ROHDE&SCHWARZ

Radio Communications Systems
Division

User Manual

VLF - HF RECEIVER
EK 085

651.6018

673.2144.12.01 - 1

User Manual

VLF - HF RECEIVER EK 085

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V L F - H F R E C E I V E R 10 kHz to 30 MHz
E K 0 8 5

User Manual
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Appendix**********

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1. Characteristics

1.1 Application

See data sheet PD 756.5740.21

1.2 Design and Functioning

See data sheet PD 756.5740.21

1.3 Technical Data

See data sheet PD 756.5740.21

1.4 Recommended Accessories

See data sheet PD 756.5740.21 and the following subchapters.

1.4.1 Mating Connector Set EK 085Z1

As an accessory Mating Connector Set EK 085Z1 can be supplied, which permits to establish all connections (except for headphone connection) of VLF-HF Receiver EK 085.

Order number of the mating connector set: 6000.0015.01

Details on the preparation of connecting cables are provided in Appendix A.2 of this User Manual. Details on the R&S Internal Guidelines for cable preparation are provided in Appendix A.3 of this User Manual.

1.4.2 List of Connectors (according to their Function)

Connection	Inscription on rear panel	Mating connector	Order no.
Teletyper	**TTY**	Male connector strip 9-way 9 x pin, size 20 Cover, shielded	567.4683.00 511.8090.00 586.9870.00
Remote control	**REMOTE**	Fem. connector strip, 15-way 15 x socket, size 20 Cover, shielded	657.5236.00 511.8102.00 586.9564.00
Control of external equipment	**EXTERN**	Male connector strip, 15-way 15 x pin, size 20 Cover, shielded	657.5365.00 511.8090.00 586.9564.00
Inputs/outputs	**INPUT / OUTPUT**	Male connector strip, 37-way 37 x pin, size 20 Cover, shielded	657.5242.00 511.8090.00 586.9570.00
IF output	**IF**	Cable plug, system BNC	241.1378.00
Frequency standard input	**5 MHz**	Cable plug, system BNC	241.1378.00
Antenna input		Cable plug, system BNC	241.1378.00
Battery	**19...31 V**	Socket, 3-way	591.1997.00
Mains	**100 / 120V** **220 / 240V**	Mains cable with Euro socket	025.2365.00

2. Preparation for Use and Operation

2.1 Preparation for Local and Remote Operation

2.1.1 Check of Set Mains Voltage

The unit is suitable for connection to mains voltages of 100, 120, 220 or 240 VAC with maximum admissible tolerances of -15 to +10 %. The range of the mains frequency is 47 to 420 Hz. Ex works the unit is set for a mains voltage of 220 VAC.

Before switching the unit on, ensure that the mains voltage selector is correctly set for the local mains supply (50, Fig. 2.14).

Note:

The setting of the unit to the local mains supply voltage that is available is described in 2.1.2.

2.1.2 Setting of Mains Supply Voltage

The receiver can be set to operate on the mains supply voltages of 100, 120, 220 or 240 VAC.

If it is necessary to change the setting to another mains supply voltage, proceed as follows:

- Pull out the cover plate with the imprinted voltage values of the mains voltage selector in the power terminal (50, Fig. 2.14) and insert the fuse holder in such a way that the required voltage rating (imprinted on the mains voltage selector) is below the triangular marker.

The receiver is then ready for operating on the newly set mains voltage.

Operation on mains supply voltages of 100 and 120 VAC calls for a microfuse T2.5D (2.5 A) and on 220 and 240 VAC for a microfuse T1.25 (1.25 A), both acc. to DIN 41571.

2.1.3 Functions of MEMORY Switch

The MEMORY switch (53, Fig. 2.14) is used for erasing the channel memory of the VLF-HF receiver. The way in which it works is as follows:

1) When the MEMORY switch is set to ON, the receiver settings in the channel memory and the last setting of the receiver are stored nonvolatile.

2) If the MEMORY switch, with the receiver switched on, is switched from ON to OFF and then back to ON, all memory locations in the channel memory will be overwritten with a "zero" the next time the receiver is switched off.

3) If, after switching off the receiver, the MEMORY switch is switched from ON to OFF, the channel memory will lose its contents after approx. 20 s and all memory locations are then in an undefined condition. All memory locations in the channel memory will be overwritten with a "zero" the next time the receiver is switched on.

2.1.4 Functions of TTY Switch

The VLF-HF receiver is fitted with a line-current source, meaning that a teletyper can be connected to the TTY socket (44, Fig. 2.14) without requiring accessories. This output is general-purpose, i.e. it is possible to connect teletypers working with

a) single current (0 mA, 40 mA)

b) polar current (-20 mA, +20 mA)

c) V.28 interface

If a teletyper using single current is used, the slot switch TTY (43) has to be set to , and for polar current the setting is necessary.

2.1.5 Functions of Jumpers in Power Supply/EMC Filter

The VLF-HF Receiver EK 085 offers the possibility of setting accessories, like antenna selector switches, AF matrixes, by way of the keypad on the front panel. The numerical range is 0 to 9, i.e. as many as ten different external units can be controlled.

According to the selected digit a code is fed to the EXTERNal socket (54) on the rear of the unit that is independent in value from the entire setting of the receiver.

If the four jumpers are inserted on connector X100 between A and B, coding is 1-out-of-10, i.e. depending on the selected number the appropriate connection on the EXTERNal socket (54) switches through to ground (open collector, max. 30 V/30 mA).

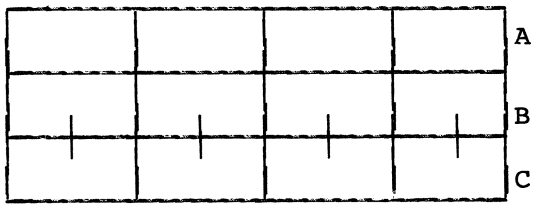
If the four jumpers on connector X100 are inserted between B and C, the first six digits (0 to 5) are coded just the same, but for the last four digits the numbers are in BCD code ("6"=1, "7"=2,"8"=4, "9"=8).

The required decoding can be set as follows;

1) Undo two screws (1 and 3, Fig. 2.2).

2) Insert jumpers X100 A, B, C with the aid of tweezers according to the following table for the required decoding.

X100



Setting	Decoding
A - B	1-out-of-10
B - C	Digits 0 to 5 = 1-out-of-10 Digits 6 to 9 = BCD

Note:

If the given decoding is to be altered, all four jumpers always have to be changed.

3) Screw cover plate back on.

2.1.6 Functions of Jumpers inside the Demodulator

In the demodulator there are four jumpers, the functions of which are as follows:

1) Jumper X6

Setting	Function
1 - 2 *	For class of emission CW a low-pass filter with a cut-off frequency of 1.2 kHz is switched into the monitoring channel.
2 - 3	The low-pass filter is not switched on.

* Basic setting

2) Jumper X7

This jumper serves for switch-over of the tone frequency in FAX operation.

Setting	Function
1 - 2 *	Tone frequency approx. 5 kHz
2 - 3	Tone frequency approx. 1.7 kHz

* Basic setting

3) Jumper X8

This jumper serves for optimally matching the FSK demodulator to the keying rate of the received FSK signals.

Setting	Function
1 - 2 *	≧ 100 baud
2 - 3	≦ 100 baud

* Basic setting

Note:

The jumper should be set to position 1-2 unless transmitters with a baud rate of ≦ 100 baud are received for the most part.

4) Jumper X9

Setting	Function
1 - 2 *	Tone keying output active for FSK
2 - 3	Tone keying output disabled for FSK

* Basic setting

Access to the demodulator for setting the jumpers is described in part 4.4.

After undoing the six screws remove the top lid of the mainframe and insert the jumpers as required.

The position of the jumpers on the circuit board of the demodulator is identified in Fig. 2.4.

2.1.7 Functions of Switches and Jumpers in IF Converter/ SINAD Evaluation

For setting the switches and jumper X15 a complete removal of the module is not required. It suffices to carry out steps 1 to 4 of part 4.4.8, which describes the removal of the above module.

Following this, pull out the module for approx. 2 to 3 cm from the cassette. The switches and jumper are now accessible, thus enabling setting to the new positions.

The resetting of jumpers X10 and X11, however, demands an entire removal of the module (refer to 4.4.8).

The locations of the switches and jumpers on the circuit board of the IF Converter/SINAD evaluation are marked in Fig. 2.5.

1. Switch S1

Rotary switch S1 is used to set the waiting period in the range 0.2 to 5 s, in increments of approx. 0.4 s, on completion of which, the search (SWEEP, SCAN, CH/CH) continues automatically.

Switch setting	Waiting period in s
0	0.2
1	0.5
2	0.8
3	1.2
4	1.6
5	2.0
6	2.3
7	2.6
8	3.1
9	3.4
A	3.8
B	4.1
C	4.3
D	4.6
E	5.0 *)
F	5.4

*) basic setting

2. Switch S2

The second IF of the receiver is tested for its S/N ratio. The demodulated signal arrives at the output of a comparator which controls a down-counter, whose starting value is set by the DIL switch. Up to a point, the relation S/N in dB to the starting value of the counter depends on the operation mode as well as the modulation type and its depth. The table below conveys a general idea and is valid for up to 30 % amplitude modulation and from a bandwidth of 300-Hz.

Switch	S/N reference value in dB
1	15
2	14
3	13
4	11 *)
5	10
6	8

*) basic setting

Possible interstages can also be set with several switches. The effect depends on the respective value.

3. Switch S3 and jumper X15

DIL switch S3 and jumper X15 are for the setting of the output IF between 10 kHz and 50 kHz, in increments of 0.5 kHz or 0.25 kHz.

The valence of the individual switches of switch S3 and the significance of jumper X15 is explained overleaf.

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---(Continuation) Functions of Switches and Jumpers in IF Converter/SINAD Evaluation

X15

Setting	Valence (kHz)
1-2	0
2-3	0.25

S3

Setting	Valence (kHz)	
1	0.5	Switched on, when the respective individual switch is set to OFFEN/OPEN.
2	1	
3	2	
4	4	
5	8	
6	16	
7	32	
8	64	

When setting the output IF, take into account that the value to be set must invariably be higher by 32 kHz than the required output IF. The four following examples help to explain this.

a) Required output IF is 10 kHz

10 kHz + 32 kHz = 42 kHz
⟶ (32 + 8 + 2) kHz.

Switches 7, 5 and 3 are set to OFFEN/OPEN; all other switches must be closed. Jumper X15 is set to 1-2.

b) Required output IF is 50 kHz

50 kHz + 32 kHz = 82 kHz
⟶ (64 + 16 + 2) kHz.

Switches 8, 6 and 3 are set to OFFEN/OPEN; all other switches must be closed. Jumper X15 is set to 1-2.

c) Required output IF is 12.75 kHz

12.75 kHz + 32 kHz = 44.75 kHz
⟶ (32 + 8 + 4 + 0.5 + 0.25) kHz.

Switches, 7, 5, 4 and 1 are set to OFFEN/OPEN; all other switches must be closed. Jumper X15 is set to 2-3.

d) Required output IF = -10 kHz

This means that the side bands are a reflection of the original position.

-10 kHz + 32 kHz = 22 kHz
⟶ (16 + 4 + 2) kHz.

Switches 6,4 and 3 are set to OFFEN/OPEN; all other switches must be closed. Jumper X15 is set to 1-2.

(Continuation)---

---(Continuation) Functions of Switches and Jumpers in IF Converter/SINAD Evaluation

Each alteration of the switch setting must be followed by a check of the control voltage on X12. If necessary, it must be adjusted to the nominal value of

4.5 ±0.5 V

with L5.

By reconnecting three jumpers, it is possible to apply three of the following five signals to socket "Input/Output" or IF output.

1. IF = 1.44 MHz
   (70 to 120 mV into 50 ohms)

2. IF = 10 to 50 kHz
   (according to setting of S3)
   0 dBm ±2.5 dB into 600 ohms.

3. Starting pulse:
   The search can be continued with a 5-V low pulse.

4. Measuring clock of the SINAD evaluation:

   5-V pulses with a pulse sequence of approx. 50 ms.

   (The results appear on socket "Input/Output", contact 10:
   5-V logic, Low = frequency stored, High = S/N too low.)

5. Overall result of the SINAD evaluation on one frequency:

   5-V logic: Low, if a measuring result (single measurement - option 2) produces a higher S/N than the threshold set with S2; but the next frequency change effects a return to High.

Position of jumpers:

Signal	IF output	Option 1	Option 3
IF = 1.44 MHz	X11.4 - X11.5		
IF = 10 to 50 kHz	X11.3 - X11.4 *)		X11.2 - X11.3
Starting pulse		X10.2 - X11.1	X11.1 - X11.2
Measuring clock		X10.1 - X10.2 *)	
Overall result		X10.2 - X10.3	X10.3 - X11.2 *)

*) basic setting

2.2 Preparation for Remote Control

If the VLF-HF Receiver EK 085 is to be remotely controlled from a central control unit, e.g. GB 606 or a central computer, e.g. PUC or PCA5, various internal settings have to be made (address, data rate, type of V. interface). These settings are described below.

2.2.1 Setting of Baud Rate

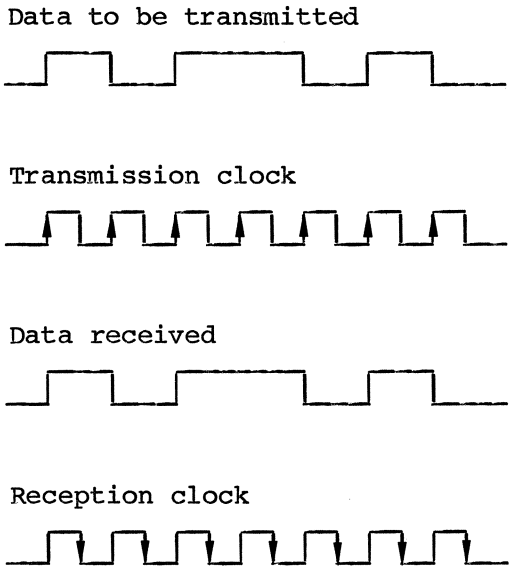
Ex works the receiver is set for a transmission rate of 2400 baud. Using switch S4 on the processor board in the control unit it is possible to set the transmission rates according to the following table.

Access to the control unit for making the settings is described in part 4.4. Switch S4 is a rotary switch with imprinted digits which can be set to the required baud rate with a screwdriver through an opening marked on the rear of the control unit.

ISO-synchronous operation

(only for mode 6 to 9)

If switch S4 is set to Ø (external clock), the transmitted and received data are transferred synchronously to a clock signal that is to be fed in from outside. This clock has to be fed in on connector X4B.5. The clock and the data have the following time relationship:



Switch setting	Baud rate	Parity	Number of stop signals
0	external clock	odd	1 (for synchronous X.21 operation)
1	50	even	2
2	100	even	2
3	110	even	2
4	300	even	2
5	600	odd	1
6	1200	odd	1
* 7	2400	odd	1
8	4800	odd	1
9	9600	odd	1

* Basic setting

In transmission the respective paritybit is always transmitted as well.

2.2.2 Definition and Connection Possibilities of X./V. Interfaces

The receiver can be remotely controlled via an X.21 or V.24 interface or a bus link (RS 485) as required.

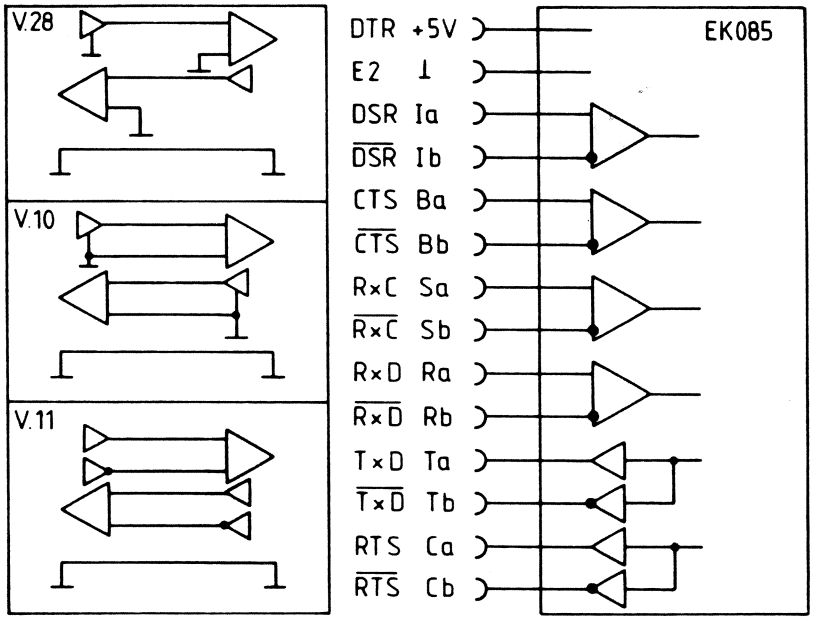
CCITT recommendation X.21 describes an interface for synchronous operation on public data networks. It permits the use of both unbalanced signal lines (similar to V.10) and balanced signal lines (similar to V.11).

V.24/V.28 is a system for short links, preferably for the connection of modems. In this standard there is one line each for sending and receiving data, the return line being common.

With the bus connection it is possible to configure local networks with as many as ten subscribers, these communicating over two twisted cable pairs.

For more subscribers (max. 99) amplifiers have to be interconnected.

The remote-control interface of the receiver is designed as a differential interface, meaning that there are the following, different possibilities of connection.



V.28 : Only terminals a are used (± 5 V level), those of b remain unwired and are referred internally to ground.

V.10 : Terminals a are user (±5 V level), inputs b are connected to the ground of the detached unit, outputs b remain unwired.

V.11 : Terminals a and b are used (level 0 V, +5 V).

BUS : Possibilities of connection like V.28, V.10 and V.11.
(RS 485)

Fig. 2.1 Interconnection of Receiver with Modem, Computer or Control Unit

2.2.3 Setting of V.24/X.21 Interfaces

Ex works the interface of the receiver is set according to standard V.24/V.28 with level of ±5 V.

With switch S3 (mode) on the processor in the control unit the interface can be set for standard X.21 or for bus operation.

The settings of the switch are as follows:

Switch setting	Mode	Parity check in reception*
0	X.21	yes
1	X.21	no
2	X.21 modification	yes
3	X.21 modification	no
4	BUS/X.21 (with GV 080)	yes
5	BUS/X.21 (with GV 080)	no
6	BUS (RS 485)	yes
7	BUS (RS 485)	no
**8	V.24	yes
9	V.24	no

* The appropriate parity bit is always sent when transmitting.

** Basic setting

The setting of the jumpers X31, X33 and X37 to X42 should also be checked with reference to 2.2.9 and altered if necessary.

Access to the control unit for setting switch X3 (mode) is described in 4.4.

Switch S3 (mode) is a rotary switch with imprinted digits which can be set to the required mode with a screwdriver through an opening marked on the rear of the control unit.

2.2.4 Connection of X.21 Interface, Mode Ø and 1

If the HF receiver is connected to a modem in line with X.21 standard, the contacts of connector REMOTE on the rear are to be connected to the modem according to Fig. 2.6.

The contact assignment of the REMOTE connector may be found in the interface description in appendix 1.

2.2.5 Connection of X.21 Interface (Modification), Mode 2 and 3

If two HF receivers are directly interconnected in line with X.21 standard, the contacts of connector REMOTE on the rear are to be connected together according to Fig. 2.7.

The contact assignment of the REMOTE connector may be found in the interface description in appendix 1.

2.2.6 Connection of Interface in Bus Operation, Mode 6 and 7

In this mode, in contrast to the V.24/X.21 interfaces, it is possible for several units (max. ten) to be both remotely controlled and scanned. The possible types of connection are illustrated in Fig. 2.8 to 2.12.

The contact assignment of the REMOTE connector may be found in the interface description in appendix 1.

2.2.7 Connection of Interface in Bus/X.21 Operation

In this mode, in contrast to the V.24/X.21 interfaces, it is possible for several units to be both remotely controlled and scanned. The interconnection of the units is illustrated in Fig. 2.12.

The contact assignment of the REMOTE connector may be found in the interface description in appendix 1.

2.2.8 Connection of V.24 Interface (RS 232), Mode 8 and 9

See Fig. 2.13

If the receiver is connected to a modem, the contacts of connector REMOTE on the rear are to be connected to the modem according to V.24 standard (see Fig. 2.13b).

If units with V.24 interfaces are interconnected that produce no acknowledgement signals, Fig. 2.13c will apply.

The shorting links shown there replace the acknowledgement signals (own handshake) and are necessary for operation.

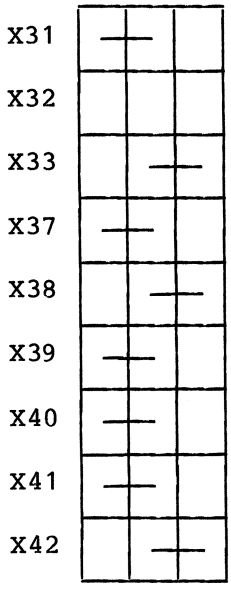
If units with V.24 interfaces are interconnected that do produce acknowledgement signals, Fig. 2.13a applies.

The contact assignment of the REMOTE connector may be found in the interface description in appendix 1.

2.2.9 Functions of Jumpers on Processor in Control Unit

With the jumpers on the processor it is possible to set different operating modes of the receiver. Access to the control unit for making the settings is described in 4.4. The jumpers can be altered with tweezers. The basic settings ex works are as follows:

(basic setting)



(possible setting)

	1 - 2	2 - 3
X31	ALE operation	ALE test
X32	SID = Ø	SID = 1
X33	Special mode	X.21/V.24/BUS
X37	Channel memory enabled	Channel memory disabled
X38	Interface levels 0 V, +5 V	Interface levels ± 5 V
X39	ECHO OFF	ECHO ON
X40	RAM - D10 V_{CC} on +5 V	RAM - D10 V_{CC} on batt.
X41	RAM - D10 V_{CC} on +5 V	RAM - D10 V_{CC} on batt.
X42	RAM - D10 V_{CC} on batt.	RAM - D10 V_{CC} on +5 V

Explanation of functions of jumpers

1) X31
   ALE operation : normal operation
   ALE test : test operation with automatic tester (ALE line has no connection to CPU)

2) X32
   SID = Ø : parallel interface/four-channel operation
   SID = 1 : normal operation/option

   Note:

   X32 is not a jumper. Switchover is made automatically by connecting the option.

(Continuation)---

---(Continuation) Functions of Jumpers on Processor in Control Unit

The transmission of tuning data to the digitally tuned or motor-tuned filter is coded by jumpers in the options according to the following table:

X32 SID	X21.b23	X9.a30	Function
Ø	Ø	1	Four-channel operation, data to motor-tuned filter
Ø	Ø	Ø	Four-channel operation, data to digitally tuned filter
Ø	1	1	Parallel interface, data to motor-tuned filter
Ø	1	Ø	Parallel interface, data to digitally and motor-tuned filter
1	Ø	1	Option, data to motor-tuned filter
1	Ø	Ø	Option, data to digitally tuned filter
1	1	1	Normal operation, data to motor-tuned filter
1	1	Ø	Normal operation, data to digitally tuned filter

3) X33
   Special mode X.21/V.24/BUS : interface has four independent drivers
   interface corresponds to standards X.21, V24 or BUS

4) X37
   Channel memory enabled : 100 channels can be programmed from front panel or via interface

   Channel memory disabled : no channels can be programmed from front panel (only via interface)

(Continuation)---

---(Continuation) Functions of Jumpers on Processor in Control Unit

5) X38

Interface levels 0V, +5 V	:	data transmission on interface with 0 V, +5 V
Interface levels ±5 V	:	data transmission on interface with ±5 V

6) X39

ECHO OFF	:	receiver does not return received data string in remote control
ECHO ON	:	receiver returns received data string in remote control

7) X40, 41, 42

RAM - D10 V_{CC} on +5 V	:	RAM D10 receives operating voltage from +5 V supply
RAM - D10 V_{CC} on batt.	:	RAM D10 receives operating voltage from built-in battery

2.2.10 Setting of Device Address

The receiver is provided with an addressing facility for remote control because each data set for remote control commences with the receiver address. The addressing of the receiver is made with the address switches S1 and S2 in the processor of the control unit. The address switches S1 and S2 are decade-oriented, i.e. the ones place of an address between 00 and 99 is set with switch S1 and the tens place with switch S2.

Access to the control unit for making the setting is described in 4.4. Switches S1 and S2 are rotary switches with imprinted digits which can be set to the required address with a screwdriver through openings marked on the rear of the control unit.

Ex works an address of 00 is set. This setting has a special function: the receiver is then in the condition "Not addressed", i.e. it accepts any data that are conveyed to it. This setting is not suitable for bus operation of course.

When the receiver is in an addressed condition, only those data strings will be accepted that are identified with the appropriate address.

Exception: data strings with the address 00 are accepted by all receivers, whether addressed or not (broadcast message).

S2		S1	
Setting	Decimal equivalent	Setting	Decimal equivalent
0	0	0	0
1	10	1	1
2	20	2	2
3	30	3	3
4	40	4	4
5	50	5	5
6	60	6	6
7	70	7	7
8	80	8	8
9	90	9	9

2.3 Equipement Set-up

2.3.1 General

The receiver can be set-up and operated in any position without its characteristics being negatively affected.

The rated values stated in the Data Sheet apply for the ambient temperature. Direct sunlight should be avoided.

C A U T I O N

Set power switch (41, Fig. 2.14) to OFF.

2.3.2 Desktop Model

The desktop model consists of the basic unit, provided with planking, side strips and a swivel carrying grip. This enables simple setting down and also functions as a prop stand.

If several units are stacked, their carrying grips can be folded away beneath the units. The position of the carrying grip is altered by simultaneously pressing the swivel points of the grip and tilting it in the required direction.

If required, the grip can be removed entirely. This can be done by unscrewing the two screws, right and left, on the frame.

2.3.3 19-inch Rackmount

Slide the 19-inch rackmount into a 19-inch rack at the allocated place and retain with two screws beneath each handgrip.

The desktop model can be simply converted into a 19-inch rackmount. First remove the planking, carrying grip and side strips. After a 19-inch adapter has been fitted, the receiver can be installed in a 19-inch rack.

2.4 Cabling of Receiver

The cabling of the receiver for operation without any peripherals is limited to - apart from the power supply - connecting a 50-ohms antenna with a BNC connector to the antenna socket (52, Fig. 2.14). For the preparation of a coaxial cable with a BNC connector, appendix 2 contains all necessary instructions.

For details of connecting the power supply, refer to 2.6.

2.5 Connection of Peripherals

The VLF-HF Receiver EK 085 exhibits versatile system capabilities and a large degree of operating ease, no matter whether it is operated locally, detached or at long distance.

Standard interfaces for controlling and connecting peripheral units enable simple integration of the receiver into existing systems. Thus it is possible, for instance, to connect teleprinters, weather-chart and facsimile recorders directly and without any internal modification of the unit and to control accessory units like an antenna selector switch, AF matrix, etc.

For detached operation, remote control or computer control, the receiver has a standard V.24/X.21 data interface (see 2.2). Available as options are an IEC 625-1 interface and a MIL BUS in line with MIL-STD-1553B. With these interfaces it is also possible to control several Receivers EK 085 from a central computer or from a master Receiver EK 085 (master/slave) and to control peripherals. Remote control is equally straightforward over telephone lines or microwave channels. The additions and accessories that are necessary for this can also be connected without interior modification of the receiver.

On Receiver EK 085 all interfaces, with the exception of the socket for the connecting headphones, are located on the rear of the unit. Fig. 2.14 illustrates the arrangement of the connectors and sockets.

Explanations, such as contact assignment of connectors with interface levels for the connection of peripherals, may be found in the interface description in appendix 1 of this user manual.

2.6 Connection of Power Supply

The power supply of Receiver EK 085 can come either from an AC mains supply (100, 120, 220, 240 VAC) and/or from a DC voltage source (19 to 31 VDC) floating, with automatic switchover if there is a mains supply failure.

C A U T I O N

The receiver is always to be connected to the power supply when switched off, i.e. the on/off switch for mains and battery operation (41, Fig. 2.14) must not be pressed.

2.6.1 Mains Supply

The receiver is connected to the local AC mains supply by means of the power cable (R&S Ident. No. 025.2365.00) connected to the power terminal (50, Fig. 2.14).

The receiver fulfils the protection requirements of category I of VDE 0411. Category I calls for isolation in operation of the power circuits and properly conducting, sustained connection af all conductive parts of the equipment that can be touched, and which can conduct voltage in the event of a fault, both with one another and with the safety earth conductor.

C A U T I O N

Only plug the power connector of the power cable into a grounding-contact type of socket.

If a terminal is available, this must always be connected to a non-fused grounded conductor. This grounded conductor may not be fused.

Fluctuation of the mains voltage from the particular rating by between -15 % and +10 % will not cause degradation of the receiver technical data stated in the Data Sheet. If the line voltage drops below the -15 % tolerance, switchover to battery supply will be automatic, provided that a battery is connected.

2.6.2 Battery Supply

The battery connector (48, Fig. 2.14) is designed for a DC voltage of between 19 and 31 V. This kind of supply is of advantage in particular if the receiver is used in a mobile application or with mains supply so that there can be automatic switchover to this battery supply in the event of a mains power failure.

The contact assignment of the battery connector and details of the matching socket my be found in the interface description in appendix 1.

2.7 Equipment Switch-on

Before switching on for the first time, ensure that the mains voltage as set on the receiver corresponds to the mains voltage that is available locally (see 2.1.1 and 2.1.2).

The receiver is switched on by means of the power switch (41, Fig. 2.14). The green LED (42, Fig. 2.14) will then illuminate to indicate that all operating voltages are applied. If the mains voltage is too low or if there is any disturbance in the internal supply voltages, the LED will remain extinguished (see part 4).

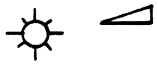
- In manual operation the slot switch (40, Fig. 2.14) must be set to LOC/REM or LOC, REM, CLOCK.
- If only remote control by a computer is required, the slot switch (40, Fig. 2.14) has to be set to REM.

The receiver EK 085 is ready for use immediately after switch-on. It incorporates a nonvolatile data memory and proceeds to work after switch-on as it was set before last being switched off. The 100 internal memory locations with all settings are preserved in their entirety. For exceptions to this, refer to 2.1.3.

2.8 Local Operation

2.8.1 Functions of Controls and Indicators

(see Fig. 2.14)

No.	Designation	Design	Function
1		Potentiometer	Dimmer that acts on all light-up indicators and enables continuous setting of luminous intensity for adaptation to different local lighting conditions.
2		Level meter	Depending on setting of switch (3) value is indicated for HF input level, AF line level or TTY line current.
3	HF, NF/AF, FSK	Stepping switch, three settings	Selector switch for level meter (2).
4	TUNING	Red LED bar	Display of frequency offset of received transmitter (tuning indicator), ineffective for USB and LSB.
5	BANDWIDTH kHz	2-digit red 7-segment display	Digital display of set IF bandwidth.
6	BFO kHz	2 1/2-digit red 7-segment display	Digital display with sign of offset of BFO when latter is active.
7	FSK	Red LED display for + or -	Shows polarity for FSK if in FSK mode.
8	STATUS	3-digit red 7-segment display	Digital display for error messages E : operator error E3: produced by ongoing continuous monitoring e.g. E32: indication of defective module after triggering test
9	kHz	7-digit red 7-segment display	Digital display of tuned frequency in kHz.

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
10	EXT	1-digit red 7-segment display	Digital display of addresses 0 to 9 for EXERNal interface (54) for remotely controlling external units; only effective with EXT key (28).
11	PROGRAM	Four red LED scripts	Indication that program CLOCK, SWEEP, CH/CH or SCAN is active.
12	TIME	Two red LED scripts	Indication that time shown on digital display (13) is start or dwell time by illumination of START or SEC.
13		4-digit red 7-segment display	Digital display of time and of start and dwell time in conjunction with display (12).
14		Red LED script	Indication whether digits on display (15) are address or channel number by illumination of ADDR or CHAN.
15		2-digit red 7-segment display	Digital display of address or channel number (00 to 99).
16	RCL STO	Keys	Input keys for recalling and loading channel memory in MEM mode, set with rotary switch (39).
17	DAT REQ	Key	Triggering of data input/output via V.24/X.21 interface (56). By pressing key a further Receiver EK 085, i.e. with address 28, can be remotely controlled. Simultaneously pressing keys SHIFT (26) and DAT REQ produces transfer of setting of Receiver EK 085 with address 28.
18	TEST	Key	Key for triggering internal test of receiver.
19		Grille	Loudspeaker

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
20		Toggle switch	Loudspeaker ON/OFF
21		Jack	Headphones connector, suitable for 6.4 mm plug
22	 NF-AF	Potentiometer	Volume control for built-in loudspeaker (19) and 100 ohms headphones connected to socket (21) as well as for external loudspeaker or headphones on INPUT/OUTPUT socket (45).
23		Red LED	LED illuminates if variable BFO (24) is active.
24	kHz BFO	Potentiometer	Variable BFO BFO frequency is continuously variable between approx. -1.5 and +1.5 kHz.
25	SWEEP CH/CH SCAN	Keys	Input keys for starting SWEEP, CH/CH and SCAN operation.
26	SHIFT	Key	Shift key for programming: - FRQ steps (stepping width) - SWEEP program - CH/CH program - SCAN program
27	+ -	Keys	Sign keys for stepped alteration of settings (for settings with prime key): CH, BFO, EXT and ADDR in ±1 steps, FRQ in ± FRQ steps e.g. CH 12 ENT + + + CH 12, CH 13, CH 14, CH 15 appear
28	FRQ BFO CH EXT	Keys	Prime keys for: - frequency entry in kHz : FRQ 21285 ENT - BFO setting : BFO 1.2 ENT - channel recall : CH 28 ENT - EXTernal interface : EXT 5 ENT - recall of frequency display : FRQ ENT

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
	ADDR START, DWELL		- recall of EXT display : EXT ENT - addressing : ADDR 28 ENT - CLOCK-PROGRAM : see 2.8.7 As long as entry is not terminated with ENT key, digits on display will flash.
29	0...9 . ENT	Keys	Numeric entry keypad with decimal point and enter key.
30	SET	Key	Prime key for setting time.
31	ABSTIMMUNG TUNING	Tuning knob	Quasicontinuous tuning of receive frequency in 10-Hz, 100-Hz or 1-kHz increments according to set stepping width (32).
32	10 Hz 100 Hz 1 kHz OFF	Keys	Prime keys for stepping width in tuning (31). Active stepping width is indicated by illumination of corresponding LED. With OFF key TUNING knob (31) is disabled to prevent unintentional mistuning of set receiver.
33	AM, LSB, USB, CW FAX, OPT, FSK1, FSK2, FSK3,	Keys	Keys for selection of class of emission: AM = A3E, LSB = J3E, USB = J3E, CW = A1A, FAX = F1C, F3C FSK = F1B (matched to freqeuncy shift) OPT = option (switch-on of option, e.g. ISB accessory) Set class of emission is indicated by illumination of corresponding LED.
34	BW < BW >	Keys	Keys for altering IF bandwidth.

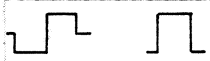
(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
35	POL	Key	Key for switching polarity in classes of emission FSK and FAX and for BFO.
36	STOP	Key	Key for switching teletyper output on socket TTY (44) on/off. Switched off TTY output (line current switched on) is indicated by illumination of LED.
37	FAST AGC MGC	Keys	Keys for switching on modes of gain control. FAST = switching of time constant of automatic gain control AGC between fast and slow AGC = switching automatic gain control on/off. MGC = switching manual gain control with potentiometer (38) on/off. AGC can only be switched off if MGC is switched on and vice versa. Switched on mode of gain control is indicated by illumination of corresponding LED.
38	HF	Potentiometer	Manual setting of HF gain control (MGC). Only effective if MGC (37) is switched on.
39	CH, MAN, MEM	Stepping switch, three settings	Selector switch for operating status of receiver - CH : only channel recall possible, e.g. CH28 ENT. - MAN : all settings possible, also channel and program recall. - MEM : recall and loading of channel memory and entry of program parameters without interrupting operation. Corresponding LED illuminates.

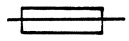
(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
40	LOC, REM, CLOCK, LOC/REM REM	Slot switch, three settings	Switchover for front-panel control (LOC), remote control (REM) or combined control (LOC/REM). - LOC : manual control - REM : remote control (priority) - CLOCK: channel recall at preprogrammed times Corresponding LED illuminates if manual control is not possible (in position REM and while data are taken over, position LOC/REM).
41	EIN·ON	Pushbutton with detent	Receiver on/off switch for mains and battery powering.
42		Green LED	Illuminated LED indicates that all operating voltages are applied.
43	 TTY	Slot switch, two settings	Switch for changing between single and polar current for teletyper connected on socket (44).
44	TTY	9-way female socket strip	Socket for connection of teletyper (see appendix 1, interface description).
45	INPUT/ OUTPUT	37-way female socket strip	Socket for different input/output signals (see appendix 1, interface description).
46	 5 MHz	BNC socket	Input for 5-MHz standard frequency for synchronizing synthesizer (see appendix 1, interface description).
47	 IF	BNC socket	IF output (see appendix 1, interface description).

(Continuation)---

---(Continuation) Functions of Controls and Indicators

No.	Designation	Design	Function
48	19...31 V	Flange connector	Connector for battery supply (see appendix 1, interface description)
49	 F2M6.3E	Screw cartridge fuse	Fuse for battery voltage.
50		Rubber connector	Power terminal with integrated mains-voltage selector and fuse.
51		Screw terminal	Terminal for communication ground.
52		BNC socket	Antenna input 50 ohms.
53	OFF ON MEM	Slot switch, two settings	Switch for erasing channel memory (if called for by application).
54	EXTERN	15-way female socket strip	Socket for connection of accessories (see appendix 1, interface description).
55	 LINE	Potentiometer with slotted axis	Control for setting level of AF line output on INPUT/OUTPUT socket (45).
56	REMOTE	15-way male plug strip	V.24/X.21 interface for remote control (see appendix 1, interface description).

2.8.2 Setting, Recalling and Storing Frequency

2.8.2.1 Setting Frequency on Keypad

Entry	Display	Remarks
FRQ	.	
8	8.	Entry of leading zeroes is permitted also filling-in up to 2nd place after decimal point.
0	80.	Display flashes
1	801.	
.	801.	
ENT	801.00	Receiver is tuned to new frequency

For incorrect entry, start again with FRQ .

2.8.2.2 Setting or Altering Frequency with Quasicontinuous Tuning

Entry	Display	Remarks
e.g. 100 Hz	Corresponding LED illuminates	
Turn tuning knob right/ left	Frequency display increases or decreases in 100-Hz increments	refer also to 2.8.11.2

2.8.2.3 Setting or Altering Frequency with Programmed Stepping Width

Entry	Display	Remarks
FRQ	.	Point flashes
ENT	801.00	
+	801.05	if 50 Hz programmed as stepping width acc. to 2.8.11
+	801.10	
-	801.05	

2.8.2.4 Recalling Frequency Setting after Status or EXTERN Display

Entry	Display	Remarks
FRQ	.	Point flashes
ENT	801.05	Frequency is displayed

2.8.2.5 Frequency Memory

General

It is possible to store a total of 20 frequencies. After each storage procedure the memory address moves up automatically. Once all 20 storage locations are occupied, the memory address starts again with location 0. Switching off the receiver results in the erasure of the entire frequency memory.

Condition:

Switch CM MAN MEM is set to MAN

Storing the receive frequency

Storing of the receive frequency is effected by pressing key [STO].

Interrogating the storage locations

Interrogation of the storage locations is performed by pressing key [RCL], beginning with the highest storage location number. The stored frequency appears on the frequency display and the associated location number on the channel display. All other displays remain dark. This has no influence on the actual operating process.

After 3 s the current operating setting is shown again.

If key [RCL] is activated once more during these 3 s, the next lower storage location number together with the associated frequency is displayed. The activation of any other key apart from RCL means a switch-over from the storage location display to the current operating setting.

Recalling a stored frequency as receive frequency

If during storage location interrogation key [ENT] is pressed within 3 s of activating key [RCL], the displayed frequency is taken over as receive frequency.

Erasing the entire frequency memory

Simultaneous activation of keys [SHIFT] and [STO] results in the erasure of the total frequency memory and the memory address is reset to 0.

Note:

With all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until an additional parameter prime key has been activated.

2.8.3 EXTERN Mode

2.8.3.1 Setting EXTERN

The range of numbers is 0 to 9. According to selected number, appropriate contact is activated on EXTERN socket on rear of receiver. The values are completely independent of the entire setting of the receiver. Any devices can be controlled (see section 2.1.5).

Entry	Display	Remarks
	12407.05	(Last frequency setting)
EXT		
7	7	Display flashes
ENT	7	Particular value appears on EXTERN socket on rear of receiver
+	8	
+	9	
+	0	
-	9	

2.8.3.2 Recalling EXTernal Function

Entry	Display	Remarks
	12407.05	(Last frequency setting)
EXT		
ENT	9	(can be altered with) + , -

2.8.4 BFO

2.8.4.1 Setting Digital BFO

Setting the digital BFO is not possible in AM class of emission.

Entry	Display	Remarks
BFO	.	Display flashes (Entry of leading zero may also be omitted)
0	0.	
.	0.	
8	0.8	
ENT	+ 0.8	

(Continuation)---

---(Continuation) Setting Digital BFO

Entry	Display	Remarks
BFO	.	Display flashes
. , 8	0.8	
-	- 0.8	Display flashes
ENT	- 0.8	

Entry without sign produces positive sign.

2.8.4.2 Altering Digital BFO with Key + or -

After the BFO has been set, it can be altered with the keys + and -.

Entry	Display	Remarks
	- 0.8	last setting
+	- 0.7	
+	- 0.6	
...		
+	- 0.1	

(Continuation)---

---(Continuation) Altering Digital BFO with Key + or -

Entry	Display	Remarks
+	0.0	
+	+ 0.1	
...		
+	+ 2.9	
+	+ 2.9	

2.8.4.3 Altering Polarity of Digital BFO with POL Key

Entry	Display	Remarks
	- 0.8	last setting
POL	+ 0.8	FSK display +/- and polarity of FSK output signal change in addition
POL	- 0.8	

2.8.4.4 On/Off Switching of the Analog BFO (Continuously Tunable BFO)

Switch-on of the analog BFO is possible only in classes of emission CW, FSK and FAX.

Condition: Switch CH MAN MEM is set to MAN or MEM

Entry	Display	Remarks
Switch-on		
[SHIFT] [BFO] Set analog BFO control to the required BFO frequency.	red LED above the analog BFO control is illuminated	Analog BFO is switched on. Digital BFO display is dark.
Switch-off		
[BFO]	red LED above the analog BFO control goes out	
	[.]	Display flashes.
[ENT]	[+ 1.0]	Analog BFO is switched off. Digital BFO is switched on.

2.8.5 Channel Operation

2.8.5.1 CH MAN MEM Switch in CH Setting

Entry	Display	Remarks
CH	CHAN	
3	CHAN 3	Display flashes
7	CHAN 3 7	
ENT	CHAN 3 7	Content of channel 37 is displayed and set
+	CHAN 3 8	Content of channel 38 is displayed and set

Pressing keys [+] and [-] can be repeated at will.

After channel 99 [+] produces display of channel 0, and after channel 0 [-] produces display of channel 99. All other keys, with exception of TEST and DAT, are disabled.

2.8.5.2 CH MAN MEM Switch in MAN Setting

Entry	Display	Remarks
CH	CHAN	Display flashes
3 , 7	CHAN 3 7	Display flashes
ENT	CHAN 3 7	Content of channel 37 is displayed and set
Selection of adjacent channel		
-	CHAN 3 6	Content of channel 36 is displayed and set
Alteration of setting, e.g. different class of emission		
AM	associated LED illuminates	Receiver sets AM class of emission
		CHAN display and channel number extinguish
Operation of tuning knob		
	12345.68	Frequency is altered
		CHAN display and channel number extinguish

(Continuation)---

---(Continuation) CH MAN MEM Switch in MAN Setting

Entry	Display	Remarks
Storage of new setting		
MAN ↓ MEM	12345.68 CHAN 3 6	CHAN flashes, yellow LED associated with MEM switch setting illuminates
CH	CHAN	Display flashes
5 , 3	CHAN 5 3	
ENT	CHAN 5 3	CHAN flashes
STO	CHAN 5 3	Above setting is stored in channel 53
MEM ↓ MAN		yellow LED extinguishes

2.8.5.3 CH MAN MEM Switch in MEM setting

The receiver continues to work with the last setting.

Entry	Display	Remarks
CH	CHAN	Display flashes
3 , 7	CHAN 3 7	Display flashes
ENT	CHAN 3 7	CHAN flashes
Recall		
RCL	CHAN 3 7	Content of channel 38 is displayed
Storage (channel recall as above)		
STO	CHAN 3 7	Setting of frequency, class of emssion, etc. is stored in channel 37

2.8.6 Setting and Recalling Time

Requisite: Operation mode MEM

2.8.6.1 Setting Time

Entry	Display	Remarks
SET	.	Display flashes
1	1.	
4	14.	
.	14.	
2	14.2	
5	14.25	
ENT	14.25	Time starts running (with 00 s)

2.8.6.2 Recalling Time

Entry	Display	Remarks
SET	.	Point flashes
ENT	14.25	Time is displayed without resetting seconds

2.8.7 Channel Recall by Clock

If the slot switch (40, Fig. 2.14) is set to LOC/REM/CLOCK, the channel recalled by the clock is set as soon as the time reaches the appropriate programmed start time.

The [CLOCK] display illuminates.

The setting can be altered, [CLOCK] will then flash.

When the dwell time has elapsed, the setting is restored that was effective before recall by the clock.

[CLOCK] extinguishes.

2.8.7.1 Storage

Requisite: MEM mode

Entry	Display	Remarks
Recall of channel		
[CH]	[CHAN] [ ]	CHAN flashes
[2] , [8]	[CHAN] [2 8]	CHAN flashes, 28 flashes
[ENT]	[CHAN] [2 8]	CHAN flashes
[RCL] or [STO]	[CHAN] [2 8]	Frequency, class of emission, etc. can be stored before or after start time and dwell time.

(Continuation)---

---(Continuation) Storage

Entry	Display	Remarks
Entry of start time		
START	START .	START flashes, point flashes
1 , 4		
. , 2		
5	START 14.25	START flashes, 14.25 flashes
ENT	START 14.25	Start time is stored
Entry of dwell time		
DWELL	SEC	SEC flashes
1 , 5		
0	SEC 150	SEC flashes, 150 flashes
ENT	SEC 150	Channel 28 occurs daily at 14.25 h, 150 s later setting is restored that was effective before recall by clock.

(Continuation)---

---(Continuation) Storage

Entry	Display	Remarks
Entry of start time for hourly channel recall		
START	START .	START flashes, point flashes
. , 1		
5	START .15	START flashes, 15 flashes
ENT	START .15	Channel 28 occurs hourly, 15 min after full hour (entry of dwell time see above).

If no dwell time is entered, the recalled channel appears for 30 s (basic setting for DWELL = 30). If there are overlaps with recall times that are already programmed, the entry is not accepted. The display shows the setting of the channel (including the start time) with which there would be overlap.

Overlaps with hourly channel recall are admissible (the hourly recall has priority).

2.8.7.2 Recall and Erasure

Requisite: MEM mode

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has also been pressed.

Entry	Display	Remarks
Recall of prompt register		
START	START .	START flashes, point flashes
ENT	START 14.25	Start time closest to current time is displayed
+	START 15.25	Recall of further start times possible without prime key
+	START 16.45	
-	START 15.25	
With each start time channel number and content also appear.		
Recall of dwell time		
DWELL	SEC	SEC flashes
ENT	SEC 120	Display of dwell time for previous start time

(Continuation)---

---(Continuation) Recall and Erasure

Entry	Display	Remarks
Recall of hourly recalls		
[START]	[START] [.]	START flashes, point flashes
[+]	[START] [.10]	First hourly recalls are displayed, then others. All with channel number and content.
[+]	[START] [.40]	With [DWELL] [ENT] dwell time can also be recalled for hourly recalls.
[+]	[START] [14.25]	
Erasure of recall		
[START]	[START] [.]	START flashes, point flashes
[ENT] or		
[+], [+]	[START] [15.25]	Start time to be erased
[SHIFT] [START]	[START] [16.45]	Start time 15.25 h is erased and next programmed start time is displayed. With start time associated dwell time is also erased.
[SHIFT] [START]	[START] [.]	No display because no further start times were programmed.

(Continuation)---

---(Continuation) Recall and Erasure

Entry	Display	Remarks
Recall of channel that is in prompt register		
CH , 2 ,	CHAN 2 8	Display of channel with content (device status) and start time (nearest if there are several start times)
8 , ENT	START 14.25	

2.8.8 Sweep Operation (frequency scan)

2.8.8.1 General

Parameters are stored nonvolatile. They can be altered (overwritten) individually. The sequence when entering parameters is random.

If sweep operation is stopped by pressing any key, it is possible from this status of the receiver to alter the frequency in single steps (stepping width from [SHIFT] [3]) by pressing keys [+], [+], [-].

After stopping the display [SWEEP] flashes. When the key [+] or [-] is pressed, the [SWEEP] display continues to flash. After pressing the [SWEEP] key the sweep operation continues to run from the frequency momentarily found.

The [SWEEP] display will not extinguish until sweep operation is exited from entering a new setting.

If the end frequency is < the start frequency or the stepping width > (end frequency minus start frequency), the start frequency remains on the display after pressing the [SWEEP] key because sweeping with these parameters is not possible.

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has been operated.

2.8.8.2 Entry of Sweep Parameters

Requisite: CH MAN MEM switch in MEM setting

Entry	Display	Remarks
Entry of start frequency		
SHIFT 1	.	Display flashes
1 , 5 ,		
0 , 0 ,	1500.	
ENT	1500.00	
Entry of end frequency		
SHIFT 2	.	Display flashes
1 , 6		
0 , 0	1600.	
ENT	1600.00	

(Continuation)---

---(Continuation) Entry of Sweep Parameters

Entry	Display	Remarks
Entry of stepping width		
SHIFT 3	.	Display flashes
0 , . ,		
5	0.5	
ENT	0.50	
Entry of dwell time		
SHIFT 4	.	Display flashes
(0), .		
1 , 5	SEC 0.15	
ENT	SEC 0.15	

2.8.8.3 Recall of Sweep Parameters

Entry	Display	Remarks
e.g. Recall of end frequency		
SHIFT 2	.	Point flashes
ENT	1600.00	

2.8.8.4 Start of Sweep Operation

Requisite: CH MAN MEM switch in MAN setting

Entry	Display	Remarks
SWEEP	SWEEP 1500.00	
	SWEEP 1500.50	
	SWEEP 1501.00	
	. . .	
	SWEEP 1600.00	
	SWEEP 1500.00	
	. . .	

Stop by pressing any key except SHIFT key.

SWEEP display flashes.

2.8.9 SCAN Operation for Channels in Numerical Sequence

2.8.9.1 General

Parameters are stored nonvolatile. They can be altered (overwritten) individually. The sequence when entering parameters is random.

If scan operation is stopped by pressing any key and then started again by pressing [SCAN] key, scan operation continues with the following channel.

If a higher channel number is stored under [SHIFT] [7] than under [SHIFT] [8], the scan starts off on the channel stored under [SHIFT] [7] via channel 99 and channel 0 on to the channel stored under [SHIFT] [8] and then jumps again to the channel stored under [SHIFT] [7], etc.

If the scan operation is stopped, the channel can be switched singly by pressing keys [+], [+], [-]. The [SCAN] display extinguishes when the scan mode is exited from (alteration of the setting).

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has been operated.

2.8.9.2 Entry of Scan Parameters

Requisite: CH MAN MEM switch in MEM setting

Entry	Display	Remarks
Entry of lowest channel number		
SHIFT 7	CHAN	Display flashes
3 , 5	CHAN 3 5	
ENT	CHAN 3 5	
Entry of highest channel number		
SHIFT 8	CHAN	Display flashes
3 , 7	CHAN 3 7	
ENT	CHAN 3 7	
Entry of dwell time		
SHIFT 9	CHAN	Display flashes
2 , .		
5	SEC 2.5	
ENT	SEC 2.50	

2.8.9.3 Recall of Scan Parameters

Requisite: CH MAN MEM switch in MEM setting

Entry	Display	Remarks
e.g. SHIFT 8	CHAN	CHAN flashes
ENT	CHAN 3 7	

2.8.9.4 Start of Scan Operation

Requisite: CH MAN MEM switch in MAN setting

Entry	Display	Remarks
SCAN	SCAN CHAN 35	Each next channel follows at interval of 2.5 s
	CHAN 36	
	CHAN 37	
	CHAN 35	
	CHAN 36	

2.8.9.5 Stop of Scan Operation

Scan operation can be stopped by pressing any key with the exception of the SHIFT key.

Entry	Display	Remarks
Any key [ ]	[SCAN] [CHAN] [36] flashes	with [SCAN] scan operation runs on (37 - 35 - 36)

2.8.9.6 Resetting Previous Channel

Entry	Display	Remarks
[-]	[SCAN] [CHAN] [35]	with [+] switching on in forward direction
[-]	[SCAN] [CHAN] [37]	
[-]	[SCAN] [CHAN] [36]	[SCAN] flashes

2.8.10 CH/CH Operation

2.8.10.1 General

Parameters are stored nonvolatile. The callup sequence of the channels and the dwell time can be altered (overwritten) individually. The sequence when entering parameters is random.

If a wrong channel number is entered, the complete callup sequence of the channels has to be entered anew. The entered sequence may have a length of up to 100 channel numbers.

After stopping CH/CH operation by pressing any key with the exception of the SHIFT key, it is possible to switch to the next channel, up or down, in the sequence by pressing the keys [-], [-], [-], [+]. After the last channel of the sequence the first one is set again, etc. After CH/CH operation has been stopped, the [CH/CH] display flashes. IF the setting is altered, the receiver exits from CH/CH operation and the [CH/CH] display extinguishes.

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has been operated.

2.8.10.2 Entry of CH/CH Parameters

Requisite: CH MAN MEM switch in MEM setting

Entry	Display	Remarks
SHIFT 5	CHAN	Present display
		Display flashes
2 , 7	CHAN 27	Present display
.	CH/CH CHAN 27	CH/CH flashes — Content channel 27
5	CHAN 5	Display flashes — Content channel 27
.	CH/CH CHAN 5	CH/CH flashes — Content channel 5
...	...	
1 , 3	CHAN 13	Display flashes — Content previous channel
.	CH/CH CHAN 13	CH/CH flashes — Content channel 13
ENT	CHAN 13	Content channel 13
Entry of dwell time		
SHIFT 6	SEC .	Display flashes
2	SEC 2.	Display flashes
ENT	SEC 2.00	

2.8.10.3 Recall of CH/CH Parameters

Requisite: CH MAN MEM switch in MEM setting

Entry	Display	Remarks
SHIFT 5	CHAN	CHAN flashes
ENT	CHAN 27	Content channel 27
+	CHAN 5	Content channel 5

2.8.10.4 Start and Stop of CH/CH Operation

Requisite: CH MAN MEM switch in MAN setting

Entry	Display	Remarks
Stop with any key		
CH/CH	CH/CH CHAN 27	Content channel 27
		next channel after 2 s
	CH/CH CHAN 5	Content channel 5
any key		
	CH/CH CHAN 5	CH/CH flashes Content channel 5
Continuation of CH/CH operation		
CH/CH	CH/CH CHAN 46	Content channel 46

2.8.11 Programming of Stepping Widths

2.8.11.1 Programming of Stepping Width FRQ (+ and - Keys)

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has been operated.

Requisite: CH, MAN and MEM switch in MEM setting

Entry	Display	Remarks
	(Frequency display)	
SHIFT FRQ	.	Point flashes
1	1.	Display flashes
.	1.	
5	1.5	
ENT	1.50	Stepping width of 1.5 kHz is stored nonvolatile

2.8.11.2 Programming of Stepping Width VAR (Tuning Button/100 Hz)

Note:

For all parameters that are set with the SHIFT key, press the SHIFT key and keep it pressed until a parameter prime key has been activated.

Requisite: CH, MAN and MEM switch in MEM setting

Entry	Display	Remarks
	(Frequency display)	
SHIFT 100Hz	.	Point flashes
0 .	0.	Display flashes
0 3	0.03	
ENT	0.03	On activating the tuning button, (switch in MAN setting) the frequency changes in 30-Hz increments.

Stepping width VAR is not stored in a nonvolatile manner; following switch-on/off of the EK 085, the stepping width is 100 Hz.

2.8.12 Data Output (receiver settings)

2.8.12.1 Data Output with DAT Key

The data output of the receiver settings is made either by the remote-control code, command: LF*A0001CR or by operating the DAT key.

Entry	Display	Remarks
DAT	Display is not influenced by data output.	Output of receiver setting data in one data string, e.g.: LF*A00K F1234567I8B08+W5R3H0Z0J0CR Setting data have following sequence within data string: - transmit address of receiver - channel number - set frequency - class of emission - BFO - bandwidth - gain control - FSK stop - FSK polarity - set EXTERN number

2.8.12.2 Data Output with SHIFT · Keys

The data output of the receiver settings is made either by the remote-control code, command: LF*A0001CR or by operating the SHIFT · Keys.

Entry	Display	Remarks
SHIFT .	Display is not influenced by data output.	Output of receiver setting data in one data string as described in 2.8.12.1, differing in the following: 1) LF. instead of LF* 2) For address, the equipment address is output.

2.8.13 Data Requests (receiver settings)

The data of the receiver settings may be requested by the computer or by a second EK 085. This is done by simultaneously operating the SHIFT and DAT keys.

Entry	Display	Remarks
SHIFT DAT	Display is not influenced by data requests. If, however, a slave receiver is interrogated, the master receiver will display the status of the slave receiver.	Output of recall code: LF*AXX01CR

2.8.14 Entry of Class of Emission

The class of emission is selected by operating the appropriate key. The associated LED illuminates.

A basic setting consisting of bandwidth, gain-control rate and possibly a BFO frequency is assigned to each class of emission. Alteration away from this basic setting is described in the following paragraphs.

2.8.15 AGC and MGC

Each class of emission is automatically assigned AGC as the basic setting (fast or slow, depending on the class of emission). By additionally pressing the MGC key, the receiver will be set to AGC=MGC. If the AGC key is then pressed, the AGC will be switched off and only the MGC is effective.

2.8.16 Setting of Bandwidth

Each class of emission is assigned a certain bandwidth as a basic setting. This basic bandwidth can be altered by pressing the key BW < or BW >.

2.8.17 BFO Entry

(Refer also to 2.8.4)

The BFO (beat-frequency oscillator) is switched on for classes of emission CW, SSB and FSK. The CW class of emission is assigned a continuously tunable BFO as a basic setting and the classes of emission FSK a digital BFO.

By pressing the BFO key, entering the BFO frequency in kHz (e.g. 0.8) and pressing ENT, the receiver is switched to the digital BFO. Pressing keys SHIFT and BFO causes the receiver to be switched to the analog BFO.

For classes of emission LSB and USB the digital BFO is always switched on.

2.8.18 STOP Key

For all classes of emission, except FSK and FAX, the LED above the STOP key is illuminated. This means that line current is flowing and any connected teletyper is not working. In an FSK class of emission the teletyper is enabled in the basic setting, i.e. the LED associated with the STOP key does not illuminate. Operation of the teletyper can then be interrupted at any time by pressing the STOP key. If the FSK class of emission is altered, e.g. from FSK 1 to FSK 2, the receiver restores the basic setting. If the STOP key has previously been operated (LED illuminated), the LED will extinguish and the teletyper is then again operative.

2.8.19 POL Key

Pressing the POL key switches the polarity. If a change is made only between the FSK classes of emission, e.g. from FSK 2 to FSK 3, the previous polarity will be retained.

2.8.20 FAST Key

The FAST key switches the speed of the gain control. The classes of emission with a carrier, e.g. AM, are assigned fast gain control as a basic setting. In this status of the receiver the LEDs AGC and FAST will illuminate. The FAST key has to be pressed to change the speed of gain control and the associated LED will then extinguish.

2.8.21 OPT Key

Condition:
The EK 085 is equipped with the option IF converter/SINAD evaluation.

By pressing key OPT, the option is alternately switched on and off. The switch-on state is indicated by the illuminated, associated LED. Keys SHIFT and BW< can also be used for switch-on and keys SHIFT and OFF for switch-off.

In the state set in this way the search is stopped, if a frequency is recognized as being stored, for the duration of the waiting period set in the option and then the search continues automatically.

With keys SHIFT and BW< the option is set in such a way that the search is stopped if a frequency has been stored. Only after key SWEEP, SCAN or CH/CH has been activated (or by means of an external starting pulse) will the search continue.

2.8.22 Test

Triggering a test by pressing the TEST key causes all LEDs and 7-segment displays on the control unit to illuminate with the exception of the yellow MEM LED. Parallel to this the receiver checks out the entire signal path through to the AF output.

If an error is detected, an E will be shown on the main display together with the code of the defective module (see 4.3).

After the test the receiver is reset to its previous operating control.

2.8.23 Volume Control

The volume of the built-in loudspeaker or of connected headphones can be altered with the volume control. The loudspeaker itself can be switched on or off with a toggle switch.

The volume control governs

1) the built-in loudspeaker,

2) headphones

3) a second loudspeaker or phones connected to the INPUT/OUTPUT socket, pins 19 and 37.

2.9 Remote-control Commands for Computers

The receiver can both receive and send data.

In the first instance the receiver is receiving its operating commands and in the second it is sending its operating data to the computer.

The receiver is remotely controlled by way of its V.24/X.21 interface. The commande code that is used for the purpose is ASCII. The strings that are used for the different settings can be seen from the following table:

Note:

If an address ≠ ØØ is set on the receiver (S1, S2), each data string must be prefixed with this address: (LF*Axx.....CR)

Setting	Range	Example	Command code
Address (destination)	adjustable from 0 to 99	Address 0 Address 99	LF*A00..... LF*A99.....
Store channel status 1), 2)			LF%K15F....
Call up channel status			LF&K47CR
Channel recall with transfer of status			LF*K47CR
Frequency	adjustable from 0 to 29999.99 kHz	801 kHz 27545.50 kHz	LF*F0080100CR LF*F2754550CR
Class of emission		AME USB LSB FAX CW OPT (Option) FSK 1 FSK 2 FSK 3	LF*I1CR LF*I2CR LF*I3CR LF*I4CR LF*I5CR LF*I6CR LF*I7CR LF*I8CR LF*I9CR
BFO	adjustable from -2.9 kHz to +2.9 kHz no BFO analog BFO	-2.9 kHz +0.8 kHz	LF*B29-CR LF*B08+CR LF*BuuuCR LF*B000CR

(Continuation)---

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

Setting	Range	Example	Command code
Bandwidth	see 2.9.1		LF*W1CR . . LF*W7CR
Gain control		AGC MGC AGC + MGC AGC + FAST AGC + MGC + FAST	LF*R0CR LF*R1CR LF*R2CR LF*R3CR LF*R4CR
FSK Stop	ON/OFF	On Off	LF*H1CR LF*H0CR
FSK polarity [3]	+, -	FSK + FSK -	LF*Z1CR LF*Z0CR
External	adjustable between 0 and 9	External 0	LF*J0CR
Store time for channel callup	Entry of callup time and dwell time Erase time memory by dwell time = 0000 [4]	Channel 95 to be called at 12.15 h, dwell time 0300 s.	LF%C12150300 K95CR LF%C12150000 K95CR
Store time for periodic channel re-call	Entry of repetition time and dwell time Erase time memory by dwell time = 0000 [4]	Callup of channel 95 every 30 min after full hour and dwell time 0400 s	LF%P300400K95CR LF%P300000K95CR
Option		Option on, waiting period on Option on, waiting period off (= oo) Option off	LF*V3CR LF*V4CR LF*V2CR

(Continuation)---

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

Setting	Range	Example	Command code
SWEEP	Entry of start frequency, stop frequency, spacing, dwell time [1]) Start SWEEP Stop SWEEP	Start frequ. 12345.67 kHz Stop frequ. 29876.54 kHz Spacing 1.5 kHz Dwell time 100 ms	LF%L1234567 2987654 000150 0010CR LF*LuCR LF*V1CR
SCAN	Entry of lowest multiplied by highest channel number, dwell time [1]) Start SCAN Stop SCAN	Lowest channel number 01, highest channel number 99 dwell time 2.5 s	LF%M0199 0250CR LF*MuCR LF*V1CR
CH/CH	Entry of channel number string and dwell time. With entry of a new dwell time, the previous channel number string is erased. Each string has a max. of 10 channel numbers. All strings beginning with LF%NF... are lined up together up to max. of 100 CH numbers. [1]) Start CH/CH Stop CH/CH	Previous channel number string is erased. Dwell time for new entry: 3.5 s Channel number string: 5, 77, 3, 81, 12, 47, 6, 79, 4, 11, 38, 5, 6, 28	LF%NS0350CR LF%NF057703 81124706CR LF%NF790411 38050628CR LF*NuCR LF*V1CR
Triggering Test			LF*TuCR

(Continuation)---

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

Setting	Range	Example	Command code
Recall	Status		LF*01CR
	CM/BITE		LF*02CR
	Time memory		LF*03CR
	Time memory (periodic)		LF*04CR
	SWEEP parameter		LF*05CR
	SCAN parameter		LF*06CR
	CH/CH parameter		LF*07CR
	Option		LF*08CR

Explanations: LF Line Feed

u Space

CR Carriage Return

* Code for direct setting of unit

% Code for storage of settings

& Code for recall of channels without interrupting operation

x Any figure between 0 and 9

1) It is not possible to store individual settings.

2) The waiting period between the end of one string and beginning of the next is ≧ 100 ms.

3) With option ISB supplement: + = Monitoring USB, - = Monitoring LSB.

4) For erasure of the time memory, only the call-up time is decisive; the channel number may be random.

(Continuation)---

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

Format of data strings:

LF

* Control code

Axx Address, can be omitted in non-addressed operation (S1 and S2 on processor/control unit to 0).

Setting The setting codes can be in any sequence and combination. Exception: Setting codes for triggering test and recalls must be entered in separate strings.

The entry of a class of emission causes the assigned basic setting (gain control, BFO, bandwidth) to be set. If a different setting from the basic one is required, the necessary commands must be entered after entry of the command for the class of emission.

CR Carriage Return

When data are called up from the receiver, it also conveys them in a data string. If several units are connected in bus operation, call-up with A00 is not permissible.

Command	Message
Status inquiry: LF*AxxO1CR	LF*AxxKuuF1234567I8B08+W5R3H0Z0J0CR
CM/BITE inquiry: LF*AxxO2CR	LF*TuuCR = GO Tu3 = CM synthesizer Tu1 = SINAD option has stopped scanning LF*Tu5CR = CM filter, see 4.3 LF*T32CR = BITE error, see 4.3
Time-memory inquiry: LF*AxxO3CR	LF*C12150060K99CR Channel number 99 . is set at 12.15 h . for 60 s . LF*CuCR End of time memory

(Continuation)---

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

Command	Message
Time-memory inquiry for periodic channel recall LF*AxxO4CR	LF*P100400K97CR Channel number 97 . is set for 0400 s . at 10 minutes after . each full hour. LF*PuCR End of time memory
Channel recall LF&AxxK47CR LF*A00K47CR	Data output as in status inquiry
SWEEP-parameter inquiry: LF*AxxO5CR	LF%L12345672987654000150010CR
SCAN-parameter inquiry: LF*AxxO6CR	LF%M01990250CR
CH/CH-parameter inquiry: LF*AxxO7CR	LF%NF05770381...06280350CR
Option inquiry: LF*AxxO8CR	LF*V2CR or LF*V3CR or LF*V4CR

In status inquiry and channel callup the setting data within the data string have the following sequence:

- transmitter address of receiver
- channel number
- set frequency
- class of emission
- BFO
- bandwidth
- gain control
- FSK stop
- FSK polarity
- set EXTERN number

2.9.1 Assignment of Filter Code to Set Bandwidth

If required, the receiver can be provided with different IF bandwidths. The processor is informed of this by the coding of the IF filters.

With the remote-control commands for bandwidth switching the bandwidth can be set according to the following table:

Filter position	Filter - basic version 1				Filter - basic version 2				
	Filter with supplements				Filter with supplements				
	none	VAR 02	VAR 03	VAR 04	none	VAR 02	VAR 03	VAR 05	VAR 06
W1	0.3	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.2
W2	2.4	0.3	0.3	0.3	3.1	0.3	0.3	0.3	0.3
W3	8.0	0.6	0.6	1.0	8.0	0.6	0.6	1.5	0.4
W4		2.4	1.5	2.4		3.1	1.5	3.1	1.0
W5		8.0	2.4	3.4		8.0	3.1	8.0	3.1
W6			6.0	6.0			6.0		8.0
W7			8.0	8.0			8.0		

Bandwidths in kHz (overall bandwidth)

0.1 is an approximate value
Nominal value: 0.15 kHz

2.9.2 Data Output following Key Activation

Following activation of key "DAT" on the EK 085, the same data string is output as with status inquiry.

After activating keys "SHIFT·" on the EK 085, a data string beginning with LF. (instead of LF*) and the particular unit address is output.

For example:
Address 56 is set on the processor by means of S1 and S2: LF.A56K....

2.10 Equipment Switch-off

The VLF-HF Receiver EK 085 can be switched off by means of the power switch (41, Fig. 2.13) in any operating condition.

The power transformer, rectifier and electrolytic capacitors remain switched on constantly.

3. Maintenance

The VLF-HF Receiver EK 085 is entirely maintenance-free.

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

4. Troubleshooting

4.1 General

The VLF-HF Receiver EK 085 is fitted with built-in test equipment (BITE) and continuous monitoring that constantly supervises the receiver, points out operator errors and carries out a test of the receiver at the push of a button.

During operation the receiver is continuously monitored without any triggering of the test. This monitoring covers, for instance, the frequency generated by the synthesizer, the driving of the mixer stages in the HF/IF unit and the BFO. An error message in continuous monitoring is read out on the status display as E3 (or E5 with options or supplementary equipment). If an internal operating voltage fails, the green POWER LED will extinguish.

For operator errors, e.g. inadmissible entries, an E appears on the status display, this extinguishes either after two seconds or if the error is rectified.

The test device also checks out the receiver internally outside of operation when the TEST button is pressed. A 900-kHz line spectrum with a bandwidth of 30 MHz is then fed into the receive path as a simulated antenna signal. The functional integrity of the receiver is then confirmed or the defective module is indicated on the status display by Exx (see error list in part 4.3).

Note:

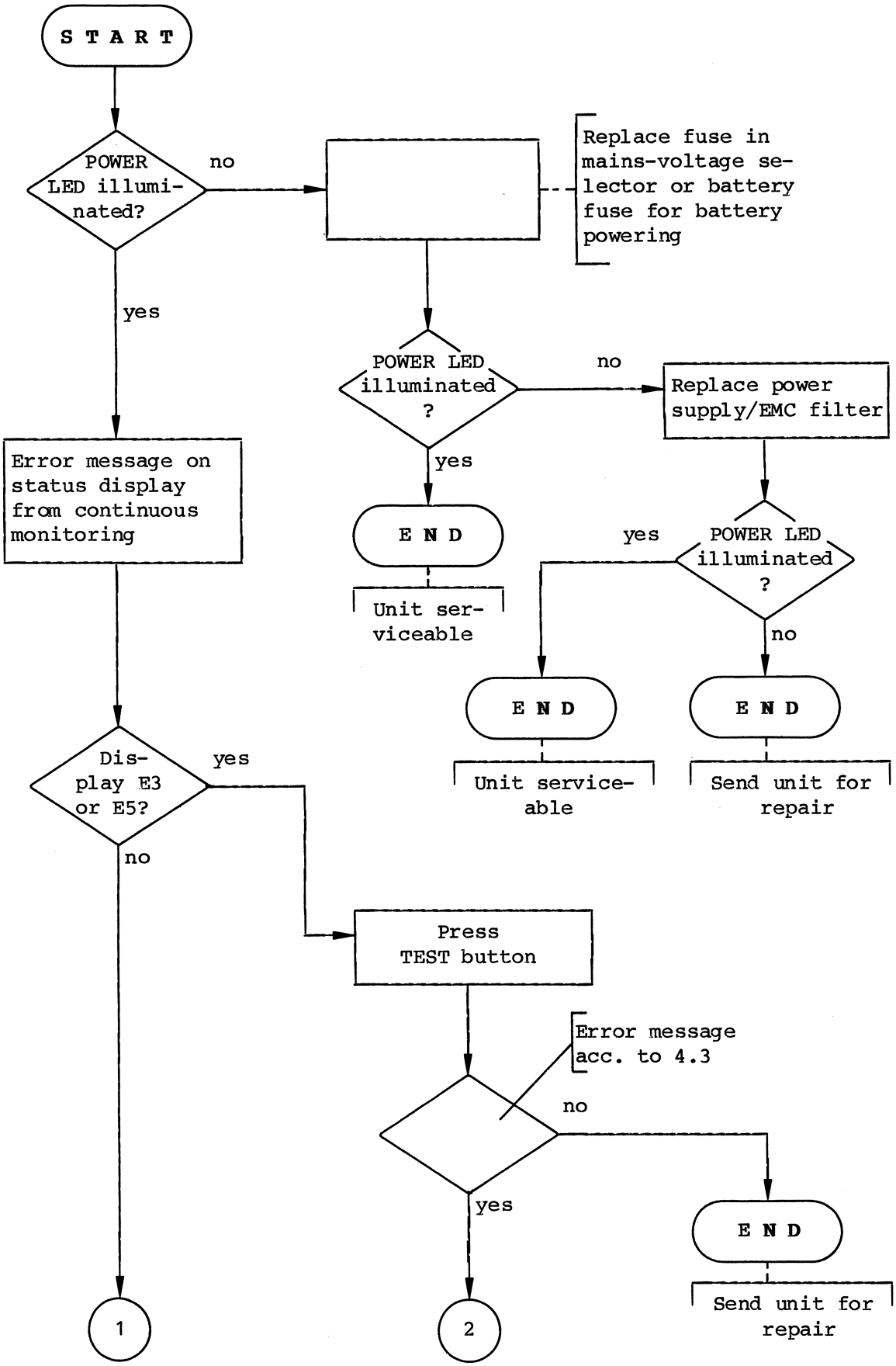
If an error is indicated, the receiver is not necessarily fully unserviceable. The cause may be that tolerances are exceeded which nevertheless permit reduced performance.

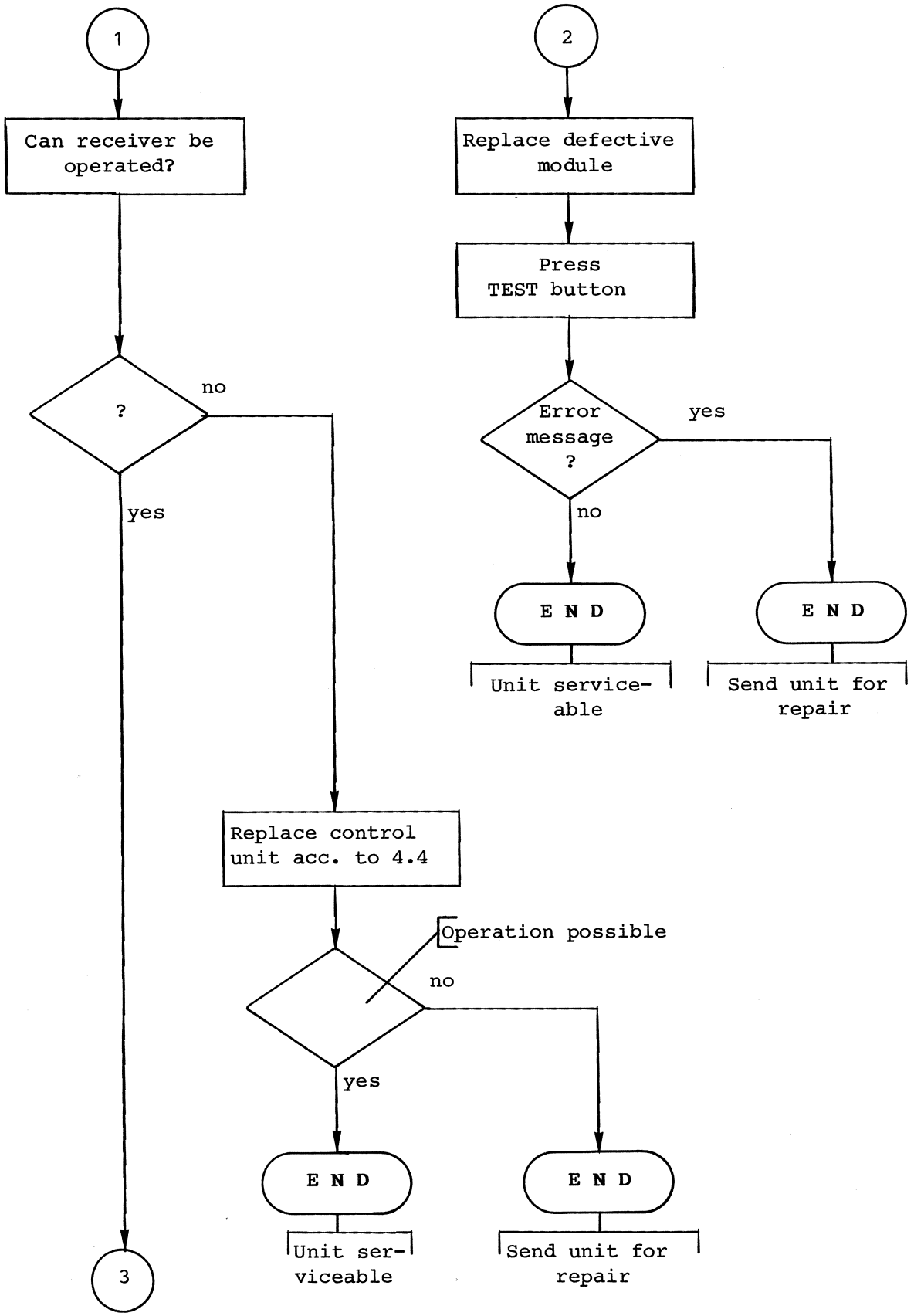
4.2 Troubleshooting Instructions

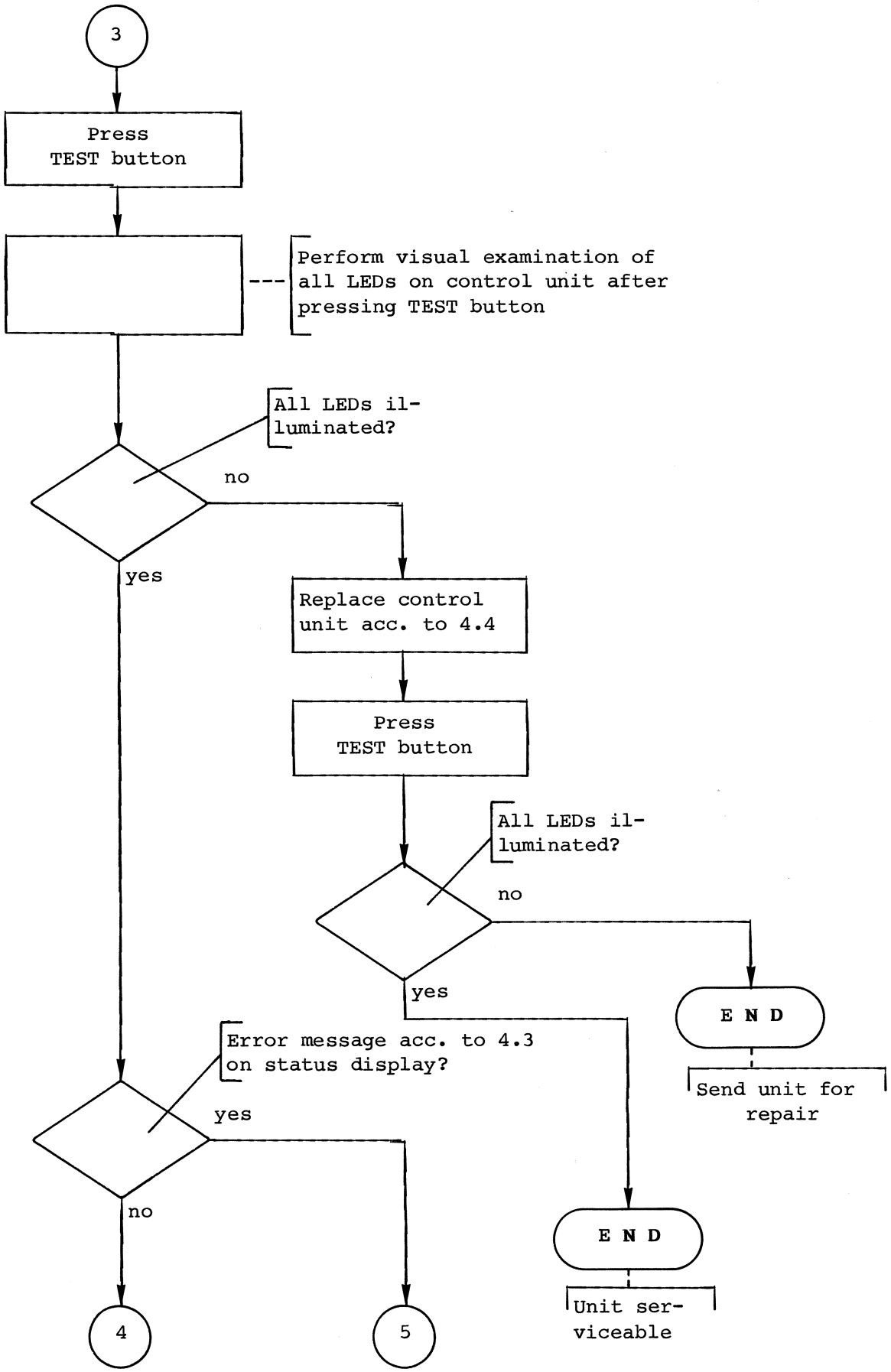
In the event of a fault or disturbance in operation, it is advisable to follow the troubleshooting instructions below:

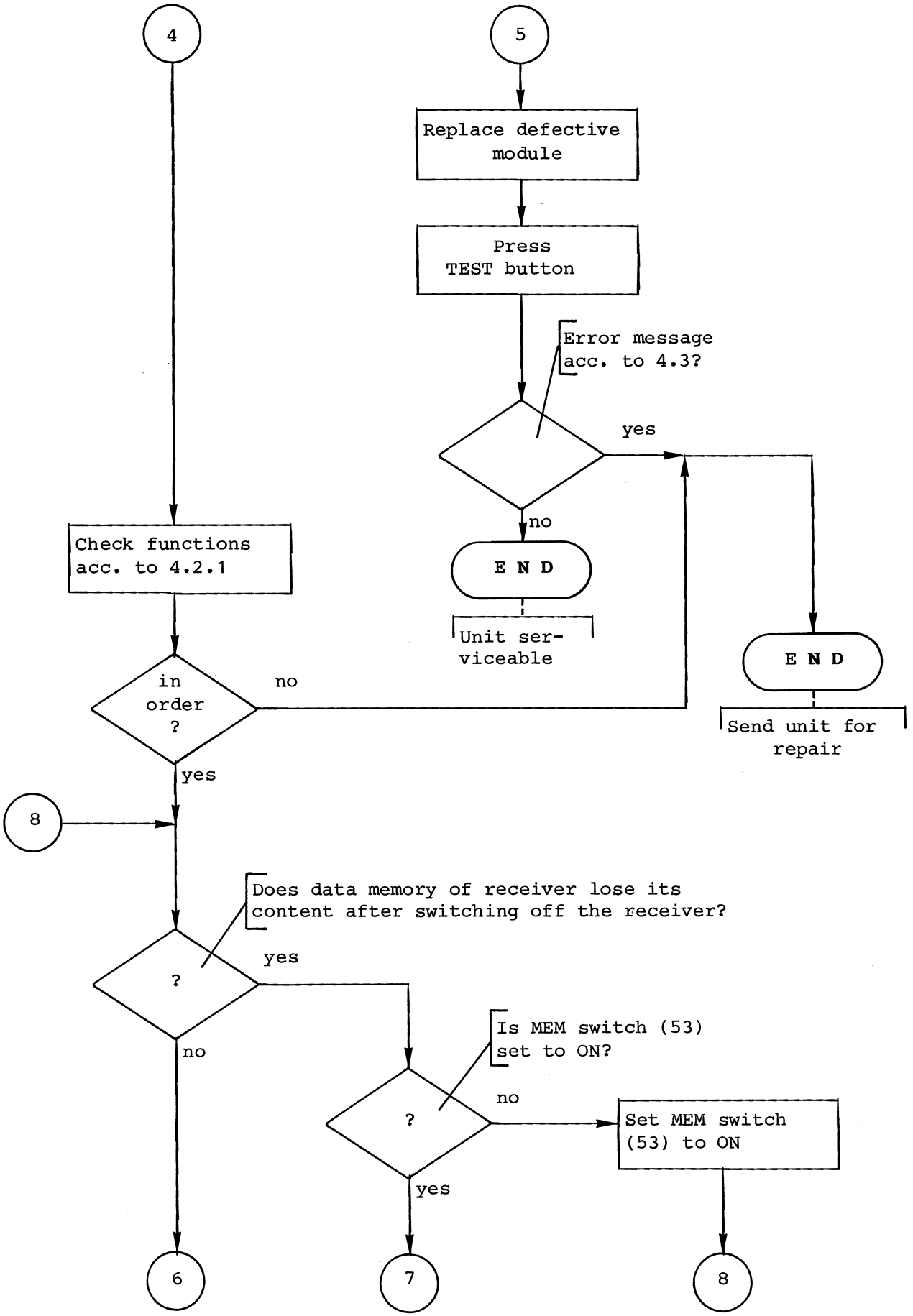
The troubleshooting described here is based on the following assumptions:

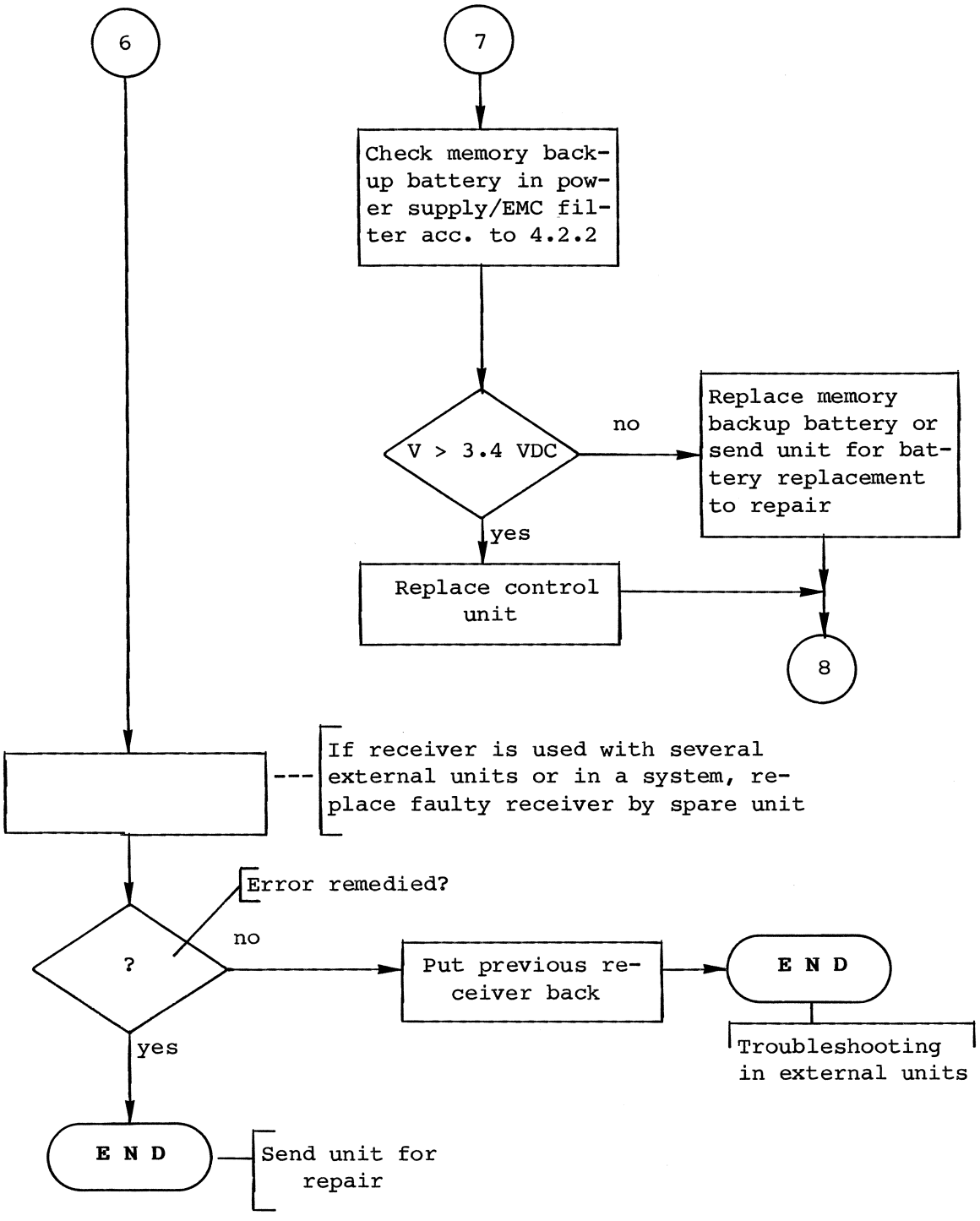
- No multiple errors
- Receiver is set to correct supply voltage
- Receiver is switched on with power switch
- Error also occurs without connection to antenna


START
POWER LED illuminated?
no
yes
Replace fuse in mains-voltage selector or battery fuse for battery powering
POWER LED illuminated ?
no
Replace power supply/EMC filter
yes
END
Unit serviceable
Error message on status display from continuous monitoring
yes
POWER LED illuminated ?
no
END
Unit serviceable
END
Send unit for repair
Display E3 or E5?
yes
no
Press TEST button
Error message acc. to 4.3
no
yes
END
Send unit for repair
1
2


1
Can receiver be operated?
?
no
yes
3
2
Replace defective module
Press TEST button
Error message ?
yes
no
E N D
Unit service-able
E N D
Send unit for repair
Replace control unit acc. to 4.4
Operation possible
no
yes
E N D
Unit ser-viceable
E N D
Send unit for repair


3
Press TEST button
Perform visual examination of all LEDs on control unit after pressing TEST button
All LEDs illuminated?
no
yes
Replace control unit acc. to 4.4
Press TEST button
All LEDs illuminated?
no
yes
END
Send unit for repair
Error message acc. to 4.3 on status display?
yes
no
END
Unit serviceable
4
5


4
5
Replace defective module
Press TEST button
Error message acc. to 4.3?
yes
no
E N D
Unit serviceable
Check functions acc. to 4.2.1
in order ?
no
yes
E N D
Send unit for repair
8
Does data memory of receiver lose its content after switching off the receiver?
?
yes
no
Is MEM switch (53) set to ON?
?
no
Set MEM switch (53) to ON
yes
6
7
8


6
7
Check memory back-up battery in power supply/EMC filter acc. to 4.2.2
V > 3.4 VDC
no
Replace memory backup battery or send unit for battery replacement to repair
yes
Replace control unit
8
If receiver is used with several external units or in a system, replace faulty receiver by spare unit
Error remedied?
?
no
Put previous receiver back
E N D
Troubleshooting in external units
yes
E N D
Send unit for repair

4.2.1 Functions Not Covered by BITE

Not all modules of the receiver can be covered by the built-in test (BITE) without introducing an excessive amount of extra circuitry for the purpose. For this reason the following functions should also be considered when troubleshooting is performed.

- Loudspeaker
- AF amplifier
- Pushbuttons, switches, potentiometers and meter
- Tuning knob
- External interfaces
- Dimmer

4.2.2 Memory Backup Battery

The lithium battery installed in the power supply/EMC filter for powering the data memory is made few demands on by the clock and memory device. Under normal operating conditions this battery has a lifetime of approx. ten years. Consequently, regular replacement of the battery is not scheduled.

Should the data memory fail to function at any time, leading to the suspicion that the battery is flat, the voltage on the battery is to be measured with a high-impedance voltmeter. Access to the power supply/EMC filter for this purpose is described in 4.4.

The rated open-circuit voltage of the battery is 3.6 VDC. The battery should be replaced if the voltage drops to less than 3.4 VDC.

4.3 Error Messages

E: Operator error, extinguishes after approx. 2 s or if error is rectified

E 1: SINAD option has stopped scanning

Note:

The state can only be inquired via the remote interface with LF*Axx02CR, message LF*Tu1CR.

E 3 + E 5 Error message due to ongoing continuous monitoring

E 31: Synthesizer defective

E 32: Demodulator defective

E 33: HF/IF unit defective

E 34: Filter or Test Relay defective Or interference to test due to an extremely large antenna signal (repeat test without antenna connected)

E 55: Option defective

E 100: Incorrect filter code set

E 101: Mode switch S3 of processor in control unit set incorrectly

E 102: Baud-rate switch S4 of processor in control unit set incorrectly

4.4 Replacement of Modules

C A U T I O N

Disconnect power and battery cables before attempting to remove modules from housing of receiver.

Note:

Before replacement of any modules in the desktop model, the panelling must be removed. Then proceed as follows:

1. Undo six screws (1, Fig. 4.1) and remove top cover (2) from housing.

2. Undo four screws (22) and remove bottom cover (13) from housing.

4.4.1 Control Unit

C A U T I O N

If ribbon cables are withdrawn from control unit, the channel memory is automatically erased.

1. Undo four screws (16, Fig. 4.1) and pull out control unit (23) frontwards.

2. Withdraw ribbon cable from connectors X4 and X24, from X9 on control unit and ribbon cable from connector X21 on motherboard.

Note:

Installation of the control unit is to be performed in the reverse order of the removal.

4.4.2 Power Supply/EMC Filter

1. Withdraw ribbon cable from connectors X41 and X4 and three HF cables not from power supply/EMC filter but from "mating" modules; undo cable clamp.

2. Undo five screws (6 and 11, Fig. 4.1) and carefully pull out power supply/EMC filter (5) upwards.

4.4.3 Synthesizer

1. Loosen four screws (12 and 19, Fig. 4.1) marked red. Lift cassette (7), shift sideways until stop and place on frame.
2. Loosen four screws (14 and 15) marked red on the sides of modules (9 and 10).
3. Loosen four screws (17 and 18) marked red on the sides of synthesizer (8).
4. Withdraw seven HF connectors.
5. Pull synthesizer (8) sideways out of cassette (7).

Note:

Installation of the synthesizer is to be performed in the reverse order of the removal described above.

4.4.4 HF/IF Unit

1. Loosen four screws (12 and 19, Fig. 4.1) marked red. Lift cassette (7), shift sideways until stop and place on frame.
2. Loosen four screws (15 and 17) marked red on the sides of modules (8 and 10).
3. Loosen four screws (14 and 20) marked red on the sides of the HF-IF unit (9).
4. Withdraw six HF cables.
5. Pull HF/IF unit (9) sideways out of cassette.

Note:

Installation of the HF/IF unit is to be performed in the reverse order of the removal described above.

4.4.5 Demodulator

1. Loosen four screws (12 and 19, Fig. 4.1) marked red. Lift cassette (7) shift sideways and place on frame.
2. Loosen four screws (14 and 17) marked red on the sides of modules (8 and 9).
3. Loosen four screws (15 and 21) marked red on the sides of demodulator (10).
4. Withdraw three HF cables.
5. Pull demodulator (10) sideways out of cassette (7).

Note:

Installation of the demodulator is to be performed in the reverse order of the removal described above.

4.4.6 Motor-tuned Filter with Tracking Control

1. Loosen four screws (4 and 27, Fig. 4.1) marked red. Lift cassette (30), shift sideways until stop and place on frame.
2. Loosen two screws (29) marked red on tracking control (28) and four screws (3 and 25) on motor-tuned filter (26).
3. Withdraw ribbon cable from connectors X24 on control unit, X32 and X33.
4. Withdraw three HF cables from motor-tuned filter (26).
5. Pull motor-tuned filter and tracking control sideways out of cassette.

(Continuation)---

---(Continuation) Motor-tuned Filter with Tracking Control

Note:

Installation of the motor-tuned filter with tracking control is to be performed in the reverse order of the removal described on previous page.

Note:

Installation of either the digitally tuned filter, of the low-pass filter or the test relay as fitted is to be performed in the reverse order of the removal described above.

4.4.7 Digitally Tuned Filter, Low-Pass Filter and Test Relay

1. Loosen four screws (4 and 27, Fig. 4.1) marked red.
2. Undo fixing strap on plug X9 and pull off plug X9.
3. Lift cassette (30), shift sideways until stop and place on frame.
4. Loosen four screws (3 and 25) marked red either on digitally tuned filter, on low-pass filter or on test relay (26) as fitted.
5. Withdraw ribbon cable from connector X33 (not for test relay).
6. Withdraw three HF cables either from digitally tuned filter, from low-pass filter or from test relay (26) as fitted.
7. Pull either digitally tuned filter, low-pass filter or test relay sideways out of cassette as fitted.

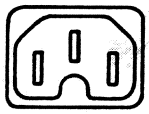
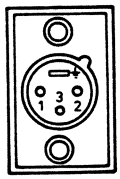
4.4.8 IF Converter/SINAD Evaluation

1. Loosen four screws marked red (4 and 27, Fig. 4.1). Lift cassette (30, Fig. 4.1), shift sideways until stop and place on frame.
2. Loosen two screws marked red (29a, Fig. 4.1) on option (28a, Fig. 4.1).
3. Withdraw ribbon cable from connector X8 on the mother board.
4. Withdraw two HF cables from the option (28a, Bild 4.1).
5. Withdraw one HF cable from synthesizer (8, Fig. 4.1). For this lift cassette 7 (refer also to 4.4.3).
6. Remove option sideways from cassette.

1. External Interface Description

The external interfaces described in this appendix define the inputs and outputs of all external interfaces for the connection of peripheral units.

With the VLF-HF Receiver EK 085 all interfaces are accessible on the rear of the equipment with the exception of the socket for the headphone connection.

Mains connector	Contact	Signal designation/level
Mating socket with mains cable R&S Ident No. 025.2365.00 	1 2 3	Mains voltage 100/120/220/240 VAC Mains voltage 47 to 420 Hz Safety earth
19 to 31 V	Contact	Signal designation/level
Manufacturer : Fa. Binder mating socket R&S Ident No. 591.1997 	 1 2 3 ⏚	Battery connector Plus pole of battery (+) Minus pole of battery (-) Output of power supply upper voltage for accessories V = 30 to 45 VDC Screen
	Contact	Signal designation/level
Socket mating socket: PL-55 R&S Ident No. 019.0487 		Headphones - output 50 mW/100 ohms

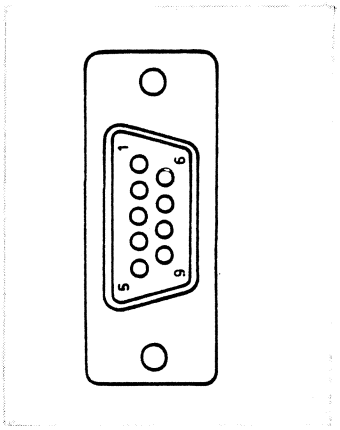
(Continuation)---

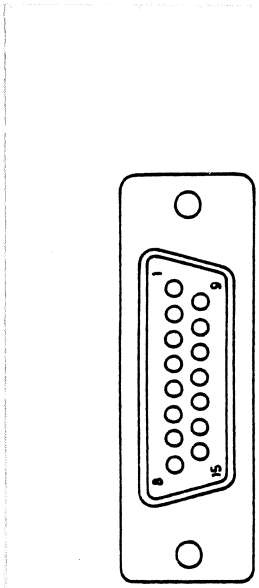
---(Continuation) External Interface Description

	Contact	Signal designation/level
BNC socket, mating BNC plug R&S Ident No. 241.1378 		Antenna input 50 ohms nominal
IF	Contact	Signal designation/level
BNC socket mating BNC plug R&S Ident No. 241.1378 		IF output 1.44 MHz, 100 mV on 50 ohms With option IF converter/ SINAD evaluation: 0 dBm into 600 ohms, frequency between 10 and 50 kHz, depending on switch setting (refer also to 2.2.11)
5 MHz	Contact	Signal designation/level
BNC socket mating BNC plug R&S Ident No. 241.1378 		Standard frequency input 5 MHz, 50 to 500 mV

(Continuation)---

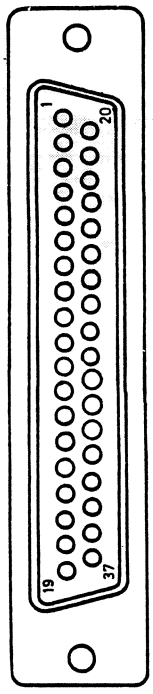
---(Continuation) External Interface Description

TTY	Contact	Signal designation/level
FM trapezoidal socket mating plug see appendix 2 	1	Ground
	2	FAX (digital), weather chart recorder
	3	TTY (V.28)
	4	FAX (digital), weather chart recorder
	5	not used
	6	Ground
	7	not used
	8	- line current, 20 mA/40 mA
	9	+ line current, 20 mA/40 mA

EXTERN	Contact	Signal designation/level
FM trapezoidal socket mating plug see appendix 2 	1	EXT. 1 — open collector 30 V, 30 mA
	2	EXT. 2 — open collector 30 V, 30 mA
	3	EXT. 3 — open collector 30 V, 30 mA
	4	EXT. 4 — open collector 30 V, 30 mA
	5	EXT. 5 — or BCD coded if required = 1
	6	EXT. 6 — or BCD coded if required = 2
	7	EXT. 7 — or BCD coded if required = 4
	8	EXT. 8 — or BCD coded if required = 8
	9	EXT. 9 — or BCD coded if required
	10	EXT. 0 — open collector 30 V, 30 mA
	11	Ground
	12	Ground
	13	not used
	14	not used
	15	+ 5.3 V (R_i 150 ohms)

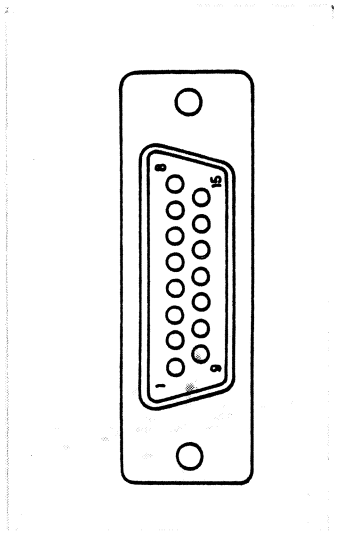
(Continuation)---

---(Continuation) External Interface Description

INPUT/OUTPUT	Contact	Signal designation/level
FM trapezoidal socket mating plug see appendix 2		
	1	Ground
	2	Ground
	3	Ground
	4	not used
	5	Soft Decision a
	6	Soft Decision b
	7	Soft Decision c
	8	Inhibit
	9	AGC (reference voltage)
	10	Option 2 (measuring result of SINAD evaluation, if option is built in)
	11	ΔF voltage (7 ±3 VDC)
	12	not used
	13	Option 1 (refer to 2.1.7)
	14	Line output (0 dBm, 600 ohms) floating
	15	Line output (0 dBm, 600 ohms) floating
	16	TTY (V.28)
	17	On b (mains)
	18	not used
	19	Loudspeaker (2 W, 5 ohms) or headphones. Volume depending upon volume control setting on front panel
	20	Ground
	21	Ground
	22	Ground
	23	Line output (0 dBm, 600 ohms) unbalanced
	24	FAX (digital), weather chart recorder
	25	FAX (digital), weather chart recorder
	26	Option 3 (refer to 2.1.7)
	27	Diversity
	28	AGC
	29	not used
	30	TTY (TTL)
	31	not used
	32	not used
	33	not used
	34	ΔF voltage (F1C, F3C)
	35	On a (mains)
	36	+5.3 VDC
	37	Loudspeaker (ground)

(Continuation)---

---(Continuation) External Interface Description

Connector REMOTE	Contact	Signal designation/level	
FM trapezoidal socket mating plug see appendix 2 	1	⏚	Can be separated by jumper, in its place addressed logic signal can be applied
	2	TxD Ta	
	3	RTS Ca	
	4	RxD Ra	
	5	DSR Ia	
	6	RxC Sa	
	7	CTS Ba	V.24/X.21 interface either ±5 V or 0 V/+5 V or level acc. to V.10 or V.11
	8	G	
	9	$\overline{\text{TxD}}$ Tb	
	10	$\overline{\text{RTS}}$ Cb	
	11	$\overline{\text{RxD}}$ Ib	
	12	$\overline{\text{DSR}}$ Eb	
	13	$\overline{\text{RxC}}$ Sb	
	14	CTS Bb	
	15	DTR	
		+5 VDC	

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

1. Preparation of Connecting Cables

Note:

All the cables required for cabling the VLF-HF Receiver EK 085 are manufactured by Rohde & Schwarz.

A list of the cables including connectors and sockets together with the ordering codes may be found in the data sheet of the VLF-HF Receiver EK 085.

This appendix describes the preparation of the HF and AF cables plus the control and supply cables. These instructions are accompanied by drawings.

In preparation of the cables the enclosed in-house regulations of Rohde & Schwarz should be observed. These provide additional information for preparing the cables.

1.1 Preparation of Cables for IF Output, 5-MHz Input and Antenna Connection

The following R&S internal guidelines (see appendix 3) should be observed:

HVC 212, HVJ 077, HVJ 250, HVP 020, HVQ 001

1.1.1 Parts List

Quantity	Designation	R&S Stock No.
1	Cable RG 213 C/U Cable connector BNC crimp	025.2071 241.1378
Material: Shrink-on sleeve		

1.1.2 Preliminaries

1) Label shrink-on sleeve either with "EK 085 IF output" or with "EK 085 5-MHz input" or with "EK 085 RF output".

2) Cut cable 025.2071 to required length.

3) Slide labelled shrink-on sleeve onto cable for identification.

1.1.3 Preparation of cable

The following steps 1) to 8) are illustrated in Fig. A2.1.

1) Remove outer insulation of cable for 16 mm.

2) Shorten shield to 8 mm.

3) Remove insulation of inner conductor for 4.5 mm.

4) Place crimp sleeve of RF connector 241.1378 on cable.

5) Position inner-conductor contact of HF connector on inner conductor and clamp tight so that contact meets cable dielectric.

6) Slightly splay shield and slide housing of HF connector under shield until inner-conductor contact sits.

7) Crimp crimp sleeve as close as possible to HF connector housing over shield (use crimping pliers 75Z-0-0-1).

8) Shrink labelled and already attached shrink-on sleeve for identifying lead over crimp sleeve.

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:

1	up 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

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

(Continuation)---

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

HVE 600 (continued)

Gauge of thin sheet metal in mm		Steel sheet, alloy-treated		Steel sheet nickel-plated		Steel sheet, stainless		Soft magnetic materials (Ni alloy)		Aluminium materials		Copper-zinc, copper-nickel-zinc alloys Also with electro-plated coatings		Copper-tin copper-beryllium alloys	
	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								

Minimum overlap u and minimum gap e and admissible load P per welding spot in direction of shear (e in mm, u in mm, P in kN).

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

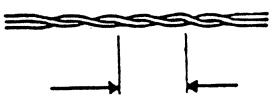
Strip ends and pre-tin them.
Nicks or scraping on the wires are not permissible.

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

HVJ 073 Twisting wires and stranded wires

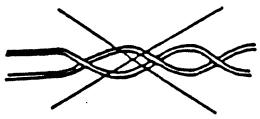
Twisting:

Right:



1 complete twist (360°)

Wrong:



(Continuation)---

---(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

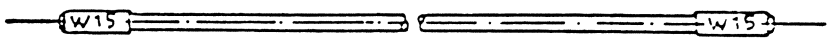
Script (white) hot-coined on shrink-on sleeve (black).

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

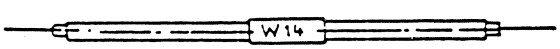
Form of identification

Fig. 1 Cable end-sleeves with labelling



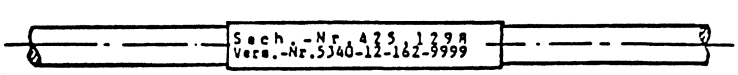
Electrical code (both ends)

Fig. 2 Labelling for cables ≤ 100 mm in length



Electrical code only in middle

Fig. 3 Stock nos.

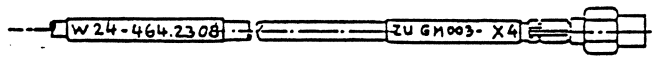


(additional identification is possible, e.g. serial no.)

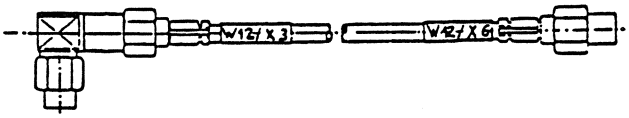
(Continuation)---

---(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 values)	≤ 50	500	No entry
	dc voltages	≤ 120		
2.3.2	Circuits with ac voltages (rms values) 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 acc. (rms value) 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 section 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.