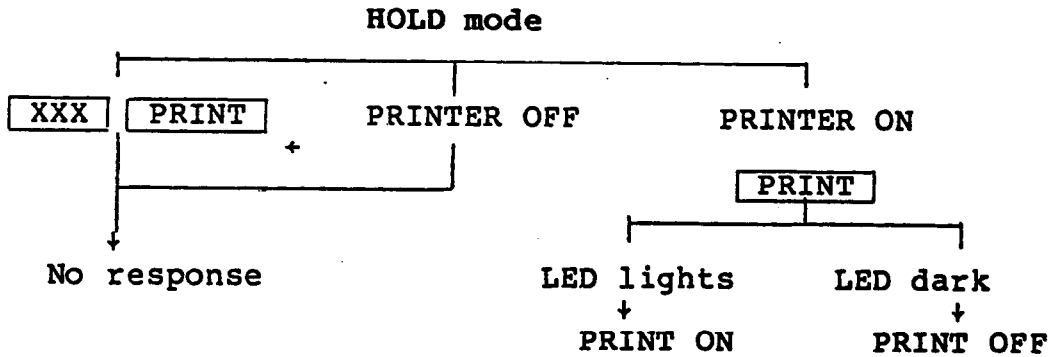
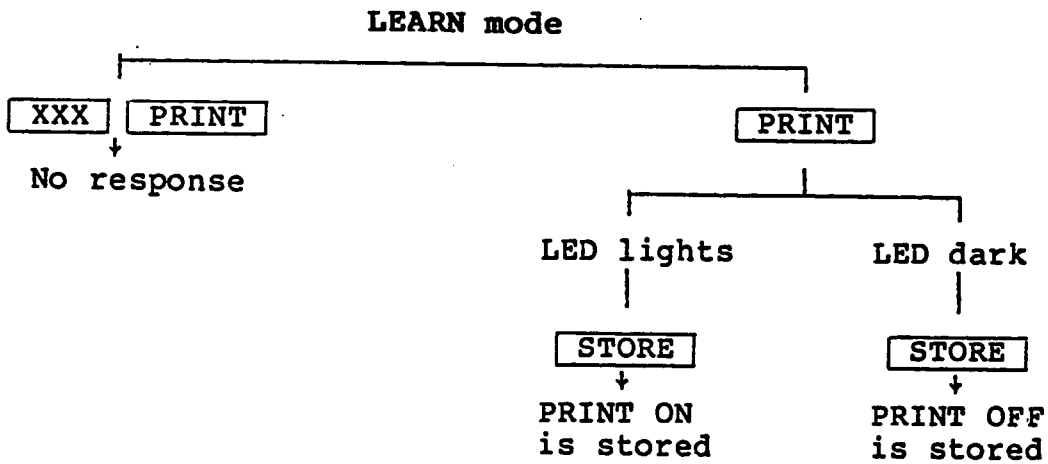
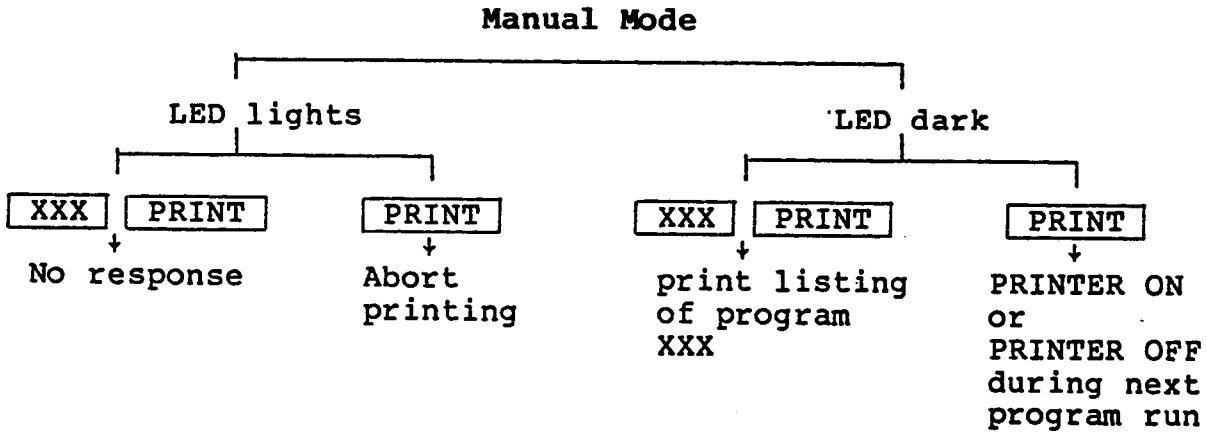


## HOLD mode

In HOLD mode, the PRINT key has a similar function as in LEARN mode, i.e. by pressing this key it is possible to decide whether a test log is to be generated in the subsequent program part (PRINT LED lights up) or not (PRINT LED goes out). If the printer has been switched off in manual mode (PRINTER OFF), the PRINT key is without function in HOLD mode.



### 2.3.10.8.2 Program Listings

Program listings can only be printed out in manual mode. During printing (PRINT LED lights), it is therefore not possible to start a program, switch over to learn mode or have a look at the directory (    ). Contrary to the readout in the  $\alpha$  display, each program line corresponds to a print line; after 60 lines and at the end of the program, a page-feed (= OCH) is automatically produced.

**Example:** (corresponding to 2.3.10.3.7)

```
000 PROGRAM 23
001 XMITTER
002 AF INT1 2 kHz
003 AF OUTPUT 5 mV
004 RF COUNT
005 POWER
006 MAX PK
007 STOP 1000
008 RECEIVER
009 SET RF RX 145 MHz
010 RF OUTPUT 10  $\mu$ V
011 MOD OFF
012 MOD INT 1 kHz
013 AF LEVEL
014 STOP 2000
```

After aborting a program, the printer head should again be set to the beginning of the next page by means of the following program:

```
000 PROGRAM 99
001 CONTROL 0C (Entry:     )
002 PRINT OFF
```

### 2.3.10.8.3 Test Logs

For logging a program run, the printer must be switched on before starting the program (  or   in manual mode  $\rightarrow$  PRINTER ON in  $\alpha$  display).

#### **$\rightarrow$ Generation of Control Characters for Printer**

- To configure the CMT for different types of printer, a hexadecimal control character set can be generated.

enables to edit this string. It may have a length of up to 14 characters. In this case, the CMT interprets the numbers 0 to 9 and A to F as hexadecimal input. Subsequent pressing of the STORE key causes the string to be stored. The CMT ignores all other key entries.

Transfer of the control character string to the printer is triggered by entering **A** **526** **SPEC** .

- If the autorun control is to transfer control characters to the printer during RUN mode, a control character string can be generated in LEARN mode as described above using **A** **527** **SPEC** . This entry is stored by pressing the STORE key, "001 CONTROL <hexadecimal control characters>" is displayed as command. These control characters are then transferred to the printer in RUN mode.

After the program start, printing always begins with line 000 so that the program number and, if necessary, a head line (in line 001) can be placed at the head of the test log.

Printing of the test log can then be suppressed at any place by means of PRINT OFF commands in the program or by pressing the PRINT key in HOLD mode.

**a) Structure of the test log**

**Test log head**

! LINE!	COMMAND	PARAMETER	RESULT	TOL
! 000 !	PROGRAM	! 00	!	!
! 001 !	***** TRANSMITTER TEST *****			

Each line (except for messages) is divided into five columns.

**Line**

The content of this column corresponds to the line number of the program, enabling the test log to be compared with the corresponding program listing.

**Command**

In this column, measurement calls and setting instructions to the CMT are printed in plain text corresponding to the command code (Section 2.3.10.7).

! LINE!	COMMAND	PARAMETER	RESULT	TOL
! 000 !	PROGRAM	! 00	!	!
! :	!	!	!	!
! 005 !	SINAD	!	49.9 dB	!
! 006 !	SET RF RX	! 120.00000 MHz	!	!

### Parameter

This field contains additionally entered parameters for measurement calls (e.g. search routines), settings and control instructions as well as the second parameter for SPEC functions (only numbers).

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	00		
005	SINAD	20 dB	49.9 dB	
->	RF LEVEL		0.032 uV	
006	SET RF RX	145.00000 MHz		
007	SPEC A600	1000		

### Result

This field contains the result obtained as reply to the command in the command column.

If a measurement call returns two results, e.g. the start of search routines, the setting value coupled with the measurement result (output level of signal generator in this case) or the second result is printed in the following line.

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	00		
005	SINAD	20 dB	49.9 dB	
->	RF LEVEL		0.032 uV	
006	SET RF RX	145.00000 MHz		

### Tol

If a measurement is evaluated with tolerances, the GO/NOGO information appears in the tolerance field which corresponds to the TOL IN/OUT LEDs on the front panel.

OK : green (TOL IN) LED lights  
FAULT : red (TOL OUT) LED lights

### Messages

Messages entered into the program may have a length of up to 33 characters. They are located in the center of the columns Command, Parameter, Result and Tol and printed with a row of stars on each side so that they can be easily recognized.

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	00		
001	***** TRANSMITTER TEST *****			
010	AF LEVEL		20.7 mV	OK
011	UPPER TOL AF LEVEL	30 mV		
012	LOWER TOL AF LEVEL	20 mV		
016	PRINT ON			
017	AF LEVEL		20.7 mV	FAULT
018	UPPER TOL AF LEVEL	55.5 mV		
019	LOWER TOL AF LEVEL	23.6 mV		

### Repetition blocks

With each run, the content of a repetition block is again printed with the current parameters and measurement results but with unchanged line numbers. For identification of the individual runs, the Result field is used.

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	01		
017	REP START	5	1	
017	REP START	5	2	
017	REP START	5	3	
017	REP START	5	4	
017	REP START	5	5	
023	REP STOP			

In the case of relative changes in parameters via  $\Delta$  VAR, the change value is contained in the Parameter field (increment or decrement) and the actually set value in the Result field.

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	02		
018	MOD INT1 DELTA VAR	0.1 KHz	3.00 KHz	

## b) Types of test logs

Depending on the intended use of the test log, it is not always necessary to print each command line (e.g. simple GO/NOGO test). For this reason, SPEC functions are provided to select one of three possible log sizes:

**A** **513** **SPEC** : Minimum log size (small)

**A** **514** **SPEC** : Restricted log size (medium)

**A** **515** **SPEC** : Complete log size (large)

### Complete test log (large)

LINE	COMMAND	PARAMETER	RESULT	TOL
000	PROGRAM	01		
001	*****	RECEIVER TEST *****		
002	RECEIVER			
003	RF OUTPUT	0.500 uV		
004	SET RF RX	145.80000 MHz		
005	AF INT1	1.000 kHz		
006	MOD INT1	2.80 kHz		
007	REP START	4	1	
008	AF LEVEL		14.4 mV	
009	SINAD		OVERFLOW	
010	MOD INT1 DELTA VAR	0.1 KHz	2.90 kHz	
007	REP START	4	2	
008	AF LEVEL		2.1 mV	
009	SINAD		54.4 dB	
010	MOD INT1 DELTA VAR	0.1 KHz	3.00 kHz	
007	REP START	4	3	
008	AF LEVEL		14.6 mV	
009	SINAD		53.6 dB	
010	MOD INT1 DELTA VAR	0.1 KHz	3.10 kHz	
007	REP START	4	4	
008	AF LEVEL		14.5 mV	
009	SINAD		53.6 dB	
010	MOD INT1 DELTA VAR	0.1 KHz	3.20 kHz	
011	REP STOP			
012	*****	TRANSMITTER TEST *****		
013	XMITTER			
014	AF INT1	1.000 kHz		
015	AF OUTPUT	10.0 mV		
016	RF COUNT		145.200180 MHz	
017	POWER		0.017 W	
018	MAX PK		-2.66 kHz	OK
019	UPPER TOL MAX PK	3.0 KHz		
020	LOWER TOL MAX PK	2.5 KHz		
021	TX DIST		0.30 %	FAULT!
022	UPPER TOL TX DIST	0.1 %		

## Restricted test log (medium)

In this operating mode, printing of the following program lines is suppressed:

- Control instructions to the CMT (e.g. RECEIVER, SPEC functions)
- Settings with the associated parameters in the program (e.g. RF OUTPUT 0.5  $\mu$ V)
- Control instructions to the autorun control (e.g. STOP, CONTINUE)
- Settings whose parameters are requested by the user during autorun mode are not suppressed

! LINE!	COMMAND	PARAMETER	RESULT	TOL
! 000 !	PROGRAM	! 01	!	!
! 001 !	***** RECEIVER TEST *****			
! 008 !	AF LEVEL	!	! 9.8 mV	!
! 009 !	SINAD	!	! 14.2 dB	!
! 008 !	AF LEVEL	!	! 12.1 mV	!
! 009 !	SINAD	!	! 54.0 dB	!
! 008 !	AF LEVEL	!	! 9.9 mV	!
! 009 !	SINAD	!	! 55.4 dB	!
! 008 !	AF LEVEL	!	! 9.8 mV	!
! 009 !	SINAD	!	! 55.9 dB	!
! 012 !	***** TRANSMITTER TEST *****			
! 016 !	RF COUNT	!	! 145.200080 MHz	!
! 017 !	POWER	!	! 0.017 W	!
! 018 !	MAX PK	!	! -2.67 kHz	! OK
! 019 !	UPPER TOL MAX PK	! 3.0 KHz	!	!
! 020 !	LOWER TOL MAX PK	! 2.5 KHz	!	!
! 021 !	TX DIST	!	! 0.31 %	! FAULT!
! 022 !	UPPER TOL TX DIST	! 0.1 %	!	!

## Minimum test log (small)

This log contains all messages in the program and the measurements (tolerance specifications inclusive) whose result lies outside the tolerance.

! LINE!	COMMAND	PARAMETER	RESULT	TOL
! 000 !	PROGRAM	! 01	!	!
! 001 !	***** RECEIVER TEST *****			
! 012 !	***** TRANSMITTER TEST *****			
! 021 !	TX DIST	!	! 0.32 %	! FAULT!
! 022 !	UPPER TOL TX DIST	! 0.1 %	!	!

c) Additional inputs in the program run

If additional information is to be entered into the printout during the program run, e.g. serial number of the radio equipment or the date, this can be prepared when writing the program by the input of    <message input>  . This message input in LEARN mode corresponds to the use of    .

During the program run, this message is output in the α display and the user can now enter e.g. the current date. This entry is terminated by pressing the STORE key. By pressing SPEC, the input mode is left. CLEAR deletes character by character. The stored prompt string is identified by "?" in the display and the program listing. The maximum length of the text to be entered depends on the length of the prompt. A maximum of 67 and minimum of 37 characters is possible. The maximum length of the prompt is 33 characters (however, only 14 can be output in the α display).

Example:

LEARN mode

Input	α display
<input type="text" value="A"/> <input type="text" value="520"/> <input type="text" value="SPEC"/>	MESSAGE INPUT
<input type="text" value="D"/> <input type="text" value="A"/> <input type="text" value="T"/> <input type="text" value="E"/> (via alphanumeric keyboard)	
<input type="text" value="STORE"/>	007 DATE

RUN mode

Input	α display
<input type="text" value="02.06.86"/>	DATE
<input type="text" value="STORE"/>	DATE 02.06.86

The program is continued by subsequently pressing CONTINUE.

Printout

! Line!	Command	! Parameter	! Result	! Tol !
! 000 !	PROGRAM	! 01	!	! !
! :	:	!	!	! :
! 007 !	DATE : 02.06.86	!	!	! :

The colon separating the request for input and the input is automatically generated by the CMT.



#### 2.3.10.8.4 Error Handling

If the printer is not available at the start of printing, the following response of the CMT is to be expected:

##### **Program listings**

First, the output buffer of the CMT is loaded (capacity: approx. 1/2 page). If the complete program can be loaded into the output buffer, the PRINT LED is immediately extinguished and all functions of the autorun control can be used without restriction. In the case of buffer overflow (PRINT LED lights continuously), the CMT waits up to 1 minute for the ready message from the printer to arrive. Use of the autorun control (LEARN, RUN) is not possible in this state, however, all other instrument functions are available without restriction.

After expiration of this waiting time, the CMT outputs "PRINTER ERROR" in the  $\alpha$  display and automatically aborts printing; the PRINT LED is extinguished.

##### **Test logs**

After the program start, the output buffer of the CMT is loaded (capacity: approx. 1/2 page), the program runs at normal speed. If this output buffer is not read out (printer switched off or not connected), the CMT waits up to one minute for the ready message from the printer to arrive, the program run is halted.

After expiration of this waiting time, the CMT outputs "PRINTER ERROR" in the  $\alpha$  display and automatically aborts printing, the PRINT LED is extinguished. The autorun control continues program execution without a test log being printed (PRINTER OFF).

#### 2.3.10.8.5 Printer Interface

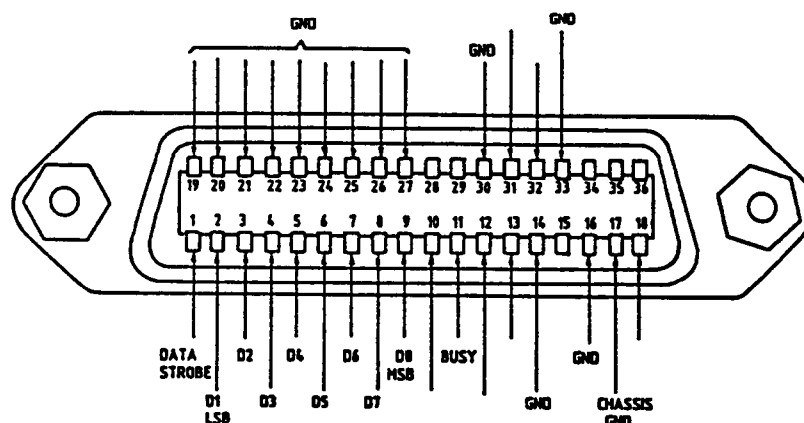


Fig. 2.13-1 PRINTER PARALLEL INTERFACE 102

From the signal lines available at the interface, the CMT only evaluates the BUSY signal.

### 2.3.10.9 Operation of Transfer Memory

The transfer memory CM-Z1 can be compared to a floppy disk for electronic data processing applications. It permits to file 100 programs of the CMT. The transfer memory must first be initialized before being used. Then any test programs can be copied from the CMT into the transfer memory and vice versa. When copying from the transfer memory into the CMT, it is possible to append the copy to already existing programs. The DELETE function allows programs to be deleted from the transfer memory, e.g. in order to provide memory space for other programs. The display directory function permits to display the first line of a program contained in the transfer memory using the spin wheel.

#### 2.3.10.9.1 Size of Transfer Memory Space

The transfer memory has a memory capacity of 7784 bytes. This memory space can be loaded with test programs. In accordance with the specified length of the vacant memory blocks of the CMT, approx. 1946 blocks are to be expected here.

#### 2.3.10.9.2 Initialization of Transfer Memory

Initialization of the transfer memory is necessary before using it for the first time or after replacing the battery.

For this purpose, plug the transfer memory into the CMT and use **A** **540** **SPEC** to start initialization. In order to avoid inadvertent deletion, the message "REALLY RESET?" appears in the display. The function is only activated when STORE is entered. During initialization, the LED of the transfer memory lights. After execution of the command, the message ">>> DONE <<<" is output in the  $\alpha$  display.

During initialization, indicated by lighting of the LED of the transfer memory, the transfer memory should not be disconnected since otherwise the function cannot be terminated.

Initialization of a transfer memory which has already been loaded with programs causes destruction of the programs.



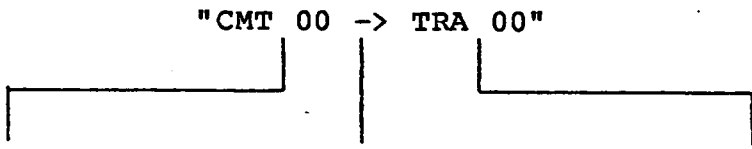
In order to prevent inadvertent overwriting of the data contained in the transfer memory, the CMT should not be switched off or on as long as the transfer memory is connected.

**Possible criteria for aborting initialization:**

- 1) Transfer memory is disconnected
  - Message "FORMAT ERROR", initialization of transfer memory cannot be terminated.
  
- 2) CMT is switched off
  - Same result as under 1)
  
- 3) Transfer memory has not been connected to the instrument
  - message "FORMAT ERROR"

**2.3.10.9.3 Copying a Program from the CMT to the Transfer Memory**

The corresponding function menu is called up using    . The following message is displayed:



CMT program no.                  Copy direction                  Transfer memory program no.

CMT program no.:                  Number of CMT program to be copied.

Transfer memory no.:                  Number of program in the transfer memory where to copy.

The arrow specifies the copy direction, indicating that the program selected is to be copied from the CMT to the transfer memory. When the menu line appears in the display, the parameters can be entered. If more than four numbers are entered, the entry is started again. Subsequent STORE starts the copy procedure, SPEC aborts this function.

During the copy procedure, indicated by lighting of the LED of the transfer memory, the transfer memory should not be disconnected, since otherwise its contents and the initialization will be lost .

Successful termination of this function is indicated in the display by the message ">>> DONE <<<".

**Possible criteria for aborting the copy procedure:**

- 1) Memory space in the transfer memory is not sufficient.  
→ Message "NO MORE MEMORY"
- 2) Transfer memory is disconnected although copying is not yet terminated.  
→ Message "TRANSFER ERROR", initialization of transfer memory is lost; programs available before are no longer accessible.
- 3) CMT is switched off  
→ Same result as under 2)
- 4) Transfer memory has not been initialized  
→ Message "TRANSFER ERROR", program is not copied.
- 5) Transfer memory has not been connected to the instrument  
→ Message "TRANSFER ERROR"
- 6) Program already exists in the transfer memory  
→ Message "PGM EXISTS", the existing program must first be deleted (prevents inadvertent deletion of a program).
- 7) The program to be copied does not exist  
→ Message "NO SUCH PGM"

#### 2.3.10.9.4 Copying a Program from the Transfer Memory to the CMT

The corresponding function menu is called up using **A** **531** **SPEC** . The following message is displayed:

"CMT 00 <- TRA 00"



CMT program no.            Copy direction            Transfer memory program no.

CMT program no.:            Number of CMT program where to copy

Transfer memory no.:        Number of program in transfer memory  
from which to copy.

The arrow specifies the copy direction, indicating that the program selected is to be copied from the transfer memory to the CMT. When the menu line appears in the display, the parameters can be entered. If more than 4 numbers are entered, the entry starts again. Subsequent STORE starts the copy procedure, SPEC aborts this function.

During the copy procedure, indicated by lighting of the LED of the transfer memory, the transfer memory should not be disconnected, since otherwise the program cannot be properly transferred.

Successful termination of this function is indicated in the display by the message ">>> DONE <<<".

#### Possible criteria for aborting the copy procedure:

- 1) Memory space in the CMT is not sufficient
  - Message "NO MORE MEMORY"
- 2) Transfer memory is disconnected although copy procedure is not yet terminated
  - Message "TRANSFER ERROR",        programs in the transfer memory  
and the CMT are retained.
- 3) CMT is switched off
  - The programs of the CMT may be lost, some information of  
the copied program may be changed.

- 4) Transfer memory has not been initialized
  - Message "TRANSFER ERROR",    the program is not copied.
  
- 5) Transfer memory has not been connected to the instrument
  - Message "TRANSFER ERROR"
  
- 6) The program already exists in the CMT
  - Message "PGM EXISTS",            the existing program must first  
                                      be deleted (prevents inadver-  
                                      tent deletion of a program).
  
- 7) The program to be copied does not exist.
  - Message "NO SUCH PGM"

#### 2.3.10.9.5 Appending a Transfer Memory Program to a CMT program

The corresponding function menu is called up using A 532  
SPEC .

The following message is displayed:

"CMT 00 << TRA 00"



CMT program no.                      Copy direction                      Transfer memory program no.  
    and symbol for  
    appending

CMT program no.:                      Number of CMT program to which to append

Transfer memory no.:                  Number of program in transfer memory from  
    which to copy

The double arrow specifies the copy direction, indicating that the program selected is to be appended to an existing program in the CMT. When the menu line is displayed, the parameters can be entered. If more than 4 numbers are entered, the entry starts again. Subsequent STORE starts the copy procedure, SPEC aborts this function.

During the copy procedure, indicated by lighting of the LED of the transfer memory, the transfer memory should not be disconnected, since otherwise the program cannot be properly transferred.

Successful termination of this function is indicated in the α display by the message ">>> DONE <<<".

Possible criteria for aborting the copy procedure, see 2.3.10.9.4.

#### 2.3.10.9.6 Deletion of a Transfer Memory Program

The corresponding function menu is called up using    .

The following message is displayed: "DELETE TRA 00".

The number of the program to be deleted from the transfer memory must be entered as parameter. The parameter can be deleted by further entry.

During deletion, indicated by lighting of the LED of the transfer memory, the transfer memory should not be disconnected, since otherwise its contents and the initialization will be lost.

Successful termination of this function is indicated in the α display by the message ">>> DONE <<<".

#### **Possible criteria for aborting deletion:**

- 1) Transfer memory is disconnected although deletion is not yet terminated
  - Message "TRANSFER ERROR", initialization of transfer memory cannot be terminated
- 2) CMT is switched off
  - Same result as under 1)
- 3) Transfer memory has not been connected to the instrument
  - Message "TRANSFER ERROR"

### 2.3.10.9.7 Display Directory of Transfer Memory

This function is called up using    . The first line of the program selected using the spin wheel is output in the  $\alpha$  display. Programs which are not occupied are identified by "PGM EMPTY". When entering this function, the first line of program 00 is displayed (basic setting). This function can be left using    .



### 2.3.10.10 Control Instructions (Brief Summary)

Input	Effect
<p>A 800 SPEC STORE</p>	<p>Initialization of autorun control. Required after each battery replacement and new fitting of option (only in manual mode).</p>
<p>A 100 SPEC to A 199 SPEC</p>	<p>Start of programming = switchover to LEARN mode. 100 to 199 = program 00 to 99 (only in manual mode).</p>
<p>A 200 SPEC</p>	<p>End of programming = switchover to manual mode (only in LEARN mode).</p>
<p>A 300 SPEC STORE to A 399 SPEC STORE</p>	<p>Deletion of a program 300 to 399 = program 00 to 99 (only in manual mode).</p>
<p>A 500 SPEC</p>	<p>Start of message entry (only in LEARN mode).</p>
<p>A 505 SPEC 1 SPEC to A 505 SPEC 1000 SPEC</p>	<p>Start of a repetition block to be executed 1 to 1000 times (only in LEARN mode).</p>
<p>A 506 SPEC</p>	<p>End of a repetition block (only in LEARN mode).</p>
<p>A 510 SPEC</p>	<p>If the tolerance is exceeded during the program run (red LED lights up), the program is interrupted (Default).</p>
<p>A 511 SPEC</p>	<p>Exceeding of the tolerance is only stored in the protocol, the program run is continued without interruption.</p>
<p>A 512 SPEC</p>	<p>After calling up this special function, the memory capacity still available is indicated (in blocks). Each command line consists of at least one block.</p>

Input	Effect
A 513 SPEC	Small format of test reports
A 514 SPEC	Medium format of test reports
A 515 SPEC	Large format of test reports
A 520 SPEC	Start of message input with input requested in RUN mode (only in LEARN mode).
A 525 SPEC	Edit the printer configuration string
A 526 SPEC	Output the printer configuration string to the printer (string is generated before by A 525 SPEC .)
A 527 SPEC	Enter a control character sequence for the autotest. In RUN mode, the programmed string is output to the printer.
A 530 SPEC	Copy CMT program to transfer memory.
A 531 SPEC	Copy transfer memory program to CMT.
A 532 SPEC	Append transfer memory program to CMT program.
A 533 SPEC	Delete transfer memory program.
A 540 SPEC	Initialize transfer memory.
A 600 SPEC 0 SPEC to A 600 SPEC 10000 SPEC	Setting of minimum time between execution of the individual commands. 0 to 10000 = 0 to 10000 ms (only in manual mode and HOLD mode).

Input	Effect
<input type="text" value="A"/> <input type="text" value="605"/> <input type="text" value="SPEC"/>	Display of directory of programs in the $\alpha$ display (only in manual mode).
<input type="text" value="A"/> <input type="text" value="606"/> <input type="text" value="SPEC"/>	Directory switched off.
<input type="text" value="A"/> <input type="text" value="607"/> <input type="text" value="SPEC"/>	Enter the function display directory of transfer memory
<input type="text" value="A"/> <input type="text" value="610"/> <input type="text" value="SPEC"/>	Output of the Autorun Control Directory on a printer
<input type="text" value="A"/> <input type="text" value="611"/> <input type="text" value="SPEC"/>	Output of the Transfer Memory Directory on a printer
<input type="text" value="A"/> <input type="text" value="1000"/> <input type="text" value="SPEC"/> to <input type="text" value="A"/> <input type="text" value="1999"/> <input type="text" value="SPEC"/>	Selection of a particular line. 1000 to 1999 = line 000 to 999. (only in LEARN mode).
<input type="text" value="A"/> <input type="text" value="2000"/> <input type="text" value="SPEC"/> to <input type="text" value="A"/> <input type="text" value="2999"/> <input type="text" value="SPEC"/>	Deletion of a program block. 2000 to 2999 = deletion of lines 000 to 999 from the set position (only in LEARN mode).
<input type="text" value="100"/> <input type="text" value="START"/> to <input type="text" value="199"/> <input type="text" value="START"/>	Start of program run. 100 to 199 = program 00 to 99 (only in manual mode).
<input type="text" value="STOP"/>	Program interrupt (in RUN mode). Program run switched off (in HOLD mode).
<input type="text" value="CONT"/>	Continuation of an interrupted program run (in HOLD mode).

## 2.4 IEC-bus Control

### IEC-bus interface:

The CMT is provided with the interface functions RL2, which means that the states REMOTE WITH LOCKOUT STATE (IEC-bus command IECLLO) and LOCAL WITH LOCKOUT STATE are omitted.

#### 2.4.1 Introduction

The IEC 625-1 interface allows to remotely control the CMT. If the CMT is remotely controlled via this interface, manual operation via the front panel is switched off. This interface is referred to as IEC bus.

The instrument is controlled via 16 control lines, whose length should not exceed 20 m.

The individual signal lines have the following functions:

- Eight lines make up the data bus via which data, addresses and control commands are transmitted.
- Three further lines handle the so-called handshake.
- The remaining five lines constitute the management bus used for controlling the data bus and transferring particular messages.

Fig. 2-14 shows the pin assignment of the IEC-bus connector 103. Table 2-4 lists the functions of the individual lines.

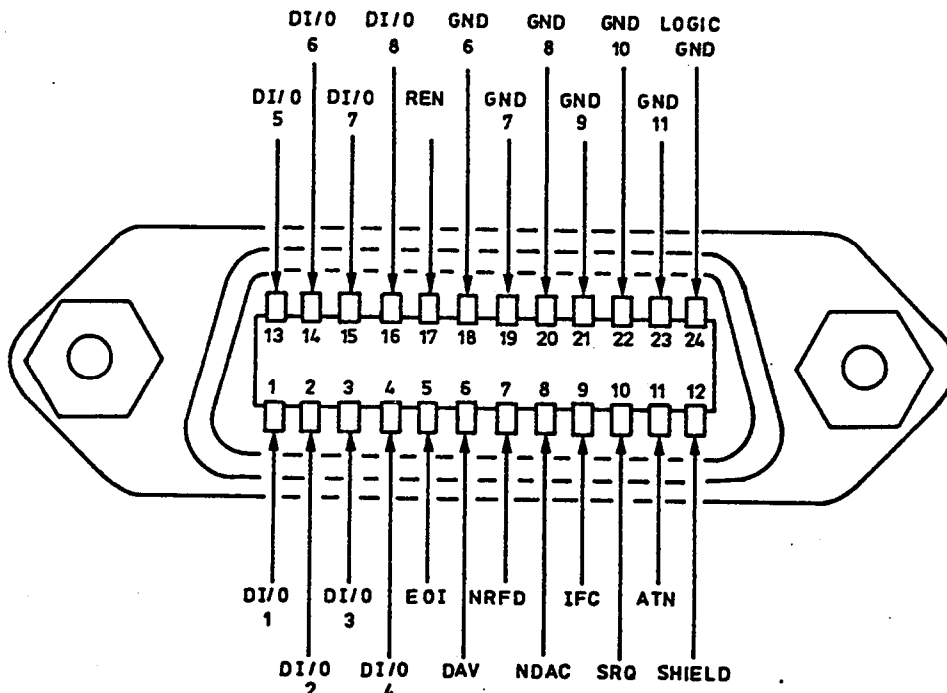


Fig. 2-14 Pin assignment of IEC-bus connector 103

Table 2-4 IEC-bus lines

DIO1 to DIO8	Transfer lines for data, addresses, and commands. DIO1 = LSB; DIO8 = MSB	Data-bus															
NRFD	<b>Not ready for data</b> Listener indicates with NRFD=Low that it cannot accept data at the moment.	Handshake bus															
NDAC	<b>Not data accepted</b> Listener indicates with NDAC=Low that it has not accepted any data.																
DAV	<b>Data valid</b> Talker indicates with DAV=Low that the data applied to DIO1 to DIO8 are valid.																
ATN	<b>Attention</b> For differentiation between device messages (ATN=Low) and interface messages (ATN=High).	Management bus															
EOI	<b>End or identify</b> Signal with two functions depending on ATN:  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>EOI</th> <th>ATN</th> <th>Significance for DIO</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>(data byte)</td> </tr> <tr> <td>1</td> <td>0</td> <td><u>END</u>: last data byte of a block</td> </tr> <tr> <td>0</td> <td>1</td> <td>(address or command)</td> </tr> <tr> <td>1</td> <td>1</td> <td><u>IDENTIFY</u>: request to identify after service request</td> </tr> </tbody> </table>		EOI	ATN	Significance for DIO	0	0	(data byte)	1	0	<u>END</u> : last data byte of a block	0	1	(address or command)	1	1	<u>IDENTIFY</u> : request to identify after service request
EOI	ATN		Significance for DIO														
0	0		(data byte)														
1	0		<u>END</u> : last data byte of a block														
0	1	(address or command)															
1	1	<u>IDENTIFY</u> : request to identify after service request															
IFC	<b>Interface clear</b> With IFC=Low, the controller sets the 100- $\mu$ s remote-control circuit (interface) to a basic status.																
REN	<b>Remote enable</b> With REN=Low, the controller switches the devices connected to the bus from manual operation to remote control. Manual operation is then disabled.																
SRQ	<b>Service request</b> If equipped with this function, each device connected can request a service from the controller via this line by setting SRQ=Low.																

If the instrument is controlled via the IEC bus, the CMT can operate either as listener or as talker.

a) CMT as listener

In this mode, the CMT receives device-specific data sent by the controller via the IEC bus. Several devices may operate as listeners. For this purpose, they must have been addressed by the controller before.

b) CMT as talker

In this mode, the CMT sends device-specific data to the controller or other devices connected to the IEC bus. However, the CMT must have been addressed as talker before. As opposed to listener mode, only one device may operate as talker in this case.

Using the key LOCAL the CMT can be switched to normal mode, provided that no IEC-bus command is being processed.

## 2.4.2 General Command Entry

The entry of commands or numbers as shown in Figs. 2-15 and 2-16 is an abstract illustration of the possible entries.

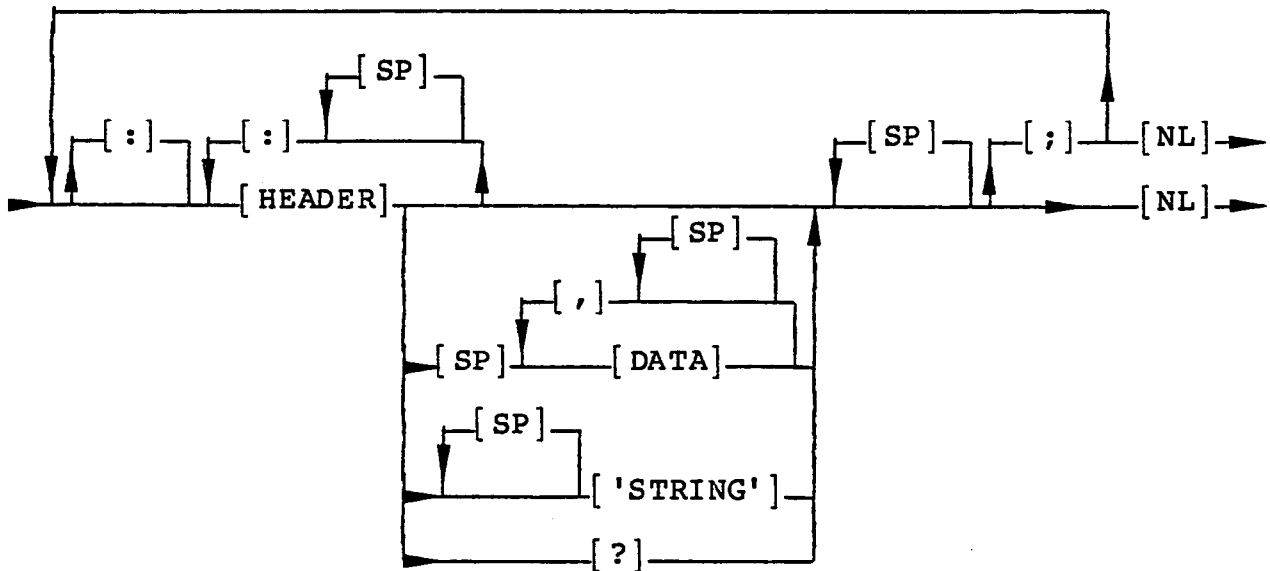


Fig. 2-15 Entry of commands

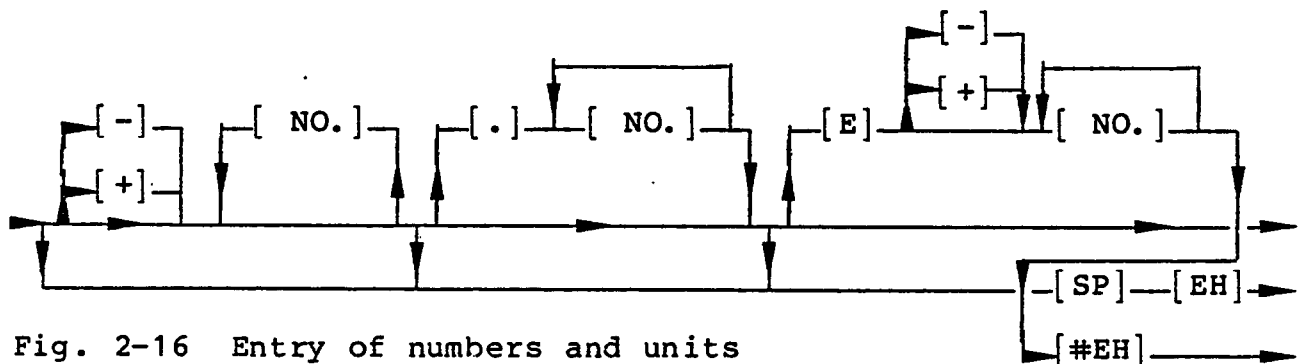


Fig. 2-16 Entry of numbers and units

Meaning of the expressions in Fig. 2-15 and Fig. 2-16:

STRING	numerical entry in inverted comma
+/-	sign
E	exponent (for numerical entry)
.	positions after decimal point
NL	New Line (ASCII ODH, OAH)
SP	space (ASCII 20H)
:	separation of headers
;	separation of commands
?	e.g. measured value is expected
DATA	numbers and/or units
EH	units
NO.	number

►counterclockwise

repeated entry of command or character is possible

►clockwise

single entry of command or character

HEADER is understood to mean a device-specific instruction. This instruction may be a complete command or part of a command.

**Example:**

Pressing of the DECODE key causes the CMT to decode a tone sequence. The corresponding IEC-bus command is:

DECODE?

In this case, the command consists of one header only.

For switching over from transmitter test to receiver test, the TX/RX key is pressed. This IEC-bus command consists of two headers.

MODE:RX\_TEST

The following is a complete command for setting the frequency of the first internal modulation generator:

FREQUENCY:AF:INT1 1 KHZ

The meaning of the command is clear from the headers. There is no need to enter a space after a header. New Line (NL) as termination of the IEC-bus command enables the command to be executed.

As can be seen from Fig. 2-15, a header or a header sequence can be terminated by a semicolon (;) with subsequent New Line (NL).

For entering a further command, it is therefore sufficient to enter only the last header if the first headers are identical.

**Example:**

Entry of the complete command with semicolon via the IEC bus.

10 IECOUT0,"FILTER:IF:NARROW ;";

For switching the filter to WIDE, it is sufficient to enter

20 IECOUT0,"WIDE " (NL)

after the header NARROW. Renewed entry of the complete command is no longer necessary.

The header NARROW is thus replaced by the header WIDE.



The individual IEC-bus commands can also be entered in abbreviated notation. The possible abbreviations can be obtained from the table containing all IEC-bus commands (see Section 2.4.3.1).

If the CMT is fitted with the IEC-bus option CM-B4, the IEC-bus address appears in the display when the instrument is switched on.

The address can be changed using the special function

**B** **100** **SPEC** <address (0 to 30)> **SPEC**

The address is retained even when the instrument is switched off.

### 2.4.2.1 Entry of Numbers

The entry of numbers, e.g. to set a frequency, corresponds to the path DATA in Fig. 2-15. This path is also shown separately in Fig. 2-16.

Example of complete numerical entry according to Fig. 2-16:

**20E-3 dB**

This corresponds to the entry of the number 0.02 with the unit dB.

Numbers outside the range of values of the CMT are ignored; before entering numbers, the user should therefore check whether the entry is meaningful.

Units accepted by the CMT:

%	nW
$\mu$ V	$\mu$ W
mV	mW
V	W
Hz	dB
kHz	dB $\mu$ V
MHz	dBm
rad	

### 2.4.3 Device-specific IEC-bus Commands

The individual commands can be easily handled if some basic rules are adhered to.

- Each terminated command ends with New Line.
- Numbers, units and headers are separated by at least one space.

- Numbers/units included in brackets may but need not necessarily be entered (see respective operation via the front panel).
- Numbers/units without brackets must be entered.

Section 2.4.3.1 lists all IEC-bus commands enabling the instrument to be set.

IEC-bus commands enabling the CMT to operate in talker mode are identified by a question mark (?) after the last header or the last character, e.g.

```

MODULATION:INT1 4 kHz?
COUNT:RF? , MODULATION:INT1?
MODULATION:INT1 4?

```

If the CMT is requested to perform a measurement, the result is sent to the controller after completion of the measurement.

The measured value has the following form:

```
<value> <exponent> <unit>
```

The units used correspond to the SI standard. The numerical value consists of a number with exponent or of a number only. If an exponent is output, its value is a multiple of three.

→ When calling up the talker with "#unit", the result is returned in the unit desired. This does not result in an instrument setting.

```

e.g.      IECOUT0,"FR:RF:TX-T 10MHZ?"
          →      10.0E6 HZ   as result.

```

The command

```

          IECOUT0,"FR:RF:TX-T #MHZ?"
then has →      10.0 MHZ   as result.

```

If a number is entered prior to #, this value is first set in the currently selected unit and the result output in the unit indicated after #.

```

          IECOUT0,"FR:RF:TX-T MHZ"
          IECOUT0,"FR:RF:TX-T 20#KHZ"
          →      20.0E3 KHZ   as result

```

The command IECOUT0,"FR:RF:TX-T 20 MHz # KHZ" is not permissible.

**Output of numbers:**

120 , -2.31E-3 , 1.23E6

**Units that are output:**

Hz	frequency
V	voltage
W	power
%	ratio
dB	ratio
dBm	ratio
rad	phase deviation

If two values are output, e.g. in the case of bandwidth measurements, the second value starts at the 20th position.

<VALUE1>	<EXP1>	<EH1>	...	<VALUE2>	<EXP2>	<EH2>
↑				↑		
1st position				20th position		

If a measurement does not produce any result, the CMT outputs a corresponding message as it would also appear in the  $\alpha$  display in normal mode.

The completion of a measurement is noted in the so-called SRQ byte (Service Request), which can then be evaluated by the controller.

Examples can be obtained from the IEC-bus BASIC programs.

**IEC bus delimiter:**

Readout of a result from the CMT to the controller is terminated by means of CR/LF. If the controller expects the additional information EOI, this can be set by means of

**B** **102** **SPEC**

It is switched off by means of

**B** **101** **SPEC** (default after switching on)

### 2.4.3.1 IEC-bus Commands of the CMT

Numbers are indicated with xyz in the tables. The range of values can be obtained from Section 2.3.1.3 . The ASCII 95 character (-) in the IEC-bus commands corresponds to <Shift> <Del> with the PCA5 and to (-) with the PUC.

Instrument setting	Response
MODE:TX_TEST MODE:TX_T  MODE:TX_LOCK MODE:TX_L  MODE:RX_TEST MODE:RX_T  MODE:RX_LOCK MODE:RX_L  MODE:LOCK_OFF MODE:LO	Switchover to transmitter test  Switchover to transmitter test and LOCK  Switchover to receiver test  Switchover to receiver test and LOCK  Switch off LOCK
MODE:FREQUENCY_FIELD:TX_TEST MODE:F:TX_T  MODE:FREQUENCY_FIELD:RX_TEST MODE:F:RX_T  MODE:RF_LEVEL_FIELD:TX_TEST MODE:RF_:TX_T  MODE:RF_LEVEL_FIELD:RX_TEST MODE:RF_:RX_T  MODE:MODULATION_FIELD:TX_TEST MODE:MODU:TX_T  MODE:MODULATION_FIELD:RX_TEST MODE:MODU:RX_T  MODE:AF_LEVEL_FIELD:TX_TEST MODE:AF_:TX_T  MODE:AF_LEVEL_FIELD:RX_TEST MODE:AF_:RX_T	<div style="border-left: 1px solid black; border-right: 1px solid black; border-bottom: 1px solid black; padding: 10px;">           Switchover of the individual displays to transmitter or receiver test         </div>
MODE:ACKTEST:ON MODE:AC:ON  MODE:ACKTEST:OFF MODE:AC:OF  MODE:INPUT:SELECT_RF MODE:INP:SELECT_R	Acknowledgement call test on  Acknowledgement call test off  Input connector RF IN/OUT <u>77</u>

Instrument setting	Response
MODE: INPUT: SELECT_2 MODE: INP: SELECT_2	Input connector INPUT 2 <u>79</u>
FILTER: IF: NARROW FI: IF: N  FILTER: IF: WIDE FI: IF: W  FILTER: HP: ON FI: H: ON  FILTER: HP: OFF FI: H: OF  FILTER: CCITT: DEMODULATION: ON FI: CC: DEMODU: ON  FILTER: CCITT: DEMODULATION: OFF FI: CC: DEMODU: OF  FILTER: CCITT: AF_INPUT: ON FI: CC: AF_: ON  FILTER: CCITT: AF_INPUT: OFF FI: CC: AF_: OF	IF filter on  IF filter off  300-Hz highpass filter on  300-Hz highpass filter off  CCITT filter in demodulation path on  CCITT filter in demodulation path off  CCITT filter AF voltmeter on  CCITT filter AF voltmeter off
STORE      XY STO XY  RECALL    XY RE XY	Storage of complete instrument settings  Call of complete instrument settings
SPECIALFUNCTION: DATA XYZ SPECIALF: DA XYZ  SPECIALFUNCTION: A XYZ SPECIALF: A XYZ  SPECIALFUNCTION: B XYZ SPECIALF: B XYZ  SPECIALFUNCTION: C XYZ SPECIALF: C XYZ  SPECIALFUNCTION: D XYZ SPECIALF: D XYZ	Entry of special function, e.g. <input type="text" value="72"/> <input type="text" value="SPEC"/>  Entry of special function, e.g. <input type="text" value="C"/> <input type="text" value="151"/> <input type="text" value="SPEC"/>

Instrument setting	Response
<p>SPECIALINPUT:DATA XX,YY SPECIALI:DATA XX,YY</p> <p>SPECIALINPUT:A XX,YY SPECIALI:A XX,YY</p> <p>SPECIALINPUT:B XX,YY SPECIALI:B XX,YY</p> <p>SPECIALINPUT:C XX,YY SPECIALI:C XX,YY</p> <p>SPECIALINPUT:D XX,YY SPECIALI:D XX,YY</p>	<p>Entry of special function, e.g.  <input type="text" value="XX"/> <input type="text" value="SPEC"/> &lt;YY&gt; <input type="text" value="SPEC"/></p> <p>Entry of special function, e.g.  <input type="text" value="A"/> <input type="text" value="XX"/>  <input type="text" value="SPEC"/> &lt;YY&gt; <input type="text" value="SPEC"/></p>
<p>FREQUENCY:AF:INT1 [XYZ] FR:AF:INT1 [XYZ]</p> <p>FREQUENCY:AF:INT2 [XYZ] FR:AF:INT2 [XYZ]</p> <p>FREQUENCY:RF:RX_TEST [XYZ] FR:RF:RX-T [XYZ]</p> <p>FREQUENCY:RF:TX_TEST [XYZ] FR:RF:TX-T [XYZ]</p>	<p>Setting the modulation generator frequency 1</p> <p>Setting the modulation generator frequency 2</p> <p>Setting the output frequency of the RF test generator</p> <p>Setting the operating frequency for the trans- mitter test</p>
<p>MODULATION:INT1 [XYZ] MODU:INT1 [XYZ]</p> <p>MODULATION:INT2 [XYZ] MODU:INT2 [XYZ]</p> <p>MODULATION:EXT [XYZ] MODU:EXT [XYZ]</p> <p>MODULATION:EXT-CALIBRATION MODU:EXT-C</p> <p>MODULATION:EXT-1VRMS MODU:EXT-1</p> <p>MODULATION:OFF MODU:OF</p>	<p>Setting the type and depth of modulation</p> <p>Calibration of AF voltage at input MOD EXT</p> <p>Nominal level 1 VRMS at input MOD EXT</p> <p>Switch off modulation of test generator</p>