL
C 28	53.22.4221	220µF	16V	EL
C 29	59.22.4101	100µF	16V	EL
C 30	57.02.7225	2,2µF		PC
C 31	59.02.0474	0,47µF		PC
C 33	59.02.0474	0,47µF	6V	EL
C 34	59.22.4221	220µF	6V	EL
C 35	59.22.4221	220µF	6V	EL
C 36	59.02.0474	0,47µF		PC
C 37	59.02.0474	0,47µF		PC
C 38	59.02.0474	0,47µF		PC
C 40	59.22.2221	220µF	6V	EL
C 41	59.22.2221	220µF	6V	EL
C 42	1.915.760-02	2,2µF	10% 250V~	PE ST
C 43	59.36.4470	47µF	3V	TA

CER	CERAMIC	ST STUDER
EL	ELECTROLYTIC	
TA	TANTALUM	
PE	POLYESTER	
PS	POLYSTYRENE	
PC	POLYCARBONATE	

IND	DATE	NAME
⑤	20.8.82	VF
④	11.3.81	VF
③	10.9.80	VF
②	11.5.79	VF
①	6.11.77	
	14.3.77	

(21)

POS NO	PART NO	VALUE	SPECIFICATIONS	EQUIVALENT MFR
D 1	50.04.4511	U_z 6,2V	ZPD 6V2 1W	
D 2	50.04.4611	U_z 6,2V	ZPD 6V2 1W	
D 3	50.04.0125	1N 4148	SI	
D 4	50.04.1112	U_z 5,1V	ZPD 5V1 0,4W	
D 5	50.04.1112	U_z 5,1V	ZPD 5V1 0,4W	
D 6	50.04.0125	1N 4148	SI	
D 7	50.04.0125	1N 4148	SI	
D 8	50.04.1112	U_z 5,1V	ZPD 5V1 0,4W	
D 9	50.04.0125	1N 4148	SI	
D 10	50.04.1112	U_z 5,1V	ZPD 5V1 0,4W	
D 11	50.04.1112	U_z 5,1V	ZPD 5V1 0,4W	
D 12...17	50.04.0125	1N 4148	SI	
IC 1	50.09.0107	RC 4558 NB	DUAL OP AMP	TI, RA
IC 2	50.09.0107	RC 4558 NB		
IC 3	50.09.0107	RC 4558 NB		
IC 4	50.05.0444	LM 324 AN	OP-AMP	NS
IC 5	50.09.0107	RC 4558 NB		
IC 6	50.09.0107	RC 4558 NB		
IC 7	50.09.0107	RC 4558 NB		
IC 8	50.09.0107	RC 4558 NB		
IC 9	50.09.0107	RC 4558 NB		
Q 1	50.03.0346	BC 160-16		S, F
Q 2	50.03.0346	BC 160-16		S, F
Q 3	50.08.0497	BC 559-C		T, ITT
Q 4	50.03.0486	BC 560-C		T, ITT
Q 5	50.03.0350	J 112		SI/NS
Q 6	50.08.0350	J 112		"
Q 7	50.03.0350	J 112		"
Q 8	50.03.0350	J 112		"
Q 9	50.03.0350	J 112		"
Q 10	50.05.0496	BC 560-C		T, ITT
Q 11	50.03.0359	J 113		SI/NS
Q 12	50.03.0350	J 112		"
R 1	57.39.2741	2,74 k	1%	
R 2	57.39.1741	2,74 k	1%	
R 3	58.01.7501	5k	LIN	TR, SP
R 4	57.11.4231	220		
R 5	57.11.4122	8,2k	2%	
R 6	57.11.4212	2,2k	2%	
R 7	50.01.11.4158	15k	2%	

FI - FELIS INSTR	F - FAIRCHILD
RA - RAYTHEON	TR - TRW
NS - NATIONAL SEM.	SP - SPECTROL
SIL - SILICONIX	
T - TELEFUNKEN	
S - SIEMENS	

IND	DATE	NAME
⑤	20.8.82	VF
④	11.3.81	VF
③	10.9.80	VF
②	11.5.79	VF
①	6.11.77	
	14.3.77	

(21)

POS NO	PART NO	VALUE	SPECIFICATIONS	EQUIVALENT MFR
R 8	57.11.4153	15k		
R 9	57.11.4103	10k		
R 10	57.11.4223	22k		
R 11	57.33.1002	10k	1%	
R 12	57.33.1002	10k	1%	
R 13	57.54.5452	4,5k	2W	
R 14	57.33.2432	24,3k	1%	
R 15	57.33.4322	43,2k	1%	
R 16	57.33.3242	32,4k	1%	
R 17	57.33.7452	74,5k	1%	
R 18	57.22.1783	178k	1%	
R 19	57.11.4222	2,2k		
R 20	57.11.4222	2,2k		
R 21	57.11.4101	100		
R 22	58.01.7203	20k	LIN 10%	TR, SP
R 23	57.11.4233	23k	2%	
R 24	58.01.8202	2 k	LIN 10%	TR, SP
R 25	57.11.4333	33k	2%	
R 26	57.33.1322	13,2k	1%	
R 27	57.33.5111	5,11k	1%	
R 28	57.33.6341	6,36k	1%	
R 29	57.33.7151	9,45k	1%	
R 30	57.33.6293	6,49k	1%	
R 31	57.11.4333	33k	2%	
R 32	58.01.8202	2k	LIN 10%	TR, SP
R 33	57.11.4303	30k	2%	
R 34	58.01.7103	10k	LIN 10%	TR, SP
R 35	57.11.4472	4,7k		
R 36	57.11.4680	68		
R 37	57.11.4154	150		
R 38	57.11.4333	33k		
R 39	57.11.4123	12k		
R 40	57.11.4123	12k		
R 41	57.11.4680	68		
R 42				
R 43	57.11.4102	1k		
R 44	57.11.4392	3,9k		
R 45	57.11.4233	33k		
R 46	57.11.4184	180k		
R 47	57.11.4103	10k		
R 48	57.22.5106	10M		
R 49	57.02.5106	10M		
R 50	57.38.0208	5,2Ω	PTC 2322 662 94005	RH
R 51	57.99.0181	5,6Ω	PTC	PH
R 52	57.11.4152	1,5k		
R 53	57.11.4152	1,5k		

PH	PHILIPS
TR	TRW
SP	SPECTROL

IND	DATE	NAME
⑤	20.8.82	VF
④	11.3.81	VF
③	10.9.80	VF
②	11.5.79	VF
①	6.11.77	
	14.3.77	

(21)

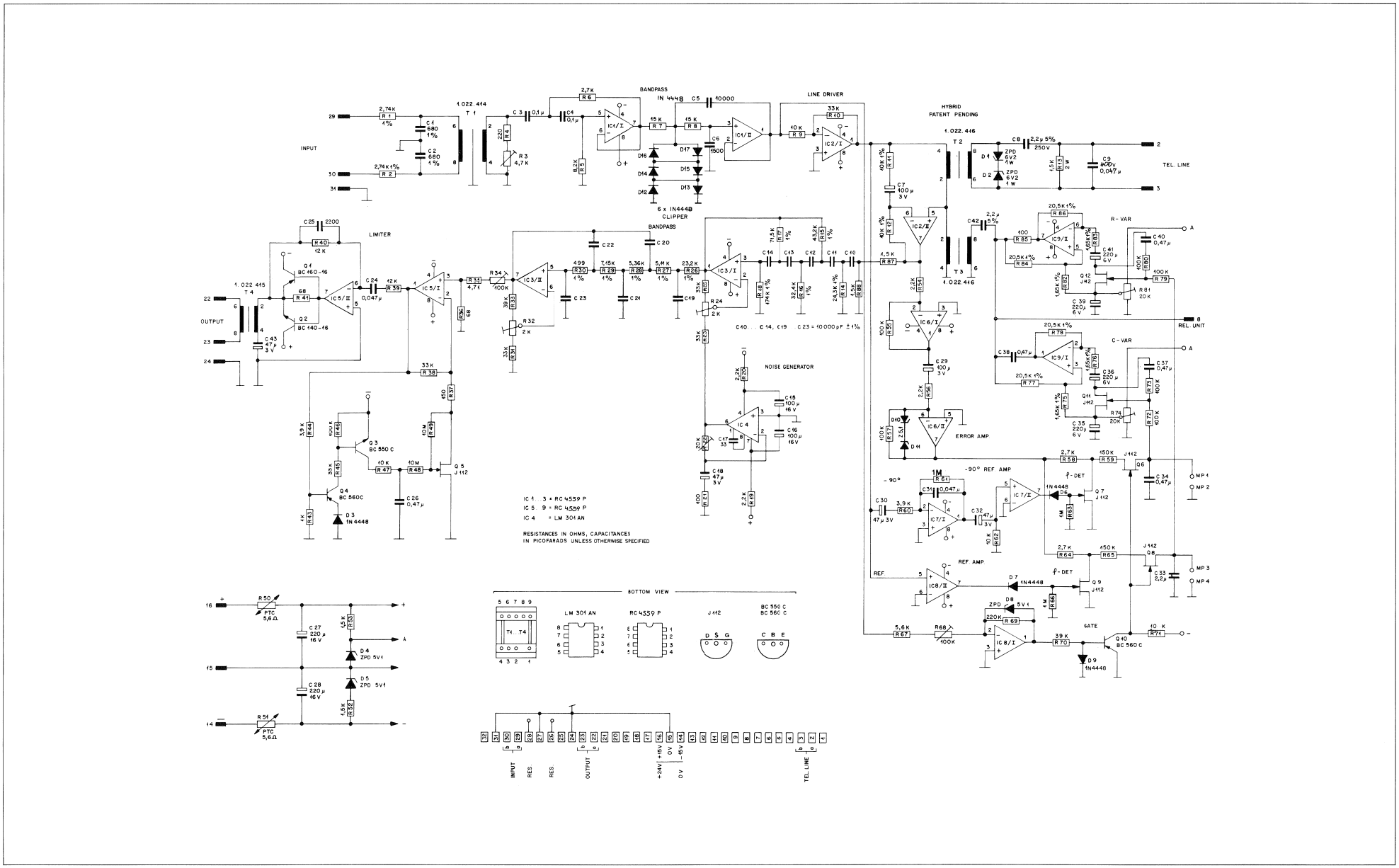
POS NO	PART NO	VALUE	SPECIFICATIONS	EQUIVALENT MFR
R 54	57.11.4222	2,2k		
R 55	57.11.4104	100k		
R 56	57.11.4222	2,2k		
R 57	57.11.4104	100k		
R 58	57.11.4272	2,7k		
R 59	57.11.4154	150k		
R 60	57.11.4392	3,9k		
R 61	57.11.4105	1M		
R 62	57.11.4103	10k		
R 63	57.11.4105	1M		
R 64	57.11.4272	2,7k		
R 65	57.11.4154	150k		
R 66	57.11.4105	1M		
R 67	57.11.4562	5,6k		
R 68	58.01.7103	10k	LIN 10%	TR, SP
R 69	57.11.4221	220k		
R 70	57.11.4233	33k		
R 71	57.11.4104	100k		
R 72	57.11.4104	100k		
R 73	58.01.8203	20k	LIN 10%	TR, SP
R 74	57.33.1651	1,65k	1%	
R 75	57.33.1651	1,65k	1%	
R 76	57.33.1651	1,65k	1%	
R 77	57.33.2052	20,5k	1%	
R 78	57.33.2052	20,5k	1%	
R 79	57.11.4104	100k		
R 80	58.01.8203	20k	LIN 10%	TR, SP
R 81	57.33.1651	1,65k	1%	
R 82	57.33.2052	20,5k	1%	
R 83	57.11.4101	100		
R 84	57.33.2052	20,5k	1%	
R 85	57.02.5152	1,5k		
R 86	57.02.5152	1,5k		
T 1	1.022.414	A : 1		ST
T 2	1.022.416	A : 1		ST
T 3	1.022.416	A : 1		ST
T 4	1.022.415	A : 2		ST

TR	TRW
SP	SPECTROL
ST	STUDER

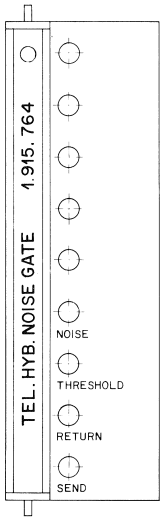
IND	DATE	NAME
⑤	20.8.82	VF
④	11.3.81	VF
③	10.9.80	VF
②	11.5.79	VF
①	6.11.77	
	14.3.77	

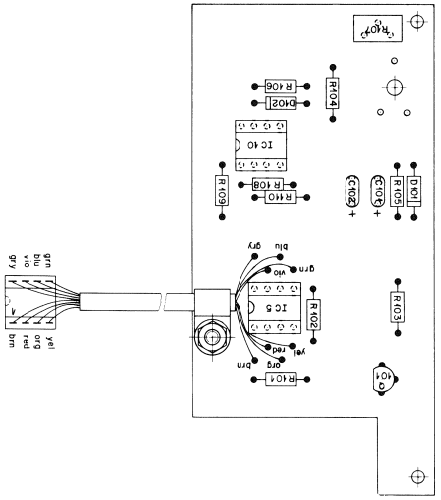
(21)

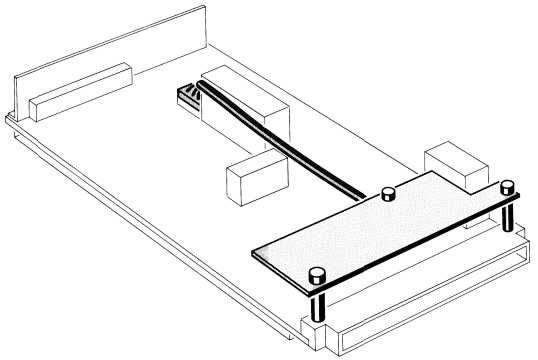
TELEPHONE HYBRID PCB 1.915.760 - 81 (PATENT PENDING)

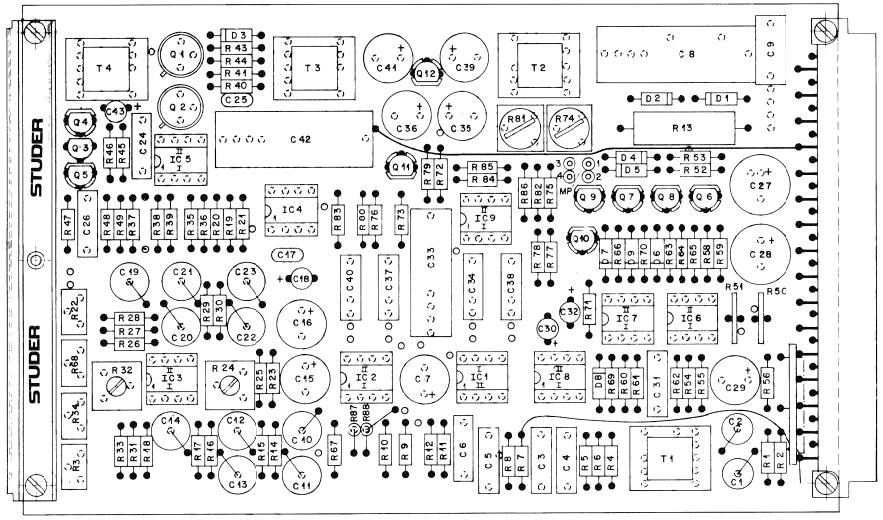


TELEPHONE HYBRID WITH NOISE GATE 1.915.764 (PATENT PENDING)







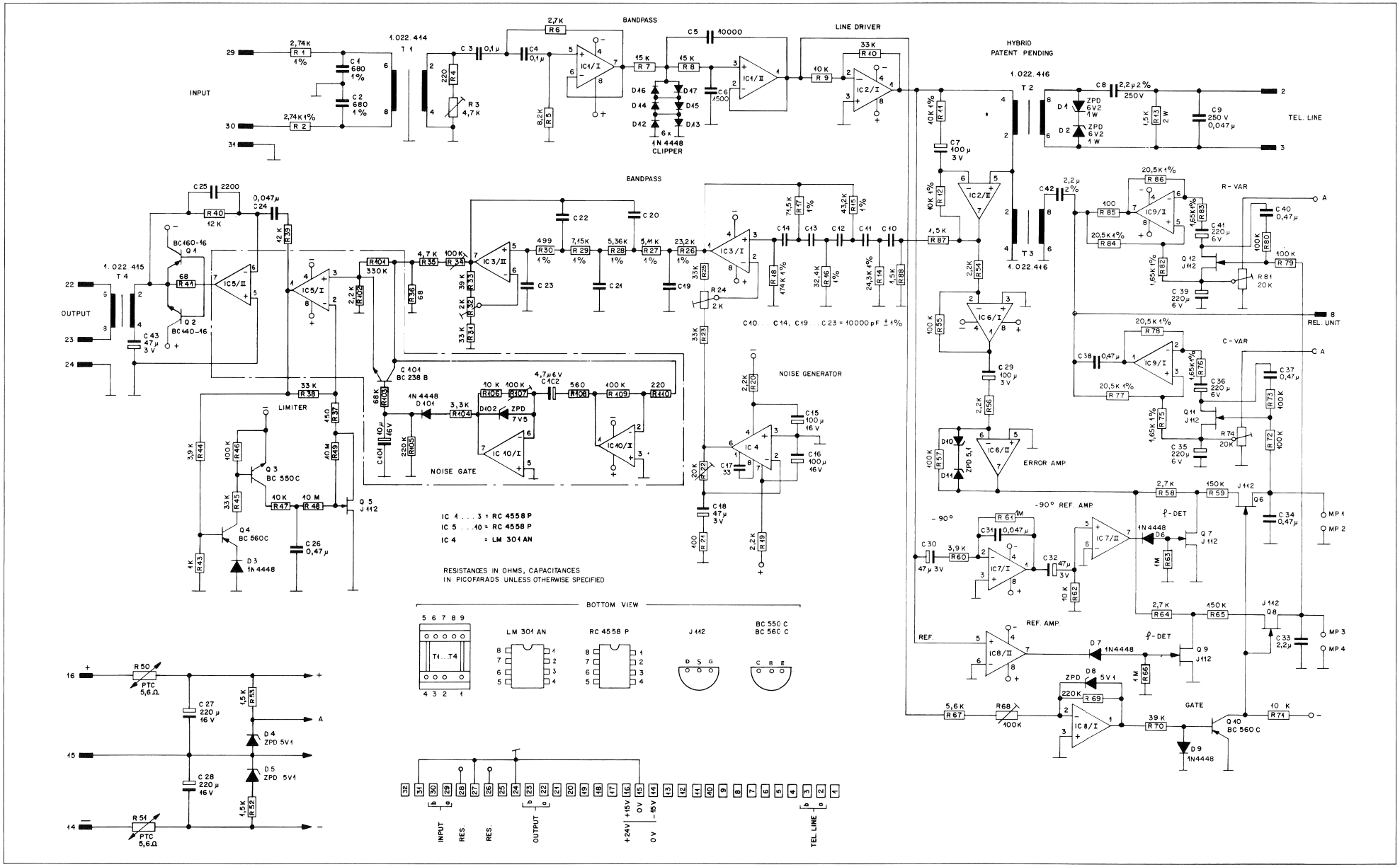


IND	POS NO	PART NO	VALUE	SPECIFICATIONS/EQUIVALENT	MFR
	C101	59.26.2400	10 µF	16V EL	
	C102	59.26.1479	4.7 µF	10V EL	
	D101	50.04.0125	1N4448		
	D102	50.04.1103	ZPD3V6		
	R101	59.11.4334	330 k		
	R102	59.11.4222	2.2 k		
	R103	59.11.4683	68 k		
	R104	59.11.4332	3.3 k		
	R105	59.11.4224	220 k		
	R106	59.11.4103	10 k		
	R107	58.01.6104	100 k	LIN	
	R108	59.11.4561	560		
	R109	59.11.4104	100 k		
	R110	59.11.4221	220		
	IC 5	50.09.0109	RC4559	DUAL OPAMP	TI, RA
	IC 10	50.09.0109	RC4559	DUAL OPAMP	TI, RA
	Q A	50.03.0436	BC237B	NPN	PS, M
		53.03.0174		ADAPTER PLUG	
		1.915.760.81		TEL. HYBRID KOMPL	ST
		21.01.0355	M3x8	SCREW	
		23.01.2032	9/3.2	WASHER	
		22.01.8030	M3	NUT	
		35.05.0311	4.8	BINDER	
		21.01.0288	M2.5x25		
		1.010.082.29	3.2/5x13	SPACER	
		1.915.764.01		LABEL	ST

IND	DATE	NAME	
4			TI = TEXAS INST. ST = STUDER
3			RA = RAYTHEON
2			P = PHILIPS
1			S = SIEMENS
○	30.11.81		M = MOTOROLA

STUDER TEL HYBRID WITH NOISE GATE 1.915.764.00 PAGE 1 OF 1

TELEPHONE HYBRID WITH NOISE GATE 1.915.764 (PATENT PENDING)



7. NACHTRAG

7.1 TELEFON-HYBRID "CURRENT ADJUST" 1.918.105

Der Telefon-Hybrid mit Abgleichmöglichkeit für den Haltestrom, der in Verbindung mit neuzeitlichen elektronischen Telefonzentralen (im Gegensatz zu konventionellen Relais-Schaltzentralen) erforderlich ist, ist im 19"-Einschub 1.918.105 untergebracht.
In diesem befindet sich, hinter dem DUAL RELAY-Einschub, ein zusätzlicher Print, der folgende Aufgaben übernimmt:

- Möglichkeit zur Anpassung des Haltestroms in vier Stufen, mittels umsteckbarer Drahtbrücke
- Unterbrechungsfreies Umschalten der Amtsleitung von der Telefonstation auf den Hybrid.

Eine Haltestrom-Anpassung kann auch bei konventionellen Telefonzentralen erforderlich sein, wenn der benötigte Haltestrom von einer, mit 600 Ohm abgeschlossenen Leitung (der üblichen Norm in Europa) abweicht.

7.1.1 Abgleich des Haltestroms

- Obere Abdeckung des Rack-Einschubes entfernen.
- Ampèremeter in Telefonleitung einschlaufen.
- Gerät einschalten

VORSICHT bei geöffnetem Gerät:
NETZSPANNUNG!

- Mit Umschalter "HYBRID ON", Telefonleitung auf HYBRID umschalten.

CURRENT ADJUST-Print 1.915.765:

- Durch Umstecken der Drahtbrücke gewünschten Haltestrom einstellen:

Pos. 1: = maximaler Strom
Pos. 2: = minimaler Strom
Bereich (U = 48V, Ri = 600Ω):
I^1 60mA
I^2 57mA
I^3 55mA
I^4 47mA

- Gleiches Vorgehen für Telefon-Leitung 2
  Obere Abdeckung wieder montieren.

7. UPDATE

7.1 TELEPHONE HYBRID WITH CURRENT ADJUST 1.918.105

The telephone hybrid with current adjusting facility, as required in conjunction with electronically switching central exchange offices, in contrast to the conventional relay operated exchange, is supplied in the 1.918.105 rack panel unit. It is equipped with an additional printed circuit board located behind the components required to perform the following functions:

- Adjustment of line holding current in 4 steps by means of a wire jumper.
- Make before break changeover from the hybrid.

The current adjusting circuit may also be required in countries where a lower value is specified for the holding current then the one specified under the European standard with 600ohms termination.

7.1.1 Adjustment of Holding Current

- Remove six mounting screws from top cover of the rack panel unit and remove cover plate.
- Connect a mA-meter into the telephone line.
- Switch on the TELEPHONE HYBRID

ATTENTION wires and components carrying **POWER LINE VOLTAGE** maybe exposed.

- By activating the control button "HYBRID ON" switch the telephone line over the HYBRID.

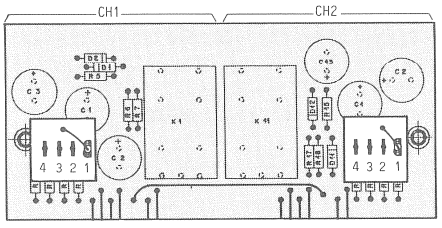


Fig. 7.1

CURRENT ADJUST PCB 1.915.765:

- Adjust holding current by moving the wire jumper between terminals 1 to 4:

Pos. 1 = maximum current
Pos. 4 = minimum current
Range (U = 48V/600 Ohms):
I^1 60mA
I^2 57mA
I^3 55mA
I^4 47mA

- Repeat same procedure on telephone line 2 (channel 2).
- Reinstall and fasten cover.

7. SUPPLEMENT

7.1 HYBRIDE TELEPHONIQUE "CURRENT ADJUST" 1.918.105

Le termineur de téléphone avec possibilité d'équilibrage du courant d'arrêt, devenu nécessaire en liaison avec les centraux téléphoniques électroniques modernes (contrairement aux centraux traditionnels à relais et commandes), est placé sur la carte de 19" embrochable 1.918.105.
Celle-ci comporte, derrière la carte DUAL RELAY, un circuit imprimé complémentaire qui est chargé des tâches suivantes:

- Possibilité d'adaptation du courant d'arrêt sur quatre niveaux, au moyen de ponts en fil commutables
- Commutation sans coupure de la ligne principale du poste téléphonique au termineur (HYBRID).

Une adaptation du courant d'arrêt peut également être nécessaire pour les centraux téléphoniques traditionnels lorsque le courant d'arrêt nécessaire s'écarte d'une ligne ayant une impédance de fermeture de 600 Ohms (soit la norme usuelle en Europe).

7.1.1 Equilibrage du courant d'arrêt

- Enlever le couvercle supérieur du rack
- Brancher l'ampèremètre sur la ligne téléphonique
- Enclencher l'appareil

PRUDENCE lorsque l'appareil est ouvert:
TENSION DU RESEAU!

- En actionnant le commutateur "HYBRID ON" (branchement du termineur), commuter la ligne téléphonique sur le termineur.

Circuit imprimé CURRENT ADJUST 1.915.765:

- En permutant les ponts de fil, régler le courant d'arrêt désiré:

Pos. 1: = courant maximal
Pos. 2: = courant minimal
Gamme (U = 48V, Ri = 600Ω):
I^1 60 mA
I^2 57 mA
I^3 55 mA
I^4 47 mA

- Procéder de la même façon pour la ligne téléphonique No 2
- Remonter le couvercle supérieur.

7.2 TELEFON HYBRID "NOISE GATE" 1.915.764

Diese Spezialausführung der Hybrid-Einheit weist eine Zusatzschaltung auf, welche während Modulationspausen jeglichen Pegelanteil an Geräusch und Übersprechen gegen den Ausgang am Hybrid unterdrückt.

7.2.1 Abgleich und Messung

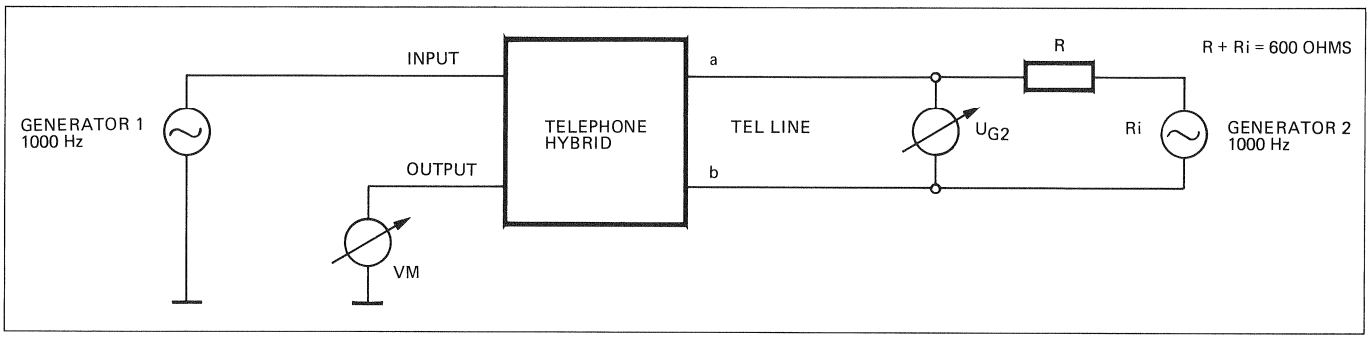


Fig. 7.2
Messaufbau

1. Abgleich des Telefon-Hybrid auf die 600 Ohm-Last:
Generator 2 aus (0 V), Generator 1 auf +6 dBu.

2. Messung des Einsatzpunktes:
Generator 1 aus (0 V), Spannung am Generator 2 langsam vergrössern, bis sie am Instrument VM erscheint.
Definition:
Der Einsatzpunkt ist derjenige Spannungswert am Ausgang, der **6 dB** unter dem gedachten (ungeschalteten) Signal liegt (Fig. 7.3)
Verstärkung: −5 dBu auf +6 dBu → V = 11 dB
Geforderter Einsatz: **−50 dBu** auf der Telefonleitung.
−50 dBu +11 dB = −39 dBu
Messung am Instrument VM: **−45 dBu**

Der Einsatzpunkt lässt sich mit R107 einstellen.

7.2 TELEPHONE HYBRID WITH NOISE GATE 1.915.764

This special version of the hybrid module features an additional circuit that suppresses any noise and cross talk in the absence of modulation on the telephone line.

7.2.1 Alignment and measurement

Fig. 7.2
Measurement set–up

1. Adjustment of the telephone hybrid to the telephone line:
Generator 2 off (0 V), output of generator 1 at +6 dBu.

2. Measurement of the threshold:
Generator 1 off (0 V), increase slowly the output signal of generator 2 until a voltage appears at the output of the hybrid (VM).
Definition:
The threshold is the voltage at the output, which is **6 dB** below the assumed (non-switched) signal level (fig. 7.3)
Gain: −5 dBu to +6 dBu → g = 11 dB
Required threshold: **−50 dBu** on the telephone line.
−50 dBu +11 dB = −39 dBu
Read on instrument VM: **−45 dBu**

The threshold can be varied by means of R107.

7.2 HYBRIDE TELEPHONIQUE "NOISE GATE" 1.915.764

Cette exécution spéciale de l'unité hybrid comporte un montage complémentaire qui, pendant les pauses de modulation, atténue toute portion de niveau de bruit ou de diaphonie à contre-sortie sur le termineur.

7.2.1 Equilibrage et mesure

Fig. 7.2
Arrangement de mesure

1. L'équilibrage de l'hybride téléphonique sur la charge ohmique de 600 ohms:
Générateur 2 à 0 volts, générateur 1 à +6 dBu.

2. Mesure du point d'insert:
Générateur 1 à 0 V, tension du générateur 2 lentement augmentée jusqu'elle apparaît sur l'instrument VM.
Définition:
Le point d'insert est défini par la valeur de tension à la sortie qui correspond à **6 dB** en dessus du signal imaginaire (non commuté) (fig. 7.3)
Gain: −5 dBu à +6 dBu → v = 11 dB
Insert demandé: **−50 dBu** sur la ligne téléphonique.
−50 dBu +11 dB = −39 dBu.
Mesure sur l'instrument VM: **− 45 dBu**

Le point d'insert peut être ajuster par R107.

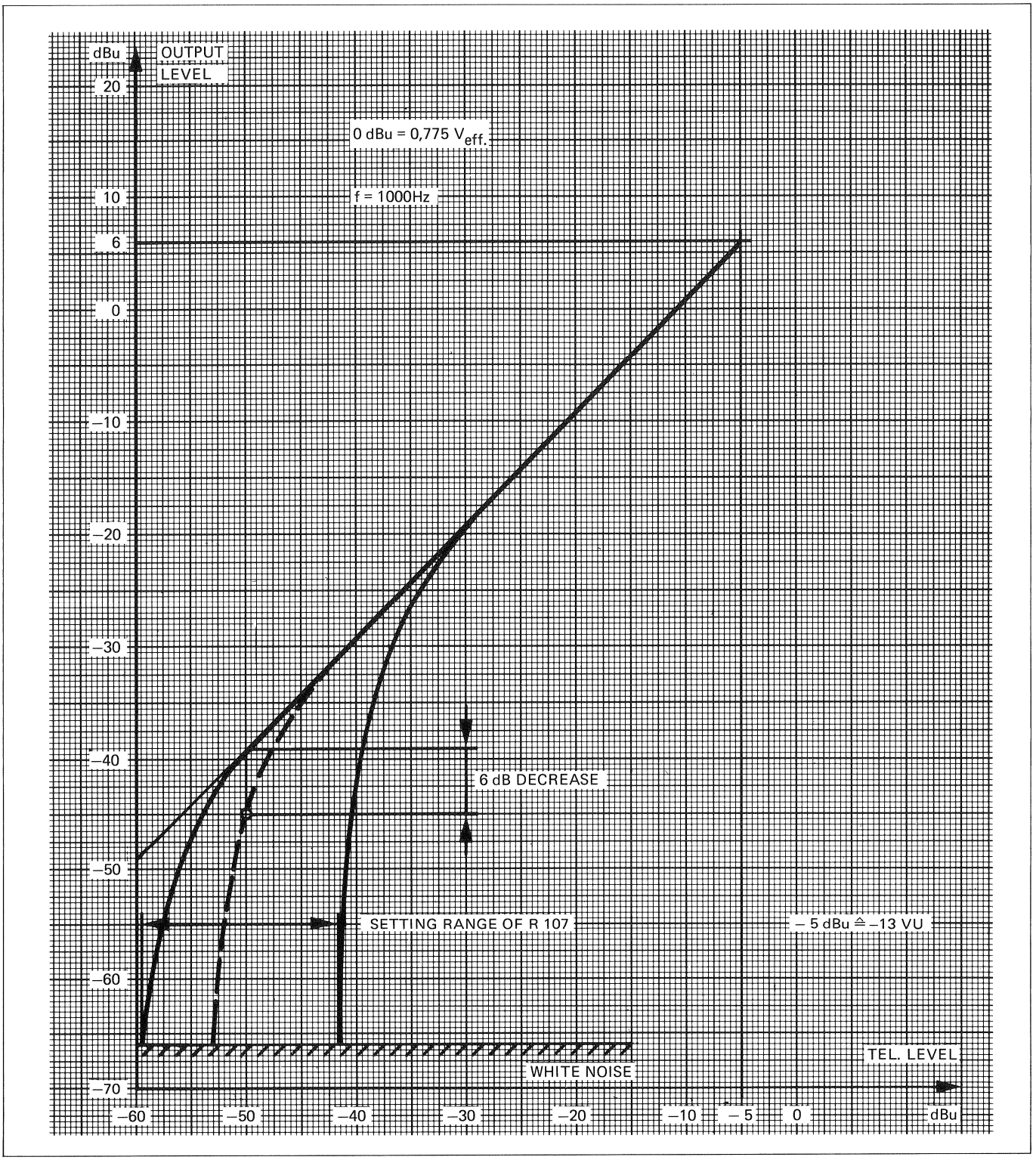

dBu
OUTPUT LEVEL
20
10
6
0
−10
−20
−30
−40
−50
−60
−70
0 dBu = 0,775 $V_{eff.}$
f = 1000Hz
6 dB DECREASE
SETTING RANGE OF R 107
− 5 dBu ≙ −13 VU
WHITE NOISE
TEL. LEVEL
−60
−50
−40
−30
−20
−10
− 5
0
dBu

Fig. 7.3