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FFV Mätteknik AB

MULTI FREQUENCY TEST EQUIPMENT
ZTEK 75302

ELMIA
A/S

MULTI FREQUENCY TEST EQUIPMENT
ZTEK 75302

OPERATOR'S MANUAL

C O N T E N T S

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1. GENERAL INFORMATION

1.1 APPLICATION

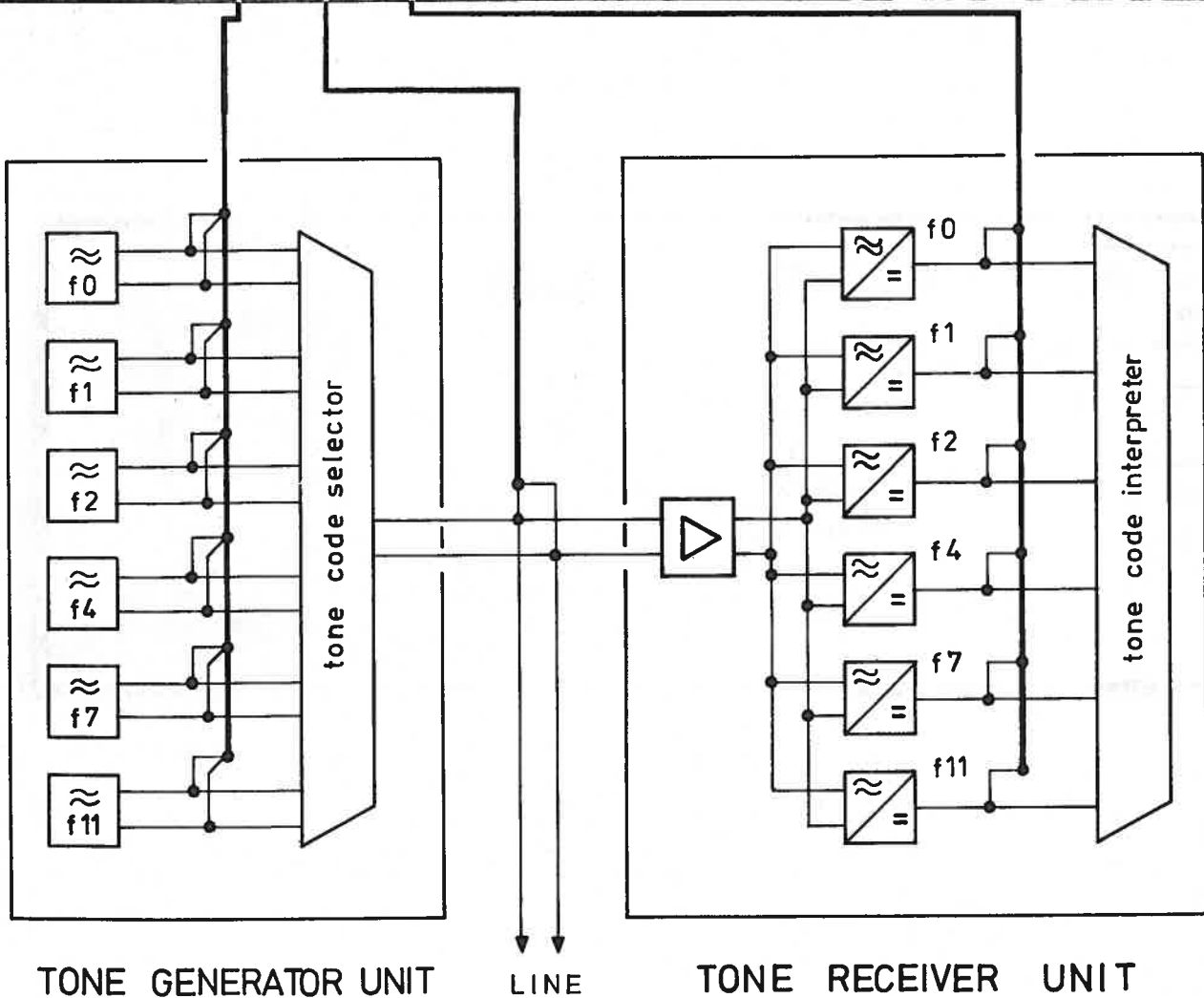
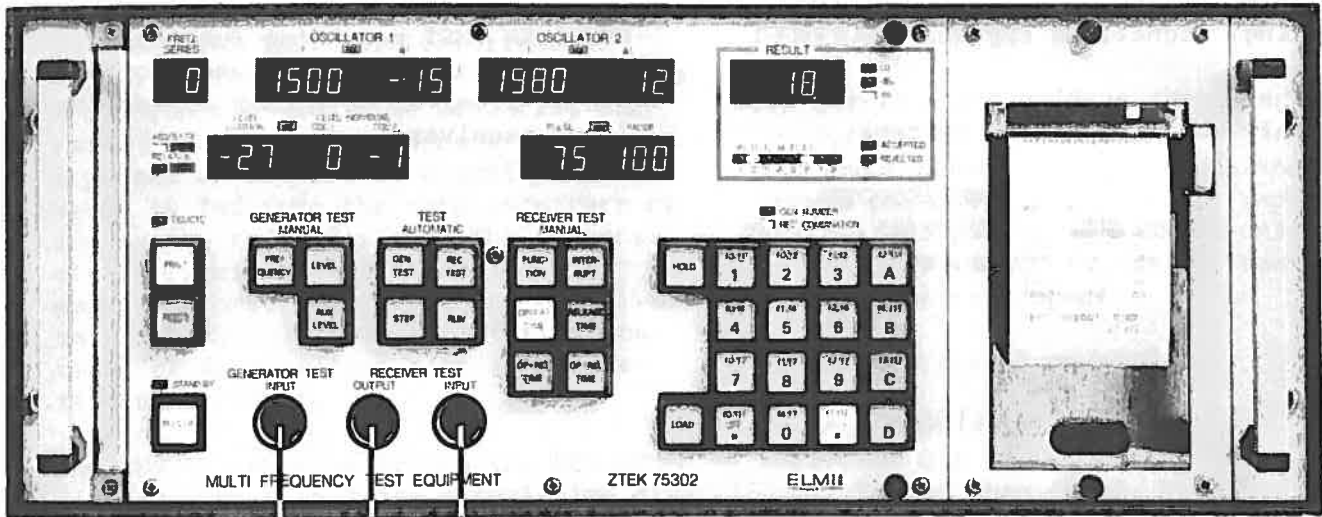


Fig. 1.1.1 Application of MFTE

The MULTI FREQUENCY TEST EQUIPMENT ZTEK 75302 is intended for carrying out tests of sending and receiving equipment in MFC (Multi Frequency Compelled), MFP (Multi Frequency Pulsed), and tests of receiving equipment in PBD (Push Button Dialling) signalling systems.

The instrument enables tests of the most commonly used signalling systems:

- MFC: CCITT/R2, CNET/SOCOTEL
- MFP: CCITT/#4, CCITT/#5, Y-Code
- PBD: Receiving equipment only.

The instrument comprises two features:

GENERATOR TEST enabling measurement of frequency and level of a generator (tone sender).

RECEIVER TEST providing functional test and reaction time measurement of a single receiver or a pair of receivers (tone receivers).

1.2 GENERAL DESCRIPTION

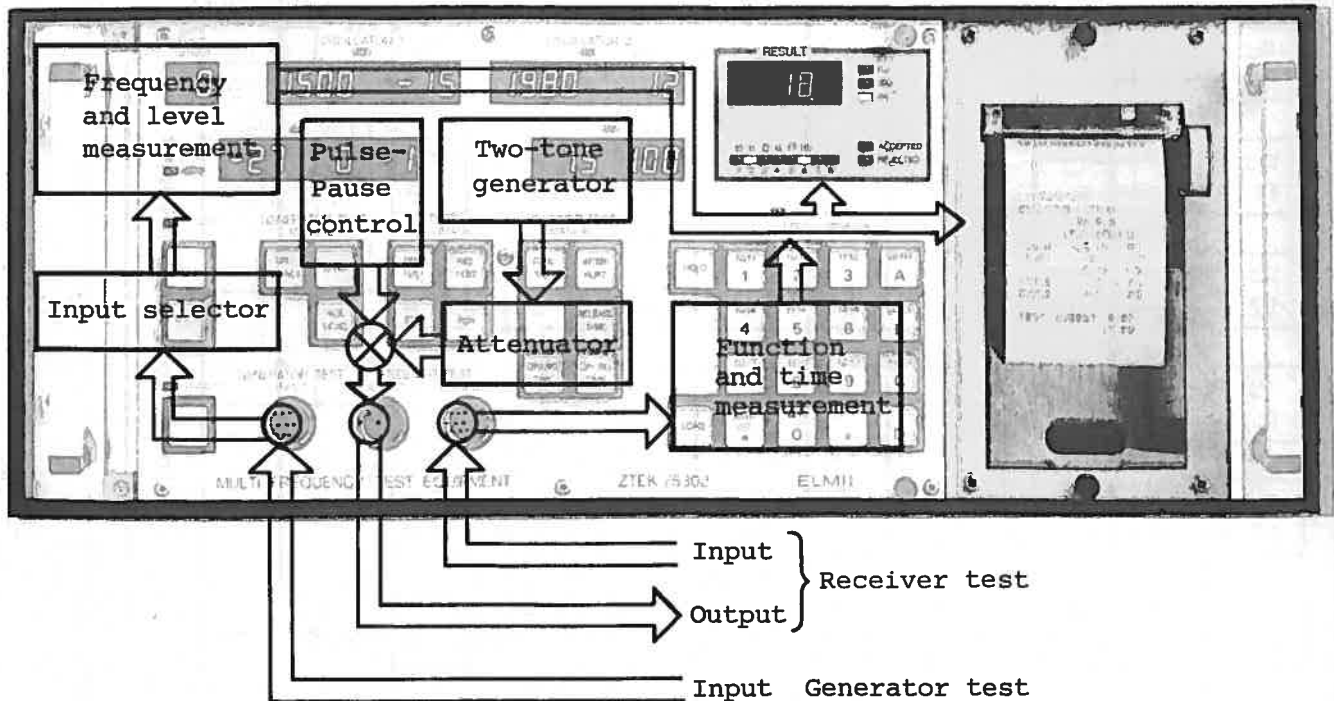


Fig. 1.2.1 Functional Block Diagram.

The GENERATOR TEST unit comprises a balanced input selector and an accurate frequency and level measuring circuit. The measurable input signals cover the range of the multi frequency signalling tone generators.

The RECEIVER TEST unit comprises an accurate programmable two-tone generator and a function and time measuring circuit. The two-tone generator provides a pulsed or continuous signal output, which is fed into the tone receivers of the system being tested. The response of the receivers is recorded by the measuring unit, which returns the result as a functional test, an interruption test, or an operation time or release time measurement.

The RESULT is presented on the RESULT display, which includes a real-time display of the receiver test input. If activated, the printer returns the result together with the test parameters.

The TEST MODE includes an automatic, a semi-automatic, and a manual test procedure. The generators and the receivers are usually grouped in a number of units in order to form a complete multi frequency signalling system. A group of generators or receivers may be connected to the MFTE. The automatic test mode provides a test of the whole group. The semi-automatic test mode is a stepped automatic test, in which each result may be examined individually. The manual test mode provides a test of a selected unit of the group.

The PARAMETERS, which are needed to enable the test procedure, are loaded into the MFTE by means of the keyboard. Each test requires a different number of parameters. The MFTE indicates the appropriate parameters by flashing the parameter display or keys, thus optimizing the parameter input sequence.

The test procedure is externally programmable through the IEC-BUS interface.

1.3 SPECIFICATIONS

The specifications apply at temperatures from 0°C to 45°C, and at a relative humidity from 15% to 80%.

GENERATOR TEST

INPUT:

The front panel comprises 6 balanced inputs parallel to 6 balanced inputs on the rear panel. One input only is selected on each measurement, the other inputs remaining open.

The inputs are AC coupled.

Impedance of selected input:

- 1) 600 Ω \pm 1%, balanced, or
- 2) higher than 40 k Ω , balanced (as set on rear panel switch).

Balance of input impedance:

- better than 60 dB (200 Hz to 2000 Hz)
- better than 50 dB (200 Hz to 6000 Hz)

The inputs are protected against voltages exceeding 25 dBu (14 Vrms). The inputs will withstand voltages up to 35 Vrms or, in other words, absorb 2 Ws in 600 Ω , e.g. a 110 Vrms tone burst consisting of a 1-second pulse and a 9-second pause.

MEASUREMENT:

The frequency and level measurements apply to sinusoidal signals.

Frequency range:

- 200 Hz to 6000 Hz
- (level higher than -25 dBu)

Level range:

- 25 dBu to 25 dBu (0 dBu = 0.775 Vrms)

The REJECTED indicates that the signal is outside the measuring range. A level measurement result will be returned even if the signal is outside the frequency range, but the accuracy will be lost. A frequency measurement will return a valid result even if the signal is above 25 dBu.

Frequency measurement:

resolution:

0.1 Hz

accuracy:

±0.1 Hz (200 Hz to 3200 Hz)

±0.2 Hz (200 Hz to 6000 Hz)

Level measurement:

resolution:

0.1 dB (1.2%)

accuracy:

±0.2 dB (±2.3%) (200 Hz to 6000 Hz)

Detector type:

average response

Sample rate:

2/second (typical)

RECEIVER TEST

The instrument is programmed to the frequencies as shown in table 5.1.1 page 5-1.

The instrument is programmed to the frequency series as shown in table 5.1.2 page 5-2.

The instrument is programmed to react to a receiver code corresponding to the tones in the test output signal; see table 1.3.1.

Frequency	f0	f1	f2	f4	f7	f11
Receiver no.	1	2	3	4	5	6

Table 1.3.1 Receiver test code.

The PBD code is more complex and follows the pattern shown in table 5.1.3 page 5-3.

SIGNAL GENERATOR (dual)

Frequency range:

256 Hz to 4095 Hz

Frequency resolution:

1 Hz

Frequency accuracy:

±0.1 Hz (15°C to 35°C)

±0.2 Hz (0°C to 45°C)

Frequency deviation:

±150 Hz (resolution: 1 Hz)

Frequency stability:

(temperature): better than ±2 ppm/°C

(long time): better than ±10 ppm/year

Output level:

15 dBu ± 0.2 dB (4.36 Vrms ± 2.3%)

Harmonic distortion of output level:

less than 46 dB (0.5%)

ATTENUATOR AND OUTPUT CIRCUIT

Attenuation:

0 dB to 79 dB (resolution: 1 dB),
or entirely off (attenuation more than 95 dB)

Output level range per tone:

15 dBm to -64 dBm (resolution: 1 dB),
or tone entirely off (level less than -80 dBm)

Output level accuracy:

±0.2 dB (±2.3%) (500 Hz to 2000 Hz)

±0.3 dB (±3.5%) (256 Hz to 4095 Hz)

Intermodulation products below output signal level:

less than 46 dB (0.5%)
(not less than -80 dBm)

Hum below output signal level:

less than 60 dB (0.1%)
(not less than -80 dBm)

Output impedance:

1) 600 Ω ±1%, balanced, or

2) 800 Ω ±1%, balanced

(as set on rear panel switch)

Balance of output impedance:

better than 60 dB (256 Hz to 2000 Hz)

better than 50 dB (256 Hz to 4095 Hz)

The output is protected against short circuit of the output terminals.

AUXILIARY SIGNAL

By means of the terminal AUXILIARY INPUT SIGNAL on the rear panel, an external signal may be added to the test tone output signal. The input of the auxiliary signal flows direct to the output stage, its level remaining unaffected by attenuators.

Input impedance:

600 Ω \pm 1%, unbalanced

Level range:

max. 0 dBu (0.775 Vrms)

Attenuation:

0 dB (\pm 0.1 dB) (200 Hz to 4000 Hz)
or tone entirely off (attenuation better than 60 dB)

The input is protected against voltages exceeding 25 dBu (14 Vrms). The input will withstand voltages up to 35 Vrms or, in other words, absorb 2 Ws in 600 Ω , e.g. a 110 Vrms tone burst consisting of a 1-second pulse and a 9-second pause.

The input is DC coupled.

TONE BURST

Pulse range: 0 ms to 999 ms

Pause range: 0 ms to 999 ms

Resolution: 1 ms

Accuracy: \pm 1 ms

Each pulse starts at a random place in the signal sine wave.

The instrument is programmed to a tone burst ratio of 100 ms/100 ms for the automatic receiver test.

EXTERNAL TONE BURST MODULATION

Both tones and the auxiliary signal may be individually modulated by feeding logic signals into the appropriate terminals on the rear panel. A logic low signal turns off the tone, while a logic high signal (or open circuit) leaves the tone turned on.

Logic low voltage:

less than 1.5 V (max. -20 μ A)

Logic high voltage:

higher than 3.5 V (max. 20 μ A)
or open terminal

The inputs will withstand continuous voltages up to 125 Vrms.

INPUT

The front panel comprises eight input terminals parallel to eight input terminals on the rear panel. The ground terminal of the jack (the 9th terminal of the front jack or the ground terminal of the rear jack) must be connected to a ground terminal on the receivers to provide a reference test ground.

Eight more receiver test input terminals are situated on the rear panel to provide a 1-out-of-16 receiver code (PBD). When using this code, the '1-out-of-16 switch' terminal must be grounded. When the frequency series incorporates a binary code, the result is returned as a binary code as shown in table 5.1.3 page 5-3. The terminal '1' corresponds to the binary digit '0'; the terminal '2' corresponds to the binary digit '1', and so on.

A receiver test input is detected as active if the voltage of the terminal ranges between -1.6 V and 1.6 V, (accuracy: \pm 0,15 V), relative to the voltage of the ground reference. Other voltages (and open circuits) are detected as non-active inputs.

Input impedance: higher than 40 k Ω .

The inputs will withstand continuous voltages up to 125 Vrms.

TEST AND MEASUREMENT

Functional:

The specified receiver combination is tested for operation during pulse and for release during pause.

Interruption:

The specified receiver combination is tested for operation during pulse and for no release during pause.

Time measurement:

range: 0 ms to 999 ms
resolution: 1 ms
accuracy: ± 1 ms

The real-time Receiver Test Input is shown on the result LED display.

Before the test begins, the Receiver Test Input is tested for active receivers. If an active receiver is found, the test is suspended.

The Receiver Test Input is tested for the specified receiver combination. A receiver must be active for at least 5 ms before the result is shown. This excludes the influence of a receiver output bounce, if any. The time measurement is still the time it takes until the first reaction of the receiver(s) is detected.

A special test is performed just before starting and stopping the pulse. When starting a pulse, no receivers should be active (unless it is an interruption test) and when stopping a pulse only the specified receiver combination should be active. Otherwise, **REJECTED** is shown. If other receivers respond for more than 7 ms during the test, **REJECTED** is shown.

A time measurement of a receiver combination includes a functional test.

Test rate: 2/ms

IEC-BUS INTERFACE

Drivers:

output low voltage:
less than 0.4 V at -48 mA output current

output high voltage: (open collector)

Receivers:

input low voltage:
less than 1.8 V (max. -0.05 mA input current)

input high voltage:
higher than 2.9 V (max. 0.3 mA input current)

Line termination:

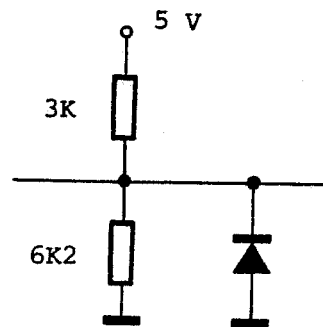


Fig. 1.3.1 Line termination.

PRINTER

The instrument is supplied with an alphanumeric printer for 20 characters/line.

The printer must be supplied with metallised paper for 24 V operation.

POWER SUPPLY

Voltage:

110 V, 127 V, 220 V, or 240 V
(as set on rear panel switch)

Frequency:

50 Hz to 60 Hz

Consumption:

stand by: 2 VA
power on: 35 VA

Primary fuse:

110 V, 127 V: 0.5 A T
220 V, 240 V: 0.25 A T

Secondary fuses: (accessible behind the printer)

5 V: 1.25 A T
 ± 15 V: 1.25 A T (2 pieces)
-30 V: 0.25 A T

CABINET

Dimensions with covers:

width: 490 mm
height: 200 mm
depth: 345 mm

Dimensions without covers:

width: 485 mm
height: 177 mm
depth: 345 mm

Weight:

total: 16.5 kg

ACCESSORIES SUPPLIED

Power cable

Cable for Generator Test Input (12 leads)

Cable for Receiver Test Output (3 leads)

Cable for Receiver Test Input (9 leads)

2. OPERATION

2.1 CONTROLS AND TERMINALS

The numbers indicated in table 2.1.1 refer to the numbers used in figs. 2.1.2 and 2.1.3.

Table 2.1.1 Controls and Terminals:

NO.	PART	FUNCTION
①	Mains switch POWER	activates the power circuit.
②	LED STAND BY	indicates that the instrument is connected to the mains but not yet switched on.
③	Key RESET	resets the instrument to its initial mode.
④	Key PRINT	activates the printer to print out a result. The print key is only enabled when flashing.
⑤	<u>Test Automatic Keys:</u> GEN.TEST REC.TEST STEP RUN	 measures frequency and level of the generators connected to the Generator Test Input. provides a functional test at three different levels of the receivers connected to the Receiver Test Output and Input. provides the semi-automatic test, i.e. each entry generates a new set of parameters. provides a three-second test of each parameter set of the automatic test.

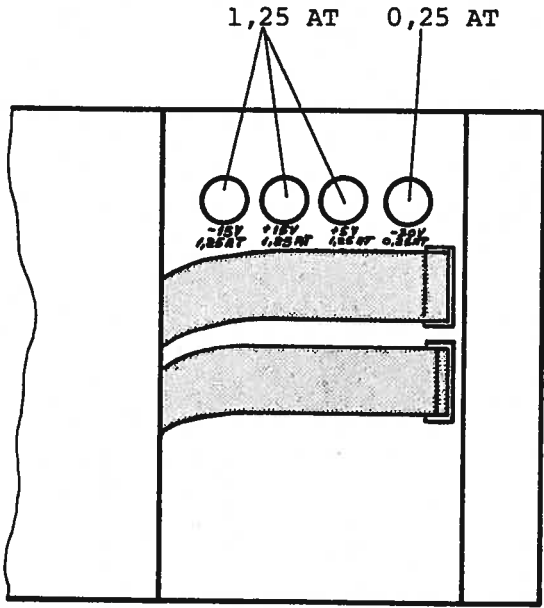
NO.	PART	FUNCTION
6	<p>GENERATOR TEST</p> <p><u>Manual Keys:</u></p> <p>FREQUENCY</p> <p>LEVEL</p> <p>AUX. LEVEL</p>	<p>measures frequency of the selected generator.</p> <p>measures level of the selected generator.</p> <p>measures level of an auxiliary signal (third-tone signal) connected on the rear panel.</p>
7	<p>RECEIVER TEST</p> <p><u>Manual Keys:</u></p> <p>FUNCTION</p> <p>INTERRUPTION</p> <p>OPERATION TIME</p> <p>RELEASE TIME</p> <p>OP + REL TIME</p> <p>OP - REL TIME</p>	<p>provides functional test of the selected receivers.</p> <p>provides interruption test of the selected receivers.</p> <p>measures operation time of the selected receivers.</p> <p>measures release time of the selected receivers.</p> <p>returns the sum of operation and release times of the selected receivers.</p> <p>returns the difference between operation time and release time of the selected receivers.</p>
8	<p><u>Numeric Keyboard:</u></p>	<p>is used for entering the parameters.</p> <p>A key denotes:</p> <ol style="list-style-type: none"> 1) the figure itself for entering the parameter value, 2) the generator number (the corresponding nominal frequency being shown on the 'OSCILLATOR 1' display),

NO.	PART	FUNCTION
		<p>3) the receiver combination number (the corresponding nominal frequencies being shown on the 'OSCILLATOR 1' and 'OSCILLATOR 2' displays).</p> <p>In cases 2) and 3) the selected key is lighted.</p>
1		The digit 1 or the combination f0/f1
2		- - 2 - - - f0/f2
3		- - 3 - - - f1/f2
4		- - 4 - - - f0/f4
5		- - 5 - - - f1/f4
6		- - 6 - - - f2/f4
7		- - 7 - - - f0/f7
8		- - 8 - - - f1/f7
9		- - 9 - - - f2/f7
0		- - 0 - - - f4/f7
*		<p>gives the digit *, the combination f0/f11, or may be used during input of the parameter</p> <p style="text-align: center;">LEVEL INDIVIDUAL</p> <p>to turn off the corresponding oscillator.</p>
#		<p>gives the digit #, the combination f1/f11, or may be used to change the sign during input of a parameter.</p>
A		The digit A or the combination f2/f11
B		- - B - - - f4/f11
C		- - C - - - f7/f11
D		- - D
		<p>In a PBD test the keyboard resembles the keyboard of a PBD telephone.</p>
	LOAD	loads the parameter appearing on the display into the parameter storage.

NO.	PART	FUNCTION
	<p>HOLD</p> <p>LED GEN. NUMBER</p> <p>LED REC. COMBINATION</p>	<p>provides that the parameter being entered will be requested during the next test.</p> <p>indicates that the lighted key denotes the selected generator number.</p> <p>indicates that the lighted key denotes the selected receiver combination.</p>
<p>9</p>	<p><u>Parameter displays:</u></p> <p>FREQ. SERIES</p> <p>OSCILLATOR 1</p> <p>OSCILLATOR 2</p> <p>LEVEL COMMON</p> <p>LED ABSOLUTE</p> <p>LED RELATIVE</p> <p>LEVEL INDIVIDUAL OSC 1</p>	<p>indicates by a number the kind of signalling system (see table 5.1.2 page 5-2)</p> <p>shows the nominal frequency of the selected generator. In the case of a receiver test mode, the nominal frequency of the first tone together with the requested frequency deviation is shown. Deviation range: -150 Hz to 150 Hz.</p> <p>shows the nominal frequency of the second tone together with the requested frequency deviation. Deviation range: -150 Hz to 150 Hz.</p> <p>shows the output level of each of the two receiver test tones. Range: -64 dBm to 15 dBm.</p> <p>The receiver test automatic stores three different levels for testing each receiver combination. These levels may be modified by a relative level.</p> <p>indicates that a common output level is set.</p> <p>indicates that a relative level is set (Receiver Test automatic only). Range: -9 dB to 9 dB.</p> <p>shows the level of oscillator 1 relative to the common level. Oscillator 1 may be turned off by activating the OFF key. It is turned on again by pressing a valid numeric key. Range: -9 dB to 9 dB.</p>

NO.	PART	FUNCTION
	<p>LEVEL INDIVIDUAL OSC 2</p> <p>PULSE</p> <p>PAUSE</p> <p>LED REMOTE</p>	<p>shows the level of oscillator 2 relative to the common level. Oscillator 2 may be turned off by activating the OFF key. It is turned on again by pressing a valid numeric key. Range: -9 dB to 9 dB.</p> <p>shows the pulse time of the receiver test output signal (test tone signal). Range: 0 ms to 999 ms.</p> <p>shows the pause time of the receiver test output signal (test tone signal). Range: 0 ms to 999 ms.</p> <p><u>Note:</u> a continuous signal is given when pause = 0 ms.</p> <p>indicates that the instrument is externally controlled.</p>
<p>⑩</p>	<p><u>Result displays:</u></p> <p>RESULT</p> <p>LED Hz</p> <p>LED dBu</p> <p>LED ms</p> <p>LED ACCEPTED</p> <p>LED REJECTED</p> <p>LEDs 1,2,3,4,5,6,7,8</p>	<p>shows the measured value of frequency, level, or time according to the selected function.</p> <p>indicates the appropriate unit of the result.</p> <p>indicates the appropriate unit of the result.</p> <p>indicates the appropriate unit of the result.</p> <p>indicates that the receiver test FUNCTION or INTERRUPTION has been accepted.</p> <p>indicates that a test has not been accepted.</p> <p>indicate the real-time receiver test input at the corresponding jack.</p>
<p>⑪</p>	<p>Jack GENERATOR TEST INPUT</p>	<p>is the balanced inputs for the generators to be tested.</p>

NO.	PART	FUNCTION
12	Jack RECEIVER TEST OUTPUT	is the balanced output of the test tone signal for the receiver test.
13	Jack RECEIVER TEST INPUT	is the detector inputs for the receivers to be tested.
14	PRINTER	prints the parameters and the result when the print key is activated.
15	Jack TEST INPUT/OUTPUT	comprises the same functions as the three jacks on the front panel. The number of Receiver Test Inputs is increased to 16 in order to enable the 1-out-of-16 receiver code. In this case, the terminal '1-out-of-16 switch' must be grounded.
16	Jack AUXILIARY INPUT SIGNAL	is the input of an auxiliary input signal (third-tone) which is added to the Receiver Test Output signal.
17	Jack TONE BURST MODULATION	enables external modulation of the tones in the Receiver Test Output. A logic low (ground) turns off the appropriate tone signal.
18	<u>Switches IMPEDANCE</u> GENERATOR TEST INPUT RECEIVER TEST OUTPUT	selects the input impedance of the balanced Generator Test Inputs. selects the output impedance of the Receiver Test Output signal. <u>Note:</u> The switches are self-locking. They are operated by pulling the knob, pressing the switch, and then releasing the knob.

NO.	PART	FUNCTION
19	<p><u>IEC-BUS INTERFACE</u></p> <p>ADDRESS</p> <p>CONNECTOR</p>	<p>sets the address of the instrument (1 - 15).</p> <p>is the interface to the IEC-BUS with terminals according to the IEC recommendation.</p>
20	<p>Power socket</p> <p>MAINS</p>	<p>is the connection to the mains.</p>
21	<p>VOLTAGE SELECTOR</p>	<p>selects the voltage corresponding to the mains.</p>
22	<p>PRIMARY FUSE</p>	<p>is 0.5 A for 110 v, 127 v and 0.25 A for 220 v, 240 v.</p>
23	<p>SECONDARY FUSES</p>	<p>are accessible on the power module when removing the printer module.</p> 

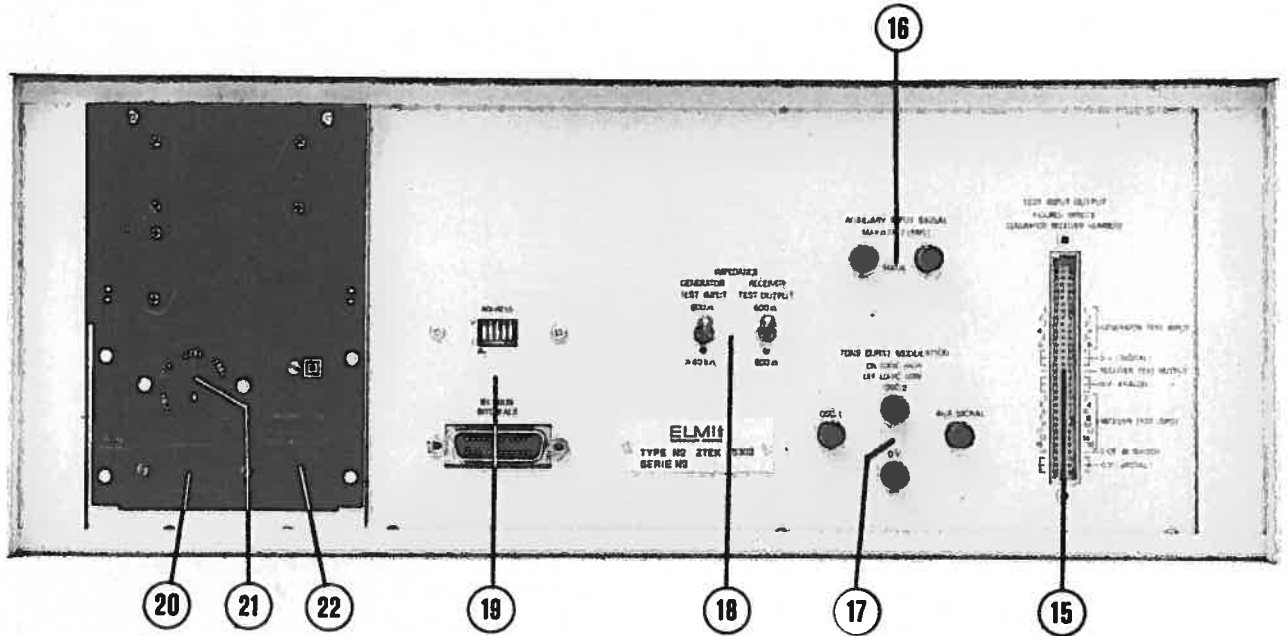
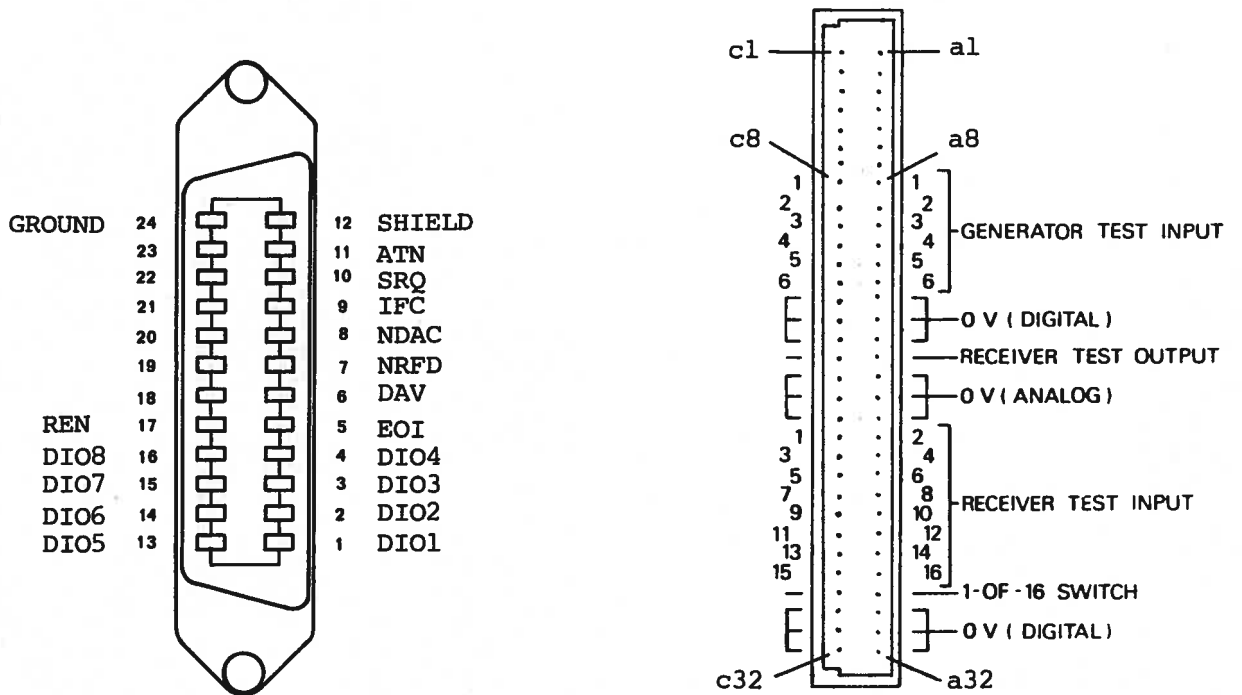


Fig. 2.1.3 Controls and Terminals, rear view.



19 IEC - BUS CONNECTOR

15 TEST INPUT / OUTPUT

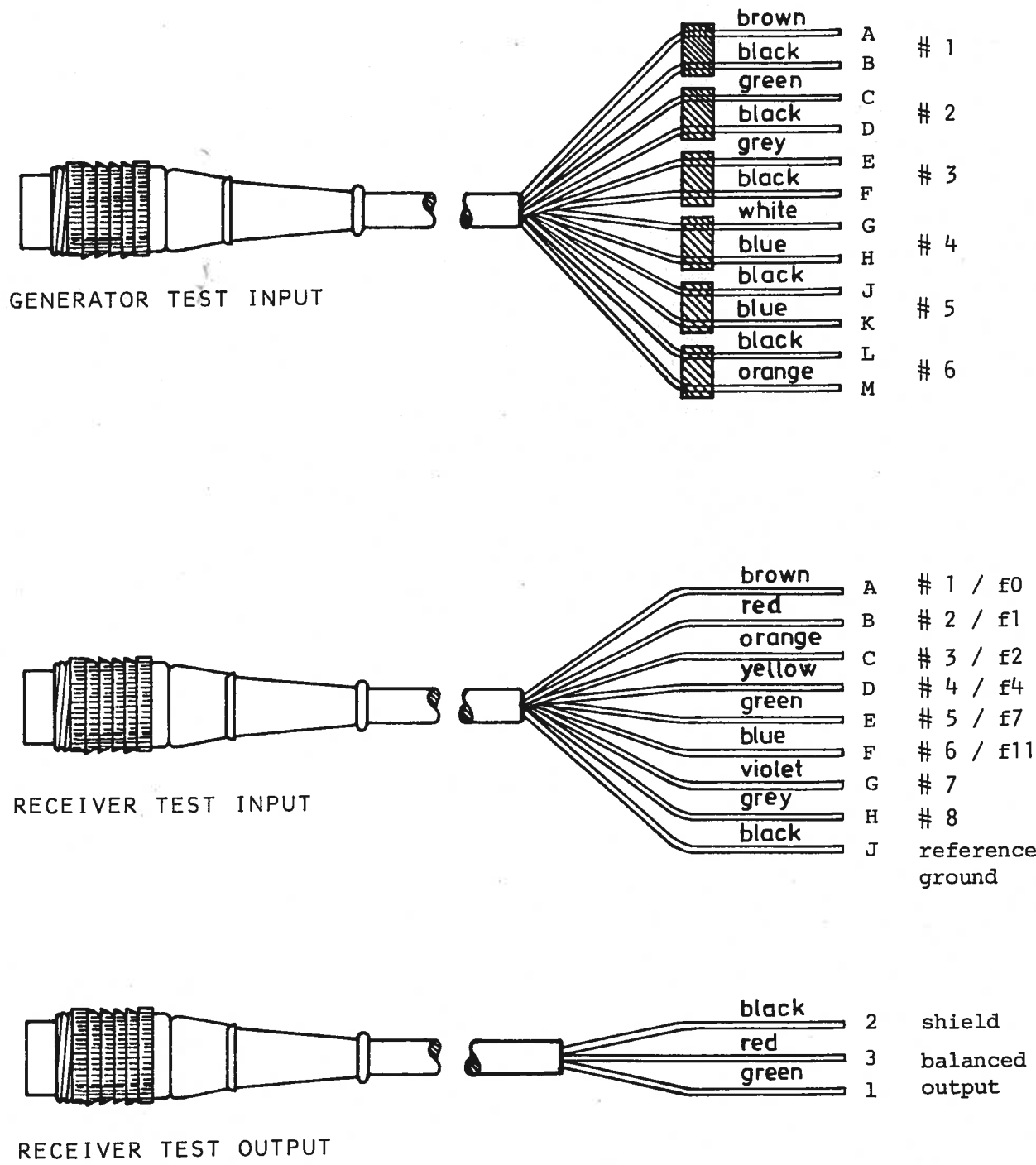


Fig. 2.1.1 Cables.

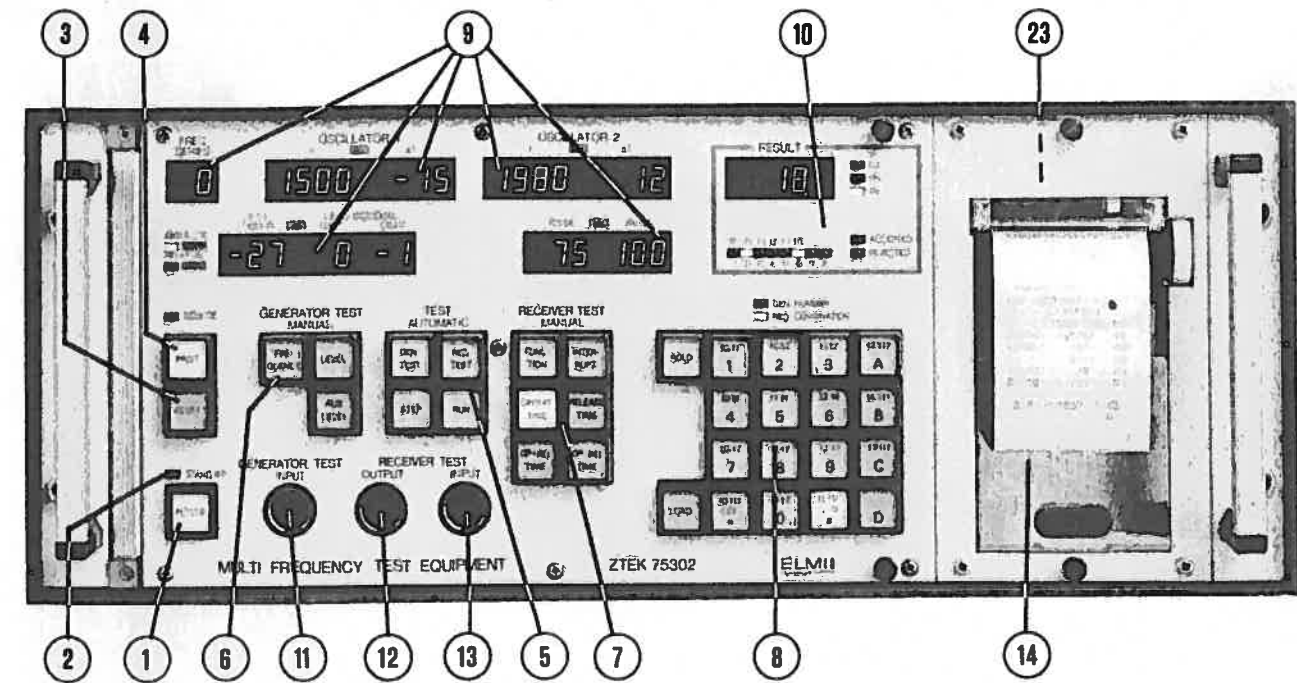
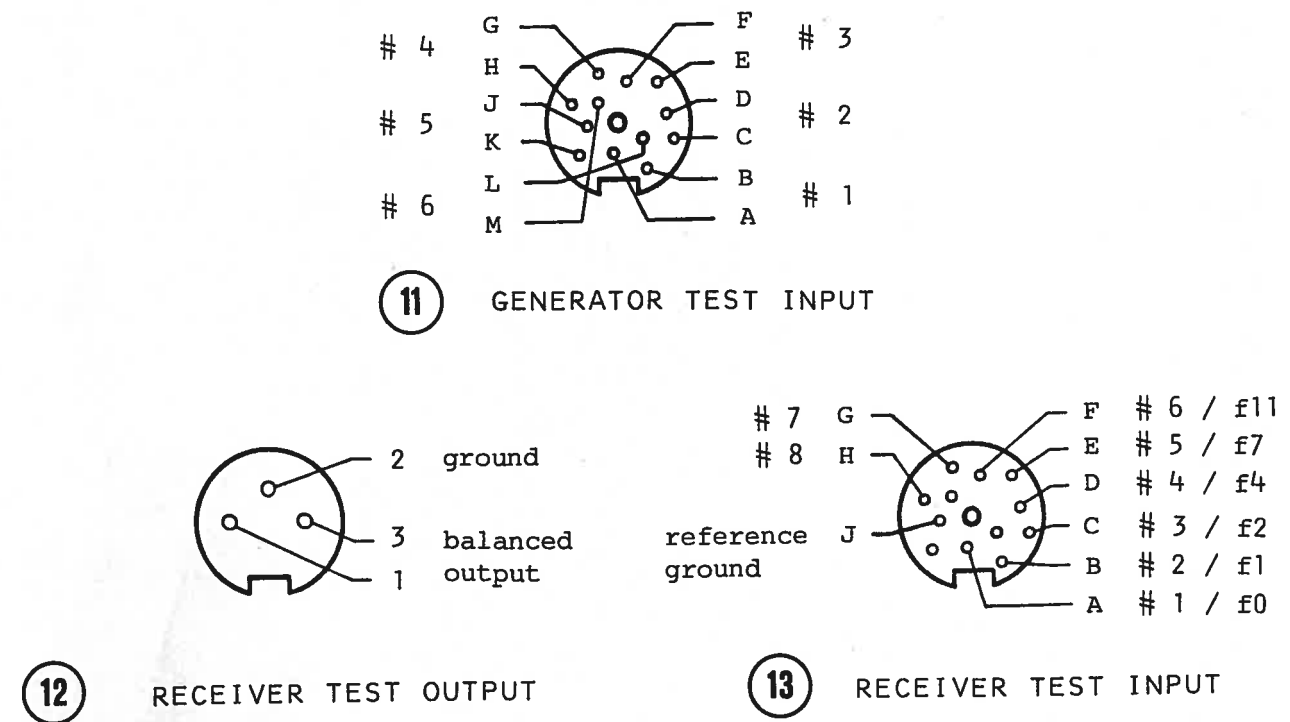


Fig. 2.1.2 Controls and Terminals, front view.



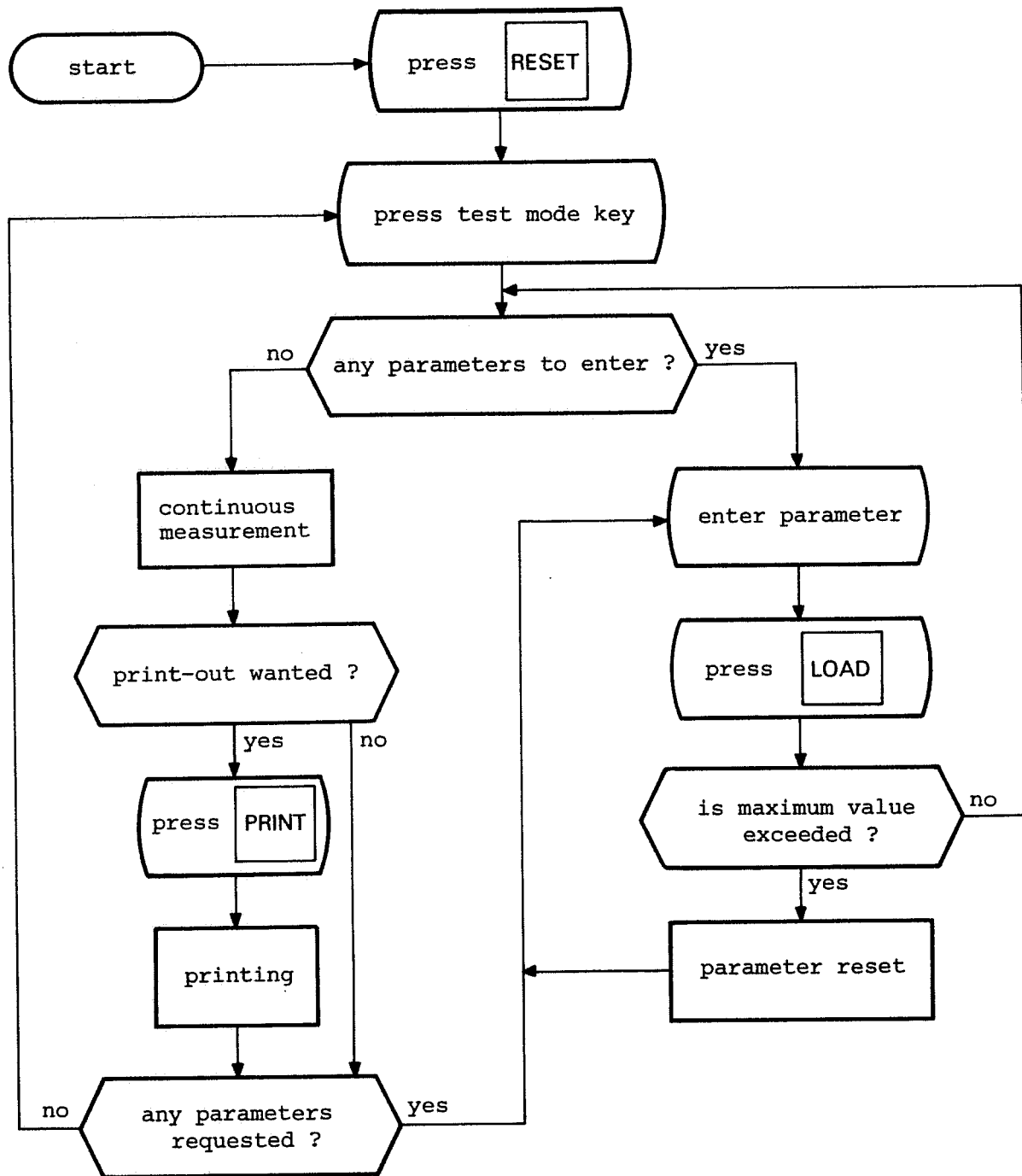


Fig. 2.2.1 Operational Procedure.

2.2 OPERATIONAL PROCEDURE

Each test requires the input of a different number of parameters. A test procedure starts with the selection of a test mode by means of the keys on the left side of the keyboard (see fig. 2.2.1). The key pressed lights to indicate the test mode. The MFTE is programmed to request the needed parameters in the right order. Each request takes place by the instrument showing the stored parameter value on the display, flashing the decimal points on the display, and flashing the LOAD key.

The parameter value is entered by means of the numeric keyboard. The numbers are rolled into the display from the right until the LOAD is pressed. Thus it is possible to correct the value until the right value is shown on the display. When the LOAD is pressed, the flashing stops, and the value is internally compared with a list of maximum parameter values. When the value is accepted, it is stored in the parameter storage, and the next parameter is requested. If a value gets outside the acceptable range, the para-

meter is reset to zero, and a new request is made. Note that only the keys, expected are accepted by the program; thus e.g. a sign key will not be accepted during input of the PULSE parameter.

When all parameters requested are entered, the test process proper starts. The result of the continuous measurement is shown on the display. The test is stopped when a key is pressed. When the test is terminated, the parameters and the result may be printed by activating the PRINT key.

A new test procedure may now start by selecting a new test mode. Parameters are again requested. The parameter values from the previous test are stored and displayed as initial values.

When RESET is pressed before the selection of a test mode, all stored parameter values are reset to zero.

EXAMPLE

Parameter input for level measurement of generator no. 3 (freq. series no. 2):

PRESS	DISPLAY	REMARKS
<div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> RESET </div>		All displays and keys are turned off.
<div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> LEVEL </div>	FREQ. SERIES <div style="border: 1px solid black; width: 60px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> 0 </div>	Level key is lighted. Freq. series (preloaded with '0') and LOAD key flash to indicate entry of this parameter.
<div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> f0/f2 2 </div>	<div style="border: 1px solid black; width: 60px; height: 60px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> LOAD </div> FREQ. SERIES <div style="border: 1px solid black; width: 60px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> 2 </div> OSCILLATOR 1 f	2 is loaded into the freq. series. OSC 1 display (preloaded with the nominal value of generator #1), LED gen. number, and LOAD flash to indicate entry of the generator number.
	<div style="border: 1px solid black; width: 120px; height: 40px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"> 1140 </div>	

PRESS

DISPLAY

REMARKS

f1/f2
3

LOAD

OSCILLATOR 1
f

900

RESULT

-5.3

LED gen. number, key 3, and the corresponding nominal value on the OSC 1 display are lighted. The result of the continuous level measurement is shown on the RESULT display. PRINT key flashes to indicate that the printer is ready to print the result.

PRINT

The printer prints the result.

CCITT/R2 BACKWARDS
GENERATOR TEST.

#3 = F2 : -5.3 DBU

The frequency measurement of the same generator:

When a new test mode key is activated, the previously loaded parameters are stored.

FRE-
QUENCY

FREQ.
SERIES

2

Measurement stops. Displays and keys are turned off.

FREQUENCY key is lighted. Freq. series shows 2 as initial value.

LOAD

OSCILLATOR 1
f

900

LED gen. number, key 3, and OSC 1 display as above.

LOAD

RESULT

901.3

The result of the continuous frequency measurement is shown on the RESULT display.

THE HOLD FEATURE (Manual Test)

When the system is tested for variations in one parameter only, the entry of parameters in each test may be simplified by using the HOLD feature. The HOLD key must be activated during the initial input of the parameter. The instrument will request the parameter again during the test process, thus providing an easy way of changing the parameter. The HOLD feature applies

to more than one function, including the test mode.

Note that it is only possible to leave the HOLD mode by means of RESET.

EXAMPLE:

Parameter input for level measurement of generators no. 3, 4, and 5 (freq. series no. 2):

PRESS	DISPLAY	REMARKS
		All displays and keys are turned off.
RESET		
LEVEL	FREQ. SERIES 0	LEVEL key is lighted. Freq. series (preloaded with '0') and LOAD key flash to indicate entry of this parameter.
f0/f2 2	LOAD	
	FREQ. SERIES 2	2 is loaded into the freq. series. OSC 1 display (preloaded with the nominal value of generator #1), LED gen. number, and LOAD flash to indicate entry of the generator number.
	OSCILLATOR 1 f 1140	
HOLD		HOLD key is lighted to indicate that the parameter will be requested during test.
f1/f2 3	LOAD	
	OSCILLATOR 1 f 900	LED gen. number, key 3, and the corresponding nominal value on the OSC 1 display are lighted. The result of the continuous level measurement is shown on the RESULT display.

PRESS

DISPLAY

REMARKS

RESULT

-5.3

PRINT key flashes to indicate that the printer is ready to print the result. LED gen. number, OSC 1 display, and LOAD flash to indicate entry of a new generator number.

PRINT

(The printer prints the result).

f0/f4
4

LOAD

OSCILLATOR 1
f

780

Key 4 is lighted, and OSC 1 display shows the nominal frequency of generator #4.

RESULT

-4.9

The result is now the level of generator #4.

Again a print-out may be obtained.

f1/f4
5

LOAD

OSCILLATOR 1
f

660

Key 5 is lighted, and OSC 1 display shows the nominal frequency of generator #5.

The result is the level of generator #5.

RESULT

-5.1

2.3 TEST PROCEDURE

GENERATOR TEST

Connect each generator to the appropriate Generator Test Input and set the impedance of the balanced test input on the switch (rear panel).

During the test, the input selector itself connects the appropriate generator to the test circuit.

For each test the parameters are shown, indicating frequency series, generator number, and nominal frequency.

The result is returned on the RESULT display, and a LED indicates the right unit. The LED REJECTED indicates if the input signal is outside the measuring range. A level measurement will return a result even if the signal is outside the frequency range, but the accuracy will be lost. A frequency measurement of an input signal exceeding the upper level limit of 25 dBu will still be valid.

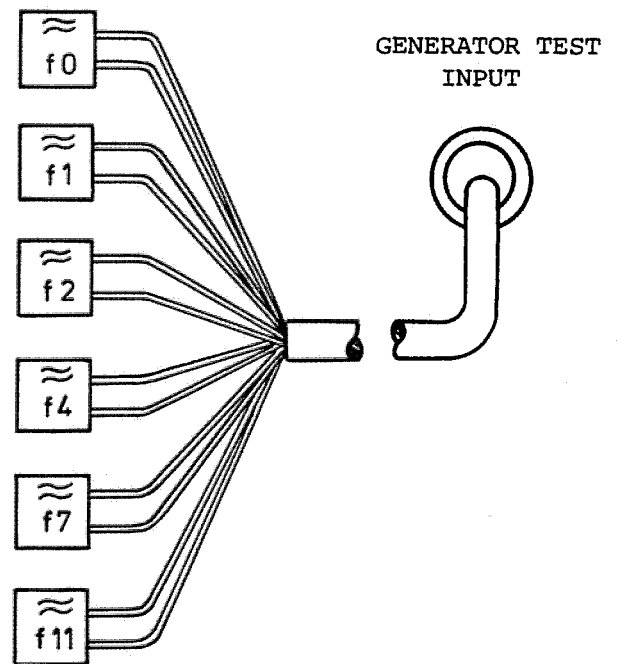


Fig. 2.3.1
Connection for Generator Test.

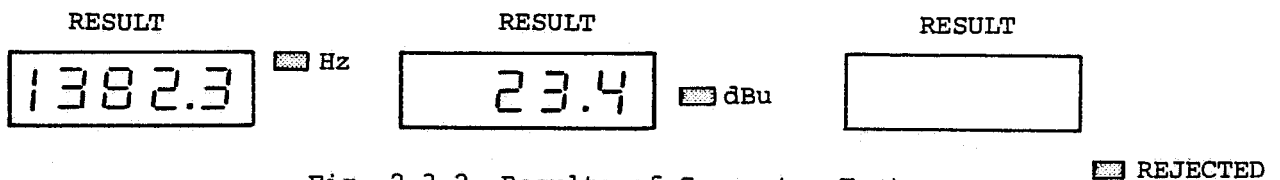
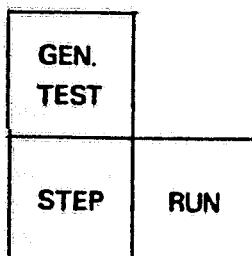


Fig. 2.3.2 Results of Generator Test.

Select the test mode key:

AUTOMATIC



Enter the parameters:

FREQ. SERIES

STEP/RUN

When the frequency series is entered, the instrument requests the parameters STEP or RUN by flashing these keys. The RUN key selects the automatic test, which measures the frequency and the level of each generator for about 3 seconds. The STEP key selects the semi-automatic test, which takes continuous measurements of a generator until the STEP key is pressed again. At any point of the semi-automatic test, the automatic test may be introduced by pressing the RUN key.

A print returns the parameters and all results.

EXAMPLE: Print of results in Generator Test Automatic.

```
*****
CCITT/R2 BACKWARDS
GENERATOR TEST.

#1 = F0 : 1138.9 HZ
           -5.1 DBU
#2 = F1 : 1019.6 HZ
           -5.1 DBU
#3 = F2 :  899.7 HZ
           -5.1 DBU
#4 = F4 :  779.3 HZ
           -5.1 DBU
#5 = F7 : DEFECTIVE
           -5.1 DBU
#6 = F11:  539.7 HZ
           -5.2 DBU
```

The 'DEFECTIVE' in the frequency measurement of generator no. 5 indicates that the frequency is too low or too high for measurement.

MANUAL

FRE- QUENCY	LEVEL
	AUX. LEVEL

Enter the parameters:
FREQ. SERIES
GEN. NUMBER

In the case of the test mode AUX. LEVEL, the result is returned immediately without the frequency series and the gen. number being requested.

In the case of only one generator in the frequency series, the parameter GEN. NUMBER is not requested.

The HOLD feature may be applied to the test mode and the parameter GEN. NUMBER.

The measurement is continued until a key is pressed.

A print returns the parameters and the result.

EXAMPLE: Print of result of Generator Test Manual.

```
*****
CCITT/R2 BACKWARDS
GENERATOR TEST.

#3 = F2 :  -5.3 DBU
```

The level measurement of generator no. 3 in the system R2, backwards signaling.

RECEIVER TEST

Connect the Receiver Test Output to the line input of the tone receivers and set the impedance of the balanced output on the switch (rear panel).

Connect the receiver outputs to the appropriate Receiver Test Inputs. Connect a ground terminal of the tone receivers to the Receiver Test Input reference ground.

A receiver is detected as active if the receiver output ranges from -1.6 V to 1.6 V, relative to the ground reference. No connection to the Receiver Test Input is detected as non-active because of an internal pull-up resistor (to 5 V).

For each test the parameters are shown, indicating frequency series, receiver combination and its nominal frequencies, frequency deviation, output level common and individual, pulse time, and pause time.

During the test, the Receiver Test Output sends out the specified two-tone

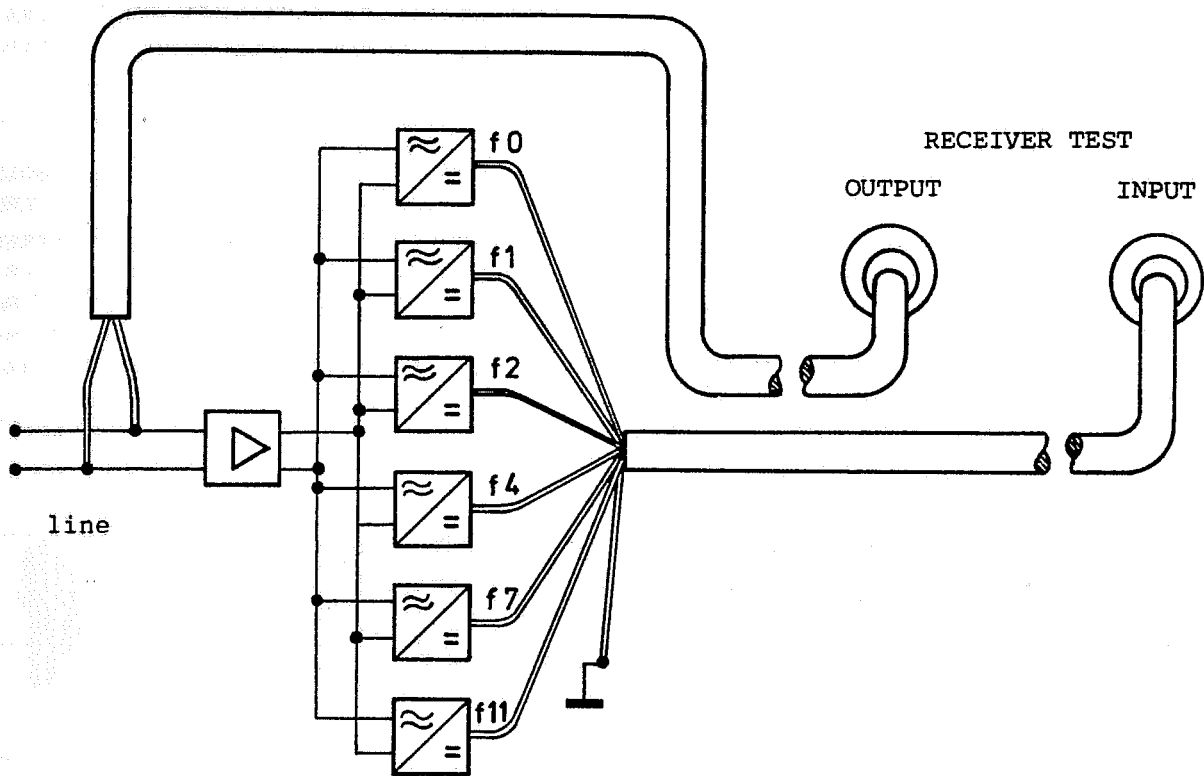


Fig. 2.3.3 Connection for Receiver Test.

signal (or one-tone signal, if specified). The Receiver Test Input is continuously tested to detect active

receivers, and a real-time output of the receivers is displayed by the result LEDs.

RECEIVER TEST OUTPUT

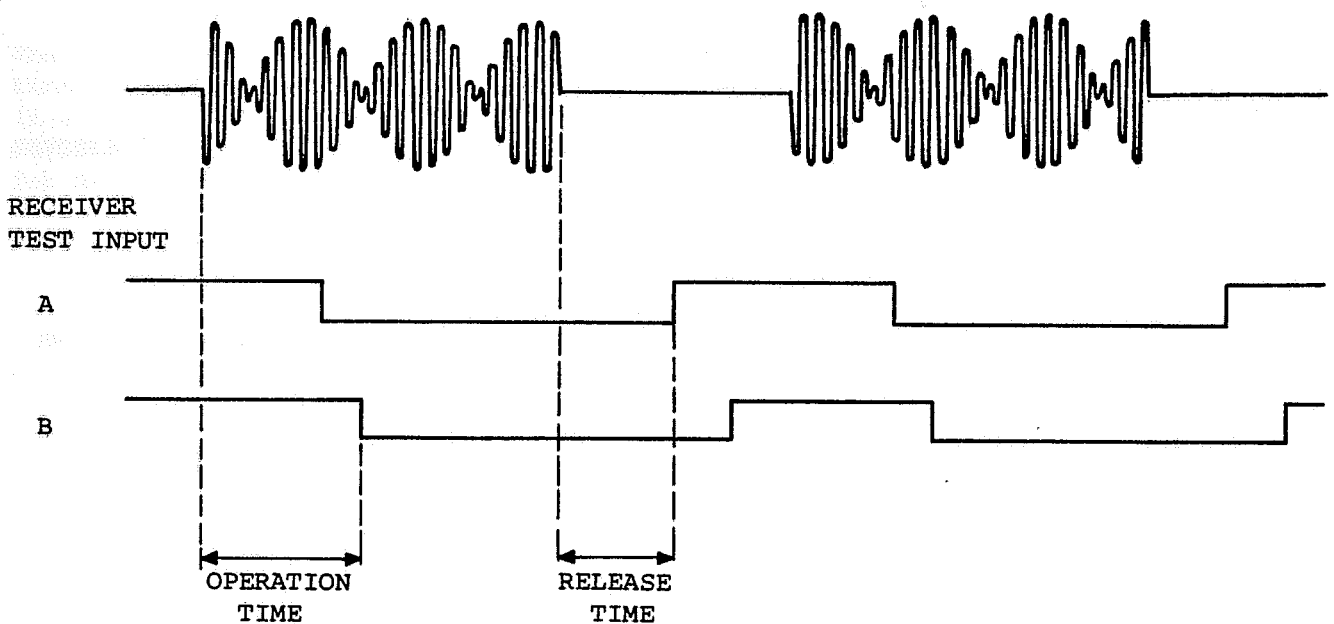


Fig. 2.3.4 Two-tone Receiver Test and Measurement (receivers are active low).

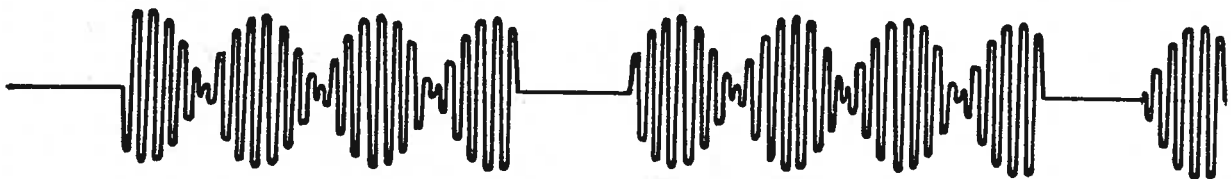
The FUNCTION test detects if the two (or one) specified receivers operate during pulse and if they release during pause.

one) specified receivers operate during pulse and if they keep operating during pause.

The OPERATION TIME measurement gives the reaction time of both receivers, while the RELEASE TIME measurement gives the time from the pulse stops until the first of the two receivers is released. The time measurement includes a functional test. The INTERRUPTION test detects if the two (or

The result is returned on the RESULT display. A valid FUNCTION or INTERRUPTION test displays ACCEPTED, while a time measurement displays the value together with the unit LED 'ms'. The LED REJECTED indicates that a non-acceptable condition has occurred at least once during the test.

RECEIVER TEST OUTPUT:



RECEIVER TEST INPUT:

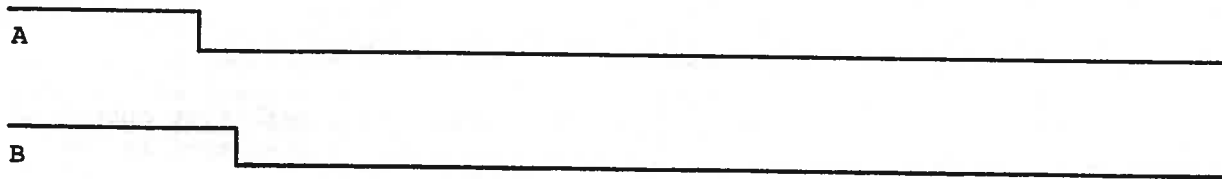


Fig. 2.3.5 Two-tone Receiver Test INTERRUPTION (receivers are active low).

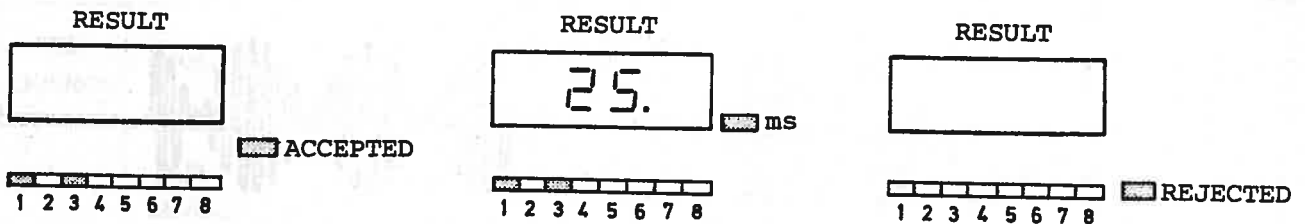


Fig. 2.3.6 Results of Receiver Test.

The REJECTED condition may originate from:

receivers are not released at the end of the pause (FUNCTION test).

- 1) The two (or one) specified receivers have not operated at the end of the pulse.
- 2) One of the receivers is released after more than 5 ms' operation during the pulse.
- 3) The two (or one) specified receivers are not released at the end of the pause (FUNCTION test).
- 4) One of the receivers is released during the pause (INTERRUPTION test)
- 5) One of the receivers has operated after more than 5 ms' reslease during the pause.
- 6) Another receiver has responded for more than 7 ms during the test.

RECEIVER TEST OUTPUT:



RECEIVER TEST INPUT:

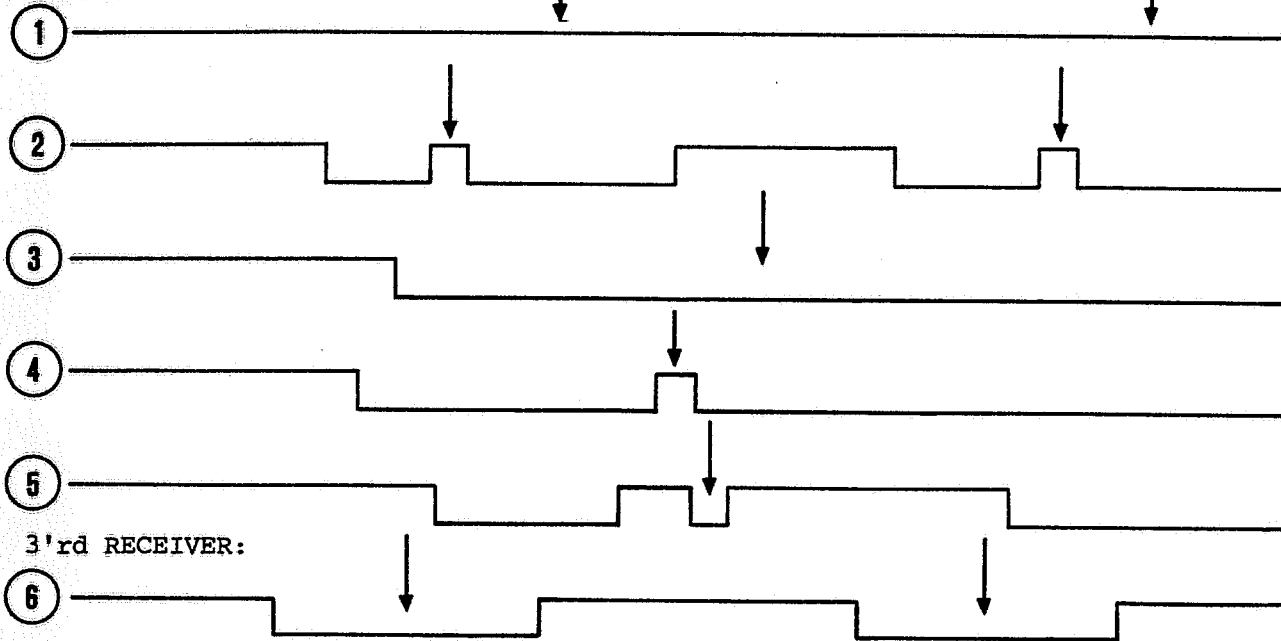


Fig. 2.3.7 Error conditions for Receiver Test.

The REJECTED remains lighted if just one error has occurred.

The receivers can be tested by a continuous Receiver Test Output signal (i.e. PAUSE = 0 ms) for FUNCTION, INTERRUPTION, and OPERATION TIME, but not for RELEASE TIME, this having no meaning.

Select the test mode key:

AUTOMATIC

	REC. TEST
STEP	RUN

Enter the parameters:

FREQ. SERIES

RELATIVE LEVEL COMMON

STEP/RUN

When the frequency series is entered, the instrument requests a relative level (-9 dB to 9 dB) to which the levels stated in table 5.1.2 page 5-2 are adjusted. The RUN key selects the automatic test, which sends out the two-tone signal at level L1 (as stated in table 5.1.2 page 5-2) and at a pulse/pause ratio of 100 ms/100 ms. The function of the receivers is tested for about 3 seconds, after which the level changes to L2. After another 3 seconds the level changes to L3. 3 seconds later the output signal changes to the next two-tone combination at level L1, and the test proceeds until all combinations have been tested at the three levels.

The STEP key selects the semi-automatic test, which tests the function of the receiver combination until the STEP key is pressed again. At any point of the semi-automatic test, the automatic test

may be introduced by pressing the RUN key.

A print returns the parameters and all the results.

If the tested system contains less receivers than indicated in the frequency table 5.1.1, it is still possible to do an automatic test. In this case connect the receiver output of the existing receiver to the Receiver Test Inputs corresponding to the existing and the missing receiver; e.g. f11 does not exist in the system R2, backwards. For the automatic receiver test, connect the receiver output of f2 to the Receiver Test Inputs f2 and f11. (This can easily be done on the rear panel jack).

EXAMPLE: Print of results of Receiver Test Automatic.

CCITT/R2 BACKWARDS
RECEIVER TEST.

PARAMETERS:
REC.COMBINATION:
A) F0/F4
1140/780 HZ
B) F1/F7
1020/660 HZ
C) F2/F11
900/540 HZ
LEVEL: 1) -5 DBM
2) -35 DBM
3) -42 DBM
PULSE: 100 MS
PAUSE: 100 MS

TEST: FUNCTION:
A1) ACCEPTED
A2) ACCEPTED
A3) REJECTED
B1) ACCEPTED
B2) ACCEPTED
B3) REJECTED
C1) ACCEPTED
C2) ACCEPTED
C3) REJECTED

The parameters show the tested combinations A, B, and C at the three test levels 1, 2, and 3. This gives nine tests, which are indicated in the results.

MANUAL

FUNC-TION	INTER- RUPT.
OPERAT. TIME	RELEASE TIME
OP+REL TIME	OP-REL TIME

Enter the parameters:

FREQ. SERIES
RECEIVER COMBINATION
DEVIATION OSCILLATOR 1
DEVIATION OSCILLATOR 2
LEVEL COMMON
LEVEL INDIVIDUAL OSCILLATOR 1
LEVEL INDIVIDUAL OSCILLATOR 2
PULSE TIME
PAUSE TIME

The deviations and the levels can be negative, which is entered by pressing the SIGN key.

Either tone of the Receiver Test Output signal may be turned off by pressing the OFF key during entry of the LEVEL INDIVIDUAL. This is indicated by the OSCILLATOR and LEVEL INDIVIDUAL being turned off. The tone is turned on again by pressing a key during entry of the LEVEL INDIVIDUAL.

In the case of only two receivers in the frequency series, the RECEIVER COMBINATION is not requested.

In the case of only one receiver in the frequency series, the RECEIVER COMBINATION, DEVIATION OSCILLATOR 2, and LEVEL INDIVIDUAL OSCILLATOR 2 are not requested.

The HOLD feature may be applied to the test mode and all parameters except FREQ. SERIES.

The test is continued until a key is pressed.

A print returns the parameters and the result.

EXAMPLE: Print of result of Receiver Test Manual.

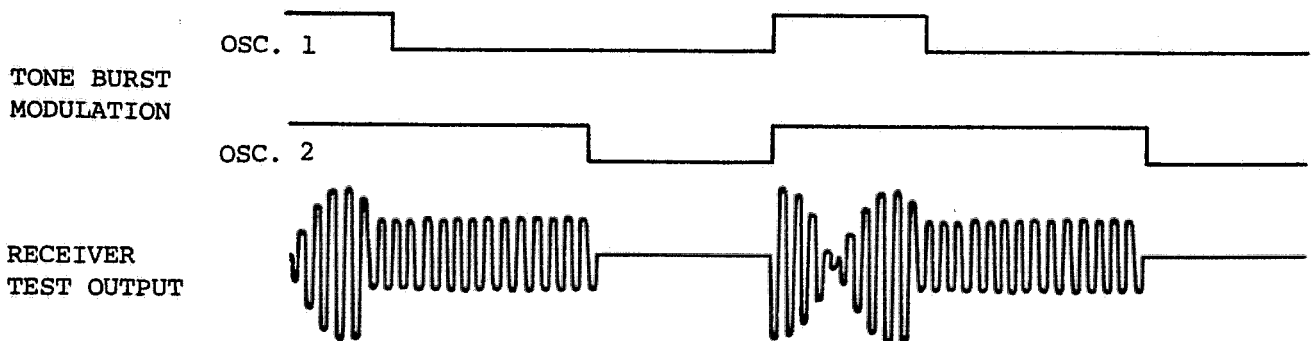
CCITT/R2 FORWARDS
RECEIVER TEST.

PARAMETERS:
REC.COMBINATION:
 F0/F2
 1380/1620 HZ
DEVIA: -8/0 HZ
LEVEL: -5 DBM
 -1/0 DB
PULSE: 70 MS
PAUSE: 65 MS

TEST: OPERAT. TIME:
 17 MS

All the entered parameter values and the result are shown.

Fig. 2.4.1 Example of external Tone Burst Modulation (in this case no internal modulation, i.e., PAUSE = 0 ms).



2.4 TESTS EMPLOYING AUXILIARY INSTRUMENTS

AUXILIARY SIGNAL

A signal fed into the AUXILIARY INPUT SIGNAL (rear panel) is added to the two-tone Receiver Test Output signal. This may be used to examine the effect of a third-tone or a noise signal in the receiver test.

The input is unbalanced (600 Ω), and the auxiliary signal must not exceed 0 dBu (0.775 Vrms). The level of the auxiliary signal may be measured by the Generator Test mode.

The auxiliary signal is fed direct into the output stage. Thus the attenuators have no effect on the auxiliary signal. The pulse/pause modulation is applied to the auxiliary signal.

TONE BURST MODULATION

The signals in the Receiver Test Output signal may be externally modulated, as to pulse/pause, independently of the internal pulse/pause modulation. The signals OSCILLATOR 1, OSCILLATOR 2, and AUXILIARY SIGNAL may be individually modulated by means of logic signals at the TONE BURST MODULATION inputs (rear panel). A logic low at the terminal turns off the signal, while a logic high (or the terminal left open) turns on the signal.

In this way, any pulse train may be simulated.

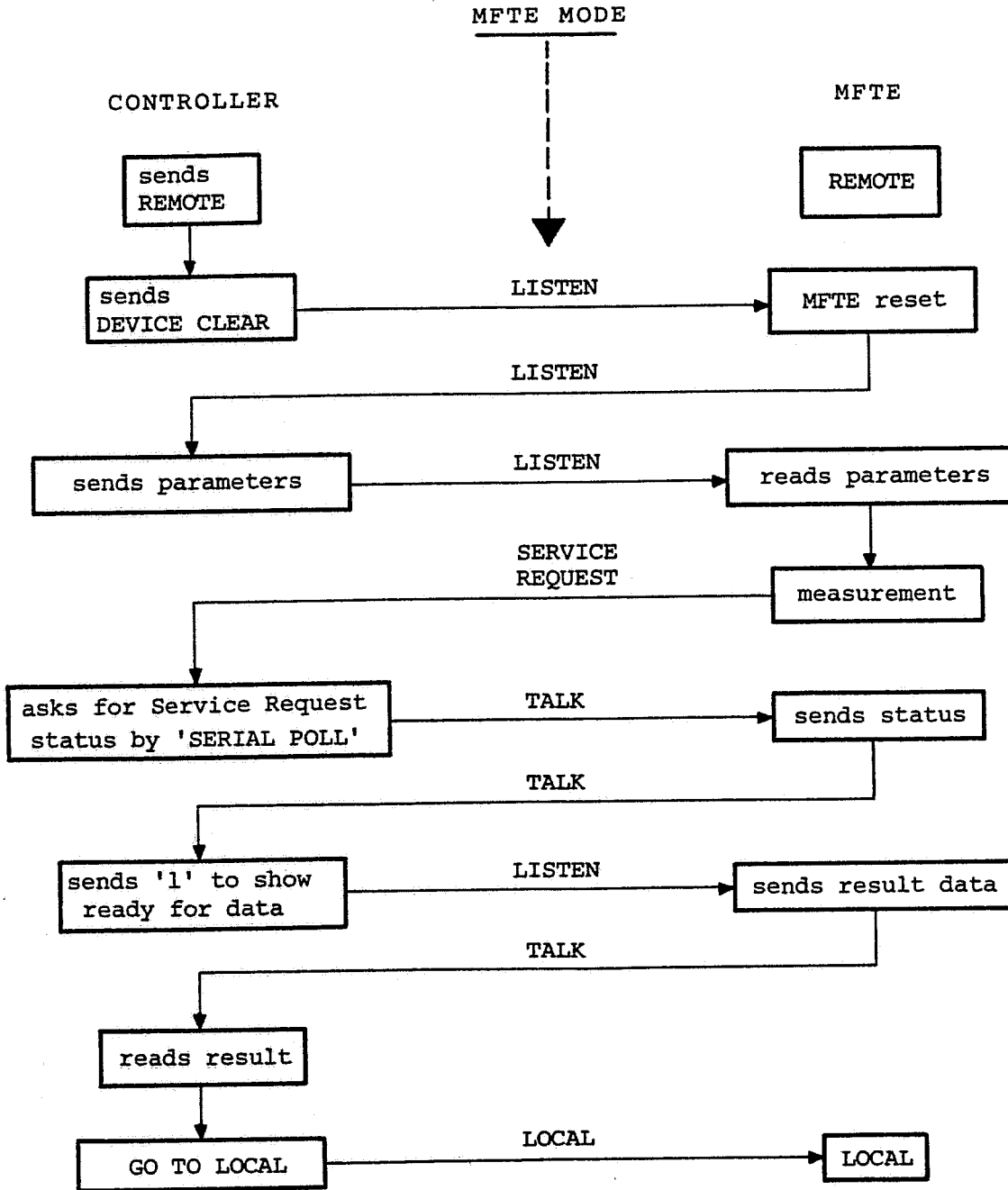


Fig. 2.5.1 Remote Control of MFTE - Sequence of Events.

2.5 IEC-BUS INTERFACE

Reference:

IEC-Publication: Standard Interface Systems for Programmable Measuring Apparatus, Part 2, July 1974.

The MFTE is supplied with an IEC-BUS interface defined as in the reference.

SEQUENCE OF EVENTS

The interface system must be controlled by a System Controller. When the MFTE is set in the REMOTE condition, interaction with the Controller may take place as follows (see fig. 2.5.1):

1. The Controller resets the MFTE by sending a DEVICE CLEAR message.
2. The Controller sets the MFTE in the LISTEN mode by sending a LISTEN address.
3. The Controller sends parameter data to the MFTE.
4. The Controller sends UNLISTEN command and may perform other tasks.
5. When the MFTE has completed the test, it sends a SERVICE REQUEST to the Controller.
6. The Controller asks the interface system for a SERVICE REQUEST status.
7. When the Controller realizes that the Service Request comes from the MFTE, it issues a LISTEN command to the MFTE and sends '1' to signify ready for data.
8. The Controller sends UNLISTEN and TALK commands to the MFTE and sets itself in the LISTEN mode.
9. The MFTE sends the result data to the Controller.
10. The Controller sends UNTALK and GO TO LOCAL to the MFTE.

ADDRESS ASSIGNMENT

The LISTEN and TALK addresses of the MFTE are the same, and both are set on the 5-bit switch (rear panel).

INTERFACE FUNCTIONS

In order to fulfil the sequence of events, the MFTE incorporates a number of interface functions:

- Source Handshake (SH1)
- Acceptor Handshake (AH1)
- Talker (T6)
- Listener (L4)
- Service Request (SR1)
- Device Clear (DC1)

Each data byte transferred by the interface system uses the handshake process, which is described in detail in the reference. Data coding is in ASCII.

When the MFTE is set in the REMOTE, the keyboard, except the RESET and the POWER key, is disabled. A RESET returns the MFTE to the LOCAL mode.

REMOTE MESSAGE CODING

The coding on the interface lines is stated in table 2.5.1. Two or more messages, as defined in the table, may be sent concurrently by different interface functions (e.g. ATN and SPE).

OPERATIONAL SEQUENCES

Data are sent in a group of ASCII characters. Each data is separated by a comma (in ASCII), and the record ends with CR and LF. If the MFTE finds an error in the parameter input or the measuring process, it issues an error code in the status byte.

The following sequences apply to message communication on the interface.

MNE-MONIC	MESSAGE NAME	BUS SIGNAL LINES															
		D I O	7	6	5	4	3	2	1	D I O	N N D R D A F A T O R F E V D C N I Q C N						
ATN	ATTENTION	X	X	X	X	X	X	X	X	X	X	X	1	X	X	X	X
DAB	DATA BYTE	Ø	D	D	D	D	D	D	D	X	X	X	X	X	X	X	X
DAC	DATA ACCEPTED	X	X	X	X	X	X	X	X	X	X	Ø	X	X	X	X	X
DAV	DATA VALID	X	X	X	X	X	X	X	X	1	X	X	X	X	X	X	X
DCL	DEVICE CLEAR	X	Ø	Ø	1	Ø	1	Ø	Ø	X	X	X	X	X	X	X	X
GTL	GO TO LOCAL	X	Ø	Ø	Ø	Ø	Ø	Ø	1	X	X	X	X	X	X	X	X
MLA	MY LISTEN ADDRESS	X	Ø	1	L	L	L	L	L	X	X	X	X	X	X	X	X
MTA	MY TALK ADDRESS	X	1	Ø	T	T	T	T	T	X	X	X	X	X	X	X	X
REN	REMOTE ENABLE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1
RFD	READY FOR DATA	X	X	X	X	X	X	X	X	X	Ø	X	X	X	X	X	X
SBA	STATUS BIT ACKNOWLEDGE	X	1	E	E	E	E	E	E	X	X	X	X	X	X	X	X
SBN	STATUS BIT NON-ACKNOWLEDGE	X	Ø	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SPD	SERIAL POLL DISABLE	X	Ø	Ø	1	1	Ø	Ø	1	X	X	X	X	X	X	X	X
SPE	SERIAL POLL ENABLE	X	Ø	Ø	1	1	Ø	Ø	Ø	X	X	X	X	X	X	X	X
SRQ	SERVICE REQUEST	X	X	X	X	X	X	X	X	X	X	X	X	X	1	X	X
UNL	UNLISTEN	X	Ø	1	1	1	1	1	1	X	X	X	X	X	X	X	X
UNT	UNTALK	X	1	Ø	1	1	1	1	1	X	X	X	X	X	X	X	X

NOTE: 1 is active low on the bus.

Table 2.5.1 Remote Message Coding.

Placing MFTE in Remote

ATN REN
1 1 MLA_{MFTE} sets the MFTE in Remote

(MFTE returns to local when '0' is on the REN line).

Clear MFTE

resets MFTE to its initial state.

ATN
1 UNL prevents other devices from being cleared.

1 MLA_{MFTE} address enables MFTE to listen.

1 DCL resets MFTE to its initial state.

Data Transfer

ATN

1 UNL
1 MLA_{MFTE}
∅ DAB₁
.
.
.
∅ DAB_{N-2}
∅ DAB_{N-1}
∅ DAB_N

the Controller sends data to the MFTE.

inhibits all current listeners (if required).

address enables MFTE to receive data (listen).

1st data byte (ASCII).

.
. .
. .
. .

(N-2)th data byte (ASCII).

Carriage Return (CR in ASCII) }
Line Feed (LF in ASCII) } END OF RECORD

Data Transfer

ATN

1 UNL
1 MTA_{MFTE}
∅ DAB₁
.
.
.
∅ DAB_{N-2}
∅ DAB_{N-1}
∅ DAB_N
1 UNT

the MFTE sends data to the Controller.

inhibits all current listeners (if required).

address enables MFTE to send data (talk).

1st data byte (ASCII).

.
. .
. .
. .

(N-2)th data byte (ASCII).

CR (ASCII) }
LF (ASCII) } END OF RECORD

UNTALK to MFTE.

Serial Poll

ATN

1 UNL
1 SPE
1 MTA_{MFTE}

issued by the Controller when SRQ = '1' appears on the interface.

prevents other devices from listening to the sent status (if required).

puts MFTE into Serial Poll Mode.

enables MFTE to send status (talk).

Ø	SBN or SBA	MFTE sends status to the Controller.
1	SPD	removes MFTE from Serial Poll Mode.

Return to Local

ATN		the MFTE is removed from the remote mode.
1	UNL	prevents other devices from returning to local.
1	MLA MFTE	sets MFTE in the listen mode.
1	GTL	go to local.

Note: When the MFTE is in local during a 'clear MFTE' or 'return to local' sequence, the Controller will place the MFTE in the REMOTE mode before it sends the message. If the MFTE receives the message within 10 µs after it has been forced into the REMOTE mode, it will not react properly to the message but instead stay in the REMOTE mode.

PARAMETER AND RESULT DATA

The valid ASCII characters in the data set are the numbers 0 - 9, - , space, comma, . , CR, and LF.

Different numbers of parameter data are required for the various MFTE test modes, which then return different numbers of results.

Note: The first parameter indicates the test mode.

(1) MODE: Generator Test Automatic

Parameters:	1, frequency series.
Result:	frequency (generator no. 1), level (generator no. 1), -----, frequency(gen. no. N), level (gen. no. N).
	'N' depends on the frequency series.

(2) MODE: Generator Test Manual

Parameters:	2, function, frequency series, generator number
	Function:
	1 indicates frequency measurement
	2 indicates level measurement
	3 indicates aux. level measurement
Result:	frequency, level, or aux. level.

NOTE: In case of a defective generator, the error code returns '5', and the result data is returned as '1' indi-

cating that measurement of the generator has been rejected.

(3) MODE: Receiver Test Automatic

Parameters: 3, frequency series, relative level

Result: functional test (rec. comb. 1) at level L1
functional test (rec. comb. 1) at level L2
functional test (rec. comb. 1) at level L3
functional test (rec. comb. 2) at level L1
: : : : :
: : : : :
: : : : :
functional test (rec. comb. N) at level L3

'N' depends on the frequency series.
The result is given as '0' for accepted and '1' for rejected.

Each test takes about 3 seconds.

(4) MODE: Receiver Test Manual

Parameters: 4, function, frequency series, receiver combination number, deviation oscillator 1, deviation oscillator 2, output level common, individual level oscillator 1, individual level oscillator 2, pulse time, and pause time.

Function:

- 1 indicates functional test
- 2 indicates interruption test
- 3 indicates operation time measurement
- 4 indicates release time measurement
- 5 indicates operation + release time measurement
- 6 indicates operation - release time measurement

Individual level = '10' indicates oscillator off.

Result: according to function:

Function = 0 or 1: 0 for accepted,
1 for rejected.

Function = 2, 3, 4, or 5: time measurement.

The test takes the time of 15 tone bursts.

The status word issued in connection with the service request returns an error code (in ASCII):

- 0: No error
- 1: Too many parameters
- 2: Too few parameters
- 3: Parameter outside range
- 4: Invalid ASCII character(s) in parameter set
- 5: Level too low for measurement
- 6: Level too high for measurement
- 7: Frequency too low for measurement
- 8: Frequency too high for measurement
- 9: Defective conditions of measurement

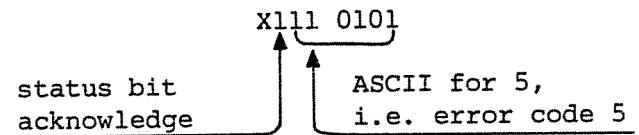
In case of more than one error, only the lowest error number is returned. If the error code is 1, 2, 3, or 4, no measuring process has taken place.

EXAMPLE:

A remote Generator Test Automatic of a system R2 (backwards) is required.

The Controller sends DEVICE CLEAR and the parameters: 1, 2 CR LF (frequency series 2 is R2/backwards).

After making a SERVICE REQUEST, the Controller reads the status word:



This means that at least one measurement has been rejected.

The Controller sends '1' to indicate ready for data and receives:

1139.3, -5.2, 1020.1, -4.9, 1, 1,
781.4, -4.9, 659.9, -5.1, 540.8,
-5.0 CR LF

The frequency is in Hz and the level in dBu. The two '1s' of the generator no. 3 result indicate that it has not been possible to take measurements of the generator.

3. MAINTENANCE

The MFTE requires no other maintenance than changing of paper in the printer and cleaning of the printer head (section 3.2). A control of the functioning of the signal generators, attenuators, and the generator test measurement is easily obtained by means of a self-test (section 3.1).

3.1 SELF-TEST

A single test returns the accuracy of the level and frequency of the Receiver Test Output signal together with the accuracy of the level and frequency measurement. This is obtained by sending out a single continuous tone, which is fed into the Generator Test Input. The level and frequency measurement then ought to return the entered parameter values of the test tone.

The self-test procedure is as follows:

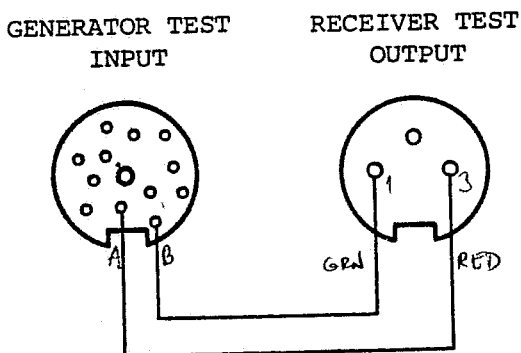


Fig. 3.1.1 Connection for Self-Test.

Connect the Receiver Test Output to one of the balanced Generator Test Inputs.

Set the input and output impedance switches to 600 Ω (rear panel).

Select FUNCTION and enter the requested parameters at random values but turn off one tone and set PAUSE to '0' ms.

When the test returns REJECTED, terminate the test by pressing the HOLD key.

The one-tone will remain at the output when a Generator Test is introduced. The level and frequency Generator Test measurement will now return the level and the frequency of the one-tone.

3.2 PRINTER

The printer is designed for metallised paper (24 V). A new paper roll is installed by the following procedure:

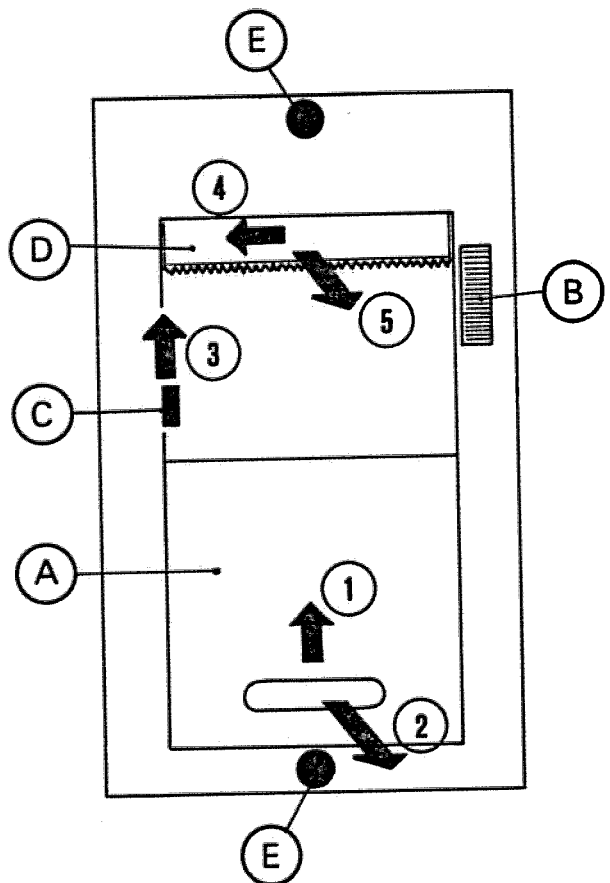
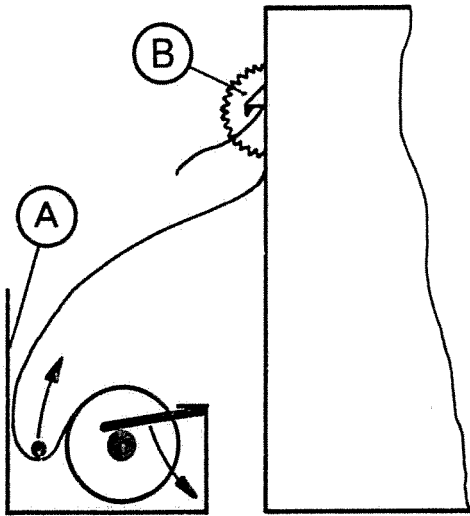


Fig. 3.2.1 The printer with paper roll installation.

The paper tray (A) is released by pulling the tray up and outwards, (1) and (2). The paper roll is installed, and the paper is fed into the printer by means of the paper feeding wheel (B). The paper tray is reset by pushing it back into the printer.



If the paper is torn in the printer, the release button (C) should be pressed upwards (3) and the paper taken out by hand.

When deterioration of the printing quality is observed, the printing head should be brushed a few times with the supplied cleaning paper. The paper cutter (D) is removed by moving it to the left (4) and pulling it outwards (5). Then the cleaning paper can be inserted under the printing head for the cleaning operation. The paper cutter is reset in the reversed way.

Note that the whole printer unit can be removed by loosening the two finger screws (E) and pulling the printer unit outwards.

4. SERVICE

The MFTE is calibrated before leaving the factory. If the MFTE needs adjusting, please refer to the 'MFTE Hardware Reference Manual.'

In case of faulty operation of the MFTE, check all controls and terminals for proper setting (see 'Operation', section 2). If the faulty operation continues, check the primary and secondary fuses. The latter are accessible on the rear of the power supply when removing the printer.

If it is established that a fault does exist in the MFTE, please contact your ELMI-agent, who will help you restore your MFTE to its proper condition.

To order replacement parts, address order or inquiry either to your authorized representative or to:

ELMI A/S

90, Kirkebjerg Alle
DK-2600 GLOSTRUP
Denmark

Phone: National: 02-45 42 11
International: + 45 2 45 42 11
Telex: 33 423 ELMI DK
Cables: ELMIWORKS

5. TABLES

S Y S T E M	f0	f1	f2	f4	f7	f11		
	Hz							
CCITT/R2 forwards	1380	1500	1620	1740	1860	1980		
CCITT/R2 backwards	1140	1020	900	780	660	540		
CCITT/R2 line	3825							
SOCOTEL, register	700	900	1100	1300	1500	1700		
SOCOTEL/5 control	1700							
SOCOTEL/6 control	1900							
CCITT/#4	2040	2400						
CCITT/#5 register	700	900	1100	1300	1500	1700		
CCITT/#5 line	2400	2600						
Y-CODE register	540	780	1020	1260	1500	1740		
Y-CODE line	3000							
	#1	#2	#3	#4	#5	#6	#7	#8
PBD	697	770	852	941	1209	1336	1477	1633

Table 5.1.1 Programmed Frequencies.

If the tested system contains less receivers than indicated in the frequency table 5.1.1, it is still possible to do an automatic test. In this case connect the receiver output of the existing receiver to the Receiver Test Inputs corresponding to

the existing and the missing receiver; e.g. f11 does not exist in the system R2, backwards. For the automatic receiver test, connect the receiver output of f2 to the Receiver Test Inputs f2 and f11. (This can easily be done on the rear panel jack).

FRE- QUENCY SERIES	SYSTEM	RECEIVER TEST AUTO							
		TEST COMBINATIONS			TEST LEVELS in dBm				
		A	B	C	L ₁	L ₂	L ₃		
0	CCITT/SYSTEM R2, FORWARDS	f0/f4	f1/f7	f2/f11	-5	-35	-42		
1					-5	-39	-49		
2	CCITT/SYSTEM R2, BACKWARDS	f0/f4	f1/f7	f2/f11	-5	-35	-42		
3					-5	-39	-49		
4	CCITT/SYSTEM R2, LINE	f0			0	-27	-33		
5	SOCOTEL, REGISTER	f0/f1	f2/f4	f7/f11	-4	-35	-44		
6					-8	-33	-41		
7	SOCOTEL/5, CONTROL	f0			-6	-31	-39		
8	SOCOTEL/6, CONTROL	f0			-4	-35	-44		
9					-6	-31	-39		
10	CCITT/SYSTEM #4	f0/f1			0	-18	-35		
11	CCITT/SYSTEM #5, REGISTER	f0/f1	f2/f4	f7/f11	0	-14	-24		
12	CCITT/SYSTEM #5, LINE	f0/f1			-2	-16	-26		
13	Y-CODE, REGISTER	f0/f1	f2/f4	f7/f11	0	-18	-33		
14	Y-CODE, LINE	f0			0	-18	-35		
15	PBD 1.1, 2 x (1-of-4)	A	B	C	D	E	-5	-28	-37
16							-13	-23	-35
17	PBD 1.2, 1-of-5, 1-of-1,*,#						-5	-28	-37
18							-13	-23	-35
19	PBD 1.3, 2-of-6						-5	-28	-37
20							-13	-23	-35
21	PBD 1.4, 2-of-5,*,#,CONTROL	1	5	9	0	D	-5	-28	-37
22							-13	-23	-35
23	PBD 1.5, binary 1, CONTROL						-5	-28	-37
24							-13	-23	-35
25	PBD 1.6, binary 2, CONTROL						-5	-28	-37
26							-13	-23	-35
27	PBD 1.7, binary 3, CONTROL						-5	-28	-37
28							-13	-23	-35

Table 5.1.2 Frequency Series.

DI-GIT	VERSION 1.1	VERSION 1.2	VERSION 1.3	VERSION 1.4	VERSION 1.5	VERSION 1.6	VERSION 1.7
	2 x (1-of-4) 12345678	1-of-5, 1-of-1,*, # 12345678	2-of-6 12345678	2-of-5,*, #, control 12345678	binary 1, control 12345678	binary 2, control 12345678	binary 3, control 12345678
1	10001000	10000000	11000000	11000000	10000000	10000000	10000000
2	10000100	01000000	10100000	10100000	01000000	01000000	01000000
3	10000010	00100000	01100000	01100000	11000000	11000000	11000000
4	01001000	00010000	10010000	10010000	00100000	00100000	00100000
5	01000100	00001000	01010000	01010000	10100000	10100000	10100000
6	01000010	10000100	00110000	00110000	01100000	01100000	01100000
7	00101000	01000100	10001000	10001000	11100000	11100000	11100000
8	00100100	00100100	01001000	01001000	00010000	00010000	00010000
9	00100010	00010100	00101000	00101000	10010000	10010000	10010000
0	00010100	00001100	00011000	00011000	00000000	00110000	00000000
*	00011000	00000010	10000100	00000100	01010000	01010000	00000100
#	00010010	00000001	01000100	00000010	11010000	11010000	00000100
A	10000001				00110000		
B	01000001				10110000		
C	00100001				01110000		
D	00010001				11110000		

'1' indicates active, C is active when Test signal is present (strobe).

Table 5.1.3 Receiver Test Code PBD.

OPERATOR'S MANUAL

SUPPLEMENT

Page 1 - 5 : The instrument is programmed to a tone burst ratio
of 100 ms / 100 ms for the automatic receiver test.

Insert :

In case of a PBD system the tone burst ratio is
45 ms / 100 .ms.

Page 2 - 21: ... and at a pulse/pause ratio of 100 ms / 100 ms.

Insert:

(In case of a PBD system the ratio is 45 ms / 100 ms).