ROHDE&SCHWARZ

Communications Division

User Manual

1 - kW HF TRANSCEIVER

XK 859C1

680.1210

consisting of:

RECEIVER / EXCITER
GX 859C1
680.2017

HF POWER AMPLIFIER 1 kW
VK 859C1
680.6012

POWER SUPPLY
IN 859C1
681.0018

RACK, STATIONARY with Supplements
KG 859C1
681.5010

User Manual

1 - kW HF TRANSCEIVER
XK 859C1

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RECEIVER / EXCITER
GX 859C1

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User Manual

RACK, STATIONARY with Supplements
KG 859C4

681.5010

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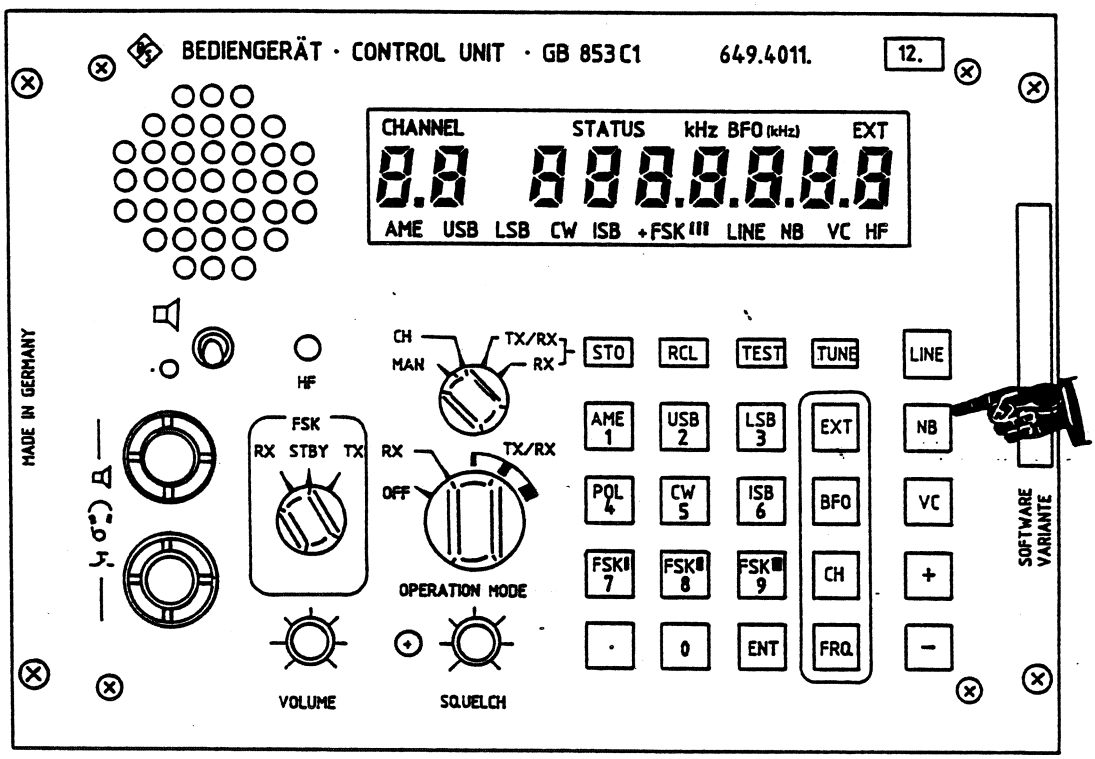


NOTICE

Please note that the key NB (noise blanker) on the Control Unit GB 853 has meanwhile been disabled.

Therefore, in the following manual please disregard all text referring to the key NB.

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Part 0: List of Contents - 0.1 -

L I S T O F C O N T E N T S

		Page
1.	Characteristics	1.0
	Data sheet (N2-350 E-1) XK 859	1.0
	Data sheet (N2-334 E-1) GB 853	1.0
2.	Preparation for Use and Operation	2.1
2.1	Safety Notes	2.1
2.2	Preparation for Use	2.1
2.2.1	General Preparation	2.1
2.2.2	Cabling of the 1-kW HF Transceiving System	2.4
2.2.2.1	General	2.4
2.2.2.2	Arrangement of Interfaces	2.4
2.2.2.3	Cabling of RF, Control and Signal Lines	2.9
2.2.3	Connection of Peripheral Units	2.10
2.2.3.1	General	2.10
2.2.3.2	Connection of Teleprinters	2.10
2.2.3.3	Connection of Accessories	2.11
2.2.4	Connection of Power Supply	2.12
2.3	Preparation for Remote Control	2.13
2.3.1	Setting of Baud Rate	2.13
2.3.2	Definition of V.Interfaces	2.14
2.3.3	Connection of V.28 Interface	2.14
2.3.4	Connection of V.10 Interface	2.15
2.3.4.1	Connection of Detached Control Unit	2.16
2.3.4.2	Setting of V.10 Interface	2.17
2.3.5	Connection of V.11 Interface	2.18
2.3.5.1	Setting of V.11 Interface	2.19
2.3.6	Connection of V.Interfaces in BUS Operation	2.20
2.3.6.1	Setting of BUS Operation	2.21
2.3.7	Function of Shorting Plugs X104 on Processor Board of Control Unit	2.22
2.3.8	Function of Shorting Plugs X104 in Processor	2.25
2.3.9	Setting of Device Address	2.27
2.4	Switching 1-kW HF Transceiver XK 859C1 ON and OFF	2.28
2.4.1	First-time Switch-on	2.28
2.4.2	Switching ON and OFF in Normal Operation	2.29
2.5	Manual Local Control	2.30
2.5.1	General	2.30
2.5.2	Brief Instructions for Manual Local Control	2.30

(Continuation)---

---(Continuation) List of Contents

		Page
2.5.3	Instructions for Manual Local Control	2.31
2.5.3.1	General Remarks on Keypad	2.35
2.5.3.2	Entries in Display	2.35
2.5.3.3	Setting of Operation Mode	2.36
2.5.3.4	Setting of Control Mode	2.37
2.5.3.5	Setting of FSK Mode	2.37
2.5.3.6	Setting of Frequency	2.38
2.5.3.7	Programming of Frequency Variation	2.38
2.5.3.8	Setting of Class of Emission	2.39
2.5.3.9	BFO Entry	2.40
2.5.3.10	EXTERNal	2.41
2.5.3.11	Channel Operation	2.42
2.5.3.12	Storage	2.43
2.5.3.13	Recall	2.48
2.5.3.14	Squelch	2.49
2.5.3.15	Loudspeaker and Headset	2.49
2.5.3.16	TEST	2.49
2.6	Remote Control	2.50
2.6.1	Remote-control Commands for Computer	2.51
2.6.2	Programming with Computer	2.55
3.	Maintenance	3.1
4.	Troubleshooting	4.1
4.1	General	4.1
4.2	Troubleshooting Instructions	4.1
4.3	Fault Lists	4.4
4.3.1	Continuous-monitoring (CM) Displays	4.5
4.3.2	BITE Displays	4.6
4.3.2.1	Displayed Fault Locations	4.6
4.3.2.2	Displayed Operating States	4.8
4.3.3	Error Displays without Code	4.9
4.3.4	Functions not Covered by BITE	4.11
4.3.5	Memory Backup Batteries	4.13
4.4	Replacement of Units	4.14
4.4.1	Replacement of Receiver/Exciter GX 859C1	4.14
4.4.1.1	Replacement of Control Unit GB 853C1	4.15
4.4.2	Replacement of Line Flattener FK 859C1	4.15
4.4.3	Replacement of 1-kW HF Amplifier VK 859C1	4.16
4.4.4	Replacement of Power Supply IN 859C1	4.16

L I S T O F F I G U R E S

Fig.	Title	Page
	XK 859C1 Variants Configuration .....5.1...5.4	
1.1	HF 850 System Configuration, 1 kW	1.1
1.2	Design of 1-kW HF Transceiver XK 859C1	1.3
2.1	Attachment of Rack, stationary KG 859C4 with Parts Set KG 859Z1	2.2
2.2	Arrangement of Interfaces on Receiver/Exciter GX 859C1	2.4
2.3	Arrangement of RF Sockets on Line Flattener FK 859C1	2.5
2.4	Arrangement of RF Socket on HF Power Amplifier VK 859C1	2.6
2.5	Arrangement of External Interfaces on Rack	2.7
2.6	Arrangement of Interfaces on Antenna Tuning Unit FK 859	2.8
2.7	Interconnection of two Units by V.28 Standard	2.14
2.8	Interconnection of two Units by V.10 Standard	2.15
2.9	Interconnection of Detached Control Unit with 1-kW HF Transceiver	2.16
2.10	Interconnection of Control Unit with 1-kW HF Transceiver by V.11 Standard	2.18
2.11	Interconnection of Several Units in BUS Operation	2.20
2.12	Cabling Plan of the 1-kW HF Transceiving System	2.57
2.13	Location Plan of Shorting Plugs on Audio Circuit Board of Control Unit	2.59
2.14	Location Plan of Shorting Plugs X104 and Switch S1 on Processor Circuit Board of Control Unit	2.61
2.15	Location Plan of Shorting Plugs X104 in Processor	2.63
2.16	Location Plan of Switches S10 and S11 in Processor	2.65
2.17	Controls, Indicators and Connectors on 1-kW HF Transceiver ...	2.67
2.18	Examples of Remote Control	2.69
2.19	System with Several Remotely Controlled and Several Locally Controlled 1-kW HF Transceivers	2.71
2.20	System with Several Individual Control Units GB 853C1 and Central Control	2.73
4.1	Troubleshooting Flowchart	4.2
4.2	Block Diagram of 1-kW HF Transceiver XK 859C1	4.17
4.3	Arrangement of Units in 1-kW Transceiver XK 859C1	4.19

Appendices **********

Appendix 1: Preparation of Connection Cables

Appendix 2: Interface Description

****
N O T E S
****

2. Preparation for Use and Operation

2.1 Safety Notes

In the setting up of premises for the operation of electrical installations and in the setting up and operation of the installations themselves, the relevant national or international safety regulations and requirements should be observed and maintained. The essence of these are contained in the safety guidelines of the IEC 364, in VDE 0100 (= DIN 57100) and DIN 57800.

They cover the following aspects:

a) Protective measures:

- accident prevention
- protection against excessive voltage
- insulation of installations
- grounding

b) Nature and laying of lines and cables

c) Rules for operating facilities and installations of a special kind:

- premises for the operation of electrical installations
- charging stations and charging devices for batteries

C A U T I O N

The 1-kW HF Transceiver XK 859C1 normally operates on a 380-VAC three-phase supply. This voltage is dangerous and one must use appropriate care and take corresponding precautions when working with it.

2.2 Preparation for Use

2.2.1 General Preparation

The 1-kW HF Transceiver XK 859C1 can be used in stationary or mobile operation. Rack KG 859C4 is available for stationary use. For mobile application, the Parts Set, Mobile KG 859Z1 is available in addition to Rack KG 859C4, thus making it possible for the 1-kW HF Transceiver to be operated in a mobile fashion.

In contrast to all other sections of part 2, general preparation for these two applications is slightly different. The differences are indicated in the following text by appropriate notes.

Prior to installing the Parts Set KG 859Z1, remove the feet of Rack, Stationary KG 859C4.

Rack, Stationary KG 859C4 can be set up at random both in the basic version for stationary use and in conjunction with the additional Parts Set KG 859Z1 for mobile use. This does not impair the characteristics of the 1-kW HF Transceiver XK 859C1 in any way.

- Set the rack up empty to begin with, i.e. without any of the slide-in units.

- Maintain a distance sideways of at least 100 mm from any other equipment.

- Leave sufficient space (approx. 30 cm) in front of and above the rack for intaking and expelling air.

(Continuation)---

---(Continuation) General Preparation

- The expelled, warmed air from other equipment in the vicinity must not be blown in the direction of the rack.

  Otherwise the units of the 1-kW HF Transceiver XK 859C1 will take in this air through their front-panel grilles.

- Leave sufficient space in front of the rack for any local operation of the equipment that may be called for.

Note:

If the 1-kW HF Transceiver is used in mobile operation (together with Parts Set KG 859Z1) and stowed in a cabin e.g., one must ensure that there is sufficient freedom for the dynamic swinging movements of the rack during travel.

- Once the location for setting up the rack has been appointed with due observation of the preceding points, the rack itself can be installed.

Note:

o When the Rack, Stationary KG 859C4 together with Parts Set KG 859Z1 is set up, the shock absorbers should be attached to the floor and to the wall.

o A total of 24 M8 screws are required for attachment, 16 on the floor for the four elastomer absorbers and eight for the absorbers between the rear of the rack and the wall.

o The dimensions for attachment of the rack can be seen from Fig. 2.1 below.

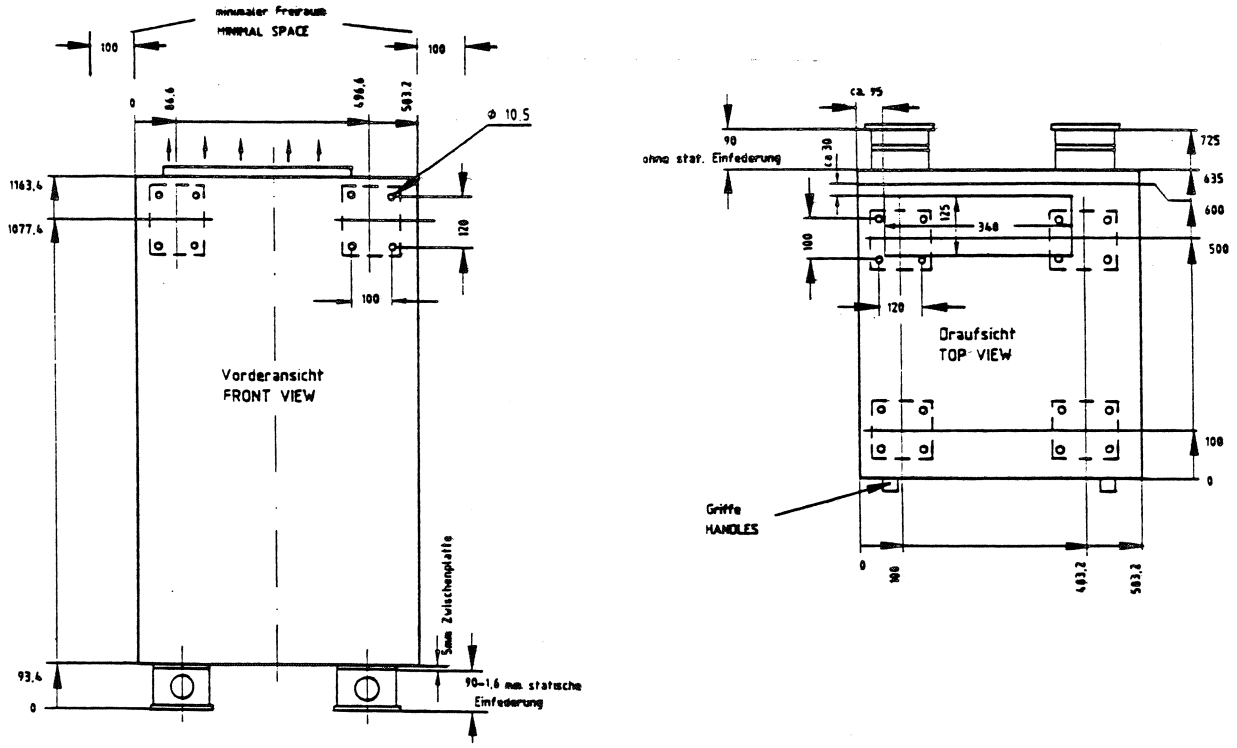


Fig. 2.1 Attachment of Rack, Stationary KG 859C4 and Parts Set, Mobile KG 859Z1

(Continuation)---

---(Continuation) General Preparation

- The opening of the duct in the top of the rack must not be obstructed during operation of the transceiver.

If the heat given off by the transceiver is not to be radiated into the operations room, a shaft can be constructed to carry it away to the exterior. The opening of the duct on the racks is prepared for this.

The blowers installed in the equipment are designed to permit a drop in pressure of 20 to 30 Pa (2 to 3 mm column of water) through external expulsion of air.

A greater drop in pressure has to be compensated for by an external exhaust blower.

The maximum air throughout the transmitter is approx. 10 m^3/min.

After the rack has been set up, HF Power Amplifier VK 859C1 and - depending on the configuration of the equipment - Line Flattener FK 859C1 can be pushed into the rack.

Secure the units in the rack with the retaining screws under their handles.

Once the general preparation of the 1-kW HF Transceiver XK 859C1 has been completed, the equipment can be cabled according to part 2.2.2.

2.2.2 Cabling of the 1-kW HF Transceiving System

2.2.2.1 General

The cables that are required for cabling the 1-kW HF Transceiver XK 859C1 are either already installed in the rack or are supplied with the equipment. The cables needed for the options are provided with these options.

To enable the user to produce cables of special lengths, a set of mating connectors (XK 859Z1) is available for the 1-kW HF Transceiver XK 859C1 which can be ordered directly from Rohde & Schwarz by stating ordering code 681.5410.02. Appendix 1 contains all necessary instructions for producing one's own cables.

The slide-in units Amplifier VK 859C1 and Power Supply IN 859C1 plus, possibly, Line Flattener FK 859C1 are automatically interconnected electrically by way of the integrated cabling when they are pushed into the rack.

Receiver/Exciter GX 859C1 plus options (GP 853C1/GM 853C1) is the only slide-in unit that is mounted on telescopic rails and connected up by hand.

2.2.2.2 Arrangement of Interfaces

In the case of Receiver/Exciter GX 859C1 all interfaces, with the exception of the sockets for connecting the two headsets, are located on the rear. Fig. 2.2 below illustrates how they are arranged.

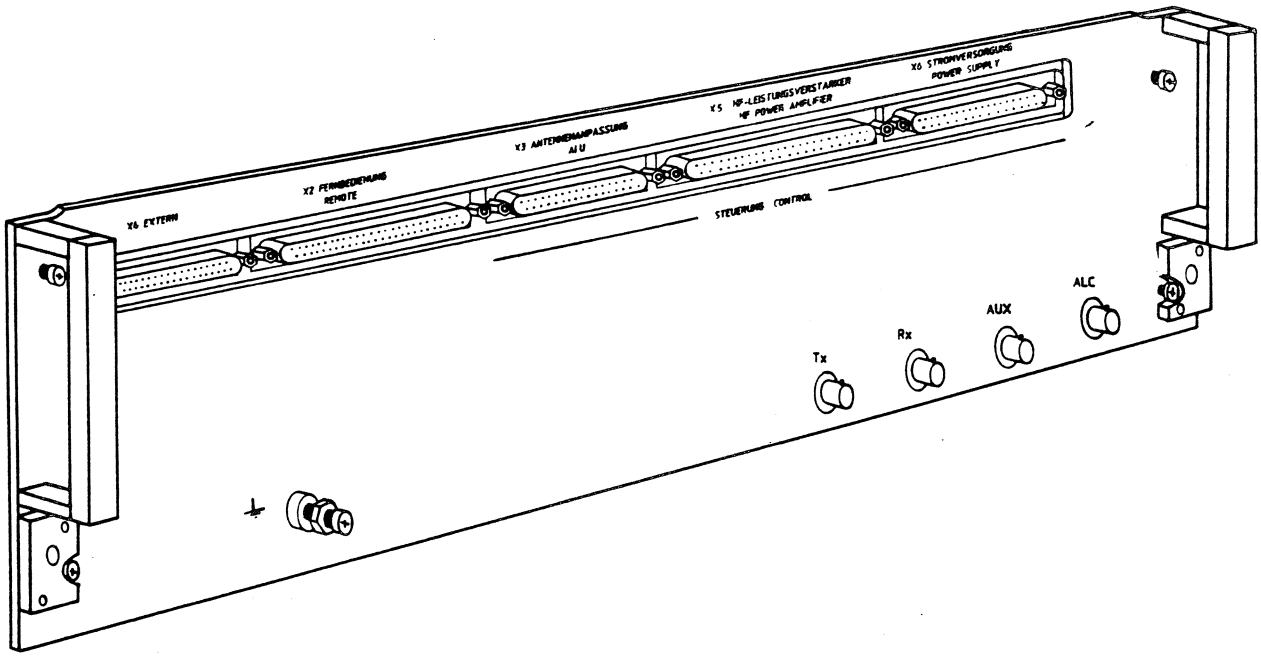


Fig. 2.2 Arrangement of Interfaces on Receiver/Exciter GX 859C1

(Continuation)---

---(Continuation) Arrangement of Interfaces

On the front panel of the optional Line Flattener FK 859C1 there are two sockets for the RF input and output. All other interfacing is by way of a connector on the rear of this unit.

When the line flattener is pushed into the rack, the connector on the rear engages automatically. Fig. 2.3 below shows the arrangement of the RF sockets on the front panel.

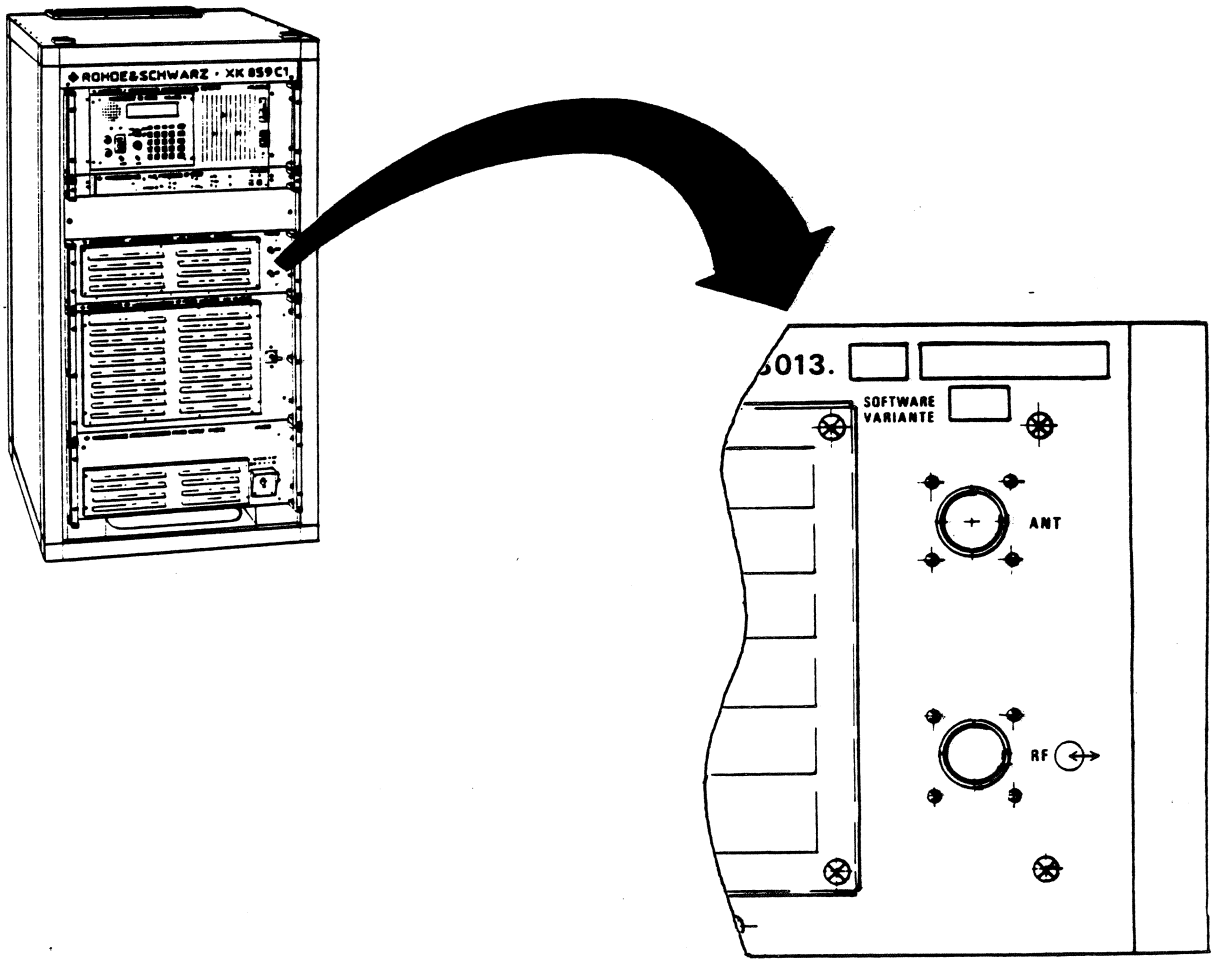


Fig. 2.3 Arrangement of RF Sockets on Line Flattener FK 859C1

(Continuation)---

---(Continuation) Arrangement of Interfaces

The electrical interfaces of HF Power Amplifier VK 859C1 consist of an RF socket on its front panel and several connectors on the rear.

When the power amplifier is pushed into the rack, all connectors on the rear engage automatically.

Fig. 2.4 below shows the location of the RF socket on the front panel.

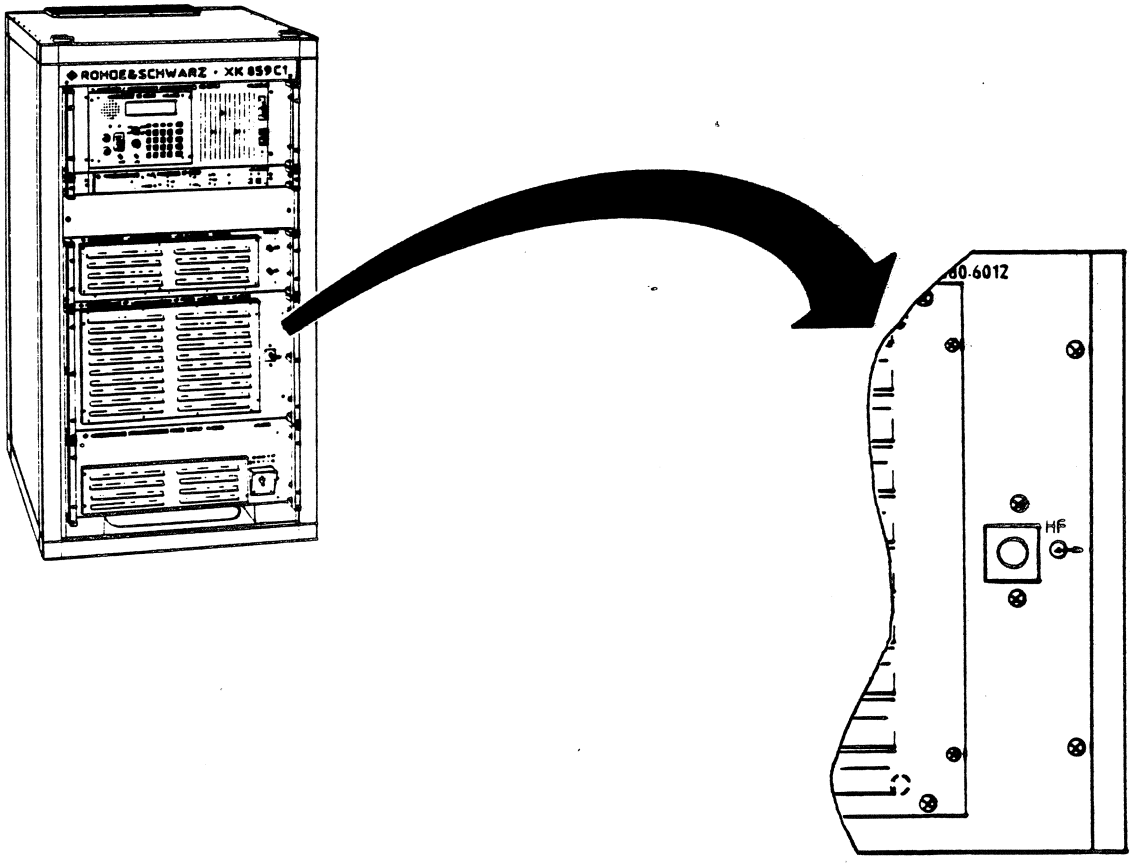


Fig. 2.4 Arrangement of RF Socket on HF Power Amplifier VK 859C1

(Continuation)---

---(Continuation) Arrangement of Interfaces

On the base-plate of the rack, below the slide-in unit Power Supply IN 859C1, there are connectors for the peripherals of the 1-kW HF Transceiver XK 859C1:

X14 for teleprinters, etc.

X13 for Antenna Tuning Unit FK 859

X12 for a detached control unit (GB 853C1 possibly with KK 853C2)

Also on the base-plate there is a four-way terminal block for the 380 VAC three-phase connection and a two-way terminal block for the 24-VDC battery connection.

There are two openings on the base of the rack for introducing all cables from the exterior.

Fig. 2.5 below illustrates the arrangement of the terminal blocks and connectors of the external interfaces on the base-plate of Rack KG 859C1 or KG 859C4.

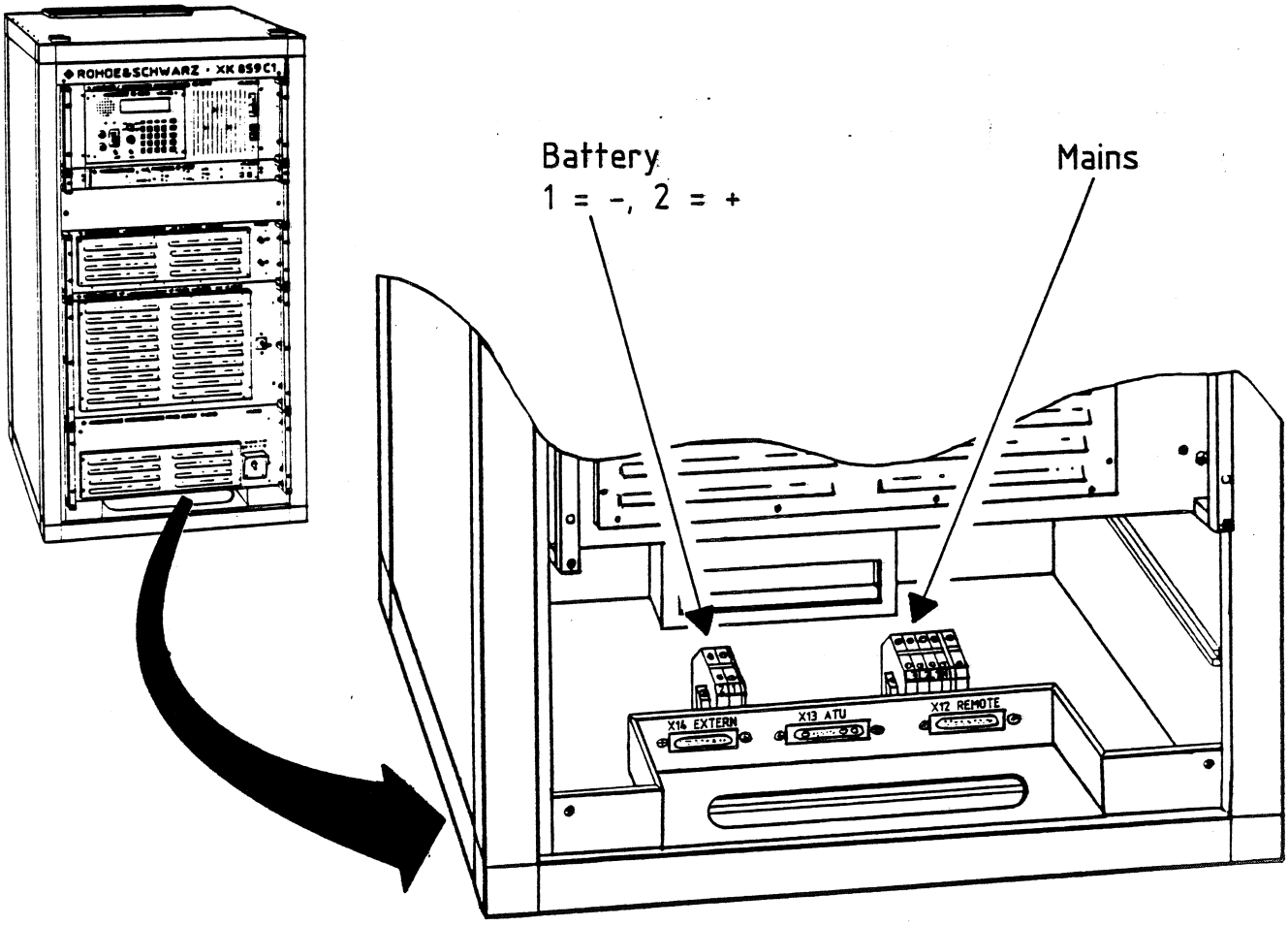


Fig. 2.5 Arrangement of External Interfaces on Rack

(Continuation)---

---(Continuation) Arrangement of Interfaces

On Antenna Tuning Unit FK 859 the connector for the control cable plus socket for the RF connection are located on the lower part at the front. The screw terminal for the transmitting/receiving antenna is on top of the unit in the centre. Fig. 2.6 shows the locations of these interfaces.

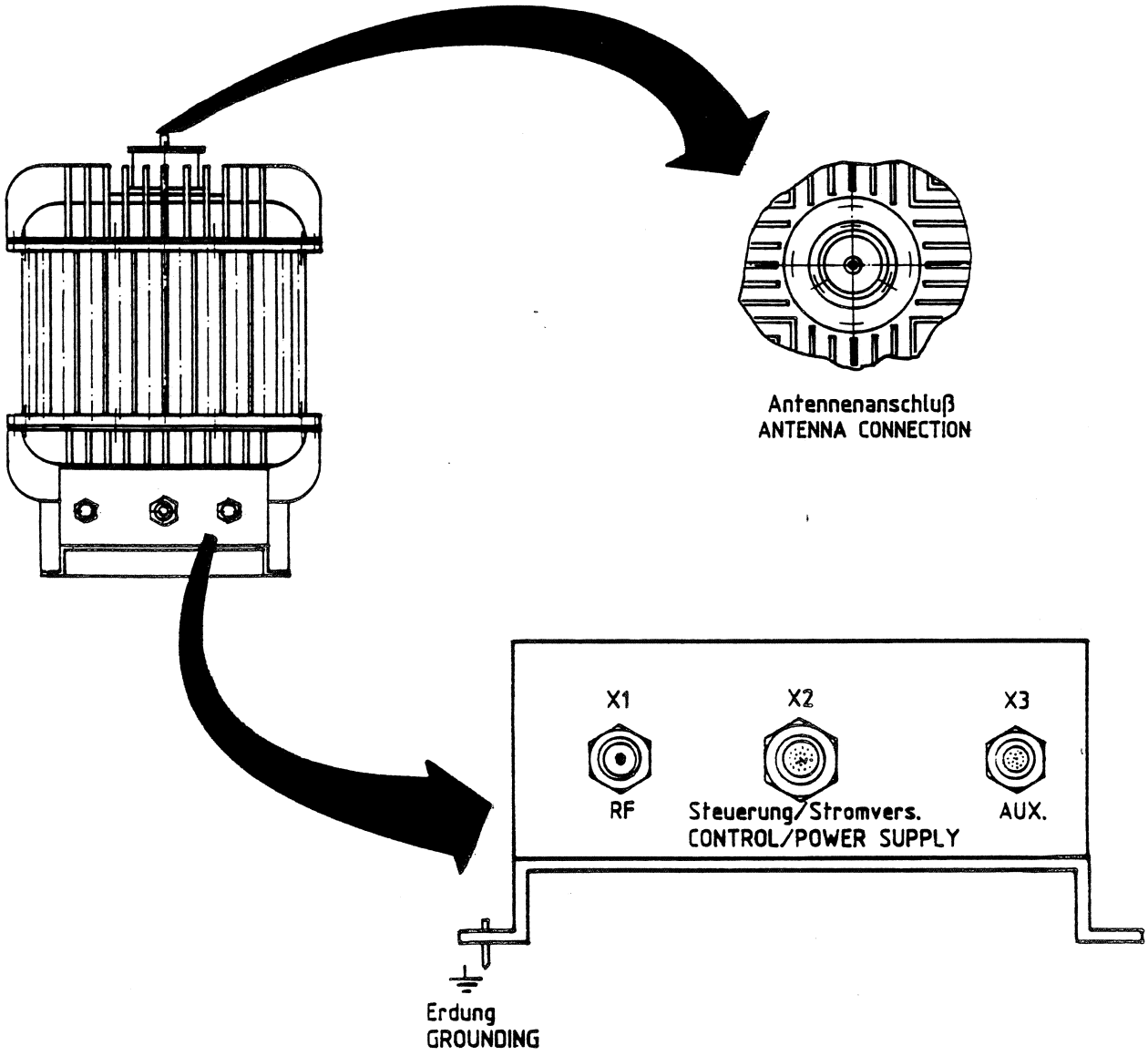


Fig. 2.6 Arrangement of Interfaces on Antenna Tuning Unit FK 859

2.2.2.3 Cabling of RF, Control and Signal Lines

The 1-kW HF Transceiver XK 859C1 should be cabled with its options and peripherals as shown in Fig. 2.12 before it is put into service.

The system is illustrated here with the cabling that is necessary. Deviations from this are of course admissible and may be implemented if the application calls for it.

For cabling the 1-kW HF Transceiver XK 859C1 proceed according to the following instructions:

C A U T I O N

- **The external power supply of three-phase 380 VAC and/or 24 VDC (battery) must not yet be connected to the rack.**
- **To ensure unobstructed access to the terminal for the three-phase and/or battery supply, Power Supply IN 859C1 should not yet be pushed into the rack.**

1. Mount Receiver/Exciter GX 859C1 and any options (ISB Modem GM 853C1 and/or ALIS Processor GP 853C1) on the telescopic rails in the top of the rack.

2. Push in the receiver/exciter until the telescopic rails lock. Thereby the safety catch is activated that prevents the receiver/exciter against falling out of the rack.

3. Connect the trailing cables inside the rack to the receiver/exciter with reference to Fig. 2.2 and Fig. 2.12.

4. Push the receiver/exciter right into the rack and secure it with the retaining screws under the handles.

C A U T I O N

If the optional Line Flattener FK 859C1 is not installed in the rack, cables W8 and W9 should be joined directly with their connectors X50 and X100.

A dummy panel should be attached to the location for the optional Line Flattener FK 859C1.

5. **If Line Flattener FK 859C1 is not included,** join the RF connecting cable to the RF ⟷ of 1-kW Amplifier VK 859C1 and the RF socket X1 of Antenna Tuning Unit FK 859.

   Join the control cable to socket X13 ATU in the bottom of the rack and to the socket X2 CONTROL/POWER SUPPLY of Antenna Tuning Unit FK 859.

Connect the rod, whip, long-wire or broadband antenna to the screw terminal on top of Antenna Tuning Unit FK 859.

(Continuation)---

---(Continuation) Cabling of RF, Control and Signal Lines

6. **If Line Flattener FK 859C1 is included,** join the RF connecting cable to the RF socket ⇔ of 1-kW Amplifier VK 859C1 and the RF socket ⇔ of the line flattener.

   Connect the coaxial lines (Z = 50 ohms) to the braodband antenna on antenna output X53 ANT of the line flattener.

C A U T I O N

If the optional line flattener is included in the rack at a later date, withdraw connector X100 (on cable W9) from socket X50 in the rack and join it to the dummy plug in the top left of the rack.

7. Connect the headset, morse key, loudspeaker, headphones, microphone to the parallel audio sockets on the front panel of the control unit in Receiver/Exciter GX 859C1.

8. Connect a detached control unit with the control cable to socket X12 REMOTE in the bottom of the rack of the 1-kW HF Transceiver.

2.2.3 Connection of Peripheral Units

2.2.3.1 General

The 1-kW HF Transceiver XK 859C1 offers diverse system capabilities plus enhanced operating ease, no matter whether it is worked locally, over short distances or truly remotely. The additions and accessories that are necessary for this (see also data sheet) may be connected without any internal alterations to the HF receiver/exciter. Explanations, e.g. pin assignment with interface levels, concerning the connection of peripherals are contained in Appendix 2: Interface Description.

2.2.3.2 Connection of Teleprinters

If the control unit is integrated, a teleprinter is connected on the EXTERNal connector X14 in the bottom of the rack. If a detached control unit is used, the AF/TTY connector may be used for this purpose (see Fig. 2.12).

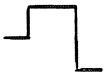
(Continuation)---

---(Continuation) Connection of Teleprinters

a) Setting for single-current or polar-current transmission

The 1-kW HF transceiver leaves the factory set for the connection of teleprinters working by a single-current method. The line current source required for that is already built in. If an end equipment using polar current is connected, it is necessary to change shorting plugs on the audio board in the control unit. Removal of the control unit for making these settings is described in user manual Receiver/Exciter GX 859C1.

The location of the shorting plugs on the audio board is shown in Fig. 2.13.

Connector links	Function	
	Single current 	Polar current 
X21	1 - 2	2 - 3 *
X22	5 - 6	4 - 5 *
X31	1 - 2	2 - 3 *
X32	5 - 6	4 - 5 *

* Basic setting

b) Line-current V.28 interface

The 1-kW HF transceiver leaves the factory set for the connection of teleprinters with a line-current interface. If a teleprinter or data end equipment with a V.28 interface is connected, it is necessary to change a shorting plug on the audio board in the control unit. Removal of the control unit for making this setting is described in user manual Receiver/Exciter GX 859C1.

The location of the shorting plug on the audio board is shown in Fig. 2.13.

Connector link	Function	
	Line current	V.28
X41	1 - 2	2 - 3 *

* Basic setting

2.2.3.3 Connection of Accessories

Possible accessory units like a teleprinter, ARQ (Automatic Repeat Request), FEC (Forward Error Correction), ALIS (Automatic Link Set-up) processor, a second loudspeaker or a PTT line can be connected on X14 EXTERN on the base-plate in the bottom of the rack using a control cable.

In the case of a detached control unit accessory units are connected using a control cable on connector AF/TTY. Connection of the ALIS processor is not possible in this case, since it is always located at the receiver/exciter.

2.2.4 Connection of Power Supply

See Fig. 2.12

Connect the power supply and ground for the 1-kW HF Transceiver XK 859C1 as follows:

C A U T I O N

To ensure unobstructed access to the terminals for the three-phase and/or battery supply, Power Supply IN 859C1 should not yet be pushed into the rack.

D A N G E R

Before making the three-phase and/or battery connection, ensure that the cables are not live.

1. Pass the cable for the three-phase connection (minimum cross-section 4 x 2.5 mm^2) through the small opening in the base of the rack on the right-hand side.

2. Make the connections for 380 VAC on the four-way terminal block X5 acc. to Fig. 2.5 and Fig. 2.12. Attach an appropriate pull-relief for the cable.

3. Pass the cable for the battery connection (minimum cross-section 2 x 6 mm^2) through the small opening in the base of the rack on the right-hand side.

   Note:

   Connection of a battery is optional and not required for pure mains operation.

4. Make the connections for 24 VDC on the two-way terminal block X6 acc. to Fig. 2.5 and Fig. 2.12. Attach an appropriate pull-relief for the cable.

5. On the base-plate of the rack there is a screw for making a central ground connection.

   Join the grounding cable (minimum cross-section 10 mm^2) to the central ground screw (see Fig. 2.5).

   Note:

   All slide-in units are thus grounded by way of the common grognd lead and the metal frame.

   C A U T I O N

   Ensure under all circumstances that the grounding cable is fastened on the mains side with a firm screwed connection. The grounding cable must not be plugged on the mains side.

6. It is advisable to provide fuse protection of 3 x 16 A (medium slow-blow) on the mains side for the three-phase connection to the rack.

7. Push the Power Supply IN 859C1 into the bottom of the rack until resistance is felt.

8. Push up the catch that prevents the unit from falling out of the rack and slide the unit in as far as it will go.

   Fasten the power supply to the frame with four screws.

9. After checking all connections with reference to Fig. 2.12, ensure that the mains switch on Power Supply IN 859C1 is OFF and that the OPERATION MODE switch on Control Unit GB 853C1 in Receiver/Exciter GX 859C1 is likewise OFF.

10. The three-phase supply of 380 VAC and, if available, the 24-VDC battery can then be switched on. Preparation for use is thus terminated.

2.3 Preparation for Remote Control

For remote control of the 1-kW HF Transceiver XK 859C1 from a detached Control Unit GB 853C1, central computer, e.g. PUC or PCA 5, or a central control unit, e.g. GB 606, various internal settings have to be made (address, data rate, type of V. interface, etc.). These settings are described in the following.

The control unit has a standard RS-232-C (V.24/V.28) interface which makes it possible for the control unit to be removed any distance away.

At distances of up to 50 m the power supply will come from the HF receiver/exciter, and at distances of more than > 50 m (detached or remote control) from a separate power supply (accommodated in KK 853C2).

Up to 1000 m the data line can be a DC four-wire line. Larger distances can be spanned using a telephone channel and modems (see also part 2.7).

2.3.1 Setting of Baud Rate

If the control unit is operated integrated into the HF receiver/exciter, the baud rate will set itself automatically to 9600 Bd because of the location (contact to ground).

The baud rate must be set for remote operation. For this there are switches and jumpers on the processor circuit board in the receiver/exciter as well as on the processor circuit board of the control unit, whose arrangement is illustrated in Fig. 2.14 to 2.16 and whose functions are explained overleaf. Removal of the subassemblies for making this setting is described in the user manuel of the Receiver/Exciter GX 859C1.

Baud rate	Switches S1 and S10 4	3	2	1	
110	Ø	Ø	Ø	Ø	Ø = open
200	Ø	Ø	Ø	1	
300	Ø	Ø	1	Ø	
600	Ø	Ø	1	1	
1200	Ø	1	Ø	Ø	
2400	Ø	1	Ø	1*	* basic
4800	Ø	1	1	Ø	setting
9600	Ø	1	1	1	
Ext.	1	X	X	X	

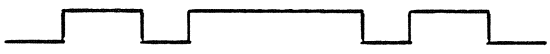
Isochronous operation

If the baud rate is set to external with switch S1 on the processor board of the control unit, the data to be transmitted and those to be received are conveyed in synchronism with signal-element timing fed in from the exterior. This timing has to be fed in on connector X61.a25 or X71.R.

Shorting plug X104.3 in the processor also has to be changed to external signal-element timing (A-B). Removal of the processor for making this setting is described in user manual Receiver/Exciter GX 859C1.

The clock and the data have the following chronology:

Transmitted data D1



Transmitter bit timing T2

Received data D2

Receiver clock T4

2.3.2 Definition of V.Interfaces

The V.24 standard defines the interfaces and standard V.28 describes the signal levels. The control unit and the 1-kW HF transceiver also meet the V.10/V.11 standard.

V.28 is a system for short lines, preferably for the connection of modems. With this standard there is one line each for sending and receiving data; the associated return line is common. V.10 is intended for longer lines. Here, in contrast to V.28, the two data lines each have their own return line, twisted with the data line itself.

V.11 is similar to V.10 but of balanced design.

2.3.3 Connection of V.28 Interface

If the 1-kW HF Transceiver XK 859C1 is connected to a modem, the pins of the REMOTE socket X12 in the bottom of the rack have to be connected to the modem according to the V.24/V.28 standard. The pin assignment of this socket can be taken from the interface description in appendix 2.

If units with V.28 interfaces are directly interconnected, e.g. a computer with an 1-kW HF transceiver, the procedure is as illustrated in Fig. 2.7. The shorting links shown here substitute for modem interfaces; they are necessary for a direct interconnection of devices.

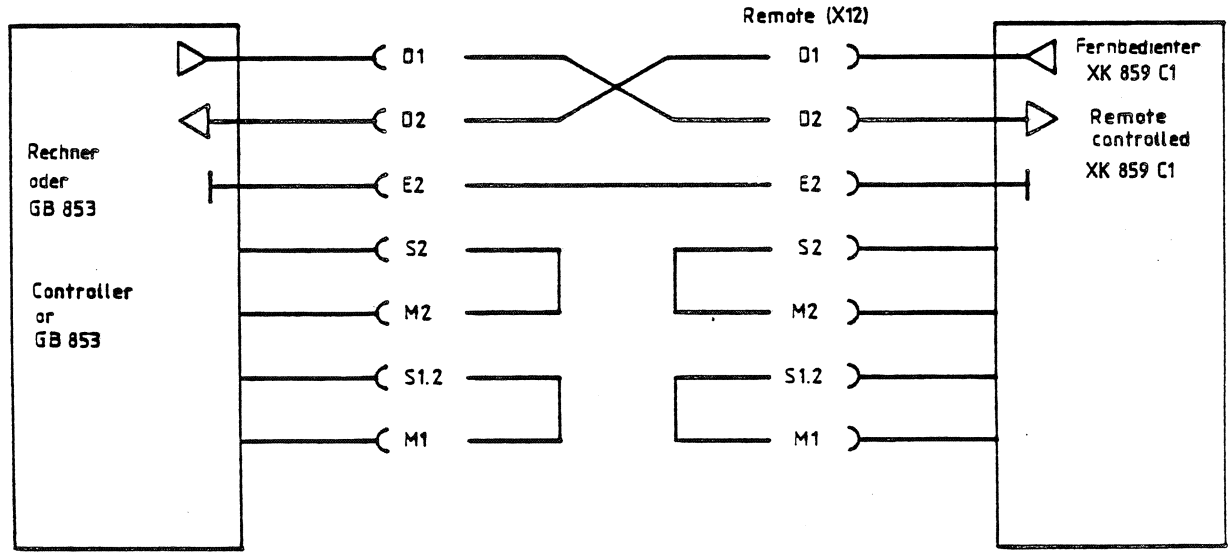


Fig. 2.7 Interconnection of Two Units by V.28 Standard

2.3.4 Connection of V.10 Interface

If two units with V.10 interfaces are directly connected, the procedure is as illustrated in Fig. 2.8. The shorting links shown here are necessary for operation. The pin assignment of the REMOTE socket X12 in the bottom of the rack can be taken from the interface description in appendix 2.

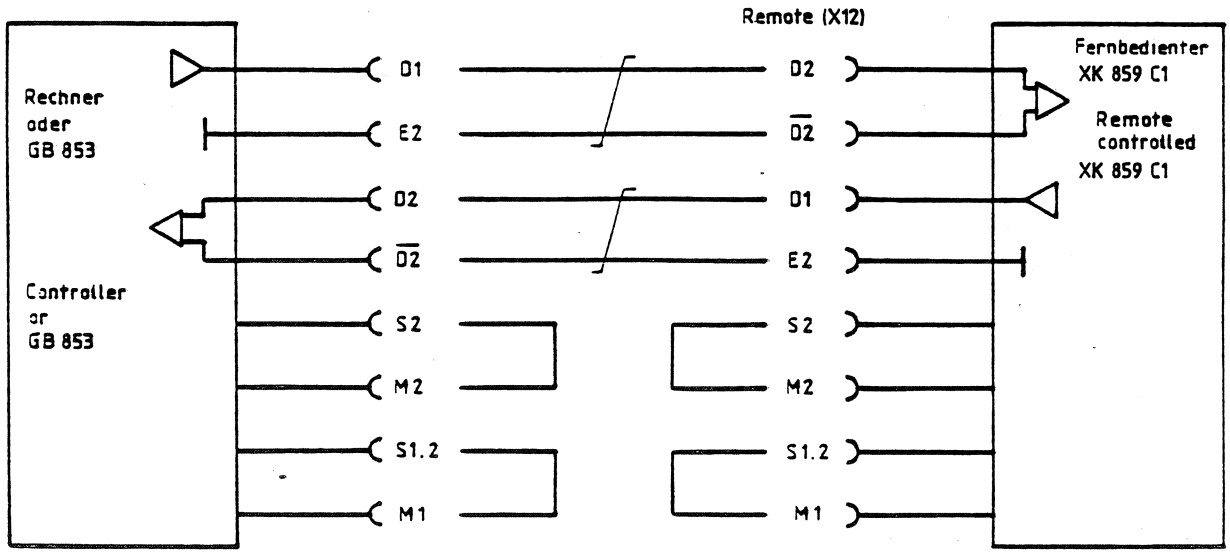


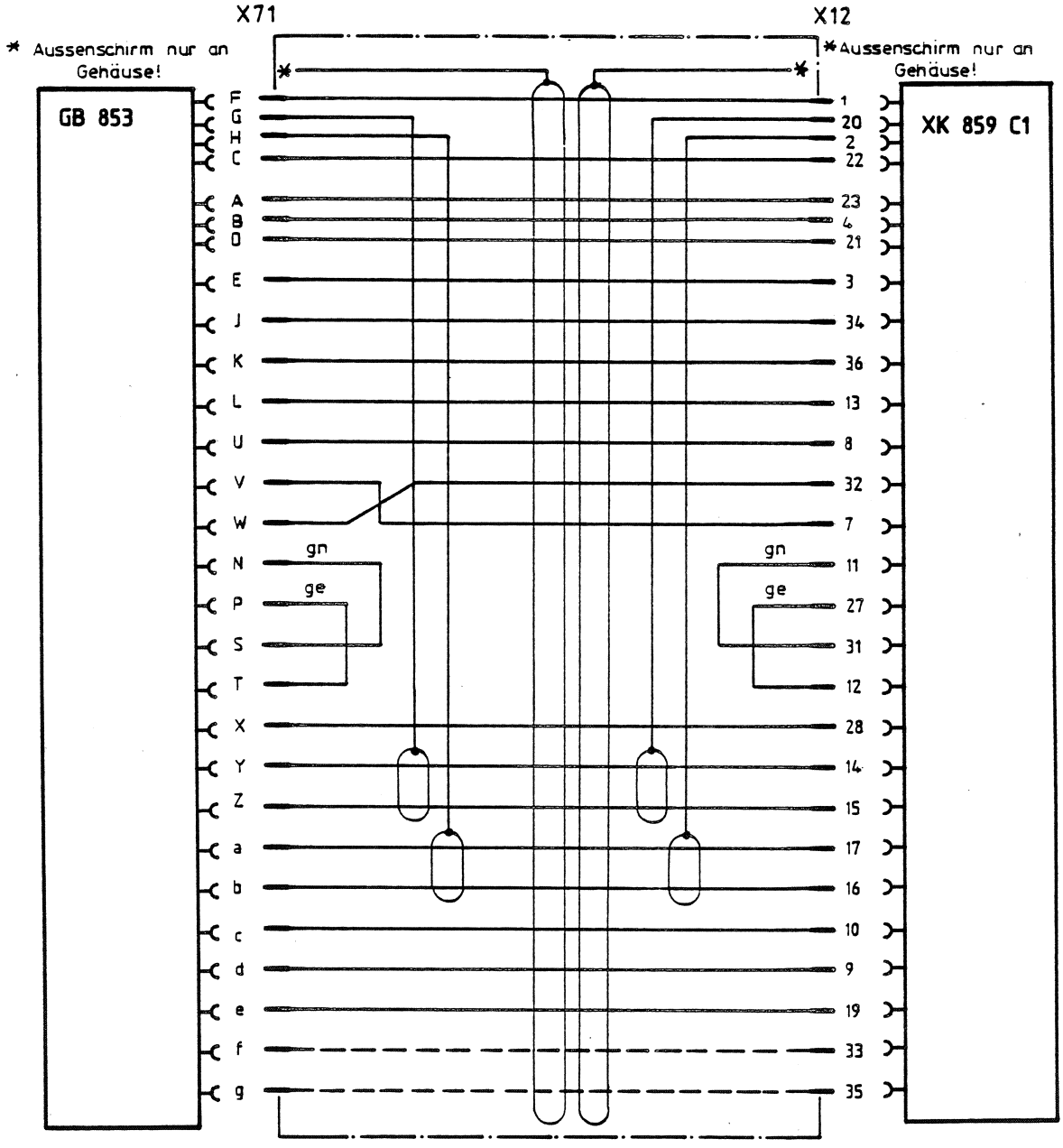
Fig. 2.8 Interconnection of Two Units by V.10 Standard

2.3.4.1 Connection of Detached Control Unit

If the 1-kW HF transceiver is to be controlled from a detached Control Unit GB 853C1, the equipment will be cabled as in Fig. 2.9. This configuration is suitable for lines up to 100 m in length, if the control unit has its own power supply.

If the control unit is powered from the 1-kW HF transceiver, the cable may be up to 50 m in length.

The assignment of the REMOTE socket X12 is given in the Interface Description in Appendix 2.



1) Connection of supply voltages only when control unit has no power supply of its own

Fig. 2.9 Interconnection of Detached Control Unit with 1-kW HF Transceiver

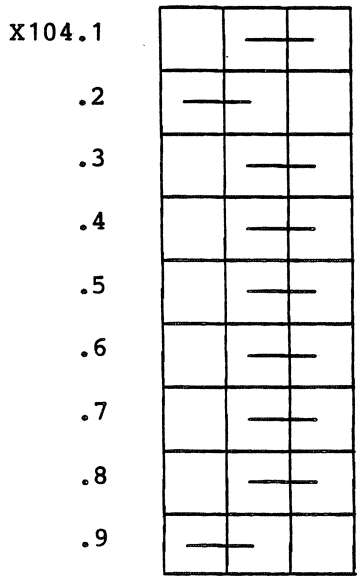
2.3.4.2 Setting of V.10 Interface

The shorting plugs X104 on the processor circuit board of the control unit and in the processor are set for V.24 interfaces when the equipment leaves the factory. Their location on the processor circuit board and in the processor is indicated in Fig. 2.14 and 2.15.

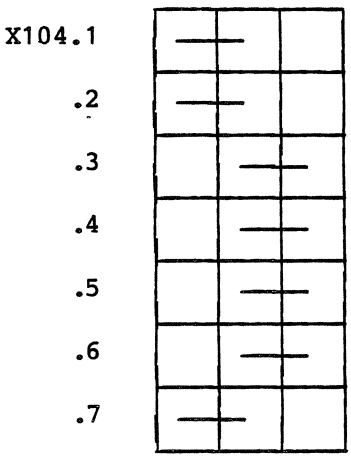
Removal of the control unit and processor for making the settings is described in the user manual of the Receiver/Exciter GX 859C1.

For changing to V.10 interface the shorting plugs have to be set as follows:

Control unit
(processor circuit board)
(Fig. 2.14)



Receiver/exciter
(processor)
(Fig. 2.15)



2.3.5 Connection of V.11 Interface

If two units with V.11 interfaces are directly connected, the procedure is as in Fig. 2.10. The shorting links shown here are necessary for operation. The pin assignment of the REMOTE socket X12 in the bottom of the rack can be taken from the interface description in appendix 2.

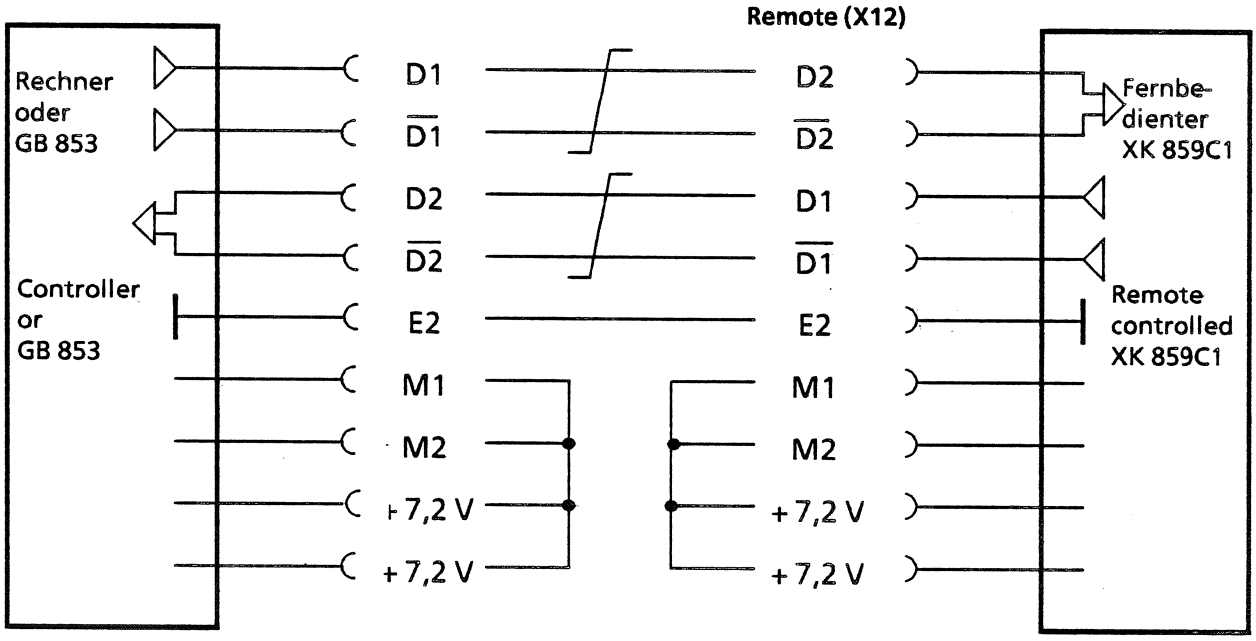


Fig. 2.10 Interconnection of Control Unit with 1-kW HF Transceiver by V.11 Standard

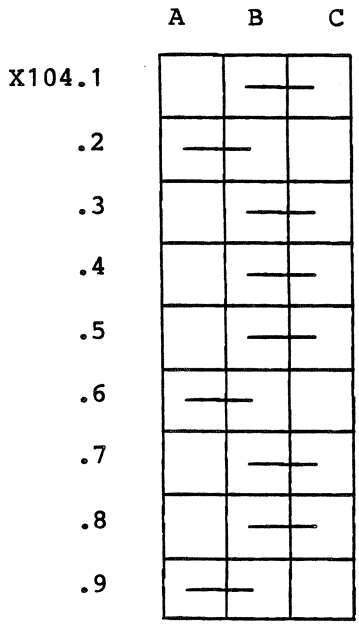
2.3.5.1 Setting of V.11 Interface

The shorting plugs X104 on the processor circuit board of the control unit and in the processor are set for V.24 interfaces when the equipment leaves the factory. Their location on the processor circuit board and in the processor is indicated in Fig. 2.14 and 2.15.

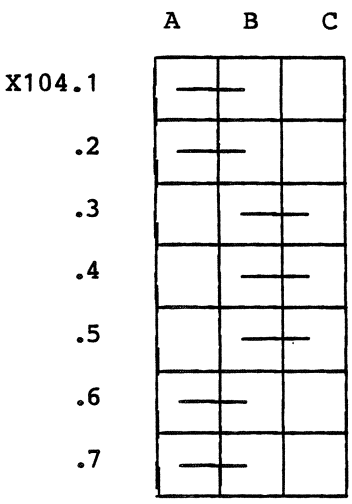
Removal of the control unit and processor for making the settings is described in the user manual of the Receiver/Exciter GX 859C1.

For changing to V.11 interface the shorting plugs have to be set as follows:

Control unit
(processor circuit board)
(Fig. 2.14)

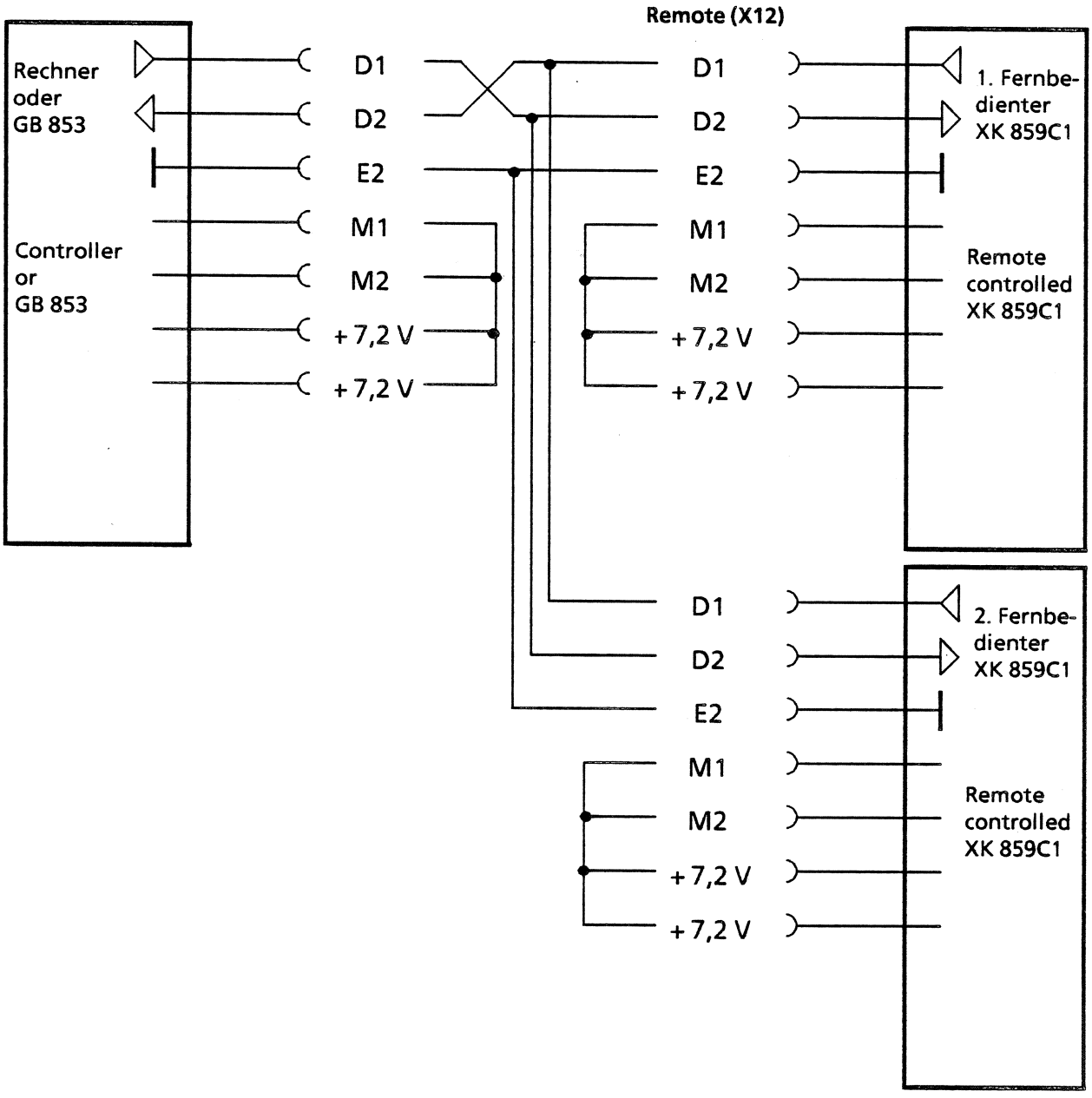


Receiver/exciter
processor
(Fig. 2.15)



2.3.6 Connection of V.Interfaces in Bus Operation

In this mode of operation, in contrast to V.24/V.10 interfaces, several units can be both remotely controlled and scanned.



2.11 Interconnection of Several Units in BUS Operation

A maximum of ten remotely controlled 1-kW HF transceivers can be combined, each having to be addressed with its address switch S11. The simultaneous scanning of all 1-kW HF transceivers, with the command A0001 for instance, is not permissible.

The controller has to be designed so that its operation will not be interfered with when input D2 is high-impedance (high-impedance tristate).

2.3.6.1 Setting of Bus Operation

The shorting plugs X104 on the processor board of the control unit and in the processor are set ex works for V.24 interfaces. Their location on the processor board and in the processor is indicated in Fig. 2.14 and 2.15.

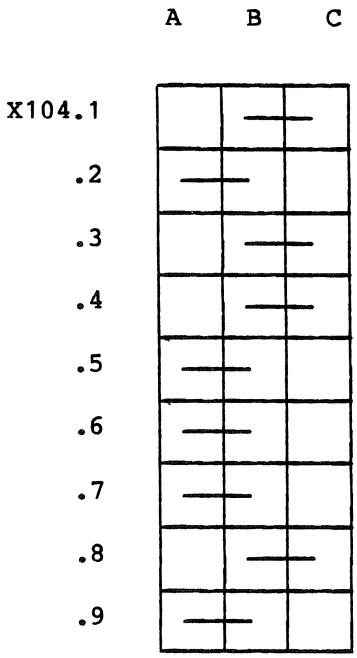
Note:

The control unit installed in XK 859C1 does not have to be changed for BUS operation since it is internally connected via an interface. An externally connected control unit has only to be set to BUS operation if simultaneously other units (terminal, processor) are switched.

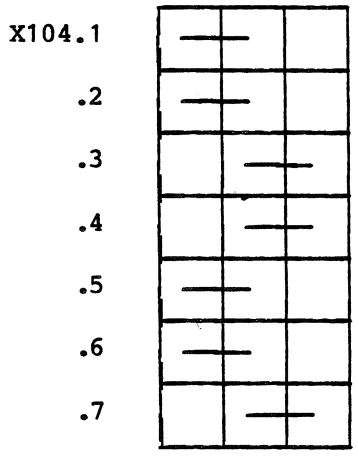
Removal of the control unit and processor for making the settings is described in user manual Receiver/ Exciter GX 859C1.

For changing to bus operation the shorting plugs have to be set as follows:

Control unit
(processor circuit board)
(Fig. 2.14)



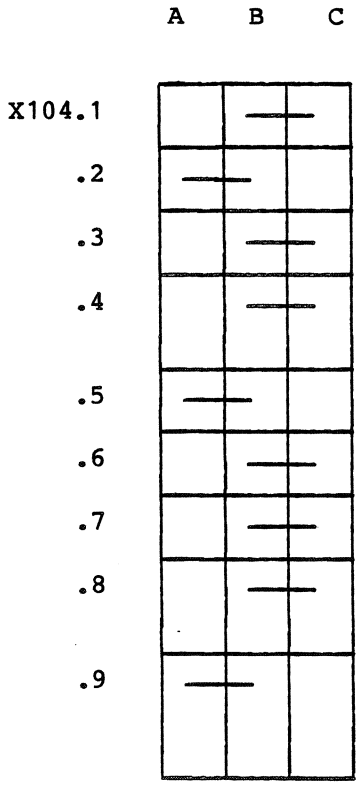
Receiver/exciter
(processor)
(Fig. 2.15)



2.3.7 Function of Shorting Plugs X104 on Processor Board of Control Unit

The location of the shorting plugs on the processor board is shown in Fig. 2.14. Their basic settings ex works and the possible settings are illustrated below.

Basic settings



Possible settings

X104.	A-B	B-C
.1	Special mode	Normal operation
.2	ALE active	ALE interrupted
.3	External clock	Internal clock
.4	V.28/V.10	S2 on/tristate for BUS
.5	V.28	V.11/V.10
.6	V.11/BUS	V.28/V.10
.7	BUS	V.11/V.10
.8	Channel storage inhibited	Channel storage not inhibited
.9	Software activation	
	OFF	ON

Explanation of the functions of the shorting plugs X104 on the processor board (see also CCITT V.24 recommendation):

1) X104.1

Normal operation	:	Processor works with operating program.
Test mode	:	Processor works with test program fed in by automatic test equipment for checking subassemblies.

2) X104.2

ALE active	:	Normal operation.
ALE interrupted	:	Test operation with automatic test equipment.

(Continuation)---

---(Continuation) Function of Shorting Plugs X104 on Processor Circuit Board of Control Unit

3) X104.3

External clock	:	Clock for USART (data transmission) comes from external unit.
Internal clock	:	Clock for USART comes from internal timer.

4) X104.4

V.10/V.28	:	Signal S2 is controlled by USART (RTS).
S2 on	:	Signal S2 is on (+5 V). Operation with Control Unit GB 853C1.

5) X104.5

V.28	:	Input comparator is referred to equipment's internal ground.
V.11/V.10	:	Input comparator works as differential amplifier.

6) X104.6

BUS/V.11	:	Data output issues difference signals D1 and $\overline{D1}$. Control lines inactive. In steady state D1 and $\overline{D1}$ are tristate (high-impedance), if X104.7 is switched to BUS operation.
V.28/V10	:	Data output issues signal D1. (Reference potential is equipment's internal ground). Control lines S1.2 and S2 are active.

7) X104.7

V.11/V.10	:	Data output $\overline{D1}$ is always active -5 V in steady state.
BUS	:	Data outputs D1 and $\overline{D1}$ are high-impedance in steady state.

(Continuation)---

---(Continuation) Function of Shorting Plugs X104 on Processor Circuit Board of Control Unit

8) X104.8

Channel storage inhibited	:	No channels can be programmed with STOre button on front panel of control unit.
Channel storage not inhibited	:	100 channels can be programmed with STOre button on front panel of control unit.

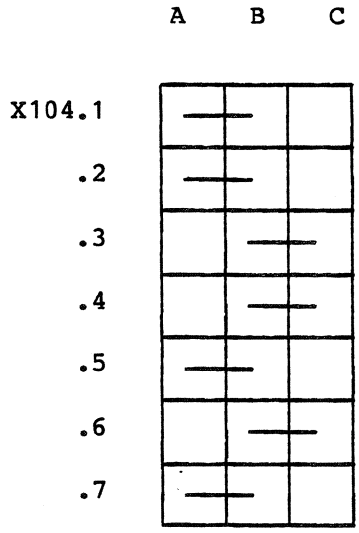
9) X104.9

Software activate OFF	:	Activate signal is not contained in data telegram from control unit to processor.
Software activate ON	:	Activate signal is contained in data telegram from control unit to processor.

2.3.8 Function of Shorting Plugs X104 in Processor

The location of the shorting plugs X104 in the processor is shown in Fig. 2.15. Their basic settings ex works and the possible settings are illustrated below:

Basic settings



Possible settings

X104.	A-B	B-C
.1	Normal operation	Test mode
.2	ALE active	ALE interrupted
.3	External clock	Internal clock
.4	V.28/V.10*	S2 on
.5	V.28/V.10	V.11/V.10
.6	V.11/BUS	V.28/V.10
.7	V.11/$\overline{D1}$ = -5 V	BUS

*S2 on to transmit

Explanation of the functions of the shorting plugs X104 in the processor (see also CCITT V.24 recommendation):

1) X104.1
   Normal operation : Processor works with operating program.

   Test mode : Processor works with test program fed in by automatic test equipment for checking subassemblies.

2) X104.2
   ALE active : Normal operation.
   ALE interrupted : Test operation with automatic test equipment.

3) X104.3
   External clock : Clock USART (data transmission) comes from external unit.

   Internal clock : Clock USART comes from internal timer.

(Continuation)---

---(Continuation) Function of Shorting Plugs X104 in Processor

4) X104.4

V.28/V.10	:	Signal S2 is controlled by USART (RTS).
S2 on	:	Signal S2 is on (+5 V). Operation with Control Unit GB 853C1.

5) X104.5

V.28/V.10	:	Input comparator is referred to equipment's internal ground.
V.11/V.10	:	Input comparator works as differential amplifier.

6) X104.6

V.11/BUS	:	Data output issues difference signals D1 and $\overline{D1}$. Control lines S1.2 and S2 inactive.
V.28/V.10	:	Data interface issues signals D1, S1.2, S2. (Reference potential is equipment's internal ground).

7) X104.7

V.11	:	Data output $\overline{D1}$ is active -5 V in steady state if X104.6 is set B-C.
BUS	:	Data outputs D1 and $\overline{D1}$ are high-impedance in steady state if no data are transmitted.

2.3.9 Setting of Device Address

For the transmission of data and their reception in BUS operation the 1-kW HF transceiver is provided with an addressing facility, because each data set for remote control commences with the receiver address. The addressing for data reception is made with the address switch S11 in the processor of the receiver/exciter.

The address switch is binary coded and decade-oriented, i.e. the ones place is set with the first four switches (1 to 4) and the tens place of an address between 00 and 99 with the second four switches (5 to 8).

The address set ex works is 00.

The location of the address switch can be seen in Fig. 2.13. Removal of the processor to enable the setting is described in user manual Receiver/ Exciter GX 859C1.

Tens decimal place Address switch 8	7	6	5	Decimal equiv.	Ones decimal place Address switch 4	3	2	1	Decimal equiv.
0	0	0	0	0	0	0	0	0	0
0	0	0	1	10	0	0	0	1	1
0	0	1	0	20	0	0	1	0	2
0	0	1	1	30	0	0	1	1	3
0	1	0	0	40	0	1	0	0	4
0	1	0	1	50	0	1	0	1	5
0	1	1	0	60	0	1	1	0	6
0	1	1	1	70	0	1	1	1	7
1	0	0	0	80	1	0	0	0	8
1	0	0	1	90	1	0	0	1	9

The setting 00 has a special function: the transceiver is then not addressed, i.e. it accepts any information that is conveyed to it.

If the processor is in an addressed condition, only those data strings will be accepted that commence with the appropriate address.

Exception: data strings with the address 00 are accepted by all installations.

2.4 Switching 1-kW HF Transceiver XK 859C1 ON and OFF

2.4.1 First-time Switch-on

Before the 1-kW HF Transceiver XK 859C1 is switched on for the first time, various checks should be made, as described below, for the sake of the safety to both the equipment and the persons using it.

Following this, switching ON and OFF in normal operation can be made as in part 2.4.2.

If any cables, subassemblies or components in the rack (KG 859C4) are replaced, this first-time check procedure should be repeated before the transceiver is switched on.

1. Ensure the the 1-kW HF Transceiver XK 859C1 is properly connected to the three-phase and/or battery supply acc. to 2.2.4.

2. Ensure that the transceiver is prepared for operation acc. to 2.2 and 2.3.

3. After undoing the retaining screws, pull Receiver/Exciter GX 859C1 out of the rack and make sure the trailing cables are properly connected and not damaged.

4. Ensure that any accessories, like ISB Modem GM 853C1, ALIS Processor GP 853C1 or Antenna Selector GV 851, are properly connected to the receiver/exciter.

5. Then slide the receiver/exciter back into the rack and secure it with the retaining screws under the handles.

6. Ensure that Power Supply IN 859C1, 1-kW Amplifier VK 859C1 and possibly Line Flattener FK 859C1 are pushed right into the rack and properly secured with the retaining screws.

7. Ensure that the air outlet on top of the rack is not obstructed.

8. Check electrical connections between the slide-in units of the transceiver and external units, e.g. detached Control Unit GB 853C1, Antenna Tuning Unit FK 859 and antennas, for proper seating.

Note:

The preparatory checks are thus completed and the 1-kW HF Transceiver XK 859C1 can be switched on as follows:

9. Set the power switch, on the right on Power Supply IN 859C1, to ON 1.

10. The LEDs MAINS and 28 V above the power switch must illuminate to indicate that the power supply is working properly.

    Note:

    The LEDs 50 V I and 50 V II will illuminate only in the operational mode Tx/Rx.

11. Then turn the OPERATION MODE switch on the control unit in Receiver/Exciter GX 859C1 to the required mode, thus switching on 1-kW HF Transceiver XK 859C1.

12. The green pilot LED on the right next to the cooling fins on the front panel of Receiver/Exciter GX 859C1 must illuminate.

(Continuation)---

---(Continuation) First-time Switch-on

Note:

If there is a fault in the internal supply voltages, this will be detected by an electronic monitoring circuit and either the LEDs of Power Supply IN 859C1 and/or the green pilot LED on the receiver/exciter will not illuminate. In such a case perform the troubleshooting acc. to chapter 4.

The 1-kW HF Transceiver XK 859C1 is ready for operation immediately after switch-on.

The transceiver has non-volatile data memories and continues to operate after switch-on in the way it was set before being switched off. The 99 internal memory channels for separate transmit/receive frequencies are entirely preserved with all settings. On the main display of the control unit "E" appears for approx. 90 s after switch-on, indicating that the warm-up phase of the oven in the synthesizer has not yet terminated.

A built-in test equipment (BITE) continuously monitors all major functions of the transceiver and indicates the momentary operating state. This means that the operating state last set is reproduced and after the warm-up phase indicated on the control unit or that error messages will appear on the main display, if required. In this case too troubleshooting should be performed acc. to chapter 4.

The transceiver can also be tested at the push of a button, with confirmation of its correct functioning or indication of a defective module. To do this, press the TEST button on the control unit. For more details of this refer to part 2.5.3.16.

While the test is in progress, the LEDs and all segments of the LC display on the control unit will illuminate. At the same time, if the transceiver is operable, an acoustic signal should be heard, provided the loudspeaker is switched on. Following the test the transceiver is reset to the operating state last set.

2.4.2 Switching ON and OFF in Normal Operation

Once the 1-kW HF Transceiver XK 859C1 has been switched on for the first time acc. to 2.4.1, it can be switched on and off as follows in normal operation:

Switch-off

Turn the OPERATION MODE switch (19, Fig. 2.17) on the control unit in Receiver/Exciter GX 859C1 to OFF.

The green pilot LED on the right next to the cooling fins on the front panel of Receiver/Exciter GX 859C1 extinguishes and the 1-kW HF Transceiver XK 859C1 is switched off.

Note:

If the 1-kW HF Transceiver XK 859C1 is to remain out of operation for a longish period, the power switch on the right on Power Supply IN 859C1 should also be switched to OFF.

Switch-on

Turn the OPERATION MODE switch (19, Fig. 2.17) on the control unit in Receiver/Exciter GX 859C1 to the required mode of operation.

The green pilot LED on the right next to the cooling fins on the front panel of Receiver/Exciter GX 859C1 illuminates and the 1-kW HF Transceiver XK 859C1 is switched on.

2.5 Manual Local Control

2.5.1 General

Manual operation of the 1-kW HF transceiver is possible in the following configurations:

1. with an integrated control unit,
2. with a detached control unit,
3. with an integrated and a detached control unit.

Manual operation as in 1. and 2. is described in the following parts.

With 1-kW HF transceivers using an integrated and a detached control unit manual operation is only possible from one of the control units.

In operation of the 1-kW HF transceiver from the detached control unit the integrated control unit must be turned OFF with the OPERATION MODE switch.

C A U T I O N

If the integrated control unit is cut in while the detached control unit is still active, it will only be possible to operate the 1-kW HF transceiver from the integrated control unit (see also 2.5.3.3).

On the engaged control unit that no longer has priority monitoring (i.e. of the current equipment status) and listening in are still possible.

Listening in to the received and the transmitted AF signal is always possible on both control units.

Activation of the transmitter is only possible from the control unit with priority.

2.5.2 Brief Instructions for Manual Local Control

The same, repetitive sequence for entering the different setting functions and defined reactions of the HF transceiver, which are communicated to the operator over the display of the control unit, ensure simple and error-free operation.

The operating philosophy, given in the form of brief instructions at the end of section 2, will serve a trained operator as a mental prop in using the 1-kW HF transceiver. The fully detailed operating instructions are given in the following sections.

2.5.3 Instructions for Manual Local Control

The following legend accompanies the front-panel illustration in Fig. 2.17.

No.	Inscription	Function
1		Loudspeaker (volume adjustable with volume control (20); can be switched off with switch (24))
2	CHANNEL	Display for channel number
3		Display array for
	STATUS	- ERROR indication
	BFO	- BFO frequency (-2.9 to +2.9 kHz)
	EXT	- Indication that BCD code is issued to externally connected unit
	kHz	- Indication of frequency in kHz
4		Display for
	AME USB LSB ISB CW FSK ▮ FSK ■ FSK ■	Type of modulation
	LINE	- AF switch-on
	NB	- Noise blanker
	VC	- Volume compressor
	HF	- Carrier activation
5	STO	- Key for storing entered equipment status under selected channel number
	RCL	- Key for recalling equipment status stored under selected channel number

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Inscription	Function
6	TEST	Key for triggering internal test of equipment
7	LINE	Key for data transmission in AME, LSB or USB (indication on display (4))
8	TUNE	Key for triggering HF tuning in antenna tuning unit
9	VC	Key reserved for switching interference blanker on/off (indication on display (4))
10	NB	Key for switching noise blanker on/off (indication on display (4))
11	+/-	Keys for - Variation of transmit or receive frequency in 10-Hz place (priority setting after each new switch-on of receiver/exciter) - Variation of transmit or receive frequency with any required frequency step, after input of this frequency step (e.g. lock ++) with keys FRQ, 1, 0, 0. - Variation of 100-Hz place when BFO is switched on - Variation of 1-kHz place in CH and EXT operation - Entry of BFO frequency with correct sign in CW operation
12		Key array for the presetting of
	EXT	- Output of BCD code to externally connected unit
	BFO	- BFO frequency
	CH	- Channel number
	FRQ	- Transmit or receive frequency

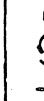
(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Inscription	Function
13	ENT	Key for - Termination of entries for functions EXT, BFO, CH and FRQ - Clearing of displayed error number - Inquiry of equipment status
14		Key array with digits for channel and frequency entries and for entering type of modulation and polarity in FSK operation
	0 to 9	Digit entries are only effective after using one of the keys in key array 12 (indication on display (2) or (3))
	AME USB LSB CW ISB FSK ▮ FSK ■ FSK ■	Entry of type of modulation (indication on display (4))
	POL	Entry of polarity in FSK operation (indication by +FSK or -FSK)
15	.	Key for assigning decimal place when entering transmit or receive frequency and BFO frequency
16		Switch for control mode
	MAN	- Manual entry of equipment status (all entries are possible)
	CH	- Channel operation In this mode frequency can be varied with keys + and - (11). All other operational settings are blocked. Upon channel recall frequency shown on display array (3) is extinguished after approx. 5 s.
	Tx/Rx	- Storage or readout of equipment status including transmit and receive frequency for simplex operation in conjunction with keys STO or RCL (5). No interruption in operation.

(Continuation)---

---(Continuation) Function of Controls and Indicators

No.	Inscription	Function
	Rx	- Storage or readout of equipment status for half-duplex operation in conjunction with keys STO and RCL (5). No interruption in operation.
17	SQUELCH	Control for setting squelch threshold
18		Squelch indicator; LED illuminates when AF is enabled
19	OPERATION MODE	Mode switch for
	OFF	- Equipment off
	Rx	- Reception
	Tx/Rx	- Transmission/reception with
	▮	- Low HF output power (100 W)
	■	- medium HF output power (250 W)
	■	- high HF output power (1000 W)
20	VOLUME	Volume control for built-in loudspeaker and/or headphones in headset
21	FSK	Switch in FSK mode for
	Rx	- Reception
	STBY	- Standby
	Tx	- Transmission
22		Parallel audio sockets for connection of loudspeaker and/or headset or morse key
23	HF	Led illuminates with activated carrier
24		On/off switch for built-in loudspeaker

2.5.3.1 General Remarks on Keypad

Settings that affect the displays (2 and 3, Fig. 2.17) must be indicated with one of the keys EXT, BFO, CH, FRQ (12). The previous display is then extinguished. The keys for the digits 0 to 9 (14) and the decimal point (15) (not for CH and EXT) may subsequently be operated. The control unit reacts to incorrect entries like FRQ > 29999.99 kHz or BFO > 2.9 kHz by showing "E" for maximally 1 s on the display array (3). A flashing display (2) or (3) means that the setting which has been made cannot be accepted until the key ENT (13) has been pressed. Incomplete entries are also accepted with the ENT key, leading zeroes being suppressed and places after the point being filled in.

All other functions are self-terminating, i.e. the key ENT (13) does not have to be pressed. Operating the ENT key after terminated functions triggers a status inquiry. After the entry of terminated functions, operation of the numeric keys 1 to 9 (14) calls up the type of modulation. Additional functions like LINE, NB, VC or POL are cleared from the display (4) if they are not admissible for the selected modulation. These additional functions have a flipflop response, i.e. every time one of these keys is operated, the opposite of the previous setting is produced. Impermissible combinations with certain types of modulation also lead to an error display "E" on the array (3).

Pressing the keys + and - (11) produces variation of the last place of terminated entries (keys EXT, BFO, CH, FRQ (12) with key ENT (13) possibly after numerics) and also of unterminated entries (key ENT (13) without keys EXT, BFO, CH, FRQ (12) with/without numerics). Without operating one of the keys EXT, BFO, CH, FRQ (12) the content of the displays (2) or (3) is varied that was last accessed. Programming of the variation stepping width is explained in section 2.5.3.7.

All terminated entries are transferred to the processor, only dashes appearing on the display (3) during this time. Displays (3) and (4) are turned off until the complete acknowledgement is received. This procedure is only visible at low baud rates however. During the transfer the keypad is furthermore blocked.

The error display "E" will produce a forced termination of the entry in some cases where a function is impermissible for instance. A new entry is then possible without pressing the ENT key (13).

2.5.3.2 Entries in Display

Unterminated entries into the display (2, Fig. 2.17) are cleared by operating the prime function keys FRQ, BFO or EXT (12) and are ineffective. A continuous-monitoring number that has just been shown on the display (3) is cleared by entries like FRQ, BFO, EXT (possible with numerics) and ENT for 5 s after pressing the ENT key (13). BITE numbers are permanently cleared by the above entries and also by the ENT key (13) alone.

The significance of the CM and BITE numbers are explained in Part 4.

2.5.3.3 Setting of Operation Mode

When the OPERATION MODE switch (19, Fig. 2.17) is OFF, the 1-kW HF transceiver is naturally turned off. The other positions of the switch are as follows:

Rx : 1-kW HF transceiver can only receive

Tx/Rx : 1-kW HF transceiver can receive and transmit at low power (100 W)

Tx/Rx : 1-kW HF transceiver can receive and transmit at medium power (250 W)

Tx/Rx : 1-kW HF transceiver can receive and transmit at full power (1000 W)

Note:

If the 1-kW HF Transceiver XK 859C1 is only powered from a battery, e.g. in mobile operation or because the three-phase supply has failed, it automatically switches itself to transmitting power of 100 W, independently of the Tx/Rx setting of the OPERATION MODE switch.

If, in operation with an additional, detached control unit, the OPERATION MODE switch (19) on the local control unit is OFF, this means that the remote control unit is active and that it is only possible to listen in on the local control unit. The displays are active on the local control unit but the keys are blocked.

When the OPERATION MODE switch (19) on the remote control unit is OFF, it is possible to listen in on this control unit.

Local control unit		Remote control unit		
OFF		OFF		system off
Rx, Tx/Rx	active	OFF	listen in	system on
OFF	listen in	Rx, Tx/Rx	active	system on
Rx, Tx/Rx	active	Rx, Tx/Rx	error message	system on

2.5.3.4 Setting of Control Mode

Explanation of the switch for the control mode (16, Fig. 2.17):

MAN : In this setting of the switch all possibilities of control are admissible. If a channel is called up with the CH key (12), the frequency on the display (3) is maintained.

CH : In this setting of the switch a channel recall is possible (e.g. CH, 19, ENT).

Also variation with keys + and - (11) of:
FRQ, BFO, EXT, CH.

Example: EXT, +, +, +, +,
Display: 4, 5, 6, 7

All other possibilities are blocked. The frequency display extinguishes approx. 5 s after a channel recall.

2.5.3.5 Setting of FSK Mode

With the FSK switch (21, Fig. 2.17) the line-current source of the 1-kW HF transceiver is switched to FSK operation.

Rx : FSK reception, the line-current source can be keyed by the FSK signal.

STBY: The line-current source is turned off.

Tx : FSK transmission, the line-current source is turned on but cannot be keyed. The 1-kW HF transceiver is activated.

2.5.3.6 Setting of Frequency

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to MAN. Press FRQ key (12). Enter frequency on keypad (14) in kHz and if necessary with decimal point (15). Press ENT key (13).	Frequency display (3) is dark, all other displays unaltered. Entered frequency flashes. Entered frequency lights up continuously, i.e. 1-kW HF transceiver is set to entered frequency

2.5.3.7 Programming of Frequency Variation

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to MAN. Press FRQ key (12). Enter frequency variation on keypad (14) in kHz and if necessary with decimal point (15). Press key + or - (11).	Frequency display (3) is dark, all other displays unaltered. Entered frequency flashes. Variation frequency is stored and is added to or subtracted from previously entered transmit or receive frequency according to the key operated. Frequency altered by variation frequency lights up continuously, i.e. 1-kW HF transceiver is set to new frequency.

Note:
If the previously set transmit or receive frequency is to be retained after storage of the variation frequency, the opposite sign key must always be pressed after storage. The frequency variation remains stored and can be called up with the keys FRQ (12) and + or - (11) until the 1-kW HF transceiver is switched off. After switchig on again the standard variation of 10 Hz is effective.

2.5.3.8 Setting of Class of Emission

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to MAN.	Display (3) is dark, all other displays unaltered.
	Select required class of emission (AME, USB, LSB, ISB, FSK) by pressing appropriate key of keypad (14).	Class of emission appears on displays (4).
	For FSK set mode switch (21) and select polarity with POL key (14).	Polarity indicated by LEDs POL (23).
	For ISB select required side-band with POL key (14).	Sideband indicated on display (4).

2.5.3.9 BFO Entry

The beat-frequency oscillator (BFO) is turned on for the classes of emission CW and FSK. It can be varied in steps of 100 Hz in the range +2.9 to -2.9 kHz, referred to the centre frequency. For FSK a frequency assignment of 1.0 kHz is made automatically for the BFO.

The basic setting of the BFO, which is made after selecting classes of emission CW and FSK, is always 1.0 kHz. In the class of emission CW variation of the BFO frequency is possible in two ways:

1. proceeding from 1.0 kHz
2. direct entry of the BFO frequency

Proceeding from 1.0 kHz

Fig. no.	Operation	Indication
2.17	Press BFO key (12).	Display (3) is dark, all other displays unaltered.
	Press ENT key (13).	BFO frequency 1.0 kHz lights up on display (3).

Direct entry of the BFO frequency

Fig. no.	Operation	Indication
2.17	By pressing key + or - (11) BFO frequency is varied by 100 Hz.	
	Press BFO key (12).	Display (3) is dark, all other displays unaltered.
	Enter BFO frequency between -2.9 and +2.9 kHz on keypad (14) (+ or - (11) following numerics).	Entered frequency flashes on display (3).
	Press ENT key (13).	Entered BFO frequency lights up continuously on display (3), i.e. 1-kW HF transceiver is set to BFO frequency.

Once BFO frequency is shown on the display (3), it is possible to return to the frequency display with the associated equipment status by pressing the keys FRQ (12) and ENT (13).

2.5.3.10 EXTERNAL

The numerical range is from 0 to 9.

According to the selected numbers a BCD code is output to the EXTERNal connector X14 in the bottom of the rack can be regarded as completely unrelated in value to the overall setting of the HF transceiver. If the EXT number last entered is to be called up, the keys EXT (12, Fig. 2.17) and ENT (13) should be pressed.

This can only be varied with the keys + and - (11). The procedure for entering a new EXT number is as follows:

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to MAN. Press EXT key (12).	Display (3) is dark, all other displays unaltered.
	Enter EXT number on keypad (14).	Entered number flashes in displays (3).
	Press ENT key (13).	Entered EXT number lights up continuously, i.e. number is present in BCD code on EXTERNal connector on rear.

Once the EXT number is shown on the display (3), it is possible to return to the frequency display with the associated equipment status by pressing the keys FRQ (12) and ENT (13).

2.5.3.11 Channel Operation

Channel operation is possible in the setting MAN or CH of the switch for the control mode (16, Fig. 2.17). In both switch settings a previously called up channel number indicated on the display (2) will extinguish as soon as another class of emission or additional function (LINE, NB, VC) is set. The previously set channel number can however be recalled on the display (2) by pressing the keys CH (12) and ENT (13). The altered equipment status is no longer assigned to this channel number, so it extinguishes after approx. 5 s.

In the CH setting of the switch for the control mode (16) only channel numbers can be called up. The frequency assigned to the channel (stored) is shown on the display (3)for approx. 5 s. It can be displayed at any time by pressing the keys FRQ (12) and ENT (13). Only then is it possible to vary the frequency with the key + or - (11) in the standard stepping width of 10 Hz or a previously programmed stepping width. The class of emission cannot be altered. An alteration of the additional functions is only possible if the selected class of emission allows it.

In the MAN setting of the switch for the control mode (16) it is possible, in contrast to the CH switch setting, to make any other kind of operation, e.g. switching of the class of emission, BFO, EXT number, etc. A further difference is that the frequency display (3) is not darkened.

For calling up a channel in the MAN or CH setting of the switch for the control mode (16) the procedure is as follows:

Fig. no.	Operation	Indication
2.17	Press CH key (12).	Any channel number on channel display (2) extinguishes. Remaining equipment status is unaltered.
	Enter channel number on keypad (14).	Entered channel number flashes. Remaining equipment status is unaltered.
	Press ENT key (13).	Entered channel number lights up continuously, i.e. 1-kW HF transceiver is set to entered channel number and stored equipment status is indicated.

2.5.3.12 Storage

a) An equipment status set in the MAN position of the switch for the control mode (16, Fig. 2.17) is to be stored under a particular channel number.

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	Channel display (2) shows channel number selected earlier with flashing point.
	Enter required channel number by pressing key CH (12), numerics (14) and key ENT (13).	Point on channel display (2) flashes. This means that keys STO and RCL (5) are activated.
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under selected channel number.
	Reset switch for control mode (16) to MAN or CH.	

(Continuation)---

---(Continuation) Storage

b) Storage of several equipment settings in different channels.

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	Channel display (2) shows channel number selected earlier with flashing point.
	Enter channel number under which equipment status still to be set is to be stored by pressing key CH (12), numerics (14) and key ENT (13).	
	Enter frequency by pressing key FRQ (12), numerics (14) and key ENT (13).	
	Enter class of emission and additional functions.	
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under selected channel number.

c) Storage of equipment status under the next channel number.

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	
	Enter channel number by pressing key CH (12), numerics (14) and key ENT (13) or move to next channel number by pressing CH key (12) and + or - (11).	Point on channel display (2) flashes. Previously set equipment status is maintained but can be altered as wished.
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under selected channel number.

(Continuation)---

---(Continuation) Storage

d) Storage of channels with fixed frequency spacing.

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	
	Enter frequency variations by pressing key FRQ (12), numerics (14) and key + or - (11).	
	Select first channel by pressing key CH (12), numerics (14) and key ENT (13).	Point on channel display (2) extinguishes.
	Select initial frequency by pressing key FRQ (12), numerics (14) and key ENT (13).	Point on channel display (2) continues to flash.
	Enter class of emission and additional functions.	
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under channel number.
	Press key CH (12) and + or - (11).	Channel number is incremented or decremented by one and point on channel display (2) flashes.
	Press key FRQ (12) and + or - (11).	Frequency on display (3) is altered by programmed variation. Point on channel display (2) flashes.
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under channel number.

A previously set class of emission including the additional functions is maintained in all channels.

(Continuation)---

---(Continuation) Storage

e) Storage of half-duplex channels.

Note:

No half-duplex channels can be programmed in the CW class of emission.

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	
	Enter channel number by pressing key CH (12), numerics (14) and key ENT (13).	Point on channel display (2) flashes and display (3) is dark.
	Enter transmit frequency by pressing key FRQ (12), numerics (14) and key ENT (13).	
	Enter class of emission and additional functions.	
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. entire equipment status is stored under channel number.
	Set switch for control mode (16) to Rx.	Frequency display (3) is dark.
	Enter receive frequency by pressing key FRQ (12), numerics (14) and key ENT (13).	Point on channel display (2) flashes.
	Press STO key (5).	Flashing point on channel display (2) extinguishes, i.e. receive frequency is stored under same channel number as transmit frequency.

(Continuation)---

---(Continuation) Storage

f) Storage of mute channels in Antenna Tuning Unit FK 859 or in Line Flattener FK 859C1.

The Antenna Tuning Unit (ATU) FK 859 or Line Flattener FK 859C1 tunes silently when a channel is called up. The data necessary for this are called from the internal memory of the ATU e.g. line flattener, the programming of which is described below.

Fig. no.	Operation	Indication
2.17	Set OPERATION MODE switch (19) to Tx/Rx. Set switch for control mode (16) to MAN or CH. Select previously stored channel by pressing key CH (12), numerics (14) and key ENT (13). Press TUNE key (8).	 Channel number with associated frequency and equipment status appear on displays (2), (3) and (4). Channel number lights up on channel display (2), "E7" (Tuning in progress) is indicated on display (3) and on display (4) "HF" lights up red for duration of tuning. This means that ATU e.g. line flattener is tuning and tuning data determined are stored in ATU e.g. line falttener memory under particular channel number that is set. Silent-tuning data stored under channel number are erased if new frequency, new class of emission or other change is entered in same channel by pressing STO key (5).

2.5.3.13 Recall

The RCL key (5, Fig. 2.14) generally serves for recalling stored channels to check the associated equipment status. The equipment status is only shown in the displays (2), (3) and (4) and not set on the 1-kW HF transceiver It can be altered in any way and then stored again by pressing the STO key (5).

Fig. no.	Operation	Indication
2.17	Set switch for control mode (16) to Tx/Rx.	Channel display (2) shows channel number selected earlier with flashing point.
	Enter required channel number by pressing key CH (12), numerics (14) and key ENT (13).	Point on channel display (2) also flashes for newly set channel number.
	Press RCL key (5).	Flashing point on channel display (2) extinguishes and entire equipment status stored under channel number is indicated without altering status set prior to this.

2.5.3.14 Squelch

The squelch control (17, Fig. 2.17) enables continuous setting of the response threshold of the squelch. The LED (18) will illuminate when the AF is enabled.

2.5.3.15 Loudspeaker and Headset

The built-in loudspeaker (1, Fig. 2.17) can be cut out with the switch (24).

The volume can be adjusted with the control (20). This control governs the following:

1) the built-in loudspeaker (1),

2) a headset connected to socket (22),

3) a second loudspeaker connected to X14 EXTERN, contacts 20 and 1 (see Fig. 4.2), on the base-plate of the rack, mobile or rack, stationary.

2.5.3.16 TEST

When the switch for the control mode (16, Fig. 2.17) is set to MAN or CH and the TEST key (6) is pressed, all segments and points of the displays (2), (3) and (4) should light up as well as the squelch (18) indicator. If the result of the test of the USART interface is positive, a letter code is sent to the processor and triggers a selftest there too. The carrier may not be activated during a test-run as this could produce a false test result.

If no fault is detected in the 1-kW HF transceiver, line flattener or antenna tuning unit, the display (3) will indicate the same as it did before the TEST key (6) was pressed. If any defect is detected however, an "E" will be displayed (= error) together with the code of the defective subassembly (e.g. "E25").

By referring to the fault lists in section 4 it is then possible to determine that the location of the fault in this example is the control unit. Several faults will be displayed in a rotating fashion changing every 1 s. The fault display can be cleared with the keys ENT, FRQ ENT, BFO ENT or EXT ENT and the previous operational status of the 1-kW HF transceiver is then indicated again.

2.6 Remote Control

The 1-kW HF transceiver can be controlled locally on the receiver/exciter itself, detached over small distances or truly remotely. A detached control unit is still powered from the receiver/exciter, but for remote control the units have their own power supply.

The telecontrol data are transmitted in both directions - for control and answer-back - in serial form over a CCITT V.24/V.28 (EIA RS-232-C) interface. The transmission speed can be set in steps between 110 and 9600 baud or is produced by external timing. The character format is that of the usual ASCII standard (CCITT V.3). Thus remote control is not only possible from the Control Unit GB 853 but also from a computer, like the Process Controller PUC, or a Central Control Unit GB 606.

Furthermore this can be done directly, i.e. without any extra interface. The interface levels are those of CCITT recommendations V.10 and X.26 (EIA RS-423). Although there is full compatibility with CCITT V.28, substantially greater distances can be covered without the interconnection of any modems. Additional push-pull outputs will also enable balanced operation in line with CCITT V.11 and X.27 (EIA RS-422). A bus interface can also be implemented for addressed operation. This is made possible by special hardware and software measures.

How different the system configurations can be in remote control is illustrated by Fig. 2.18 to 2.20. For greater clarity the modulation lines for the receive and transmit signal (including the PTT key) are not shown.

Fig. 2.18a illustrates the simplest case of remote control. For simplest case of remote control. For control and answer-back only one twisted, DC four-wire line is required. According to CCITT V.11 (EIA RS-422) a distance of 1 km is admissible for 9600 bd and twisted telephone wires with a diameter of 0.51 mm (AWG 24). Larger distances by way of a telephone channel are achieved by inserting modems (Fig. 2.18b).

Fig. 2.18c shows the central control of several HF transceivers. As a result of the bus wiring that is possible here, the configuration is particularly simple. Matching to the modem, which is not bus-compatible, is handled by the Impedance Converter GV 080. As many as ten 1-kW HF transceivers can be connected to the latter. A larger number is possible by cascading the converters.

Two impedance converters can be accommodated in one case. A maximum of 99 units can be addressed. Because of the extensive status displays and the addressing that is necessary, a process computer such as the PUC or a central control unit like the GB 606 is required for remotely controlling several 1-kW HF transceivers.

The operating concept is optimized for the conditions of operating by appropriate programming. The Impedance Converter GV 080 has two inputs, one with priority and a subordinated one, so remote control is possible with the two central control units (PUC or GB 606) or central local control (Fig. 2.18d). Here too, greater distances can be covered with the aid of modems.

(Continuation)---

---(Continuation) Remote Control

Fig. 2.19 shows a complex system with several remotely controlled and several locally controlled transceivers. Control is as in Fig. 2.18d with two central control units. The remotely controlled 1-kW HF transceivers are divided into two groups and the impedance converters are connected up so that, if transmission path I fails, all the 1-kW HF transceivers can still be remotely controlled by way of transmission path II (and vice versa). More than two transmission paths (e.g. three in Fig. 2.19) can be implemented with the V.24 Multiplexer GV 081. The selection of the transmission path (maximum of seven) is then made by the V.24 multiplexer controlled by the control units.

In a system as outlined in Fig. 2.20, the 1-kW HF transceivers can be controlled by individual control units or centrally. A notable feature of this configuration is the fact that the operator with the Control Unit GB 853 is able to govern all functions of his 1-kW HF transceiver without any restrictions.

Note:

Before the 1-kW HF transceiver is put into use under remote control it is necessary to ensure that the preparations for operation described in part 2.2 and 2.3 have been made.

2.6.1 Remote-control Commands for Computer

The 1-kW HF transceiver is able to both receive and send data. In the first case the transceiver receives its operating commands, and in the second it communicates its operating data to a computer.

Remote control of the 1-kW HF transceiver by a computer is possible via the V.24/V.28 (RS-232-C) interface. For this ASCII code is used. The strings that are used for the various settings can be seen from the following table.

(Continuation)---

---(Continuation) Remote-control Commands for Computer

Setting	Range/scope	Example	Instruction code
Address	Setting from 0 to 99	Address 0 Address 99	LF*AØØCR LF*A99CR
BFO	Setting from -2.9 to +2.9 kHz	-2.9 kHz +0.8 kHz	LF*B29-CR LF*BØ8+CR
Frequency	Setting from 0 to 29999.99 kHz	801 kHz 27545.50 kHz	LF*FØØ8Ø1ØØCR LF*F275455ØCR
Line	On/off	On Off	LF*G1CR LF*GØCR
FSK stop	On/off	On Off	LF*H1CR LF*HØCR
Class of emission		AME USB LSB CW ISB FSK ■ FSK ■ FSK ■	LF*I1CR LF*I2CR LF*I3CR LF*I5CR LF*I6CR LF*I7CR LF*I8CR LF*I9CR
External	Setting from 0 to 9	No. 7	LF*J7CR
Channel	Setting from 0 to 99	Channel mode no. 34 Manual mode no. 34 RCL mode no. 34	LF*K34CR LF*K34CR LF*K34CR
Noise blanker	On/off	On Off	LF*N1CR LF*NØCR
Inquiry	Status or CM	Status inquiry CM inquiry	LF*O1CR LF*O2CR
Operation mode		Off Receive	LF*SØCR LF*S1CR
		Transmit 1 Transmit 2 Transmit 3	LF*S2CR LF*S3CR LF*S4CR
Test	Trigger Feedback Feedback	Test Feedback CM Test feedback BITE	LF*TuCR LF*Tu5CR LF*T28CR

(Continuation)---

--(Continuation) Remote-control Commands for Computer

Setting	Range/scope	Example	Instruction code
Voice control	On/off	On Off	LF*V1CR LF*VØCR
Carrier activation HF display	On/off On/off (feedback)	On Off HF display On HF display OFF	LF*X1CR LF*X2CR LF*X1CR LF*XØCR
Tune		Trigger	LF*YuCR
FSK polarity	+/-	FSK + FSK -	LF*Z1CR LF*ZØCR

Explanations:
LF Line Feed
u Space
CR Carriage Return

Command: LF*01CR Answer: LF*F1234567K99I5B29+J9GØNØVØZ1HØS4CR
Command: LF*02CR Answer: LF*TuuCR = GO or LF*Tu3CR CM error 3
(answers also without command)
Command: LF*TuCR Answer: LF*TØCR = GO or LF*T38CR bite error 38
Command: LF*YuCR Answer: LF*Tu7CR

Control characters: [LF] Line Feed [CR] Carriage return

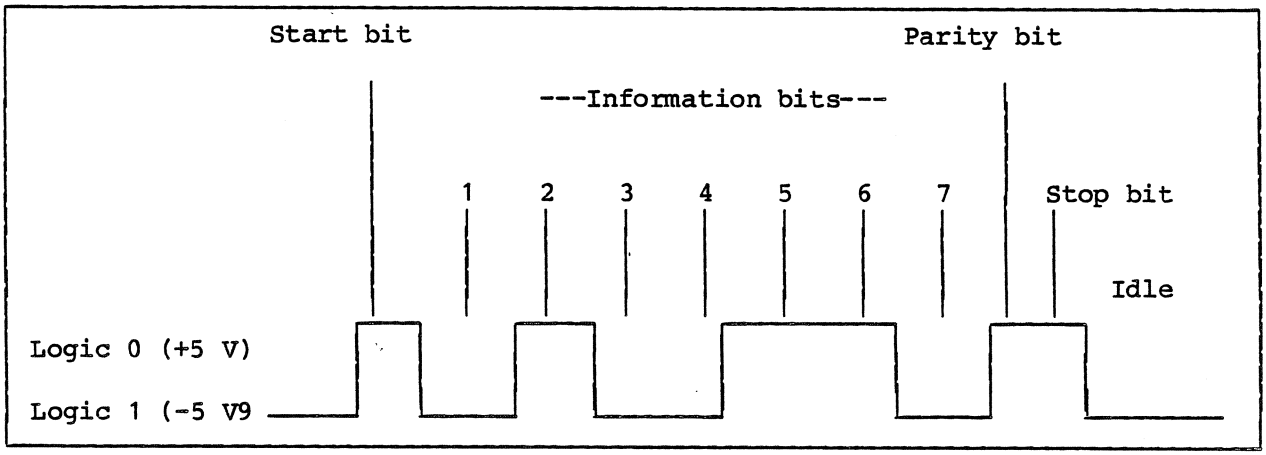
String identifiers:

*	Control mode: MAN
/	Control Mode: CH
%	Store transmit and receive frequency, Tx/Rx-STO
&	Inquire transmit and receive frequency, Tx/Rx-RCL
(	Store receive frequency, Rx-STO
)	Recall receive frequency, RX-RCL

(Continuation)---

---(Continuation) Remote-control Commands for Computer

The instruction-code characters from the table are coded in ISO 7-bit code (ASCII code) and serially transmitted with the following word structure:



Example:

Shown here is the letter "M" with even parity coding. The character "M" has the ASCII code 1ØØ11Ø1, which is transmitted beginning with the lowest bit position. The even parity bit completes the sum of the bits with logic 1 to form an even value. The start bit is always Ø and the stop bit 1. The stop bit can be followed without any pause by a new character with a start bit.

The 1-kW HF transceiver detects voltages from 0.3 to 15 V and -0.3 to -15 V as definite logic states. The unit issues +5 V and -5 V. These values meet both V.24 and V.10 standards. The transmission rate can be set between 110 and 9600 bd (see also section 2.3). At 110 bd two stop bits are transmitted, all other baud rates having only one stop bit.

Every character string is to be preceded by the address in the form A (digit, digit). If the address switch S11 in the processor is set to ØØ however, the address code may by omitted.

The address number must always be two-digit, i.e. for numbers below 10 a zero has to be prefixed (example: address 3 = AØ3).

Any number of instruction codes can be lined up in each character string.

The character string must commence with LF*.

The last character must always be CR (Carriage Return).

Example:

transmission of the class of emission CW (instruction code I5) and the BFO 1.5 kHz (code B15+) to the unit with the address 10.

Character string:
LF*A 1 Ø I 5 B 1 5 +

(Continuation)---

---(Continuation) Remote-control
Commands for Computer

Many a computer, e.g. Tektronix 4051, automatically outputs the characters LF and CR in each line, meaning that they do not have to be programmed separately.

The sequence of the individual instruction codes is quite random.

In the selection of the class of emission the BFO is initially firmly assigned. If a different setting is called for, the class of emission first has to be programmed before the BFO is given another value. If data are to be read into the unit's internal data memory, a complete data string has to be sent.

Example:

L F % F Ø Ø 8 Ø 1 Ø Ø K Ø 3 I 5 B 2 Ø
- J 4 G O N O V O Z 1

2.6.2 Programming with computer

The commands necessary for remote control are different with the computers of different producers.

With these commands the program (software) has to be generated by which the 1-kW HF transceiver executes all required settings.

The creation of programs of this kind generally calls for a corresponding level of know-how and experience and is usually very time-consuming.

****

N O T E S

****

3. Maintenance

The 1-kW HF Transceiver XK 859C1 is entirely maintenance-free

****
N O T E S
****

4. Troubleshooting

4.1 General

Troubleshooting is performed with the aid of the built-in test and monitoring devices. These execute an internal checkout of the 1-kW HF Transceiver XK 859C1 including its large-signal units and the connected external units from the HF 850 radio-equipment family during service without having to be triggered and also signal the functional status of the particular operating mode (continuous monitoring).

The test device furthermore executes an internal checkout of the individual units of the 1-kW HF Transceiver XK 859C1 at component level outside of equipment use when triggered by the TEST key on the control unit.

The connected Antenna Tuning Unit FK 859 or Line Flattener FK 859C1 is also covered by this test, i.e. the test comprises the entire HF transceiving system.

The results of the checkouts are indicated by a single-digit (CM) or two-digit (BITE) code on the frequency display of the control unit.

Note:

If a fault is indicated, this does not necessarily mean that the 1-kW HF Transceiver XK 859C1 is unserviceable. The cause of the fault may be an out-of-tolerance condition which will nevertheless allow restricted operation to continue.

Troubleshooting also involves observing the LEDs and LC displays and listening in to the AF.

4.2 Troubleshooting Instructions

For the event of any disturbance in operation it is admissible to proceed according to the following troubleshooting instructions.

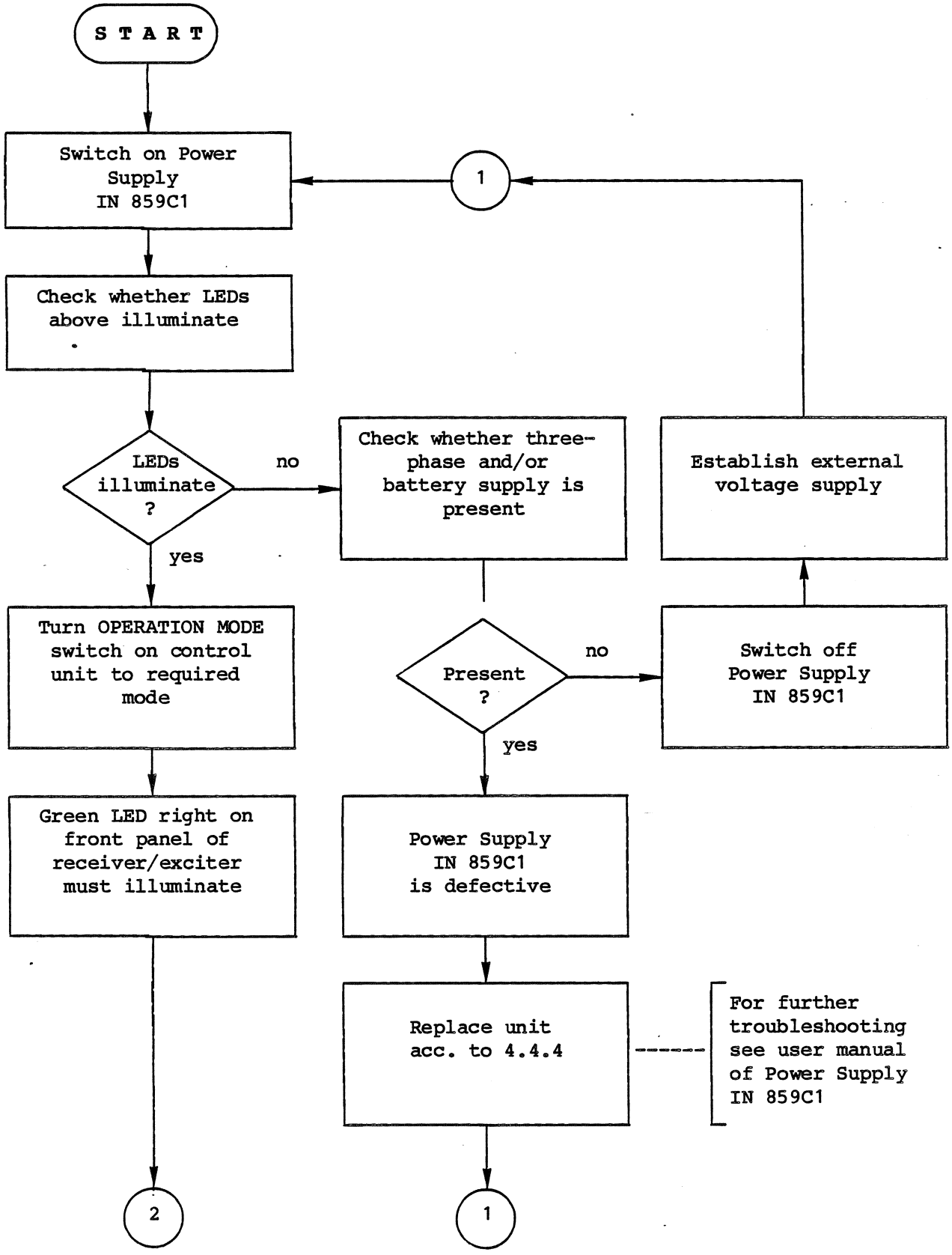


Fig. 4.1 Troubleshooting Flowchart (page 1 of 2)

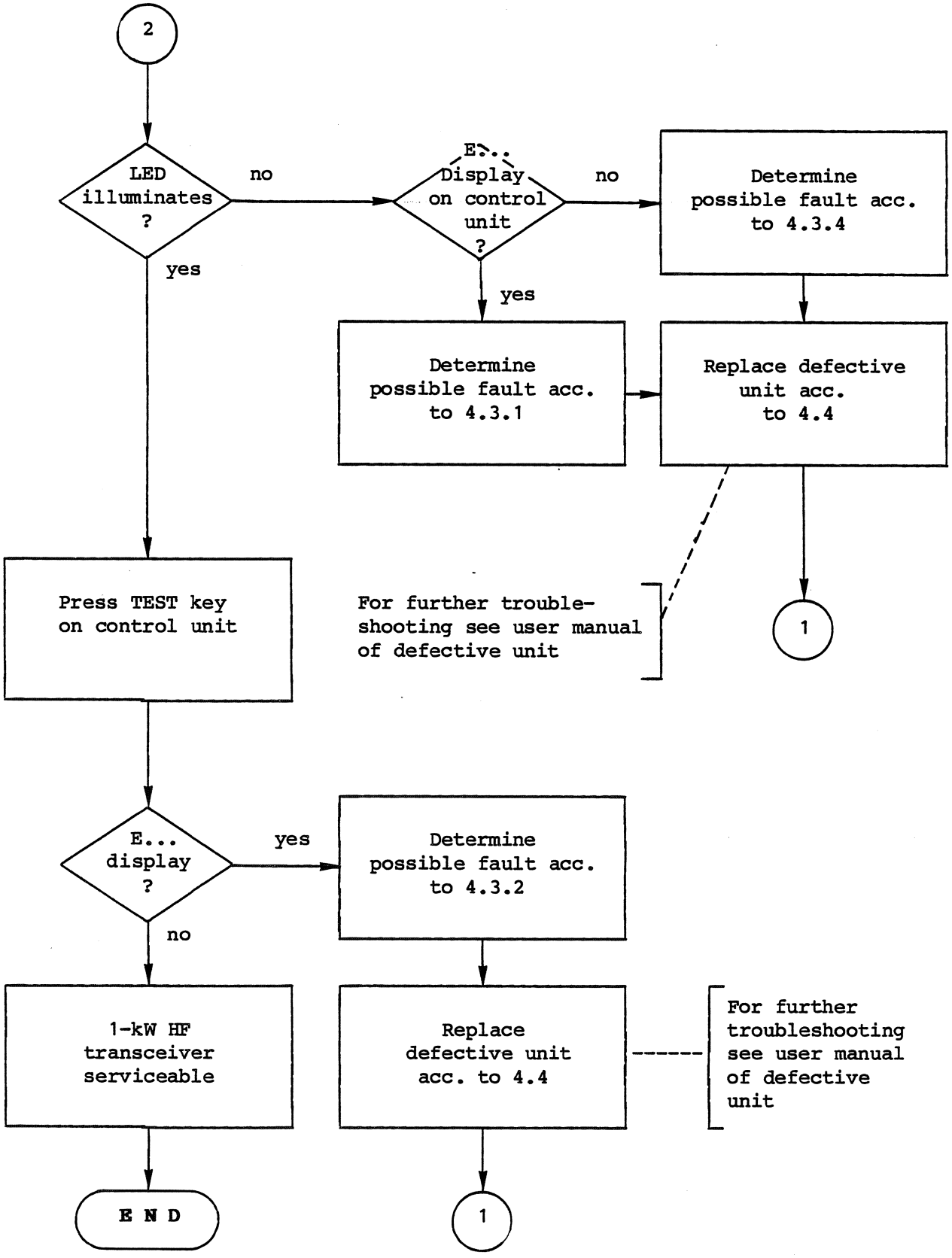


Fig. 4.1 Troubeshooting Flowchart (page 2 of 2)

4.3 Fault Lists

The following control units subassemblies and operational statuses are continuously monitored (CM):

- Synthesizer (unlock)
- Tuning of ATU
- Temperature of ATU (T > 95° C)
- VSWR (amplifier)
- Amplifier
- Oven (synthesizer)
- BFO (modem)
- Tx/Rx section
- Accessory unit
- External unit

4.3.1 Continuous Monitoring (CM) Displays

The following table shows the continuous monitoring displays in their order of priority:

Priority	Code	Designation	Remarks/measure
1	E1	Silence	Transmission inhibited, reception automatically
2	E3	Synthesizer	Transmission and tuning pulse inhibited
3	E9	Amplifier	CM amplifier
4	E7	Tuning	Set OPERATION MODE switch before tuning pulse to Tx/Rx low power (100 W). After tuning one can return to original power.
5	E6	ATU overtemperature	If OPERATION MODE switch is on Tx/Rx high power (1 kW), medium power level (250 W) is engaged automatically. If overtemperature becomes > 95° C, i.e. if E6 extinguishes again, medium power level remains engaged until HF transceiver is switched to reception or TUNE button is operated.
6	E8	VSWR too high	VSWR > 3; power is reduced by ALC.
7	E4	Oven	Warm-up phase
8	E3	BFO error	Transmission and tuning pulse inhibited
9	E3	T/R Section	
10	E5	Accessory	Fault in accessory unit
11	E5	External	Fault in external unit

4.3.2 BITE Displays

4.3.2.1 Displayed Fault Locations

Code	Fault location		Remarks
	RECEIVE TEST		
E25	Control unit	Receiver/ exciter	Selftest of control unit
E31	Synthesizer		CM synthesizer
E32	Modem		CM modem or BITE result
E33	T/R section		CM T/R section or BITE result
E34	Filter		BITE result
E35	FSK modem		BITE result
E36	T/R section or modem		BITE result
E37	Filter or T/R section		BITE result
E38	T/R section or synthesizer		CM T/R section
E39	Modem or FSK modem		BITE result
E49	Filter or noise signal		BITE result: disconnect antenna, repeat test
	TRANSMIT TEST		
E60	ATU		BITE result
E63	Antenna, ATU, RF cable to ATU or wrong tuning data		
E66	ATU, RF cable to ATI or T/R switchover		BITE result
E68	In operation without ATU: antenna In operation with ATU: ATU or control cable to ATU		BITE result
E69	ATU or antenna		BITE result

(Continuation)---

---(Continuation) Displayed Fault Locations

Code	Fault location	Remarks
	TRANSMIT TEST	
E71	Power-supply module I	in IN 859C1
E72	Power-supply module II	in IN 859C1
E73	Power supply 28 V	in IN 859C1
E74	Power-supply module I and amplifier overtemperature	
E75	Power-supply module II and amplifier overtemperature	
E77	Power supply and amplifier overtemperature	
E81	Harmonics filter	
E82	Harmonics filter, control, ALC cable or T/R section	
E83	Preamplifier or RF line to amplifier	
E84	ALC cable or T/R section	
E90	Both output stages in amplifier	antenna, repeat test
E93	Output stage 1	
E94	Output stage 2	
E95	Preamplifier	
E96	Control	
E97	Amplifier overtemperature	
E98	Battery operation and overtemperature	

4.3.2.2 Displayed Operating States

Code	Significance
E10	Transmission test blocked because of SILENCE
E15	Test blocked because f < 400 kHz
E19	Transmission test blocked because f < 1.5 MHz
E45	Test aborted because transceiver is transmitting when test is triggered
E70	Test aborted because transceiver is tuning when test is triggered

The following codes do not appear after a test has been triggered but after certain keys have been pressed on the control unit.

Code	Significance
E20	Transceiver setting incorrect, new setting (modulation, frequency, etc.) is necessary (processor status destroyed)
E21*)	Input format in data telegram wrong or output format wrong with RCL (empty channel) Note: The display E21 can appear when ALIS Processor GP 853 is used in operation. However, this does not influence error recognition or localization in local operation.
E22	"Data set ready" missing
E23*)	Data word processor - control unit incorrect
E24*)	Data word control unit - processor incorrect
E26*)	Input or output operation of channel memory incorrect (empty channel)
E29*)	Wrong string identification in data telegram
	*) Errors in data telegram caused by: - Control Unit GB 853C1 - communication link - processor of receiver/exciter

4.3.3 Error Displays without Code

Below are the possible causes of an error display "E" without an accompanying code:

1. When entering numerics after pressing FRQ key

   - 1-kW HF transceiver in CH mode
   - Entered frequency < 29999.99 kHz

2. When entering numerics after pressing BFO key

   - 1-kW HF transceiver in CH mode
   - BFO < 2.9 kHz

3. When entering numerics after pressing EXT key

   - 1-kW HF transceiver in CH mode

4. After variation of frequency with key + or -

   - New frequency < 29999.99 kHz
   - New frequency > 0.00 kHz

5. After variation of BFO frequency with key + or -

   - CW class of emission is not set
     $|BFO|$ < 2.9 kHz

6. After operating numeric keys 1 to 3, 5 to 9 for class of emission without pressing one of the prime keys (EXT, BFO, CH, FRQ) beforehand

   - Switch for control mode is on CH or Rx

7. After operating numeric key 4 for polarity without pressing one of the prime keys (EXT, BFO, CH, FRQ) beforehand

   - Switch for control mode is on CH or Rx
   - No FSK class of emission

8. After entering decimal point

   - No prime key (BFO, FRQ) has been operated
   - Prime key EXT has been operated
   - Prime key CH has been operated

(Continuation)---

---(Continuation) Error Displays without Code

9. After operating LINE key

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in CH mode
   - 1-kW HF transceiver not in AME, USB or LSB mode
   - Switch for control mode is on Rx

10. After operating NB key (noise blanker)

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in ISB or FSK mode
   - Switch for control mode is on Rx

11. After operating VC key (noise compressor)

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in CW, ISB or FSK mode
   - Switch for control mode is on Rx

12. After operating ENT key following complete entries for EXT, BFO, CH or FRQ

   - Switch for control mode is on Tx/Rx or Rx

13. After operating BFO key

   - 1-kW HF transceiver in AME, USB, LSB or ISB mode
   - Switch for control mode is on Rx

14. After operating EXT key

   - Switch for control mode is on Rx

15. After operating STO key

   - 1-kW HF transceiver in MAN or CH mode
   - Channel number missing
   - Memory lockout engaged by shorting plug X104.8 on processor board of control unit

16. After operating RCL key

   - 1-kW HF transceiver in MAN or CH mode
   - Channel number missing

(Continuation)---

---(Continuation) Error Displays without Code

17. After operating TEST key

    - Switch for control mode is on Tx/Rx or Rx
    - Tuning is in progress ("E7" on display)

18. After operating TUNE key

    - Switch for control mode is on Tx/Rx or Rx

19. For all keys

    - OPERATION MODE switch is on OFF

4.3.4 Functions not Covered by BITE

The monitoring of all functions in the control units and subassemblies of the 1-kW HF transceiver would make the circuitry excessively complex. For this reason the following functions should also be considered when performing troubleshooting:

- Loudspeaker
- Volume control
- Squelch
- Voice compressor (VC)
- AME demodulation (only in Rx), AME transmission
- Polarity switching
- AGC switching in reception
- EMC filter, in particular EXT interface

For these functions the BITE produces no error indication "Exx" on the frequency display of the control unit after operation of the TEST key.

(Continuation)---

---(Continuation) Functions not Covered by BITE

Symptom	Remarks	Possible fault location
No display on control unit	Power supply LEDs do not illuminate	- External power supply - Internal power supply
	Power supply LEDs illuminate	- Power supply of control unit - Control unit
On control unit all segments and points of displays illuminate as well as LEDs	Power supply LEDs do not illuminate	- Internal power supply
	Power supply LEDs illuminate but after turning 1-kW HF transceiver off and back on again error display "E24" appears	- Processor - Transmission link between control unit and processor
	Power supply LEDs illuminate but after turning 1-kW HF transceiver off and back on again undefined display appears on control unit	- Control unit
Undefined display appears on control unit	Power supply LEDs do not illuminate	- Internal power supply
	Power supply LEDs illuminate	- Control unit

4.3.5 Memory Back-up Batteries

There are lithium batteries for powering the data memories in the processor of Receiver/Exciter GX 859C1, in Line Flattener FK 859C1 and in Antenna Tuning Unit FK 859. The batteries are hardly loaded by the memory devices. They only age as a result of their own self-discharge and under normal operating conditions can be expected to last at least five years. Consequently no regular replacement of the batteries is necessary.

If a data memory should suddenly not function and it is thought that this is caused by a flat battery, measure the voltage on the battery with a high-impedance voltmeter.

The nominal open-circuit voltage is 3.7 V. The particular battery should be replaced if it reads less than 3.5 V.

Removal of the processor in Receiver/Exciter GX 859C1 or of the processor circuit board in Line Flattener FK 859C1 or in Antenna Tuning Unit FK 859 as is necessary for battery replacement is described in the user manual of the particular unit.

4.4 Replacement of Units

The arrangement of the units in the rack of the 1-kW HF Transceiver XK 859C1 can be seen from Fig. 1.2. The cabling is shown in Fig. 2.12.

Note:

Replacement of the individual components of the different units of equipment is described in the separate user manuals.

C A U T I O N

- **Before replacing the units ensure in each case that Power Supply IN 859C1 is switched off.**
- **The cabling of the 1-kW HF Transceiver XK 859C1 is described in 2.2.2.**
- **After replacing units perform the first-time switch-on acc. to 2.4.1. After this the transceiver can be switched on and off again acc. to 2.4.2.**

4.4.1 Replacement of Receiver/ Exciter GX 859C1

1. Undo the four captive screws under the handles of the receiver/exciter.

   Note:

   If options like ALIS Processor GP 853C1 are connected to the receiver/exciter, the captive screws under the handles of these units also have to be undone.

2. Pull the receiver/exciter together with any options out of the rack, as far as they will go. The connections on the rear of the equipment must be accessible.

   Note:

   To simplify cabling of the receiver/exciter and its options, the receiver/exciter is mounted on telescopic rails in the rack.

3. Separate all connectors on the rear of the receiver/exciter.

   Note:

   - Also separate the connectors from the rear of any options connected to the receiver/exciter.
   - Connectors on the front of any option must also be separated.

4. If any options are connected to the receiver/exciter, the four quick-release catches on the bottom of the receiver/exciter then have to be undone. Hold the option while doing this. Afterwards remove the option from the receiver/exciter.

5. Push up the catch that prevents the equipment from falling out of the telescopic rails.

6. Lift the receiver/exciter out of the telescopic rails.

7. The installation of the receiver/exciter is in the reverse order to the previously described removal.

   Note:

   - The installation of any option with the receiver/exciter is described in the relevant user manual.
   - For the cabling of the receiver/exciter refer to Fig. 2.12.

4.4.1.1 Replacement of Control Unit GB 853C1

If the Control Unit GB 853C1 integrated into Receiver/Exciter GX 859C1 is defective, it must be removed according to the following instructions and a new one inserted in its place.

1. Undo the outer four Phillips screws on the front panel of the control unit.
2. Take the control unit out of Receiver/Exciter GX 859C1.
3. Lift out the 50-way connector on the rear of the control unit with the two locking levers.
4. The installation of the control unit is in the reverse order to the previously described removal.

4.4.2 Replacement of Line Flattener FK 859C1

1. Remove the coaxial lead (Z = 50 ohms) to the broadband antenna

   from antenna output X53 ANT of the line flattener.
2. Remove connecting cable W50 from the RF output of Amplifier VK 859C1 and X67 RF ⇔ and the RF input of the line flattener X52 RF ⇔.
3. Undo the four captive screws under the handles of the line flattener.
4. Pull the line flattener about halfway out of the rack, until resistance is felt.
5. Push up the catch (on the left-hand side of the housing) that prevents the equipment from falling out of the rack.
6. Pull the line flattener entirely out of the rack.
7. The installation of the line flattener is in the reverse order to the previously described removal.

Note:

- o If the optional Line Flattener FK 859C1 is installed in the rack at a later date, withdraw connector X100 (on cable W9) from socket X50 in the rack and join it to the dummy plug in the rack (KG 859C1/C4) top left.
- o When the line flattener is pushed into the rack (KG 859C4 or KG 859C1), the connectors on the rear engage automatically. Consequently no connectors, cables, etc. have to be separated from the rear of the equipment when it is being removed and none have to be replaced when the equipment is put back in place.

4.4.3 Replacement of 1-kW HF Amplifier VK 859C1

1. Remove the RF connection to the antenna, to the optional Line Flattener FK 859C1, to Antenna Tuning Unit FK 859 or to any other option from the front panel of the 1-kW HF Amplifier VK 859C1.
2. Undo the four captive screws under the handles of the amplifier.
3. Pull the amplifier about halfway out of the rack, until resistance is felt.
4. Push up the catch that prevents the equipment from falling out of the rack.
5. Pull the amplifier entirely out of the rack.
6. The installation of the amplifier is in the reverse order to the previously described removal.

Note:

When 1-kW HF Amplifier VK 859C1 is pushed into the rack KG 859C4, the connectors on the rear engage automatically.

Consequently no connectors, cables, etc. have to be separated from the rear of the equipment when it is being removed and none have to be replaced when the equipment is put back in place.

4.4.4 Replacement of Power Supply IN 859C1

1. Undo the four captive screws under the handles of the power supply.
2. Pull the power supply about halfway out of the rack, until resistance is felt.
3. Push up the catch that prevents the equipment from falling out of the rack.
4. Pull the power supply entirely out of the rack.
5. The installation of the power supply is in the reverse order to the previously described removal.

Note:

When Power Supply IN 859C1 is pushed into the rack KG 859C4, the connectors on the rear engage automatically.

Consequently no connectors, cables, etc. have to be separated from the rear of the equipment when it is being removed and none have to be replaced when the equipment is put back in place.

ROHDE&SCHWARZ

Appendix 1
to
1-KW HF TRANSCEIVER
XK 859C1

Preparation of Connection Cables

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1. Preparation of Connection Cables

All cables necessary for the internal cabling of 1-kW HF Transceiver XK 859C1 are built into the respective rack. Those required for the optional modules are supplied with the optional module concerned.

Figure A.1 shows the external cabling of the 1-kW HF transceiver together with the units to be connected.

Refer also to Table 1.

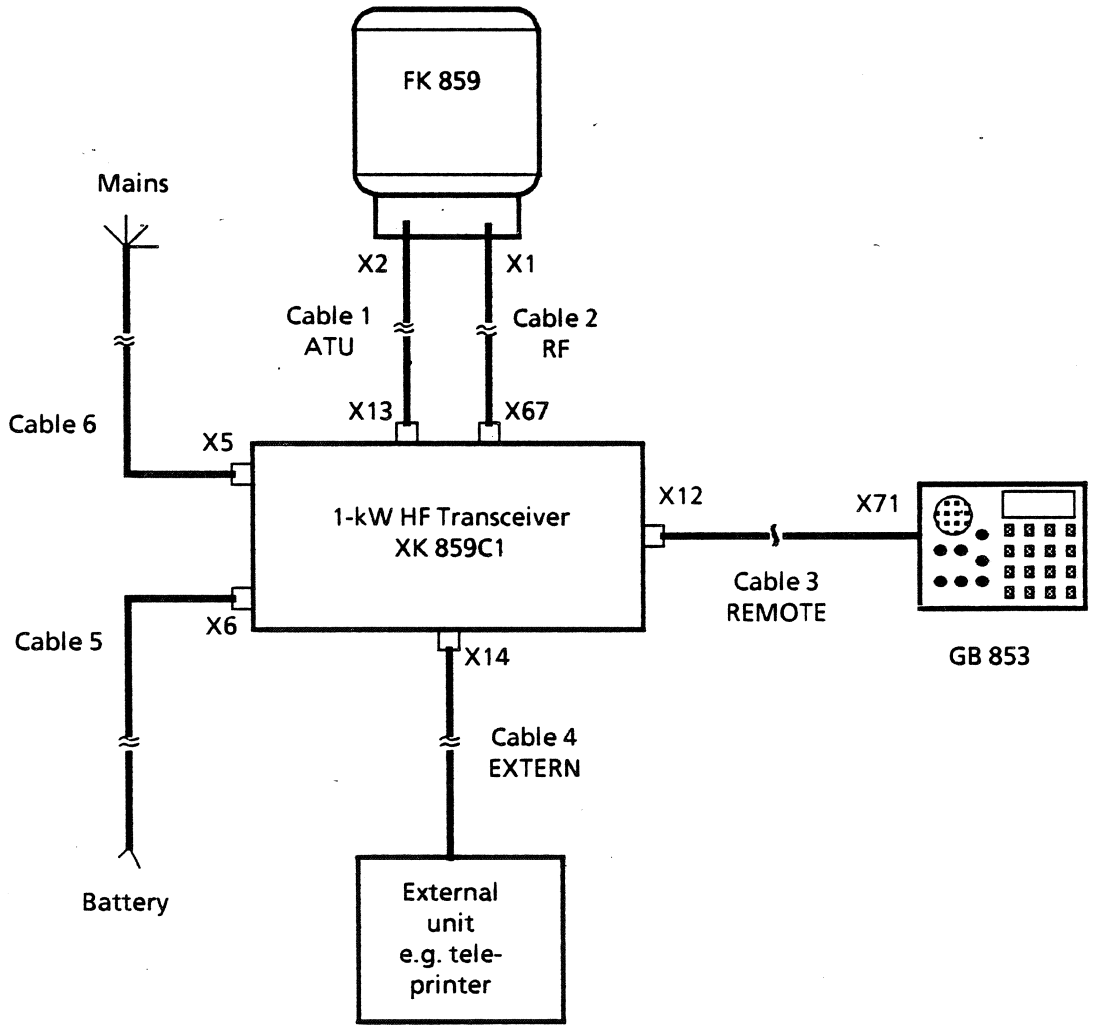


Fig. A1.1 External Cabling of 1-kW HFTransceiver XK 859C1

Cable	Connection from - to	Designation	Length (standard)	R & S Order No.
1	XK 859C1 - FK 859 (X13 - X2)	ATU	20 m	724.9904.01
2	XK 859C1 - FK 859 (X67 - X1)	RF	20 m	724.9856.01
3	XK 859C1 - GB 853C1 (X12 - X71)	REMOTE	20 m	724.9956.01
4	XK 859C1 (X14) - external unit	EXTERN	20 m	DG 307.0221
5	XK 859C1 (X6) - 24 VDC battery	BATTERY	20 m	DS 025.5493
6	XK 859C1 (X5) - three-phase mains	MAINS	20 m	DS 025.5458

Table 1 Cables obtainable from Rohde & Schwarz

The cables stated in the Table (cables 1 to 3) can be ordered ready-made from Rohde & Schwarz.

Standard length of the cables is 20 metres, but they can also be supplied in other lengths on request.

To allow for utmost flexibility in the cabling of the 1-kW HF trransceiver, all cables listed in the above Table (cables 1 to 6) can be finished by the customer in any required length. For this purpose it is possible to obtain sets of mating connectors from Rohde & Schwarz. The order nos. for the mating connectors are contained in drawing 680.1210.01, page 3 at the end of this appendix.

The following paragraph describes the preparation of control and supply lines plus RF cable. In addition to the instructions for preparation there are references to the respective parts lists and circuit diagrams in the sub-sections for the preparation of individual cables. Drawings are included as an additional aid for the preparation.

The extracts from 'Internal Guidelines' by Rohde & Schwarz are to be taken into account during preparation.

The following conventional tools are required for the preparation of the cables:

- Cable stripper
- Stripping pincers
- Hot-air blower
- Soldering iron
- Set of crimping tools

Each finished cable is to undergo an optical, a mechanical and an electrical check. For this proceed as follows:

Optical and Mechanical Check

Check the cables and lines for perfect condition of

- Crimpings
- Plug and socket contacts
- Fitted plug case and connections.

Elektrical Check

Using suitable test equipment (e.g. Digital Multimeter UDL 33, Order No. 388.8011.02 from Rohde & Schwarz), check the cables and lines for

- Continuity
  Short circuit or interruption
  High-voltage test (800 V) between:
  - Inner conductor/inner conductor
  - Inner conductor/shield and/or
  - Inner conductor/ground.

1.1 Preparation of the Control Cable from the 1-kW HF Transceiver to Antenna Tuning Unit FK 859

General:

The terminal designation of the cable is ATU. The fixed socket on 1-kW HF Transceiver XK 859C1 is designated X13 and the fixed socket on Antenna Tuning Unit FK 859 X2.

The following internal guidelines should be observed when preparing the cable:

HVC 212, HVJ 077, HVJ 250, HVL 170, HVM 110, HVQ 001.

1.1.1 Circuit Diagram and Parts List

Circuit diagram and parts list are found at the end of this appendix with the drawing nos.

724.9904.01 S and 724.9904.01 SA.

Consumables:		
Designation	Quantity	R & S Order No.
Shrink-on sleeve	2 pieces	DJ 099.3020
Shrink-on sleeve	approx. 8 mm	DJ 025.2020
Adhesive tape	1 roll	WW 002.2730

1.1.2 General Preparations

1. Label one shrink-on sleeve DJ 099.3020 'XK 859C1 ATU'.

2. Label the other sleeve DJ 099.3020 "FK 859 ATU".

3. Cut the 37-way cable to the required length.

1.1.3 Preparing the Cable

1.1.3.1 Connecting the Flat Connector

1. At one end of the 37-way cable remove approx. 55 mm from outer insulation and attach shrink-on sleeve marked 'XK 859C1 ATU'.

2. Remove foil winding and shrink 8 mm of shrink-on sleeve DJ 025.2020 to end of outer insulation under the shield of the 37-way cable.

3. Tin-coat approx. 10 mm of cable shield and shorten to 6 mm.

4. Attach cap (FM 588.2673) for the 25-way connector strip (FM 520.6244) to the 37-way cable.

5. Strip 4 mm of each of the 22 inner conductors (stranded wires) of following colours, crimp on 22 pin contacts (FM 520.6344) and lock same into the following contacts of the 25-way connector strip (FM 520.6244):

Colour	Contact
brown	1
red	2
orange	3
yellow	4
green	5
blue	6
violet	7
grey	8
white	9
black	10
white-brown	11
white-red	12
white-orange	13
white-yellow	14
white-green	15
white-blue	16
white.-violet	17
white-grey	18
white-black-grey	19
white-brown-red	20
white-brown-orange	21
white-brown-yellow	22

6. Strip 4 mm of each of the following 4 inner conductors (stranded wires) and dip-tin:

   - white-black-yellow,
   - white-black-green,
   - white-black-blue,
   - white-black-violet

7. Solder the ends of the 4 stranded wires to a high-current contact (FP 531,9240) and lock into contact A1 of the 25-way connector strip.

8. Strip 4 mm of each of the following 4 inner conductors (stranded wires) and dip-tin:

   - white-black,
   - white-black-brown,
   - white-black-red,
   - white-black-orange

9. Solder the ends of the 4 stranded wires to a high-current contact (FP 531,9240) and lock into contact A2 of the 25-way connector strip.

10. Cut off all remaining inner conductors (7 pieces).

11. Attach the cap (FM 588.2673) with the locking screw FM 588.2696 to the 25-way connector strip, secure with loctite and pull-relieve the cable.

12. Shrink on the sleeve marked 'XK 859C1 ATU' up to approx. 30 mm before the pull-relief.

1.1.3.2 Connecting the Round Connector

1. Strip 55 mm of outer insulation at the second end of the 37-way cable and attach the shrink-on sleeve marked 'FK 859 ATU'.

2. Disentangle shield of the 37-way cable, remove foil winding and place shield towards cable centre.

3. Attach the adapter and the shrink-on sleeve (FO 080.2463) of the 26-way cable socket (FO 511.9296), taking care of correct positionning, to the 37-way cable.

4. Strip 5 mm at the ends of each of the following 22 inner conductors, crimp on 22 socket inserts and lock into following contacts of the 26-way cable socket (FO 511.9296):

Colour	Contact
brown	E
red	F
orange	G
yellow	H
green	J
blue	K
violet	L
grey	M
white	N
black	P
white-brown	R
white-red	S
white-orange	T
white-yellow	U
white-green	V
white-blue	W
white-violet	X
white-grey	Y
white-black-grey	Z
white-brown-red	a
white-brown-orange	b
white-brown-yellow	c

5. Strip 5 mm of each of the two following inner conductors (stranded wires):

   - white-black-yellow
   - white-black-green;

   Crimp on one socket insert of the 26-way cable socket and lock into contact A of the cable socket.

6. Strip 5 mm of each of the following inner conductors (stranded wires):

   - white-black-blue,
   - white-black-violet.

   Crimp on one socket insert of the 26-way cable socket and lock into contact B of the cable socket.

7. Strip 5 mm of each of the following 2 inner conductors (stranded wires):

   - white-black,
   - white-black-brown;

   Crimp on one socket insert of the 26-way cable socket and lock into contact C of the cable socket.

8. Strip 5 mm of each of the following 2 inner conductors (stranded wires):

   - white-black-red
   - white-black-orange.

   Crimp on one socket insert of the 26-way cable socket and lock into contact D of the cable socket.

9. Cut off any inner conductors that have not been locked into the cable socket at this point.

10. Fix the attached adapter to the cable socket, secure with loctite and clamp the shield to the adapter. Now wind two layers of adhesive tape in groove and knurling of adapter.

11. Shrink on the attached sleeve in such a way that its bulb comes to rest in the groove of the adapter.

12. Under the narrow end of the shrink-on section, wind two layers of adhesive tape round the cable and complete shrinking-on procedure.

13. Shrink on the sleeve marked 'FK 859 ATU' up to approx. 30 mm before the shrink-on section of the cable socket.

1.2 Preparation of the RF Cable from the1-kW HF Transceiver to Antenna Tuning Unit FK 859

General:

The terminal designation of the cable is RF. The fixed socket on transceiver Amplifier VK 859C1 is designated X67, and the fixed socket on Antenna Tuning Unit FK 859 X1.

The following internal guidelines should be observed when preparing the cables:

HVC 212, HVJ 077, HVJ 250, HVM 110, HVQ 001.

1.2.1 Parts List

The parts list is found at the end of this appendix with the drawing no. 724.9856.01SA.

Two shrink-on sleeves DJ 099.3020 are required as consumables.

1.2.2 General Preparations

1. Label one shrink-on sleeve DJ 099.3020 'XK 859C1 RF'.
2. Label the other DJ.099.3020 'FK 859 RF'.
3. Cut the RF cable to the required length.

1.2.3 Preparing the Cable

1. Attach the shrink-on sleeve marked 'XK 859C1 RF' over the cable end .
2. Finish this cable end according to Fig. A1.2 and solder on the RF angle connector (FJ 117.8917).
3. Attach the shrink-on sleeve marked 'FK 859 RF' to the other cable end.
4. Finish this cable end according to Fig. A1.3 and solder on the RF cable plug (FJ 018.4472).
5. Shrink on the sleeve marked 'XK 859 C1 RF' up to approx. 30 mm before the RF angle connector (FJ 117.8917).
6. Shrink on the sleeve marked 'FK 859 RF' up to approx. 30 mm before the RF cable plug (FJ 010.4472).

1.3 Preparation of the Connection Cable from the 1-kW HF Transceiver to detached Control Unit GB 853

General:

The terminal designation of the cable is REMOTE. The fixed socket on 1-kW HF Transceiver XK 859C1 is designated X12 and the fixed socket on detached Control Unit GB 853 is designated X71.

The following internal guidelines should be observed when preparing the cable:

HVC 212, HVJ 072, HVJ 077, HVJ 250, HVM 110, HVQ 001.

1.3.1 Circuit Diagram and Parts List

These are included at the end of this appendix, having the following drawing nos.:

724.9956.01 and 724.9956.01SA

Consumables:		
Designation	Quantity	R & S Order No.
Shrink-on sleeve	2 pieces	DJ 099.3020
Shrink-on sleeve	approx. 10 mm	DJ 092.6298
Shrink-on sleeve	4 x approx.20 mm	DJ 080.6630
Stranded wire AWG 24 grey	2 x approx. 50 mm	DM 099.6429
Stranded wire AWG 24 grey	2 x approx. 60 mm	DM 099.6429
Stranded wire AWG 24 green	1 x approx. 40 mm	DM 099.6393
Stranded wire AWG 24 green	1 x approx. 70 mm	DM 099.6393
Stranded wire AWG 24 yellow	1 x approx. 40 mm	DM 099.6387
Stranded wire AWG 24 yellow	1 x approx. 70 mm	DM 099.6387
Adhesive Tape	1 roll	WW 002.2730

1.3.2 General Preparations

1. Label one shrink-on sleeve DJ 099.3020 'XK 859C1 REMOTE'.

2. Label one shrink-on sleeve DJ 099.3020 'GB 853 REMOTE'.

3. Cut the 32-way shielded cable to the required length.

1.3.3 Preparing the Cable

1.3.3.1 Connecting the Flat Connector

1. At one end of the 32-way cable remove approx. 60 mm of the outer insulation and attach the shrink-on sleeve marked 'XK 859C1 REMOTE'.

2. Shrink approx. 10 mm of sleeve DJ 092.6298 up to the end of the outer insulation under the shield of the 32-way cable.

3. Dip-tin approx. 10 mm of the cable shield and shorten to 8 mm.

4. The cable consists of 26 inner conductors resting on the outer insulation and of 5 shielded internal conductor pairs. Cut off 8 of the 26 inner conductors and 3 of the 5 conductor pairs.

5. On the remaining 2 conductor pairs, disentangle the shield up to approx. 10 mm before the outer insulation of the 32-way cable, twist the ends, dip-tin same and shorten to approx. 6 mm.

6. Strip two grey stranded wires (50 mm) at both ends for 5 mm and dip-tin each at one end.

7. Solder the dip-tinned ends of the grey stranded wires one to each shield of the two remaining conductor pairs, thus lenghtening the shield towards cable end.

8. Shrink a 20 mm long sleeve (DJ 080.6630) over the solder joints on each shield.

9. Strip 5 mm at the ends of the 18 inner conductors and the 2 conductor pairs.

10. Crimp on 24 pin contacts (FM 511.8090) to the uninsulated cable ends of the 18 inner conductors, the 2 conductor pairs (4 stranded wire ends) and the 2 shield stranded wires.

11. Strip 5 mm at both ends of a green and a yellow stranded wire (each 40 mm in length).

12. Crimp on 4 pin contacts (FM 511.8090) to the uninsulated stranded wire ends of the green and yellow stranded wires.

13. Lock the 28 pin contacts (18 on inner conductors, 4 on 2 conductor pairs, 2 on shield stranded wires and 4 on green and yellow stranded wires) into connector strip FM 657.5242 as follows:

Line	Contact
Inner conductor white	1
Soldered-on grey stranded wire of conductor pair II	2
Inner conductor white	3
Inner conductor white	4
not used	5
not used	6
Inner conductor white	7
Inner conductor white	8
Inner conductor white	9
Inner conductor white	10
1st end of green stranded wire	11
1st end of yellow stranded wire	12
Inner conductor white	13
First stranded wire of conductor pair I	14
Second stranded wire of conductor pair I	15
First stranded wire of conductor pair II	16
Second stranded wire of conductor pair II	17
not used	18
Inner conductor white	19
Soldered-on grey stranded wire of conductor pair I	20
Inner conductor white	21
Inner conductor white	22
Inner conductor white	23

not used	24
not used	25
not used	26
2nd end of yellow stranded wire	27
Inner conductor white	28
not used	29
not used	30
2nd end of green stranded wire	31
Inner conductor white	32
Inner conductor white	33
Inner conductor white	34
Inner conductor white	35
Inner conductor white	36
not used	37

14. If the 32-way cable contains coulered inner conductors and coloured conductor pairs, determine the colours and make a note.

15. Fix the shielded cap FM 645.7868 to the 37-way connector strip FM 657.5242 and pull-relieve the cable.,

16. Shrink on the sleeve marked 'XK 859C1 REMOTE' up to approx. 30 mm before the shielded cap.

1.3.3.2 Connecting the Round Connector

1. Strip 60 mm of the outer insulation at the second end of the 32-way cable and attach the shrink-on sleeve marked 'GB 853 REMOTE'.

2. Disentangle the shield of the 32-way cable and place same towards cable centre.

3. Strip two grey stranded wires (60 mm) at both ends for 5 mm and dip-tin on one end each.

4. Check the two conductor pairs locked into the flat connector for continuity in the region of the second cable end.

5. Cut off the three conductor pairs which do not show continuity.

6. On the two conductor pairs checked for continuity disentangle the shield up to approx. 10 mm before the end of the outer insulation of the 32-way cable, twist the ends, dip-tin and shorten to approx. 6 mm.

7. Solder the dip-tinned ends of the grey stranded wires one to each shield of the two conductor pairs, thus lengthening the shield towards the cable end.

8. Shrink a 20 mm long sleeve (DJ 080.6630) over the solder joints on each shield.

9. Check the 18 inner conductors, locked into the flat connector, for continuity in the region of the second cable end.

10. Cut off the 8 inner conductors which do not show continuity.

11. Strip 5 mm at the ends of each of the remaining 18 inner conductors and 2 conductor pairs.

12. Strip 5 mm at both ends of a green stranded wire and of a yellow one (each 70 mm in length).

13. Crimp the four inserts of the round connector on to the uninsulated ends of the green and yellow stranded wires.

14. Attach the adapter and the shrink-on section of the round connector (FO 5439.8474), taking care of correct positionning, to the 32-way cable.

15. Crimp 24 inserts of round connector FO 549.8474 on to the uninsulated cable ends of 18 inner conductors, 2 conductor pairs and the two shield stranded wires.

16. On the contacts (1 to 37) of the flat connector, check all inner conductors and conductor pairs towards second cable end for continuity and, by taking into account circuit diagram 724.9956.01S, lock into round connector FO 549.8474 as follows:

Line	Contact flat connector	Contact round connector
Inner conductor white	1	F
Soldered-on grey stranded wire of conductor pair II	2	H
Inner conductor white	3	E
Inner conductor white	4	B
not used	5	-
not used	6	-
Inner conductor white	7	V
IInner conductor white	8	U
Inner conductor white	9	d
Inner conductor white	10	c
1st end of green stranded wire	11	N
1st end of yellow stranded wire	12	P
Inner conductor white	13	L
First stranded wire of conductor pair I	14	Y
Second stranded wire of conductor pair I	15	Z
First stranded wire of conductor pair II	16	b
Second stranded wire of conductor pair II	17	a
not used	18	-
Inner conductor white	19	e
Soldered-on grey stranded wire of conductor pair I	20	G
Inner conductor white	21	D
Inner conductor white	22	C
Inner conductor white	23	A
not used	24	-
not used	25	-
not used	26	-
Second end of yellow stranded wire	27	T
Inner conductor white	28	X
not used	29	-
not used	30	-
Second end of green stranded wire	31	S
Inner conductor white	32	W
Inner conductor white	33	f
Inner conductor white	34	J
Inner conductor white	35	g
Inner conductor white	36	K
not used	37	-

17. Lock three inserts into terminals M, h and j of the round connector without line and close from the back with three dummy plugs.

18. Fix the attached adapter to the round connector, secure with loctite and clamp shield to the adapter. Now wind two layers of adhesive tape in the groove and knurling of the adapter.

19. Shrink on the attached sleeve section of the round connector in such a way that the bulb of the shrink-on section comes to rest in the groove of the adapter.

20. Under the narrow end of the shrink-on section, wind two layers of adhesive tape round the cable and complete shrinking procedure.

21. Shrink on the sleeve marked 'GB 853 REMOTE' up to approx. 30 mm before the shrink-on section of the round connector.

1.4 Preparation of the Connection Cable for the Control of External Equipment

General:

The terminal designation of the cable is EXTERN. The fixed connector on 1-kW HF Transceiver XK 859C1 is designated X14 .

The following internal guidelines should be observed when preparing the cable:

HVC 212, HVJ 077, HVJ 250, HVL 170, HVQ 001.

1.4.1 Parts List and Circuit Diagram

The circuit diagram for this cable is shown in Fig. A1.6.

Parts List		
Designation	Quantity	R & S Order No.
Female connector strip 37-way	1 piece	FM 305.3869
Socket contact GR20	32 pieces	FM 511.8102
Cap for 37-way female connector strip	1 piece	FM 588.2673
Locking screws	1 set	FM 588.2696
Cable CU-Li 37xAWG24 RD 10.3	length on request	DG 307.0221
Shrink-on sleeve	1 piece	DJ 099.3020
Shrink-on sleeve	approx. 8 mm	DJ 025.2020

1.4.2 Preparing the Cable

1. Label the shrink-on sleeve DJ 099.3020 'XK 859 C1 EXTERN'.

2. Cut the 37-way cable to the required length.

3. At one end of the 37-way cable remove approx. 55 mm of the outer insulation and attach the marked shrink-on sleeve.

4. Remove foil winding and shrink 8 mm of sleeve DJ 025.2020 up to the end of the outer insulation under the shield of the 37-way cable.

5. Dip-tin the cable shield and shorten to 6 mm.

6. Strip 4 mm of each of the 32 inner conductors (stranded wires).

7. Crimp 32 socket contacts (FM 511.8102) on to the uninsulated stranded wire ends of the 32 inner conductors.

8. Insulate all other inner conductors (5 pieces).

9. Attach the cap (FM 588.2673) for the 37-way female connector strip (FM 305.3869) to the 37-way cable.

10. Lock the 32 socket contacts according to Fig. A1.6 into the 37-way female connector strip (FM 305.3869) and write down the colours of the inner conductors.

11. Fix the cap (FM 645.7868) with the locking screws FM 588.2696 to the 37-way female connector strip, secure with loctite and pull-relieve the cable.

12. Shrink on the marked sleeve up to approx. 30 mm before the pull-relief.

13. Strip and wire up the other end of the 37-way cable, depending on the connector used.

1.5 Preparation of the Supply Cable for the Battery Voltage

General:

The terminal designation for the 24-VDC connection of 1-kW HF Transceiver XK 859C1 is X17, and it is marked with 1 and 2.

The following internal guidelines must be observed when preparing the cable:

HVC 212, HVJ 077, HVQ 001.

1.5.1 Cable and Consumables

The designation of the cable is

battery connection cable
DS NSH DEU 2x4.0
without ground wire.

It can be obtained from Rohde & Schwarz under the order no. DS 025.5493. Standard length of the cable is 20 m, but it can be supplied in other lengths on request.

A shrink-on sleeve (DJ 099.3020) is necessary as consumables.

1.5.2 Preparing the Cable

1. Label the shrink-on sleeve DJ 099.3020 'XK 859C1 BATTERY'.

2. Cut the 2-way cable to the required length.

3. At one end of the 2-way cable remove approx. 55 mm of the outer insulation and attach marked shrink-on sleeve.

4. Strip 12 mm of the two inner conductors coloured blue and brown.

5. Contact assignment and designation of the inner conductors are illustrated in Fig. A1.8.

6. Shrink on the labelled sleeve up to approx. 30 mm before the end of the outer insulation of the 2-way cable.

7. Strip and wire up the other end of the 2-way cable, depending on the connector used.

1.6 Preparation of the Supply Cable for Mains Voltage

General:

The terminal for the 380-V three-phase connection of 1-kW HF Transceiver XK 859C1 is designated X15 and marked with L1, L2, L3 N and .

The following internal guide lines should be observed when preparing the cable:

HVC 212, HVJ 077, HVQ 001.

1.6.1 Cable and Consumables

The designation of the cable is

380-V connection cable
DS NYMHY 4x2.5
with ground wire.

The cable can be obtained from Rohde & Schwarz under the order no. DS 025.5458. Standard length of the cable is 20 m, but it can also be supplied in other lengths on request.

For consumables one shrink-on sleeve (R&S No. DJ 099.3020) and four multicore cable ends (R&S No. DZ 507.4587) are needed.

1.6.2 Preparing the Cable

1. Label the shrink-on sleeve 'XK 859C1 MAINS'.
2. Cut the 4-way cable to the required length.
3. Remove approx. 60 mm of the outer insulation at one end of the 4-way cable and attach labelled shrink-on sleeve.
4. Strip 12 mm of each of the four inner conductors coloured brown, black (2) and green/yellow mm and crimp on each of same a multicore cable end DZ 507.4587.
5. Contact assignment and designation of the inner conductors are illustrated in Fig. A1.9.
6. Shrink on the labelled sleeve up to approx. 30 mm before the end of the outer insulation of the 4-way cable.
7. Strip and wire up the other end of the 4-way cable, depending on the connector used.

1.7 Reference List of R&S Internal Guidelines

HVC 155 Labelling PVC films by hot coining

Script: DIN 1451

Colour of script:
black
for highly transparent, white, yellow and grey films
white
for black films

After coining coat labels with colourless, protective varnish.

HVC 212 Crimped connections

Ensure that a suitable tool is used and that it is correctly set and works properly. The extracting strength must at least reach the following values:

AWG 12	=	498 N
AWG 14	=	317 N
AWG 16	=	226 N
AWG 18	=	140 N
AWG 20	=	90 N
AWG 22	=	54 N
AWG 24	=	36 N

HVE 250 Working with beryllium bronze

Observe the processing and safety instructions of the manufacturer.

S p e c i a l r e q u i r e m e n t s f o r d i s p o s a l o f r e f u s e !

HVE 600 Spot welding (testing acc. to DIN 50124)

Minimum number of welding spots of a welded joint:

l	to 50	51 to 100	101 to 200	201 to 300	301 to 400	401 to 500	501 to 600	601 to 700
a	2	3	4	5	6	7	8	9

l = Length of welded joint in mm
a = Number of welding spots

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

HVE 600 (continued)

Metal thickness of thinner metal in mm		Sheet-steel, low alloy		Sheet-steel nickel-plated		Sheet-steel non-corrosive		low rentitivitiy materials (ni alloy)		Alumi-nium		Copper/zinc alloy Copper/ nickel/zinc alloy (also with galvanic coat)		Copper/tin alloy Copper/ beryllium alloy (also with galvanic coat)	
	u	e	P	e	P	e	P	e	P	e	P	e	P	e	P
0,3	8											8	0,2	8	0,3
0,5	10	10	1	10	1	8	1	10	0,3	10	0,4	10	0,4	10	0,6
0,75	12	13	2	12	2	10	2	12	0,5	12	0,6	12	0,6		
1	14	17	3	15	3	12	3	15	0,7	14	0,8	14	0,8		
1,5	16	27	4	20	4	15	4	20	1	18	1	18	1		
2	18	35	6	25	6	20	6	25	1,5	22	2	22	2		
2,5	20	41	8	30	8	25	8			24	3	25	4		
3	22	45	10			30	10			27	4	30	6		
3,5	24	48	15			35	15								

HVF 000 Electroplated surfaces

galNiCr

on steel:	on Cu and Cu alloys:
2 µm Cu	1 µm Cu
8 µm Ni	5 µm Ni
0.3 µm Cr	0.3 µm Cr

HVJ 071 Preparation of jumper wires

Strip ends and pre-tin them.
Nicks or scraping on the conductor are not permissible.

The tin coating must be smooth and uniform.

HVJ 072 Preparation of stranded hookup wires

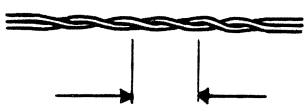
Strip ends and pre-tin them.
Nicks or scraping on the wires are not permissible.

The tin coating must be smooth and uniform.
No pre-tinning for crimped connections!

HVJ 073 Twisting wires and stranded wires

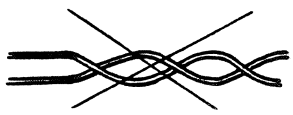
Twisting:

Right:



1 complete twist (360°)

Wrong:



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---(Continuation) Reference List of R&S Internal Guidelines

HVJ 073 (continued)

AWG	Wire dia. fil	Stranded wire mm^2	Twist length mm approx.
28	0.32	-	6
26	-	0.15	10
24	0.5	0.24	10
20	0.8	0.62	12
18	-	0.96	20
14	-	1.94	30
12	-	2.92	40
10	-	4.72	50

HVJ 077 Identification of cables

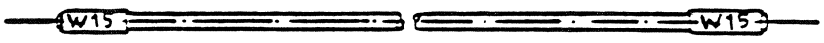
Script (black) hot-coined on shrink-on sleeve (withe).

For cables dia: ≤ 1 mm 1 x on perimeter
> 1 mm 2 x on perimeter

Script size for cables dia.
< 5 mm 2mm
> 5 to 20 mm = 3 mm
> 20 mm = 4 mm

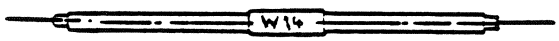
Form of identification

Fig. 1 Cable end-sleeves with labelling



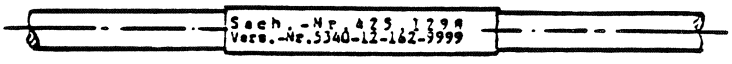
Electrical code (both ends)

Fig. 2 Labelling for cables ≤ 100 mm in length



Electrical code only in middle

Fig. 3 Stock nos.



(additional identification is possible, e.g. serial no.)

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

HVJ 077 (continued)
Fig. 4 Cable with fittings

a) Electrical code, stock no. Point of connection

b) Electrical codes of cable and fitting

HVJ 250 Working of braided cables
Cut inner conductor, dielectric, shield braiding and outer insulation properly to size for fitting, pre-tin inner conductor and shield braiding.

HVL 010 General fundamentals of adhesion
Observe the processing and safety instructions of the manufacturer.

HVL 170 Securing screws with liquid plastic
For screws ≤ M3: Loctite 222
> M3: Loctite 242

The surfaces for application must not be greasy or dirty.

HVL 700 Application of self-adhesive films
The surfaces for adhesion must be free of dirt, oil and grease and must be dry.

Air bubbles must be avoided.

HVM 110 Soft soldering by hand
See MIL-STD-454, requirement 5.

HVM 210 Soft soldering of chassis or similar parts of brass or nickel silver
Line up the parts and wedge them over if necessary. Soldering gap 0.3 mm.

Warm workpiece on regulated oven plate and with handheld gas burner.

For soldering use non-corroding flux and filler wire acc. to DIN 1707 (L-Sn 63 Pb).

The solder and wetting must be small.

Soldered seams must not exhibit any breaks, cracks or pores.

Remove flux by washing. Grind smooth and deburr in the case of chassis.

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

HVM 510 Hard soldering (brazing) (steel, copper, copper alloys, aluminium)

Deburr edges on the joints for soldering.

On the joints for soldering the parts must be made completely clean, free of oxidation, paint and grease by washing, grinding, pickling them, etc., i.e. without wearing away any material in the case of threads and tolerance fits.

To achieve maximum strength, the right flux should be used for the particular solder that is in use, whilst observing the procedure prescribed by the solder producer.

HVQ 001 Safety requirements when working with teflon
Observe the processing and safety instructions of the manufacturer.

S p e c i a l r e q u i r e m e n t s f o r d i s p o s a l o f r e f u s e !

HVQ 015 Safety requirements
Observe safety requirements with combustible liquids and dangerous work materials.

XVE 502 Pickling and yellow chroming of aluminium
XVE 503 Pickling and yellow chroming of aluminium
XVE 504 Pickling and yellow chroming of aluminium

} Layer weight at least 430 mg/m^2

XVE 511 Passivation of stainless steel
Acc. to QQ-P-35

Quality requirements
The passivated parts may exhibit no traces of rust

a) after being kept in water acc. to method 100 of MIL-STD-753 or

b) after being kept in a humid climate acc. to QQ-P-35 (95 to 100 % relative humidity, 38 to 43° C, 24 to 26 hours) or

c) after a 2-hour salt-spray test ASTM B117/4.2.2

Appearance
After passivation the surfaces must be bare, clean, uncorroded, without any pitting and unclouded.

A slight discolouration may appear in isolated cases.

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

XVF 000 Electroplated coatings

gal Ag 5	acc. to MIL-F-14072 M351 (QQ-N-290, quality C and QQ-5-365, quality A)
gal AG 15.2	(on steel) acc. to MIL-F-14072 M211 (QQ-N-290 and QQ-5-365, quality A)
gal AG 15.2	(on Cu and Cu alloys) acc. to MIL-F-14072 M311 (QQ-N-290, quality C and QQ-5-365, quality A)
gal Cd 7.6	acc. to MIL-F-14072 M261 (QQ-P-416, type III class 2)
gal Ni 15.2	acc. to MIL-F-14072 M313 (QQ-N-290, quality E, dull)
gal Ni 15.3	(on steel) acc. to MIL-F-14072 M253 (MIL-C-14550, class 3 and QQ-N-290, quality F, dull)
gal Ni 15.3	(on Cu and Cu alloys) acc. to MIL-F-14072 M452 (MIL-C-14550, class 3 and QQ-N-290, quality F, dull)
gal Ni 20.3	acc. to MIL-F-14072 M413 (MIL-C-14550, class 3 and QQ-N-290, quality E, dull)
gal Ni 27.9	acc. to MIL-F-14072 M213 (MIL-C-14550, class 2 and QQ-N-290, class 1, quality E, dull)
gal Sn 5.1 or gal Ni Sn	acc. to MIL-T-10727 (type I)
gal Sn 7.6	MIL-F-10727, (type II) M256
gal Zn 7.6	acc. to MIL-F-14072 M264 (QQ-Z-325, type II)
gal Zn 12.7	acc. to MIL-F-14072 M266 (QQ-Z-325, type II or III, class 2)

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

XVH 812 Varnishing with finishing varnish, cold-hardening

Acc. to TAA 003/3a The base must fulfil the requirements of TL 8010-001/2, class II, type 4 the top coating the requirements of TL 8010-002/2a, class II, type 2.

Quality requirements:

Appearance
An even and non-porous coating; must be free of wrinkles, bubbles or other blemishes that detract from appearance or degrade functioning.

Colour shade
Must correspond to RAL 480 HR standard.

Gloss
The varnish must exhibit (measured acc. to DIN 67530) a gloss of 15 to 50 % measured at an angle of 85°.

Adhesive strength
Gt 1 (DIN 53151)

Overall layer thickness

Layer thickness:	At least 70 um for sprayed surfaces unless a greater dry film thickness is called for.
Testing:	Measured on plane surfaces, at least 5 cm from edges, with suitable thickness meter (from TL-003, point 3.3.1).

XVH 820 Varnishing with finishing varnish, thermosetting

Acc. to TLA 003/3a, the base must fulfil the requirements of TL 8010-001/2, class II, type 44 or class III, the top coating the requirements of TL 8010-002/2a, class II, type 2.

Quality requirements:

As for XVH 812

XVM 110 Soft soldering by hand

See MIL-STD-454, requirement 5.

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

1 Preliminary Remarks

1.1 Applicability

All cables from production are to be subjected to a 100 % test. Cables are all multicore or shielded lines, also coaxial lines, which are provided with a connecting fixture at one end at least, plus rigid cables with or without connectors.

1.2 Regulations Applied

The tests correspond to DIN 57411/VDE 0411 and DIN 57804/VDE 0804 for equipment of protective category I.

1.3 Additional Requirements

It is assumed that the correct selection of line and connecting device for the particular application has been made and a type-acceptance test with the appropriate equipment.

If the cable is used with or in equipment for which higher test voltages are prescribed, e.g. equipment of protective category II or acc. to DIN 57866/VDE 0866, these test voltages are to be used for examining the cable.

The same applies if higher test voltages are required by the customer.

1.4 Entry in Blueprint

A blueprint entry is only necessary if higher demands, e.g. higher test voltages or a defined reflection coefficient, are set for testing.

In as much as necessary, existing documents are to be added to accordingly.

For examples of a blueprint entry see section 2.

2 Scope of Testing

2.1 Visual Check

In a visual check the following points are to be observed for example:

agreement with basic production blueprint, inscriptions, angular position of coding and between angle connectors.

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

2.2 Continuity Test

Every wire and possibly the shield connected to the connector is to be checked for continuity with reference to the circuit diagram or assembly and wiring instructions.

The continuity test is omitted for coaxial cables and cables that are provided with a connecting device at only one end.

2.3 Voltage Test

The connected wires and shields will be tested wire to wire and possibly wire to shield.

The test voltage must be sinusoidal and between 45 and 65 Hz. The rated power of the test instrument should be at least 500 VA.

The test voltage will be defined acc. to Table 1 and the operating voltage of the circuits routed through the cable.

If Table 1 produces a test voltage < 1500 V, a DC test voltage amounting to the peak value of the AC test voltage may be used instead of an AC test voltage.

Table 1

		Operating voltage in V	Test voltage in V (rms)	Blueprint entry
2.3.1	Circuits with AC voltages (rms value)	≤ 50	500	No entry
	DC voltages	≤ 120		
2.3.2	Circuits with AC voltages (rms value) or DC voltages	> 50 AC > 120 ≤ 250 DC	1500	Tested acc. to HVP 020 Test voltage ... V
		> 250 ≤ 650	2000	
		> 650 ≤ 1000	3000	
		> 1000	As prescribed[1])	
2.3.3	Power circuits (rms value) referred to ground	> 250	1500	Tested acc. to HVP 020 Test voltage 1500 V

(Continuation)---

---(Continuation) Reference List of R&S Internal Guidelines

Table 1 (continued)

		Operating voltage in V	Test voltage in V (rms)	Blueprint entry
2.3.4	Power circuits acc. to part 2.3.3 together with other circuits in one cable	< 50 AC ≤ 120 DC > 50 AC > 120 DC	2500 As pre-scribed[1])	Tested acc. to HVP 020 Test voltage ... V

1) e.g. DIN 57411/VDE 0411 or DIN 57804/VDE 0804

2.3.5 If a high-voltage test is necessary for coaxial cables (power cables), the test voltage is to be stated in the basic blueprints.

2.4 Testing of Characteristic Impedance (Z_O)

All coaxial cables will be tested for characteristic impedance and assembly faults in a comparative, statistical measurement.

2.4.1 Coaxial cables for which no additional tests are required will not call for blueprint entries.

2.4.2 In the case of cables for which defined operating data are called for, such entries are to be made in the blueprint.

Example:

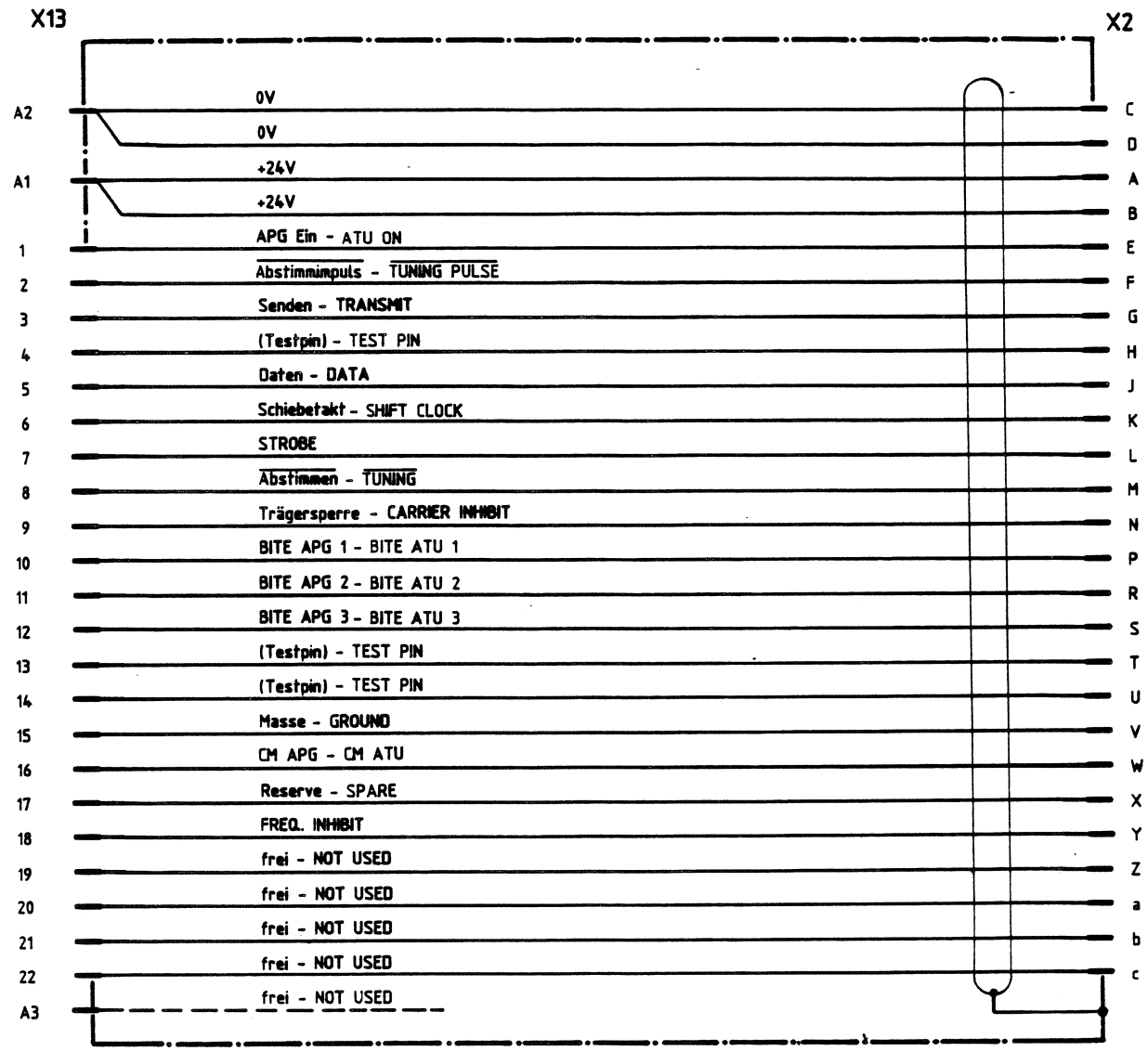
Tested acc. to HVP 020
Z_O = 50 ohms; r ≤ 0.5 %;
f = 100 to 300 MHz

These tests cannot be performed as a part of the cable preparation. but instead require handling of the cables in a special test bay.

3 Performance

The performance of the tests made during cable preparation is defined in TAA 503.

XK 859 FK 859



A 39 683 09.87 BU	6KBH	Tag	Name	Benennung	
	Bearb	11.86	GO	XK 859 Z3 Kabel - Cable XK 859 - FK 859	
	Gepr	3.87	Fa		
	Norm				
	ROHDE&SCHWARZ			Zeichn.-Nr 724.9904.01 S	Blatt-Nr 1
Änd Zust Änderungs-Mitteilung Tag Name	zu Gerät XK 859 Z3			reg. v 724.9904 V erste Z	v 1 Bl

Kennz. Comp.No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
.	VARIANTENERKL. / VERSIONS VAR 02 = KABELLANGE 2M MOD 02 = LENGHT 2M VAR 03 = KABELLAENGE 3M MOD 03 = LENGTH 3M VAR 04 = KABELLAENGE 4M MOD 04 = LENGTH 4M VAR 20 = KABELLAENGE 20M MOD 20 = LENGH 20M VAR 10 = KABELLAENGE 10M MOD 10 = LENGTH 10M VAR 30 = KABELLAENGE 30M MOD 30 = LENGTH 30M VAR 40 = KABELLAENGE 40M MOD 40 = LENGTH 40M VAR 50 = KABELLAENGE 50M MOD 50 = LENGTH 50M				
X2	BESTEHT AUS/CONSISTING OF 1X FO511.9296 1X FO080.2463				
X13	BESTEHT AUS/CONSISTING OF 1X FM520.6244 21X FM520.6344 2X FP531.9240 1X FM588.2673 1X FM588.2696				
					- ENDE -

ROHDE & SCHWARZ	Äl	Datum Date	Schaltteilliste für Parts list for	Sachnummer Stock Nr.	Blatt Page
	04	0388	XK859Z3 KABEL XK859-FK859 CABLE XK859-FK859	724.9904.01 SA	1-

ROHDE&SCHWARZ	ÄZ	Datum / Date	Schaltteilliste für / Parts list for	Sachnummer / Stock No.	Blatt / Page
	01	0886	XK859Z4 KABEL XK859-FK859	724.9856.01 SA	1

Kennzeichen / Component No.	Benennung/Beschreibung / Designation	Sachnummer / Stock No.	enthalten in / contained in
-	VARIANTENERKL. / VERSIONS VAR 02 = KABELLAENGE 20M MOD 02 = LENGTH 20M		
X1	FJ KABELSTECKER SYST. N N-CONNECTOR 50 OHM SPINNER NUG-21D/UBN922400	FJ 018.4472	
X67	FJ KABELWINKELST.SYST.N N ANGLE PLUG, 50 OHMS SUHNER 16N-50-7-9C/133	FJ 117.8917	
			- ENDE -

095.0026-0186

GB 853		XK 859	
* Aussenschirm nur an Gehäuse!			* Aussenschirm nur an Gehäuse!
* Outer screen taken to connector housing!			* Outer screen taken to connector housing!
X71		X12	
F		1	
G		20	⊥ Masse GROUND
H		2	
C		22	+15VDC
A		23	+7,2VDC
B		4	7,2VDC
D		21	-15VDC
E		3	-5VDC
J		34	Ein a / ON a
K		36	Ein b / ON b
L		13	D2
U		8	D1
V		32	$\overline{D2}$
W		7	E2 ⊥ Masse GROUND
N	gn	11	S1.2
P	ge	27	S2
S		31	M1
T		12	M2
X		28	Hochschalten Fern PTT REMOTE
Y		14	NF Mod. a / AF MOD. A
Z		15	NF Mod. b / AF MOD. B
a		17	NF Demod. a / AF DEMOD. A
b		16	NF Demod. b / AF DEMOD. B
c		10	FS Mod. Fern / TTY MOD REMOTE
d		9	FS-Demod Fern / TTY DEMOD REMOTE
e		19	FS-Masse / TTY GROUND
f		33	Ein Fern a / ON REMOTE A
g		35	Ein Fern b / ON REMOTE B

A 39 682 09.87 BU	6KBH	Tag	Name	Benennung	
	Bearb	12.86	GO	XK 859 Z2 Kabel- Cable	
	Gepr	3.87	Fq	XK 859 - GB 853	
	Norm				
	ROHDE&SCHWARZ			Zeichn.-Nr 724.9956.01 S	Blatt-Nr 1 v 1 Bl
Änd Zust Änderungs-Mitteilung Tag Name	zu Gerät XK 859 Z2			reg. v 724.9956 V erste Z	

Kennz. Comp.No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
.	VARIANTENERKL. / VERSIONS VAR 02 = KABELLAENGE 2M MOD 02 = LENGTH 2M VAR 03 = KABELLAENGE 3M MOD 03 = LENGTH 3M VAR 04 = KABELLAENGE 4M MOD 04 = LENGTH 4M VAR 10 = KABELLAENGE 10M MOD 10 = LENGTH 10M VAR 20 = KABELLAENGE 20M MOD 20 = LENGTH 20M VAR 30 = KABELLAENGE 30M MOD 30 = LENGTH 30M VAR 40 = KABELLAENGE 40M MOD 40 = LENGTH 40M VAR 50 = KABELLAENGE 50M MOD 50 = LENGTH 50M				
X12	BESTEHT AUS/CONSISTING OF 1X FM657.5242 31X FM511.8090 1X FM645.7868 1X FM586.9570				
X71	BESTEHT AUS/CONSISTING OF 1X F0549.8474 1X F0080.2457				
					- ENDE -

ROHDE&SCHWARZ

Appendix 2
to
1-KW HF TRANSCEIVER
XK 859C1

Interface Description

Printed in the Federal
Republic of Germany

673.4199 - 0A2

1. Interface Description

This section provides advice about using the inputs and outputs of the 1-kW HF transceiver for connection of peripheral equipments.

The connectors are located on the base plate of the rack, below the slide-in unit Power Supply IN 859C1.

Note:

The interface description for the Control Unit GB 853C1, when integrated in the Case with Power Supply KK 853C2, is contained in the User Manual of the KK 853C2.

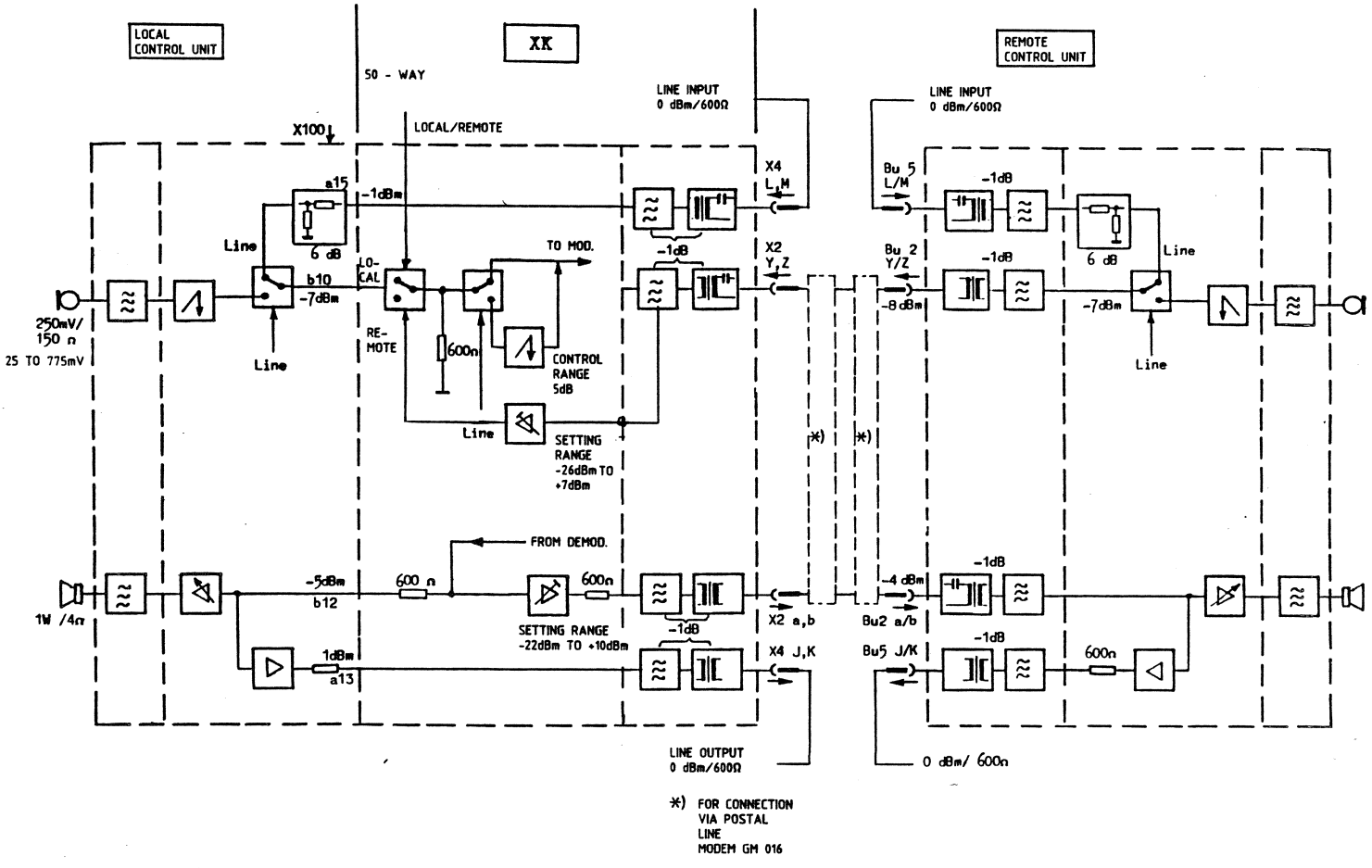


Fig. A2.1 AF Interfaces of 1-kW HF Transceiver XK 859C1

---(Continuation) Interface Description

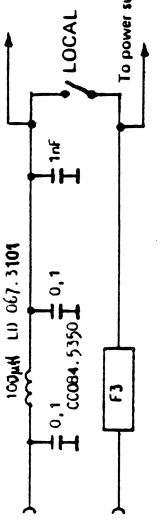
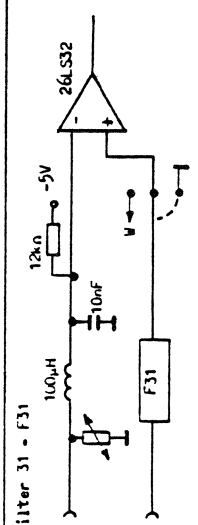
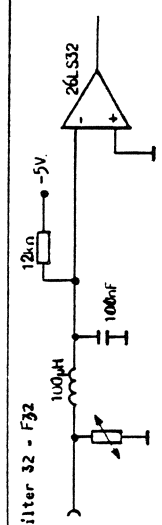
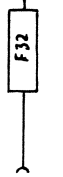
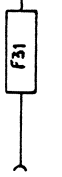
Contact assignment

Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu X12 Remote (37-way) (designation in overall circuit diagram)

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
23		+7.2 V	LD 026.4049, 25 µH, 1 µF, CX 009.2993, 1 µF, Filter 2 = F2, F2	SO		
4		+7.2 V	F2	SO		
22		+15 V	F1	SO		
21		-15 V	F2	SO		
3		-5 V	F2	SO		
1, 20, 2	⊥ ⊥ ⊥	Ground				

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu : X12 Remote (37-way) (designation in overall circuit diagram) Sheet 2

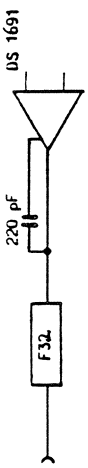
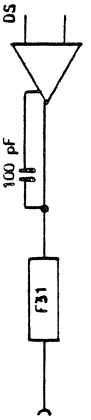
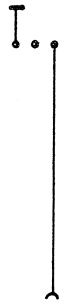
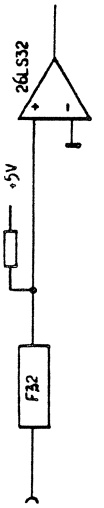
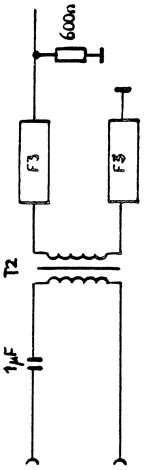
Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source	Sink	Remarks	Nominal level
34		On a	Filter type 3 - F3 		SI		+ – ? current, contact loading
36		On b			SI		
13	D2		Filter 31 - F31 		SI		Low ≙ –3 to –15 V High ≙ +3 to +15 V Range –3 to +3 V is undefined
32	$\overline{D2}$				SI		
31	M1	DSR	Filter 32 - F32 		SI		As 13
12	M2	CTS			SI		As 13
30	T					Not connected in cable to GB 853 C2	As 13

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.4 -

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu. : X12 Remote (37-way) (designation in overall circuit diagram) Sheet 3

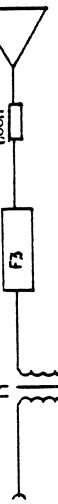
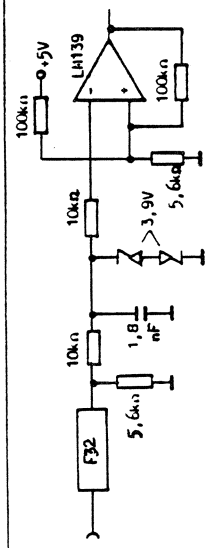
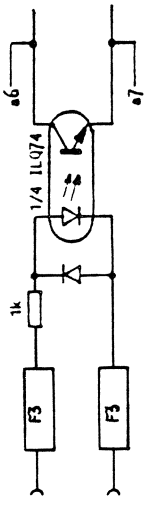
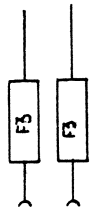
Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
11	S1.2	DTR		SO		Low ≙ −5 V High ≙ +5 V
27	S2	RTS	As 11	SO		As 11
8	D1			SO		As 11
29	$\overline{D1}$		As	SO		As 11
7	E2 ⊥					
28		Active remote		SI	Low ≙ transmit	As 13
14	AF Ma	Modulation a		SI	R_i 600 ohms floating	0 dBm 600 ohms −26 to +7 dB internally adjustable
15	AF Mb	Modulation b		SI		

1 - kW HF TRANSCEIVER
XK 859 C1

User Manual
Appendix 2: Interface Description - A2.5 -

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu : X12 Remote (37-way) (designation in overall circuit diagram) Sheet 4

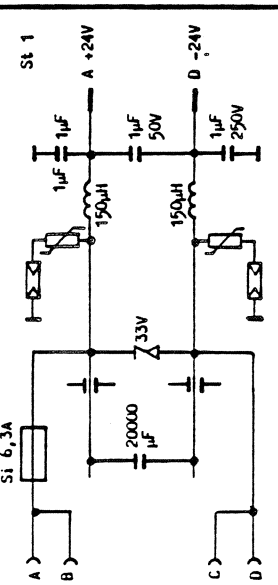
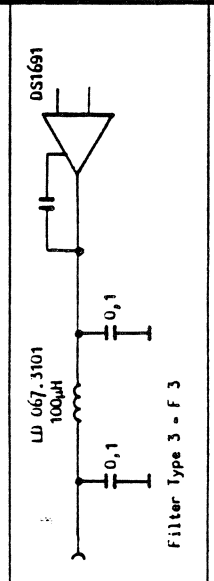
Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
17	NFD a	Demodulation a		SO	R_i 600 ohms	0 dBm 600 ohms −22 to +10 dB internally adjustable
16	NFD b	Demodulation b		SO		
10	FS M	TTY Mod. remote		SI	Low ≙ −Δf High ≙ +Δf referred to RF output	As 13
9	FS D	TTY Demod. remote		SO		As 11
19		TTY ground				
33		On remote a		SI	High ≙ on	High ≦ > +3 V I_{min} 1.5 mA
35		On remote b		SI		
18		Reserve				
26		Reserve				

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.6 -

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu : X13 ATU (25-way) (designation in overall circuit diagram) Sheet 1

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
A1	+24 V	Power supply for ATU		SO	Floating 19 to 31 V 6.3 A fuse	24 V max. 6.3 A
A2	−24 V			SO		
1		ATU on		SO	High = on Off = f < 1.5 MHz = transceiver off	Low ≙ −5 V High ≙ +5 V
2		$\overline{\text{Tuning pulse}}$	As 1	SO	Low pulse for: 1) channel and frequency change 2) tuning button 3) with ATU on (see E)	As 1
3		Transmit	As 1	SO	Transmit ≙ High	As 1

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.7 -

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu X13 ATU (26-way) (designation in overall circuit diagram) Sheet 2

Contact no.	Assignment Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
4		Pretransformation ready			Not wired in XK 859	
5		Data	As 1  +3V -3V	Q	Data transfer when tuning pulse low – channel info – mute – memory bit –half-duplex	As 1
6		Shift timing	As 1  +3V -3V	Q		As 1
7		Strobe	As 1  +3V -3V	SO		As 1
8		Tune		SI	Low when tuning in progress	Low ≙ –3 V High ≙ +3 V Range –3 to +3 V is undefined
9		Carrier block		SI	High = blocked	As 8
10		BITE ATU 1	As 8	SI	Code with 10,11,12	As 8

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.8 -

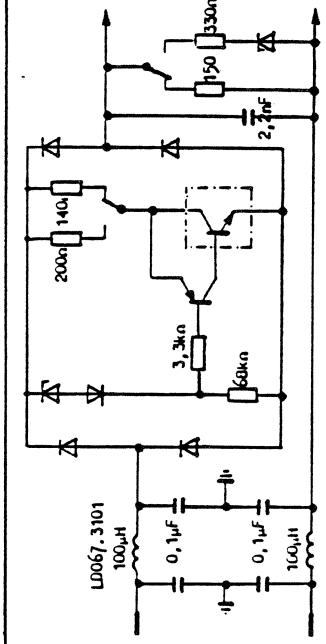
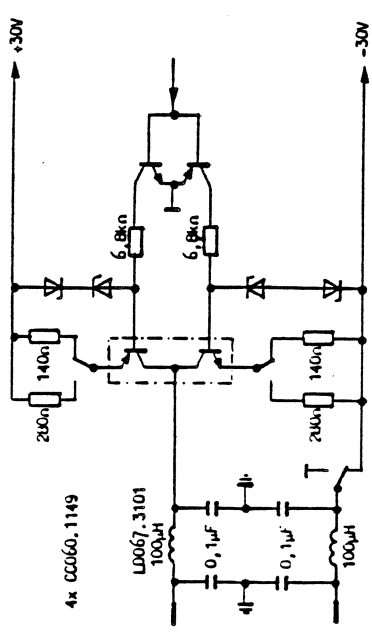
---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) Bu X13 ATU (25-way) (designation in overall circuit diagram) Sheet 3

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
11		BITE ATU 2	As 8	SI	Code with 10,11,12	As 8
12		BITE ATU 3	As 8	SI		As 8
13		Data serial in			Not wired in XK 859	
14		Data serial out			Not wired in XK 859	
15	⊥	Ground				
16		$\overline{\text{CM ATU}}$	As 8	SI	Low Δ overvoltage or overtemperature	As 8
17		Wired reserve	F3			
18		Frequency inhibit	F3	SI	Not used in ATU	
19 20 21 22		Reserve				
A3		not used				

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver XK 859 C1 (name) (type) St: X14 EXTERNal (37-way) (designation in overall circuit diagram) Sheet 1

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
A	⊥	Ground				
11		TTY transmit a		SI	Line current	60 V / 40 mA switchable ±30 V / ±20 mA
30		TTY transmit b		SI	2-wire operation is possible	
29		TTY receive a		SO	Line current	60 V / 40 mA switchable ±30 V / ±20 mA
14		TTY receive b		SO		

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.10 -

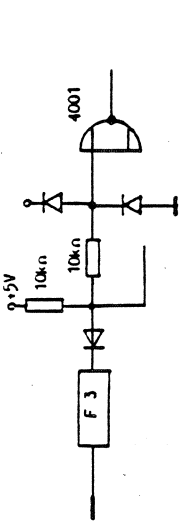
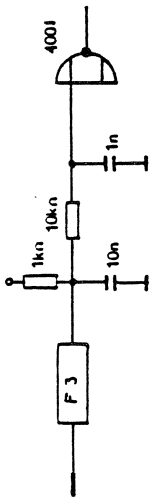
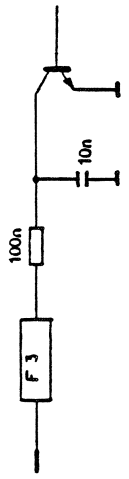
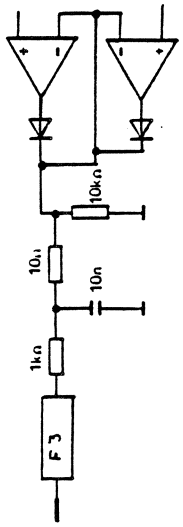
---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) St: X14 EXTERNal (37-way) (designation in overall circuit diagram) Sheet 2

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
10		TTY transmit V.28	LD 067.3101, 100µH, 0,1µF, 0,1µF, CC 084.5350, 100n, 1n, 264.532, Filter Type 3 (F3)	SI		Low Space ≙ +5 V; High Mark ≙ −5 V
28		TTY receive V.28	1691, 1n, 100n, F 3	SO		As 10
9		⊥ TTY				
32		AF receive a	562n, 10n, F 3, T3, Trafo 586.7932	SO	R_i 600 ohms floating	0 dBm
13		AF receive b	F 3			
12		AF transmit a	200n, 825n, 200n, F 3, 1µF, 586.7932	SI	R_i 600 ohms floating	0 dBm
31		AF transmit b	F 3			

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) St: X14 EXTERNal (37-way) (designation in overall circuit diagram) Sheet 3

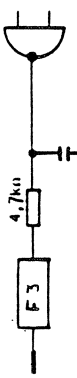
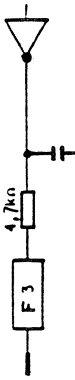
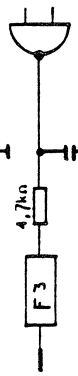
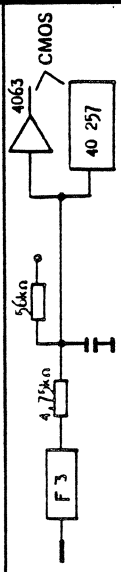
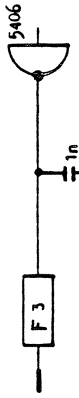
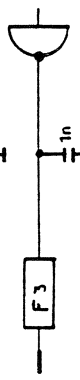
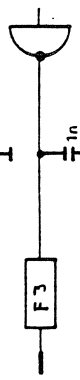
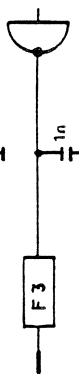
Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
27		F1 transmit		SI	Low ≙ transmit Activation only effective with F1	⊥ or −6 V ≙ Low +6 V or high-impedance ≙ High
8		Transmit		SI	Low ≙ transmit effective in all modes except F1	As 27
26		Squelch		SO	OC output Low for open squelch	
7		AGC IF		SO	R_i 1 kohm	+3 V ≙ 1 µV +3.7 V ≙ 30 mV

1 - k W H F T R A N S C E I V E R
X K 8 5 9 C 1

User Manual
Appendix 2: Interface Description - A2.12 -

---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) St: X14 EXTERNal (37-way) (designation in overall circuit diagram) Sheet 4

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	SOurce Sink	Remarks	Nominal level
25		a		SO	Shift value 1	CMOS 5 V
6		b		SO	Shift value 2	CMOS 5 V
24		c		SO	Low ≙ −Δf High ≙ +Δf	CMOS 5 V
		Soft decision				
5		Silence		SI	Low ≙ silence	CMOS level 5 V High ≙ > 4 V Low ≙ < 1 V
23		Ex 1		SO	Number 0–9 can be set on keypad; output by these 4 lines in BCD code	TTL level
4		Ex 2		SO		TTL level
22		Ex 3		SO		TTL level
3		Ex 4		SO		TTL level

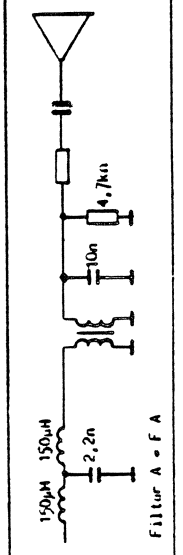
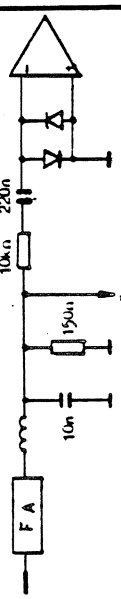
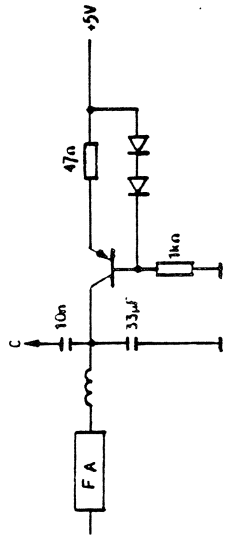
---(Continuation) Interface Description

Contact assignment Equipment: 1-kW HF Transceiver (name) XK 859 C1 (type) St: X14 EXTERNal (37-way) (designation in overall circuit diagram) Sheet 5

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
21		Reserve	F3			
2		$\overline{\text{CM external}}$	CMOS 40257; 100kΩ; 4,7kΩ; 1n; F3	SI	Low ≙ error	CMOS Low ≙ < 1 V High ≙ > 4 V
34		$\overline{\text{CM/BITE NOGO}}$	54C904; 1n; F3	SO	"	
15		$\overline{\text{Receive inhibit}}$	+15V; 100n; 33kΩ; 47kΩ; 10n; 1kΩ; F3	SI	Blocked ≙ Low	Low ≙ ⊥
20		Loudspeaker	10µH 1A 026.4626; PTT	SO	Loudspeaker is cut off by PTT for transmission	1 W into 5 ohms
1		Loudspeaker ⊥	10µH 1A; PTT	SO		
16		$\overline{\text{Transmit}}$	DS1691; F3; Bu 3.6	SO	High ≙ transmit	Low ≙ −5 V High ≙ +5 V
33		$\overline{\text{Trigger test}}$ $\overline{\text{external}}$	CMOS; 100kΩ; 4,7kΩ; F3	SI	Low ≙ test run	Low ≙ < 1 V High ≙ > 4 V

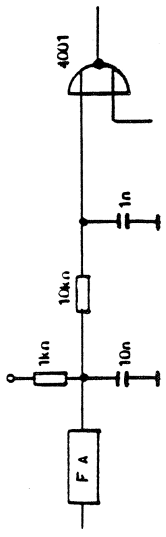
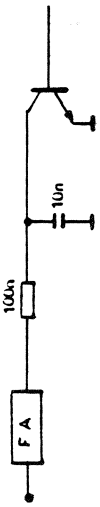
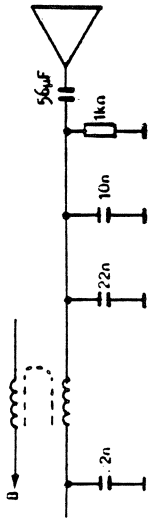
---(Continuation) Interface Description

Contact assignment Equipment: Control Unit (name) GB 853 (type) Bu / St : X32/X33 (10-way audio) (designation in overall circuit diagram) Sheet 1

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
A		Phones		SO		50 mV into 600 ohms, adjustable with loudspeaker potentiometer
B		Ground for phones (A) and loudspeaker (J)				
C		Microphone input		SI	High microphone input	250 mV into 150 ohms
D		Microphone BV	Not wired in GB 853			
E		Microphone +6 V		SO for mike current	Low microphone input 5.3 V / 15 mA max. for microphone amplifier	4 to 12 V / 15 mA

---(Continuation) Interface Description

Contact assignment Equipment: Control Unit (name) GB 853 (type) Bu / St : X32/X33 (10-way audio) (designation in overall circuit diagram) Sheet 2

Contact no.	Abbreviation	Assignment Name	Interface description Current, voltage, source or load impedance	Source Sink	Remarks	Nominal level
F		Transmitter keying		SI	Low ≙ transmit	Contact to ⊥ ≙ Low = transmit
G	⊥	Ground				
H		Squelch information			Low for open squelch OC output	
J		Loudspeaker		SO	1 W into 5 ohms	
K		Intercom	Not wired in GB 853			

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N O T E S

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ROHDE&SCHWARZ

Radiocommunications Division

User Manual

RECEIVER / EXCITER
GX 859C1

680.2017

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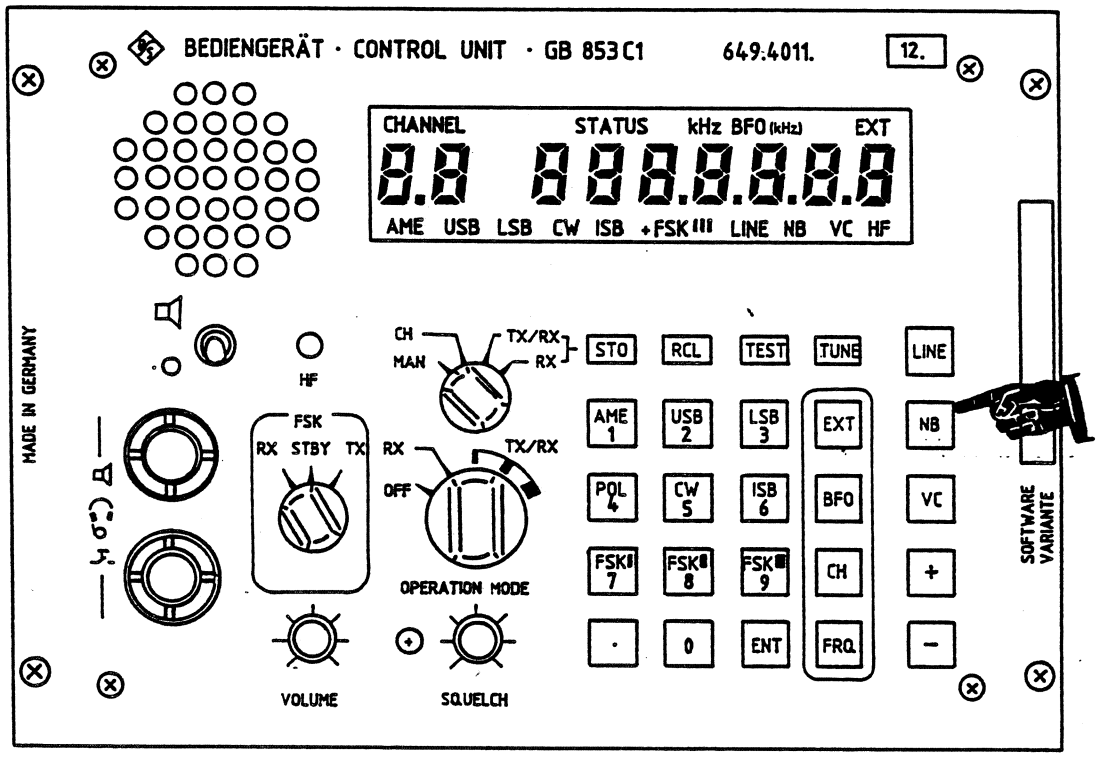
Radiocommunications Division



NOTICE

Please note that the key NB (noise blanker) on the Control Unit GB 853 has meanwhile been disabled.

Therefore, in the following manual please disregard all text referring to the key NB.

L I S T O F C O N T E N T S

		Page
1.	Characteristics	1.1
1.1	Application	1.1
1.2	Design and Functioning	1.2
1.2.1	Design	1.2
1.2.2	Functioning	1.3
1.2.2.1	Functioning Principles	1.3
1.2.2.2	Functioning of Control Unit	1.3
1.2.2.3	Receive Signal Path	1.3
1.2.2.4	Signal Path in Exciter	1.4
1.3	Technical Data	1.6
1.4	Models	1.12
1.5	Options	1.13
1.6	Accessories	1.13
2.	Preparation for Use and Operation	2.1
2.1	Preparation for Use	2.1
2.1.1	General Preparation	2.1
2.1.2	Preparation for Remote Control	2.2
2.2	Operation	2.3
2.2.1	Switching On and Off	2.3
2.2.2	Manual Local Control	2.3
2.2.2.1	Functions of Controls and Indicators	2.4
2.2.3	Functional Test	2.9
2.2.4	Remote Control	2.9
3.	Maintenance	3.1

(Continuation)---

---(Continuation) List of Contents

		Page
4.	Troubleshooting	4.1
4.1	General	4.1
4.2	Troubleshooting Instructions	4.1
4.3	Error Lists	4.4
4.3.1	Continuous Monitoring (CM) Displays	4.4
4.3.2	BITE Displays	4.5
4.3.2.1	Displayed Error Locations	4.5
4.3.2.2	Displayed Operating States	4.6
4.3.3	Error Displays without Code	4.7
4.3.4	Functions not Covered by BITE	4.9
4.3.5	Memory Back-up Batteries	4.11
4.4	Replacement of Modules	4.12
4.4.1	Removal of Receiver/Exciter GX 859C1	4.12
4.4.2	Replacement of Control Unit GB 853C1	4.13
4.4.3	Plug-in Cassettes	4.13
4.4.4	Power Supply	4.13
4.4.5	Processor	4.13
4.4.6	EMC Filter	4.14

L I S T O F F I G U R E S

Fig.	Title	Page
1.1	Receiver/Exciter GX 859C1	1.1
1.2	Receiver/Exciter GX 859C1, Structure	1.15
1.3	Receiver/Exciter GX 859C1, System Modules	1.17
2.1	Arrangement of Interfaces at Receiver/Exciter GX 859C1	2.1
2.2	Cabling Plan of Receiver/Exciter GX 859C1	2.11
2.3	Receiver/Exciter GX 859C1, Controls and Indicators	2.13
4.1	Troubleshooting Flowchart	4.2
4.2	Receiver/Exciter GX 859C1, Block Diagram	4.15
4.3	Disassembly of Receiver/Exciter GX 859C1	4.17
4.4	Receiver/Exciter GX 859C1, HF Cabling	4.19

R E C E I V E R / E X C I T E R
G X 8 5 9 C 1

User Manual
Part 1: Characteristics - 1.1 -

1. Characteristics

1.1 Application

The 20-mW Receiver/Exciter GX 859C1 is part of the HF 850 radio equipment series.

It is the heart of the microprocessor controlled 1-kW HF radio unit with a separate power amplifier. The receiver/exciter takes over all receiver functions as well as frequency generation, signal conditioning and control of subsequent units Power Supply IN 859C1 and Power Amplifier VK 859C1. The Receiver/Exciter supplies a 20-mW output signal for excitation of the power amplifier in transmission.

Reception is possible in the frequency range 0.4 to 30 MHz and transmission in the frequency range 1.5 to 30 MHz.

With the exception of the 150-W amplifier and EMC filter the receiver/exciter consists of the same modules as the small-signal unit of the 150-W Transmitter/Receiver XK 852.

Because of its robust, drip-proof and dust-proof construction and the fact that it fulfils major military standards it is equally suitable for both stationary and land-mobile or shipboard use.

The built-in test equipment (BITE) and the operational monitoring system enable operator personnel to detect any irregularities and localize them down to module level. Modules can be exchanged simply and without any realignments. This means that repair work down to module level can be performed on the job.

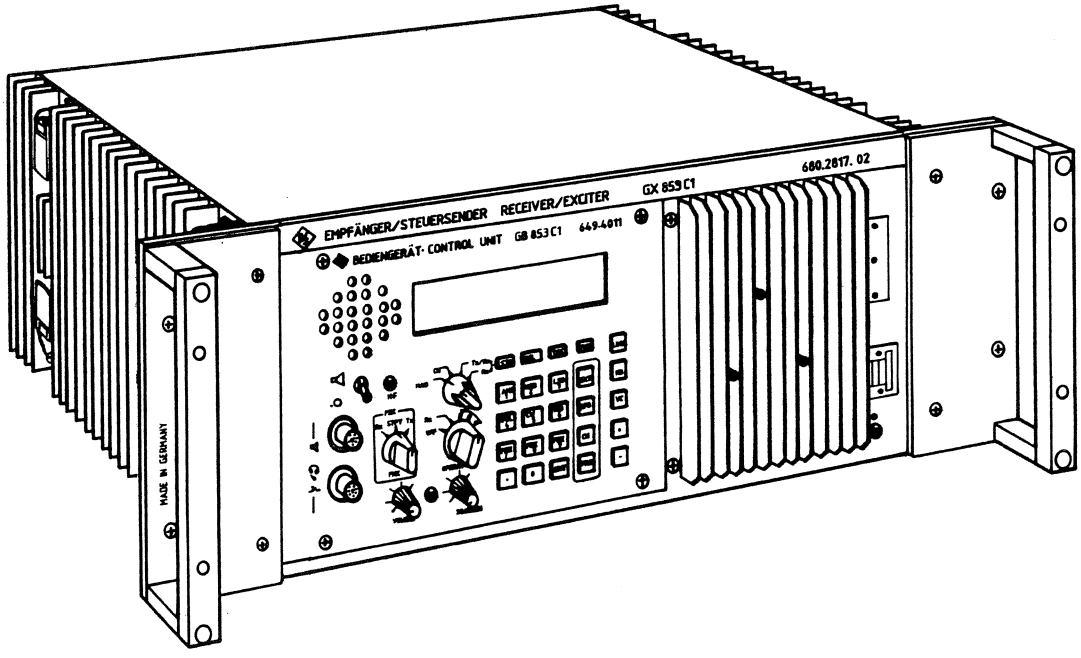


Fig. 1.1 Receiver/Exciter GX 859C1

1.2 Design and Functioning

1.2.1 Design

See also Figs. 1.1 and 1.2

The Receiver/Exciter GX 859C1 is a modular designed 19" slide-in unit. The basic model consists of the following basic modules of the HF 850 HF radio equipment series:

- Mainframe	KR 852P1
- Power Supply	IN 852P1
- Processor	GS 852P1
- Tx/Rx Section	GX 852P1
- Synthesizer	GF 852P1
- Modem	GM 852P1
- Filter Unit	(optional)
- EMC Filter	FK 852P7
- Set of cables	GK 852P1
- Control Unit	GB 853C1

The Control Unit GB 853C1 is not included, if the receiver/exciter is only to be remotely controlled or operated with a detached control unit. The blank space on the front panel is covered up with filler panel GB 853Z1.

All the above basic modules can be plugged into the 19" Mainframe KR 852 P1. Optional modules such as the FSK Modem GM 852P2 can also be housed in the mainframe.

Upside and downside the receiver/exciter is fully covered by an upper and lower cover. The covers are fixed by means of four quick-release fasteners.

Rubber sealings are attached to the side panels as well as to the front and rear panel where the cover meets the panels so that no dust can penetrate the receiver/exciter.

The individual modules of the receiver/exciter are electrically interconnected by means of a plug-in connector and a carrier printed circuit board. HF signals are not routed via the carrier printed circuit board. They are exchanged via HF cables plugged in on the upper face of the receiver/exciter, directly between the individual modules.

All interfaces to the large-signal units, such as the 1-kW amplifier, are positioned at the rear of the receiver/exciter, at the EMC Filter FK 852P7.

Two identical connectors for the morse key, head phones, microphone, loudspeaker and push-to-talk (PTT) button are positioned at the front on the Control Unit GB 853C1 of the receiver/exciter.

The receiver/exciter is convection cooled. Pressure cooling with ventilators is not necessary.

1.2.2 Functioning

See also Fig. 4.2

1.2.2.1 Functioning Principles

The 20-mW receiver/exciter is used for frequency generation, signal conditioning and the control of subsequent large-signal units, which together go to form the 1-kW HF transceiver.

The entire receiver/exciter is centrally controlled by a microprocessor in the processor module. It takes over the control data from the control unit via the internal, serial V.24 interface and with the detached control unit via the serial V.24/V.28 remote control interface and contains the channel storage for 99 channels. The modules are controlled by a unit integrated data bus. The microprocessor also controls the operating sequence of the internal tests (BITE) and supplies the Line Flattener FK 859C1, or the antenna tuning unit with the required control information.

1.2.2.2 Functioning of Control Unit

A microphone, morse key, head phones, loudspeaker, data terminal and teleprinter can be connected to the Control Unit GB 853. The applied signals are processed as follows:

The microphone voltage is amplified and brought to a constant level of -6 dBm (600 ohms) by a dynamic control circuit. The demodulated incoming signal from the receiver/exciter at a level of -6 dBm (600 ohms) is either switched to an interface with 0 dB (600 ohms) (LINE) or amplified in an AF amplifier to the required level for head phones, integrated loudspeaker or external loudspeaker (1 W, 5 ohms).

An integrated line current source with a level of 60 V/40 mA or ±30 V/±20 mA (V.28) makes it possible to connect a teleprinter. A microprocessor takes over the control of the indicator and serves the V.24/V.28 control interface to the basic unit.

1.2.2.3 Receive Signal Path

The incoming antenna signal can be fed in either via the Tx/Rx junction or a separate input. At first, the incoming signal passes through the filter modules. Each of the three following modules is equipped with a receiver input protection up to 100 V EMF and a low-noise amplifier with high intercept point to compensate the pass-band attenuation of the filter. The appropriate filter is used depending on the requirement at hand:

- The **30-MHz low-pass filter** (basic version) is used in the absence of very strong interfering transmitters and when maximum sensitivity is required.

- The **digitally tuned filter** suppresses interfering transmitters by approx. 15 dB occurring at a frequency spacing of 20 %. It is particularly suitable for frequency hopping because of its short tuning time of only 20 ms.

(Continuation)---

---(Continuation) Reveive Signal Path

- The **motor-tuned filter** is necessary when operating several transceivers simultaneously, for low antenna spacing as well as for nearby interfering transmitters. Suppression of interfering transmitters is effective from a frequency spacing of only 3 to 5 %.

The circuit components of the Tx/Rx section in the signal path are used for transmission as well as reception. A PIN diode control circuit with a control range of 40 dB is positioned in front of the 1st mixer stage, which ensures that no limiting effects occur in the receiver up to an input level of 3 V EMF.

Conversion into the 1st IF of 80.64 MHz occurs with the variable synthesizer output frequency in steps of 10 Hz. An 8-kHz wide quartz filter, which determines the maximum receiving bandwidth takes over the selection in the 1st IF stage.

Two quartz filters are available in the 2nd IF stage with 1.44 MHz. They are used for all transmission modes because of the appropriate control of the transformation frequencies. A vacant filter position is available for customer specified bandwidths. It is possible to use a single sideband filter with levelled group delay for rapid data transmission. Demodulation in an AF signal occurs in the modem (demodulator unit) or in the FSK modem depending on the transmission mode.

A direct voltage source (19 to 31 VDC, e.g. Power Supply IN 859C1) provides the power supply.

1.2.2.4 Signal Path in Exciter

The conversion of AF signals into the low IF (1.44 MHz) occurs in transmission modes LSB, USB, AME and CW in the modem (modulator unit) and in the transmission mode FSK in the FSK modem. For single sideband transmissions the modulation principle results in a lowering of the carrier and the undesired sideband. The subsequent 1.44-MHz IF filter in the Tx/Rx section lowers the undesired signal further, and limits transmission on the transmission mode related bandwidth.

A compressor (IF clipper) is also in the 1.44-MHz IF level. It raises the average output power by 3 dB for speech transmission modes. Two further frequency transformations follow, first in the intermediate frequency 80.64 MHz and then in the transmission frequency in the shortwave band.

The subsequent filters serve to limit synthesizer noise. Three different modules can be used alternatively:

- **30-MHz low-pass filter** (basic version)
- **Digitally-tuned filter** (single circuit filter)
- **Motor-tuned filter** (three circuit filter)

(Continuation)---

---(Continuation) Signal Path in Exciter

The 20-mW transmission signal is output to an external power amplifier (e.g. VK 859C1) which amplifies it, for example to 1 kW (PEP). The output power of the external amplifier is controlled by a PIN diode control circuit in the IF level at the Tx/Rx section output.

The optimum control action is selected in accordance with the various transmission modes.

1.3 Technical Data

Common Data of Transmitter and Receiver

Frequency range

Transmission	1.5 to 29.99999 MHz
Reception	0.4 to 29.99999 MHz
Frequency setting	decadic in 10-Hz increments
Frequency error	
after 10 min warm-up	< 3 x 10^{-7} at +25 °C
within 24 h	< 3 x 10^{-8}
through aging	< 1 x 10^{-6}/year
in operating-temperature range	< 3 x 10^{-7}
Frequency switch-over time incl. Tx/Rx switch-over	≤ 100 ms (without new tuning process of ATU)
Tx/Rx switch-over time	< 10 ms (at same frequency)
Tx/Rx switch-over in classes of emission J3E (A3J), H3E (A3H)	Key on microphone or headset or via separate line
Programmable channels	100 (transmit and receive frequencies programmable separately for half-duplex operation)
Classes of emission	A1A (A1), J3E (A3J) upper sideband and lower sideband switchable, H3E (A3H) upper sideband, J7B (A7J) data radio (via accessories)
Options	
ISB modem	B8E (A3B, Data link operation
FSK modem	F1B (F1) with three deviation steps +42.5 Hz (max. 100 baud) +85 Hz (max. 200 baud) +425 Hz (max. 200 baud)

(Continuation)---

---(Continuation) Technical Data

Selectivity Characteristics

Digitally-tuned Filter
(Alternative version)

Frequency range	1.5 to 30 MHz
Selection ($\Delta f/f \geq 0.15$)	≥ 15 dB
Band-pass filter range	0.4 to 1.5 MHz
Tuning time	approx. 20 ms.

Motor-tuned Filter
(Alternative version)

Frequency range	1 to 30 MHz
Selection ($\Delta f/f = 0.05$)	> 30 dB
($\Delta f/f = 0.1$)	> 40 dB
Low-pass filter range	0.5 to 1 MHz
Tuning time	< 2 s

Operating modes

Rx	Equipment ready to receive
Tx/Rx	Equipment ready to transmit/ receive with 3 power levels low/medium/high

Data radio (with alternative fitting of Tx/Rx section data)

Frequency response 250 to 3350 Hz	≤ 3 dB
Minimal group delay	< 1 ms
Differential group delay	
600 to 3050 Hz	< 500 µs
495 to 3050 Hz	< 900 µs

Connections

AF input/output	0 dBm, 600 ohms, floating
AF output for loudspeaker	1 W at 5 ohms, adjustable, built-in loudspeaker can be switched off
AF output for headphones	50 mW at 600 ohms, adjustable

(Continuation)---

---(Continuation) Technical Data

Microphone input	250 mV (25 to 775 mV), 150 ohms (with power supply for carbon microphone)
Connection for morse key	Transmit: contact closed
Connection for TTY (with optional FSK Modem)	V.28 Line current 60 V/40 mA (Single current) Line current +30 V/±20 mA (Double current)
Connection for external Frequency standard	5 MHz (50 to 500 mV, 50 ohms)
Data interface	for remote control of control unit, computer or terminal (also via modem). Interface lines correspond to V.24 standard. Interface levels correspond to V.11 (RS-422-A) standard. They are also switchable to V.28 (RS-223-C) V.10 (RS-423-A) and RS 485 standards.
Transmit inhibit (Forced reception)	Contact to ground
Receive inhibit (e.g. with simplex ARQ)	Contact to ground

Receiver data

Antenna input	50 ohms
Max. permissible input voltage	
in frequency range 0.4 to 30 MHz	100 V EMF
in frequency range 30 to 400 MHz	50 V EMF
Oscillator reradiation	≤ 5 µV at the antenna input with a 50-ohms termination
Sensitivity (f = 1.5 to 30 MHz) for	
A1A (A1)	< 0,3 µV (< 0.6 µV*) EMF for (S+N)/N = 10 dB, B = 300 Hz
J3E (A3J), J7B (A7J), H3E (A3J)	< 0,6 µV (< 1.5 µV*) EMF for (S+N)/N = 10 dB, B = 2.4 kHz

(Continuation)---

---(Continuation) Technical Data

Receiving bandwidths

Class of emission	CCIR designation	3-dB bandwidth	60-dB bandwidth
CW	A1A, A1B	± 150 Hz	± 375 Hz
AME in Rx mode	H2A, H2B, H3E	- 100 to +2300 Hz	- 700 to +2900 Hz
USB** (and AME Rx/Tx mode)	J3E, R3E**	+ 300 to +2700 Hz	- 300 to +3300 Hz
LSB**		- 300 to -2700 Hz	+ 300 to -3300 Hz
FSK narrow	F1A, F1B	± 150 Hz	± 375 Hz
FSK medium		± 150 Hz	± 375 Hz
FSK broad		±1200 Hz	±1800 Hz

* With motor-tuned or digitally-tuned filter module

**With Tx/Rx section data, 3-dB bandwidth 300 to 3400 Hz, 60-dB bandwidth 300 to 4000 Hz (with corresponding change in AME or FSK mode). Further bandwidths upon request (one filter place, not used is provided).

Interference immunity, non-linearities

Intermodulation (Δ f > 30 kHz
f = 1.5 to 30 MHz) ..... > 70 dB (interfering signals 2 x 100 mV EMF), by using a filter module this value is improved corresponding to the filter attenuation

Blocking ..... ≤ 3 dB signal attenuation, Useful signal 2 mV EMF, interfering signal 4 V EMF Δ f > 30 kHz

Cross modulation ..... ≤ 10 % modulation transfer, useful signal 1 mV EMF, interfering signal 500 mV EMF m = 0.3/1 kHz Δ f > 30 kHz

(Continuation)---

---(Continuation) Technical Data

Inherent noise signals (with low-pass filter)	< 0.4 µV equivalent EMF
Image frequency rejection	> 80 dB
with motor-tuned filter	> 100 dB
IF rejection	> 100 dB
Spurious response (spacing)	> 80 dB for f > 30 kHz
Desensitization	< 24 dB SINAD useful signal 30 µV EMF interfering signal 300 mV EMF Δ f > 30 kHz, B = 2.4 kHz
Weighted S/N ratio	> 46 dB SINAD for 1 mV EMF

Control (HF)

Error of amplitude control	≤ 4 dB (1 µV to 3 V EMF) with motor-tuned filter: 1 µV to 2 V EMF)
Delay time for 60-dB jump	≤ 10 ms
Decay time	50 ms or 500 ms (matched to class of emission)
Beacon frequency oscillator (BFO)	variable by ±2.9 kHz in 100-Hz increments in CW

AF

Monitoring in transmission	Volume adjustable (when pressing the PTT key, loudspeaker switches off automatically)
AF distortion factor	
Line output (0 dBm)	< 1 % for J3E (A3J)
Phones and loudspeaker output at nominal power	< 5 %

.(Continuation)---

---(Continuation) Techncal Data

General Data

Nominal conditions

Nominal temperature range
(VG 95 332, p. 3 and 4) ..... -25 to +55 °C

Storage temperature range
(VG 95 332, p. 3 and 4) ..... -40 to +85 °C

Shock with shockmount ..... 40 g, 11 ms

Vibration with shockmount
(IEC 68-2-6 or VG 95 332 p. 224) ..... 10 to 500 Hz, max. 2 g

Protection against foreign
matter and water ..... DIN 40 050, IP 41
(foreign matter 1 mm,
dripping water)
(detachable control unit
IP 54)

Max. permissible altitude
above sea level ..... 3000 m

Max. permissible humidity
Operation ..... 95 % at +45 °C without
condensation
Storage ..... 95 % at +45 °C with
condensation

EMC ..... acc. to MIL-STD 461 B
class A3, A4

MTBF ..... > 2000 h

Availability $\frac{MTBF}{MTBF \quad MTTR}$ 0.999

Error localisation ..... built-in and displayed digitally upon request on the control unit at module and subassembly level

Power supply

DC (minus connected to ground) ..... 28 VDC nom.

Dimensions (w x h x d) ..... 482 x 176 x 360 mm
(4 height units)

Mass ..... approx. 25 kg

1.4 Models

The Receiver/Exciter GX 859C1 is available in the model range from 05 to 24. To begin with, the different colours of the outer visible parts are categorised as follows:

MOD 05 MOD 08 MOD 12 MOD 15 MOD 18 MOD 22	Front panel: RAL 7035 other outer components: RAL 7011
MOD 06 MOD 09 MOD 13 MOD 16 MOD 19 MOD 23	All outer visible components: RAL 6014
MOD 07 MOD 10 MOD 14 MOD 17 MOD 20 MOD 24	All outer visible components: RAL 7001

Furthermore, the models depend upon the internal fitting of the Receiver/Exciter GX 859C1 (see model survey at the end of part 1).

1.5 Options

The Receiver/Exciter is available in the following optional configuration (see also Fig. 1.3).

Alternative with one of the three following filters:

- 30-MHz Low-pass Filter FK 852P5 or
- Digitally-tuned Filter FK 852P2 or
- Motor-tuned Filter FK 852P4

Alternative either with the

- Tx/Rx section, standard or
- Tx/Rx section with data.

Furthermore, the following module can be alternatively and additionally integrated:

- FSK Modem GM 852P2

1.6 Accessories

Accessories are not required for the basic configuration - without integrated control unit - of the 20-mW receiver/exciter.

If, however, the Control Unit GB 853C1 is integrated for local control, the following accessories, available on special order from Rohde & Schwarz are recommended.

- Handset	GA 852C1	Ident. no. 648.9510.03
- Handset	GA 852C2	Ident. no. 655.5816.03
- Morse key	GA 852C3	Ident. no. 655.5839.03
- Headphones	GA 852C4	Ident. no. 655.5851.02/0
- Headset	GA 852C5	Ident. no. 648.9549.03
- Carbon microphone	GA 852C6	Ident. no. 648.9578.03
- Loudspeaker	GA 852C7	Ident. no. 648.9603.02/0
- Headphones	GA 852C8	Ident. no. 648.9632.02
- Microphone	GA 852C9	Ident. no. 648.9661.02

A Service Kit KA 852C1 (Ident. no. 724.8508.02) is available for repair work.

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2. Preparation for Use and Operation

2.1 Preparation for Use

2.1.1 General Preparation

Prior to operation, the Receiver/ Exciter GX 859C1 is to be installed in a rack either stationary KG 859C4 or mobile KG 859C1 and wired up with the cables inside the rack.

The receiver/exciter is to be fixed in the relevant rack on telescopic rails and connected up manually. Proceed as follows:

1. Mount the Receiver/Exciter GX 859C1 onto the telescopic rails in the upper part of the rack, together with the optional ISB Modem GM 853C1 and/or ALIS Processor GP 853C1 as far as present.

2. Push the receiver/exciter into the rack until the telescopic rails lock on. Thereby the protection device is activated that prevents the equipment from falling out of the rack.

3. Connect the rack internal cables to the receiver/exciter acc. to Fig. 2.1 and 2.2.

4. Push the receiver/exciter fully into the rack and secure with the fixing screws beneath the handles.

5. Connect headset, morse key, loudspeaker, headphones, microphone to the audio sockets that are connected in parallel and located on the front panel of Control Unit GB 853C1 in the receiver/exciter.

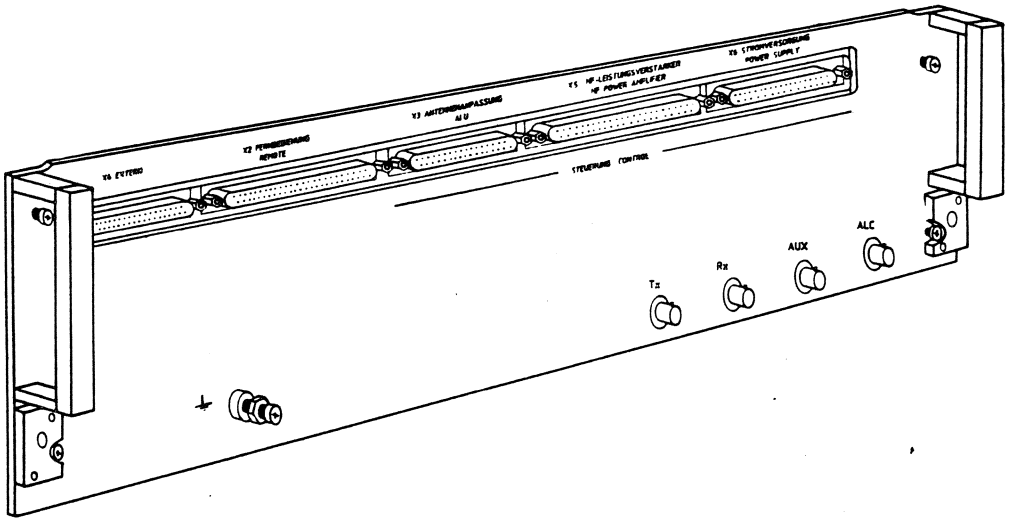

Fig. 2.1 Arrangement of Interfaces at Receiver/Exciter GX 859C1

Note:

The connection of peripheral units and the necessary adjustments are described in the User Manual of the 1-kW HF Transceiver.

2.1.2 Preparation for Remote Control

For remote control of the Receiver/Exciter GX 859C1 from a detached Control Unit GB 853C1, a central computer, e.g. PUC or PCA 5, or a central control unit, e.g. GB 606, various internal settings have to be made (address, data rate, type of V. interface, etc.).

Note:

These settings are described in the user manuals of Control Unit GB 853C1 and 1-kW HF Transceiver XK 859C1.

In local operation the control unit is integrated into the Receiver/Exciter GX 859C1.

It can be removed any distance away due to the standard RS-232-C (V.24/V.28) interface.

At distances of up to 50 m the power supply will come from the receiver/exciter, and at distances of more than > 50 m (detached or remote control) from a separate power supply (accommodated in case KK 853C2).

Up to 1000 m the data line can be a DC four-wire line. Larger distances can be spanned using a telephone channel and modems.

2.2 Operation

2.2.1 Switching On and Off

C A U T I O N
Before switching on, make certain that the receiver/exciter is properly installed in its respective rack and correctly wired up with it.

Switching on

Turn the OPERATION MODE switch (19, Fig. 2.3) on the control unit to the desired operation mode, thereby switching on the receiver/exciter.

The green control LED on the right next to the cooling fins on the front panel of the receiver/exciter must light up.

Note:

- The above instructions are based on the assumption that the appropriate power supply is available at the receiver/exciter.
- If the receiver/exciter is part of the 1-kW HF transceiver, the entire transceiver is switched on when carrying out the above instructions, provided the Power Supply IN 859C1 is switched on.

Switching off

Turn the OPERATION MODE switch (19, Fig. 2.3) on the control unit to OFF.

The green control LED on the right next to the cooling fins on the front panel of the receiver/exciter goes out and the receiver/exciter is switched off.

Note:

If the receiver/exciter is part of the 1-kW HF transceiver, the entire transceiver is switched off when carrying out the above instructions.

2.2.2 Manual Local Control

Manual operation of the Receiver/Exciter GX 859C1 is possible in the following configurations:

1. with an integrated control unit
2. with a detached control unit
3. with an integrated and a detached control unit.

Manual operation is described in detail in the user manuals of the 1-kW HF transceiver and of the control unit.

When using an integrated and a detached control unit manual operation is only possible from one of the control units.

In operation of the receiver/exciter from the detached control unit the integrated control unit must be switched to OFF with the OPERATION MODE switch. If the integrated control unit is cut in while the detached control unit is still active, it will only be possible to operate the receiver/exciter from the integrated control unit.

On the engaged control unit that no longer has priority monitoring (i.e. of the current equipment status) and listening in are still possible.

Listening in to the received and the transmitted AF signal is always possible on both control units.

Activation of the transmitter is only possible from the control unit with priority.

2.2.2.1 Functions of Controls and Indicators

See Fig. 2.3

No.	Inscription	Function
1		Loudspeaker (volume adjustable with volume control (20); can be switched off with switch (24))
2	CHANNEL	Display for channel number
3		Display array for
	STATUS	- ERROR indication
	BFO	- BFO frequency (-2.9 to +2.9 kHz)
	EXT	- Indication that BCD code is issued to externally connected unit
	kHz	- Indication of frequency in kHz
4		Display for
	AME USB LSB ISB CW FSK ▮ FSK ■ FSK ■	Type of modulation
	LINE	- AF switch-on
	NB	- Noise blanker
	VC	- Volume compressor
	HF	- Carrier activation

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Inscription	Function
5	STO	- Key for storing entered equipment status under selected channel number
	RCL	- Key for recalling equipment status stored under selected channel number
6	TEST	Key for triggering internal test of equipment
7	LINE	Key for data transmission in AME, LSB or USB (indication on display (4))
8	TUNE	Key for triggering HF tuning in antenna tuning unit
9	VC	Key reserved for switching interference blanker on/off (indication on display (4))
10	NB	Key for switching noise blanker on/off (indication on display (4))
11	+/-	Keys for - Variation of transmit or receive frequency in 10-Hz place (priority setting after each new switch-on of receiver/exciter) - Variation of transmit or receive frequency with any required frequency step, after input of this frequency step (e.g. lock ++) with keys FRQ, 1, 0, 0. - Variation of 100-Hz place when BFO is switched on - Variation of 1-kHz place in CH and EXT operation - Entry of BFO frequency with correct sign in CW operation
12		Key array for the presetting of
	EXT	- Output of BCD code to externally connected unit
	BFO	- BFO frequency

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Inscription	Function
	CH	- Channel number
	FRQ	- Transmit or receive frequency
13	ENT	Key for
		- Termination of entries for functions EXT, BFO, CH and FRQ
		- Clearing of displayed error number
		- Inquiry of equipment status
14		Key array with digits for channel and frequency entries and for entering type of modulation and polarity in FSK operation
	0 to 9	Digit entries are only effective after using one of the keys in key array 12 (indication on display (2) or (3))
	AME USB LSB CW ISB FSK ▮ FSK ■ FSK ■■	Entry of type of modulation (indication on display (4))
	POL	Entry of polarity in FSK operation (indication by +FSK or -FSK)
15	.	Key for assigning decimal place when entering transmit or receive frequency and BFO frequency
16		Switch for control mode
	MAN	- Manual entry of equipment status (all entries are possible)

(Continuation)---

---(Continuation) Function of Controls and Indicators

No.	Inscription	Function
	CH	- Channel operation In this mode frequency can be varied with keys + and - (11). All other operational settings are blocked. Upon channel recall frequency shown on display array (3) is extinguished after approx. 5 s.
	Tx/Rx	- Storage or readout of equipment status including transmit and receive frequency for simplex operation in conjunction with keys STO or RCL (5). No interruption in operation.
	Rx	- Storage or readout of equipment status for half-duplex operation in conjunction with keys STO and RCL (5). No interruption in operation.
17	SQUELCH	Control for setting squelch threshold
18		Squelch indicator; LED illuminates when AF is enabled
19	OPERATION MODE	Mode switch for
	OFF	- Equipment off
	Rx	- Reception
	Tx/Rx	- Transmission/reception with
	▮	- Low HF output power (100 W)
	■	- medium HF output power (250 W)
	■	- high HF output power (1000 W)
20	VOLUME	Volume control for built-in loudspeaker and/or headphones in headset

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Inscription	Function
21	FSK Rx STBY Tx	Switch in FSK mode for - Reception - Standby - Transmission
22		Parallel audio sockets for connection of loudspeaker and/or headset or morse key
23	HF	Led illuminates with activated carrier
24		On/off switch for built-in loudspeaker

2.2.3 Functional Test

If the OPERATION MODE switch (16, Fig. 2.3) is set to MAN or CH and if then the key TEST (6) is pressed, all segments and points of display arrays (2 to 4) and the SQUELCH indicator (18) must illuminate. If the self-test of the USART interface is positive, a designation letter is sent to the processor module, initiating there a self-test.

The indication that has been present in display area (3), before pressing key TEST (6) reappears if no error is detected. The indication E together with a code of the defective module, e.g. E25 appears, if a defect has been detected.

By using the error lists of part 4 it can be seen that E25 designates the control unit as the location of fault. Several errors are indicated sequentially rotating in a 1-s rythm. The error display can be erased with the keys ENT, FRQ ENT, BFO ENT or EXT ENT. The operating status last present appears again.

2.2.4 Remote Control

The receiver/exciter can be controlled locally on the receiver/exciter itself, either detached over small distances or truly remotely.

A detached control unit is still powered from the receiver/exciter, but for remote control the units have their own power supply.

The telecontrol data are transmitted in both directions - for control and answer-back - in serial form over a CCITT V.24 (EIA RS-232-C) interface.

The transmission speed can be set in steps between 110 and 9600 baud or is determined by external timing. The character format is that of the usual ASCII standard (CCITT V.3). Thus remote control is not only possible from the Control Unit GB 853 but also from a computer, like the Process Controller PUC, or a Central Control Unit GB 606. Furthermore this can be done directly, i.e. without any extra interface.

The interface levels are those of CCITT recommendations V.10 and X.26 (EIA RS-423). Although there is full compatibility with CCITT V.28, substantially greater distances can be covered without the interconnection of any modems. Additional push-pull outputs will also enable balanced operation in line with CCITT V.11 and X.27 (EIA RS-422).

A bus interface can also be implemented for addressed operation. This is made possible by special hardware and software measures.

Note:

Further information on remote control including remote control computer commands are to be found in the user manual of the 1-kW HF transceiver.

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3. Maintenance

The Receiver/Exciter GX 859C1 is entirely maintenance-free.

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4. Troubleshooting

4.1 General

Troubleshooting is performed with the aid of the built-in test and monitoring devices. These execute an internal checkout of the receiver/exciter as part of the 1-kW HF Transceiver XK 859C1 including its large-signal units and the connected external units from the HF 850 radio-equipment family during service without having to be triggered and also signal the functional status of the particular operating mode (continuous monitoring).

The test device furthermore executes an internal checkout of the individual units of the receiver/exciter at module level outside of equipment use when triggered by the TEST key on the control unit.

The results of the checkouts are indicated by a single-digit (CM) or two-digit (BITE) code on the frequency display of the control unit.

Note:

If a fault is indicated, this does not necessarily mean that the Receiver/ Exciter GX 859C1 is unserviceable. The cause of the fault may be an out-of-tolerance condition which will nevertheless allow restricted operation to continue.

Troubleshooting also involves observing the LED and LC displays and listening in to the AF.

4.2 Troubleshooting Instructions

For the event of any disturbance in operation it is advisable to proceed according to the following troubleshooting instructions.

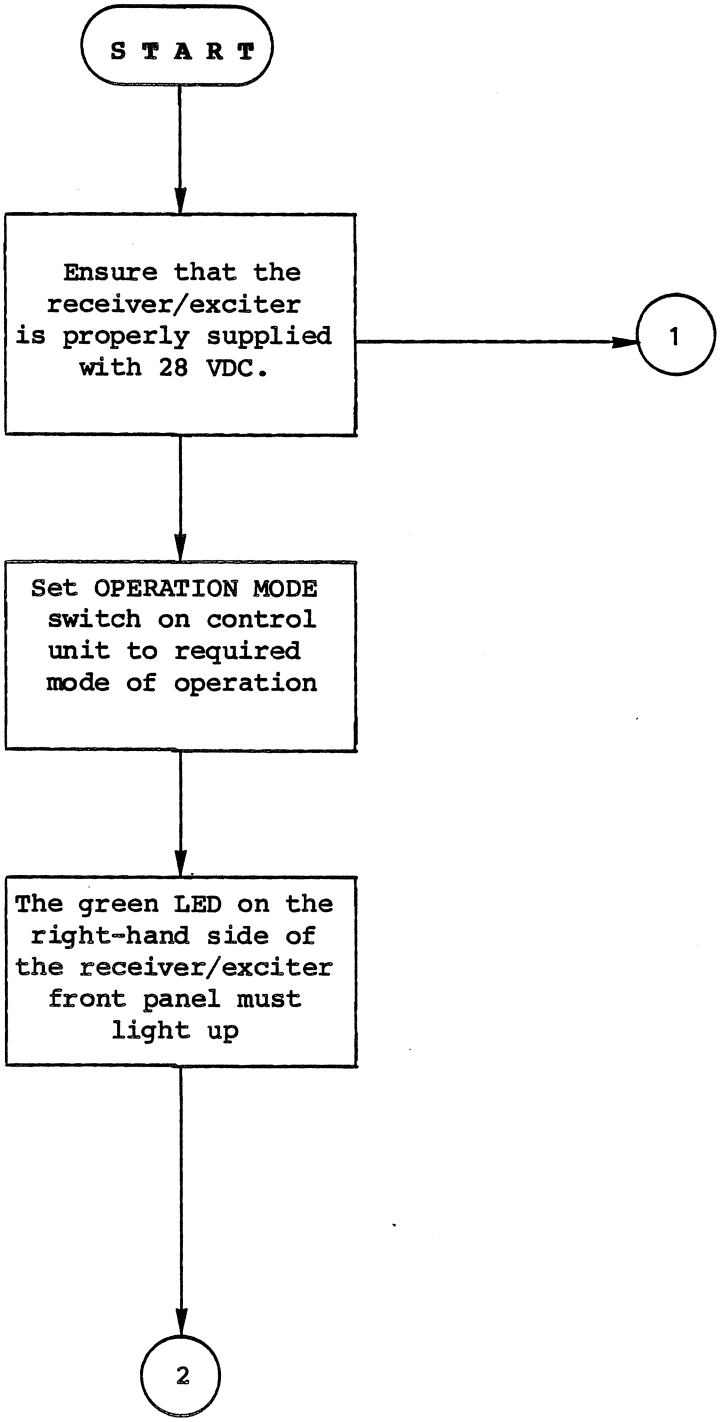

Fig. 4.1 Troubleshooting Flowchart (page 1 of 2)

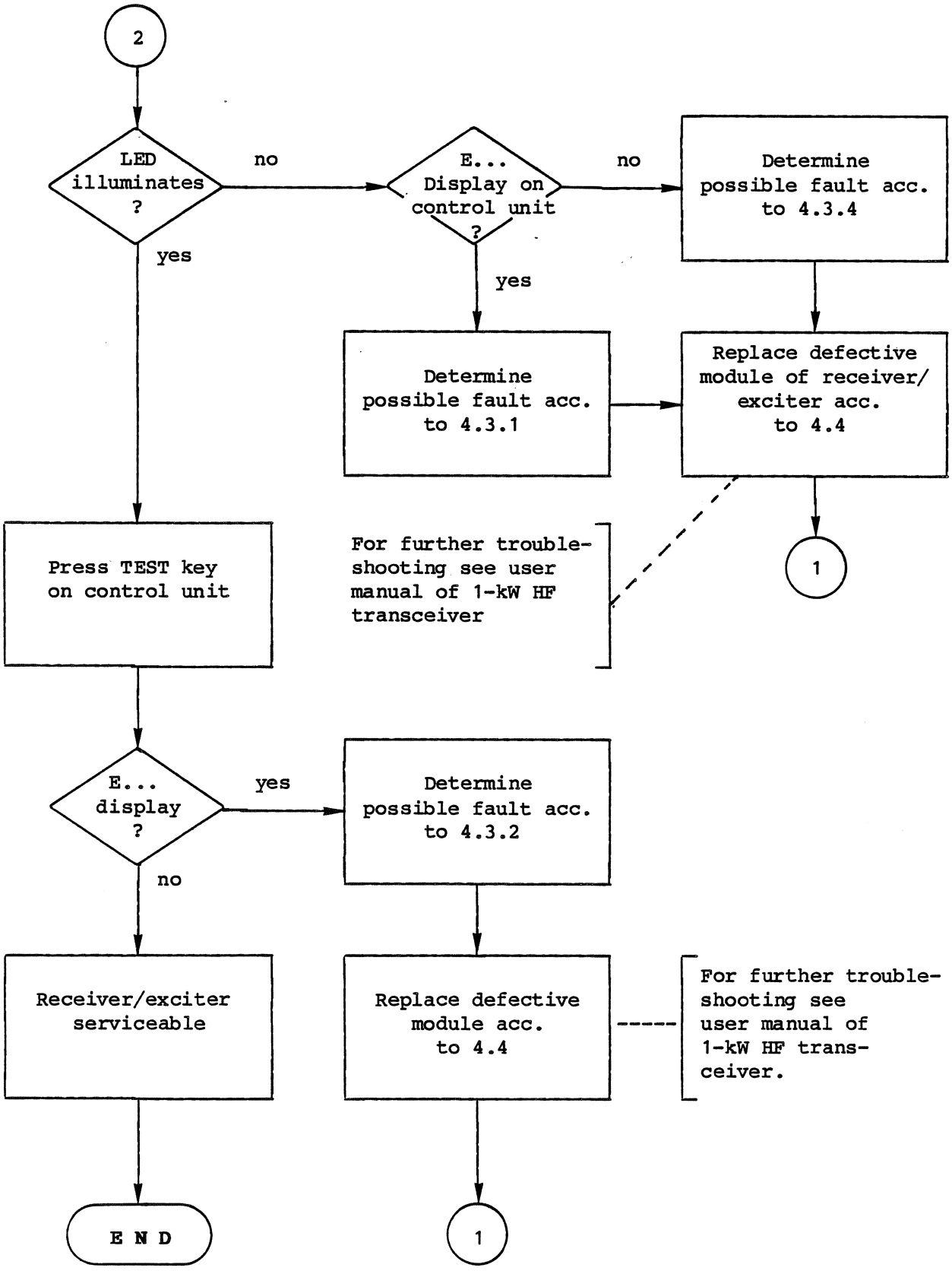

Fig. 4.1 Troubleshooting Flowchart (page 2 of 2)

4.3 Error Lists

The following modules and operational statuses are continuously monitored (CM):

- Synthesizer (unlock)
- Thermostat (synthesizer)
- BFO (modem)
- Tx/Rx section
- Accessory unit
- External unit

4.3.1 Continuous Monitoring (CM) Displays

The following table shows the continuous monitoring displays which apply to the receiver/exciter in their order of priority:

Priority	Code	Designation	Remarks/measure
1	E1	Silence	Transmission inhibited, therefore forced reception only
2	E3	Synthesizer	Transmission and tuning pulse inhibited
3	E4	Thermostat	Warm-up phase
4	E3	BFO error	Transmission and tuning pulse inhibited
5	E3	T/R Section	
6	E5	Accessory	Fault in accessory unit
7	E5	External	Fault in external unit

4.3.2 BITE Displays

4.3.2.1 Displayed Error Locations

Code	Fault location		Remarks
	RECEIVE TEST		
E25	Control unit	Receiver/ Exciter	Self-test of control unit
E31	Synthesizer		CM synthesizer
E32	Modem		CM modem or BITE result
E33	Tx/Rx section		CM Tx/Rx section or BITE
E34	Filter		BITE result
E35	FSK modem		BITE result
E36	Tx/Rx section or modem		BITE result
E37	Filter or Tx/Rx section		BITE result
E38	Tx/Rx section or synthesizer		CM Tx/Rx section
E39	Modem or FSK modem		BITE result
E49	Filter or noise signal		BITE result: disconnect antenna, repeat test
	TRANSMIT TEST		
E63	Antenna, ATU, RF cable to ATU or wrong tuning data		
E82	Harmonic filter (in external amplifier), control, ALC cable or Tx/Rx section		
E83	Preamplifier or RF cable to amplifier		
E84	ALC cable or Tx/Rx section		

4.3.2.2 Displayed Operating States

Code	Significance
E10	Transmission test blocked because of SILENCE
E15	Test blocked because f < 400 kHz
E19	Transmission test blocked because f > 1.5 MHz
E45	Test aborted because control unit is set to TRANSMIT when test is triggered
E70	Test aborted because control unit is on TUNE when test is triggered

The following codes do not appear after a test has been triggered but after certain keys have been pressed on the control unit.

Code	Significance
E20	Receiver/exciter setting incorrect, new setting (modulation, frequency, etc.) is necessary (processor status destroyed)
E21*)	Input format in data telegram wrong or output format wrong with RCL (empty channel)
E22	"Data Set Ready" missing
E23*)	Data word processor — control unit faulty
E24*)	Data word control unit — processor faulty
E26*)	Input or output operation of channel memory faulty (empty channel)
E29*)	Wrong string identification in data telegram
	*) Errors in data telegram caused by: - Control Unit GB 853C1 - communication link - processor of receiver/exciter

4.3.3 Error Displays without Code

Below are the possible causes of an error display "E" without an accompanying code:

1. When entering numerics after pressing FRQ key

   - 1-kW HF transceiver in CH mode
   - Entered frequency < 29999.99 kHz

2. When entering numerics after pressing BFO key

   - 1-kW HF transceiver in CH mode
   - BFO < 2.9 kHz

3. When entering numerics after pressing EXT key

   - 1-kW HF transceiver in CH mode

4. After variation of frequency with key + or -

   - New frequency < 29999.99 kHz
   - New frequency > 0.00 kHz

5. After variation of BFO frequency with key + or -

   - CW class of emission is not set
   - $|BFO|$ < 2.9 kHz

6. After operating numeric keys 1 to 3 and 5 to 9 for class of emission without pressing one of the prime keys (EXT, BFO, CH, FRQ) beforehand

   - Switch for control mode is on CH or Rx

7. After operating numeric key 4 for polarity without pressing one of the prime keys (EXT, BFO, CH, FRQ) beforehand

   - Switch for control mode is on CH or Rx
   - No FSK class of emission

8. After entering decimal point

   - No prime key (BFO, FRQ) has been operated
   - Prime key EXT has been operated
   - Prime key CH has been operated

(Continuation)---

---(Continuation) Error Displays without Code

9. After operating LINE key

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in CH mode
   - 1-kW HF transceiver not in AME, USB or LSB mode
   - Switch for control mode is on Rx

10. After operating NB key (noise blanker)

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in ISB or FSK mode
   - Switch for control mode is on Rx

11. After operating VC key (noise compressor)

   - Last EXT, BFO, CH or FRQ entry is still incomplete (indicated by flashing)
   - 1-kW HF transceiver in CW, ISB or FSK mode
   - Switch for control mode is on Rx

12. After operating ENT key following complete entries for EXT, BFO, CH or FRQ

   - Switch for control mode is on Tx/Rx or Rx

13. After operating BFO key

   - 1-kW HF transceiver in AME, USB, LSB or ISB mode
   - Switch for control mode is on Rx

14. After operating EXT key

   - Switch for control mode is on Rx

15. After operating STO key

   - 1-kW HF transceiver in MAN or CH mode
   - Channel number missing
   - Memory lockout engaged by jumper X104.8 on processor board of control unit

16. After operating RCL key

   - 1-kW HF transceiver in MAN or CH mode
   - Channel number missing

(Continuation)---

---(Continuation) Error Displays without Code

17. After operating TEST key

    - Switch for control mode is on Tx/Rx or Rx
    - Tuning is in progress ("E7" on display)

18. After operating TUNE key

    - Switch for control mode is on Tx/Rx or Rx

19. For all keys

    - OPERATION MODE switch is on OFF

4.3.4 Functions not Covered by BITE

The monitoring of all functions in the modules of the receiver/exciter would make the circuitry excessively complex. For this reason the following functions should also be considered when performing troubleshooting:

- Loudspeaker
- Volume control
- Squelch
- Voice compressor (VC)
- AME demodulation (only in Rx), AME transmission
- Polarity switching
- AGC switching in reception
- EMC filter, in particular EXT interface

For these functions the BITE produces no error indication "Exx" on the frequency display of the control unit after operation of the TEST key.

(Continuation)---

---(Continuation) Functions not Covered by BITE

Symptom	Remarks	possible location of fault
No indication on control unit	Green LED on front panel of receiver/exciter does not light up	- External power supply
	Green LED lights up	- Power supply of control unit - Control unit
All segments and points of display arrays on control unit light up (as well as the LED)	Green LED does not light up	- External power supply
	Green LED lights up, however indication E24 appears when switching off and then switching on again receiver/ exciter	- Processor - Transmission path between control unit and processor
	Green LED lights up, however undefined indication appears when switching off and then switching on again receiver/exciter	- Control unit
Undefined indication appears on control unit	Green LED does not light up	- External power supply
	Green LED lights up	- Control unit

4.3.5 Memory Back-up Batteries

There are lithium batteries for powering the data memories in the processor of the Receiver/Exciter GX 859C1. The batteries are hardly loaded by the memory devices. They only age as a result of their own self-discharge and under normal operating conditions can be expected to last at least five years. Consequently no regular replacement of the batteries is necessary.

If a data memory should suddenly not function and it is thought that this is caused by a flat battery, measure the voltage on the battery with a high-impedance voltmeter.

The nominal open-circuit voltage is 3.7 VDC. The particular battery should be replaced if it reads less than 3.5 VDC.

Removal of the processor in the Receiver/Exciter GX 859C1 as is necessary for battery replacement is described in 4.4.

4.4 Replacement of Modules

The arrangement of the modules in the relevant receiver/exciter can be seen from Fig. 4.2. The HF cabling is shown in Fig. 4.3.

C A U T I O N

- **Before replacing modules, make certain that the power supply to the receiver/exciter is disconnected.**

- **The cabling of the receiver/exciter is described in 2.1.1.**

4.4.1 Removal of Receiver/ Exciter GX 859C1

1. Undo the four captive screws under the handles of the receiver/ exciter.

   Note:

   If options like ALIS Processor GP 853C1 or others are connected to the receiver/exciter, the captive screws under the handles of these optional units also have to be undone.

2. Pull the receiver/exciter together with any options out of the rack, stationary or mobile as far as they will go. The connections on the rear of the equipment must be accessible.

   Note:

   To simplify cabling of the receiver/exciter and its optional equipment, the receiver/exciter is mounted on telescopic rails in the relevant rack.

3. Separate all connectors on the rear of the receiver/exciter.

   Note:

   - Also separate the connectors from the rear of any options connected to the receiver/exciter.

   - Connectors on the front of any option must also be separated.

4. If any options are connected to the receiver/exciter, the four quick-release catches on the bottom of the receiver/exciter then have to be undone. Hold the option while doing this. Afterwards remove the option from the receiver/exciter.

5. Push up the catch that prevents the equipment from falling out of the telescopic rails.

6. Lift the receiver/exciter out of the telescopic rails.

7. The installation of the receiver/ exciter is in the reverse order to the previously described removal.

   Note:

   - The installation of any option with the receiver/exciter is described in the relevant user manual.

   - For the cabling of the receiver/ exciter refer to Fig. 2.2.

4.4.2 Replacement of Control Unit GB 853C1

If the Control Unit GB 853C1, integrated into Receiver/Exciter GX 859C1 is defective, it must be removed according to the following instructions and a new one inserted in its place.

If the receiver/exciter is to be operated with a detached or remote control unit and if no second control unit is available, the built-in control unit must also be removed acc. to following instructions and must be reinstalled, if required.

1. Undo the outer four Phillips screws on the front panel of the control unit.
2. Take the control unit out of Receiver/Exciter GX 859C1.
3. Lift out the 50-way connector on the rear of the control unit with the two locking levers.
4. The installation of the control unit is in the reverse order to the previously described removal.

4.4.3 Plug-in Cassettes

1. Remove receiver/exciter acc. to 4.4.1.
2. Undo the four quick-release catches on each cover panel, top and bottom, of the receiver/exciter and then remove them.
3. Withdraw the RF connections from the module.
4. Turn the Philipps screws holding the module to the frame two or three times to undo them.
5. Undo the retaining screws marked red on the base of the equipment and push them slightly to shift the module upwards.
6. Withdraw the module from the top.
7. Installation of a module is carried out in the reverse order of sequence as the above described removal.

4.4.4 Power Supply

1. Remove receiver/exciter acc. to 4.4.1.
2. Undo the four quick-release catches on each cover panel, top and bottom, of the receiver/exciter and then remove them.
3. Undo the three Philipps screws on the heatsink on the front panel.
4. Withdraw the power supply from the top of the equipment.

4.4.5 Processor

1. Remove receiver/exciter acc. to 4.4.1.
2. Undo the four quick-release catches on each cover panel, top and bottom, of the receiver/receiver and then remove them.

(Continuation)---

---(Continuation) Processor

3. Undo the two Philipps screws marked red on the right-hand side of the frame and on the base of the equipment.

4. Push the Philipps screws slightly on the base of the equipment to shift the processor upwards.

5. Withdraw the processor from the top of the equipment.

6. Installation of the processor is carried out in the reverse order of sequence as the above described removal.

4.4.6 EMC Filter

1. Remove receiver/exciter acc. to 4.4.1.

2. Detach outer Phillips screws securing EMC filter at rear of receiver/exciter.

3. Detach all RF connections from the connectors.

4. Separate all ribbon cable connections.

5. Remove EMC filter to the rear.

6. Installation of EMC filter is carried out in the reverse order of sequence as the above described removal.

ROHDE&SCHWARZ

Radiocommunications Division

User Manual

HF POWER AMPLIFIER 1 kW
VK 859C1

680.6012

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User Manual

HF POWER AMPLIFER 1 kW
VK 859C1

CHARACTERISTICS

PREPARATION FOR USE AND OPERATION

MAINTENANCE

TROUBLESHOOTING

APPENDIX Retrofit of the Transmit/Receive Switch

List of Contents

1. Characteristics

		Page
1.1	Application	1.1
1.2	Design and Functioning	1.4
1.2.1	Design	1.4
1.2.2	Functioning	1.6
1.3	Technical Data	1.9
1.4	Accessories	1.10
1.5	Explanation of Models	1.10

List of Figures

Fig.	Title	Page
1.1	HF Power Amplifier 1 kW VK 859C1	1.1
1.2	HF Power Amplifier with and without Tx/Rx Switch	1.2
1.3	HF Power Amplifier 1 kW VK 859C1 within the System	1.3
1.4	Design of the HF Power Amplifier	1.5
1.5	HF Power Amplifier 1 kW VK 859C1, Block Diagram	1.7

1. Characteristics

1.1 Application

The HF Power Amplifier 1 kW VK 859C1 is part of the HF series of 1-kW shortwave radio equiment. It is designed for the frequency range of 1.5 to 30 MHz and delivers a maximum continuous output power of 1 kW in this frequency range.

The HF power amplifier ist used in 1-kW transceiver systems and in 1-kW transmitters that are installed in the Rack, stationary KG 859C4. This rack can be converted for mobile operation if required.

The HF power amplifier receives the transmission signal from the Receiver/Exciter GX 859C1 and amplifies it to the power output of 1000 W, 250 W or 100 W which is manually set on the Control Unit GB 853 or automatically preset.

The HF power amplifier is operated on one supply voltage of 28 VDC and two voltages of 50 VDC. In addition, a voltage of 220 VAC is required for powering the blowers. All these voltages are furnished by the Power Supply IN 859C1 which is also mounted in the Rack, stationary KG 859C4.

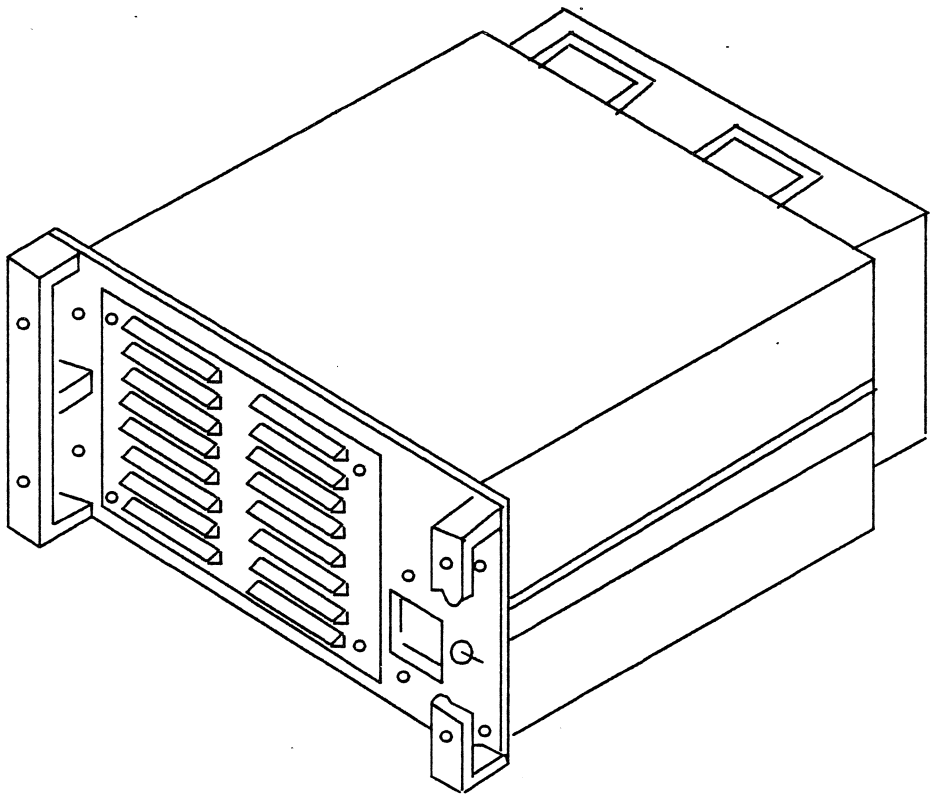
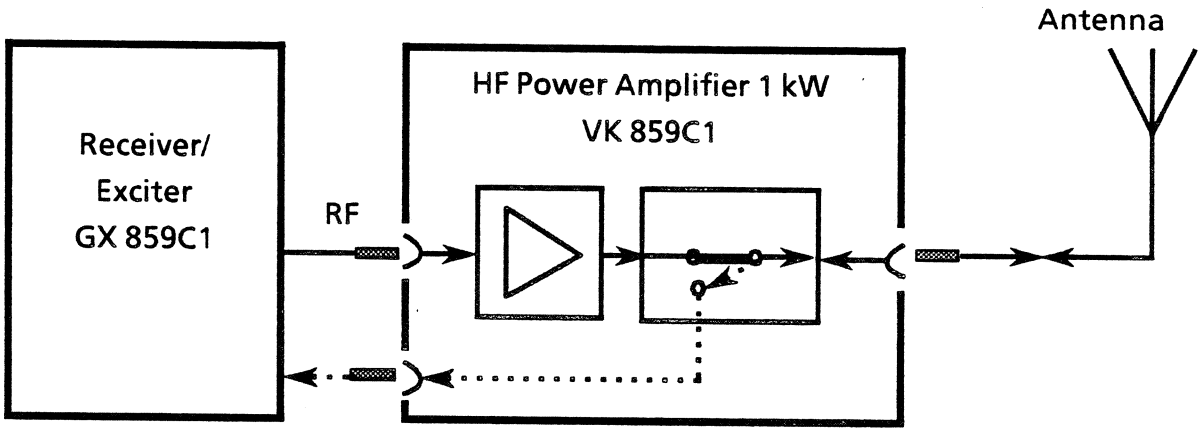


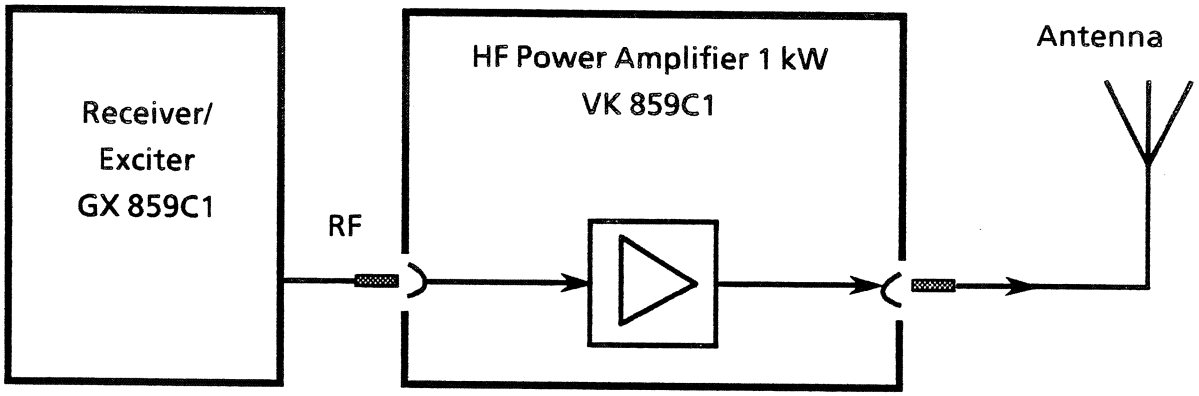
Fig. 1.1 Power Amplifier 1 kW VK 859C1

The HF power amplifier is offered in several models to cater for different applications. A Tx/Rx relay is installed in the basic model. The HF power amplifier can therefore be operated in 1-kW transceiver systems with a combined transmitting/receiving antenna. Another model has a Tx/Rx PIN diode switch instead of the Tx/Rx relay.

The HF power amplifier is also available in a model without any Tx/Rx switchover circuit. Therefore it is particularly suitable for use in 1-kW transmitters.



a) with Tx/Rx switchover circuit



b) without Tx/Rx switchover circuit

Fig. 1.2 HF Power Amplifier with and without Tx/Rx Switch

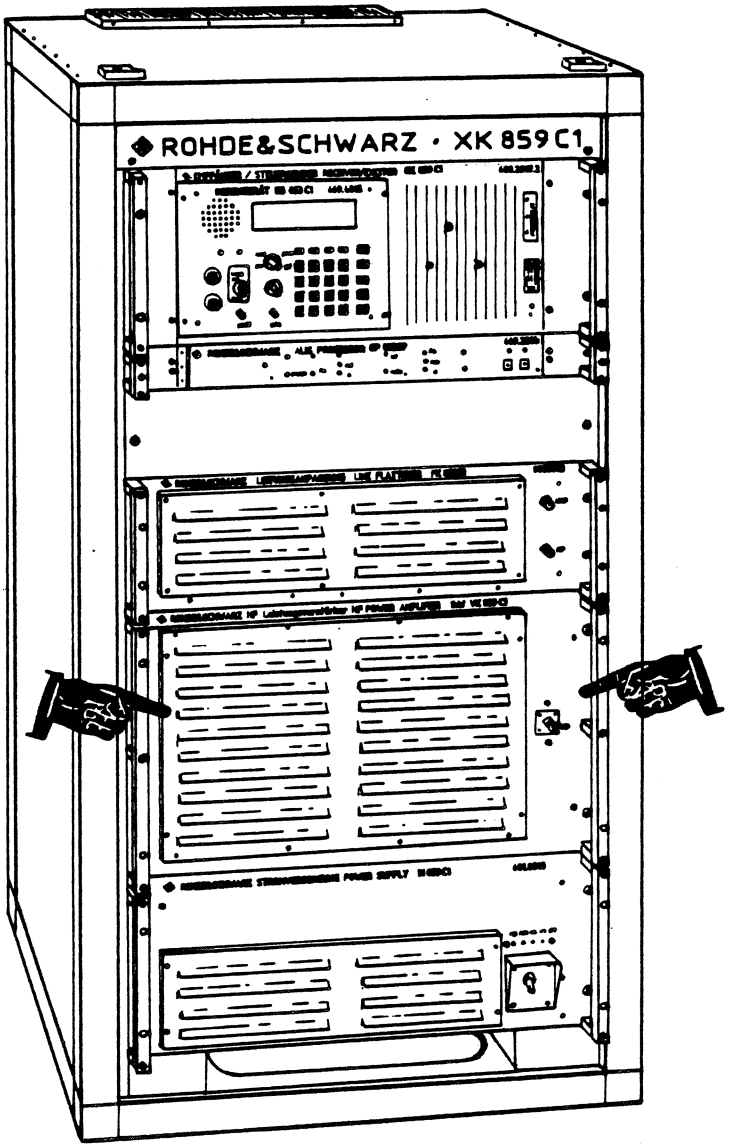


Fig. 1.3 HF Power Amplifier 1 kW VK 859C1 within the System

1.2 Design and Functioning

1.2.1 Design

The HF Power Amplifier 1 kW VK 859C1 consists of a frame, a ventilation system and of several assemblies. The frame is composed of a front panel, a rear panel, two side covers with one guiding rail each to facilitate rack mounting, a top and a bottom cover.

The front panel includes two handles, a protective grid for the ventilation ducts and the antenna connector. A locking device is screw-mounted to both side covers. It prevents the unit from dropping out of the rack when the four screws are loosened which secure the unit to the rack. Two rails on the inside are used for fixing the assemblies to the frame. The right side cover includes two brackets with one attachment rail each for the installation of assemblies. A guiding rail in the centre of the unit facilitates the installation of the harmonics filter.

The rear panel contains the connectors and the blower hood with the necessary protective grids. Two radial blowers and the blower control circuit are mounted inside the blower hood.

The cooling air is taken in by the radial blowers through the protective grid at the front panel and flows by the heat sinks of the individual assemblies, passing an internal partition and an air inlet duct and arriving at the blowers through the rear panel.

The heated air is exhausted by the radial blowers through the protective grids mounted to the blower hood.

Seen from the front the output stage A30 is mounted to the upper attachment rails. The preamplifier is installed behind the output stage. The amplifier control circuit is installed in the upper corner of the right-hand side cover.

The harmonics filter to which, if present, also the Tx/Rx relay or the Tx/Rx PIN diode switch is mounted, is fixed to the centre guiding rail. The output stage A40, is screw-mounted to the lower guiding rails, seen from the front. The combiner is installed behind the output stage and also screw-mounted to the lower guiding rails.

The mechanical design of the preamplifier, combiner and output stage assemblies is very similar. The assemblies consist of a shielded PCB, a cover, a spring plate and a heat sink with cooling plates. The amplifier control circuit consists of a PCB only. The harmonics filter is installed in a housing of its own that contains a separate blower.

The HF power amplifier is intended to be installed into the Rack, stationary KG 859C4 directly above the power supply. All connectors at the rear panel of the HF power amplifier are automatically connected when it is installed into the rack. The antenna is connected to the RF connector at the front panel. This ensures all electrical and signal connections between the HF power amplifier, the Rack, stationary KG 859C4, and the antenna.

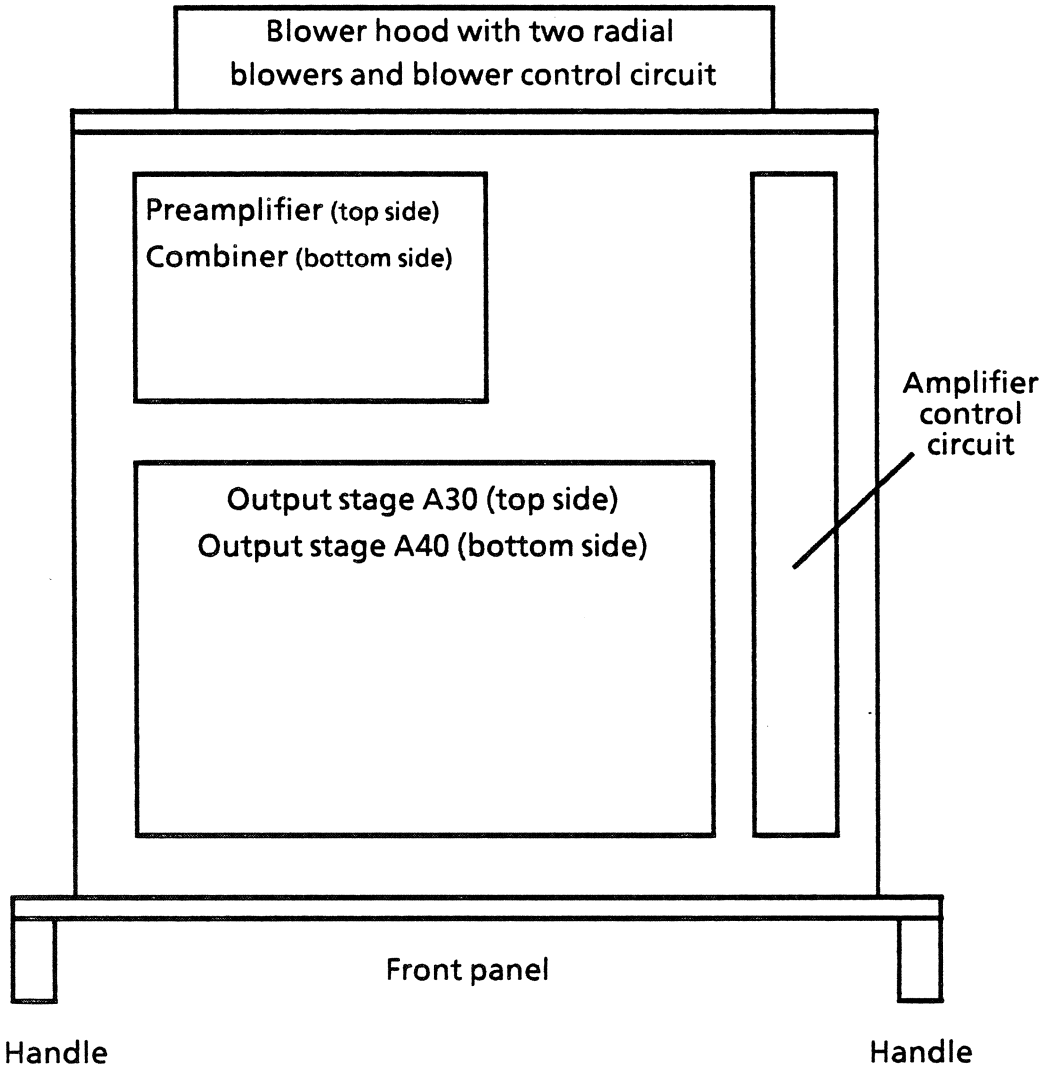


Fig. 1.4 Design of the HF Power Amplifier

1.2.2 Functioning

The HF Power Amplifier 1 kW VK 859C1 consists of the assemblies listed below:

- Preamplifier
- Two 500-W output stages
- Combiner
- Harmonics filter
- Amplifier control circuit
- Blower control circuit
- Two radial blowers
- Optional Tx/Rx relay or Tx/Rx PIN diode switch

Transmitting Mode Operation

Two stages contained in the preamplifier boost the signal applied to the HF input to approx. 10 W. A subsequent splitter divides the boosted signal into two voltages of equal phase. Each of these two voltages is applied to a separate 500-W output stage. In both output stages, a splitter divides the amplified voltage into four signals of equal phase. Each of these signals is amplified separately by a push-pull stage.

The four amplified voltages are combined as signals of equal phase in a subsequent combiner that also decouples the amplifiers from each other. Absorber resistors are used to compensate phase differences and line imbalance. The combiner, which also compensates for any imbalances, produces the sum signal of each output stage.

The combined signal is fed from the combiner to the harmonics filter. There the harmonics generated by the amplification are filtered out by means of a low-pass filter switched into circuit.

The control circuit of the harmonics filter selects the low-pass filters, switches on the blowers and also controls the Tx/Rx relay or the Tx/Rx PIN diode switch via a control cable, if a Tx/Rx switch has been installed. The filtered signal is fed via the directional coupler either directly or via the Tx/Rx switch to the antenna connector. The directional coupler provides the control voltages required for the power control. The amplified and filtered signal is then routed to the antenna.

The amplifier control circuit monitors and controls the individual assemblies, evaluates an error message and the "overtemperature" signal from the preamplifier. It also controls the operating points of the power transistors and the 10-dB attenuator inside the preamplifier, which is only switched on at the lowest power level.

If overtemperature is detected inside the HF power amplifier the radial blowers are switched on by the amplifier control circuit. If the thermal load continues to rise the output power is continuously decreased by the amplifier control circuit. In this case the signal amplifier overtemperature is sent to the control unit and E9 is then displayed.

If the thermal load continues to rise in spite of the power reduction, the amplifier control circuit switches off the entire HF power amplifier. The signal overtemperature is set and signalled to the control unit. The control unit then displays E97 = "overtemperature".

The amplifier control circuit also monitors the preamplifier, the Tx/Rx PIN diode switch (if installed) and itself.

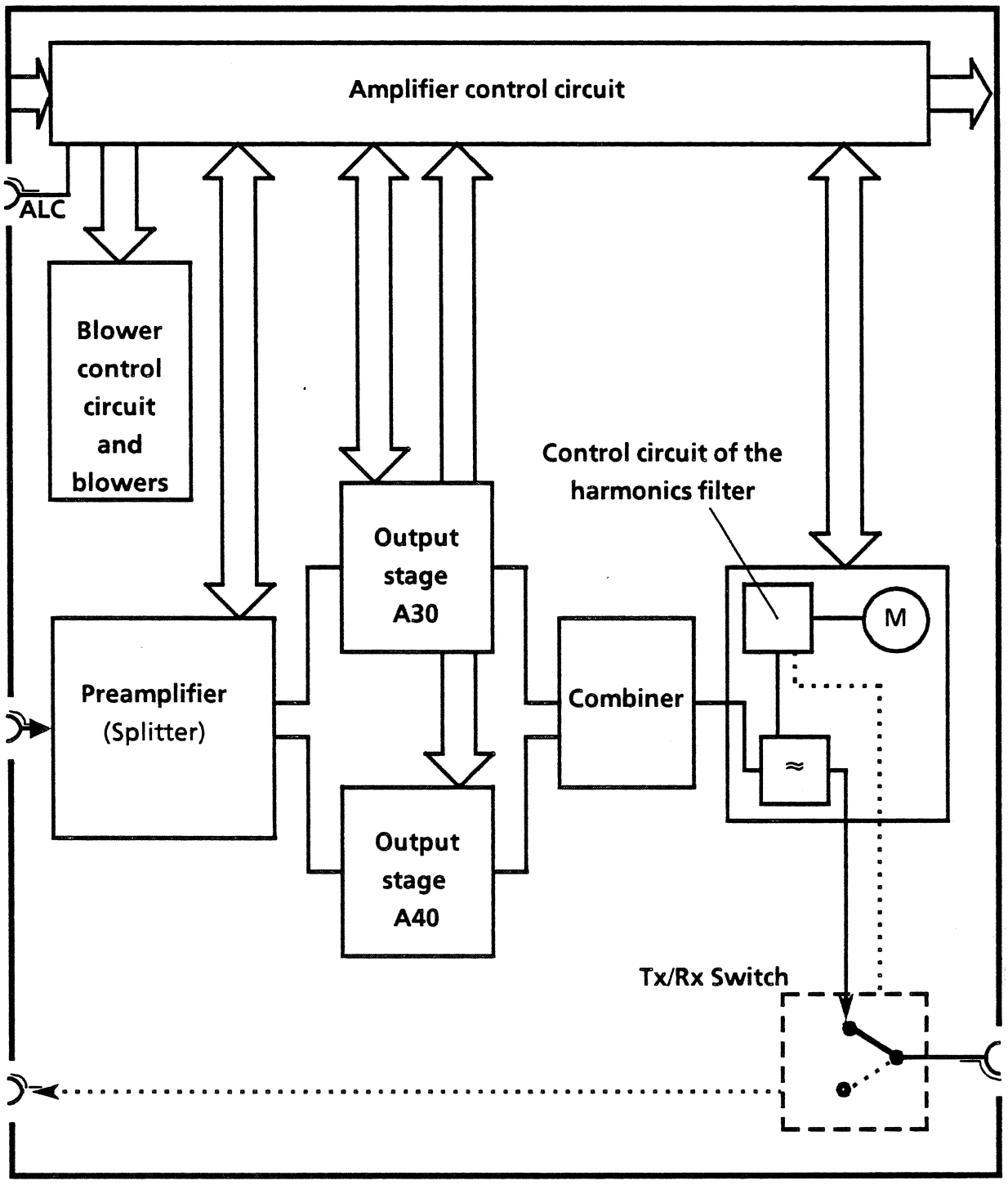


Fig. 1.5 HF Power Amplifier 1kW VK 859C1, Block Diagram

---(continued)

If the preamplifier reports overlevel (e.g. when an output stage has too little gain), an immediate "emergency switch-off" of the HF power amplifier is performed by the amplifier control circuit. The error message preamplifier is set and forwarded to the control unit, which then displays E95.

The Tx/Rx PIN diode switch, when installed in the HF power amplifier, reports if the 700-V control voltage for the PIN diodes is missing. The amplifier control circuit then switches off the HF power amplifier. Additionally, the Tx/Rx PIN diode switch measures the power at the outputs of the combiner, the filters and the directional coupler in the harmonics filter and at the output to the antenna. Deviations from the nominal value are reported to the amplifier control circuit which switches off the HF power amplifier when the deviations are too great. The corresponding error message is then set and displayed on the control unit.

If the Tx/Rx relay is installed in the HF power amplifier instead of the Tx/Rx PIN diode switch, no error message is generated by the Tx/Rx relay.

If a failure occurs in the amplifier control circuit itself, the HF power amplifier is also switched off. The error message amplifier control circuit is set and forwarded to the control unit, which then displays E96.

The power of the output stages is also reduced if the product of current and voltage is greater than the preset nominal value, e.g., with overcurrent or overvoltage. In this case a controlled power reduction is performed. The power is continuously reduced in correspondence with the measured output stage currents. If the VSWR becomes ≥ 1.3, a continuous reduction also takes place.

The amplifier control circuit evaluates the signals "overtemperature", "VSWR" and "available HF power" from the harmonics filter. It is also used to control the control circuit in the harmonics filter. When the overtemperature message is output by the harmonics filter, the "amplifier overtemperature" signal is set.

Receiving mode operation

Receiving mode operation is only possible if either the Tx/Rx relay (model 02, 03 and 04) or the Tx/Rx PIN diode switch (model 22, 23 and 24) is installed.

During receiving mode operation, the HF power amplifier is by-passed by the appropriate Tx/Rx switch. The HF signal is then directly routed from the antenna to the HF input via the Tx/Rx switch.

1.3 Technical Data

Frequency range	1.5 to 30 MHz
Output power (switchable at 50 ohms)	1000 W ± 0.5 dB 250 W 100 W
Permissible impedance mismatch	VSWR ≤ 1.3
Signal-to-noise ratio (according to CCIR specifications for the A3E mode as referred to peak envelope power)	> 50 dB
Harmonics filter attenuation	> 56 dB_c
Spurios signal attenuation	> 70 dB_c
Power supply	
Blowers	220 VAC, 47 to 63 Hz
Output stage	45 to 52 VDC
Preamplifier	28 VDC
Power consumption (for an HF output power of 1 kW)	approx.. 3 kW
Temperature ranges Operating temperature	-25 to + 55 °C
Storage temperature	-40 to + 60 °C
Dimensions	
Front panel (W x H)	482.6 mm x 265.2 mm
Seated depth from front panel	547 mm
Mass	50 kg

1.4 Accessories

One user manual is supplied as an accessory with each HF Power Amplifier 1 kW VK 859C1. If the HF power amplifier is delivered as part of a system, the user manual is part of the system user manual.

1.5 Explanation of Models

The HF Power Amplifier 1 kW VK 859C1 is available in several models, which have either a Tx/Rx relay or a Tx/Rx PIN diode switch or no Tx/Rx switch at all. Accordingly, they are characterized by different colours.

Model	Colour	Built-in Tx/Rx Switch
02	RAL 7035, light grey	with built in Tx/Rx relay
03	RAL 6104, NATO olive	
04	RAL 7001, Navy grey	
12	RAL 7035, light grey	without built-in Tx/Rx switch for application in transmitters only.
13	RAL 6104, NATO olive	
14	RAL 7001, Navy grey	
22	RAL 7035, light grey	with built-in Tx/Rx PIN diode switch
23	RAL 6104, NATO olive	
24	RAL 7001, Navy grey	

List of Contents

2. Preparation for Use and Operation

Page

2.1 Preparation for Use 2.1

2.1.1 Installation of the HF Power Amplifier into the Rack KG 859C4 .... 2.1

2.2 Operation 2.2

2.2.1 General 2.2

2.2.2 Restricted Operation with a Combined Transmit/receive Antenna 2.2

List of Figures

Fig.	Title	Page
2.1	Front and Rear View of the HF Power Amplifier 1 kW VK 859C1	2.3

2. Preparation for Use and Operation

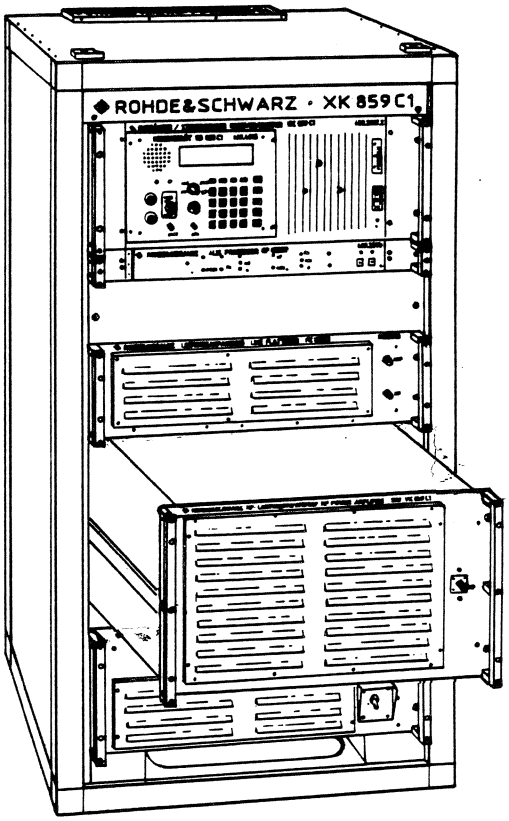
2.1 Preparation for Use

2.1.1 Installation of the HF Power Amplifier into the Rack KG 859C4

WARNING

The HF power amplifier 1 kW has a mass of 50 kg. We recommend lifting the HF power amplifier into the rack by 2 persons only to prevent injuries.

1. Push the HF power amplifier into the space provided until some resistance is felt (see Fig. below).
2. Push the locking devices on both sides upwards that prevent the unit from dropping out of the rack, and push the unit into the rack until it comes to a stop.
3. Fix the HF power amplifier to the rack using four captive screws under the handles.
4. Connect the RF cable of the antenna to the RF socket (2. Fig. 2.1).



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2.2 Operation

2.2.1 General

The HF Power Amplifier 1 kW VK 859C1 does not require any manual operation. The HF power amplifier is automatically controlled according to the settings on the control unit by the processor in the Receiver/Exciter GX 859C1.

Three different HF output power levels (100 W, 250 W and 1 kW) can be preselected manually on the Control Unit GB 853C1.

2.2.2 Restricted Operation with a Combined Transmit/receive Antenna

Combined transmit/receive operation is only possible when a Tx/Rx switch is installed. If the Tx/Rx switch becomes defective for some reason, it must be replaced.

If the defective Tx/Rx switch cannot be replaced and transmission must be continued, the Tx/Rx relay or the Tx/Rx PIN diode switch must be removed according to 4.3.8.

List of Contents

3. Maintenance

Page

3.1. General 3.1

3. Maintenance

3.1 General

The HF Power Amplifier 1 kW VK 859C1 is entirely maintenance-free.

List of Contents

4. Troubleshooting

		Page
4.1	General	4.1
4.2	Troubleshooting	4.1
4.2.1	Functional Test	4.2
4.2.2	Visual Inspection	4.3
4.3	Replacing Defective Assemblies	4.4
4.3.1	General	4.4
4.3.2	Removal of the HF Power Amplifier	4.4
4.3.3	Replacing the Output Stage A30	4.4
4.3.4	Replacing the Output Stage A40	4.5
4.3.5	Replacing the Harmonics Filter	4.5
4.3.6	Replacing the Amplifier Control Circuit	4.5
4.3.7	Replacing the Preamplifier	4.6
4.3.8	Replacing the Combiner	4.6
4.3.9	Replacing the Tx/Rx Switch	4.6
4.3.9.1	Replacing the Tx/Rx Relay	4.6
4.3.9.2	Replacing the Tx/Rx PIN Diode Switch	4.7

List of Figures

Fig.	Title	Page
4.1	HF Power Amplifier 1 kW VK 859C1, Block Diagram	4.9
4.2	Front View	4.11
4.3	Top View	4.11
4.4	Side View	4.11
4.5	Bottom View	4.11
4.6	Harmonics Filter	4.13
4.7	Harmonics Filter with Tx/Rx Relay	4.13
4.8	Harmonics Filter	4.15
4.9	Harmonics Filter with Tx/Rx PIN Diode Switch	4.15

4. Troubleshooting

4.1 General

A constant check is maintained on the HF Power Amplifier 1 kW VK 859C1 during operation. This supervision is performed by the continuous monitoring (CM) circuit in the Receiver/Exciter GX 859C1.

It also monitors the individual assemblies of the HF power amplifier. All failures occuring in the HF power amplifier are combined and forwarded as a sum message to the CM circuit.

Failures in the HF power amplifier cause an error message E9 to be output on the Control Unit GB 853 of the associated transmitter or transceiver systems.

Note:

A built-in self-test circuitry (BITE) continuously monitors all essential functions of the HF power amplifier.

4.2 Troubleshooting

Additionally, an interruptive test can be initiated at the Control Unit GB 853, which interrupts operation and checks the HF power amplifier assemblies individually.

If the error message E9 "amplifier" appears on the Control Unit GB 853, first perform the functional test acc. to 4.2.1. This functional test via BITE should locate a defective assembly.

The defective assembly must then be replaced acc. to 4.3. Perform the visual inspection acc. to 4.2.2 after removing the HF power amplifier.

After replacing the defective assembly, carry out the functional test acc. to 4.2.1 again to ensure that the fault is corrected.

If, however, the functional test acc. to 4.2.1 should not reveal a defective assembly in the HF power amplifier, then carry out the visual inspection acc. to 4.2.2. Give special attention to the mating connectors.

To shorten the downtime, the HF power amplifier can be replaced completely when a corresponding error message is displayed. The faulty HF power amplifier must then be sent for repair.

4.2.1 Functional test

Note:

The HF power amplifier must be mounted in the Rack KG 859C4 for the functional test.

When a test routine is started by pressing the appropriate key on the control unit, error messages of the HF power amplifier are evaluated by the processor of the Receiver/Exciter GX 859C1.

If the test routine detects a fault in the HF power amplifier, the error message E (Error) appears in the frequency display of the control unit together with a code number (Code) that identifies the defective assembly.

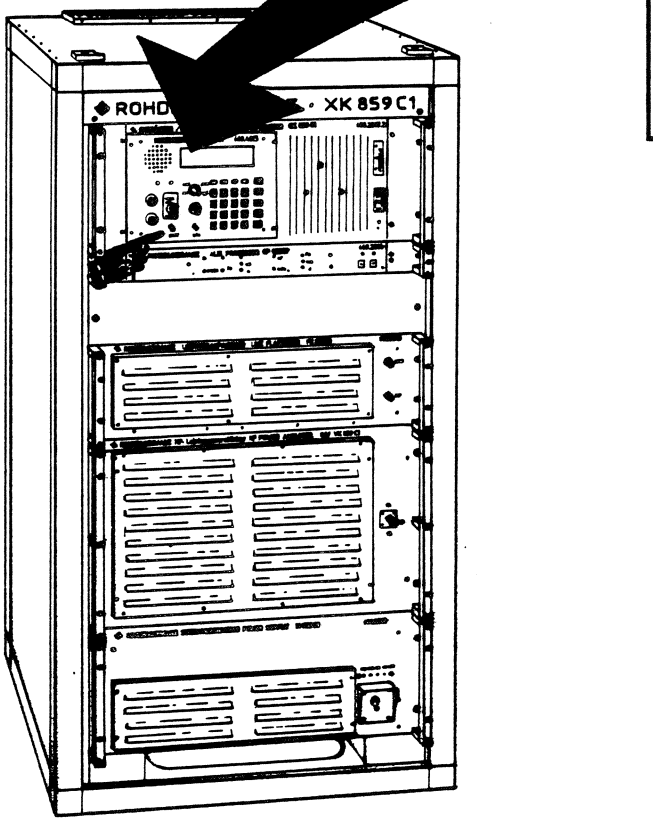
If the error message E9 "amplifier" appears on the Control Unit GB 853 as a result of the continuous monitoring, the HF power amplifier must be checked for the following:

- Protective grids of front panel and blower hood dusty or obstructed?

Should the protective grids be dusty or obstructed, any dust or obstruction must be removed.

If the radial blowers are not operational, blowers and blower control circuit should be checked by the repair facility.

Error message	Defective Assembly
E 81	Harmonics filter
E 82	Harmonics filter, amplifier control circuit, cable for automatic level control
E 90	Both output stages
E93	Output stage A30
E94	Output stage A40
E95	Preamplifier
E96	Amplifier control circuit
E 97	Overtemperature



4.2.2 Visual Inspection

1. Disconnect the HF connection cable to the antenna at the front panel of the HF power amplifier.

2. Undo the four captive screws under the handles that fix the HF power amplifier to the rack.

3. Pull the HF power amplifier by the handles out of the rack until the stop is felt.

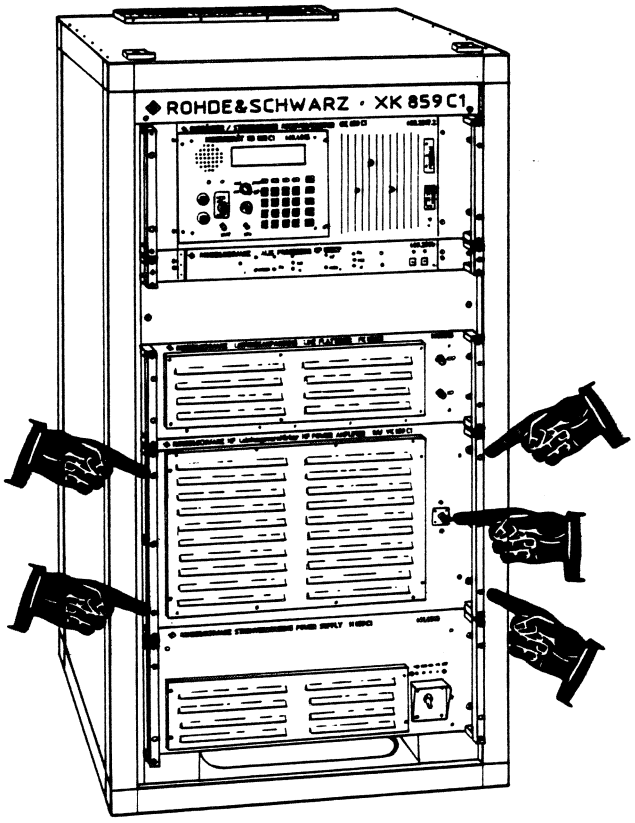
WARNING

The HF Power Amplifier 1 kW VK 859C1 has a mass of 50 kg! We recommend lifting the HF power amplifier out of the rack KG 859C4 by two persons only to prevent injuries.

4. Push the locking devices on both sides that prevent the unit from dropping out of the rack upwards, then pull the HF power amplifier out of the rack.

5. Check that all connectors are firmly seated, then inspect for bent, corroded or broken contacts. If necessary, send the unit for repair.

6. Check that all screws on the frame are present. Replace any missing screws.



4.3. Replacing Defective Assemblies

4.3.1 General

Note:

- *Replacement of the assemblies should only be performed by skilled personnel.*
- *Remove defective assemblies very cautiously. If some resistance is felt, ensure that all instructions for the replacement have been performed in the order given. Further inspect all visible cables of the relevant assembly if they are still fixed somewhere.*
- *All location numbers mentioned refer to Figs. 4.2 to 4.9.*

4.3.2 Removal of the HF Power Amplifier

1. At the front panel disconnect the HF connection to the antenna.
2. Undo the four screws that fix the HF power amplifier to the rack.
3. Pull out the HF power amplifier until the locking devices mounted on the sides are visible.
4. Push the locking devices on both sides that prevent the unit from dropping out of the rack upwards, then carefully pull the unit further out.

WARNING

The HF Power Amplifier 1 kW VK 859C1 has a mass of 50 kg! We recommend lifting the HF power amplifier out of the rack KG 859C2 by two persons only to prevent injuries.

5. Remove the HF power amplifier from the rack completely and place it on the blower hood.
6. Before replacing defective assemblies, undo the twelve screws (1, 5 and 8, Fig. 4.2) that secure the protective grid of the amplifier.
7. Remove the protective grid.

4.3.3 Replacing the Output Stage A30

1. Remove the HF power amplifier according to 4.3.2.
2. Undo the ten screws (1, Fig. 4.3) that secure the top cover of the HF power amplifier.
3. Remove the top cover.
4. Unlock the HF connector (12) to the left and disconnect it.
5. Unscrew and disconnect the RF cable (7).
6. Disconnect the 50-V connectors (14).
7. Push the locking tabs of the data bus connector (8) behind the front panel to the side and disconnect it.
8. Undo the screws (2, 3, 6 and 7, Fig. 4.2) that secure the front panel of the HF power amplifier.
9. Remove the front panel.
10. Undo the four screws (11, Fig. 4.3)
11. Remove the output stage A30 by pulling it upwards.
12. Installation of the output stage is performed in the reverse order.

4.3.4 Replacing the Output Stage A40

1. Remove the HF power amplifier according to 4.3.2.
2. Undo the ten screws (1, Fig. 4.5) that secure the bottom cover of the HF power amplifier.
3. Remove the bottom cover.
4. Unlock the RF connector (7) by turning it counter-clockwise and disconnect it.
5. Unscrew and disconnect the RF cable (3).
6. Disconnect the 50-V connectors (8).
7. Push the locking tabs of the data bus connector (5) behind the front panel to the side and disconnect it.
8. Undo the ten screws (2, 3, 6 and 7, Fig. 4.2) that secure the front panel of the HF power amplifier.
9. Remove the front panel.
10. Undo the four screws (6, Fig. 4.5).
11. Remove the output stage A40 by pulling it upwards.
12. Installation of the output stage is performed in the reverse order.

4.3.5 Replacing the Harmonics Filter

1. Remove the HF power amplifier according to 4.3.2.
2. Undo the ten screws (1, Fig. 4.3) that secure the top cover of the HF power amplifier.
3. Remove the top cover.
4. Disconnect the data bus connector (10).
5. Undo the ten screws (1, Fig. 4.5) that secure the bottom cover of the HF power amplifier.
6. Remove the bottom cover.
7. ***CAUTION***

   Unscrew and disconnect the RF connector (3, Fig. 4.4). If a TxIRx switch (TxIRx relay or TxIRx PIN diode switch) is screw-mounted to the harmonics filter, disconnect also the RF connector (4) by turning it counter-clockwise.
8. Undo the ten screws (2, 3, 6 and 7, Fig. 4.2) that secure the front panel of the HF power amplifier.
9. Undo the screws (2, Fig. 4.4) at the right and left side cover.
10. Remove the front panel and the harmonics filter by pulling them upwards.
11. Undo the four screws (4, Fig. 4.2) that secure the harmonics filter to the front panel.
12. Remove the front panel.
13. Installation of the harmonics filter is performed in the reverse order.

4.3.6 Replacing the Amplifier Control Circuit

1. Remove the HF power amplifier according to 4.3.2.
2. Undo the ten screws (1, Fig. 4.3) that secure the top cover of the HF power amplifier.
3. Remove the top cover.
4. Push the locking tabs of the data bus connectors (5, 6 and (8)) at the side of the HF power amplifier to the side and disconnect it.

5. Undo the three screws (1, Fig. 4.4) that secure the amplifier control circuit to the right side cover.

6. Carefully remove the amplifier control circuit by pulling it out sidewards.

7. Disconnect the data bus connectors (2, 3, 4 and 10, Fig. 4.3)

8. Installation of the amplifier control circuit is performed in the reverse order.

4.3.7 Replacing the Preamplifier

1. Remove the HF power amplifier from the rack according to 4.3.2.

2. Remove the output stage A30 according to 4.3.3.

3. Undo the ten screws (1, Fig. 4.5) that secure the bottom cover of the HF power amplifier.

4. Remove the bottom cover.

5. Disconnect the 28-V connector (15, Fig. 4.3).

6. Push the locking tabs of the data bus connector (6) to the side and disconnect it.

7. Unscrew the two cable clamps (16).

8. Unlock the RF connector (7, Fig. 4.5) and disconnect it by turning counterclockwise.

9. Unscrew the two cable clamps (10, Fig. 4.5).

10. Undo the four screws (13, Fig. 4.3).

11. Remove the preamplifier by pulling it out upwards (and thereby feed the RF connector 7 through the cable duct).

12. Installation of the preamplifier is performed in the reverse order.

4.3.8 Replacing the Combiner

1. Remove the HF power amplifier from the rack according to 4.3.2.

2. Remove the output stage A40 according to 4.3.4.

3. Unlock the RF connector (3, Fig. 4.4) by turning it counterclockwise and disconnect it..

4. Unlock the HF connector (2, Fig. 4.5) and disconnect it.

5. Unscrew the two cable clamps (10, Fig. 4.5).

6. Undo the four screws (9).

7. Remove the combiner by pulling it out upwards.

8. Installation of the combiner is performed in the reverse order.

4.3.9 Replacing the Tx/Rx Switch

4.3.9.1 Replacing the Tx/Rx Relay

1. Remove the HF power amplifier from the rack according to 4.3.2.

2. Remove the harmonics filter together with the Tx/Rx relay according to 4.3.5.

3. Undo the 32 screws (1, Fig. 4.5) that secure the cover of the harmonics filter.

4. Remove the cover.

5. Undo the five screws (10) that secure the cover of the harmonics filter control circuit.

6. Remove the cover.

7. Undo the four screws (5, Fig. 4.7) that secure the cover of the Tx/Rx relay.

8. Remove the cover.

9. Undo the contact screws (8, Fig. 4.6).

10. Unscrew the cable bracket (7) and the cable clamp (6).

11. Undo the contact screws (3, Fig. 4.7).

12. Unscrew the cable bracket (2) and the cable clamp (4).

13. Disconnect the control cable connector (9, Fig. 4.6).

14. Unscrew the cable clamp (4).

15. Undo the four screws (1, Fig. 4.7) that secure the Tx/Rx relay to the harmonics filter.

16. Remove the Tx/Rx relay together with cables W5 and W10.

17. Secure the cover of the Tx/Rx relay with four screws (5, Fig. 4.7).

18. Installation of the Tx/Rx relay is performed in the reverse order.

4.3.9.2 Replacing the Tx/Rx PIN Diode Switch

1. Remove the HF power amplifier from the rack according to 4.3.2.

2. Remove the harmonics filter together with the Tx/Rx PIN diode switch according to 4.3.5.

3. Remove the cover.

4. Undo the five screws (10, Fig. 4.8) that secure the cover of the harmonics filter control circuit.

5. Remove the cover.

6. Undo the four screws (4, Fig. 4.9) that secure the cover of the Tx/Rx PIN diode switch.

7. Remove the cover.

8. Undo the contact screws (8, Fig. 4.8).

9. Unscrew the cable bracket (7) and the cable clamp (6).

10. Undo the contact screws (3, Fig. 4.9).

11. Unscrew the cable bracket (2).

12. Disconnect the control cable connector (9, Fig. 4.8).

13. Unscrew the cable clamp (4).

14. Undo the four screws (1, Fig. 4.9) that secure the Tx/Rx PIN diode switch to the harmonics filter.

15. Remove the Tx/Rx PIN diode switch together with cables W5 and W10.

16. Secure the cover of the Tx/Rx PIN diode switch with four screws (4, Fig. 4.9).

17. Installation of the Tx/Rx PIN diode switch is performed in the reverse order.

List of Contents

Appendix
Retrofit of the Transmit/Receive Switch

		Page
A.1	General	A.1
A.2	Retrofit of the Tx/Rx Relay	A.2
A.3	Retrofit of the Tx/Rx PIN Diode Switch	A.4

List of Figures

Fig.	Title	Page
A.1	Harmonics Filter with Tx/Rx Relay	A.3
A.2	Harmonics Filter with Tx/Rx PIN Diode Switch	A.5

A Appendix
Retrofit of the Transmit/Receive Switch

A.1 General

The HF Power Amplifier 1 kW VK 859C1 is delivered without a Tx/Rx switch for use with 1-kW HF transmitters.

In this case the HF power amplifier has the model designation 12, 13 or 14, depending on its external colour.

If required, the 1-kW HF transmitter can be easily retrofitted to a transceiver without large difficulty or cost.

This is possible because a transmitter only differs from a transceiver due to its missing Tx/Rx switch.

A transmitter can be converted to a transceiver by installing a Tx/Rx switch (either Tx/Rx relay or Tx/Rx PIN diode switch) in the HF Power Amplifier 1 kW VK 859C1.

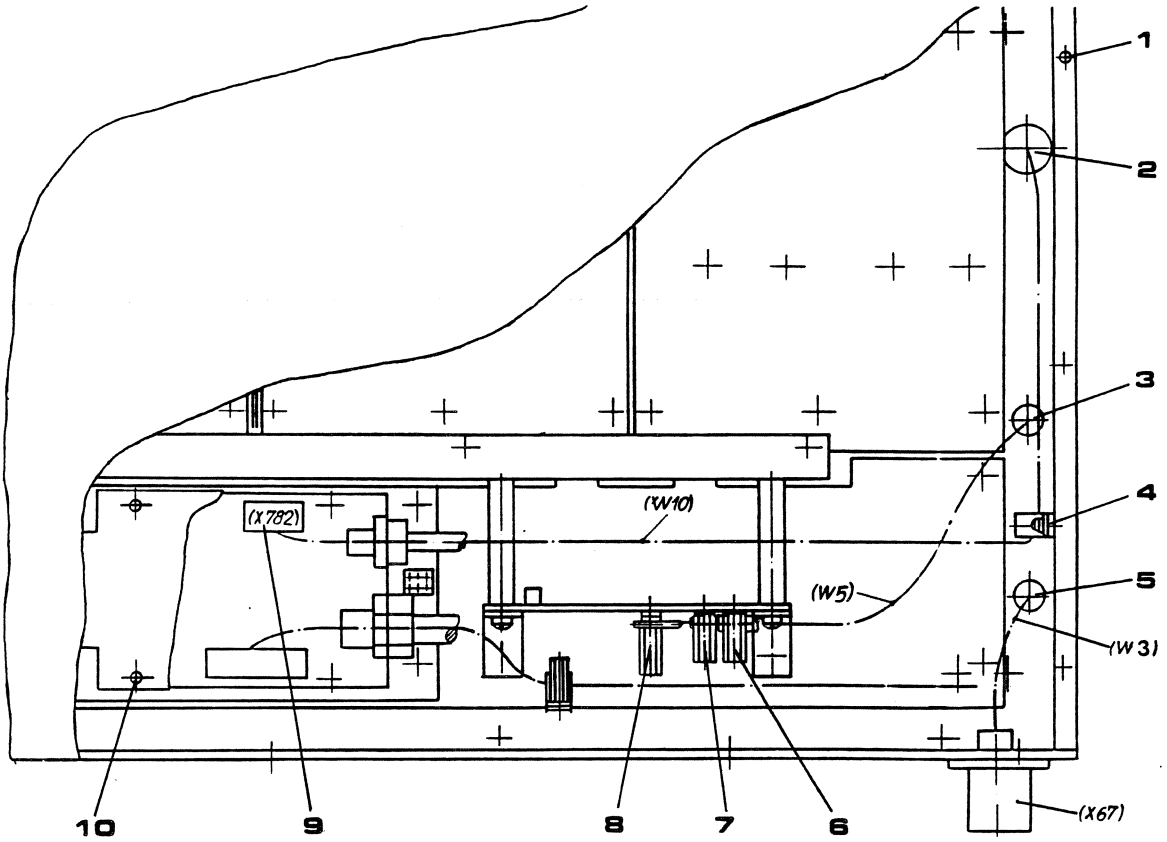
This retrofit of the Tx/Rx switch can be easily performed by the customer. Follow the instructions in A.2 for the Tx/Rx relay or A.3 for the Tx/Rx PIN diode switch.

CAUTION

The model label on the HF Power Amplifier 1 kW VK 859C1 must be exchanged after retrofitting the TxlRx switch.

A.2 Retrofit of the Tx/Rx Relay

1. Remove the HF power amplifier according to 4.3.2.
2. Remove and open the harmonics filter according to 4.3.5, steps 2 to 13. (If W3 is connected, remove it from the directional coupler).
3. Undo the four screws that secure the cover plate to the bottom of the harmonics filter. (The plate is located in the position where the Tx/Rx relay is to be mounted).
4. Remove the plate.
5. Undo the 32 screws (1, Fig. A.1) that secure the cover of the harmonics filter.
6. Remove the cover.
7. Undo the five screws (10, Fig. A.1) that secure the cover of the harmonics filter control circuit.
8. Remove the cover.
9. Fix the Tx/Rx relay to the bottom of the harmonics filter with four screws (11).
10. Undo the four screws (15) that secure the cover of the Tx/Rx relay.
11. Remove the cover.
12. Undo the contact screw (8).
13. Unscrew the cable bracket (7) and the cable clamp (6).
14. Unscrew the cable bracket (12) and the cable clamp (14).
15. Undo the screw (13).
16. Lead RF cable W3 through the opening (5), the bottom of the harmonics filter, the cable clamp (14) and the cable bracket (12).
17. Secure the contact using the screw (3).
18. Secure the cable bracket (12) and the cable clamp (14) using the respective screws.
19. Lead RF cable W5 simultaneously with W3 through the bottom of the harmonics filter and the opening (3).
20. Simultaneously with W3 lead the control cable W10 through the bottom of the harmonics filter and through the opening (2).
21. Lead cable W5 through the cable clamp (6) and the cable bracket (7).
22. Secure the contact using the screw (8).
23. Secure the cable bracket (7) and the cable clamp (4) using the respective screws.
24. Lead cable W10 through the cable clamp (4) and connect to its mating connector (9).
25. Secure the cable clamp (4) using the repective screw.
26. Screw down the cover of the Tx/Rx relay with four screws (15).
27. Secure the cover of the harmonics filter control circuit with five screws (10).
28. Fix the cover of the harmonics filter with 32 screws (1).
29. Reinstall the harmonics filter in the HF power amplifier acc. to 4.3.5.
30. Reinstall the HF power amplifier in the rack.



Harmonics Filter

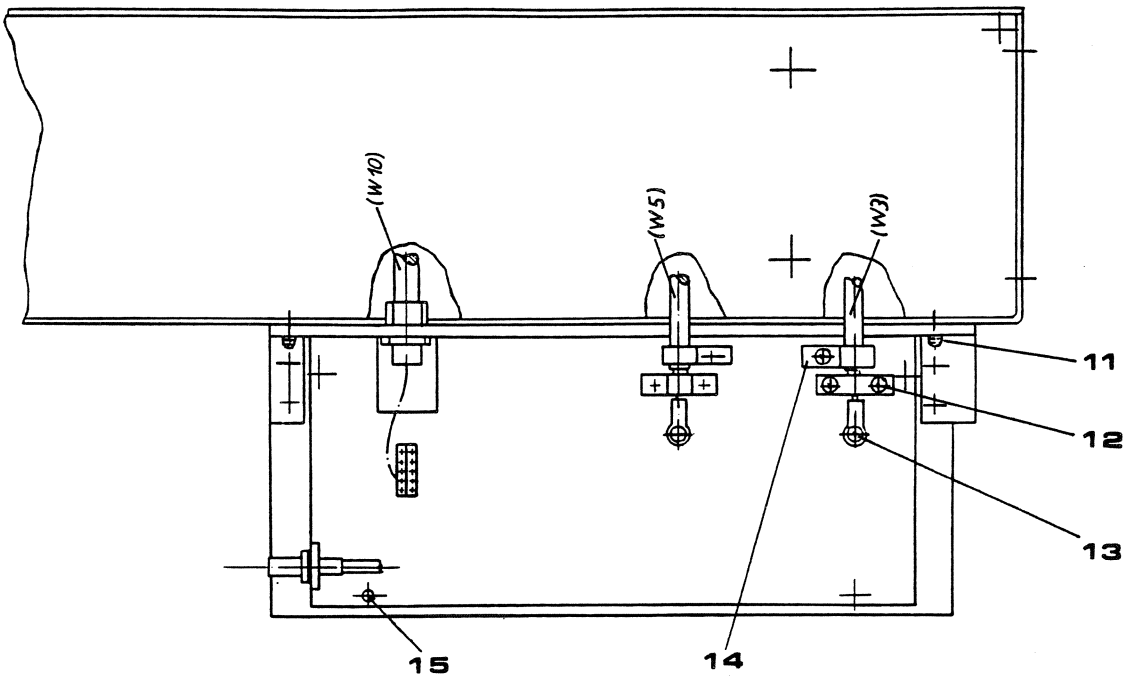
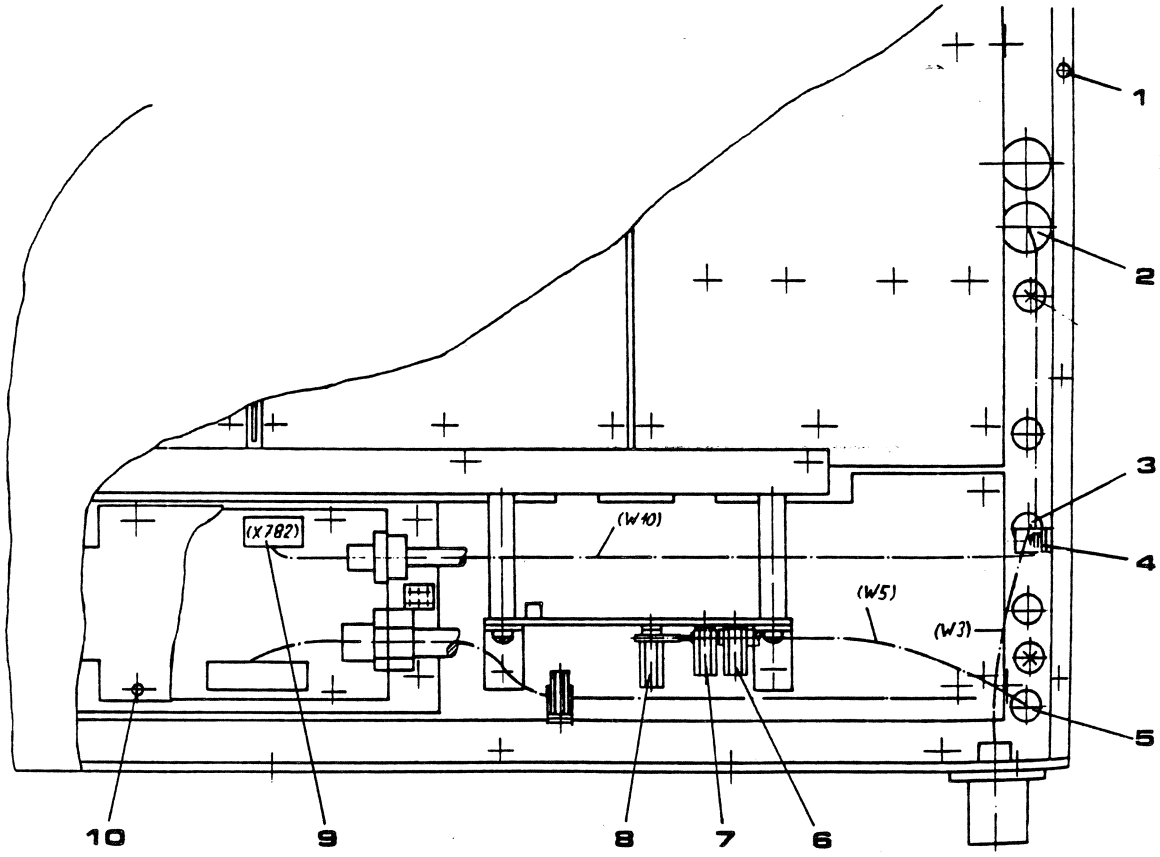


Fig. A.1 Harmonics Filter with Tx/Rx Relay

A.3 Retrofit of the Tx/Rx PIN Diode Switch

1. Remove the HF power amplifier according to 4.3.2.
2. Remove and open the harmonics filter according to 4.3.5, steps 2 to 13. (If W3 is connected, remove it from the directional coupler).
3. Undo the four screws that secure the cover plate to the bottom of the harmonics filter. (The plate is located in the position where the Tx/Rx PIN diode switch is to be mounted).
4. Remove the plate.
5. Undo the 32 screws (1, Fig. A.2) that secure the cover of the harmonics filter.
6. Remove the cover.
7. Undo the five screws (10) that secure the cover of the harmonics filter control circuit.
8. Remove the cover.
9. Fix the Tx/Rx PIN diode switch to the bottom of the harmonics filter with five screws (11).
10. Undo the six screws (14) that secure the cover of the Tx/Rx PIN diode switch.
11. Remove the cover.
12. Undo the contact screw (8).
13. Unscrew the cable bracket (7) and the cable clamp (6).
14. Unscrew the cable bracket (12).
15. Undo the screw (13).
16. Lead RF cable W3 through the opening (3), the bottom of the harmonics filter, and the cable bracket (12).
17. Secure the contact using the screw (13).
18. Secure the cable bracket (12) using the respective screw.
19. Lead RF cable W5 simultaneously with W3 through the bottom of the harmonics filter and the opening (5).
20. Simultaneously with W3 lead the control cable W10 through the bottom of the harmonics filter and through the opening (2).
21. Lead cable W5 through the cable clamp (6) and the cable bracket (7).
22. Secure the contact using the screw (8).
23. Secure the cable bracket (7) and the cable clamp (4) using the respective screws.
24. Lead cable W10 through the cable clamp (4) and connect to its mating connector (9).
25. Secure the cable clamp (4) using the repective screw.
26. Screw down the cover of the Tx/Rx PIN diode switch with five screws (14).
27. Secure the cover of the harmonics filter control circuit with five screws (10).
28. Fix the cover of the harmonics filter with 32 screws (1).
29. Reinstall the harmonics filter in the HF power amplifier acc. to 4.3.5.
30. Reinstall the HF power amplifier in the rack.



Harmonics Filter

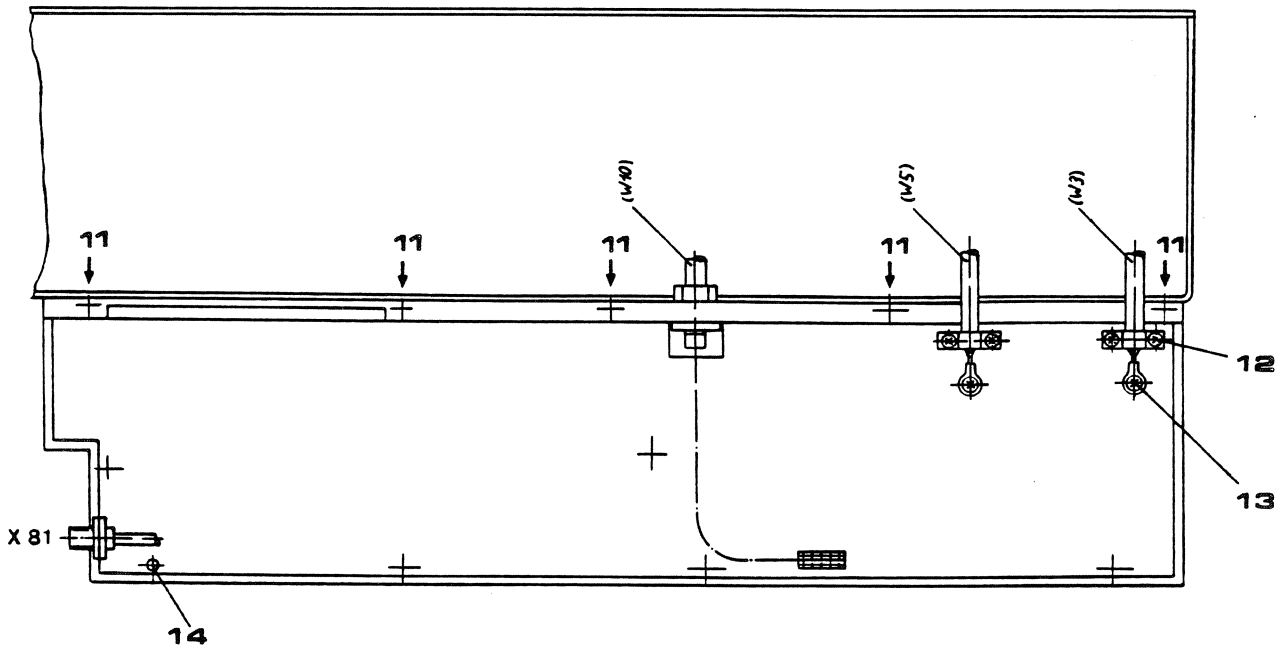


Fig. A.2 Harmonics Filter with Tx/Rx PIN Diode Switch

ROHDE&SCHWARZ

Communications Division

User Manual

POWER SUPPLY IN 859C1

681.0018

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List of Contents

1. Characteristics

		Page
1.1	Application	1.1
1.2	Design and Functioning	1.2
1.2.1	Design	1.2
1.2.2	Functioning	1.4
1.3	Technical Data	1.6
1.4	Models of Power Supply IN 859C1	1.8
	Parts List	681.0018.01SA

2. Preparation for Use

2.1	Preparation for Use	2.1
2.2	Unpacking and Visual Inspection	2.1
2.3	Installation	2.1

Page

2.4 Functions Set Ex Works 2.2
2.4.1 Operating Voltage 2.2
2.4.2 Jumpers 2.2

2.5 Functions of Connectors and Blowers 2.3

3. Operation

3.1 General 3.1

3.2 Functions of Control Elements and Indicators 3.2

4. Maintenance and Troubleshooting

4.1 Maintenance 4.1
4.1.1 Taking Care 4.1
4.1.1.1 Cleaning 4.1
4.1.1.2 Repair of Blemishes in Varnish Coating 4.1

4.2 Troubleshooting 4.2
4.2.1 General 4.2
4.2.2 Troubleshooting Instructions 4.2

Page

4.2.3 Replacement of Assemblies and Components 4.8

4.2.3.1 Removal and Opening of the Module 4.8
4.2.3.2 Replacement of Fuses F1 to F3 ..... 4.8
4.2.3.3 Replacement of Defective Converters 4.9
4.2.3.3.1 Replacement of 50-V Converters 4.9
4.2.3.3.2 Replacement of 28-VDC Converter 4.9

List of Figures

Fig. Title Page

1.1 Power Supply IN 859C1 ..... 1.1
1.2 Simplified View of the Interior 1.3
1.3 Simplified Block Diagram 1.9

2.1 Installation into Rack KG 859 ..... 2.5
2.2 Installation Drawing - Rack 2.7
2.3 Rear View of Power Supply IN 859C1 ..... 2.9

3.1 Front View of Power Supply IN 859C1 ..... 3.5

4.1 Troubleshooting Flowchart 4.3
4.2 Removing and Opening the Power Supply 4.11
4.3 Position of Fuses F1 to F3 on the Filter Circuit 4.13
4.4 Replacement of Converters 4.15
4.5 Power Supply IN 859C1, Block Diagram 4.17

Appendix 1 ..... Interface Description

1. Characteristics

1.1 Application

The Power Supply IN 859C1 is part of the HF 850 family of 1-kW short-wave radio equipment. It is used in Rack KG 859 in conjunction with HF transmitters or transceivers.

The power supply can be operated on a 110-VAC or 220-VAC mains voltage (**only three-phase AC voltages**). This corresponds to a phase / phase voltage of 200 V (220 V) or 380 V (400 V, 440 V).

Power Supply IN 859C1 provides two DC voltages from 45 to 52 VDC adjustable in steps of 1 VDC and one fixed DC voltage of 28 VDC. These DC voltages are generated by three primary-switched voltage converters. The DC voltages are used to power the 1-kW Amplifier VK 859 and the Receiver / Exciter GX 859.

In addition, the power supply provides a single-phase voltage of 220 VAC which is used to power the blowers contained in the 1-kW amplifier.

By connecting the power supply to an external 24-VDC battery, transmit or transceive operation is still possible (switchover operation) at reduced HF output power even if there is a mains power failure.

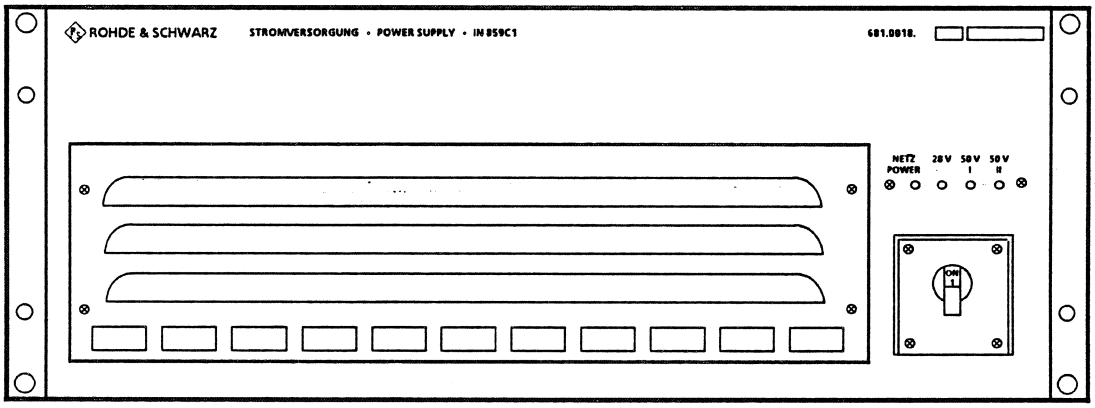


Fig. 1.1 Power Supply IN 859C1

1.2 Design and Functioning

1.2.1 Design

(See Fig. 1.2)

Power Supply IN 859C1 consists of a housing, several subassemblies with their respective heat sinks and a hood.

The housing (A50) is made up of two side panels, the base plate, a rear and an intermediate panel, the front panel as well as control circuit A10 and filter circuit A501.

The front panel includes two handles, a protective grill for the ventilation ducts, an LED board (A502), a cover for the protective switch and the protective switch MAINS for the mains input (three-phase current).

To each of the side panels a guiding rail and a locking device are fixed.

The guiding rails are required for installation of Power Supply IN 859C1 into Rack KG 859. The locking devices prevent the power supply from falling out unintentionally when it is pulled out of the rack.

On the rear panel there are two blower hoods and the connectors.

The cooling air is taken in by the blowers through the protective grill on the front panel. It passes the cooling fins, and the heated air is exhausted through the blower hoods on the rear panel.

After removal of the hood the 28-VDC converter (A40) can be seen in the front part of the rack. The converter consists of two interconnected heat sinks, a hood, a rectifier V100, the converter board (A101) and the control circuit (A102).

On the left-hand side behind the 28-VDC converter the 50-VDC converter (A20) is located whereas the 50-VDC converter (A30) is on the right-hand side. The converters are of identical design and consist of a heat sink, a hood, the converter board (A101), the control circuit (A102) as well as of the capacitor board (A103).

Directly in front of the rear panel, that is, on the blower housing, the control circuit (A10) is located.

To the intermediate panel the toroidal-core transformer T100 and the filter circuit (A501) are fixed. The filter circuit contains the fuses F1, F2 and F3.

On the right-hand side panel the noise-suppressing chokes (L1 to L3) and the EMC filters (Z1 to Z4) are located.

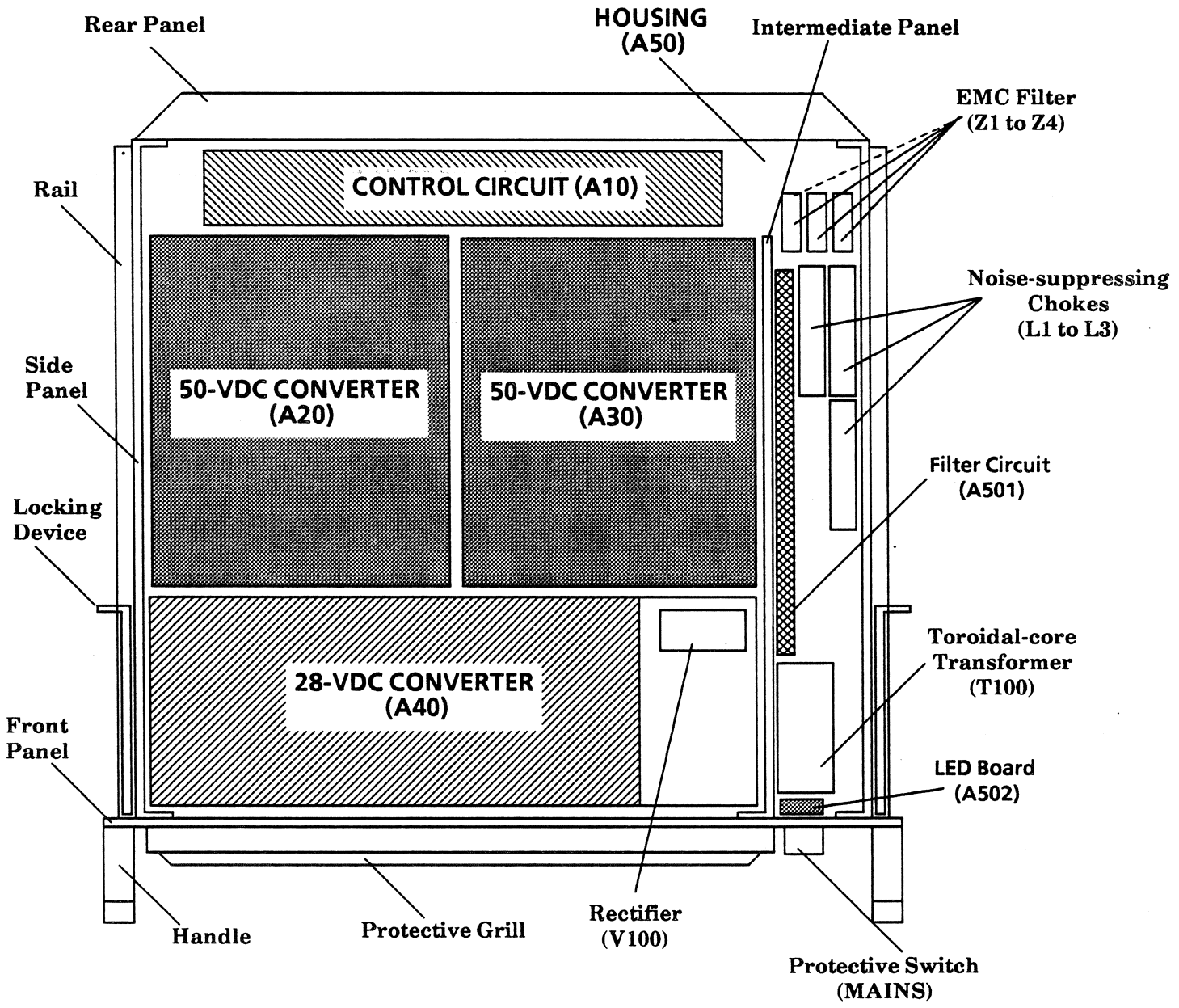


Fig. 1.2 Simplified View of the Interior

1.2.2 Functioning

(See Figs. 1.3 and 4.5.)

The voltage provided by the external three-phase network is fed via connector X76 and the input filter to the protective switch MAINS (automatic cut-out, 16 A).

The input filter consists of an EMC filter and a noise-suppressing choke (per phase). The input filter prevents line-specific noise voltages which are generated by the converters clocked with the primary current from being fed into the network.

If the protective switch MAINS is closed, the three-phase current is fed via a rectifier and the filter circuit (A501) to the two 50-VDC converters and the 28-VDC converter (A40).

Simultaneously, two of the three phases are connected via fuse F2 (1.6 A) and an insulated wire link to the corresponding tap (200 / 220 / 380 / 400 / 440 VAC) of toroidal-core transformer T100. Via the wire link T100 can be set to the available mains voltage. The toroidal-core transformer transforms the voltage to a value of 220 VAC. This 220-VAC voltage is fed via an EMC filter to socket X71 and at the same time via fuse F3 (100 mA) to the 12-VDC auxiliary-voltage generator.

Via socket X71 the blowers in 1-kW Amplifier VK 859 are powered. The 12-VDC voltage drives the LED MAINS on the LED board (A502). If a DC voltage is available, the LED MAINS will be illuminated. Simultaneously, the 12-VDC voltage provides the current for the control circuit (A10).

The three phases are monitored by a logic circuit. If one of these phases is without current, the auxiliary-voltage generator is switched off and thus the entire power supply unit.

The rectified and filtered input voltage is fed to the input of the respective converter. The outputs of the converters are connected to socket X75 via the filter circuit. Via socket X75 the preamplifier in the 1-kW amplifier is supplied by a fixed 28-VDC voltage of 42 to 52 V.

At the same time the output of the 28-VDC converter is connected to the internal blowers and socket X73. Via socket X73 the receiver / exciter is powered.

External units, such as an antenna tuning unit for example, are also powered via socket X75.

Socket X75 is connected via the filter circuit (A501) to battery connector X74. If on connector X74 a battery (22 to 31 VDC) is connected, switchover operation is possible, that is, in case of a mains failure the battery takes over the supply at a reduced transmit power.

The filter contains, amongst other components, decoupling diodes, a protection against a mix-up of the poles and fuse F1 (20 A). The decoupling diodes prevent the battery from being charged by the converters. Fuse F1 protects the output of the 28-VDC converter and a battery which may be connected to X74 from overcurrents.

Each of the converters contains two push-pull stages. Depending on the external mains voltage, the two push-pull stages have to be connected via insulated wire links either in series (380 VAC, 400 VAC and 440 VAC) or in parallel (200 VAC and 220 VAC). If the two push-pull stages are connected in series, a balancing circuit prevents the individual stages from being loaded irregularly.

The MOSFET switching transistors in the push-pull stages are triggered by a pulsewidth-modulated signal. This signal is provided by the control circuit (A102). In the control circuit the output voltage is compared with a nominal value and thus produces the control voltage. The control voltage is compared in a comparator with an internal sawtooth voltage. The result of this comparison is a rectangular voltage with variable pulse duration.

The pulse duration is a function of the output voltage, that is, if the output voltage drops, the control loop increases the pulse duration, causing the output voltage to be increased to its nominal value.

The clock generators of the individual converters are synchronized by the control circuit (A10). By means of two data lines the synchronizing frequency can be influenced in such a manner that the harmonics of the generated clock frequency do not act upon a receive frequency.

Power Supply IN 859C1 contains a pre-control circuit, i.e. mains input variations may exert an influence directly on the pulse duration of the converters by bypassing the control loop so that they are compensated to a great extent.

As a result of the clocked operation of the switching transistors a rectangular voltage is generated from the rectified and filtered input voltage. This voltage is fed via the transformers, the output diodes and a storage choke to the capacitor board (A103). By means of the capacitors on the capacitor board the voltage is smoothed. Thus an AC voltage is obtained again.

The control circuit (A102) not only provides the pulsewidth-modulated signal for the converter board (A101), but also monitors the latter. If the temperature in the 50-VDC converters exceeds 90° C, the converter concerned is cut out. Cut-out is also performed, if the balancing circuit is no longer able to compensate irregular loading of the push-pull stages. In case of overcurrents the control circuit reduces the pulse duration. If the converter is cut out, this is indicated to the control circuit via a NoGo message on the CM (continuous monitoring) line.

The control circuit (A10) continuously evaluates the signals on the CM lines and via the filter circuit (A501) drives the LEDs on the LED board (A502). For a NoGo the respective LED is dark. At the same time a sum NoGo signal is transmitted via socket X73 to the receiver / exciter. The receiver / exciter controls the power supply via socket X73.

Via a data line the respective 50-VDC converter can be switched on or off. By means of three further data lines it is possible to set the output voltage of the 50-VDC converter, which has been switched on, in the range of 45 to 52 VDC in steps of 1 VDC.

1.3 Technical Data

Input

Three-phase mains voltage	200, 220, 380, 400 or 440 VAC; + 10 % to -15 %; 47 to 63 Hz
Average power consumption	approx. 3.5 kW
Battery voltage	19 to 31 VDC
Permissible battery current	≤ 35 A

Converters

Crystal oscillator frequencies	98.04 kHz, 100 kHz, 100.01 kHz
Regulating time	approx. 10 ms

Control logic

Crystal oscillators	5.000 MHz, 5.005 MHz

Output

220-VAC voltage	220 VAC ≤ 150 VA
DC voltage I (50 VDC regulated, adjustable)	45 to 52 VDC ± 0.5 VDC
Step width	1 VDC
Continuous output current	30 A max.
Battery operation	≥ $V_{batt.}$ - 1.2 VDC
DC voltage II (50 VDC regulated, adjustable)	45 to 52 VDC ± 0.5 VDC
Step width	1 VDC
Continuous output current	30 A max.
Battery operation	≥ $V_{batt.}$ - 1.2 VDC

28-VDC voltage (regulated)	28 VDC ± 0.5 VDC
Permissible load current	15 A
Ripple voltage	≤ 1 VDC
Battery operation	≥ V_{batt} - 1.2 VDC

TTL output

Test (power supply functional)	high level

Temperature ranges

Operating temperature	-25° C to + 55° C
Storage temperature	-40° C to + 60° C

Dimensions (see Fig. 1.4)

Front panel (W × H)	482.6 mm × 176.3 mm
Seated depth from front panel (rear side), connectors not included	451 mm

Mass	31.5 kg
Radio interference suppression	see data sheet of transmitter concerned

1.4 Models of Power Supply IN 859C1

Power Supply IN 859C1 is available in different models which differ only in their colours.

Models 02, 03 and 04 are identified by the following colours:

02: RAL 7035, light grey

03: RAL 6014, NATO olive and

04: RAL 7001, NAVY grey

Kennz. Comp.No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
.	VARIANTENERKL. / VERSIONS VAR 02 = RAL7035 LICHTGRAU VAR 03 = RAL6014 OLIV VAR 04 = RAL7001 MAR.GRAU VAR 11 = RAL6031 BRONZEGN.				
A20	ZE WANDLER 50V TRANSFORMER 50V HIERZ.STROML.681.1266 BL.2 SEE CIRC.DIA.681.1266 BL.2	681.1266.03			
A30	ZE WANDLER 50V TRANSFORMER 50V HIERZ.STROML.681.1266 BL.2 SEE CIRC.DIA.681.1266 BL.2	681.1266.03			
A40	ZE WANDLER 28V TRANSFORMER 28V NUR VAR/ONLY MOD: 11 HIERZ.STROML.681.2179 BL.2 SEE CIRC.DIA.681.2179 BL.2	681.2179.03			
A40	ZE WANDLER 28V NUR VAR/ONLY MOD: 02 03 04 HIERZU STROML.734.9194 S SEE CIRC.DIAG.734.9194 S	734.9194.02			
A50	ZE GEHAEUSE CASE NUR VAR/ONLY MOD: 02 HIERZ.STROML. 681.0018.01S SEE CIRC.DIAG.681.0018.01S	681.0060.02			
A50	ZE GEHAEUSE CASE NUR VAR/ONLY MOD: 03 HIERZ.STROML. 681.0018.01S SEE CIRC.DIAG.681.0018.01S	681.0060.03			
A50	ZE GEHAEUSE CASE NUR VAR/ONLY MOD: 04 HIERZ.STROML. 681.0018.01S SEE CIRC.DIAG.681.0018.01S	681.0060.04			
A50	ZE GEHAEUSE CASE NUR VAR/ONLY MOD: 11 HIERZ.STROML. 681.0018.01S SEE CIRC.DIAG.681.0018.01S	681.0060.11			
					- ENDE -

2. Preparation for Use

2.1 General

Preparation for use of Power Supply IN 859C1 includes unpacking, a visual inspection, installation into Rack KG 859 and switching on.

WARNING

Power Supply IN 859C1 should only be lifted / carried with the assistance of a second person since the mass of the module exceeds 30 kg.

2.2 Unpacking and Visual Inspection

1. Carefully unpack Power Supply IN 859C1.
2. Check the number of screws (4). Replace any missing ones.
3. Check the power supply for any damage which may have occurred during transport.

   If any such damage is found notify the transport agents immediately.
4. Keep the packaging for future use, e.g. the module may have to be sent to the nearest repair shop.

2.3 Installation

(See Figs. 2.1 and 2.2)

1. Install the power supply in Rack KG 859 just below 1-kW Amplifier VK 859.
2. Slide the power supply into the rack until resistance is felt.
3. Press the locking device (2, Fig. 4.2) on both sides of the power supply up and push in power supply until the locking devices can be folded back completely.

   Note:

   Take care that the locking devices return to their rest position and that they do not become entangled with the screws.
4. Secure the power supply to the rack by means of the four screws (1).
5. The connection between the rack and the power supply is automatic, both on a signal and electrical level.

2.4 Functions Set Ex Works

2.4.1 Operating Voltage

Power Supply IN 859C1 may be operated on a 110-VAC or 220-VAC three-phase mains voltage. This corresponds to a phase / phase voltage of 200 V (220 V) or 380 V (400 V, 440 V).

The setting for the required operating voltage of Power Supply IN 859C1 is invariably customer-specific and is usually made at the factory.

If, as an exception, no value should be stated on the order form, then the works' setting would be 380 V (phase / phase voltage).

The operating voltage set ex works is indicated on the label of the power switch, e.g.:

VOLTAGE SET TO 380 VAC

Note:

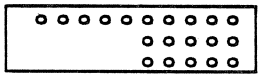
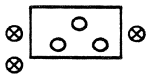
Any alteration to the set operating voltage should only be carried out by qualified personnel and only in cases of absolute necessity. If such a case should arise, refer to the repair manual R&S 744.2557.01.xx for instructions.

2.4.2 Jumpers

The jumpers contained in the converters are needed for service purposes only.

2.5 Functions of Connectors and Blowers

(See Fig. 2.1)

No.	Designation	Design	Function
1	E1	Blower	As soon as the mains switch (5, Fig. 3.1) is in the on-position, the blower starts to run. If a battery is connected, the blower remains in action even in the event of a mains failure or a defective 28-VDC converter (2, Fig. 3.1). The blower is not active if fuse F1 is faulty.
2	E2	Blower	As soon as the mains switch (5, Fig. 3.1) is in the on-position, the blower starts to run. If a battery is connected, the blower remains in action even in the event of a mains failure or a defective 28-VDC converter (2, Fig. 3.1). The blower is not active if fuse F1 is faulty.
3	 (X73)	30-way female connector strip with 20 socket contacts	Control connector for the receiver / exciter. Upon installation into Rack KG 859 the connection at signal level is fully automatic. For contact assignment refer to the description of interfaces in the appendix to this manual.
4	 (X71)	3-way female connector	220-VAC connection for blowers in the 1-kW amplifier. Upon installation into Rack KG 859 the electrical connection is made automatically. The output is protected by means of fuse F2 (1.6 A). For contact assignment refer to the description of interfaces in the appendix to this manual.

No.	Designation	Design	Function
5	 X74	5-way male connector strip with two contacts	DC connection for an external battery. The battery is needed for switchover operation. Upon installation into the rack the electrical connection is made automatically. The input is protected by means of a device to guard against a mix-up of the poles and fuse F1 (20 A). For contact assignment refer to the description of interfaces in the appendix to this manual.
6	 X75	5-way female connector strip	DC connection for the preamplifier (28 V) and the output stages (50 V) in the 1-kW amplifier. Upon installation into the rack the electrical connection is made automatically. For contact assignment refer to the description of interfaces in the appendix to this manual.
7	 X76	4 + 1-way male connector strip	Connection for external three-phase mains voltage. The input is protected by an automatic cut-out device (5, Fig. 3.1). Upon installation into the rack the electrical connection is made automatically. For contact assignment refer to the description of interfaces in the appendix to this manual.
8			Earthing screw

3. Operation

3.1 General

(See Fig. 3.1)

For Power Supply IN 859C1 no operation is required except for switching the unit on and off.

Note:

Prior to switching on the power supply make sure that the mains voltage applied to the rack is the same as the operating voltage set in the power supply.

The voltage set in the power supply is indicated on the label of the mains switch.

If necessary, alter the set operating voltage to the required value (see 2.4.1).

Set power switch (5) to position 'ON 1'.

In case of mains powering, readiness for operation is indicated by the following illuminated LEDs:

MAINS (1)

28 V (2)

green LED on Receiver / Exciter GX 859

If via Receiver / Exciter GX 859 the 50-VDC converters are switched on, the following LEDs should also be iluminated:

50 V I (3)

50 V II (4)

For switchover operation and when a battery is connected only the

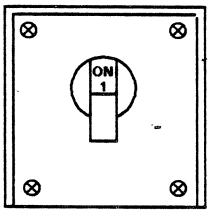
green LED on Receiver / Exciter GX 859

is illuminated.

3.2 Functions of Control Elements and Indicators

(See Fig. 3.1)

No.	Designation	Design	Function
1	**NETZ** **POWER** ○	green LED	When mains switch (5) is in the On-position the LED is illuminated. The LED remains dark, even when the mains switch is set to 'On', for • mains failure • undervoltage • defective fuses F2 and F3.
2	**28 V** ○	green LED	When mains switch (5) is in the On-position the LED is illuminated. The LED remains dark, even when the mains switch is set to 'On', for • mains failure • undervoltage • defective fuses F2 and F3 • overcurrent • asymmetry between push-pull stages too large.
3	**50 V** **I** ○	green LED	When mains switch (5) is in the On-position and the 50-V converter is switched on via the receiver / exciter the LED is illuminated. The LED remains dark, even when the mains switch is set to 'On' and the converter is switched on, for • mains failure • undervoltage • defective fuses F2 and F3 • overcurrent • asymmetry between push-pull stages too large • temperature > 90 °C.

No.	Designation	Design	Function
4	50 V II ○	green LED	When mains switch (5) is in the On-position and the 50-V converter is switched on via the receiver / exciter the LED is illuminated. The LED remains dark, even when the mains switch is set to 'On' and the converter is switched on, for • mains failure • undervoltage • defective fuses F2 and F3 • overcurrent • asymmetry between push-pull stages too large • temperature > 90 °C.
5		16-A automatic cut-out device	Protects the mains input against excessive currents. ***CAUTION*** ***Before switching on the power supply make sure that the available operating voltage is the same as that indicated on the label (refer also to 2.4.1).***

4. Maintenance and Troubleshooting

4.1 Maintenance

The Power Supply IN 859C1 is entirely free from scheduled maintenance.

The following notes are to be regarded as hints on taking care of the module.

4.1.1 Taking Care

Such measures involve cleaning and retouching slight damages to the varnish coating of the unit. The following materials are required:

No.	Description
1	soft brush
2	duster
3	isopropyl alcohol
4	varnish, light grey, RAL 7035

4.1.1.1 Cleaning

WARNING

- ***Beware of risk of explosion when using isopropyl alcohol.***

  Make sure to work in a well ventilated room when cleaning with isopropyl alcohol.

- ***Wear goggles when working with compressed air in order to avoid any injuries to the eyes.***

CAUTION

- ***Direct compressed air first towards ground until no more condensed water is contained in the air jet.***
- ***Keep a minimum distance of 20 cm between compressed air and module.***

1. First of all clean outside of the module. with compressed air.
2. Continue cleaning with a soft brush or a duster.
3. Clean heavily contaminated surfaces, especially grease stains, with a soft, lint-free cloth soaked in isopropyl alcohol.
4. Clean exposed PCB carefully with a soft brush and / or compressed air.

4.1.1.2 Repair of Blemishes in Varnish Coating

Repair blemishes in the varnish coating of the housing of Power Supply IN 859C1 as follows:

1. Remove any loose paint particles from the area of repair.
2. Clean area to be retouched with a soft, lint-free cloth soaked in isopropyl alcohol.
3. Wait for the isopropyl alcohol to dry out.
4. Retouch with varnish carefully and allow plenty of time to dry out.
5. Once the first coating is completely dry, apply a second coating and again allow it to dry. The repair is thus completed.

4.2 Troubleshooting

4.2.1 General

A built-in self-test facility (BITE) continuously monitors all essential functions of the power supply.

If a fault occurs a message is output and the error code E9 is displayed on Control Unit GB 853C1 of Receiver / Exciter GX 859. In the event that the 1-kW transceiver or transmitter is remotely controlled an appropriate status message will appear on the remote control unit or the computer.

When a test routine is started by pressing the appropriate key on the control unit of the receiver / exciter, a message (sum signal) of Power Supply IN 859C1 is received by the processor of the receiver / exciter. The processor disables the converters one after the other until the defective converter(s) is (are) identified.

On the frequency display of the control unit the error message 'E' is indicated together with a code number of the defective assembly.

Error message	Defective assembly
E 71	50-VDC converter (A20)
E 72	50-VDC converter (A30)
E 73	28-VDC converter (A40)

The LEDs on the front panel of the power supply provide additional error information.

4.2.2 Troubleshooting Instructions

If during operation a fault occurs, we recommend to proceed acc. to the troubleshooting flowchart in Fig. 4.1.

The troubleshooting described in this section is based on the following conditions:

1. The power supply has definitely been proved to be defective.
2. The fault is due to one cause only.
3. The power supply is set to the correct operating voltage.
4. The power supply is installed in Rack KG 859 together with a receiver / exciter and a 1-kW amplifier.
5. The rack is connected to a three-phase mains voltage.

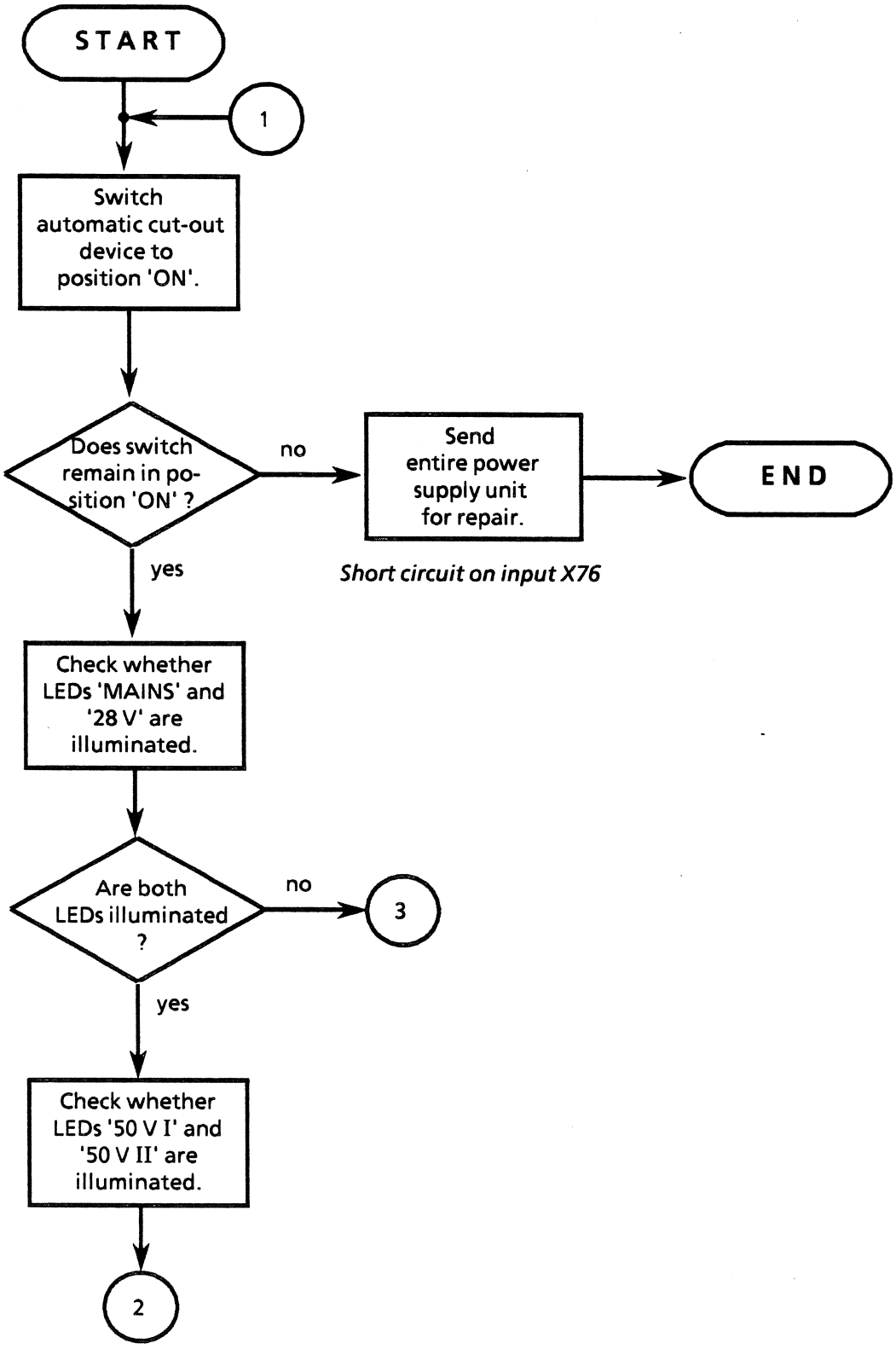


Fig. 4.1 Troubleshooting Flowchart (page 1 of 5)

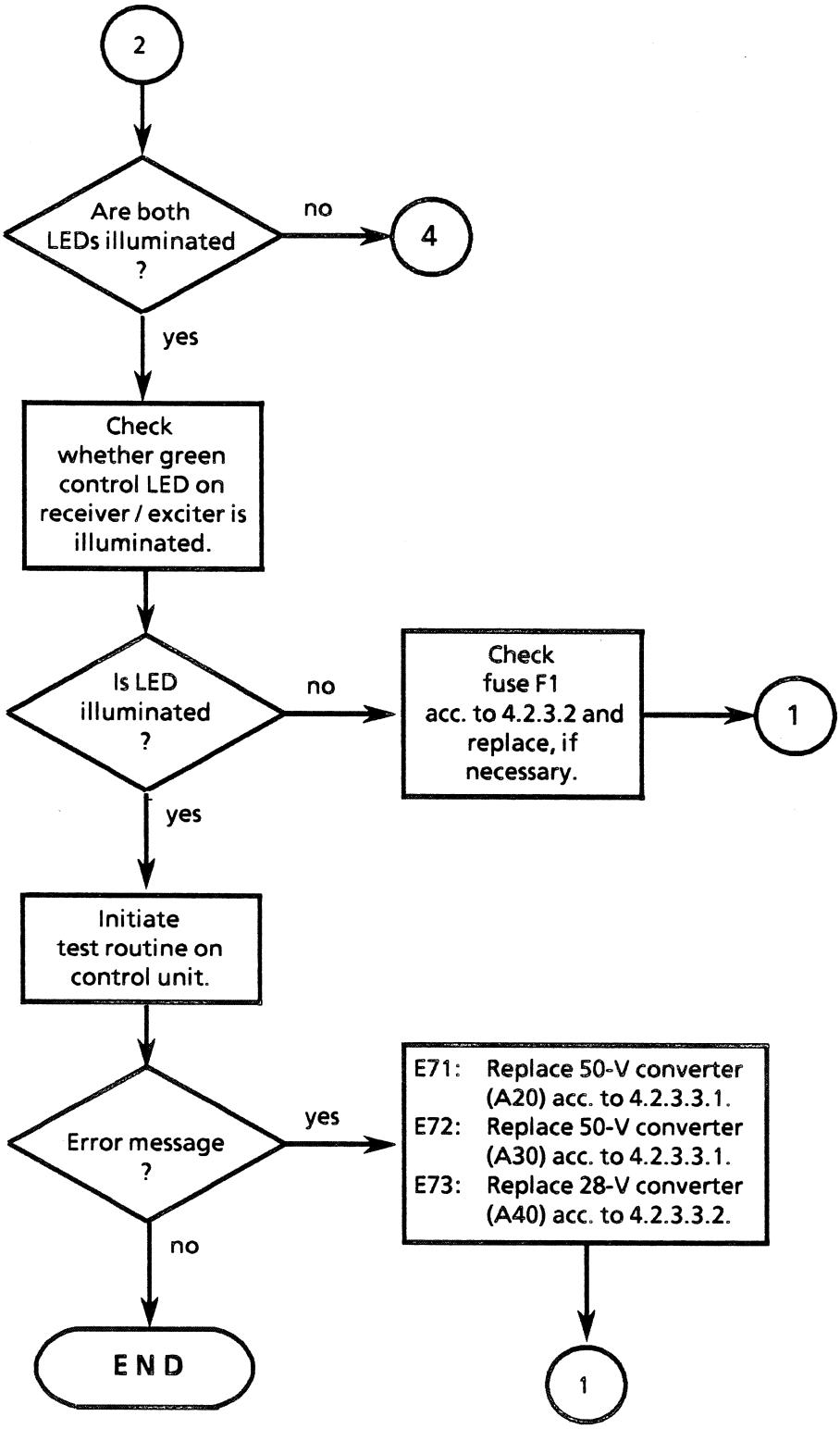


Fig. 4.1 Troubleshooting Flowchart (page 2 of 5)

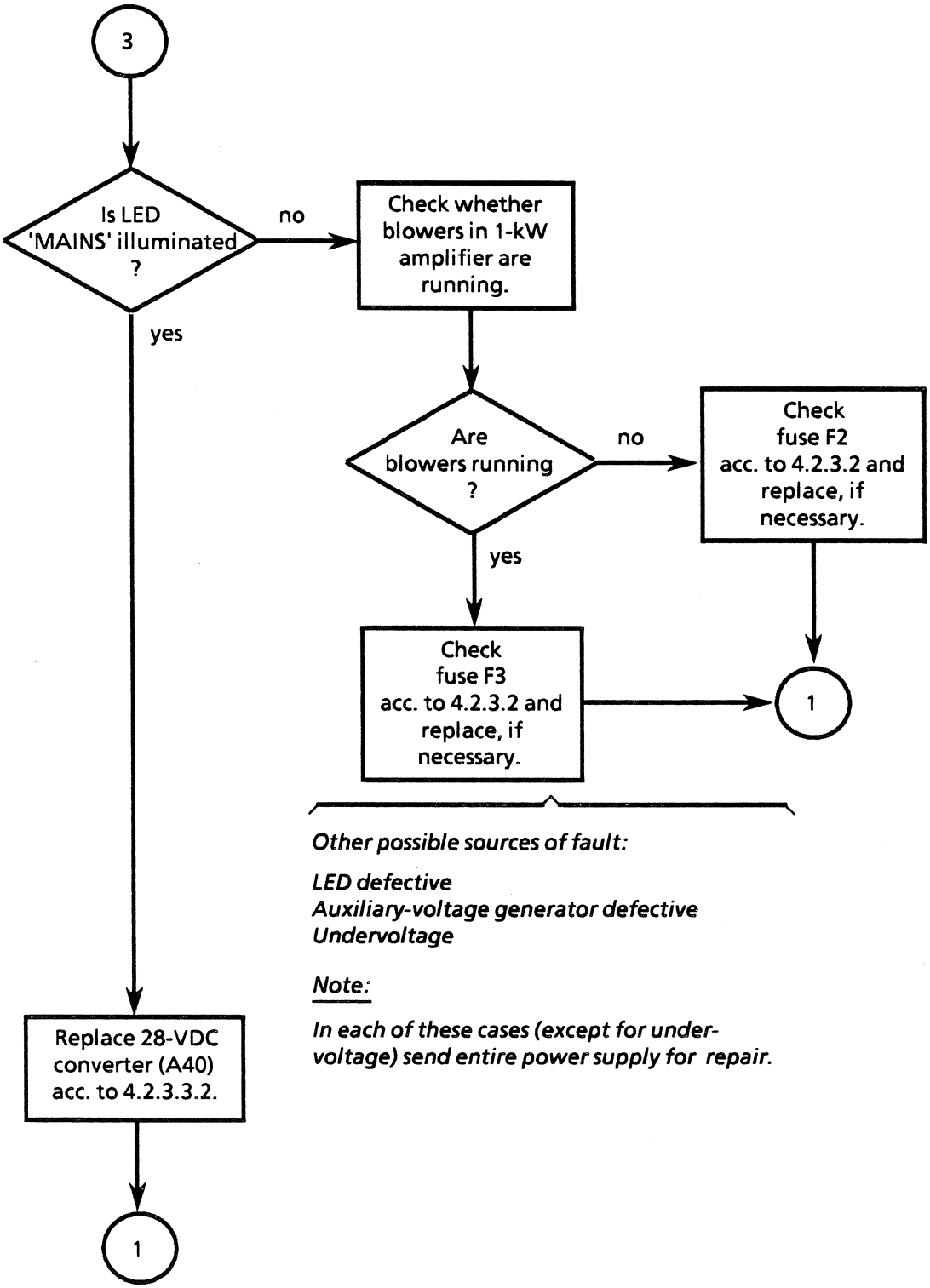


Fig. 4.1 Troubleshooting Flowchart (page 3 of 5)

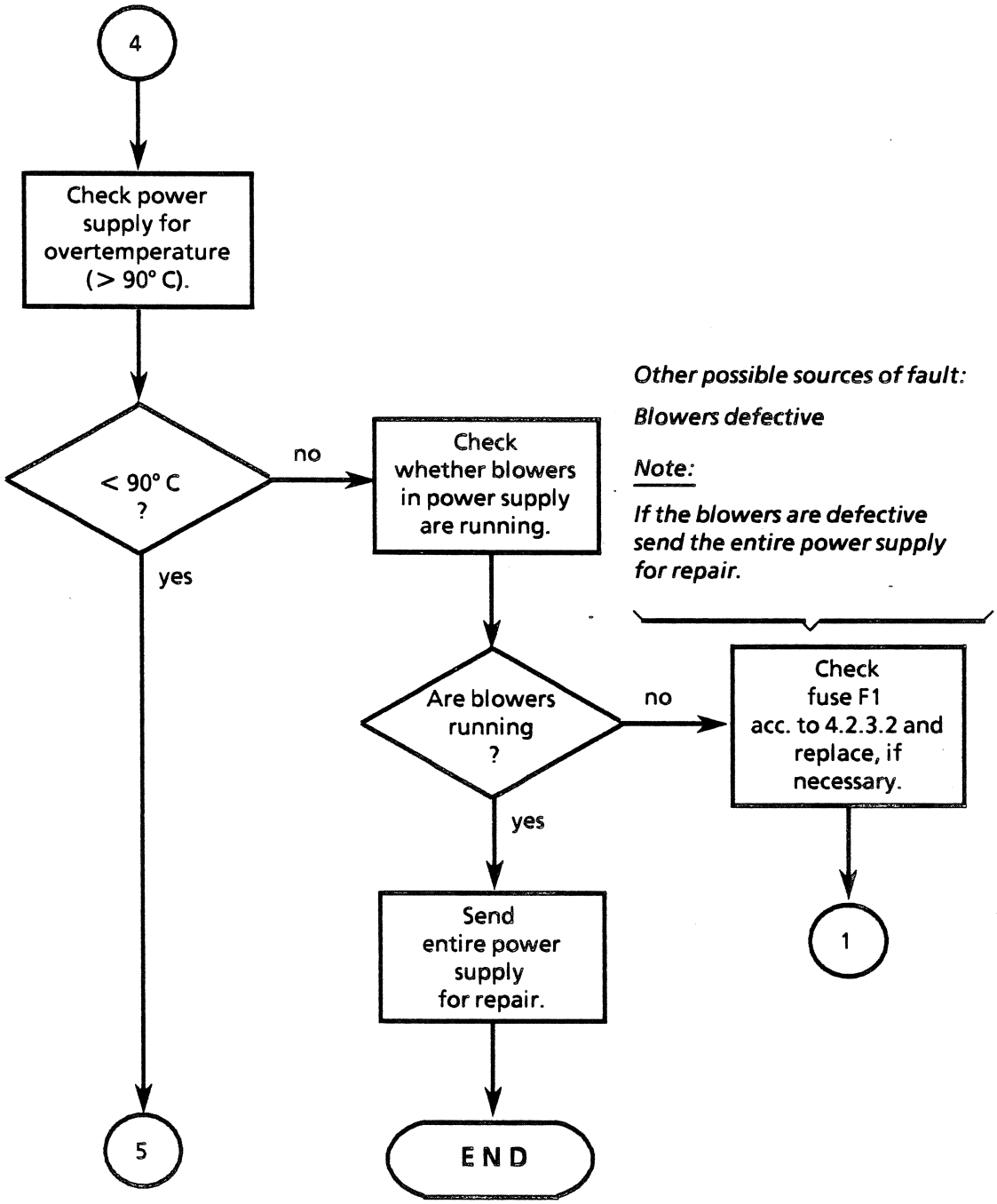


Fig. 4.1 Troubleshooting Flowchart (page 4 of 5)

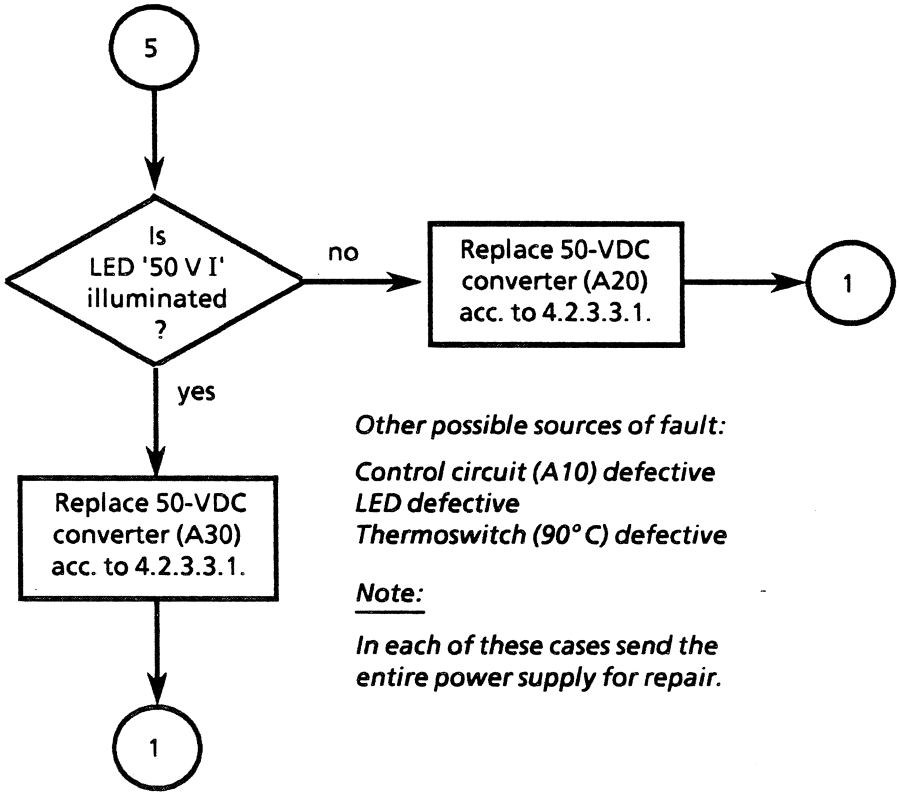


Fig. 4.1 Troubleshooting Flowchart (page 5 of 5)

4.2.3 Replacement of Assemblies and Components

WARNING

Power Supply IN 859C1 should only be lifted / carried with the assistance of a second person since its mass exceeds 30 kg.

4.2.3.1 Removal and Opening of the Module

(See Fig. 4.2)

Remove the power supply from the rack as follows:

1. Switch off power supply.
2. Undo the four screws (1) fixing the power supply to the rack.
3. Carefully pull out power supply towards front until resistance is felt.
4. Press the locking device (2) on both sides of the power supply up and pull out the power supply completely.
5. Place the power supply onto a suitable surface in such a way that the cover and side panels are accessible.
6. Undo and remove 22 screws (3) fixing the cover to the power supply.
7. Remove the cover.

4.2.3.2 Replacement of Fuses F1 to F3

(See Figs. 4.2 to 4.4)

1. Remove the power supply from the rack in line with 4.2.3.1 and take off cover.
2. Undo and remove eight screws (4, Fig. 4.2) fixing the right-hand side panel to the power supply.
3. If necessary, separate the two connection cables from filter Z4 (1, Fig. 4.2).
4. Remove the right-hand side panel.
5. Fuses F1 to F3 (see Fig. 4.3) are now accessible. Replace the defective fuse(s).

Installation is in the reverse order to the removal described above.

4.2.3.3 Replacement of Defective Converters

(See Figs. 4.2 and 4.4)

Note:

Replacement of the converters should only be performed by qualified personnel.

4.2.3.3.1 Replacement of 50-V Converters

Note:

The following steps apply to both converters (I and II).

1. Remove the power supply from the rack according to 4.2.3.1.
2. Disconnect ribbon cable (2, Fig. 4.4) on PCB 'Control Circuit'.
3. Press straps on 500-V connector (3) and pull out plug.
4. Undo and remove two screws securing the 50-V connector and disconnect.
5. Undo two socket-head screws (5) through the openings in the screening hood.
6. For removal of the left-hand 50-V converter also disconnect the ribbon cable (6) for the 28-V converter on the PCB 'Control Circuit'.

Note:

If Power Supply IN 859C1 contains a varistor instead of the rectifier remove the former carefully.

7. Carefully pull out the 50-V converter on the screening hood (7).

Installation is in the reverse order to the removal described above.

4.2.3.3.2 Replacement of 28-VDC Converter

1. Remove the power supply from the rack according to 4.2.3.1.
2. Disconnect connector (6, Fig. 4.4) on PCB 'Control Circuit'.
3. Press straps on 500-V connectors of 50-VDC converters (3) and 28-VDC converter (9) and disconnect.
4. Separate 28-VDC connector (10).
5. Undo and remove two screws (11) fixing the rectifier to the 28-VDC converter.
6. Carefully remove rectifier with cable harness.
7. Undo three of four socket-head screws through the openings (12) in the screening hood and the fourth (12) directly.
8. Carefully pull out 28-VDC converter on screening hood (13).

Installation is in the reverse order to the removal described above.

A1. Interface Description, Power Supply IN 859C1

Contact	Signal Name / Description	Direction	Type	Range of Value	Remarks
X71.1	Mains output	test point	power	220 VAC ± 5 % for V_{mains} = nominal voltage, load max. 150 VA	supply for blowers of amplifier
X71.2	Mains output	test point	power	220 VAC ± 5 % for V_{mains} = nominal voltage, load max. 150 VA	supply for blowers of amplifier
X71.3	Protective wire	bidirec-tional	power		
X73.A0	CM power supply	output	high	high = Go 4 VDC ≤ V ≤ 5.2 VDC low = NoGo V ≤ 1 VDC	
X73.A1	Signal ground	bidirec-tional		0 V	A1, B1, C1 parallel
X73.A2	Data 2	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A3	Data 6	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A4	Data 5	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A5	Data 4	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A6	Data 3	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A7	Data 7	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	

Interface Description, Power Supply IN 859C1 (continued)

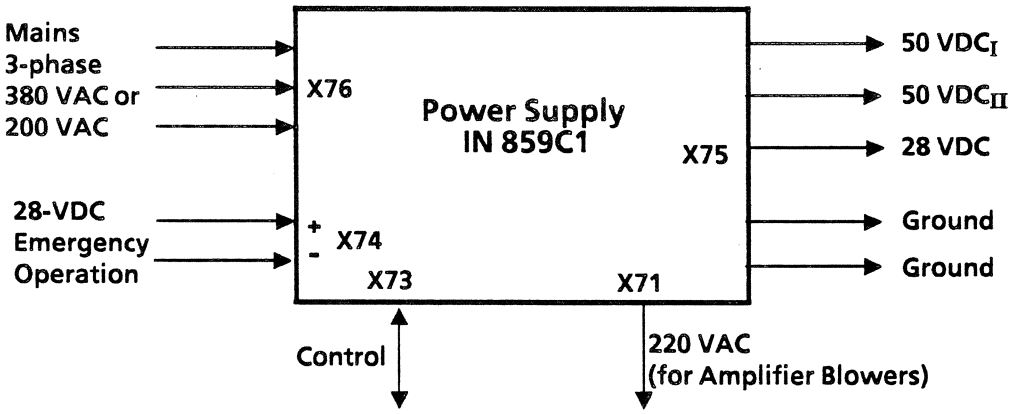
Contact	Signal Name Description	Direction	Type	Range of Value	Remarks
X73.A8	Data 1	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.A9	Data 0	input	high	CMOS B series input V_{op} = 5.2 VDC, low ≤ 1.5 VDC high ≥ 3.5 VDC	
X73.B1	Signal ground	bidirec-tional		0 V	A1, B1, C1 parallel
X73.B2	V_{out}, output 28 VDC	output	power	28 ± 0.5 VDC for mains operation, I ≤ 5 A V_{out} = 28 + 1 / -0.5 VDC for battery operation: $V_{out} \geq (V_{batt} - 1.2$ VDC)	B2, B3, B4, B5 parallel for supply of exciter
X73.B3	V_{out}, output 28 VDC	output	power	28 ± 0.5 VDC for mains operation, I ≤ 5 A V_{out} = 28 + 1 / -0.5 VDC for battery operation: Vout ≥ (V_{batt} -1.2 VDC)	B2, B3, B4, B5 parallel for supply of exciter
X73.B4	V_{out}, output 28 VDC	output	power	28 ± 0.5 VDC for mains operation, I ≤ 5 A V_{out} = 28 + 1 / -0.5 VDC for battery operation: Vout ≥ (V_{batt} -1.2 VDC)	B2, B3, B4, B5 parallel for supply of exciter
X73.B5	V_{out}, output 28 VDC	output	power	28 ± 0.5 VDC for mains operation, I ≤ 5 A V_{out} = 28 + 1 / -0.5 VDC for battery operation: $V_{out} \geq (V_{batt} - 1.2$ VDC)	B2, B3, B4, B5 parallel for supply of exciter
X73.C1	Signal ground	bidirec-tional		0 V	A1, B1, C1 parallel
X73.C2	Ground	output	power	0 V	C2, C3, C4, C5 parallel for supply of exciter
X73.C3	Ground	output	power	0 V	C2, C3, C4, C5 parallel for supply of exciter

Interface Description, Power Supply IN 859C1 (continued)

Contact	Signal Name / Description	Direction	Type	Range of Value	Remarks
X73.C4	Ground	output	power	0 V	C2, C3, C4, C5 parallel for supply of exciter
X73.C5	Ground	output	power	0 V	C2, C3, C4, C5 parallel for supply of exciter
X74.2	$-V_{op}$, battery input	input	power	0 V ground	
X74.4	$+ V_{op}$, battery input	input	power	19 to 31 VDC I ≤ 35 A	
X75.1	0 V ground	output	power	0 V	ground for 50 VDC_I, 50 VDC_{II} and 28 VDC
X75.2	50 VDC_{II} DC output	output	power	adjustable between 45 and 52 VDC via data bus $V_{out} = V_{nom} \pm 0.5$ VDC I_{max} = 30 A for battery operation: $V_{out} \geq (V_{batt} - 1.2$ VDC)	
X75.3	28-VDC output	output	power	mains operation: 28 ± 0.5 VDC, I ≤ 16 A V_{out} = 28 + 1 / -0.5 VDC for battery operation: $V_{out} \geq (V_{batt} - 1.2$ VDC)	I_{cont} 16 A I_{peak} 18A protected with 20 A
X75.4	50 VDC_I DC output	output	power	adjustable between 45 and 52 VDC via data bus $V_{out} = V_{nom} \pm 0.5$ VDC I_{max} = 30 A for battery operation: $V_{out} \geq (V_{batt} - 1.2$ VDC)	
X75.5	0 V ground	output	power	0 V	ground for 50 VDC_I, 50 VDC_{II} and 28 VDC
X76.1	Mains input	test point	power	can be set to 200 VDC + 10 / -15 % or 380 / 400 / 440 VDC + 10 / -15 %	3-phase mains input together with X76.2 and .3

Interface Description, Power Supply IN 859C1 (continued)

Contact	Signal Name Description	Direction	Type	Range of Value	Remarks
X76.2	Mains input	test point	power	can be set to 200 VDC + 10 / -15 % or 380 / 400 / 440 VDC + 10 / -15 %	3-phase mains input together with X76.1 and .3
X76.3	Mains input	test point	power	can be set to 200 VDC + 10 / -15 % or 380 / 400 / 440 VDC + 10 / -15 %	3-phase mains input together with X76.1 and .2
X76.4	not connected				
X76.5	Protective wire	bidirec-tional	power		



ROHDE&SCHWARZ

Radiocommunications Division

User Manual

RACK, STATIONARY with Supplements KG 859C4

681.5010

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RACK, STATIONARY
KG 859C4

User Manual
Part 0: List of Contents

LIST OF CONTENTS

		Page
1.	Characteristics	1.1
1.1	Application	1.1
1.2	Design and Functioning	1.2
1.2.1	Design	1.2
1.2.2	Functioning	1.2
1.3	Technical Data	1.3
1.4	Models of the Rack, Stationary KG 859C4	1.4
2.	Preparation for Use and Operation	2.1
2.1	Preparation for Use	2.1
2.1.1	General	2.1
2.1.2	Installation	2.1
2.1.3	Connection of the Rack	2.1
2.2	Operation	2.1
3.	Maintenance	3.1
4.	Troubleshooting	4.1
4.1	Visual Inspection	4.1
4.2	Troubleshooting of Cables and Connectors	4.1
4.3	Replacement of Cables	4.2
4.4	Test and Replacement of the Mains Filter Z1	4.2

LIST OF FIGURES

Fig.	Title	Page
1.1	Rack, Stationary KG 859C4	1.1
1.2	Rack, Stationary KG 859C4, Installation Drawing	1.5
4.1	Rack, Stationary KG 859C4, Circuit Diagram	4.3

R A C K , S T A T I O N A R Y
K G 8 5 9 C 4

User Manual
Part 1: Characteristics

1. Characteristics

1.1 Application

The Rack, Stationary KG 859C4 is part of the HF 850 family of 1-kW shortwave radio equipment.

It is of 19-inch design and is intended to accommodate the plug-in units of the 1-kW HF Transceiver XK 859C1.

Due to the compact and robust, water and dust-protected design it is ideally suited for stationary applications.

The rack offers 20 19" height units for installation of the units of the 1-kW HF transceiver.

The supply voltages as well as the electrical control signals from/to the plug-in units are routed via terminal connectors and cables.

For the 1-kW Amplifier VK 859 and the Power Supply IN 859C1 the electrical connections are established automatically when the units are inserted into the rack.

The Receiver/Exciter GX 859C1 is manually connected through trailing cables.

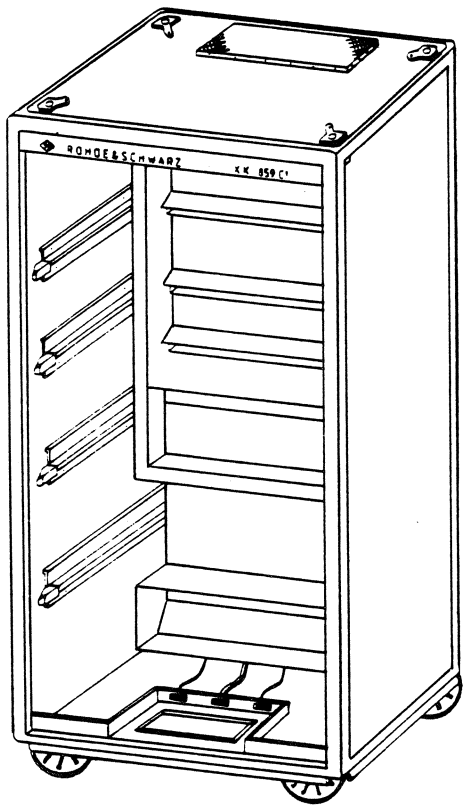

Fig. 1.1 Rack, Stationary KG 859C4

1.2 Design and Functioning

1.2.1 Design

The Rack, Stationary KG 859C4 is constructed on a 19-inch design principle.

It consists of a frame, two side panels with guide rails, a rear panel, a built-in trough and the top cover with air exhaust grill.

The rack stands on four plastic feet that are bolted to the bottom side of the frame.

The rack offers 20 height units available for installation of the plug-in units.

The following units can be installed into the rack (the units are listed in top-to-bottom order):

- o Receiver/Exciter GX 859C1
- o Alis Processor GP 859, and/or
- o ISB Modulator, GM 853C1 (optional), or two blanc panels,
- o Line Flattener FK 859C1 (optional), or one blanc panel,
- o 1-kW Amplifier VK 859C1, and
- o Power Supply IN 859C1.

The amplifier and power supply plug-in units are automatically interconnected to the rack's internal cabling when inserted into the rack.

The Receiver/Exciter GX 859C1 with optional units GP 859/GM 853C1 is the only plug-in unit equipped with telescopic rails and must be connected manually.

The rack contains a common air exhaust duct for all plug-in units. At its end, the air exhaust duct is covered with a grill that is mounted to the top cover.

1.2.2 Functioning

See Fig. 4.1

The only electrical component of the Rack, Stationary KG 859C4 is the mains filter (Z1) for the 380-VAC three-phase input.

A 4-pole terminal block for the connection to the 380-VAC three-phase network and a 2-pole terminal block for the connection to the 24-VDC battery are mounted to the trough at the bottom of the rack.

All connecting cables from outside are run through two feed-through openings provided at the bottom of the rack.

The connectors for the connection of peripheral devices are mounted in the trough beneath the plug-in Power Supply IN 859C1:

- o X14 for teletypers, etc.,
- o X13 for the Antenna Tuning Unit FK 859, and
- o X12 for the remote Control Unit GB 853C1 (with KK 853C2, if required).

The supply voltages and the electrical signals from/to the plug-in units are routed via terminal connectors and cables.

All plug-in units are connected to ground through a common ground line and the metal frame.

A grounding screw for common grounding is mounted to the rack's trough.

If the optional Line Flattener FK 859C1, is not installed in the rack, cables W8 and W9 with their connectors X50 and X100 must be connected directly.

Additionally, a blanc panel is then to be mounted at the position provided for installation of the optional Line Flattener FK 859C1.

1.3 Technical Data

Electrical connections:

Mains operation	380 VAC, three phases, 47 to 60 Hz
Battery operation with reduced output power (100 W)	24 VDC (19 to 31 VDC)

Interfaces to peripheral devices:

Antenna connector HF	N-type male connector, 50 ohms
Without optional Line Flattener FK 859C1	X67 at the amplifier
With optional Line Flattener FK 859C1	X53 at FK 859C1
REMOTE control connector	X12 at the rack's trough
EXTERNal output	X14 at the rack's trough
Antenna tuning unit (ATU)	X13 at the rack's trough

Dimensions

Height (including height-adjustable feet)	approx. 1168 mm min. to 1200 mm max.
Width	584 mm
Depth	600 mm
Total mass (without plug-in units installed)	approx. 55 kg

1.4 Models of the Rack, Stationary KG 859C4

The Rack, Stationary KG 859C4 is available in different colours.

First of all there are the models:

02/03 and 04 for the Rack, Stationary KG 859C4

The second digit in the model designation identifies the colour as follows:

.2 : dark grey (RAL 7011)

.3 : yellow olive (RAL 6014)

.4 : NAVY grey (RAL 7001)

Kennz. Comp.No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
.	VARIANTENERKL. / VERSIONS VAR 02 = RAL7011 DUNKEL- GRAU VAR 03 = RAL6014 GELBOLIV VAR 04 = RAL7001 MAR.GRAU				
W1	DX NETZKABEL (W1)	681.3898			
W2	DX 28V-KABEL (W2)	681.3900			
W3	DX LEITUNG-GESCHIRMT(W3)	681.3917			
W4	DX LEITUNG-GESCHIRMT(W4)	681.3923			
W5	DX KABEL (W5)	681.3930			
W6	DX KABEL (W6)	681.3946			
W7	DX LEITUNG-GESCHIRMT(W7)	681.3952			
W8	DX LEITUNG-GESCHIRMT(W8)	681.3969			
W9	ENTHALTEN IN/INCLUDED IN 681.3975				
W10	DX LEITUNG-GESCHIRMT(W10)	681.3981			
W19	ENTHALTEN IN/INCLUDED IN 681.3975				
W21	ENTHALTEN IN/INCLUDED IN 681.3881				
W22	ENTHALTEN IN/INCLUDED IN 681.3881				
W23	ENTHALTEN IN/INCLUDED IN 681.3881				
W30	DX NETZKABEL (W30)	681.4459			
X2	BESTEHT AUS/CONSISTING OF 31X FM511.8090 1X FM657.5242 1X FM681.5832 2X FM681.5849 1X FM681.5861 1X FM681.5884				681.3917
X3	BESTEHT AUS/CONSISTING OF 25X FM511.8090 1X FM511.8077 1X FM681.5826 2X FM681.5849 1X FM681.5861 1X FM681.5884				681.3969
X4	BESTEHT AUS/CONSISTING OF 33X FM511.8102 1X FM305.3869 1X FM681.5832 2X FM681.5849 1X FM681.5861 1X FM681.5884				681.3923
X5	BESTEHT AUS/CONSISTING OF 25X FM511.8090 1X FM657.5242 1X FM681.5832 2X FM681.5849 1X FM681.5861 1X FM681.5884				681.3952
X6	BESTEHT AUS/CONSISTING OF 20X FM511.8102 1X FM511.8083 1X FM681.5826 2X FM681.5849 1X FM681.5855 1X FM681.5878				681.3981
X12	BESTEHT AUS/CONSISTING OF 31X FM511.8102 1X FM305.3869				681.3917
X13	BESTEHT AUS/CONSISTING OF 21X FM520.6338 2X FP531.9233 1X FM645.7874				681.3975
X14	BESTEHT AUS/CONSISTING OF 33X FM511.8090 1X FM657.5242				681.3923
X50	BESTEHT AUS/CONSISTING OF 25X FM547.0776 1X FM547.0760				681.3969
X61	BESTEHT AUS/CONSISTING OF 25X FM547.0776				681.3952

Kennz. Comp.No.	Benennung Designation	Sachnummer Stock No.	Hersteller Manufacturer	Bezeichnung Designation	enthalten in contained in
	1X FM547.0760				
X62	FJ KABELSTECKER SYST.BNC BNC CONNECTOR	FJ 272.5930	SUHNER	11BNC-50-2-14C	681.3881
X63	FJ KABELSTECKER SYST.BNC BNC CONNECTOR	FJ 272.5930	SUHNER	11BNC-50-2-14C	681.3881
X64	FN EINBAUNETZBUCHSE FIXED SOCKET	FN 530.6047	KLAR&BEIL	GSD 2F QUERFLANSCH	
X71	FM STECKERLEISTE3P.NETZSP	FM 282.6380	COMPACT	C3S 109001	
X73	BESTEHT AUS/CONSISTING OF 20X FM552.1102 1X FM552.1090				681.3981
X74	ZM BUCHSENLEISTE 2-POLIG	681.3675			
X75	ZM STECKERLEISTE 5-POLIG	681.3700			
X76	ZM BUCHSENLEISTE 5-POLIG	681.3698			
X100	BESTEHT AUS/CONSISTING OF 21X FM552.1102 1X FM552.1090 1X FM087.7754				681.3975
X602	FJ KABELSTECKER SYST.BNC BNC CONNECTOR	FJ 272.5930	SUHNER	11BNC-50-2-14C	681.3881
X620	BESTEHT AUS/CONSISTING OF 3X FJ017.7161 1X FJ063.5645				681.3881
X630	ZM BUCHSENLEISTE 5-POLIG	681.4994			
					- ENDE -

2. Preparation for Use and Operation

2.1 Preparation for Use

See also Fig. 1.2

2.1.1 General

The preparation for use essentially consists of installation and attachment as well as connection of the Rack, Stationary KG 859C4 to the supply voltages and the peripheral devices.

CAUTION

Before and above the rack, a clearance of approx. 30 cm should be maintained to allow free circulation of cooling and exhaust air.

The fans built into the plug-in units allow for a permissible air pressure reduction of 20 to 30 Pa (0.080 to 0.12 inch H_20) which might be caused by an external air exhaust duct.

Air pressure reduction exceeding the above values should be compensated for by an external air blower. The maximum air flow through the transmitter is approx. 10 square metres per minute.

2.1.2 Installation

The dimensions required for installation of the rack are shown in Fig. 1.2.

2.1.3 Connection of the Rack

1. Lead the cable with four wires, each 2.5 mm^2 minimum (AWG13) for connection to the three-phase network on the right through the narrow opening at the bottom trough.
2. Connect the wires for 380 VAC to the 4-pole terminal block X5 as shown in Fig. 4.1. Use a cable clamp to secure the cable.
3. Lead the cable with two wires, each 6 mm^2 minimum (AWG9) for connection to the battery on the right through the narrow opening at the bottom trough.
4. Connect the wires for 24 VDC to the 2-pole terminal block (X6) as shown in Fig. 4.1. Use a cable clamp to secure the cable.
5. Connect one end of the grounding cable, minimum 10 mm^2 (AWG7) to the common grounding screw as shown in Fig. 4.1.

It is recommended to use three 16-A fuses (normal-blow) for protecting the three-phase input.

Refer to the user manual XK 858C1 for connecting the peripheral devices and for the preparations for use of the 1-kW HF transceiver system.

2.2 Operation

The Rack, Stationary KG 859C4 does not have any controls. Operation of the rack is therefore not required.

Refer to the user manual XK 858C1 for operation of the 1-kW HF transceiver system.

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3. Maintenance

The Rack, Stationary KG 859C4 is entirely maintenance-free.

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4. Troubleshooting

4.1 Visual Inspection

Troubleshooting of a Rack, Stationary KG 859C4 with no plug-in units installed essentially consists of a visual inspection.

If an electrical failure is assumed in the rack's cabling, proceed as follows:

CAUTION

Disconnect the Rack, Stationary KG 859C4 completely from the mains and the battery before performing the steps below.

1. Inspect all cables, connectors and terminals as well as the mains filter (Z1) for obvious damage.
2. Inspect the connectors for bent, corroded or broken pins and sockets.
3. Inspect the cables and lines for burnt or damaged insulation or broken wires.
4. If the cable is found to be defective, either submit the complete rack for repair or replace the defective cables (W...) according to 4.3.

4.2 Troubleshooting of Cables and Connectors

See Fig. 4.1.

Use the circuit diagram, Fig. 4.1 to identify the routing of wires and shielded cables. Use an ohmmeter to measure the cable resistances and the isolation from ground.

If a particular cable (W...) is found to be defective, it should be replaced according to 4.3.

4.3 Replacement of Cables

1. Loosen the four screws at the respective side panel and remove the side panel to make the cabling accessible.
2. Loosen the screw connections at the relevant connector.
3. Remove cable clamps only as far as required following the cable routing. Use side-cutting pliers to cut cable binders as required.
4. Carefully and individually remove the defective cables (W...) from the rack.
5. **Defective cables must always be sent for repair.**

Install a new cable in the reverse order. Connectors should be mounted as floating devices.

4.4 Test and Replacement of the Mains Filter Z1

Check the mains filter for continuity and short-circuit to ground using an ohmmeter. If the mains filter is found to be defective, it should be replaced as follows:

1. Disconnect cables W1 and W30 from the terminal connectors at both sides of the mains filter.
2. Loosen the screw at the pull-relief clamp and remove cable W1.
3. Undo the six Phillips screws and remove them together with the mains filter from the trough.
4. Install a new mains filter Z1 by performing steps 1 to 3 in the reverse order and reconnect cables W1 and W30.

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ROHDE&SCHWARZ

Radiocommunications Division

Supplements to User Manual

RACK, STATIONARY
KG 859C4

Note:

For some models of 1-kW HF Transceiver XK 859C1 additional interfaces have been provided in the Rack, Stationary KG 859C4. These additional connectors permit to disconnect optional equipment such as HF Data Modem 720 GM 856C1 or ALIS Processor GP 853C1 directly on the rack from external units and signals.

The following pages show how these additional connectors are wired.

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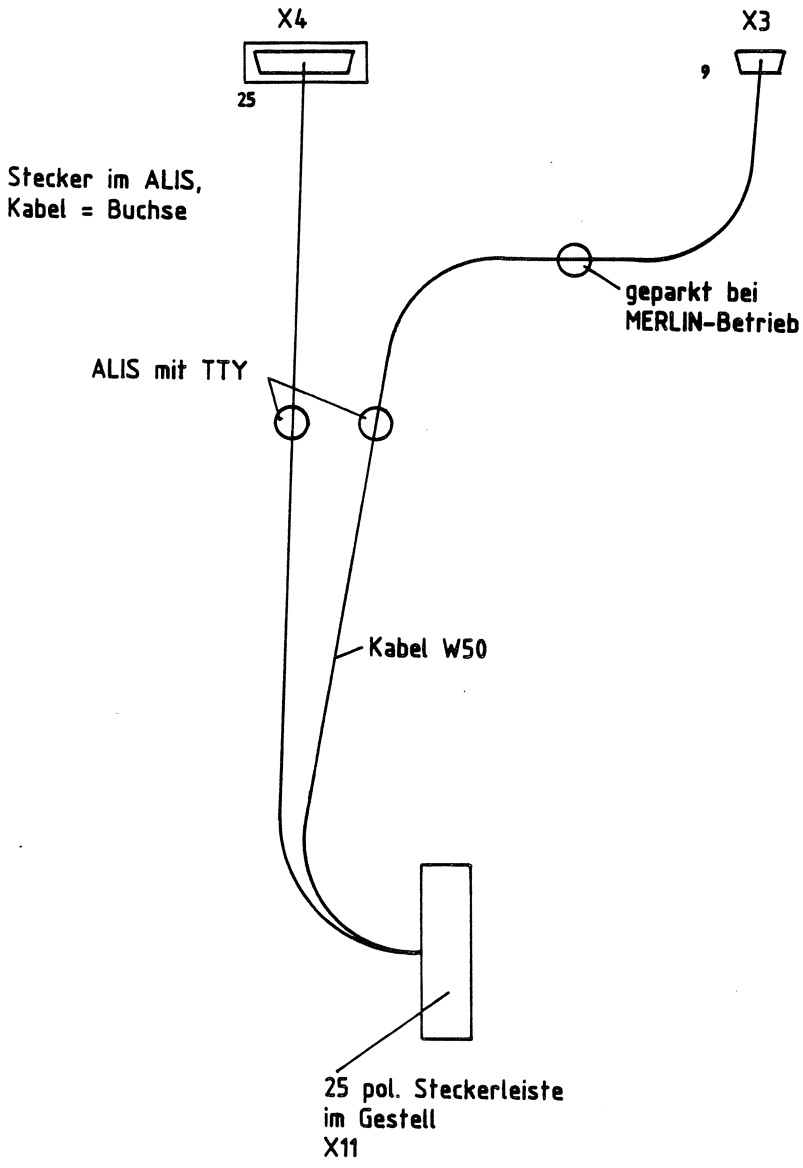
0890

673.4799.01.01 - 4

X3 und X4 am ALIS GP853
gesteckt



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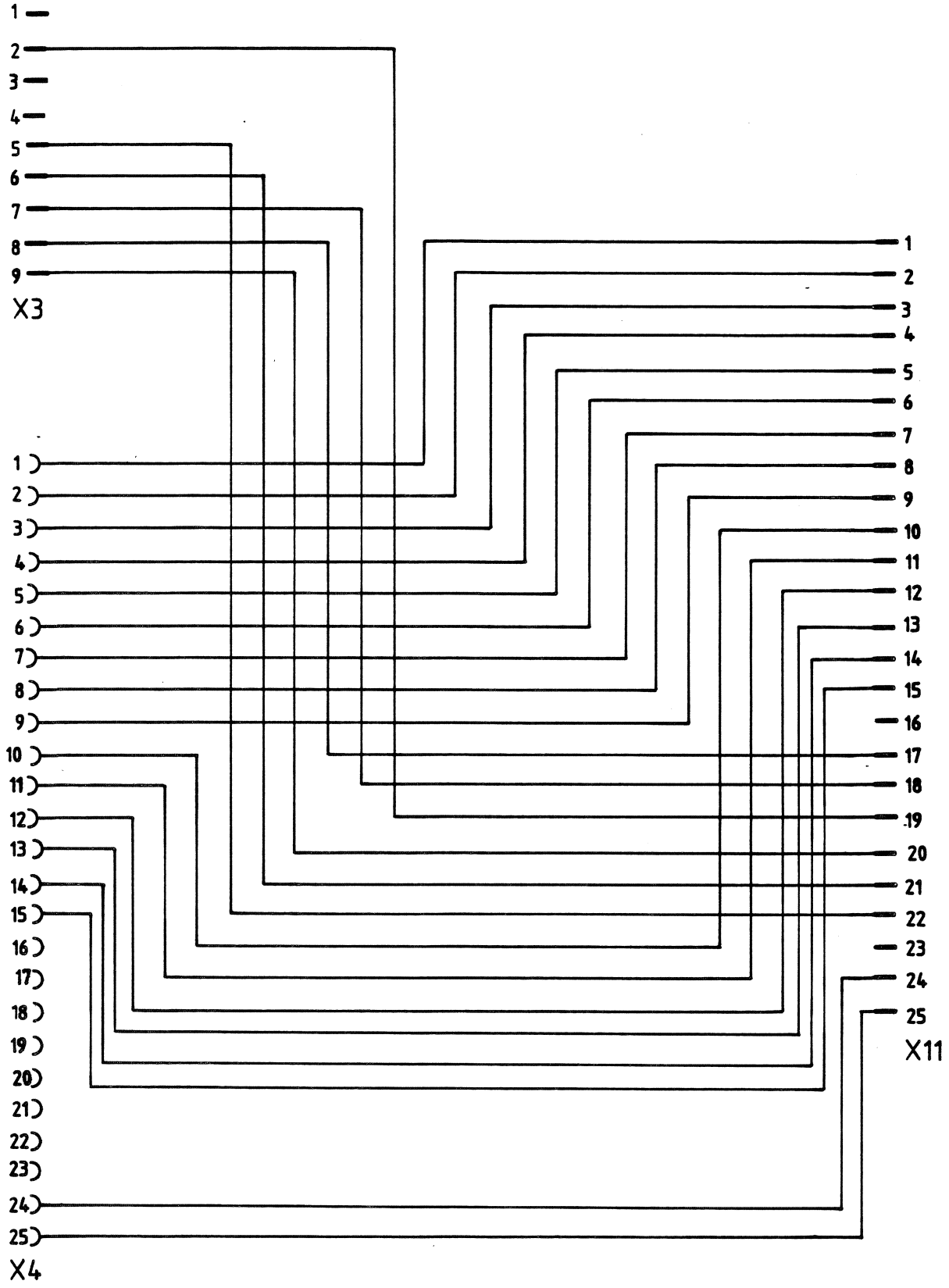
				Gepr	
				Norm	
Ana Zust	Änderungs-Mitteilung	Tag	Name	ROHDE&SCHWARZ	Zeichn.-Nr 685.6510 Blatt-Nr
				zu Gerät	reg. v 685.6510V erste Z —— v Bl

Projektion
Methode E



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				Gepr	
				Norm	
				ROHDE&SCHWARZ	Zeichn.-Nr 685.6527 S
Änd Zust	Änderungs-Mitteilung	Tag	Name	zu Gerät KG859Z2	reg. v 685.6510 V erste Z 685.6510

Blatt-Nr
v Bl

STUECKLISTE

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Benennung/Beschreibung	Z	Sachnummer	Äl FP	DIN A	Blatt Nr.
KG859Z2 TEILESATZ	Z	685.6510		4	1

Stückliste					SA	Fertigungsplan		Fertigungs-Vorschrift	FH	Werk	K.-St.
Konstr. Abt. / Name	Äl	Änd. Mittlg.	Datum	Name		Aussteller	Änderung Datum Name				
6KBH RY	A	44579	0690	LUO	S						

Teile/Nutzen	Losgröße	Stückzahlbereich 1 bis Stück	2 bis Stück

Druckanforderung 752 3EPF

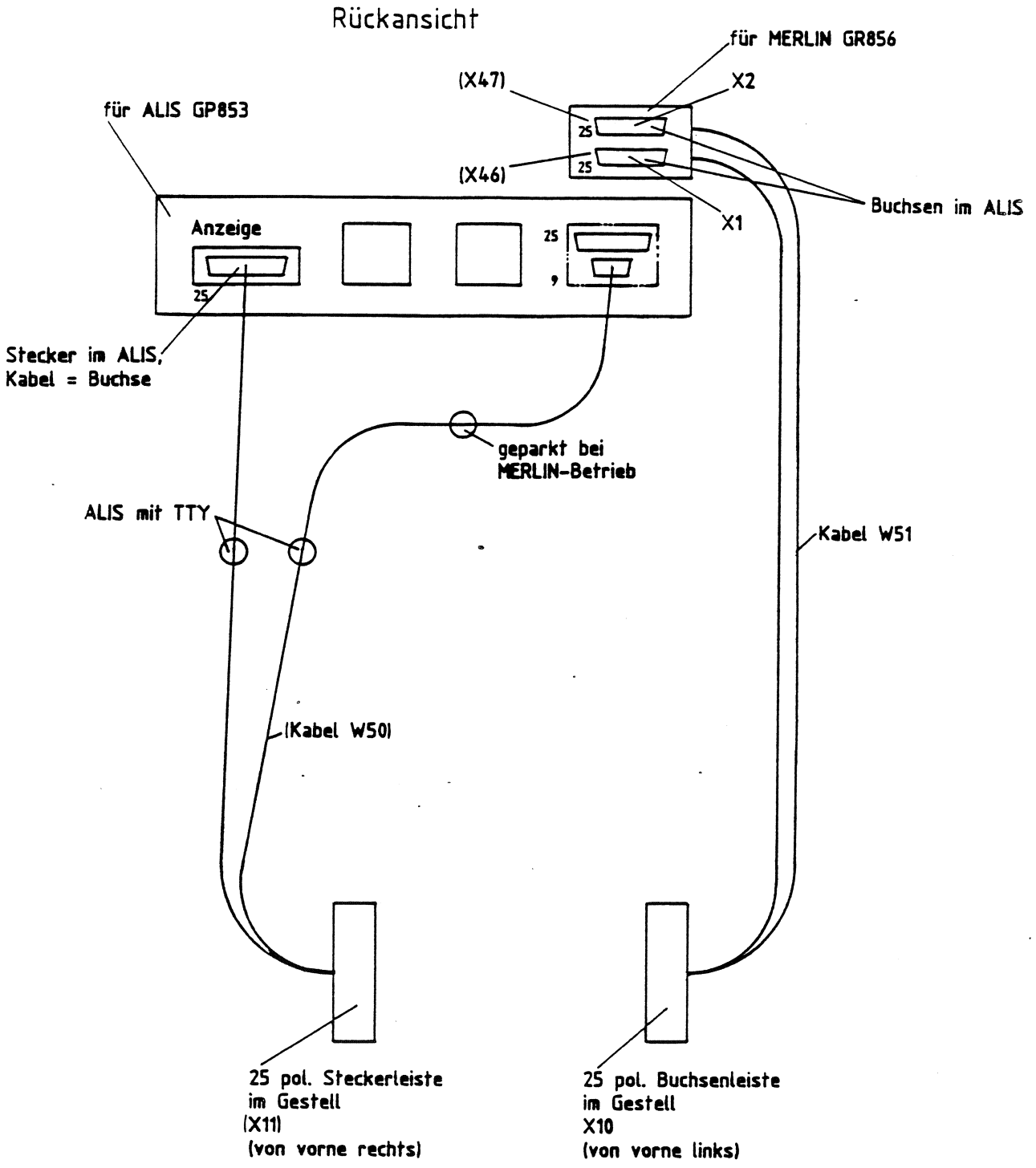
zugehöriges Verzeichnis	enthalten in Sachnummer
685.6510	000.0000

KG859Z2 TEILESATZ

VH	Lfd.-Nr.	Menge ME	Kennzeichen	Benennung / Beschreibung	Z	KT Sachnummer	Besch. Art. AK	Einbau-Code	FH
Arbg. Nr.	Termin	WK-KST	Arb.-Pl.-Gr.	Arbeitsgang		B Werkzeug-Nr.	tr	te	
	0001			ZUGEH.UNTERL./ADDIT.DOCUM					
	1					681.3017	BL.4		
						681.3017	M-BL.12+13		
	0020	1 S	W50	DX KABEL W50	Z	685.6527	F5A		
	1			ALIS (TTY)-LED ANZEIGE					
+	0030	2 S		VS DIN965-M3X8-A4		VS 081.9384	H1H		
	0040	7 S		DZ KABELBI.RD1,5BIS45B5		DZ 082.5018	B1E		W
							ENDE		

Werk: München 10, Teisnach 12, Memmingen 20

ME: S = Stück, G = Gramm, K = Kilogr., M = m, Q = m², L = Liter



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	6KBH / Tag / Name		Benennung
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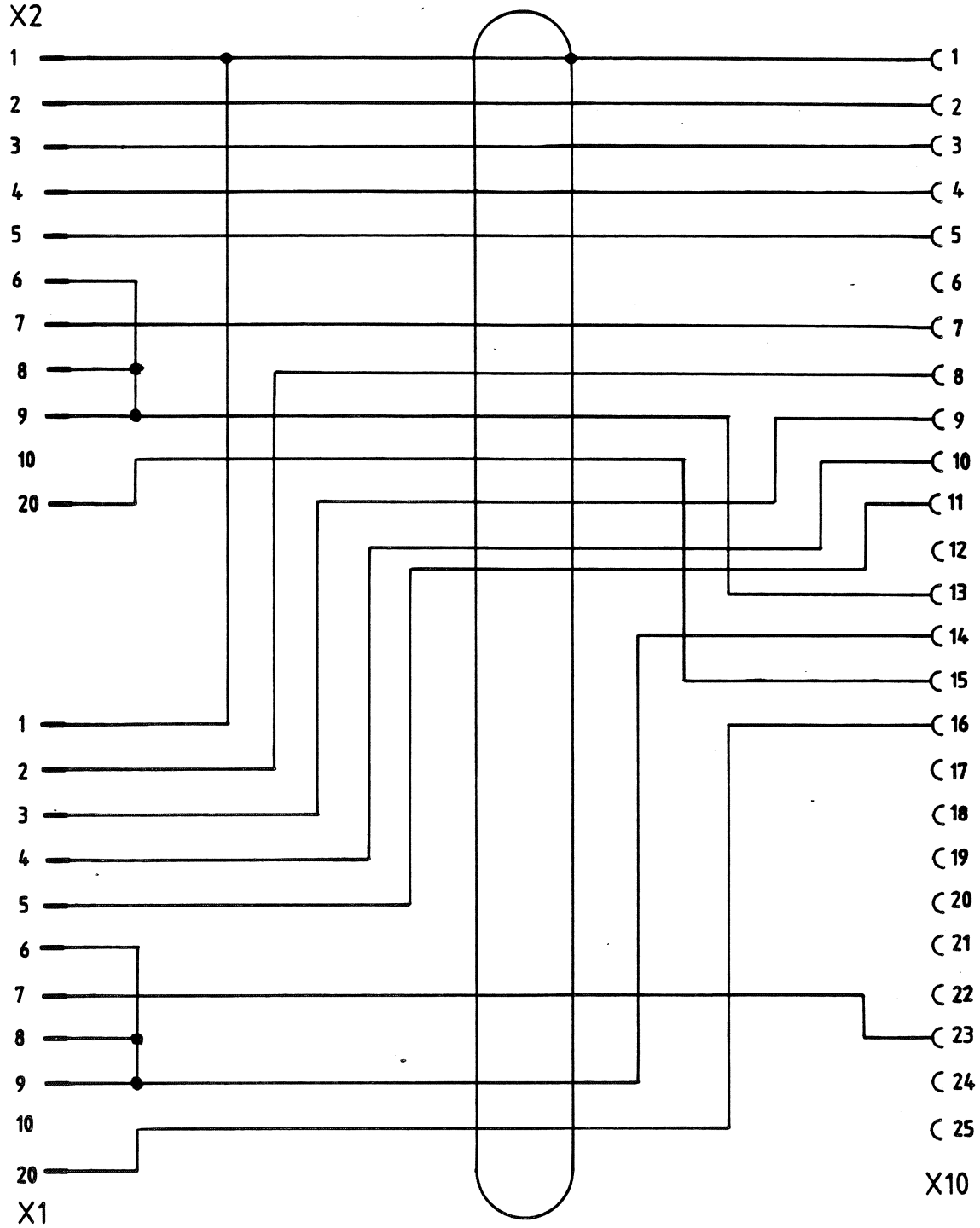
	Gepr.		
	Norm		
	ROHDE&SCHWARZ		Zeichn.-Nr 685.6610 / Blatt-Nr v 8
And Zust	Änderungs-Mitteilung	Tag / Name	zu Gerät / reg i V 685.6610V / erste Z ——

D-Projektion
ethode E



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				6KBH Tag Name	Benennung
				Bearb 08.89 Gr / my	Kabel W51
				Gepr	
				Norm	
				ROHDE&SCHWARZ	Zeichn -Nr 685.6627 S
Ana Zust	Anderungs-Mitteilung	Tag	Name	zu Gerat KG859Z3	reg i v 685.6610V erste Z 685.6610

Blatt-Nr v Bl

D-Projektion
etnode E

STUECKLISTE

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Benennung/Beschreibung	Z	Sachnummer	ÄI FP	DIN A	Blatt Nr.
KG859Z3 TEILESATZ	Z	685.6610		4	1

Stückliste					SA	Fertigungsplan		Fertigungs-Vorschrift	FH	Werk	K.-St.
Konstr. Abt./Name	ÄI	Änd. Mittlg.	Datum	Name		Aussteller	Änderung Datum Name				
6KBH RY	A	44580	0690	LU	S						

Teile/Nutzen	Losgröße	Stückzahlbereich 1 bis Stück	2 bis Stück

Druckanforderung 752 3EPF

zugehöriges Verzeichnis	enthalten in Sachnummer
685.6610	000.0000

KG859Z3 TEILESATZ

VH	Lfd.-Nr.	Menge ME	Kennzeichen	Benennung/Beschreibung	Z	KT Sachnummer	Besch. Art. AK	Einbau-Code	FH
Arbg. Nr.	Termin	WK-KST	Arb.-Pl.-Gr.	Arbeitsgang		B Werkzeug-Nr.	tr	te	
	0001			ZUGEH.UNTERL./ADDIT.DOCUM					
	1					681.3017	BL.4		
						681.3017	M-BL.14-16		
	0020	1 S	W51	DX KABEL W51	Z	685.6627	F5A		
	1			ALIS(V24)-MERLIN					
+	0030	2 S		VS DIN965-M3X8-A4		VS 081.9384	H1H		
	0040	1 S		DZ KABELBI.RD1,5BIS45B5		DZ 082.5018	B1E		W
	0050	2 S		DZ KABELBINDER L 200		DZ 086.8340	B1E		W
							ENDE		

Werk: München 10, Teisnach 12, Memmingen 20

ME: S = Stück, G = Gramm, K = Kilogr., M = m, Q = m², L = Liter