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OPERATING MANUAL

VHF-UHF-RECEIVER ESM 500 A-F

570.5012

Order-No.: 617.2294.44

Contents

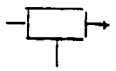
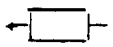
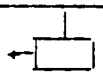
2. Preparation for Use and Operation

2.1 Legend for Operating Controls

(see Figs. 2-1, 2-2, 2-3 and 2-5)

No.	Marking	Function
1	SSB[1] A0, A1, LSB, USB, ISB. DISPLAY kHz	If SSB operation is switched in with 30, one of the operating modes A0, A1, LSB, USB, ISB can be selected with "□" "□". The tuning step for 29 is switched to 100 Hz/step. When the DISPLAY kHz button is depressed, the frequency indication 11 is switched from MHz to kHz, at the same time the tuning step is reduced to 10 Hz/step.
2		Loudspeaker
3	HF 40 dB	Pushbutton to switch in 40 dB of RF attenuation for MGC and SSB operation and for the RF panorama display with the EZP. In AM and FM operation with AGC the 40-dB attenuation is automatically switched in for large input levels. The presence of this attenuation is indicated by the +40-dB LED on the SIGNAL level meter.
4	AGC	AGC: Gain control is automatically switched in. The additional 40 dB of RF attenuation is automatically cut in when the input signal level exceeds 75 dBµV, if button 3 is pushed and AM or FM is selected.
5	MGC	MGC: Gain control is switched in manually in the range of 80 dBµV with 40. The control voltage is indicated.
6	ZF-IF-PANORAMA[1] ±100 kHz	IF display in the range ±100 kHz from the received centre frequency.

[1] See section 1.5

No.	Marking	Function
7	SIGNAL	AGC: RF input level in dBµV. If the +40-dB LED is lit, +40 dB must be added to the indicated value. If the squelch is operative, the squelch threshold is indicated if the signal is too small. With MGC, the MGC control voltage is indicated.
8	ABLAGE TUN. ERROR	Tuning error indication shows the relative offset. The sensitivity of the indication is adjusted to the IF bandwidth.
9	AFC	The LED lights when automatic frequency control is cut in. The capture range corresponds to one-half the IF bandwidth. The AFC functions with signals ≥ 1 µV.
10 ... 12	MHz EMPF.-REC.FREQ. MARKEN-FREQ.	Main panel meter with status indication. Receiver frequency indicated with IF display, LED 10 lights. Marker frequency with RF display using the EZP, LED 12 lights.
13		Transfer of instrument status to selected memory location.
14		Memory location or address of a hand-off receiver. Blinking indication signifies that the indicated frequency does not correspond to the stored value.
15		Transfer of the frequency indicated in 17 to the main display 11.
16		Transfer of frequency from the auxiliary display 17 to memory (frequency only).
17		Auxiliary display for KEYBOARD, MEMORY, ERROR (Err), Module error, (Comp. error) CF and antenna identification digit.

[1]) See Section 1.5

No.	Marking	Function
18	0 to 9, CE, decimal point	Input keyboard. Frequency input in MHz with decimal point, appears in the auxiliary display with KEYBOARD lighted.
19	DATA[1] out	Receiver status output via output unit, for example to a hand-off receiver.
20	VIDEO[1] 0.3/2M	IF bandwidth switch 300 kHz/2 MHz for wideband-IF amplifier/demodulator.
21	TEST	Functional test of entire receiver.
22	EXT.	LED lights for external operation.
23	MAN./EXT.	Switch for selecting manual or external control. In MAN./EXT. operation, external control has precedence. In EXT. operation no manual settings are possible.
24	O I	Instrument on/off switch.
25	RUN STOP	Memory scan on/off, set memory locations are automatically interrogated.
26	SEC 2, 5, 10, ∞ VERWEILZEIT DWELL TIME	Dwell time during scanning operation, when the received signal is greater than the set squelch threshold.
27	FEST LOCK	Disables the tuning knob 29. Provides protection against undesired detuning.
28	M1 to 99	Selection of memory locations 01 to 99. Individual setting for automatic scanning operation by pressing the point key twice. Individual reset by pressing point and null keys. With setting 00 (auxiliary indication ALL), all memory locations can be set or reset.

[1] See recommended extras in data sheet

No.	Marking	Funktion
28	M1 to 99	In RF analysis with the EZP, with the selection of the memory locations, the stored frequency in the auxiliary display is shown directly as marker on the EZP screen.
29	ABSTIMMUNG TUNING	Quasi-continuous tuning with magnetic latching, step size increases with rotation of the knob from 1 kHz/step to 30 kHz/step. In SSB operation, the step size goes from 100 to 3000 Hz/step, or when button 1 is depressed from 10 to 300 Hz/step. In RF-panorama operation with the EZP, the step size increases from 100 to 3000 kHz/step.
30	DEMODULATION SSB, AM, FM	Demodulation types: SSB, AM, FM.
31 ... 34	ZF BANDBREITE kHz IF BANDWIDTH	IF bandwidths: 8, 15, 30, 100 kHz
35	EXT	LED lights with external gain control.
36	SIGNAL	LED lights when signal is larger than the set squelch threshold.
37	S/N	LED lights when S/N-ratio squelch is operative.
38	SQU EXT./MEM.	LED lights when squelch threshold is externally set or set from memory.
39		Squelch threshold knob. When knob is turned fully counterclockwise, S/N-ratio squelch is operative. LED 37 is lit. When knob is rotated clockwise, carrier squelch is switched in and threshold is set, set value is indicated on 7.
40		Manual gain setting knob for MGC 5.

No.	Marking	Function
41	SQUELCH	Squelch on. Threshold set with 39.
42	Filter	AF filter, 300 to 3300 Hz switched in/out.
43	(Symbol)	Volume control for loudspeaker 2 and headphone output 44.
44	(Symbol)	Socket for headphone plug. Loudspeaker disconnected when plug is inserted.
45	IEC 625 - INTERFACE GH 023 (basic model) or V.24 Interface GH 024 (optional)	IEC-bus connector for remote control. (parallel interface) V.24/RS-232-C connector for remote control (serial interface)
46	BU1 PANORAMAZUSATZ EZP PANORAMIC ADAPTER EZP	Connector for Panoramic Adapter EZP.
47	BU2 EINGÄNGE/AUSGÄNGE INPUTS/OUTPUTS	For external inputs and measurement of output signals (analog/digital signals).
48	BU3 ANT.-STEUERAUS-GANG ANT.CONTROL OUTPUT	Antenna-control connector. BCD-coded outputs controlled by the set receiver frequency (100-MHz, 10-MHz position) e.g. for direct connection of the antenna selection switch GS 050 or Serial/Parallel Converter GH 034.
49	ERSATZSICHERUNGEN SPARE FUSES	
50	BATT. T10	Battery fuse.

No.	Marking	Function
51	47 - 440 Hz NETZ	AC power connector.
52	100 V/120 V T1,6 220 V/240 V T0,8	AC voltage selector with AC voltage fuses.
53 54	(-) ⊥ +	Connector for external battery. Connect negative terminal to chassis.
55	BU13 EXT.REF. 10 MHz	Connector for external 10-MHz reference frequency.
56	BU11 FM-VIDEO[1]	FM-video output. 75 Ω, V_{pp} = 0.5 V, for Δf = ±500 kHz at f_{mod} = 1 kHz
57	BU9 ZF-IF 10,7 MHz B = 2 MHz	Wideband IF output, level 10 dB above receiver input.
58	BU10 AM-VIDEO[1]	AM-video output. 75 Ω, V_{pp} = 0.5 V, for m = 0.5.
59	BU8 ZF-IF 10,7 MHz (21,4 MHz)[1] NARROW	IF output narrow corresponding to selected (31 to 34) IF bandwidth 10.7 MHz or 21.4 MHz[1].
60	BU5 VHF/UHF-ANT. 50 Ω	50 Ω VHF/UHF antenna input.
61	BU4 NF AF/COR 600 Ω SYMM. 0 dBm	AF output connector/control COR output for tape recording.
62		Mode and address setting on the built-in data interface 45 (GH 023 or GH 024)
63	BU6	Synthesizer frequency 110.7 MHz to 210.7 MHz (-10 dBm)

[1] See recommended extras in data sheet

No.	Marking	Function
64	BU7	10-MHz int. reference frequency (-10 dBm)
65	BU12	narrowband IF, unregulated (+30 dB above antenna input)

2.2 Preparation for Use

(see figures 2-1, 2-2, 2-3 and 2-5)

2.2.1 Setting up the Instrument

The receiver can be operated satisfactorily in any position. Vibrations arising during normal transportation have no damaging effect.

The ambient temperature must be within the limits given in the data sheet section 1.

2.2.2 Operation with AC Power Input

The receiver satisfies the safety specifications for Protective Class I of Specification VDE 0411. Protective Class I prescribes that the AC power supply circuit be isolated and that exposed parts of the instrument that could conduct current in case of a failure are well bonded electrically to each other and connected to a nonfused grounding conductor.

Therefore: Insert the power cable plug only into an outlet socket provided with a nonfused grounding contact. If a binding post is present, it must be permanently connected to a nonfused grounding conductor.

2.2.2.1 Adjusting the Instrument to the Available AC Voltage

The instrument as shipped is set up for a 220-Volt AC input. By reinserting the voltage selector, the receiver can be set up for operation with 110, 120 or 240 V AC input. In detail:

Remove the AC-voltage selector 52 with fuse Si1. Replace the fuse with the proper fuse for the available voltage and reinsert the AC-voltage selector so that the arrow marked on the mounting surface points to the available voltage marked on the selector.

110/120 V	T 1,6
220/240 V	T 0,8

Fine-wire fuses per Specification DIN 41571 are used. Connection to the AC supply is made through the power input plug 51.

AC-voltage variations of -12 % to +10 % from nominal value do not impair the functioning of the instrument, as indicated in Section

1.3. If the voltage variations exceed these limits, line-voltage stabilization should be provided to avoid difficulties.

The receiver is switched on with the power switch 24.

2.2.2.2 Connection to the AC Power, Switch-on

The receiver is connected to the AC power source via an Europa power cable. This connection must be made with the instrument switched off - power switch 24 in the 0 position. When the power switch 24 is then set to position I, a number of LED lamps on the front panel must light as a check of the switch-on.

The receiver is ready for operation immediately after switch-on.

2.2.3 Battery Operation

The receiver can be operated with a 19 to 30 V DC supply from a battery.

The battery is connected to connector 19 to 30 V: negative pole (chassis) to 53 and positive pole to 54. Battery operation is of particular advantage when the instrument is used in a mobile system. The receiver is switched on with the power switch 24. Required fuse:

Battery operation 19 to 30 V: T10 fine-wire fuse per DIN 41571.

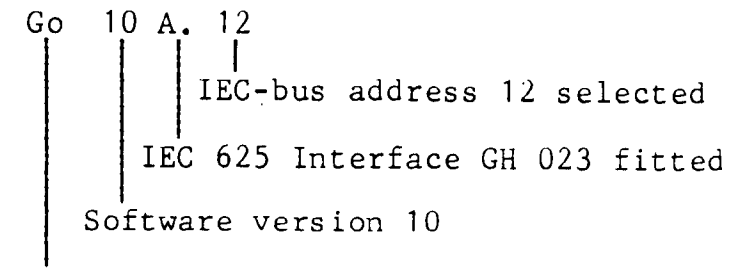
2.2.4 Simultaneously Connection to AC Power Supply and Battery

If the receiver is connected to the AC power supply and a battery at the same time, it will operate from the battery.

2.2.5 Automatic Check after Switching on
(with built-in IEC 625 Interface GH 023)

After switch-on, a positive test result is signalled by the word GO appearing in the display field 14 and the number of the EPROM version used for microprocessor control in field 17.

Display after switching on:



No component error C.F.XXX detected

Go 10 ton

talk only mode selected

Go 10 lon

listen only mode selected; selected IEC bus address > 9
(entries via IEC bus are processed in any case)

Go 10 lo9

listen only mode selected; IEC-bus Adress = 9
(corresponds to Ø to 8 being possibly selected)
Entries via IEC bus are only processed after message "A9" or "A09".

CF 110 Error message (see table 2-7)

The following functions are not part of software versions earlier than version 10:

1) frequency scan

2) setting dwell time on front panel

3) *) switchover of antenna control output BU3 between parallel output of frequency (contacts 9 to 16) and serial output of an antenna no. (contacts 13 to 16) together with parallel output of frequency (contacts 9 to 12) (see sections 2.27, 2.3.11 and 2.7).

If the missing functions are required, the software is to be updated to the latest version by exchanging EPROMs B19 and B20 on module GP 050.

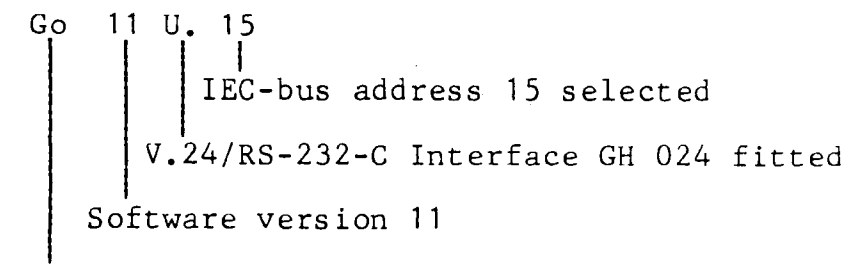
*) optional with version 08

2.2.6 Automatic Check after Switching on

(with built-in V.24/RS-232-C Interface GH 024)

After switch-on, a positive test result is signalled by the word GO appearing in the display field 14 and the number of the EPROM version used for microprocessor control in field 17.

Display after switching on:



CF 110 Error message (see table 2-7)

The following functions are not part of software versions earlier than version 10:

1) frequency scan

2) setting dwell time on front panel

3) *) switchover of antenna control output BU3 between parallel output of frequency (contacts 9 to 16) and serial output of an antenna no. (contacts 13 to 16) together with parallel output of frequency (contacts 9 to 12) (see sections 2.27, 2.3.11 and 2.7).

If a software version < 11 or version 16 is displayed, the instrument cannot be controlled via the Interface GH 024.

If the missing functions are required, the software is to be updated to the latest version by exchanging EPROMs B19 and B20 on module GP 050.

*) optional with version 08

2.2.7 Setting the Coding Switches on the Interface Input Board 570.8070

Coding switches S1 and S2 on the Interface Input Board signal to the microprocessor the equipment fitted to the instrument and, in addition, permit modification of the technical characteristics of the instrument, if this should be necessary.

The function on the label is operative, if the right-hand side of the associated rocker switch, i.e. the side away from the other components and pointing towards the edge of the board, is pressed down.

Information transferred to the microprocessor:

Signalling is as follows:

S1.4 - Wideband Demodulator (Breitbanddemodulator) VZ 050 V1,
S1.2 - D/A-A/D Converter GH 026 for digitization of signal level and offset,
S1.1 - IEC-625-bus Interface GH 023, } Cannot be fitted at same
S1.3 - V.24/RS232C Interface GH 024. } time!

S1.5 to S1.8 (BBR A to BBR D) are without function from software version 10 onwards.

S2.7 and S2.8 permit the progression in the variation of the TUNING RATE to be modified:

Max. increase factor (per step)	(1) S2.7	(2) S2.8
*) 4 kHz		
36 kHz	o	
107 kHz		o
321 kHz	o	o

*) factory setting
o ≙ right-hand side of rocker switch pushed in

S2.5 marked VZ 051 A1 signals whether the instrument is equipped with the IF section of the same number. The IF Section VZ 051 A1 has a lower modulation distortion factor and a control circuit with a shorter response time than the IF Section VZ 050 A1. The signals for the serial output of the antenna number are taken to the antenna control output BU3 48 (contacts 13 to 16) by means of S2.4 ANT.NR.SERIELL. This serial data message is then output by the Serial/Parallel Converter GH 034 in the form of 2 BCD digits. S2.1 to S2.3 are set in the factory to the respective type of receiver has been given a special function and is set in the factory; its position must not be changed.

2.2.8 Functions Check

The receiver functions are checked by the built-in test facility when the TEST button 21 is pressed.

During the test of a fully functioning receiver, all LED indicators on the front panel light up and an aural signal is generated, the pointer of the SIGNAL meter 7 lies in the green section of the scale, the tuning error indicator 8 is in midposition, and the test signal is visible in the centre of the panoramic display 6.

When the TEST button 21 is released, any error message generated will appear in the auxiliary display field 17. The message consists of letters and digits, e.g. C.F.201. The faulty module can be identified, by the use of the error listing of Table 2-7. If no fault is detected, GO is displayed as according to sections 2.2.5 and 2.2.6. A brief tone is heard with software versions > 10 on releasing the button 21.

2.2.8.1 Squelch

Switch the squelch on and off using key 41. In the case of carrier squelch operation the threshold can be set manually with 39.

When the SQUELCH button 41 is pressed and the squelch control knob 39 is set fully counterclockwise, the signal-to-noise squelch is operative and the S/N LED 37 lights. If the control knob is not in the fully ccw position, the carrier squelch is operative and the squelch threshold set with 39 is indicated on the signal meter 7 provided the input signal level lies below the threshold (otherwise the signal meter indicates the signal level).

If the receiver is set according to a status specification stored in memory, the type of squelch and threshold are also set provided they have been stored and key 41 is pressed. Lamp SQU EXT./ MEM. 38 lights and at the same time manual control 39 is disabled. It is switched on again by simply manipulating control 39. The switch-on is indicated by LED 38 being turned off.

2.3 Operation

(see Figs 2-1 and 2-2 and Appendix 1)

2.3.1 Entering the Frequency

Reception ranges:	10 to 999.999 MHz	(at ESM 500 A)
	10 to 499.999 MHz	(at ESM 500 B)
	500 to 999.999 MHz	(at ESM 500 C)

Corresponding to the signal frequency, the receiver frequency, in MHz, is entered on the keyboard 18. The decimal point must be entered only if nonzero values follow it. The entered frequency is displayed in the auxiliary readout 17. A correction of the entered value is possible by use of the CE key (18). When this key is pressed, the entered value is erased and another value can be entered. Button 15 is pressed to transfer the entered value to the main readout. If the entered value falls outside the permitted frequency range, the receiver does not accept it, and an error code (see Table 2-7) plus an aural signal are generated. The previously entered frequency is retained. The frequency can be altered with the tuning knob 29. The size of the steps by which the frequency is altered depends on how fast the knob is turned. In SSB demodulation, the stepsize is set to 100 Hz, and this can be reduced to 10 Hz/step by pressing the DISPLAY kHz button 1.

2.3.2 Storable Receiver Status (M1 to 99)

The receiver status is specified by the receiver frequency, demodulation type, IF bandwidth, type of squelch, squelch threshold and antenna number. Type of gain control and AF filter are relevant only for A0 to A9.

2.3.3 Writing into Memory

A memory location is selected by means of rotary knob 28. The memory address 1 to 99 appears in area 14. The frequency is entered via the keyboard as explained in 2.3.1 and written into memory by pressing button 16. All previously stored information in the selected location is erased and only the frequency is stored. The storage of the complete receiver status is effected by pressing button 13. Squelch type and threshold are only stored if the SQUELCH button 41 is depressed.

2.3.4 Clearing the Memory

The memory location to be completely cleared is called with 28. Key CE of 18 and then key 16 are pressed. All information of the displayed memory location - with the exception of frequency - is erased if key 16 (without CE of 18) is pressed.
All information in memory locations 1 to 99 and A0 to A9 is erased when memory location 00 is set with 28 (and ALL appears in field 17) and the CE key (18) and then button 16 are pressed.

2.3.5 Memory Scan

2.3.5.1 Setting the Memory Locations to be Scanned

The desired memory locations (14) are selected with knob 28. The decimal-point key on keypad (18) is pressed two times to set the locations for automatic interrogation. The decimal points appear as markings in the location display area 14. If all memory locations are to be scanned, knob 28 is so positioned that the digits 00 appear in area 14 and the word ALL in the auxiliary display 17. With this setting, the decimal-point key is pressed twice to set all 99 memory locations for automatic scan.

2.3.5.2 Cancelling a Scan Setting

With knob 28 select the set memory location. Press the decimal point key (18) and then the 0 key (18) in this particular sequence to reset the location. All locations can be reset at once by positioning knob 28 to 00 (ALL) and pressing the decimal-point and 0 keys.

2.3.5.3 Automatic Memory Scan

The set memory locations are scanned when the RUN/STOP button 25 is pressed and "run" is displayed.

Scan without squelch (key 41 not pressed)

The receiver stops at each set memory location and stays there for the set dwell time.

Scan with squelch (key 41 pressed)

If squelch and threshold have been stored they are transferred to the receiver status when the memory location is scanned.

If squelch type and threshold have not been stored, the last squelch and threshold in the receiver status are maintained.

If in this "memory-scan operation", the signal strength for the set frequency is greater than the set squelch threshold, the memory scan is halted for the length of time set by the DWELL TIME switch 26. By pressing the RUN/STOP button, the scan can be halted indefinitely or continued.

The memory scan may be carried out with the dewell time 0, if, for instance, only the signals found via the data output of the unit are to be recorded.

First press key PRE and then DW. 0 on keyboard 18. STOP 0 blinks in the auxiliary display 17. When the RUN key (25) is pressed now, "run o" appears in display 17 meaning that the dwell time for the scan is 0. STOP 0 may be cleared by pressing the CE key.

In addition to the receiver frequency, the remaining status parameters are at the same time scanned in memory scan operation.

The IF section of the ESM 500 settles to the correct value for signals about 10 dB (V) faster than for signals of lower levels. Memory and frequency scanning therefore operate faster with switched-on squelch and correspondingly high value of threshold. The criterion is that the "squelch too high" of the message "Lx..." is applied to the data output of the ESM 500 (interface 45, GH 023 or GH 024) (Table 2-5).

2.3.6 Frequency Scanning

The ESM 500 is switched to the frequency scanning mode by successively pressing the keys PRE and FRQ SC on keyboard 18. By pressing the keys in the sequence PRE and MEM or the CE key, on 18 the receiver is set to normal operating mode again. After pressing the PRE key on 18, the indication PrE on the auxiliary display 17 is blinking until the key FRQ SC is pressed.

2.3.6.1 Setting of Start Frequency, Stop Frequency and Step Size

After pressing the keys PRE and FRQ SC on keyboard 18, Fr and STOP are indicated on the auxiliary displays 14 and 17, respectively. Clockwise turning of switch 28 by one position or three

positions to the left, causes indication of F1 on display 14 and 6-digit readout of a previously entered start frequency on display 17. A new start frequency can be selected via the keyboard 18. The input is made in MHz, the decimal point need only be set if digits after the decimal point are to be entered.

Until termination of the input the indication F1 is blinking and the display of KEYBOARD lights. The input is terminated by means of key 16. After pressing the key 16, Fr and STOP are indicated on the displays 14 and 17, respectively and the display KEYBOARD is turned off.

Turning switch 28 another two positions clockwise or anticlockwise causes indication of F2 on display 14 and 6-digit readout of a previously entered stop frequency in 17. A new stop frequency can be entered and terminated in the same way as the start frequency via the keyboard 18. The input is again terminated by pressing 16 with Fr and STOP being indicated on displays 14 and 17, respectively. The display KEYBOARD is also turned off. Turning the switch 28 again either by one position counterclockwise or by three positions clockwise causes indication of F3 on display 14 and of a previously entered step size in kHz on display 17. A new entry is in this case, too, made with keyboard 18 and terminated with 16 resulting in the same display as before. The input range is from 1 kHz to 10 MHz, the resolution is 10 or 100 Hz, and the decimal point need only be set if for special channel spacings a step size of e.g. 12.5 kHz is required. Since the synthesizer of the ESM 500 is tuned in kHz steps, the microprocessor automatically rounds off the accurate step frequency to the nearest kHz digit. The maximum possible mistuning is 0.5 kHz. A faulty summing up is not possible.

Turning the switch 28 clockwise causes indication of the frequency sequence Fr, F1 and F2, turning it counterclockwise causes indication Fr, F3, F2. Continuing to turn switch 28 in either of the two directions causes indication of the frequency sequence as specified before.

With the aid of key 13 it is also possible to select the receive frequencies from the main display 11 as start and stop frequencies F1 and F2.

Key CE on keyboard 18 only cancels the keyboard entry, not however the stored scanning frequency. A stored scanning frequency can only be cancelled by entering a new scanning frequency with the aid of keys 13 or 16.

2.3.6.2 Control of Automatic Scanning Operation

The automatic scanning operation can only be started if Fr STOP is indicated on the auxiliary displays 14 and 17. This stop mode is obtained either after input of one of the three frequencies or by turning switch 28 to the fourth position after F3 or by pressing the keys PRE and FRQ SC or by pressing the STOP key during scanning operation.

The scanning mode is triggered from the stop mode by means of the keys RUN+ or RUN-. Fr run or Fr run- appears on the auxiliary displays 14 and 17. The keys RUN+ and RUN- trigger the scanning operation with rising or falling frequency. It is thus possible to scan transmitter signals that are above or below the current tuning frequency at a keystroke.

With a step size of 100 kHz and the squelch switched on, the receiver tuning procedes in 100-kHz steps with a bandwidth of 100 kHz. If the signal exceeds the squelch threshold, the tuning returns to the start of the last 100-kHz step and continues without interruption with the selected step size and bandwidth.

If again a signal exceeds the squelch threshold, the tuning stops for the duration of the dwell time. The dwell time is selected by means of switch 26, the squelch function is switched on with key 41 and the squelch response threshold is set with potentiometer 39. If the squelch is switched off or the threshold low, the scanning is effected with the selected step size and bandwidth.

By pressing the keys PRE and DW.0 on keyboard 18 the dwell time can be made zero if for instance detected signals are to be logged only via the data output of the receiver. After actuating the key DW.0, the indication Fr STOP 0 is blinking on the display 17. The zero dwell time is cancelled by CE.

2.3.7 Automatic Frequency Control (AFC)

When the AFC button 9 is pressed, the receiver tuning tracks a changing signal frequency. The capture range of the AFC corresponds approximately to the selected IF bandwidth. When the AFC button is pressed, the LED lamp above the button lights. If the receiver is exactly tuned to the carrier, the TUNing ERROR indicator 8 is positioned in the centre. AFC cannot be activated in MGC or SSB operation. AFC is discontinued when a comparator senses a signal level below 1 V, since in the absence of sufficient signal strength, wideband noise could produce a false indication of detuning.

2.3.8 Operating Modes

The FM, AM or SSB operating mode is selected by pressing the appropriate DEMODULATION button 30.

2.3.8.1 FM Operation

FM operation is used for the monitoring of frequency-modulated signals. It is switched in by pressing the FM button 30.

2.3.8.2 AM Operation

AM operation is used for monitoring amplitude-modulated signals. It is switched in by pressing the AM button 30.

2.3.8.3 SSB Operation

(see Appendix 1)

SSB operation is used for monitoring single-side-band-modulated signals. When SSB operation is selected, by pressing the SSB button 30, the narrowest IF bandwidth (8 kHz) and the AF filter are automatically switched in. At the same time, one of the LEDs on the SSB-control panel 1 lights. By use of the two pushbuttons on the right, the desired operating mode, A0, A1, LSB, USB or ISB, can be activated.

In A0 operation, unmodulated signals can be tuned to receiver centre frequencies (zero-beat of the AF signals).

A1 operation is used for monitoring on-off-keyed carriers.

In SSB operation the tuning step size is automatically switched to 100 Hz/step. If the DISPLAY kHz button 1 is depressed, the step size is reduced to 10 Hz, and at the same time the frequency display is switched from MHz to kHz, so that the 100-Hz and 10-Hz places can be read.

2.3.9 Squelch

See Section 2.2.8.1

2.3.10 AF Filter

When the FILTER button 42 is depressed, the frequency response of the AF amplifier is limited to the range 300 to 3300 Hz. This reduction of the AF range enhances the intelligibility of monitored signals under conditions of poor reception (low input level, strong disturbances).

2.3.11 Output of Antenna Number

With the ESM 500 an antenna selector may be controlled via the built-in data interface or the Serial/Parallel Converter GH 034.

The antenna number is included in each standard output via the data interface. The antenna number is output automatically each time the number is changed:

1) Via the Serial/Parallel Converter GH 034 by appropriate positioning of the coding switch contact on the interface input board 570.8070 (see section 2.2.7).
2) In the form of an antenna number string of fixed length as described under 2.4.5.2 and 2.5.4.2 following commands J5 and H5.

The antenna number is changed by pressing twice the key ANT 00 of keyboard 18 and two figure keys within the range 00 to 99. The antenna number is automatically stored in the current receiver status and by pressing key 13 twice it may be transferred to a memory location together with the current status.

The antenna number is also changed via the data interface when the content of a memory location is transferred to the current receiver status provided that the antenna used is different from the previously used antenna. The antenna number 00 is not transferred from the memory to the current status. Thus a selected antenna 00 is maintained at all memory locations during memory scan.

Provided the appropriate coding switch contact on the Interface Input Board 570.8070 (see section 2.2.7) has been operated, an entered antenna number is only output via the Serial/Parallel Converter GH 034 and not via the data interface.

By pressing the ANT 00 key twice the antenna number may be display 17 during operation. After pressing the CE key the display is blanked; the antenna number is maintained.

2.3.12 Headphones or Loudspeaker Output

Headphones or an external loudspeaker can be connected to socket 44. This socket requires the following plug: PL 55, R&S Stock No. FT 019.0487. The built-in loudspeaker is disconnected when the plug is inserted.

2.3.13 IF Bandwidth

The IF bandwidth is selected by pressing one of the IF BANDWIDTH buttons 31, 32, 33 or 34. The bandwidths marked on the buttons are the 3-dB values.

2.3.14 IF Panorama

The (optional) IF panorama display 6 is used for the observation of channel occupancy and as a tuning aid. The signal centre frequency is shown on the display with a vertical stroke, the receiver IF bandwidths are indicated by horizontal lines true to scale. The level display is not affected by the IF gain control of the receiver.

2.3.14.1 Panoramic Display with Panoramic Adapter EZP

(see Section 2.3.21 for connection of EZP.)

The ESM 500 together with the EZP can produce an IF panoramic display of up to 2-MHz bandwidth, an RF panoramic display of up to 500-MHz bandwidth, or a display of any selectable subrange of these bands.

The display width MAX on the EZP corresponds to the frequency range of the respective receiver (ESM 500 A, B or C). The switch-over occurs automatically through the marker frequency 11 set on the ESM 500 when the switch-over threshold 499.999/500.000 MHz is crossed. The switch-over of the LED "reception frequency" 10 to LED "marker frequency" 12 follows automatically when one of the RF-analysis display types is selected on the EZP. In this operating mode the AF channel of the ESM 500 is blocked and the tuning step size (control 29) is increased to 100 kHz/step.

In case of very high signal levels, the 40-dB RF attenuation of the ESM 500 can be switched in with the 40-dB button 3.

In RF analysis, the operation of the memory-location knob 28 results in the stored frequency being immediately used as marker frequency; transfer by means of button 15 is in this case not required.

2.3.15 Input Signal Levels

The SIGNAL meter 7 indicates the level of the input signal to the receiver. The scale has a range of 0 to 80 dBµV. With the HF button 3 depressed, the range of the input signal level indication can be extended by 40 dB because of the additional RF attenuation.

In MGC and SSB operation, the 40-dB RF attenuation is switched in whenever the HF button 3 is depressed.

In AGC operation, the 40-dB RF attenuation is automatically switched in as soon as the input signal level exceeds 75 dBµV, if HF button 3 is depressed.

In all cases the presence of the 40-dB RF attenuator in the circuit is indicated on the signal meter 7 by the +40-dB lamp being lit.

In AGC operation therefore, the input signal level in this case is the pointer indication of the meter plus 40 dB.

In MGC operation the signal meter does not indicate the actual signal level, but shows instead the signal level for which the set gain is optimal.

2.3.16 External Control

With switch 23 set to EXT., EXT. LED 22 lights up.

For such operation, all controls on the front panel are blocked and the instrument is under remote control.

2.3.17 MAN./EXT.

Switch 23 set to MAN./EXT.

For such operation the receiver can be operated via the IEC bus or the RS 232 C interface. Provided that no data exchange takes place with the controller, the ESM 500 can be operated manually. See also section 2.4.5.7.

2.3.18 Wideband Demodulator

The (optional) wideband demodulator has two switchable IF bandwidths, 0.3 and 2 MHz. If button 20 is depressed, the 300-kHz bandwidth is switched in.

2.3.19 IF Output

An unregulated 10.7-MHz IF output of about 2 MHz bandwidth is provided on output 57 (BNC connector). The voltage level is $\geq$ 10 dB above the receiver input level, except when the 40-dB RF attenuator is switched in, in which case the voltage lies 30 dB under the input signal level.

A 10.7-MHz regulated voltage of 10 mV into 50 Ω is provided on the NARROW GC output 59 (BNC connector). (With option GC 050, a 21.4-MHz voltage is possible; with option VZ 050 V1 a 10.7-MHz regulated voltage of 70 mV into 50 Ω is possible)

An unregulated IF voltage of +30 dB above the antenna input level is provided on the NARROW output 65 *) (BNC connector). A fast logarithmic-function stage may be connected to this output.

*) with models 22 to 27 only

2.3.20 AM-video and FM-video Outputs

AM-video and FM-video signals, 0.5 V_{pp} into 75 Ω, m = 0.5 for AM and Δf = ±500 at f_{mod} = 1 kHz for FM signals are brought out to rear-panel terminals 56 and 58.

2.3.21 Panoramic Adapter EZP

A connector is provided for connecting the EZP (connecting cable provided with EZP). In RF analysis, the receiver frequency marker, whose value is shown in the main display field 11, must be displayed and is shiftable by means of tuning knob 29. If this is not the case, the fault may be due to a missing wire bridge between BU1/36 and BU2/6 in the EZP. Any differences in potential that may occur between the outer conductor of the antenna cable and the non-fused earth conductor of the power supply may impair the panoramic display. This can be overcome by capacitive separation of inner and outer conductors of the antenna cable and/or by providing a lowresistance connection between the two instruments by means of a ground-strap (with suitable fixing lugs) attached to the rear-panel fixing screws.

2.3.22 External Reference Frequency

Connector BU13 55 provides for the inputting of a 10-MHz reference signal.

2.3.23 VHF/UHF Antenna Input

The VHF/UHF antenna with Z = 50 Ω is connected to connector BU5 60 (Z = 50 Ω, coaxial).

2.3.24 Antenna Control Output

Connector BU3 48 is provided for connecting the antenna selector switch GS 050, which is controlled by the set receiver frequency and switches the appropriate antenna to the receiver.

2.3.25 Balanced AF Output/COR

A 600- AF-conductor output is available at connector BU4 61. A tape recorder can be connected to the same connector for recording signals. The tape recorder is controlled by the COR (carrier-operated relay), which is operated by the squelch threshold. The COR-dropout delay after the end of a signal is internally adjustable.

2.4 Control of ESM 500 via IEC Bus

(see Figs 2-3 and 2-4 and Appendix 1)

The VHF/UHF Receiver is fitted with the IEC-625-Bus Interface GH 023 to IEC Publication 625-1 for the transfer of setting and measured data using a byte-serial bus system. The IEC-bus connector 45 is located on the rear panel of the receiver. See Fig. 2-4 for pin configuration.

For data transfer, the standard ASCII character set (see Table 2-6) is used. For the interface specifications (control lines, handshake lines, data lines) and data transfer sequence see IEC standard.

2.4.1 Setting the Device Address /TALK ONLY/LISTEN ONLY

The listener and the talker address are set together by means of the coding switches S1.4 to S1.8 (62) in accordance with Table 2-1. The receiver is factory set to the listener address "2" and to the talker address "R". This corresponds to device address 18 (e.g. for use with R&S Process Controller PPC).

The Talk Only mode can be selected by means of the coding switch S1.3 (62) which permits the ESM 500 as master to send data to a Listen Only device via the IEC bus.

The receiver is set to the Listen Only mode by means of coding switch S1.2 (62) and then operates as slave receiver.

Note: The VHF/UHF Receiver ESM 500 must be switched off when changing the device address or switching the Talk Only and Listen Only modes on or off.

2.4.2 Interface Functions

The ESM 500 implements the following interface functions:

SH1 Source handshake function,
complete capability

AH1 Acceptor handshake function,
complete capability

T5 Talker function, capability to answer serial poll,
unaddressing if MLA, Talk Only mode

L3 Listener function, unaddressing if MTA, Listen Only mode

SR1 Service request,
complete capability

RL1 Remote/local switchover function,
complete capability

PP1 Parallel poll function,
remote-controllabe configuration

DCØ Device clear function, no capability

DTØ Device trigger function, no capability

CØ Control function, no capability.

2.4.3 Setting Instructions

The following describes the setting instructions for the remote control of front panel controls, the program data and format as well as functions that cannot be set manually. The receiver responds to the IEC-bus setting instructions and data in remote operation exactly as it does to direct, manually keyed settings in local operation. Therefore, the same sequence of settings that is used for manual operation can be used as basis for a controller program for setting the receiver functions.

The programming instructions consist of an alphanumeric header and the numeric data. The header consists of one or two alphanumeric characters (ASCII upper-case letters); the numeric data consists of one or several numeric characters (Ø to 9, decimal point, polarity sign and spaces).

2.4.4 Data Entry

All the entry commands start with a header which consists of one or two alphanumeric characters. The actual data consist of a string of ASCII decimal figures with an optional decimal point, which may be preceded by a + or - sign.

Any number of spaces and + signs may be placed between the header und the data string; the ESM 500 simply ignores them. The following examples of receiver frequency programming illustrate the possible input formats:

F20	20 MHz
F20.000 12	20 MHz with SSB, fine tuning of 120 Hz
F146.3	146.3 MHz

Setting and data commands are allowed to be entered in any sequence of order without the use of separators. The execution of the entries is initiated by adding the appropriate terminating character or exceeding the range of the input buffer (48 ASCII characters). Switching on the ESM 500 generates the CR delimiter (decimal 13 or hexadecimal 0D) both for the Talker and Listener modes. A different delimiter (e.g. ; or ETX or other characters) may be selected by the use of the XØxx, X1xx, X2xx or Yxx commands (see table 2-5).

The following are not available as delimiter: SP, +, -, ., numbers, upper-case characters and ↺ .

Generally, the following applies to all setting commands:

A check is made whether the entered commands have the correct syntax and are compatible with current receiver settings as well as whether received data are within the limit values. A fault detected during the check results in the setting command not being executed and an error message displayed if the output has been prepared with commands H7 and J7. Data entries set the ESM 500 immediately to the required status.
All data bytes available on the IEC-bus are received in the listen-only mode. The ESM 500 processes the data bytes only if an address > 9 is set on the rear switch S1 (62) or if the set IEC-bus address 0 to 9 is detected in message A before the first data to be processed (see also section 2.2.5).

2.4.5 Data Output

2.4.5.1 Initiation of Data Output

Depending on what triggers the data release, different types of data are output together with two coded letters. Order of sequence, data output format and the units (although not transferred) are always fixed. The output is terminated with the programmed delimiter and, provided not inhibited by the X1 command, the END message. The output of data takes place as a result of one of the factors listed in Table 2-3 only when the corresponding Hxx and/or Jxx have previously been received. With the command Jxx (see under 2.4.5.4) a PP may be issued, wheras an Hxx command (see under 2.4.5.3) results in an SRQ.

Factors causing a data output in Talk Only mode are listed in Table 2-4.

Each factor has an assigned status byte generated with an SRQ.

The controller can generate a data output by means of the command Ox (see Table 2-3), provided that the previous or the current command has a Hx or Jx (e.g. J404).

2.4.5.2 Output Data Formats

The meaning of the coded letters and data are explained in Table 2-5. The following formats are available:

Standard (fixed length):
A 12 B 12 F 123.45678 I1 W1 R1 C123
D 1 G 1 L12 3.4 N 123 delimiter

Extended standard (fixed length): (after receipt of J8 and H8)
A12 B12 F123.45678 I1 W1 R1 C123
D1 G1 L123.4 N123 FA123.456 FB123.456 FC12345.67 delimiter

Memory scan (fixed length):
P 1 2 F 1 2 3 . 4 5 6 7 8 L 12 3.4 N 1 2 3 delimiter

Antenna number (fixed length):
A 1 2 B 1 2 delimiter

Type of receiver (fixed length):
A12 Uabcdefghij delimiter

Individual data (variable length with acknowledgement):
A12 ... delimiter

Memory scan (frequency scan of fixed length):
P12 F123.45678 L123.4 N123.4 delimiter

Antenna number (fixed length):
A12 B12 delimiter

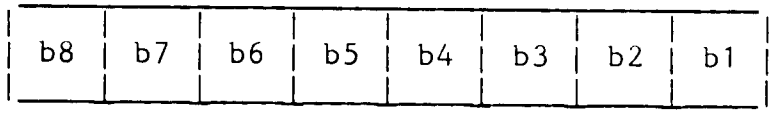
Component/loop test error (variable length):
T 123 T 123 .... L123.4 delimiter

Bus input command (variable length):
Tx12 Tx12 .... delimiter

Each time a bus input error is output, the message "Err 30" is displayed on the ESM 500 (see table 2-7).

2.4.5.3 SERVICE REQUEST (SRQ)

The VHF-UHF Receiver ESM 500 is an autonomous IEC-bus device, which means that it receives instructions from the process controller and processes them independently without any support. The instructions H1 to H8 cause the device to send an asynchronous Service Request to the process controller in the case of certain events (the controller may execute other tasks in between). By a Serial Poll the process controller receives the device status byte containing the information which event has triggered the SRQ in the receiver and which data byte is to be expected (see section 2.5.2 and 2.5.4).



b8 and b6 to b1 = coding

b7 = request service bit (rsv = 1)

In the case of large systems, however, the interrogation of the status byte of all instruments after every SRQ requires quite a long time.

In the Extended Talker Listener mode (switch position TE/LE), the status byte must be interrogated individually for every cassette after a Serial Poll.

2.4.5.4 Parallel Poll (PP)

The ESM 500 can be configured to answer a Parallel Poll request sent from the IEC-bus controller via the primary command "PPC" and the subsequent secondary command "PPE", the latter consisting of " X 1 1 Ø S P P P". The three least significant bits "P P P" define the data line, on which the answer is to be sent. The sense bit S together with the current device status "ist" (individual status bit) determines whether the answer sent is a "1" ("ist" = S) or "Ø" ("ist" ≠ S).

Note: With the IEC bus, "1" (i.e. true) corresponds to a low level on the data line.

The controller carries out a Parallel Poll at regular intervals to determine which one of a maximum number of 8 devices needs servicing. The polling itself requires little time.

Since several devices may be assigned to the same data line in a PPE command, this allows the identification of groups of devices in systems made up of more than 8 devices.

2.4.5.5 Linking of SRQ and PP

The ESM 500 has the facility to combine SERVICE REQUEST and PARALLEL POLL in a simple way whenever an output with SRQ and PP is brought about (e.g. by the command H2J2). The control program, in this case, is interrupted by SRQ which then initiates the SRQ routine. The device or group of devices raising an SRQ is at first determined using the PP mode. The status byte of the calling device is then determined through one or two serial polling and will then be further processed or transferred.

2.4.5.6 MASTER-SLAVE Mode

The master receiver ESM 500 is set in the Talk Only mode with addressing switch 62. A maximum number of 10 slave receivers ESM 500 in Listen-only mode can be sent data via the IEC bus. The slave receivers are assigned slave addresses from Ø to 9 in BCD code with the same coding switches as used to set the IEC address in the controller mode.

The slave addresses are set in the master receiver with the memory switch 28 set between AØ and A9. The standard data set is transferred to the slave receivers for a DATA OUT key 19 and stored in the selected location in the master between AØ and A9. Slave receivers with different addresses ignore the data until the delimiter is transferred. Slave receivers with address numbers > 9 function exclusively in Listen Only mode so that bus data with correct syntax are processed without the address being taken into account. AØ to A9 can only be set if the talk-only mode is selected.

2.4.5.7 REMOTE/LOCAL Mode

On receiving a listen address from a controller, the receiver ESM 500 switches over to REMOTE. At the end of the data transfer the receiver stays in REMOTE if the controller has previously set it in the LOCAL-LOCKOUT (LLO) mode. Front panel controls remain disabled, and the set state is indicated by LED EXT. 22. The

receiver locked in REMOTE by LLO may be changed to LOCAL by the addressed command GO TO LOCAL (GTL), the message $\overline{\text{REN}}$ or operating the mains switch.

With EXT. switch selected the ESM 500 may be operated only remotely with all operating controls being ineffective. The device goes into LOCAL on switching over to MAN./EXT. provided that no data transfer takes place via the data interface.

2.4.5.8 Receiver Identification

After a request with command 08 the ESM 500 indicates its type, equipment, operating mode and software version. The receiver identifiers are shown in Table 2-5.

2.4.6 Table for IEC bus

Table 2-1 Setting the Device Address on GH 023

ASCII Character		Binary address					Decimal equivalent	
Listen adress	Talk adress	Adress switch S1 *) 16	8	4	2	1		
(SPACE)	@	Ø	Ø	Ø	Ø	Ø	Ø	
!	A	Ø	Ø	Ø	Ø	Ø	1	
"	B	Ø	Ø	Ø	1	Ø	2	
#	C	Ø	Ø	Ø	1	1	3	
$	D	Ø	Ø	1	Ø	Ø	4	
%	E	Ø	Ø	1	Ø	1	5	
&	F	Ø	Ø	1	1	Ø	6	
'	G	Ø	Ø	1	1	1	7	
(	H	Ø	1	Ø	Ø	Ø	8	
)	I	Ø	1	Ø	Ø	1	9	
*	J	Ø	1	Ø	1	Ø	1Ø	
+	K	Ø	1	Ø	1	1	11	
,comma	L	Ø	1	1	Ø	Ø	12	
-	M	Ø	1	1	Ø	1	13	
.	N	Ø	1	1	1	Ø	14	
/	O	Ø	1	1	1	1	15	
Ø	P	1	Ø	Ø	Ø	Ø	16	
1	Q	1	Ø	Ø	Ø	1	17	
2	R	1	Ø	Ø	1	Ø	18	**)
3	S	1	Ø	Ø	1	1	19	
4	T	1	Ø	1	Ø	Ø	2Ø	
5	U	1	Ø	1	Ø	1	21	
6	V	1	Ø	1	1	Ø	22	
7	W	1	Ø	1	1	1	23	
8	X	1	1	Ø	Ø	Ø	24	
9	Y	1	1	Ø	Ø	1	25	
:	Z	1	1	Ø	1	Ø	26	
;	[	1	1	Ø	1	1	27	
<	\	1	1	1	Ø	Ø	28	
=	]	1	1	1	Ø	1	29	
>	^	1	1	1	1	Ø	3Ø	

*) Pos. 62 in Fig. 2-3

**) Factory set

A logical "1" for the binary address is selected by switching to the side marked "|".

Table 2-2 General IEC-bus Commands

Command	PPC	hp 9835/45	hp 9825	Tektronix 4051
Go to Local	IECLAD 17 IECGTL IECUNL	LOCAL 717 or LOCAL 7	lcl 717	WBYTE a 49.1:
Local Lockout	IECLLO	LOCAL LOCKOUT 7	llo 7	WBYTE a 17:
Parallel Poll Configure	IECLAD 17 IECPPC IECPPE s_1s_2 IECUNL	PPOLL CONFIGURE 717; mask	polc 717, mask	--
Parallel Poll Unconfigure (universal)	IECPPU	PPOLL UNCONFI-GURE 7	plu 7	--
Parallel Poll Unconfigure (addressed)	IECLAD 17 IECPPD IECUNL	PPOLL UNCONFI-GURE 717	plu 717	--
Parallel Poll	IECPPL v%	PPOLL (7)	pol (7) A	--
Serial Poll	IECSPL17, s%	STATUS 717; s	rds (717) A	POLL A, S; 17

2.5 Remote Control of ESM 500 via V.24/RS-232-C Interface

(see Figs. 2-5 to 2-11 and Appendix 1)

V.24/RS-232-C Interface GH 024 (option) enables the remote control of the ESM 500 by devices equipped for serial data transfer. The Interface GH 024 fulfills the German standard DIN 66020 and the US EIA standard RS-232-C and thus the international CCITT recommandation V.24.

Table 2-3 shows the pin allocation and function of the interface.

In serial data transfer, datas are transferred on a line consecutively in time, i.e. serially. The characters to be transferred are sent in ASCII code by the ESM 500. The data bit sequence determined by the character to be transferred is prefixed by a start bit and appended by a stop bit. These two additional bits ensure the synchronization of transmitter and receiver.

Data is transferred via the V.24 Interface GH 024 in asynchronous operation. In order to obtain synchronization between data transmitter and receiver, the receiver is triggered every time by the rising edge of the start bit which is sent with the bit pattern of each character.

Hardware handshaking is used for the data transfer. For the purpose of transferring the handshake signals between ESM 500 and external instrument, the lines RTS, CTS and DTR are to be used according to Table 2-3.

Fig. 2-7 shows the logic levels of the V.24 interface.

2.5.1 Specifications

(see Fig. 2-8)

Data format:	8-bit ASCII (7 character bits + 1 parity bit	fixed by software
Stop bit:	1	fixed by software
Parity:	even, odd, off	selected with 62 on rear panel
Band rate:	50 to 19.2k*)	selected with 62 on rear panel

*) Edge slope is about 5 % of pulse width at 19.2k baud rate

Mode: asynchronous
Address: 0 to 15

for transferring data code characters in serial telegrams, selected with 62 on rear panel

2.5.2 Preparation for Use

(see Fig. 2-8)

Set parity and baud rate with selector switch 62 on the rear panel of ESM 500. Set address switch ADDR. 1 to 8 in 62 corresponding to the required Axx message in line with 2.5.6, but at first to 15 (all four switches to "|").

The settings of baud rate and parity on the ESM 500 must agree with these of the external instrument.

The switch positions are read in by the ESM 500 only if the latter is switched on. In order to read in changed switch positions it is necessary to operate the power switch of the ESM 500 off and then on again. The baud rate can however be newly set with switched-on instrument because these switch positions are read immediately without having to switching off and on the ESM 500.

The ESM 500 is connected to the external instrument by a suitable cable with crossed data and interface lines. Examples of wiring are shown in Figs. 2-9 and 2-10.

2.5.3 Setting Commands

This section deals with the setting commands for the remote control of front-panel controls, program data and format as well as functions that cannot be set manually. The receiver responds to V.24/RS-232-C instructions and data exactly as it responds to keyed-in entries. Therefore, the sequence of settings used for manual operation can form the basis for a controller program for setting the receiver functions.

The programming instructions consist of an alphanumeric header and the numeric data.

The header consists of one or two alphanumeric characters (ASCII upper-case letters), the numeric data of one or several numeric characters (0 to 9, decimal point, polarity sign and spaces, if any).

2.5.4 Data Entry

All entry commands start with a header which consists of one or two alphanumeric characters. The actual data consists of a string of ASCII decimal figures with an optional decimal point which may be preceded by a + or - sign. Any number of spaces and + signs may be placed between the header and the data string; the ESM 500 simply ignores them.

The following examples of receiver frequency programming illustrate the possible input formats:

F 20	20 MHz
F 20.00012	20 MHz with SSB, fine tuning of 120 Hz
F 146.3	146.3 MHz

Setting commands and data can be entered in any sequence without the use of separators. The execution of the entries is initiated by adding the appropriate terminating character or exceeding the range of the input buffer (48 ASCII characters). On powering up the ESM 500, CR (decimal 13) is automatically selected as delimiter. A different delimiter (e.g.; or ETX) may be selected by the use of the X or Y command.

The following characters are not available as delimiter: SP, +, -, ., numbers, @ and upper-case characters.

Generally, the following applies to all setting commands:

A check is made whether the entered commands are of correct syntax and are compatible with current receiver settings as well as whether received data within tolerance. A fault detected during the check results in the setting command not being executed and an error message displayed if the output has been generated by commands H7 or J7. Data entries set the ESM 500 immediately to the required status.

2.5.5 Data Output

2.5.5.1 Initiation of Data Output

Depending on the source of trigger, different types of data are output together with two coded letters which are provided for the purpose of identification. Order of sequence, data output format and units (although not transferred) are always fixed. The output

is terminated with the programmed delimiter and, provided not inhibited by the X1 command, with the END message.

Data output takes place as a result of one of the factors listed in Table 2-4 only when the corresponding command Hxx or Ixx has previously been received.

Every factor is assigned a status byte which can be output as Axx message (see section 2.5.6).

The controller can generate a data output by means of the command Ox (see Table 2-5), provided that the controller has output an Hx or Jx (e.g. J404) in the previous or current command.

2.5.5.2 Output Data Formats

The meaning of the coded letters and data are explained in Table 2-5. The following formats are available:

Standard (fixed length):
A12 B12 F123.45678 I1 W1 R1 C123
D1 G1 L123.4 N123 delimiter

Extended standard (fixed length) (following receipt of J8 or H8)
A12 B12 F123.45678 I1 W1 R1 C123
D1 G1 L123.4 N123 FA123.456 FB123.456 FC12345.67 delimiter

Memory scan (fixed length):
P12 F123.45678 L123.4 N123 delimiter

Antenna number (fixed length):
A12 B12 delimiter

Type of receiver (fixed length):
A12 Uabcdefghij delimiter

Memory scan (frequency scan of fixed length):
P12 F123.45678 L123.4 delimiter

Component/loop test error (variable length):
Ta123 Ta123 ... L123.4 (only for loop test) delimiter

2.5.5.3 Receiver Identification

After a request with command 08, the ESM 500 indicates its type, equipment, operating mode and software version. The receiver identifies are shown in Table 2-5.

2.5.6 Address Switch and Axx Message

Addresses between 0 and 15 can be set in binary on the switch ADDR. 62 at the rear panel of the ESM 500 (see Fig. 2-8). An address of 9, for example, is selected by setting switches 1 and 8 to "|", switches 2 and 4 to "0". The form and function of the Axx message (different from those of Table 2-5) depend on the address value.

Data input:

ADDR between 0 and 9:

The ESM 500 accepts the input data between Axx and delimiter only if xx = ADDR. The input data is simply ignored if xx does not agree with the set address. Receivers can therefore be addressed in this way.

ADDR between 10 and 15:

All valid input data are accepted, i.e. Axx is irrelevant.

Data output:

ADDR between 0 and 9:

A00...A09 corresponding to the address value is always output provided that the data string in line with section 2.5.5.2 contains a Axx message. A controller is thus able to identify a particular receiver from several ESM 500 receivers with the uid of the data string.

ADDR between 10 and 15:

The decimal value of the status byte listed in Table 2-4 between parenthesis is output in the Axx message (e.g. A 32 for outputting an antenna number). The source of data output can thus be easily determined.

Exception:
If the memory switch is set to A0...A9, the value set is output in the Axx message on pressing DATA OUT or following the V.24 command 02.

A code number which is freely selectable manually, however not via remote control, can therefore be added to the data output. This number may also be used as an address.

2.5.7 Interconnecting Two ESM 500

(see Fig. 2-9)

Two Receivers ESM 500 can be connected together via their V.24 interfaces. Either of the receivers may transfer its setting data to the other receiver on pressing the DATA OUT key 19 provided that the setting data are continued in the standard string (see section 2.5.5.2). It is necessary to set switches ADDR 62 on both receivers to a value between 10 and 15. The baud rate is required to be at least 2000 because otherwise the standard string cannot be transferred within 2 seconds (see section 2.5.9).

2.5.8 Operation of One or Several ESM 500 with a Computer

(see Figs. 2-10 and 2-11)

ESM 500 fitted with the V.24/RS-232-C Interface GH 024 can be simply controlled by a computer and send measured data such as level and frequency offset to the computer.

Additional triggering factors for data output can be programmed with the commands Hx or Jx (see Tables 2-4 and 2-5). J2 is effective following the switch-on of the ESM 500.

The process controller must have the same number of V.24 interfaces as the number of receivers connected to it. The controller can be informed with the Axx message (see sectin 2.5.6) on the trigger of the data output, address setting or on required target address.

2.5.9 Timeout

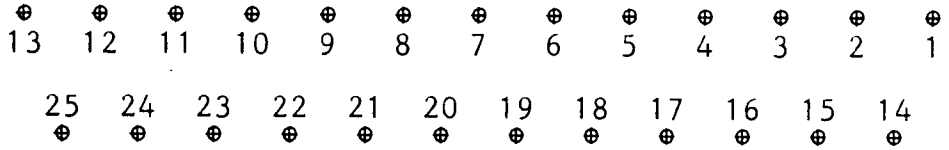
ESM 500 interrupts the output of data if not completed within a period of 2 seconds and signals with error 13. The standard string (41 characters) - in particular the extended standard string - cannot be transferred within 2 seconds at baud rates of < 200.

If baud rates of < 200 are nevertheless to be used, a longer timeout has to be selected at the controller with a command X2xx or X3xx (permissible range of 1 to 99 sec.) Timeout is reset to 2 seconds after activating the power switch.

2.5.10 Table for V.24-/RS-232-C-Interface GH 024

Table 2-3 Contact assignment of V.24/RS-232-C Interface GH 024

25-contact connector, viewed from connector



Contact	Designation	Function	Inp.	Outp.
1	⊥	Protective earth		
7	⊥	Protective earth		
2	TxD	Transmitted data ESM 500 --→ external unit		X
3	RxD	Received data Externes unit --→ ESM 500	X	
4	RTS	"1": ESM 500 ready to receive "Ø": ESM 500 not ready to receive because received data are being processed		X
5	CTS	"1": Data byte ready to be output "Ø": Data byte not ready to be output	X	
6	DSR	Not polled by ESM 500 software	X	
20	DTR	On receiving a data byte, goes to "Ø" "1": Ready to receive new data byte "Ø": Not yet ready to receive new data byte		X

2.6 Table for Data Transfer with Remote Control of ESM 500

(valid for IEC-bus and V.24/RS-232-C interface)

Table 2-4 Conditions for Data Outputs and Status Byte Coding

Trigger-source	Operating instruction for SRQ, PP or direct output 3*		Status byte (decimal value without R) 1*, 4*	Data format	output in Talk Only Mode 4*	Remarks
DATA OUT key Command 02	H2	J2 2*	0R011111 (31)	Standard	X	
	H2 and H8 or J8	J2 and H8 or J8	0R011111 (31)	extended standard		
Inadmissible or faulty input via interface	H7	J7	0R101111 (47)	bus input error	-	
TEST key new component errors	H6	J6	0R101110 (46)	Component error, loop test error	-	
Command T1 Command 06					-	No loop test after 06
Signal < threshold	H3	J3	0R100001 (33)	Standard	-	

1* R = request service bit = 1.
2* selected after power-on.
3* with V.24/RS-232-C: Hx or Ix can be used
4* not applicable for V.24/RS-232-C

Table 2-4 Conditions for Data Outputs and Status Byte Coding

(continued)

Trigger source	Operating instruction for SRQ 3*	PP or direct output	Status byte (dezimal value without R) 1*, 4*	Data format	Output in Talk Only Mode 4*	Remarks
Signal > threshold	H4	J4	OR100010 (34)	Standard	X	
Signal > threshold in scanning mode and frequeny search run	H4	J4	OR100011 (35)	Memory scan		
Command o5, selection of an antenna number	H5	J5	OR100000 (32)	Antenna number	X	
Memory location 99 exceeded during scanning and start stop/frequency attained during frequency search run	H1	J1	OR111010 (58)	-		No message, only status byte and delimiter with IEC-bus.
				A58		With V.24/ RS-232-C

1* R = request service bit = 1
2* selected after power on
3* with V.24/RS-232-C: Hx or Jx can be used
4* not applicable for V.24/RS-232-C

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Slave address	A	XX 00 to 09	No.	X		Address with Lon (2.4.5.6) and V.24
		XX 00 to 30			X	own address set on rear panel
		XX 00 to 09			X	with V.24: own address set on rear panel < 10
		XX 00 to 09			X	with ton/V.24 and address set > 10: address selected with memory switch 28 and displayed in 14
		XX 31 to 58			X	decimal code of status byte according to table 2-4
Antenna No.	B	XY 00 to 99	No.	X	X	
Squelch, threshold						
off	CØ			X	X	
on, manual	C1	XX -9 to 80			X	XX = threshold value
on, manual S/N	C3				X	
on, remote	C5	XX -9 to 80	dB (µV)		X	
on, remote S/N	C7				X	

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
on	C1	XX -9 to 80		X		XX may be omitted; entry of XX sets the bit "squelch threshold ext." (C5 in the output)
on	C5	XX -9 to 80		X		
on, S/N	C3			X		
	C7			X		
internal	C8			X		Threshold adjustable by hand (C1 or C3 in the output); Squelch must be switched on.

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
AF filter						
off	DØ			X	X	
on	D1			X	X	
Frequency						
Tuning frequency with waiting time	F	20 to 999.99999	MHz	X	X	With decimal point, the two last digits only with SSB.
Tuning frequency without waiting time	FD	20 to 999.99999	MHz	X	X	Entry stops scanning and frequency search run.
Frequency search run				*)		Output of frequencies in extended standard string only possible with H8 or J8.
Start frequency	FA	20 to 999.999	MHz	X	X	
Stop frequency	FB	20 to 999.999	MHz	X	X	
Step width	FC	1.00 to 10000	kHz	X	X	Resolution 10 Hz
AFC						Input is ignored during scanning
off	GØ			X	X	
on	G1			X	X	
RF panorama on (EZP)	G2				X	without AFC

*) stops frequency search run and scanning

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Triggering of an output and generation of an SRQ in the case of:						
no function	HØ			X		Single functions are reset with H1Ø to H8Ø
highest memory location in scanning mode or stop frequency in frequency search run exceeded	H1			X		
trigger command 02, DATA OUT key	H2			X		
signal < threshold	H3			X		
signal > threshold	H4			X		
antennna number changed or 05	H5			X		
new component error or 06 or T1	H6			X		
bus input error	H7			X		
output of receiver identification (U..) and of extended standard string (FA, FB, FC)	H8					

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Demodulation						
No function	IØ			X		Input stops scanning process
Asynchronous synthesizer	IØ				X	
AM	I1			X	X	
FM	I2			X	X	
AO	I3			X	X	I3 to I7 select the SSB mode, provided the SSB option is fitted, and set the bandwidth to 8 kHz.
A1	I4			X	X	
LSB	I5			X	X	
USB	I6			X	X	
ISB	I7			X	X	
Triggering of an output and, if required, generation of a PP in the case of:						Initialization of a Parallel Poll (see Section 2.3.26.5.4)
no function	JØ			X		Status after power-on or Device Clear is J2. J1 is only useful in conjunction with H1.
highest memory location in scanning mode or stop frequency in frequency search run exceeded	J1			X		Single functions are reset with J1Ø to J7Ø.
Standard output 02, DATA OUT key	J2			X		
signal < threshold	J3			X		with V.24/ RS-232-C: Hx and Jx of equal priority
signal > threshold	J4			X		

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
antenna number changed or 05	J5			X		
new component error or 06 or T1	J6			X		
bus input error	J7			X		
output of receiver identification (U..) and of extended standard string (FA, FB, FC)	J8			X		
Memory scan						
STOP	KØ			X		Frequency search run is disabled with K1 to K8.
RUN with dwell time =	K1			X		Memory scan stops with K1,
10 s	K2			X		if signal > threshold. The
5 s	K3			X		control time constant is
2 s	K4			X		300 Hz with K1 to K8 and
0.5 s	K5			X		100 Hz with KØ.
1 s	K8			X		
without dwell time	K6			X		

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Frequency search run						
STOP	KAØ			X		
started with increasing frequency	KA1 to KA8			X		Memory scan is disabled with KA1 to KA8 and KB1 to KB8. Dwell times and time constants same as during the scan.
started with decreasing frequency	KB1 to KB8			X		
Signal level	LØ	XY.Z -9.0 to 80.0	dB (µV)		X	XY.Z = value of signal level in dB (µV)
40 dB in	L1				X	
Signal > threshold	L2				X	
40 dB in and signal > threshold	L3				X	
Squelch high	L4				X	
Signal > threshold						
Squelch low	L6				X	
40 dB in Signal > threshold	L7				X	

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Calling of memory location	M	XX 01 to 99	No.	X		Transfer of memory location contents to current status: XX = location number; input stops scanning process.
Offset	N	XX.X -50 to +50	kHz		X	XX.X = value of offset > ±5 kHz not calibrated.
Trigger commands for:						An output is only triggered if the additional commands H2, H5, H6, H8 or J2, J5, J6 and J8 have been entered.
Standard output	02			X		
Antenna number	05			X		
Component error	06			X		
Receiver identifier (UXX)	08			X		
Memory location No.	P	XX 01 to 99	No.		X	Applies only to memory scan.
Load memory location only with frequency	Q	20 to 999.999	MHz	*) X		Does not load SSB places, clears the memory contents with the exception of the frequency.

*) ignored with scanning

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Mode of gain control						
No variation	RØ			X		
External GC, 40 dB off	R1			X	X	
MGC, 40 dB off	R2			X	X	
AGC, 40 dB off	R3			X	X	
Mode of gain control unchanged 40 dB on	R4			X	X	
External GC, 40 dB on	R5			X	X	
MGC, 40 dB on	R6			X	X	
AGC, 40 dB on	R7			X	X	
Store in memory location, SET/ RESET scanning, clear				*)		
No storage	SØ	XX 00 to 99	No.	X		XX = location number
Scanning off (RESET)	S1	XX 00 to 99		X		If location 00 is selected, SET, RESET and CLEAR apply to all locations.
Scanning on (SET)	S2	XX 00 to 99		X		
Clear/cleared location	S3	XX 00 to 99		X		
Store, scanning unchanged	S4	XX 01 to 99		X		Transfer of current status to memory.

*) stops scanning

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Store without scanning	S5	XX 01 to 99		X		Transfer of current status to memory.
Store with scanning	S6	XX 01 to 99		X		Transfer of current status to memory.
Test						
off	TØ			X		
on	T1			X		
Hardware error	T ?	XXX			X	XXX = figure
Operating error	T	WXX			X	W = letter A to Z+); significance listed in error table in section 2-7
Receiver identifier	U	abcdefghij				
		a 0			X	
Type (frequency range)		bc 08, 09 or 10			X	bc: 08 ≙ 10 to 999 MHz 09 ≙ 10 to 499 MHz 10 ≙ 500 to 999 MHz
IF option		d 1 or 5			X	d: 1 ≙ 8 to 100 kHz 5 ≙ wideband demodulator option fitted

+) from code column

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
SSB option		e 0, 1 or 2			X	e: 0 ≙ option not fitted 1 ≙ option of narrow bandwidth fitted 2 ≙ option of wide bandwidth fitted
		f 0			X	
Software version		gh 00			X	
		ij 00 to 99			X	Software version
Peep when data received						V1 occupied after switching on
no	VØ			X		
yes	V1			X		
IF bandwidth						
narrow / wide (Video)						
no variation	WØ			X		
8 kHz / 2 MHz	W1			X	X	
15 kHz / 2 MHz	W2			X	X	
30 kHz / 2 MHz	W3			X	X	
100 kHz / 2 MHz	W4			X	X	
8 kHz / 0.3 MHz	W5			X	X	
15 kHz / 0.3 MHz	W6			X	X	
30 kHz / 0.3 MHz	W7			X	X	
100 kHz / 0.3 MHz	W8			X	X	

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function	Code	Date Numeric range	Unit	Input	Output	Remarks
Delimiter as talker						XX = decimal equivalent of delimiter in ASCII code
Send EOI with delimiter:						
unchanged	XØ	XX	X			
without	X1	00 to 99	X*)			
with	X2		X*)			
Time out during data output						
	X3	XX 01 to 99	0.1s	X		2 s are set during power-on or DEVICE CLEAR.
	X4		1 s			1 to 99 s
Delimiter as listener	Y	XX 00 to 99		X		XX = decimal equivalent of delimiter in ASCII code.

*) not with V.24/RS-232-C

Table 2-5 Data Formats for Setting Instructions, Data Input and Data Output (continued)

Magnitude/ Function			Code	Date Numeric range	Unit	Input	Output	Remarks
Control time constant, IF blanking								With ZØ and Z4, the previous setting of the time constant is maintained.
Time constant (Hz)		IF blanking						With memory or frequency scan, time constant is 300 Hz. With "Stop", 100 Hz.
100	300							
-	-	0	ZØ			X		
1	0	0	Z2			X		Z2 is set after power-on.
0	1	0	Z3			X		
-	-	1	Z4			X		With Z4, the AGC capacitor is discharged.

Table 2-6 ASCII-Code (CCITT-Alphabet No.5)

International Reference-Version (to DIN 66003)

Bit b_7 b_6 b_5 →					0	0	0	0	1	1	1	1
					0	0	1	1	0	0	1	1
					0	1	0	1	0	1	0	1
				Spalte	0	1	2	3	4	5	6	7
b_4	b_3	b_2	b_1	ZL	H							
0	0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	1	SOH	DC_1	!	1	A	Q	a	q
0	0	1	0	2	2	STX	DC_2	"	2	B	R	b	r
0	0	1	1	3	3	ETX	DC_3	#	3	C	S	c	s
0	1	0	0	4	4	EOT	DC_4	¤	4	D	T	d	t
0	1	0	1	5	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	B	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	C	FF	FS	,	<	L	\	l	|
1	1	0	1	13	D	CR	GS	-	=	M	]	m	}
1	1	1	0	14	E	SO	RS	.	>	N	^	n	~
1	1	1	1	15	F	SI	US	/	?	O	_	o	DEL

H = HEX-Code

German Reference Version (to DIN 66003)

Bit b_7 b_6 b_5 →					0	0	0	0	1	1	1	1
					0	0	1	1	0	0	1	1
					0	1	0	1	0	1	0	1
				Spalte	0	1	2	3	4	5	6	7
b_4	b_3	b_2	b_1	ZL	H							
0	0	0	0	0	0	NUL	DLE	SP	0	§	P	`	p
0	0	0	1	1	1	SOH	DC_1	!	1	A	Q	a	q
0	0	1	0	2	2	STX	DC_2	"	2	B	R	b	r
0	0	1	1	3	3	ETX	DC_3	#	3	C	S	c	s
0	1	0	0	4	4	EOT	DC_4	$	4	D	T	d	t
0	1	0	1	5	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	A	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	B	VT	ESC	+	;	K	Ä	k	ä
1	1	0	0	12	C	FF	FS	,	<	L	Ö	l	ö
1	1	0	1	13	D	CR	GS	-	=	M	Ü	m	ü
1	1	1	0	14	E	SO	RS	.	>	N	^	n	ß
1	1	1	1	15	F	SI	US	/	?	O	_	o	DEL

H = HEX-Code

2.7 Contact Assignment of Connectors BU2, BU3 and BU4

BU2 Inputs/Outputs

All voltages measured with respect to ground, unless otherwise specified.

Contact	Designation	Input/ Output	Signal type Analog/Digital (active)	Comment
1	Ground		⊥	
2	AF-LSB, A_1	0	A 0 dBm	into 600 Ω
3	Squelch threshold ext.	I	A 0 V to +5 V	0 V to +50 mV corr. to S/N squelch threshold. +150 mV to +5 V corr. to carrier squelch threshold.
4	AF-USB, AØ	0	A 0 dBm	into 600 Ω
5	Level-indication voltage	0	A 0 V to +5 V	* 0.6 V corr. to 0 dBµV +5 V corr. to 80 dBµV
6	COR time	I		ext. resistance
7	Bandwidth B	0	D (L) TTL	*
8	Bandwidth A	0	D (L) TTL	*
9	Bandwidth C	0	D (L) TTL	*
10	Squelch ext.	I	D (L)	
11	Activates test generator	0	D +10 V/-10 V	*
12	Ext. control	I	D (L)	
13	AF (symm.)	0	A 0 dBm	into 600 Ω, floating
14	"	0	"	
15	AF (symm.) #	0	A 0 dBm	into 600 Ω, floating
16	"	0	"	

* for test purposes only.

also connected to BU4

Contact	Designation	Input/ Output	Signal type Analog/Digital (active)	Comment
17	+12V to ground	A		*
18	-12V to ground	A		*
19	+5V to ground			*
20	Loudspeaker ext.	A	A $P_{max} \geq 0.5$ W into 4 Ω	R_L 4 to 25 Ω
21	Ext. control voltage	E	A 0 V to +5 V	IF control 0 to -80 dB
22	Tuning error 200 mV/kHz	A	A -10V to +10V	200 mV/kHz in range of ±20 kHz
23	Activation of 40-dB switch	A	D +10V/-10V	* for +10 V on
24	Tuning voltage from synthesizer	A	A +5 V to 20 V	*

BU3 Antenna-control Outputs

Contact	Designation	Input/ Output	Signal type Analog/Digital (active)	Comment	
3	+5 V to chassis	0	(+5 V)		
4 5 6 7 8	Ground		⊥	Signal functions with Frequency control via GS 050	Frequency control via GH 034
9	8	0	D (H) TTL +)	8 x 100 MHz	8 x 100 MHz
10	4			4 x 100 MHz	4 x 100 MHz
11	2			2 x 100 MHz	2 x 100 MHz
12	1			1 x 100 MHz	4 x 100 MHz
13	8	0	D (H) TTL +)	8 x 10 MHz	Select
14	4			4 x 10 MHz	Clock
15	2			2 x 10 MHz	MSB
16	1			1 x 10 MHz	LSB
	x 100 MHz				
31	Band width B	A	D (L) TTL	*)	
32	Band width A	A	D (L) TTL	*)	
33	Band width C	A	D (L) TTL	*)	
34	Activates test generator	A	D +10 V/-10 V	*)	
35	Activation of 40-dB-switch	A	D +10 V/-10 V	*)	
36	Tuning voltage from sythesizer	A	A +5...+20 V	*)	

+) signal output in BCD
*) for test puposes only

BU4 AF/COR

Contact	Designation	Input/ Output	Signal type Analog/Digital (active)	Comment
1	AF (symm.)	0	0 dBm	600 Ω between BU4.1 and BU4.3
2	Ground		⊥	
3	AF (symm.)	0	0 dBm	
4	---		Contact:	Switching power:
5	COR (NC)		Normally closed	P_{max} = 30 VA
6	COR (C)		Changeover	I_{max} = 1 A
7	COR (NO)		Normally open	V_{max} = 110 V

Definition of Terms

Level display voltage:	Output voltage 0 to +5 V logarithmically scaled, +5 V corr. to 80 dBµV. In AGC operation: signal level, with squelch: when signal < threshold value the squelch threshold is indicated. In MGC operation: IF control value (+5 V corr. to -80 dB) is indicated.
Squelch ext.	Command: Switch squelch to external threshold value.
Squelch threshold ext.:	Input of a squelch threshold value: 0 to +50 mV for S/N-ratio squelch, +0.15 to +15 V corr. to 0 to 80 dBµV for carrier squelch. (Functions only when "Squelch ext." is switched on.)
COR (NC-C-NO):	Carrier-operated relay. Switches when a signal reaches the squelch criterion. Reset at end of signal is delayed (1 to 20 s). The reset delay is internally adjustable (Squelch module).
COR time:	In addition to the internal adjustment, the dropout time can be reduced with an external resistor.
Ext. Control:	Command: IF section is switched to external control voltage.
Ext. control voltage:	Input of a control voltage, 0 to +5 V corr. to control of IF from 0 to -80 dB (not dB-proportional). (Functions only when "Ext. control" is switched on.) Polarity + for receiver frequency > set signal frequency.

Tuning error 200 mV/kHz:	Sensitivity: 200 mV/kHz for offsets $\leq$ 20 kHz, max. level ±10 V.
Loudspeaker ext.:	Provision for connecting additional loudspeaker to chassis (asymmetric).
AF symm.:	Symmetrical, floating AF output.
AF USB, A0:	AF output of upper sideband or A0 (tuning to zero beat of AF signal)
AF LSB, A1:	AF output of lower sideband or A1 (telegraphy).

2.8 Table 2-7 Error List

OPERATOR ERRORS

Err. 0	More than 5 errors found with input from bus
Err. 1	Input too small
Err. 2	Input too large
Err. 3	Frequency invalid (enter kHz)
Err. 5	No search run possible (memory empty)
Err. 6	Not with RF analysis
Err. 7	Not with search run
Err. 8	Not with frequency search run
Err. 10	BUS output unit not equipped
Err. 11	Memory location only loadable via DATA OUT
Err. 12	IEC BUS: "listen only" (LON) selected
Err. 13	No listener connected, no response to SRQ
Err. 15	SSB option not present
Err. 16	Wideband demodulator not present
Err. 17	Bandwidth not equipped
Err. 20	Not with MGC
Err. 21	Not with VIDEO/IF-B
Err. 22	Not with SSB
Err. 30	Syntax error in bus input
Err. 31	Transfer error of V.24 interface

RAM/ROM ERROR or SERIAL INPUT/OUTPUT ERROR

C.F. 40	Address error (e.g. IEC switch position wrong)
C.F. 110	Memory content erased (e.g. failure of back-up battery)
C.F. 120	RAM error
C.F. 140	N (OUT) error
C.F. 10x	ROM error
C.F. 1xx	Several of these errors concurrently
GO*) XYZ	None of these errors found at switch-on

*) see section 2.2.5 and 2.2.6

RECEIVER MODULE ERRORS

T 010 Error of loop test (output via BUS interface only)

	Tuner 2	Wideband demodulator	Tuner 1	Synthesizer asynchronous
C.F. 201	o			
C.F. 202		o		
C.F. 203	o	o		
C.F. 204			o	
C.F. 206		o	o	
C.F. 210				o
C.F. 211	o			o
C.F. 212		o		o
C.F. 213	o	o		o
C.F. 214			o	o
C.F. 216		o	o	o

	Operating voltages	IF amplifier	Frequency processing	IF converter
C.F. 301	o			
C.F. 302		o		
C.F. 303	o	o		
C.F. 304			o	
C.F. 305	o		o	
C.F. 306		o	o	
C.F. 307	o	o	o	
C.F. 310				o
C.F. 311	o			o
C.F. 312		o		o
C.F. 313	o	o		o
C.F. 314			o	o
C.F. 315	o		o	o
C.F. 316		o	o	o
C.F. 317	o	o	o	o